TECHNICAL MANUAL

ENGINEERING MANUAL SERIES

AIRCRAFT AND MISSILE REPAIR

STRUCTURAL HARDWARE

(ATOS)

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TOTAL NUMBER OF PAGES IN THIS MANUAL IS 866, CONSISTING OF THE FOLLOWING:

Page No.	*Change No.
Title	**3**
A	**3**
i - xix	**3**
xx Blank	**3**
xxi - xxii	**3**
1-1 - 1-164	0
1-165 - 1-181	2
1-182 Blank	2
2-1 - 2-52	0
3-1 - 3-45	0
3-46 Blank	0
4-1 - 4-13	0
4-14 Blank	0
5-1 - 5-195	0
5-196 Blank	0
6-1 - 6-63	0
6-64 Blank	0
7-1 - 7-31	0
7-32 Blank	0
8-1 - 8-10	0
9-1 - 9-55	0
9-56 Blank	0
10-1 - 10-30	0
11-1 - 11-33	0
11-34 Blank	0
12-1 - 12-37	0
12-38 Blank	0
13-1	**3**
13-2 Blank	**3**
13-3 - 13-122 Deleted	**3**
14-1	0
14-2 Blank	0
15-1 - 15-7	0
15-8 Blank	0
16-1 - 16-27	0
16-28 Blank	0
17-1 - 17-3	0
17-4	**3**
17-5 - 17-6	0
18-1 - 18-2	0
19-1 - 19-11	0
19-12 Blank	0
20-1	1
20-2	0
A-1 - A-22	0
Index 1 - Index 4	0

*Zero in this column indicates an original page

TABLE OF CONTENTS

LIST OF ILLUSTRATIONS

LIST OF TABLES

FOREWORD

1. INTRODUCTION.

This is one of a series of manuals prepared to assist personnel engaged in the maintenance and repair of aerospace equipment. The purpose of this manual is to provide concise and accurate information to aid in the selection and correct use of aerospace hardware.

2. STRUCTURAL HARDWARE.

Because of the small size of most hardware items, their importance is often overlooked; however, the safe and efficient operation of any aerospace vehicle is greatly dependent upon correct selection and use of aerospace hardware. This manual covers mainly structural hardware, but certain nonstructural items such as electrical wiring, tubing, and flexible hose are also covered.

3. INSTRUCTIONS.

WARNING

Eye and ear protection shall be worn when and where deemed necessary.

CAUTION

Do not modify any structural hardware for use other than its intended purpose. Except on emergency war orders and approval from LG/CC. This restriction includes cutting, modifying or altering fasteners or fastener's threads. These fasteners are designed to safely withstand specific loads. Any alteration to their design will cause these fasteners to fail prematurely at loads lower than their design loads.

The instructions in this manual are general and are applicable except when otherwise specified in the manuals for the specific aerospace vehicle. If there is a conflict between this manual and the manuals for a particular aerospace vehicle, subsequent technical orders, technical notes, or change orders, the latter will govern in all cases.

3.1 Use of ''Shall,'' ''Will,'' ''Should,'' and ''May'' in this technical manual.

3.2 Whenever the word ''Shall'' appears, it will be construed to mean that the requirements are binding.

3.3 The word ''Will'' is used to express declaration of purpose

3.4 Whenever the words ''Should'' or ''May'' appear, they will be construed as nonmandatory provisions.

3.5 The word ''Should'' is normally used to express a nonmandatory desire or preferred method of accomplishment.

3.6 The word ''May'' is normally used to express an acceptable or suggested means of accomplishment.

SAFETY SUMMARY

1. DEFINITIONS.

The following definitions apply to WARNINGS, CAUTIONS, and NOTES found throughout this publication.

WARNING

Highlights an essential operating or maintenance procedure, practice, condition, statement, etc., which, if not strictly observed, could result in injury to, or death of, personnel or long-term health hazards.

CAUTION

Highlights an essential operating or maintenance procedure, practice, condition, statement, etc., which, if not strictly observed, could result in damage to, or destruction of equipment or loss of mission effectiveness.

NOTE

Highlights an essential operating or maintenance procedure, condition or statement.

2. PRECAUTIONS.

The following are general precautions. These are precautions that personnel must understand and apply during the various phases of operation and maintenance required throughout this manual.

3. WEAR PROTECTIVE CLOTHING.

Wear protective clothing (gloves, goggles, etc) approved for the materials and tools being used.

4. USE SAFETY APPROVED EQUIPMENT.

When cleaners and primers are being applied, approved explosion-proof lights, blowers, and other equipment shall be used. Insure that firefighting equipment is available and in working order.

5. GIVE CLEANERS SPECIAL CARE.

Keep cleaners in approved safety containers and in minimum quantities. Discard soiled cleaning clothes into safety containers. Observe manufacturer's warning labels; Material Safety Data Sheets (MSDS) instructions.

5.1 Icons are used in this manual to identify dangers associated with hazardous material. The icons used and their definitions are as follows:

The abstract symbol bug shows that a material may contain bacteria or viruses that present a danger to life or health.

The symbol of drops of liquid onto a hand shows that the material will cause burns or irritation of skin and tissue.

The rapidly expanding symbol shows that the material may explode if subjected to high temperatures, sources of ignition or high pressure.

The symbol of a person wearing goggles shows that the material will injure eyes.

The symbol of a flame shows that the material can ignite and burn.

The symbol of a skull and crossbones shows that the material is poisonous or a danger to life

The symbol of three circular wedges shows that radioactive energy is emitted which can injure tissue and organs.

The symbol of a human figure in a cloud shows that the material gives off vapors that are a danger to life or health.

6. CHEMICAL SUBSTANCES.

SOLVENT, TYPE II/III 1
Military Specification, MIL-PRF-680

This solvent is toxic to skin, eyes and respiratory tract. Use in a well ventilated area. Avoid repeated and prolonged contact. Solvent is flammable, keep away from ignition sources. May leave a slight residue, do not use for final wipe down prior to painting.

SOLVENT, ISOPROPYL ALCOHOL 2
Military Specification, TT-I-735

Using this product can cause skin, eye and respiratory tract irritation. Wear appropriate Personal Protective Equipment (PPE). Use general ventilation. Can explode when exposed to heat or open flames.

7. RESUSCITATION.

Personnel working with or near hazardous chemicals should be trained in modern methods of resuscitation.

8. HAZARDOUS WASTE DISPOSITION.

WARNING

Unused or waste chemical substances may be hazardous and must be disposed of in accordance with Federal, State, and Local directives. Contact Base Environmental Personnel and applicable Material Safety Data Sheet (MSDS) for specific disposal instructions.

CHAPTER 1
RIVETS

1.1 RIVETS.

The different types of rivets are: common, solid shank; pin; self-plugging (friction lock); self-plugging (mechanical lock); explosive; internally threaded (two piece); rivnut; and tubular. For aircraft work, rivets are generally made from aluminum alloys. However, in special applications, Monel, corrosion-resistant steel, mild steel, titanium, iron, or copper rivets may be used. Common, solid shank rivets are usually used for fastening aircraft structures; the other rivets are used where special consideration must be given to strength, accessibility of installation area, and heat ranges to which the rivet may be exposed. Blind rivets, i.e., self-plugging, explosive, internally threaded, and rivnut rivets, are designed for use where only one side of the work is accessible. There are various types and designs of blind rivets, but all have in common the feature of self-heading. (See Figure 1-1.) The heading operation can be accomplished either mechanically or chemically. Rivets A and B in Figure 1-1 are self-plugging and employ a hollow rivet shank and a pin. Rivet C is hollow shanked and is expanded by a small explosive charge in the shank. Rivets D and E are threaded rivets; rivet D is a rivnut rivet and rivet E is a two-piece rivet.

1.1.1 Rivet Part Numbers.

Part numbers for common, solid shank rivets consist of a basic number, letters, and dash numbers that indicate material, diameter, and length. For example, AN470AD5-12 is the number for a universal head rivet. The AN470 is the basic number; the AD5 indicates the material is 2117-T4 alloy with a 5/32-inch diameter, and the -12 indicates the length in sixteenths of an inch. The same rivet made of 2017-T4 material would have the number AN470D5-12. In the case of mild steel rivets only, when the letter P is added to the last dash group in the part number, it indicates that the rivet is cadmium or zinc plated. The National Aircraft Standards (NAS) numbering system for the other rivets is derived from several sources. For the most part, conventional rivets retain the standard Air Force-Navy (AN) system as previously described. In other cases, the manufacturers part number has been adapted, and in certain instances Military Standard (MS) numbers are used.

1.1.2 Rivet Code.

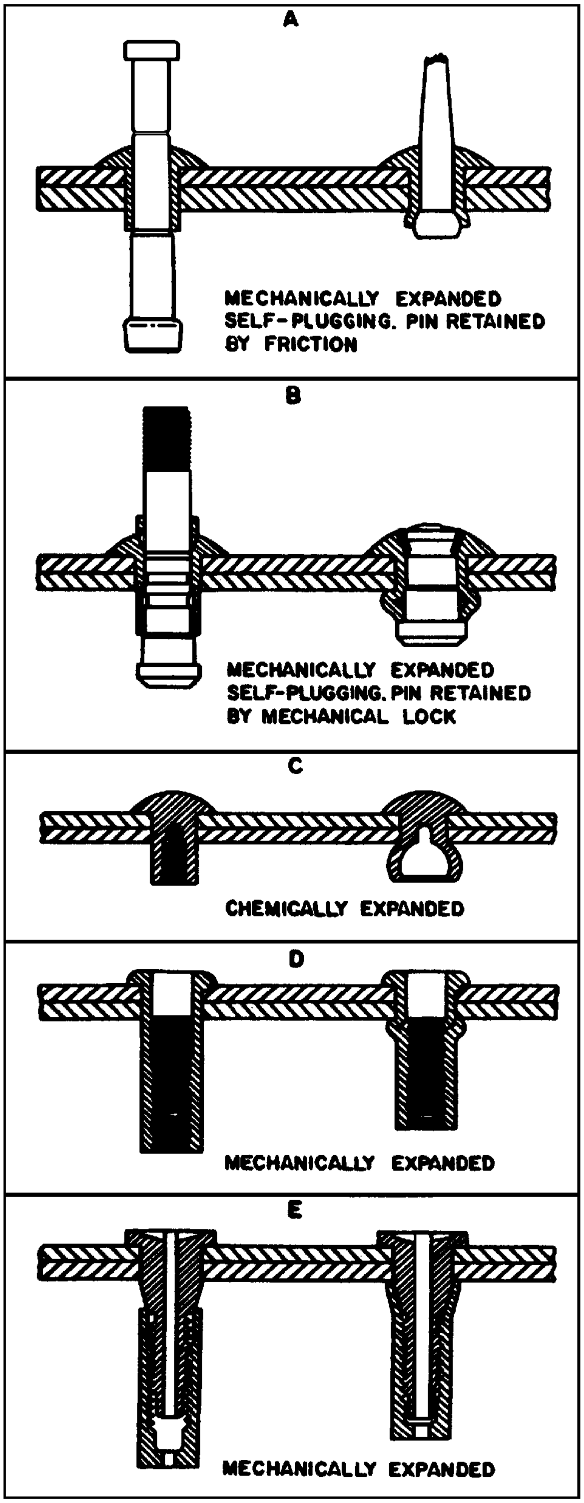
(See Figure 1-2.) The rivet code index is used by engineering departments to obtain the basic code designation of a given fastener for use in the northwest quadrant. This index is for engineering reference only and may be shortened by individual companies who have no need for all the types of fasteners listed. Additional data for other quadrants shall be added as covered in paragraph 3 of Figure 1-2. A general note or decal (stamp or Stik-On) similar to the sample decal layout shall be added to the drawing giving a cross reference to the codes used so that the identity of the fasteners may be determined on each drawing itself. (The shop has no need for reference to the rivet code index.) Decals (stamps or Stik-Ons) for this purpose, if used instead of general notes, may be prepared by each manufacturer to suit his own usage. Such decals may contain additional data not in conflict with the code and such decals may leave off optional items which the individual company chooses not to use. A local note or direct callout may always be used in place of the code at the discretion of the individual company.

1.1.3 Rivet Materials.

Except under unusual conditions rivets should be used only for the type of application for which they are designed. In aircraft structural repair procedures the same type rivets should be used as in the original manufacture. Choice of materials is dependent upon three factors: usage, corrosion resistance, and strength.

1.1.4 Rivet Identification Markings.

Table 1-1 shows common rivet identification markings.



F01-001

Figure 1-1. Types of Blind Rivets

1.1.5 Rivet General Uses. The 1100-F alloy rivet is made of pure aluminum and is used for riveting nonstructural parts fabricated from the softer aluminum alloys such as 1100-F, 3003, and 5052. The 2117-T4 alloy rivet is the rivet most commonly used in aluminum alloy structures. The main advantage of this rivet is that it may be used without further treatment, either heat or otherwise. The 2017-T4 and 2024-T alloy rivets are used in aluminum alloy structures where strength greater than that provided by the 2117-T4 rivet is required. These rivets are generally in 3/16-inch diameter sizes and larger. The 5056-H32 alloy rivet is used for riveting magnesium alloy structures because of its corrosion resistant qualities when used with magnesium. Other rivets should not be used with magnesium except in emergencies, as they produce an adverse corroding condition. Mild steel rivets are used primarily in riveting steel parts. Galvanized rivets should never be used on steel parts subject to high heat. Corrosion-resistant steel rivets are used primarily in riveting corrosion-resistant steel parts, such as firewalls, exhaust stack bracket attachments, and similar structures. Monel rivets are used for riveting high nickel steel alloys and nickel alloys. Monel rivets may be used interchangeably with stainless steel rivets; however, it is preferable to use stainless steel rivets in stainless steel parts. Titanium rivets are used in high performance aircraft where weight, shank, and hole tolerances are critical. Titanium rivets have high tensile strength with low weight, as well as resistance to heat and corrosion. Copper rivets are used for riveting copper alloys, leather, and nonmetallic materials. These rivets have limited usage in aircraft.

1.1.6 Rivet Corrosion Resistance.

CAUTION

Dangerous corrosion will result if steel, corrosion-resistant steel, Monel, titanium, copper, or iron rivets are used in riveting aluminum structures. Such applications should be confined to extreme emergencies. In such cases, one coat of zinc chromate primer should be applied to the rivet before and after installation. Proper replacement should be made as soon as materials are available.

In general, corrosion resistance is adequate when the rivet material is the same or nearly the same as that of the structure being riveted, provided the proper anticorrosion treatment has been applied. Anodized 2117-T4, 2017-T4, and 2024-T4 rivets may be used to rivet any aluminum alloy structure without producing corrosion.

General Description of Rivet Code

1. Types Of Fasteners

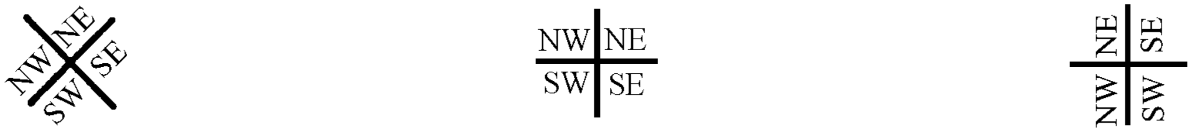
The word rivet has been assumed to include all types of fasteners in which the installation thereof imparts a permanent deformation which would force the destruction of the fastener to remove it.

2. Limitations

Fasteners which would be included in the above TYPES OF FASTENERS such as staples or wire stitching are not covered by the code.

3. Features Covered and Method of Showing

The symbol includes a single cross whose intersection is at the location of the fastener. When space does not permit, the symbol may be located off to the side and the location of the fastener indicated by an arrow. Fastener identity, size, installation requirements, etc, shall be indicated by a letter-numeric coding within the quadrants of the cross as defined herein. Quadrant orientation of the symbol is determined by the direction of the letter-numeric coding as written within the symbol. When the symbol is viewed in a position such that the letters are upright, the upper left hand quadrant is NW, etc. The following examples illustrate the basic symbol and quadrant identity.

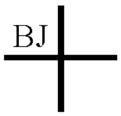


QUADRANT IDENTITY

P01-003A

Northwest Quadrant

Fastener Identity. - The identity of the fastener is shown in the NW quadrant by a two letter code as listed herein (see paragraph 4, APPLICATION). The code is made up of two nonsignificant letters and defines all features of the fasteners except diameter and grip. The code letters are assigned in sequence with the exception of the letters G, I, Q and U, and the combinations AD, AN and DD. These letters shall not be used in the fastener symbol.

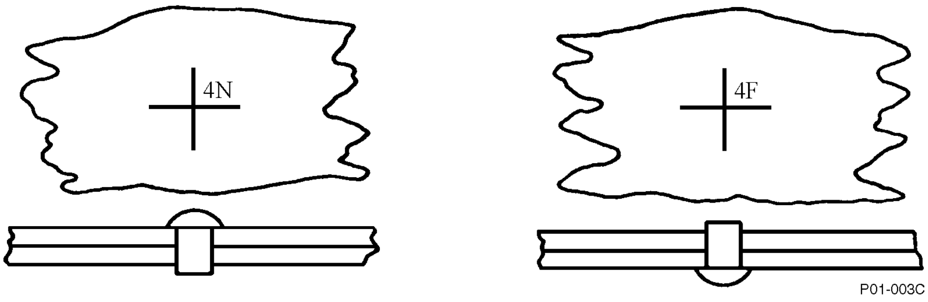


Northeast Quadrant

Fastener Diameter and Location of the Manufactured Head. - The fastener diameter and location of the manufactured head is shown in the NE quadrant by a numeric-letter code as defined below. The fastener diameter is shown by a number which is the dash number that represents the diameter in the full part number, if the diameter is designated by digits of the basic part number, then the significant digits shall be shown. The location of the manufactured (preformed) head of the fastener is defined by the code letter F for Far Side and N for Near Side. When the location of the manufactured head is insignificant or otherwise determined by the drawing itself, the code letter may be omitted.

Figure 1-2. Rivet Code (Sheet 1 of 11)

General Description of Rivet Code



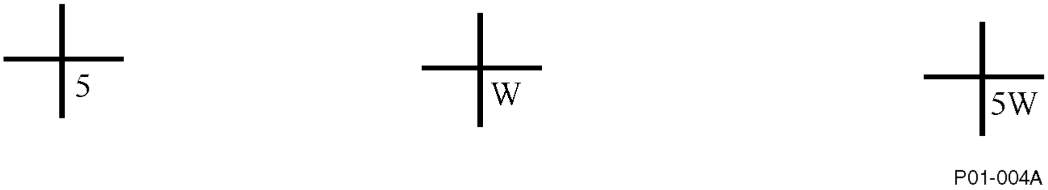
Southeast Quadrant

Length and Spot Weld Alternate. - The length and permission to spot weld as an alternative assembly method is shown in the SE quadrant by a numeric-letter code as defined below.

The length is shown by a number which is the dash number that represents the length in the full part number.

Engineering permission to spot weld in lieu of using the fastener called for is denoted by the letter W.

The preceding data is an optional feature of the code, but the use of any alternate method of designating the preceding data within the symbol is not optional.



Southwest Quadrant

Dimple and Countersink Data. - The sheets to be dimpled or countersunk are shown in the SW quadrant by a numeric-letter code as defined below, not to exceed three digits per line. Unless otherwise noted the nominal angle for the dimple or countersink shall be the same as the angle of the manufactured rivet head.

The letter D is used to show a dimpling (form countersinking) operation and when more than one sheet is dimpled a number follows the D to show how many sheets are dimpled.

The letter C is used to show a countersinking (machine countersinking) operation. No number is used after the, countersinking designation because it is the responsibility of the individual designer to see that the thickness of materials to be countersunk for a flush condition will not violate applicable company requirements.

Protruding head rivets to be upset flush may be indicated by placing the numeric-letter code on the first line which indicates the dimple or countersink operation for the upset end. The second line indicates the nominal angle for the upset end.

The flush both sides condition may be indicated by placing the numeric-letter code on separate lines where:

Figure 1-2. Rivet Code (Sheet 2)

General Description of Rivet Code

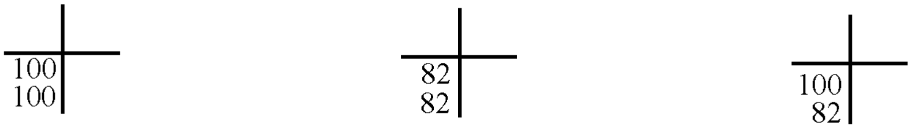
a. The first line indicates the dimple or countersink operation for the manufactured head.

b. The second line indicates the dimple or countersink operation for the upset end.

c. The third line indicates the nominal angle for the upset end when different than the angle of the manufactured head.

P01-004D

d. Optional, when the dimple-countersink operation for the double-flush rivets are controlled by applicable company requirements, the instruction to double flush may be indicated by noting the angle of the manufactured head on the first line and the angle of the upset end on the second line.

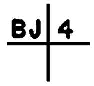


P01-004E

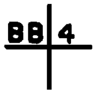
The use of the dimple-countersink feature of the symbol is optional. Any alternate method of designating the dimple-countersink feature for the flush one or both sides within the symbol is not optional.

4. Application

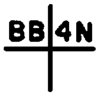
Examples and Expansion of Typical Symbols



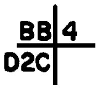
AN470AD4 Rivet, Univ Head (Head direction is not shown - assumed to be insignificant).



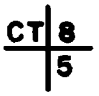
AN426AD4 Rivet, 100° Countersunk Head (Head location not shown - assumed to be obvious in this case; since there is always a reason for using countersunk rivets, the head location of this type can never be insignificant.)



AN426AD4 Rivet, 100° Countersunk Head Mfd Head to be located on the near side.



AN426AD4 Rivets, 100° Countersunk Head first and second sheets adjacent to Mfd Head to be dimpled, remainder of sheets to be countersunk. The location of the Mfd Head is assumed to be obvious from the drawing in this case. (Some companies will not use this Southwest Quadrant as the information regarding dimpling and countersunk is covered in their process specification manual.)

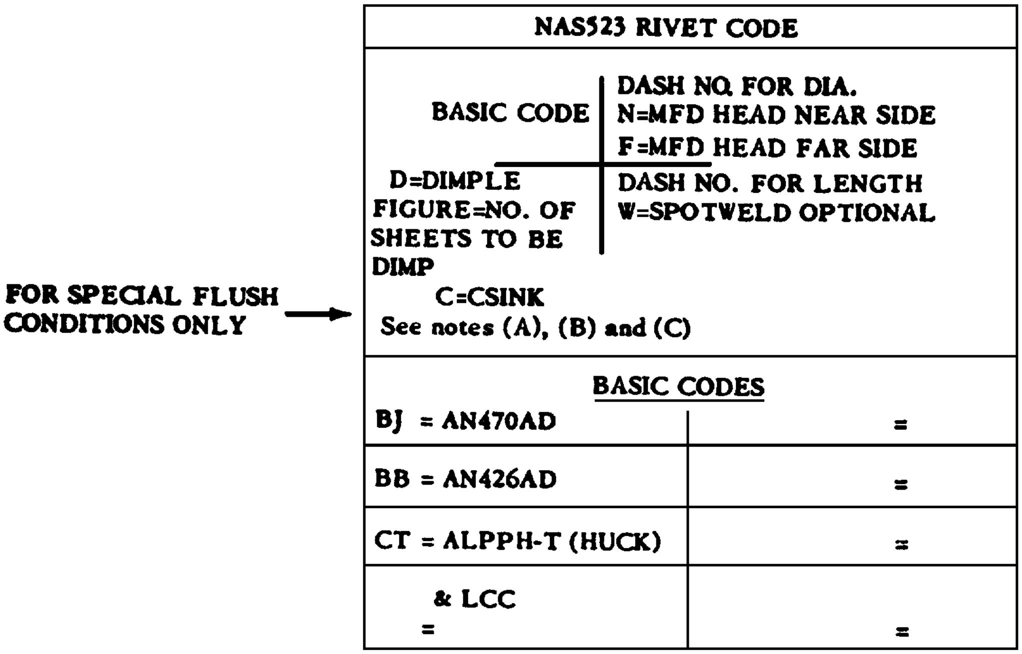


ALPPH-T8-5 Lock Bolt - Pull-Type Protruding Head. Including LC-C8 collar. The location of the Mfd Head is assumed to be insignificant or obvious in this case.

Figure 1-2. Rivet Code (Sheet 3)

4. Application (Cont)

SAMPLE DECAL LAYOUT



P01-005F

This suggested decal is intended to be included on all production drawings which will use the rivet code and is intended to give the shop all the information needed to completely identify the fasteners. As many as are required of the eight blanks in the lower portion are to be filled in by the draftsman to identify the basic code of the fasteners used on the particular drawing. (This suggested decal is composed for use at the top of a drawing. If the decal is to be used at the bottom of the drawing, the blanks could be provided at the top of the decal.) When the double-flush or the flush upset end conditions are to be used, the following notes shall be incorporated in the decal or appear elsewhere on the drawing as applicable.

(a) For Flush Upset End on Protruding Head Rivet
    1st Line - Dimple or Countersink
    2nd Line - Nominal Upset Angle

(b) Flush Both Sides
    1st Line - Mfd Head Dimple or Countersink
    2nd Line - Upset Head Dimple or Countersink
    3rd Line - Upset Head Angle Different Mfd Head

(c) Flush Both Sides Optional
    1st Line - Nominal Angle of Mfd Head
    2nd Line - Nominal Angle of Upset Head

Figure 1-2. Rivet Code (Sheet 4)

5. Rivet Code Index

Basic Code	Basic Part No.	Shank Material	Description
			Conventional Rivets - Protruding Head
DF	AN435F	CRES	Rivet - Roundhead
AS	AN435-()C	Steel	Rivet - Roundhead
AT	AN435M	Monel	Rivet - Roundhead
HH	AN435C	Copper	Rivet - Roundhead
HX	AN435M-C	Monel	Rivet - Roundhead, Cadmium Plated
BH	AN470A	1100-F	Rivet - Universal Head
BJ	AN470AD	2117-T3	Rivet - Universal Head
BK	AN470B	5056-F	Rivet - Universal Head
BL	AN470D	2017-T31	Rivet - Universal Head (Driven Ice-Boxed)
BM	AN470D	2017-T3	Rivet - Universal Head (Driven Hard)
CX	AN470DD	2024-T31	Rivet - Universal Head
BO	NAS508M	Monel	Rivet - Universal Head
			Conventional Rivets - Countersunk Head
*BA	AN426A	1100-F	Rivet - 100° Csunk Head
*BB	AN426AD	2117-T3	Rivet - 100° Csunk Head
*BC	AN426B	5056-F	Rivet - 100° Csunk Head
*BD	AN426D	2017-T31	Rivet - 100° Csunk Head (Driven Ice-Boxed)
*BE	AN426D	2017-T3	Rivet - 100° Csunk Head (Driven Hard)
*CY	AN426DD	2024-T31	Rivet - 100° Csunk Head
CL	AN427-()C	Steel	Rivet - 100° Csunk Head
BF	AN427M	Monel	Rivet - 100° Csunk Head
DH	AN427F	CRES	Rivet - 100° Csunk Head
HF	AN427C	Copper	Rivet - 100° Csunk Head
HW	AN427M-C	Monel	Rivet - 100° Csunk Head, Cadmium Plated
			Blind Rivets - Protruding Head
AY	CR117	2117-T4	Rivet - Blind, Pull-Thru Protruding Head (Cherry)
FV	CR317	Steel	Rivet - Blind, Pull-Thru Protruding Head (Cherry)
AK	CR517	Monel	Rivet - Blind, Pull-Thru Protruding Head (Cherry)
EM	CR127	5056-F	Rivet - Blind, Pull-Thru Protruding Head (Cherry)
JK	RV5033C	2117-T4	Rivet - Blind, Pull-Thru Protruding Head (Olympic)
FS	RV550C	5056-F	Rivet - Blind, Pull-Thru Protruding Head (Olympic)
HJ	RV590C	Monel	Rivet - Blind, Pull-Thru Protruding Head (Olympic)
JL	CR6634	A286	Rivet - Blind, Mech Expanding, Protruding Head (Cherry)
EN	CR163C	2117-T4	Rivet - Blind, Mech Expanding, Protruding Head (Cherry)
EO	CR157C	5056-F	Rivet - Blind, Mech Expanding, Protruding Head (Cherry)
AL	CR563	Monel	Rivet - Blind, Mech Expanding, Protruding Head (Cherry)
FJ	CR175	2117-T4	Rivet - Blind, Mech Expanding, Protruding Head (Cherry)
AA	MS20600AD	2117-T4	Rivet - Blind, Mech Expanding, Protruding Head
AB	MS20600B	5056-F	Rivet - Blind, Mech Expanding, Protruding Head
JS	MS20600M	Monel	Rivet - Blind, Mech Expanding, Protruding Head

Figure 1-2. Rivet Code (Sheet 5)

5. Rivet Code Index - Continued

Basic Code	Basic Part No.	Shank Material	Description
		Blind Rivets - Protruding Head (Cont)	
KV	MS20600MP	Monel Cad Pltd	Rivet - Blind, Mech Expanding, Protruding Head
HT	7951-S	CRES	Rivet - Blind, Mech Expanding, Protruding Head (Deutsch)
AW	6951S	CRES	Rivet - Blind, Mech Expanding, Protruding Head (Deutsch)
EK	CR1984	2117-T4	Rivet - Blind, Mech Expanding, Protruding Head (Cherry)
EV	RV250C	5056-F	Rivet - Blind, Mech Expanding, Protruding Head (Olympic)
EW	RV200C	2117-T4	Rivet - Blind, Mech Expanding, Protruding Head (Olympic)
FW	RV203C	2117-T4	Rivet - Blind, Mech Expanding, Protruding Head (Olympic)
HL	RV290C	Monel	Rivet - Blind, Mech Expanding, Protruding Head (Olympic)
EX	9SP-B-A	2117-T4	Rivet - Blind, Mech Expanding, Protruding Head (Huck)
CE	P	5056-F	Rivet - Blind, Keystone Brazier Head (Huck)
CZ	OS	5056-F	Rivet - Blind, Structural Head (Huck)
FB	DR-()A	2017-T4	Rivet - Blind, Explosive, Brazier Head (DuPont)
FC	56S-()A	5056-F	Rivet - Blind, Explosive, Brazier Head (DuPont)
JM	N()A	Nickel	Rivet - Blind, Explosive, Brazier Head (DuPont)
AF	MS20602AD	2017-T4	Rivet - Blind, Explosive, Brazier Head
AO	MS20602B	5056-F	Rivet - Blind, Explosive, Brazier Head
FL	P-56S-()A	5056-F	Rivet - Blind, Explosive, Brazier Head (Blast Free) (DuPont)
HC	PN()A	Nickel	Rivet - Blind, Explosive, Brazier Head (Blast Free) (DuPont)
HZ	CP PN()A	Nickel Cad Pltd	Rivet - Blind, Explosive, Brazier Head (Blast Free) (DuPont)
KX	PA286()A	A286	Rivet - Blind, Explosive, Brazier Head (Blast Free) (DuPont)
		Blind Rivets - Countersunk Head	
AX	CR116	2117-T4	Rivet - Blind, Pull-Thru 100° Csunk Head (Cherry)
EL	CR126	5056-F	Rivet - Blind, Pull-Thru 100° Csunk Head (Cherry)
BP	CR516	Monel	Rivet - Blind, Pull-Thru 100° Csunk Head (Cherry)
FT	RV551C	5056-F	Rivet - Blind, Pull-Thru 100° Csunk Head (Olympic)
HK	RV591C	Monel	Rivet - Blind, Pull-Thru 100° Csunk Head (Olympic)
AR	CR178	2117-T4	Rivet - Blind, Mech Expanding 100° Csunk Head (Oversize Cherry)
BR	CR562	Monel	Rivet - Blind, Mech Expanding 100° Csunk Head (Cherry)
EP	NS454	2117-T4	Rivet - Blind, Mech Expanding 100° Csunk Head (Cherry)
ER	CR156C	5056-F	Rivet - Blind, Mech Expanding 100° Csunk Head (Cherry)
FF	CR174	2117-T4	Rivet - Blind, Mech Expanding 100° Csunk Head (Cherry)
JN	CR6624	A286	Rivet - Blind, Mech Expanding 100° Csunk Head (Cherry)
FH	CR176	2117-T4	Rivet - Blind, Mech Expanding 100° Csunk Head (Oversize Cherry)
AC	MS20601AD	2117-T4	Rivet - Blind, Mech Expanding 100° Csunk Head
AE	MS20601B	5056-F	Rivet - Blind, Mech Expanding 100° Csunk Head
JT	MS20601M	Monel	Rivet - Blind, Mech Expanding 100° Csunk Head
KW	MS20601MP	Monel Cad Pltd	Rivet - Blind, Mech Expanding 100° Csunk Head

Figure 1-2. Rivet Code (Sheet 6)

5. Rivet Code Index - Continued

Basic Code	Basic Part No.	Shank Material	Description
		Blind Rivets - Countersunk Head (Cont)	
EY	9SP-100-A	2117-T4	Rivet - Blind, Mech Expanding 100° Csunk Head (Huck)
AV	6950S	CRES	Rivet - Blind, Mech Expanding 100° Csunk Head (Deutsch)
HS	7950-S	CRES	Rivet - Blind, Mech Expanding 100° Csunk Head (Deutsch)
ES	RV201C	2117-T4	Rivet - Blind, Mech Expanding 100° Csunk Head (Olympic)
ET	RV251C	5056-F	Rivet - Blind, Mech Expanding 100° Csunk Head (Olympic)
HM	RV291C	Monel	Rivet - Blind, Mech Expanding 100° Csunk Head (Olympic)
CD	100-V	5056-T4	Rivet - Blind, Keystone 100° Csunk, Head (Huck)
AH	MS20603AD	2017-T4	Rivet - Blind, Explosive, 100° Csunk Head
AJ	MS20603B	5056-F	Rivet - Blind, Explosive, 100° Csunk Head
JO	N()100	Nickel	Rivet - Blind, Explosive, 100° Csunk Head (DuPont)
EZ	DR-()-100	2017-T4	Rivet - Blind, Explosive, 100° Csunk Head (DuPont)
FA	56S-()-100	5056-F	Rivet - Blind, Explosive, 100° Csunk Head (DuPont)
FK	P-56S-()-100	5056-F	Rivet - Blind, Explosive, 100° Csunk Head (Blast Free) (DuPont)
HB	PN()100	Nickel	Rivet - Blind, Explosive, 100° Csunk Head (Blast Free) (DuPont)
HY	CP PN()100	Nickel Cad Pltd	Rivet - Blind, Explosive, 100° Csunk Head (Blast Free) (DuPont)
KY	PA286()100	A286	Rivet - Blind, Explosive, 100° Csunk Head (Blast Free) (DuPont)

Figure 1-2. Rivet Code (Sheet 7)

5. Rivet Code Index - Continued

Basic Code	Basic Part No.	Mating Collar	Shank Material	Collar Material	Description
		Lockbolts - Protruding Head			
CS	ALPPN-E	LC-F	7075-T6	6061-T6	Lockbolt - Protruding Head (Huck)
CT	ALPPH-T	LC-C	Steel	2024-T4	Lockbolt - Protruding Head (Huck)
CS	ALPPH-E	LC-F	7075-T6	6061-T6	Lockbolt - Protruding Head (Huck)
CT	ALPPN-T	LC-C	Steel	2024-T4	Lockbolt - Protruding Head (Huck)
EB	ALPPH-T	LC-R	Steel	Steel	Lockbolt - Protruding Head (Huck)
EB	ALPPN-T	LC-R	Steel	Steel	Lockbolt - Protruding Head (Huck)
FM	R1028H-T	LC-C	Steel	2024-T4	Lockbolt - Protruding Head (Huck)
FN	R1028H-T	LC-F	Steel	6061-T6	Lockbolt - Protruding Head (Huck)
FM	R1028N-T	LC-C	Steel	2024-T4	Lockbolt - Protruding Head (Huck)
FN	R1028N-T	LC-F	Steel	6061-T6	Lockbolt - Protruding Head (Huck)
DS	R3001	LC-R	Steel	Steel	Lockbolt - Protruding Head, CT Shank (Huck)
DT	R3001	LC-C	Steel	2024-T4	Lockbolt - Protruding Head, CT Shank (Huck)
JE	R3001	7LC-C	Steel	2024-T4	Lockbolt - Protruding Head, CT Shank (Huck)
DX	SALP	6LC-C	Steel	2024-T4	Lockbolt - Shear, Protruding Head (Huck)
JV	SALP	DC-C	Steel	2024-T4	Lockbolt - Shear, Protruding Head (Huck)
KP	NAS2406 thru 2412	NAS1080-C	Titanium	2024-T4	Lockbolt - Shear, Protruding Head (Huck)
DY	SLSP	6LC-C	Steel	2024-T4	Lockbolt - Shear, Stump Type, Protruding Head (Huck)
JW	SLSP	DC-C	Steel	2024-T4	Lockbolt - Shear, Stump Type, Protruding Head (Huck)
KS	NAS2606 thru 2612	NAS1080-6	Titanium	2024-T4	Lockbolt - Shear, Stump Type, Protruding Head (Huck)
CV	ALSF-E	LC-F	7075-T6	6061-T6	Lockbolt - Stump Type, Protruding Head (Huck)
DA	ALSF-T	LC-C	Steel	2024-T4	Lockbolt - Stump Type, Protruding Head (Huck)
EC	ALSF-T	LC-R	Steel	Steel	Lockbolt - Stump Type, Protruding Head (Huck)

Figure 1-2. Rivet Code (Sheet 8)

5. Rivet Code Index - Continued

Basic Code	Basic Part No.	Mating Collar	Shank Material	Collar Material	Description
		Lockbolts - Protruding Head (Cont)			
KD	HL18	HL70	Steel	2024-T4	Shear Bolt - Hi-Lok, Protruding Shear Head (Hi-Shear)
KL	NAS2006 thru 2010	NAS1080	Titanium	2024-T4	Lockbolt - Tension, Protruding Head (Huck)
KN	NAS2206 thru 2210	NAS1080	Titanium	2024-T4	Lockbolt - Tension, Stump Type, Protruding Head (Huck)
		Lockbolts - Countersunk Head			
-CP	ACT509H-E	LC-F	7075-T6	6061-T6	Lockbolt - 100° Csunk CT Head (Huck)
CR	ACT509H-T	LC-C	Steel	2024-T4	Lockbolt - 100° Csunk CT Head (Huck)
DM	ACT509H-T	LC-R	Steel	Steel	Lockbolt - 100° Csunk CT Head (Huck)
CP	ACT509N-E	LC-F	7075-T6	6061-T6	Lockbolt - 100° Csunk CT Head (Huck)
CR	ACT509N-T	LC-C	Steel	2024-T4	Lockbolt - 100° Csunk CT Head (Huck)
ED	ACT509N-T	LC-R	Steel	Steel	Lockbolt - 100° Csunk CT Head (Huck)
AM	ALP509H-E	LC-F	7075-T6	6061-T6	Lockbolt - 100° Csunk Head (Huck)
AP	ALP509H-T	LC-C	Steel	2024-T4	Lockbolt - 100° Csunk Head (Huck)
AM	ALP509N-E	LC-F	7075-T6	6061-T6	Lockbolt - 100° Csunk Head (Huck)
AP	ALP509N-T	LC-C	Steel	2024-T4	Lockbolt - 100° Csunk Head (Huck)
FP	R1029H-T	LC-C	Steel	2024-T4	Lockbolt - 100° Csunk CT Head (Huck)
FR	R1029H-T	LC-F	Steel	6061-T6	Lockbolt - 100° Csunk CT Head (Huck)
FP	R1029N-T	LC-C	Steel	2024-T4	Lockbolt - 100° Csunk CT Head (Huck)
FR	R1029N-T	LC-F	Steel	6061-T6	Lockbolt - 100° Csunk CT Head (Huck)
DJ	ALP426-E	LC-F	7075-T6	6061-T6	Lockbolt - 100° Csunk Head (Huck)
DV	R3002	LC-R	Steel	Steel	Lockbolt - 100° Csunk CT Head and Shank (Huck)
DW	R3002	LC-C	Steel	2024-T4	Lockbolt - 100° Csunk CT Head and Shank (Huck)
JF	R3002	7LC-C	Steel	2024-T4	Lockbolt - 100° Csunk CT Head and Shank (Huck)
DZ	SAL100	6LC-C	Steel	2024-T4	Lockbolt - Shear, 100° Csunk Head (Huck)

Figure 1-2. Rivet Code (Sheet 9)

5. Rivet Code Index - Continued

Basic Code	Basic Part No.	Mating Collar	Shank Material	Collar Material	Description
Lockbolts - Countersunk Head (Cont)					
JX	SAL100	DC-C	Steel	2024-T4	Lockbolt - Shear, 100° Csunk Head (Huck)
KR	NAS2506 thru 2512	NAS1080-C	Titanium	2024-T4	Lockbolt - Shear, 100° Csunk Head (Huck)
EA	SLS100	6LC-C	Steel	2024-T4	Lockbolt - Shear, Stump Type, 100° Csunk Head (Huck)
JY	SLS100	DC-C	Steel	2024-T4	Lockbolt - Shear, Stump Type 100° Csunk Head (Huck)
KT	NAS2706 thru 2712	NAS1080-C	Titanium	2024-T4	Lockbolt - Shear, Stump Type, 100° Csunk Head (Huck)
CW	ASCT509-E	LC-F	7075-T6	6061-T6	Lockbolt - Stump Type, 100° Csunk CT Head (Huck)
DB	ASCT509-T	LC-C	Steel	2024-T4	Lockbolt - Stump Type, 100° Csunk CT Head (Huck)
EE	ASCT509-T	LC-R	Steel	Steel	Lockbolt - Stump Type, 100° Csunk CT Head (Huck)
JH	R3014	LC-C	Steel	2024-T4	Lockbolt - 100° Csunk Head, CT Shank (Huck)
JJ	R3014	7LC-C	Steel	2024-T4	Lockbolt - 100° Csunk Head, CT Shank (Huck)
KE	HL19	HL70	Steel	2024-T4	Shear Bolt - Hi-Lok, 100° Csunk CT Shear Head (Hi-Shear)
KM	NAS2106 thru 2110	NAS1080	Titanium	2024-T4	Lockbolt - Tension, 100° Csunk Head (Huck)
KC	NAS2306 thru 2310	NAS1080	Titanium	2024-T4	Lockbolt - Tension, Stump Type, 100° Csunk Head (Huck)
Hi-Shear Rivets - Protruding Head					
BZ	HS38P	NAS528	Steel	2024-T4	Rivet - Hi-Shear, Protruding Head, CT Shank, High H.T.
CB	HS48	NAS528	Steel	2024-T4	Rivet - Hi-Shear, Protruding Head, High H.T.
HO	HS48	HS32	Steel	Steel	Rivet - Hi-Shear, Protruding Head, High H.T.
*BT	NAS529	NAS528	Steel	2024-T4	Rivet - Hi-Shear, Protruding Head, CT Shank, High H.T.
*BW	NAS529	NAS179	Steel	2117-T4	Rivet - Hi-Shear, Protruding Head, CT Shank, High H.T.
JC	HS128	HS60	CRES (17-4)	CRES (321)	Rivet - Hi-Shear, Protruding Head, CT Shank, High H.T., High Temp.
JD	HS128	HS60M	CRES (17-4)	Monel	Rivet - Hi-Shear, Protruding Head, CT Shank, High H.T., High Temp.
DN	HS68	HS60	CRES (431)	CRES (321)	Rivet - Hi-Shear, Protruding Head, High H.T. High Temp.
HR	HS68	HS60M	CRES	Monel	Rivet - Hi-Shear, Protruding Head, High H.T., High Temp.

Figure 1-2. Rivet Code (Sheet 10)

5. Rivet Code Index - Continued

Basic Code	Basic Part No.	Mating Collar	Shank Material	Collar Material	Description
		Hi-Shear Rivets - Protruding Head (Cont)			
FE	HS26	HS24	7075-T6	2117-T4	Rivet - Hi-Shear, Protruding Head
JZ	NAS1054	NAS179	Steel	2117-T4	Rivet - Hi-Shear, Protruding Head
KA	NAS1054	NAS528	Steel	2024-T4	Rivet - Hi-Shear, Protruding Head
KF	NAS1806 thru 1816	NAS179	Titanium	2117-T4	Rivet - Hi-Shear, Protruding Head, Interference Fit
KH	NAS1806 thru 1816	NAS528	Titanium	2024-T4	Rivet - Hi-Shear, Protruding Head, Interference Fit
		Hi-Shear Rivets - Countersunk Head			
BY	HS37P	NAS528	Steel	2024-T4	Rivet - Hi-Shear, 100° Csunk CT Head and Shank, High H.T.
*BS	NAS525	NAS528	Steel	2024-T4	Rivet - Hi-Shear, 100° Csunk CT Head and Shank, High H.T.
*BV	NAS525	NAS179	Steel	2117-T4	Rivet - Hi-Shear, 100° Csunk CT Head and Shank, High H.T.
CA	HS47	NAS528	Steel	2024-T4	Rivet - Hi-Shear, 100° Csunk CT Head, High H.T.
DP	HS67	HS60	CRES (431)	CRES (321)	Rivet - Hi-Shear, 100° Csunk CT Head, High H.T., High Temp.
HP	HS67	HS60M	CRES	Monel	Rivet - Hi-Shear, 100° Csunk CT Head, High H.T., High Temp.
HN	HS47	HS32	Steel	Steel	Rivet - Hi-Shear, 100° Csunk CT Head, High H.T.
EF	HS2R7C	NAS528	CRES (302)	2024-T4	Rivet - Hi-Shear, 100° Csunk CT Head
KB	NAS1055	NAS179	Steel	2117-T4	Rivet - Hi-Shear, 100° Csunk CT Head
KC	NAS1055	NAS528	Steel	2024-T4	Rivet - Hi-Shear, 100° Csunk CT Head
EH	HS23	HS24	7075-T6	2117-T4	Rivet - Hi-Shear, 100° Csunk CT Hi-Shear Head
EJ	HS25	HS24	7075-T6	2117-T4	Rivet - Hi-Shear, 100° Csunk CT AN426 Head
JA	HS127	HS60	CRES (17-4)	CRES (321)	Rivet - Hi-Shear, 100° Csunk CT Shank, High H.T., High Temp.
JB	HS127	HS60M	CRES (17-4)	CRES (321)	Rivet - Hi-Shear, 100° Csunk CT Shank, High H.T., High Temp.
KJ	NAS1906 thru 1916	NAS179	Titanium	2117-T4	Rivet - Hi-Shear, 100° Csunk Head, Interference Fit
KK	NAS1906 thru 1916	NAS528	Titanium	2024-T4	Rivet - Hi-Shear, 100° Csunk Head, Interference Fit

Code CF, CH, CJ, and CK are inactive due to the inactivation for design of NAS177 and NAS178.

Figure 1-2. Rivet Code (Sheet 11)

5. Rivet Code Index - Continued

Basic Code	Basic Part No.	Shank Material	Description
			Bolt - Blind Protruding Head
CC	BL	Steel	Bolt - Blind, Protruding Head (Huck)
DR	P	Steel	Bolt - Blind, Hex Head (Jo-Bolt)
JP	P()A	A286	Bolt - Blind, Protruding Head (Jo-Bolt)
HD	BB352	CRES	Bolt - Blind, Protruding Head (Hi-Shear)
			Bolt - Blind Countersunk Head
DK	F	Steel	Bolt - Blind, 100° Csunk (Jo-Bolt)
JR	F()A	A286	Bolt - Blind, 100° Csunk (Jo-Bolt)
DL	FA	7075-T6	Bolt - Blind, 100° Csunk (Millable Jo-Bolt)
HE	BB351	CRES	Bolt - Blind, 100° Csunk Head (Hi-Shear)
			Miscellaneous
*FO	AN450C	Steel	Rivet - Tubular, Style C
*CM	AN450C()AD	2117-T4	Rivet - Tubular, Style C
*CN	AN450C() B	Brass	Rivet - Tubular, Style C
*CO	AN450D() AD	2117-T4	Rivet - Tubular, Style D
*FX	AN450A()C	Copper	Rivet - Tubular, Style A
*FY	AN450D	Steel	Rivet - Tubular, Style D
*FZ	AN450D()B	Brass	Rivet - Tubular, Style D
*HA	AN450D()M	Monel	Rivet - Tubular, Style D
DC	11101ADJ4()	2117-T3	Rivet - Flush, Jacketed, AN426 (Pastushin)
DE	44401ADJ4()	2117-T3	Rivet - Protruding Head, Jacketed, AN470 (Pastushin)
FD	860-015	2117-T4	Rivet - Sealing, 100° Csunk Head (Franklin C. Wolfe)
HV	860-065	5056-F	Rivet - Sealing, 100° Csunk Head (Franklin C. Wolfe)

*SUPERSEDURES

NAS528 Supersedes HS15	(Same Code Retained)
NAS525 - NAS528 Supersede HS51P - HS15	(Same Code Retained)
NAS525 - NAS179 Supersede HS51P - NAS179	(Same Code Retained)
NAS529 - NAS528 Supersede HS52P - HS15	(Same Code Retained)
NAS529 - NAS179 Supersede HS52P - NAS179	(Same Code Retained)
MS20450 - Supersedes AN450 (Identical Material Coding)	(Same Code Retained)
MS20426 - Supersedes AN426 (Identical Material Coding)	(Same Code Retained)

Special Coding

The XA through XZ series indicate special individual company rivets.

Figure 1-2. Rivet Code (Sheet 11)

Table 1-1. Rivet Identification Markings

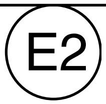
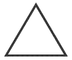
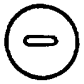
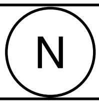
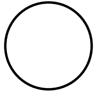
Head Marking		Physical Characteristics	Material	Classification or Specification
	Indented		Steel, Carbon	QQ-S-633, FS1010
	Raised or Indented			
Revised to		2.Hardness: Maximum - Rockwell B60 or equal	Steel	AMS7225
	Indented Dash	Shear Strength: 45,000 to 55,000 PSI Hardness: Maximum - Rockwell B60 or equal	Steel, Corr Res	QQ-W-423, FS302 or 304 Composition
	Raised or Indented Mark ''H1'' only on 0.062 Rivets		Steel, Heat and Corr Res	AMS7229 (18 Cr-11 N)
	Raised or Indented Mark ''H2'' only on 0.062 Rivets		Steel, Heat and Corr Res	AMS7232
	Indented		Nickel Steel	QQ-S-624, FS2317 Alternates: FS3115, 4615, 8615, SAE8751, SAE2315, FS3315
	Projected Cross	Tensile Strength: 53,000 - 68,000 PSI - Heat Treat	Steel, Medium	MIL-R-1223A
	Plain		Aluminum Alloy	2S (A)

Table 1-1. Rivet Identification Markings - Continued

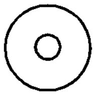
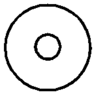
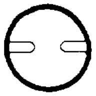
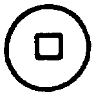
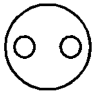
Head Marking	Physical Characteristics	Material	Classification or Specification
 Indented Dimple	Shear Strength of Driven Rivet - 26,000 PSI Recommended Safe Shear Design Stress - 9,500 PSI	Aluminum Alloy Aluminum Alloy	A17ST (AD) A17S-T4 A17S-T4 A17S-T
 Raised Teat	Shear Strength of Driven Rivet - 33,000 PSI Recommended Safe Shear Design Stress - 11,000 PSI	Aluminum Alloy Aluminum Alloy	17ST (D) 17S-T4 (Anodized) 17S, 17ST, 17S-0, A17S-T
 Raised Double Dash	Shear Strength of Driven Rivet - 37,000 PSI Recommended Safe Shear Design Stress - 12,000 PSI	Aluminum Alloy Aluminum Alloy	24ST (DD) 24S-T4 (Anodized)
 (1) Indented, Blind Explosive (2) Raised, Solid		Aluminum Alloy Aluminum Alloy	56S (B) and 56S-F 56S (B)
 Shank Marking	Shear Strength of Driven Rivet - 11,000 PSI Recommended Safe Shear Design Stress - 3,000 PSI	Aluminum Alloy	2F-S (As fabricated)
 Shank Marking	Shear Strength of Driven Rivet - 23,000 PSI Recommended Safe Shear Design Stress - 6,500 PSI	Aluminum Alloy	53S-T-61

Table 1-1. Rivet Identification Markings - Continued

Head Marking		Physical Characteristics	Material	Classification or Specification
	Projected Flutes	Tensile Strength: 68,000 - 83,000 PSI; Yield Point: 38,000 Heat Treat, Shear Strength: Min 64,000 PSI	Steel, Grade HT	MIL-R-1223A
	Indented Square	Heat Treatment: 160,000 - 180,000 PSI for MIL-H-6875	Steel; Cr, Ni, Mo Steel; Cr, Ni, Mo Steel; Cr, V Steel; Ni, Cr Steel Steel; Cr, Mo Steel; Cr, Ni, Mo Steel; Mo Steel; Cr, Mo	MIL-S-6098 for #8735 MIL-S-6049 for #8740 AN-QQ-S-687 for #6150 AN-QQ-S-690 for #3140 Optional - AN-QQ-S-690 for #313 MIL-S-5626 for #4140 MIL-S-5000 for #4340 MIL-S-8695 for #4037 MIL-S-6758 for #4130
	Twin Teats or Dimples	Shear Strength: 49,000 - 59,000 PSI	Monel	QQ-N-281, Class A, Annealed
△	Recessed	When on non-aluminum alloy rivets denotes mild steel.		
○	Raised	Denotes 2017-T3, -T4, -T31, -T41 (type D) aluminum alloy.		
○	Dimple	Denotes 2117-T3, -T4 (type AD) aluminum alloy.		
✚	Raised	Denotes 5056 or 5056-F (type B) aluminum alloy.		
	Plain	Indicates 1100 or 1100-F (type A) aluminum alloy.		
— —	Raised	Denotes 2024-T4 or -T31 (type DD) aluminum alloy.		

1.1.7 Rivet Pattern Layout. Specific repair procedures are prescribed in Structural Repair Manuals for the various aircraft; however, there are some general procedures which will apply in all instances. Whenever possible, rivets should have the same configuration as the original installation. When new sections are to be added or when repairs are being made, the edge distance from the center of the rivet shank to the edge of the material should never be less than twice the diameter of the shank, nor should it be more than four times the shank diameter. (See Figure 1-3.) The distance between rivets in the same row, measured from center to center, should never be less than four times the shank diameter nor should it be more than ten times the shank diameter. The distance between rows of rivets should not be less than two and half times the shank diameter nor more than the largest rivet spacing within either row. The rivet sheet surface angle should not exceed values given in Figure 1-4 for either the manufactured or formed head. Spotfacing is required for larger angles. (See Figure 1-5.) When laying out a rivet pattern, use a pencil, aircraft marking MIL-P-83953A, yellow NSN 7510-00-537-6930, red NSN 7510-00-537-6935.

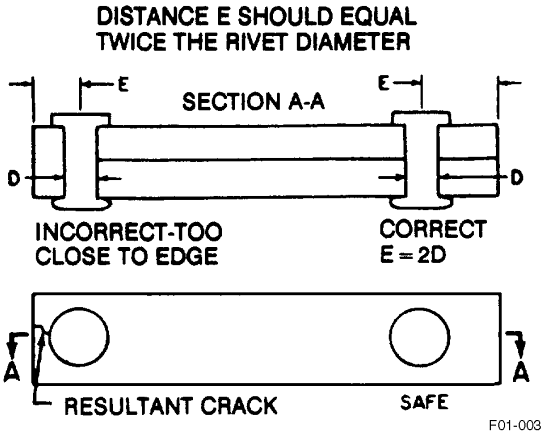
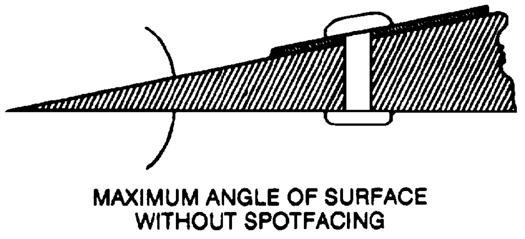


Figure 1-3. Rivet Edge Distance

1.1.8 Drilling for Installation of Rivets. Rivet repair holes may be drilled with a light power drill or a hand drill, using a standard straight shank twist drill. The holes can be located by placing the drilled part over the part to be drilled and using the existing holes as a guide for the drill. The hole location can also be established by scribing through the drilled part, then taking the part to be drilled to a work bench for center punching and drilling. When complete new sections are involved, 0.098-inch pilot holes are drilled first. Then the new sections are positioned in the finished attitude and fixed with C-clamps or skin fasteners. The rivet holes are drilled through the pilot holes; the sheets are separated and the holes deburred. In drilling light stringers, the rivet line is marked along the length of the member with a pencil. The predrilled skin is placed over the stringer and the rivet line aligned with the holes. Skin fasteners are used to hold the stringer through the skin may prove more convenient, this will often result in an unsatisfactory, irregular rivet line.



RIVET DIAMETER	MAXIMUM ANGLE
3/32	20°
1/8	20°
5/32	20°
3/16	15°
1/4	10°
3/16	5°

F01-004

Figure 1-4. Sheet Surface Angle Limitations for Riveting

1.1.9 Rivet Drill Sizes. Table 1-2 through Table 1-8 list the hole and drill sizes for most, commonly used rivets. Table 1-9 specifies the sizes of twist drills from 1/2 inch down to number 80.

1.1.10 Rivet Hole Drilling Procedure. The procedure for drilling rivet holes is as follows:

a. Center punch all rivet locations. The center punch mark must be large enough to prevent the drill from slipping out of position, yet it must not dent the surface of the material. To prevent denting, place a bucking bar behind the material during punching. After center punching, use a 0.098 drill bit to pilot drill all hole locations.

b. Make sure the drill bit is the correct size and the point is ground properly. (See Figure 1-6.)

c. Place drill in center punch mark and drill hole.

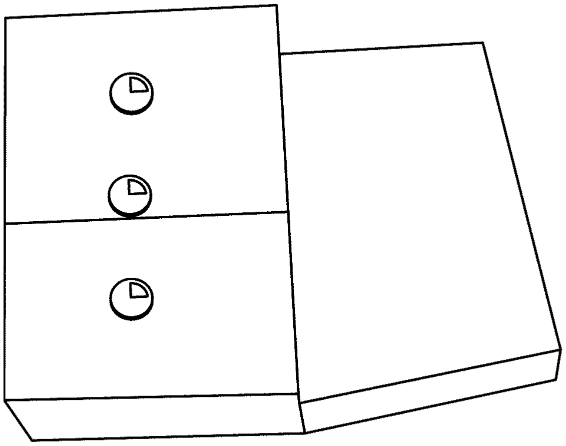
d. While drilling, hold drill at a 90-degree angle to material surface.

e. Avoid excessive pressure. Let drill do cutting.

f. Do not push drill through material.

g. Remove all burrs with a metal countersink or file.

h. Clean away all drill chips.



SPOT FACE DIAMETER MUST BE 1/16 INCH GREATER THAN DIAMETER OF RIVET HEAD

Figure 1-5. Spotfacing for Rivets

Table 1-2. Drill Sizes for Common, Solid Shank Rivets

Rivet Diameter	Drill Size	Drill Diameter
1/16	51	0.0670
3/32	41	0.0960
1/8	30	0.1285
5/32	21	0.1590
3/16	11	0.1910
1/4	F	0.2570
5/16	P	0.3230
3/8	W	0.3860

Table 1-3. Drill Sizes for Pin Rivets

Rivet Diameter	Drill Size	Drill Diameter
3/16	16	0.177
7/32	5	0.205
1/4	B	0.238
9/32	1	0.272
5/16	N	0.302
11/32	Q	0.332
3/8	U	0.368
13/32	X	0.397
7/16	27/64	0.4219
15/32	29/64	0.4531
1/2	31/64	0.4844
17/32	33/64	0.5156

Table 1-4. Drill Sizes and Hole Size Limits for Self-Plugging Rivets (Friction Lock)

Rivet Diameter	Finish Drill Size	Inspection Limits	
		Min	Max
3/32	40	0.097	0.101
1/8	30	0.128	0.132
5/32	20	0.160	0.164
3/16	10	0.192	0.196
7/32	2	0.220	0.225
1/4	F	0.256	0.261
9/32	L	0.289	0.295
1/8 oversize	29	0.137	0.141
5/32 oversize	16	0.177	0.181
3/16 oversize	5	0.206	0.210
9/32 Monel	M	0.294	0.300

Table 1-5. Drill Sizes for Self-Plugging Rivets (Mechanical Lock)

Rivet Diameter	Pilot Drill	Finish Drill	Hole Size
1/8	32 (.116)	30 (.1285)	0.129 to 0.132
5/32	26 (.147)	20 (.161)	.1595 to 0.1635
3/16	16 (.177)	10 (.1935)	.1915 to 0.196

Table 1-6. Drill Sizes for Explosive Rivets

Rivet Diameter	Pilot Drill Size	Finish Drill Size	Hole Size
1/8	30	29 (0.1360)	0.1345 to 0.138
5/32	22	17 (0.1730)	0.1730 to 0.176
3/16	12	6 (0.2040)	0.2040 to 0.207

Table 1-7. Drill Sizes for Internally Threaded Rivets (Two Piece)

Rivet Diameter	Drill Size	Drill Diameter
0.187	3/16	0.187
0.234	A	0.234
0.265	17/64	0.265

Table 1-8. Drill Sizes for Rivnut Rivets

Rivet Thread Size	Pilot Drill	Finish Drill
6-32	19 (0.166)	12 (0.189)
8-32	8 (0.199)	2 (0.221)
10-32	1 (0.228)	1/4 (0.250)

Table 1-9. Sizes of Twist Drills from 1/2 Inch to Number 80 with Decimal Equivalents

Size	Decimal Equiv
1/2	0.5000
31/64	0.4844
15/32	0.4687
29/64	0.4531
7/16	0.4375
27/64	0.4219
Z	0.4130
13/32	0.4062
Y	0.4040
X	0.3970
25/64	0.3906
W	0.3860
V	0.3770
3/8	0.3750
U	0.3680
23/64	0.3594
T	0.3580
S	0.3480
11/32	0.3437
R	0.3390
Q	0.3320
21/64	0.3281
P	0.3230
O	0.3160
5/16	0.3125
N	0.3020
19/64	0.2969
M	0.2950
L	0.2900
9/32	0.2812
K	0.2810
J	0.2770
I	0.2720
H	0.2660
17/64	0.2656
G	0.2610
F	0.2570
1/4	0.2500
D	0.2460
C	0.2420
B	0.2380
15/64	0.2344
A	0.2340
1	0.2280
2	0.2210
7/32	0.2187
3	0.2130
4	0.2090
5	0.2055
6	0.2040
13/64	0.2031
7	0.2010
8	0.1990
9	0.1960
10	0.1935

Table 1-9. Sizes of Twist Drills from 1/2 Inch to Number 80 with Decimal Equivalents - Continued

Size	Decimal Equiv
11	0.1910
12	0.1890
3/16	0.1875
13	0.1850
14	0.1820
15	0.1800
16	0.1770
17	0.1730
11/64	0.1719
18	0.1695
19	0.1660
20	0.1610
21	0.1590
22	0.1570
5/32	0.1562
23	0.1540
24	0.1520
25	0.1495
26	0.1470
27	0.1440
9/64	0.1406
28	0.1405
29	0.1360
30	0.1285
1/8	0.1250
31	0.1200
32	0.1160
33	0.1130
34	0.1110
35	0.1100
7/64	0.1094
36	0.1065
37	0.1040
38	0.1015
39	0.0995
40	0.0980
41	0.0960
3/32	0.0937
42	0.0935
43	0.0890
44	0.0860

Table 1-9. Sizes of Twist Drills from 1/2 Inch to Number 80 with Decimal Equivalents - Continued

Size	Decimal Equiv
45	0.0820
46	0.0810
47	0.0785
5/64	0.0781
48	0.0760
49	0.0730
50	0.0700
51	0.0670
52	0.0635
1/16	0.0625
53	0.0595
54	0.0550
55	0.0520
3/64	0.0469
56	0.0465
57	0.0430
58	0.0420
59	0.0410
60	0.0400
61	0.0390
62	0.0380
63	0.0370
64	0.0360
65	0.0350
66	0.0330
67	0.0320
1/32	0.0313
68	0.0310
69	0.0292
70	0.0280
71	0.0260
72	0.0250
73	0.0240
74	0.0225
75	0.0210
76	0.0200
77	0.0180
78	0.0160
1/64	0.0156
79	0.0145
80	0.0135

Table 1-9. Sizes of Twist Drills from 1/2 Inch to Number 80 with Decimal Equivalents - Continued

Size	Decimal Equiv
Fractional sizes are available in 1/64 increasing up to 1-3/4 inch diameter. Tolerances on drilled holes, unless otherwise specified, are as follows:	
Nominal Drill Diameter	**Hole Tolerance**
0.404 to 0.1285	+0.002 -0.001
0.136 to 0.228	+0.003 -0.001
0.234 to 1/2	+0.004 -0.001
33/64 to 3/4	+0.005 -0.001
49/64 to 1	+0.007 -0.001
1-1/64 to 2	+0.010 -0.001

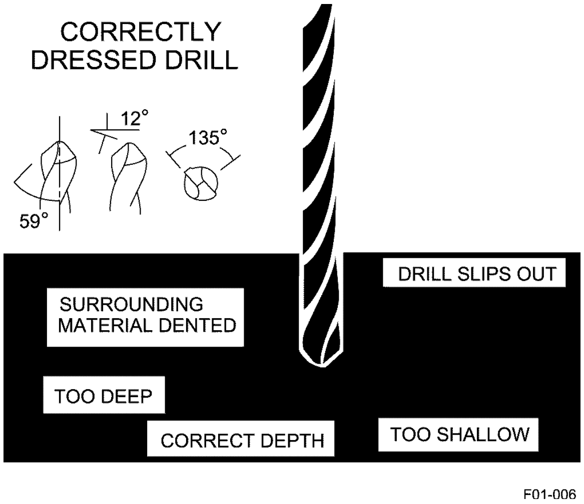


Figure 1-6. Drilling for Rivets

1.1.11 Countersinking for Installation of Rivets. When using countersunk rivets the material must also be countersunk so the rivet will fit flush with the surface. (See Figure 1-7.) When using a hand-operated countersink, the hole must be tried with a rivet so the recess will not be too deep. It is best to use a stop countersink with an electric drill motor so that the depth of the hole can be controlled. The minimum sheet thickness for machine countersinking 100-degree rivets is subject to the limitations shown in Table 1-10.

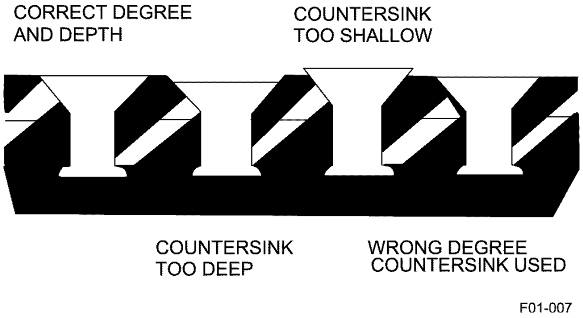


Figure 1-7. Countersinking for Rivet

1.1.12 Dimpling for Installation of Rivets. Dimpling is done with a punch and die set. The punch has a guide pin the size of the rivet hole and the same degree countersink as the rivet. The die has a hole and the same degree countersink as the punch. Dimpling is accomplished by inserting the punch in the rivet hole and then into the die, which should be resting on a solid surface. The punch is then struck, forming a dimple. Care must be taken to keep the striking surfaces parallel with the skin surface. Coin dimpling is accomplished by inserting the proper countersunk rivet in the hole. A recessed gun draw tool is placed over the rivet shank. As the rivet is driven, the head forms its own dimple and the rivet shank is upset in the usual manner. Power squeezers may be used for these operations. (See Figure 1-8.) Countersunk pin rivets are used only with machine countersinking or machine subcountersinking, then coin dimpling the top or outer sheet upon installation of the rivet.

1.1.13 Subcountersinking for Installation of Rivets. Subcountersinking is the process where the inner structure or skin is machine countersunk and the outer surface is dimpled or coin dimpled. The sheet thickness limitations for subcountersinking are shown in Table 1-11.

1.1.14 Rivet Failure. As a rule, riveted joints are designed on the assumption that the total joint strength is the summation of the strength of the rivets in the joint. It is then obvious that when any one rivet fails, its load must be distributed to the others, and if they are unable to withstand the added load, progressive joint failure will occur. Stress concentrations will usually cause one rivet to fail first, and visual detection of such a rivet in a joint indicates that it has been highly loaded, with the possibility that other rivets may actually have partially failed.

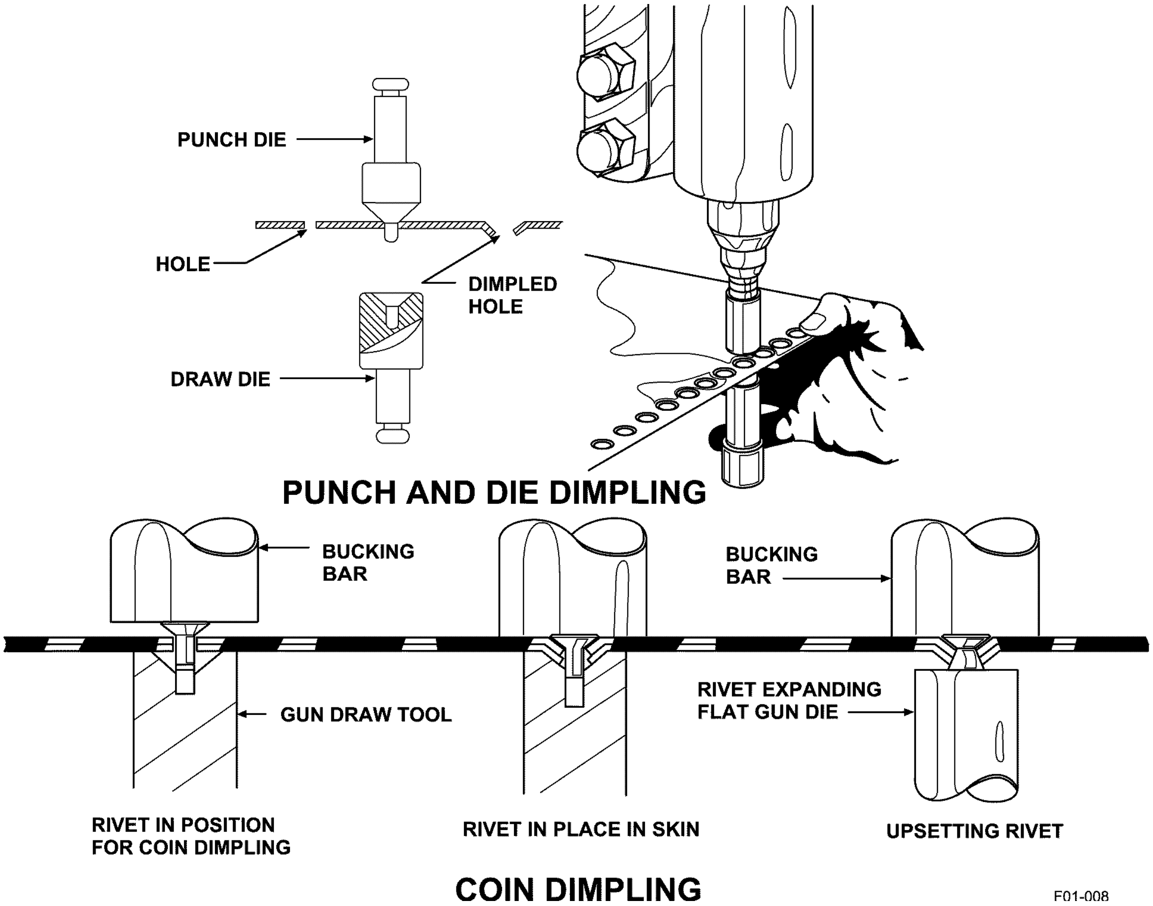


Figure 1-8. Dimpling for Installation of Rivets

1.1.15 Rivet Shear Failure. Shear failure, which is perhaps the most common, is simply a breakdown of the rivet shank caused by parallel forces exerted in opposite directions on the two sheets joined by the rivet. The slipping action may be severe enough to break the rivet shank in two. If the rivet shank has been loaded beyond the yield point of the material, permanent deformation occurs and the shank of the rivet is notched. Sheet displacement also occurs, causing the rivet holes to become out of alignment.

Table 1-10. Minimum Sheet Gage for 100-Degree Machine Countersink

Rivet Size	3/32	1/8	5/32	3/16	1/4
Gage	0.040	0.050	0.064	0.072	0.072

1.1.16 Rivet Bearing Failure. Bearing failure can occur in the sheet at the edge of the rivet hole if the rivet is excessively strong in shear. Large rivets in thin sheets cause such failures. The sheet is locally crushed in such cases, having been loaded beyond its yield point, and the resulting permanent distortion destroys the mechanical rigidity of the joint. If the hole elongation is slight, replacement can be made by the next larger size rivet. If the failure occurs at the edge of the sheet, causing appreciable distortion out to the sheet edge, or if complete tear-out has occurred, the sheet must be replaced.

1.1.17 Rivet Head Failure. Certain more complex loadings may be placed on a joint, causing tensions to be applied to the rivet head. Since rivets are not designed to withstand appreciable tension loads, the head may fall by shearing through the area corresponding to the rivet shank, or may fail through a prying action which causes failure of the head itself. Any visible head distortion in cause for replacement. This latter type of failure usually occurs with blind rivets (mechanically expanding or explosive) wherein the formed head is distorted by tension forces, allowing the rivet to crack, which continues until a rivet tension failure occurs. This is especially true of single shear lap joints in the thicker sheet gages.

1.1.18 Detecting Rivet Failures. Signs of rivet failure include tipped heads and looseness and sometimes chipped or cracked paint. If the heads are tipped in the same direction and the rivets are loose in consecutive groups, the joint has undergone excessive load. Rivet heads which appear to be tipped in different directions and are not in groups may be improperly installed. In the case of chipped or cracked paint, it may be necessary to remove the paint to check the true condition of the rivets. Rivets that have been subjected to critical loads but show no distortion should be inspected if failure is suspected. The head should be drilled off, and the shank should be carefully punched out. Failure will be indicated by the notched rivet shank and misaligned holes. Flush rivets that show head slippage within the dimple or countersink indicate either sheet bearing or rivet shear failure and must be removed for inspection and replacement. If failure of rivets cannot be detected by visual inspection, the joint can be checked by drilling and punching out several rivets. If the rivet shanks are notched, the rivets should be replaced with the next larger size rivets. If the rivet holes show elongation due to local failure in bearing of the sheet, the next larger size rivet must be used in replacement. Any deformation of the sheet around the rivet, tear outs, or cracks between the rivets usually indicates partially failed or damaged rivets. Complete repair of the joint will require replacement by the next larger size rivets. The practice of using the next 1/32-inch larger diameter rivet is necessary to obtain a tight joint when the original hole has been enlarged. If the original size rivet were installed, the rivet would not be able to carry its share of the shear load, and the joint would not meet its strength requirements.

Table 1-11. Minimum Gage for Subcountersinking

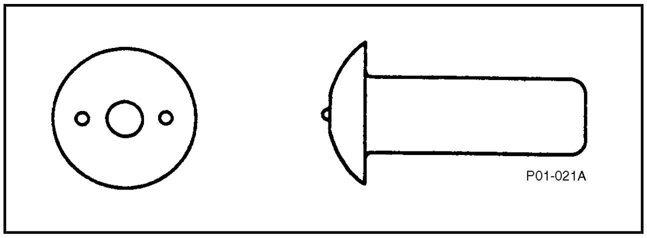
Rivet Size	3/32	1/8	5/32	3/16	1/4
Gage	0.040	0.064	0.072	0.072	0.072

1.1.19 Removal of Rivets. When removing rivets, care should be taken not to enlarge the rivet hole, as this would necessitate the use of a larger size rivet for replacement. To remove a rivet, file a flat surface on the manufactured head if accessible. It is always preferable to work on the manufactured head rather than on the one that is bucked over, since the former will always be more symmetrical about the shank. Indent the center of the filed surface with a center punch and use a drill of slightly less than shank diameter to drill through the rivet head. Remove the drill and, if the other rivet end is supported, shear the head off with a sharp chisel. Always cut along the direction of the plate edge. Firmly support the sheet from the opposite side and drive the shank out with a pin punch. If the rivet is unduly tight because of swelling between the sheets, drill the rivet out with an undersize drill. (See Figure 1-9.)

1.2 COMMON, SOLID SHANK RIVETS.

(Refer to Table 1-12 through Table 1-19.)

Table 1-12. NAS508 Universal Head, Monel, Common, Solid Shank Rivet



First Dash Number	Shank Diameter	Head Diameter
-M2	0.062 - 0.001/+0.003	0.125 ± 0.006
-M3	0.094 - 0.001/+0.003	0.187 ± 0.009
-M4	0.125 - 0.001/+0.003	0.250 ± 0.012
-M5	0.156 - 0.001/+0.004	0.312 ± 0.016
-M6	0.187 - 0.001/+0.004	0.375 ± 0.019
-M8	0.250 - 0.001/+0.004	0.500 ± 0.025

Code:

First dash number indicates nominal shank diameter in 1/32 inch.

Second dash number indicates length in 1/16 inch

Example of part number:

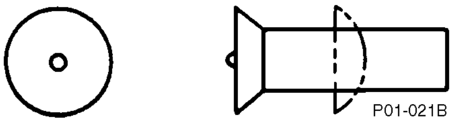
NAS508M3-12 = universal head rivet, 0.094-inch diameter, 3/4-inch length.

Material:

Monel, Federal Specification QQ-N-281, Class A annealed.

1.2.1 Types of Common, Solid Shank Rivets. Universal head, roundhead, flathead, brazier head, and countersunk head are the head styles of rivets used in aircraft repair. Universal head rivets are used for both interior and exterior application. Roundhead rivets are used in the interior of aircraft except where clearance is required for adjacent members. Flathead rivets are used in the interior of aircraft where interference of adjacent members does not permit the use of roundhead rivets. Brazier head rivets are used on the exterior of aircraft where there is no requirement for a flush surface. Countersunk head rivets are used on the exterior of aircraft where a smooth aerodynamic surface is desired. Countersunk head rivets permit dimpling of the structure to provide a higher shear strength.

Table 1-13. AN425 78-Degree Countersunk Head, Common, Solid Shank Rivet



First Dash Number	Shank Diameter	Head Diameter
-2	0.062 - 0.001/+0.003	0.112 ± 0.006
-3	0.094 - 0.001/+0.003	0.170 ± 0.008
-4	0.125 - 0.001/+0.0035	0.225 ± 0.011
-5	0.156 - 0.001/+0.004	0.282 ± 0.014
-6	0.187 - 0.001/+0.004	0.339 ± 0.017
-8	0.250 - 0.001/+0.004	0.452 ± 0.023

Code:

First dash number indicates nominal diameter in 1/32 inch.

Second dash number indicates length in 1/16 inch.

A after basic part number indicates 1100-H14 aluminum rivet.

AD after basic part number indicates 2117-T4 aluminum alloy rivet.

DD after basic part number indicates 2024-T4 aluminum alloy rivet.

D after basic part number indicates 2017-T4 aluminum alloy rivet.

Example of part number:

AN425A3-12 = 1100-H14 aluminum rivet, 3/32-inch diameter, 3/4-inch long.

Material:

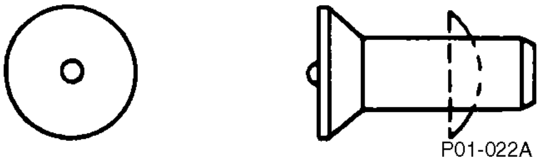
1100-H14 aluminum, Military Specification MIL-W-7986.

2017-T4 aluminum alloy, Military Specification MIL-W-7986.

2024-T4 aluminum alloy, Military Specification MIL-W-7986.

2117-T4 aluminum alloy, Military Specification MIL-W-7986.

Table 1-14. MS20426 100-Degree Countersunk Head, Common, Solid Shank Rivet



First Dash Number	Shank Diameter		Head Diameter ±0.004
	Min	Max	
-2	0.061	0.065	0.114
-3	0.093	0.097	0.179
-4	0.124	0.128	0.225
-5	0.155	0.159	0.286
-6	0.186	0.190	0.353
-8	0.249	0.253	0.476
-10	0.311	0.315	0.564
-12	0.374	0.378	0.694

Code:

First dash number indicates nominal diameter in 1/32 inch.

Second dash number indicates length in 1/16 inch.

A after basic part number indicates 1100-H14 aluminum rivet.

B after basic part number indicates 5056-H32 aluminum rivet.

AD after basic part number indicates 2117-T4 aluminum rivet.

DD after basic part number indicates 2024-T4 aluminum rivet.

D after basic part number indicates 2017-T4 aluminum rivet.

Example of part number:

AN426B3-12 = 5056-H32 aluminum rivet, 3/32-inch diameter, 3/4-inch long.

Material:

1100-H14 aluminum, Military Specification MIL-W-7986.

5056-H32 aluminum alloy, Military Specification MIL-W-7986.

2117-T4 aluminum alloy, Military Specification MIL-W-7986.

2024-T4 aluminum alloy, Military Specification MIL-W-7986.

2017-T4 aluminum alloy, Military Specification MIL-W-7986.

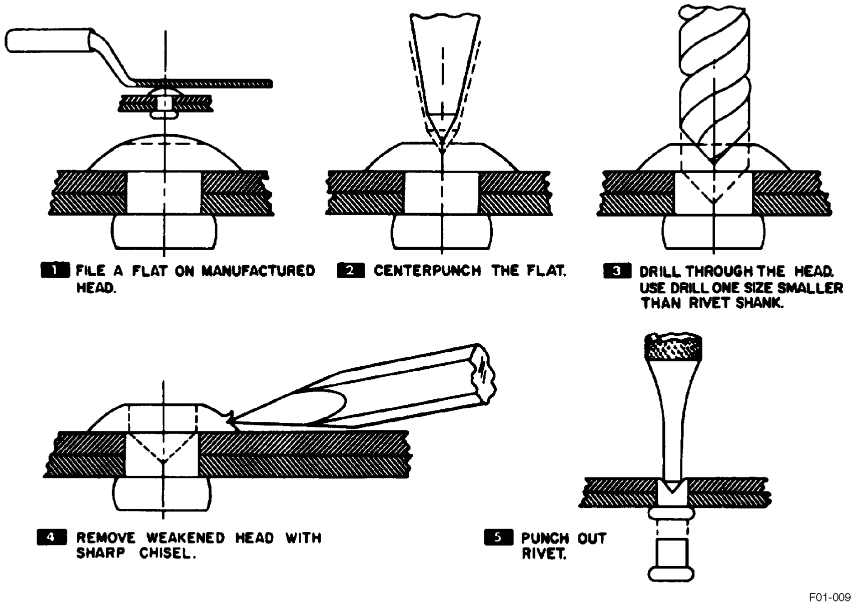
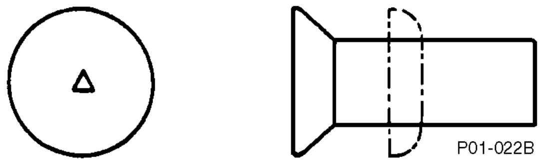


Figure 1-9. Removal of Rivets

Table 1-15. MS20427 100-Degree Countersunk Head, Common, Shank Rivet



First Dash Number	Shank Diameter		Head Diameter (Min)
	Min	Max	
-2	0.061	0.065	0.0898
-3	0.093	0.097	0.1548
-4	0.124	0.128	0.2006
-5	0.155	0.159	0.2566
-6	0.186	0.190	0.3234
-8	0.249	0.253	0.4412
-10	0.311	0.315	0.5288
-12	.0374	0.378	0.6586

Code:

First dash number indicates nominal diameter in 1/32 inch.

Second dash number indicates length in 1/16 inch.

Dash numbers shown are for carbon steel rivets, either cadmium- or zinc-plated.

C after basic part number indicates copper rivet (available in nominal diameters of 1/16 through 3/16 inch only).

F after basic part number indicates corrosion-resistant steel rivet.

M after basic part number indicates Monel rivet.

C after first dash number indicates cadmium-plated rivet.

U after first dash number indicates unplated, carbon steel rivet.

Z after first dash number indicates zinc-plated rivet.

Example of part number:

AN427-2C4 = cadmium-plated carbon steel rivet, 1/16-inch diameter, 1/4-inch long.

AN427M2C4 = cadmium-plated Monel rivet, 1/16-inch diamerer, 1/4-inch long.

Material:

Carbon steel, Federal Specification QQ-W-409 or QQ-S-633.

Corrosion-resistant steel, Federal Specification QQ-W-423.

Monel, Federal Specification QQ-N-281.

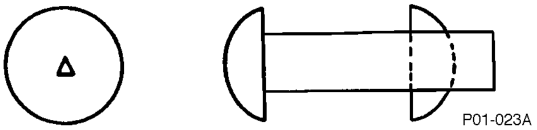
Copper, Federal Specification QQ-W-341.

Finish:

Cadmium plating, Federal Specification QQ-P-416, Type I, Class C.

Zinc plating, Federal Specification QQ-Z-325.

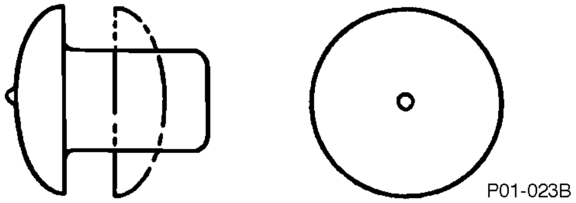
Table 1-16. AN435 Roundhead, Common, Solid Shank Rivet



First Dash Number	Shank Diameter	Head Diameter
-2	0.063 - 0.004/+0.003	0.109
-3	0.094 - 0.004/+0.003	0.166
-4	0.125 - 0.004/+0.004	0.219
-5	0.156 - 0.004/+0.004	0.273
-6	0.188 - 0.006/+0.004	0.327
-8	0.250 - 0.006/+0.004	0.438
-10	0.313 - 0.008/+0.004	0.546
-12	0.375 - 0.010/+0.005	0.656
-14	0.438 - 0.010/+0.005	0.765

Code:
First dash number indicates nominal diameter in 1/32 inch.
Second dash number indicates length in 1/16 inch.
Dash numbers shown are for carbon steel rivets.
C after basic part number indicates copper rivet (available in nominal diameters of 1/16 through 3/16 inch only).
F after basic part number indicates corrosion-resistant steel rivet.
M after basic part number indicates Monel rivet (available in nominal diameters of 1/16 through 1/4 inch only).
C after first dash number indicates cadmium-plated rivet.
U after first dash number indicates unplated, carbon steel rivet.
Z after first dash number indicates zinc-plated rivet.
P after last dash number indicates carbon steel rivet, either cadmium- or zinc-plated.
Example of part number:
AN435-2-2P = cadmium- or zinc-plated carbon steel rivet, 1/16-inch diameter, 1/8-inch long.
AN435M2C2 = cadmium-plated Monel rivet, 1/16-inch diameter, 1/8-inch long.
Material:
Carbon steel, Federal Specification QQ-W-409 or QQ-S-633.
Corrosion-resistant steel, Federal Specification QQ-W-423.
Monel, Federal Specification QQ-N-281.
Copper, Federal Specification QQ-W-341.
Finish:
Cadmium plating, Federal Specification QQ-P-416.
Zinc plating, Federal Specification QQ-Z-325.

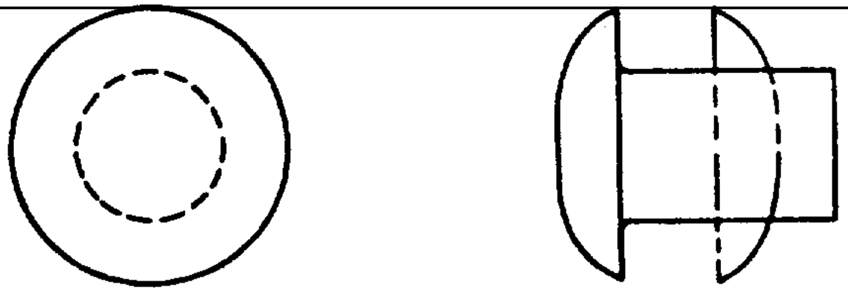
Table 1-17. MS20470 Universal Head, Common, Solid Shank Rivet



First Dash Number	Shank Diameter -0.001	Head Diameter
-2	0.062 + 0.003	0.125 ± 0.006
-3	0.094 + 0.003	0.187 ± 0.009
-4	0.125 + 0.0035	0.250 ± 0.012
-5	0.156 + 0.004	0.312 ± 0.016
-6	0.187 + 0.004	0.375 ± 0.019
-8	0.250 + 0.004	0.500 ± 0.025
-10	0.312 + 0.004	0.625 ± 0.031
-12	0.375 + 0.004	0.750 ± 0.037

Code:
First dash number indicates nominal diameter in 1/32 inch.
Second dash number indicates length in 1/16 inch.
A after basic part number indicates 1100-H14 aluminum rivet.
AD after basic part number indicates 2117-T4 aluminum alloy rivet.
B after basic part number indicates 5056-H32 aluminum alloy rivet.
D after basic part number indicates 2017-T4 aluminum alloy rivet.
DD after basic part number indicates 2024-T4 aluminum alloy rivet.
Example of part number:
AN470A2-12 = 1100-H14 aluminum rivet, 1/16-inch diameter, 3/4-inch long.
Material:
1100-H14 aluminum, Military Specification MIL-W-7986.
2017-T4 aluminum alloy, Military Specification MIL-W-7986.
2024-T4 aluminum alloy, Military Specification MIL-W-7986.
2117-T4 aluminum alloy, Military Specification MIL-W-7986.
5056-H32 aluminum alloy, Military Specification MIL-W-7986.

Table 1-18. AN123151 through AN123300, Universal Head, High Temperature, Common, Solid Shank Rivets; AN123301 through AN123450, Universal Head, High Temperature, Common, Solid Shank Rivets; AN125401 through AN125550, Universal Head, Common, Solid Shank Rivets; and AN125551 through AN125700, Universal Head, Common, Solid Shank Rivets



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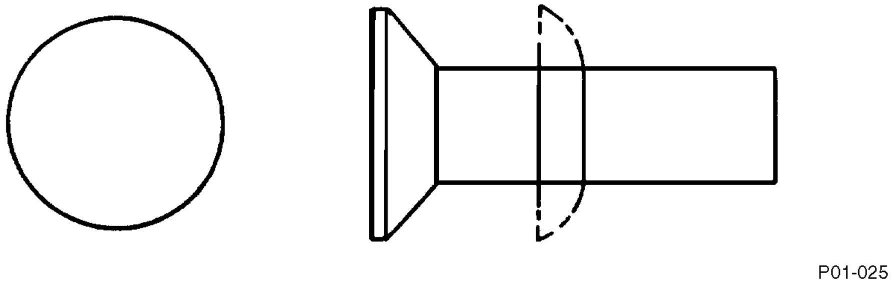
Basic Part Number	Shank Diameter	Head Diameter
AN123151 through AN123157 AN123301 through AN123307 AN125401 through AN125407 AN125551 through AN125557	0.062 ± 0.001	0.125 ± 0.006
AN123168 through AN123178 AN123318 through AN123328 AN125420 through AN125430 AN125570 through AN125580	0.094 ± 0.001	0.188 ± 0.009
AN123184 through AN123198 AN123334 through AN123348 AN125438 through AN125452 AN125588 through AN125602	0.125 +0.001/-0.002	0.250 ± 0.012
AN123201 through AN123214 AN123351 through AN123364 AN125457 through AN125470 AN125607 through AN125620	0.156 +0.001/-0.002	0.312 ± 0.016
AN123217 through AN123230 AN123367 through AN123380 AN125475 through AN125488 AN125625 through AN125638	0.188 +0.001/-0.002	0.375 ± 0.019
AN123234 through AN123246 AN123384 through AN123396 AN125494 through AN125506 AN125644 through AN125656	0.250 ± 0.002	0.500 ± 0.025
AN123255 through AN123262 AN123405 through AN123412 AN125517 through AN125524 AN125667 through AN125674	0.312 ± 0.002	0.625 ± 0.031
AN123272 through AN123278 AN123422 through AN123428 AN125536 through AN125542 AN125686 through AN125692	0.375 ± 0.002	0.750 ± 0.037

Table 1-18. AN123151 through AN123300, Universal Head, High Temperature, Common, Solid Shank Rivets; AN123301 through AN123450, Universal Head, High Temperature, Common, Solid Shank Rivets; AN125401 through AN125550, Universal Head, Common, Solid Shank Rivets; and AN125551 through AN125700, Universal Head, Common, Solid Shank Rivets - Continued

Material:
Corrosion- and heat-resistant steel, Aeronautical Material Specification AMS7229 (applicable to AN123151 through AN123300 only).
Corrosion- and heat-resistant steel, Aeronautical Material Specification AMS7232 (applicable to AN123301 through AN123450 only).
Corrosion-resistant steel, Aeronautical Material Specification AMS7228 (applicable to AN125401 through AN125550 only).
Steel, Aeronautical Material Specification AMS7225 (applicable to AN125551 through AN125700 only).
Finish:
Cadmium plating, Aeronautical Material Specification AMS2400 (applicable to AN125551 through AN125700 only).

Table 1-19. AN123451 through AN123600, Countersunk Head, High Temperature, Common, Solid Shank Rivets; AN123601 through AN123750 Countersunk Head, High Temperature, Common, Solid Shank Rivets; and, AN124951 through AN125100, 100-Degree Countersunk Head, Common, Solid Shank Rivets



Basic Part Number	Shank Diameter	Head Diameter
AN123451 through AN123459 AN123601 through AN123609 AN124951 through AN124959	0.062 ± 0.001	0.105 + 0.002/-0.006
AN123468 through AN123478 AN123618 through AN123628 AN124970 through AN124980	0.094 ± 0.001	0.170 +0.002/-0.006
AN123486 through AN123498 AN123636 through AN123648 AN124989 through AN125002	0.125 +0.001/-0.002	0.216 +0.002/-0.006
AN123502 through AN123514 AN123652 through AN123664 AN125008 through AN125020	0.156 +0.001/-0.002	0.278 +0.002/-0.006
AN123519 through AN123530 AN123669 through AN123680 AN125027 through AN125038	0.188 +0.001/-0.002	0.344 +0.003/-0.007
AN123537 through AN123546 AN123687 through AN123696 AN125047 through AN125056	0.250 ± 0.002	0.467 +0.003/-0.007
AN123555 through AN123562	0.312 ± 0.002	0.555 +0.003/-0.007

Table 1-19. AN123451 through AN123600, Countersunk Head, High Temperature, Common, Solid Shank Rivets; AN123601 through AN123750 Countersunk Head, High Temperature, Common, Solid Shank Rivets; and, AN124951 through AN125100, 100-Degree Countersunk Head, Common, Solid Shank Rivets - Continued

Basic Part Number	Shank Diameter	Head Diameter
AN123705 through AN123712 AN125067 through AN125074		
AN123572 through AN123578 AN123722 through AN123728 AN125086 through AN125092	0.375 ± 0.002	0.685 + 0.003/-0.007

Corrosion- and heat-resistant steel, Aeronautical Material Specification AMS7229 (applicable to AN123451 through AN123600 only).

Corrosion- and heat-resistant steel, Aeronautical Material Specification AMS7232 (applicable to AN123601 through AN123750 only).

Corrosion- and heat-resistant steel, Aeronautical Material Specification AMS7228 (applicable to AN124951 through AN125100).

1.2.2 Common, Solid Shank Rivet Strength. For structural applications, strength of the replacement rivet is of primary importance. Replacement should not be made with rivets of lower strength material unless the difference in strength is compensated for by use of a larger rivet. For example, a rivet of 2024-T4 material should not be replaced by a rivet of 2017-T4 or 2117-T4 material unless the next larger size is used. Similarly, when 2117-T4 rivets are used to replace 2017-T4 rivets, the next larger size should be used. Table 1-20 gives the allowable shear strength for raised head, machine countersunk, and simple countersunk rivets. Since shear values of rivets are dependent upon sheet thickness, Table 1-20 also shows single and double shear strength factors for figuring shear strength of rivets in various sheet thicknesses. Sheet thickness is that of the thinnest sheet in single shear joints and the middle sheet in double shear joints. The values of shear strength should be multiplied by the strength factors given in Table 1-20 when the ratio of hole diameter divided by sheet thickness is greater than 3.0 for single shear joints or 1.5 for double shear joints. See paragraaph 1.2.5 for other factors which affect the interchangeability of rivets with respect to head styles. A17050 rivets may be used as an optional substitute when strength is considered.

1.2.3 Common, Solid Shank Rivet Heat Treatment. For specific details in the heat treatment of metals used in rivets, refer to T.O. 1-1A-9, U.S. and British Commonwealth of Nations Aircraft Metals. The 2024-T4 rivets must never be driven while in a hardened condition. Rivets of 2024-T4 material must be driven within 20 minutes after quenching to avoid cracking, unless the rivets are kept at low temperatures. These rivets may be stored in dry ice for a period of two weeks, or for 24 hours when stored in ordinary ice. When removed from storage they must be driven within 20 minutes. If care is exercised, 2024-T4 rivets may be heat treated repeatedly without injury to the alloy. The number of heat treatments should be controlled on the basis of workability after repeated heat treatments. Parts to be riveted should be heat treated before riveting, since heat treating after riveting will cause the parts to warp. In addition to warping, the salt solution cannot be thoroughly washed out of crevices, which result in corrosive action on the parts.

1.2.4 Selection of Common, Solid Shank Rivets. The AN rivet code designation gives head type, material, and dimensions. To determine the correct rivet length for a given job, add to the thickness of the material through which the rivet must pass the values calculated as shown in Table 1-21.

1.2.5 Common, Solid Shank Rivet Substitution and Interchangeability. Substitution of rivets depends on material, size, and head style. Material considerations, as specified in paragraph 1.1.3, must be followed in substituting one rivet material for another. Where replacement of aluminum alloy rivets is necessary, the AN470 universal head rivets should be used to replace roundhead, flathead, and brazier head rivets. However, existing stocks of AN430, AN442, and AN456 rivets should be used until depleted. Countersunk rivets must be replaced by rivets of the same type and degree of countersink. If the required countersunk rivet heads are not available, a raised head rivet may be driven from the opposite side and upset into the countersink. Care must be taken in this operation to keep the flat surface of the tools parallel to the work. Rivet length should be such that both the hole and the countersink are completely filled. If this procedure is impractical, the drilled-out rivet head may be used as a washer, and a brazier head rivet inserted and driven in the normal manner. In this procedure, care must be taken to drill the hole in the center of the countersunk rivet head.

NOTE

The procedures outlined above should be confined to interior work and should not be used in exterior applications on flush-riveted skin surfaces.

1.2.6 Replacement of Common, Solid Shank Rivets with Special Rivets. In certain cases, common, solid shank rivets may be replaced by special rivets. (Refer to paragraphs 1.3.15 and 1.3.24.)

Table 1-20. Shear Strength of Aluminum Alloy Rivets (Pounds per Rivet)

Raised Head Rivets								
Rivet Material	**Rivet Diameter**							
	1/16	3/32	1/8	5/32	3/16	1/4	5/16	3/8
2117-T4	106	217	389	596	860	1556	2458	3511
2017-T4	120	246	441	675	974	1764	2786	3979
2024-T4	144	296	532	814	1175	2127	3359	4798
5056-H32	95	195	347	536	774	1400	2210	3160
100° Dimple Countersunk								
2117-T4		276	480	735	1020			
2017-T4		300	530	810	1130			
2024-T4		350	620	950	1325			
100° Machine Countersunk								
2117-T4		186	331	518	745			
2017-T4		206	368	574	828			
2024-T4		241	429	670	966			
Shear Strengths of Protruding and Flush Head Aluminum Alloy Rivets (Pounds)								
5056	99	203	363	556	802	1450	2290	3280
2117-T3	106	217	388	596	862	1550	2460	3510
2017-T31	120	247	442	675	977	1760	2790	3970
2017-T3	135	275	494	755	1090	1970	3110	4450
2024-T31	145	296	531	815	1180	2120	3360	4800
Single Shear Rivet Strength Factors								
Sheet Thickness								
0.014								
0.016	0.964							
0.018	0.984							
0.020	0.996							
0.025	1.000	0.972						
0.032		1.000	0.964					
0.036			0.980					
0.040			0.996	0.964				
0.045			1.000	0.980				
0.051				0.996	0.972			
0.064				1.000	1.000	0.964		
0.072						0.980	0.964	
0.081						0.996	0.974	
0.091						1.000	0.984	
0.102							0.996	0.972
0.128							1.000	1.000

Table 1-20. Shear Strength of Aluminum Alloy Rivets (Pounds per Rivet) - Continued

Single Shear Rivet Strength Factors

Sheet Thickness								
0.156								
0.188								
0.250								

Double Shear Rivet Strength Factors

Sheet Thickness								
.014								
.016	0.688							
.018	0.753							
.020	0.792							
.025	0.870	0.714						
.032	0.935	0.818	0.688					
.036	0.974	0.857	0.740					
.040	0.987	0.896	0.792	0.688				
.045	1.000	0.922	0.831	0.740				
.051		0.961	0.870	0.792	0.714			
.064		1.000	0.935	0.883	0.818	0.688		
.072			0.974	0.919	0.857	0.740		
.081			1.000	0.948	0.896	0.792	0.688	
.091				0.974	0.922	0.831	0.753	
.102				1.000	0.961	0.870	0792	0.714
.128					1.000	0.935	0.883	0.818
.156						0.987	0.935	0.883
.188						1.000	0.974	0.935
.250							1.000	1.000

Table 1-21. Calculating Correct Rivet Length

Rivet Diameter	Material Thickness	Add
1/4 inch or less	1/2 inch or less	1-1/2 X diameter of rivet
1/4 inch or less	Over 1/2 inch	1-1/2 X diameter of rivet +1/16 inch for every 1/2 inch of material thickness
5/16 inch or more	1 inch or less	1-1/2 X diameter of rivet
5/16 inch or more	Over 1 inch	1-1/2 X diameter of rivet +1/16 inch for every 1 inch of material thickness

1.2.7 Replacement of Common, Solid Shank Rivets with Bolts and Screws. Cadmium- or zinc-plated steel standard bolts or NAS, AN, or MS structural screws may be used to replace standard, solid shank rivets only when the proper rivets or riveting equipment are not available. In such cases, steel bolts or screws the same size as the replaced rivet are adequate. Care should be taken to obtain a close fit in such installations. Zinc-plated bolts are not to be used in place of stainless steel rivets where subjected to temperatures in excess of 371°C (700°F), because of rapid deterioration. Cadmium-plated bolts are not to be used in place of stainless steel rivets where subjected to temperatures in excess of 204°C (400°F), because of lessened resistance to corrosion at the higher temperatures. Countersunk head screws may be used to join thin, dimpled sheets with threads in bearing, since the load carried from sheet to sheet through the dimples imposes a load on the screw in tension rather than in shear.

1.2.8 Installation of Common, Solid Shank Rivets. After drilling and prior to driving the rivets, the parts to be joined must be secured firmly in position to prevent slipping during riveting. C-clamps may be used for this purpose, or any of several varieties of skin fasteners may be inserted in previously drilled holes. (See Figure 1-10.) Self-tapping screws may also be used, but they must be small enough so that the holes may be reworked to the proper rivet size. Take care when installing the screws to prevent the screwdriver from marring the skin surface. When riveting thin gage materials, care must be taken in handling rivet tools to avoid damaging the material. All aircraft power riveting is done by upsetting or heading the rivet shank against a bucking bar. The three methods of driving rivets are: hand, squeeze, and pneumatic gun.

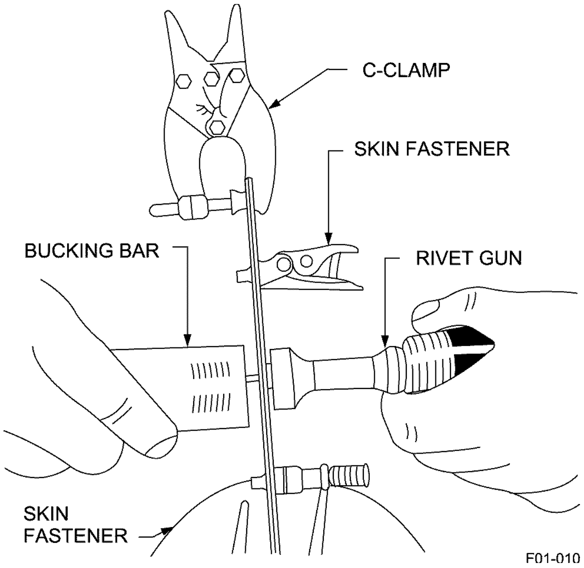


Figure 1-10. Fasteners for Riveting

1.2.9 Driving Common, Solid Shank Rivets by Hand. Hand riveting should be done only when power riveting is impossible due to lack of facilities or to inaccessibility to work area. Hand riveting is generally accomplished by driving from the head end and bucking the shank, or by driving from the shank end and bucking the head with a rivet set attached to a bucking bar. A 12– to 16-ounce ballpeen hammer is heavy enough to drive most rivets. The bucking bar and rivet set must be held square to the work. To get good results, as few hammer strokes as possible should be used. It is possible to install countersunk rivets by bucking the shank and driving on the head; however, it is preferable to insert a nonflush rivet and upset the shank into the countersink.

1.2.10 Driving Common, Solid Shank Rivets Using Rivet Squeezers. The squeeze method is limited to locations where it is effective and is used only over the edge of sheets. The two types of riveters, hand and pneumatic, are basically the same, the difference being in the actuating power. One jaw of the squeezer is stationary and serves as a bucking bar, while the movable jaw upsets the shank. (See Figure 1-11.)

1.2.11 Driving Common, Solid Shank Rivets Using Pneumatic Rivet Gun. The pneumatic rivet gun (Figure 1-12) used in conjunction with a separate bucking bar (Figure 1-13) is the most common and most satisfactory method of riveting. It is used with a rivet set and applied to the head end of the rivet. Pressure is applied in a series of rapid strokes and the shank end is upset against the bucking bar. The gun and bucking bar must be held at right angles to the work at all times, and sufficient pressure exerted to keep the tools from jumping off the rivet. Excessive pressure should be avoided because it may result in dented surfaces and bent stringers.

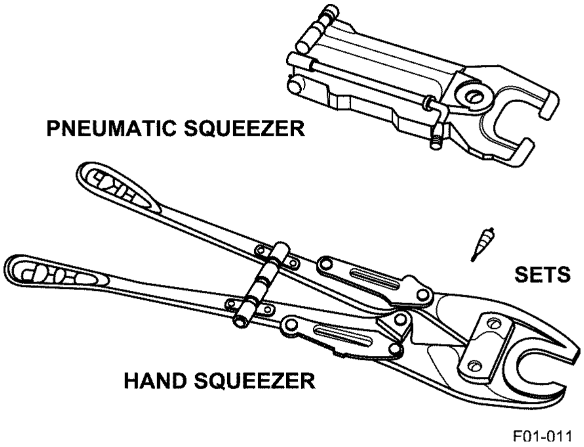


Figure 1-11. Rivet Squeezers

1.3 RIVET SETS.

A rivet set is a tool with a die in one end for driving a particular type of rivet and is used in both hand and pneumatic methods. Rivet sets are made of hardened, polished steel. They must be kept smooth and well-polished at all times.

1.3.1 Rivet Draw Sets. A draw set (Figure 1-14) is essentially a rod with a hole drilled in one end which is 1/32-inch larger than the rivet shank for which it is made. The depth of the hole is sufficiently shallow to expand the shank of the rivet at the same time the rivet draws the sheets together.

1.3.2 Rivet Bucking Bars. Bucking bars are made in a variety of shapes to facilitate rivet bucking in any possible location. They are made of hardened steel and must be kept clean, smooth, and well-polished at all times. Figure 1-13 gives general shapes for a set of bucking bars required to perform work in most locations of aircraft. Certain areas may require specially made bucking bars.

1.3.3 Rivet Driving Practice and Precautions. Inasmuch as riveting is the major means of joining aircraft parts, the proper procedures must be followed to maintain a high quality of workmanship. Examples of correctly and incorrectly driven rivets are shown in Figure 1-15. Table 1-22, which should be used with Figure 1-15, lists types of faulty rivet installations, their causes, and corrective action to be taken. The height of the shop head of a solid shank rivet should be 0.3 to 0.5 of the shank diameter. The diameter of the shop head should be 1.4 to 1.5 times the shank diameter. If there is any appreciable deviation, remove and replace rivet.

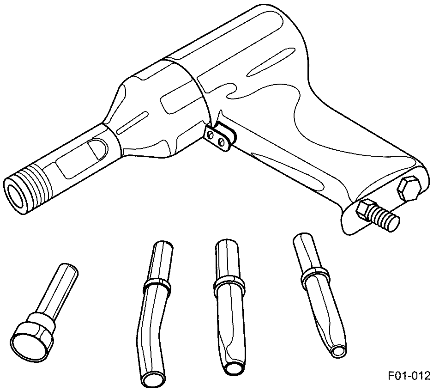


Figure 1-12. Pneumatic Rivet Gun and Rivet Sets

1.3.4 Pin Rivets. (Refer to Table 1-23 through Table 1-32.) Pin rivets are essentially threadless bolts. The pin is headed at one end and is grooved about the circumference at the other. A metal collar is swaged onto the grooved end, effecting a firm tight fit. Pin rivets are made in a variety of materials and are used only in shear applications. Due to the shear strength being greater than either the shear or bearing strength of aluminum alloys, pin rivets are used to greater advantage only in the thicker gage sheets. They are never used where the grip length is less than the shank diameter. The 100-degree countersunk type is used where flush surfaces are desired. An example of the part numbering system is shown in Table 1-23.

1.3.5 Substitution of Bolts for Pin Rivets. Pin rivets may be replaced with AN bolts of the same diameter and self-locking nuts, using flush head bolts for flush head rivets and protruding head bolts for protruding head rivets. The bolt thread must not extend into the material.

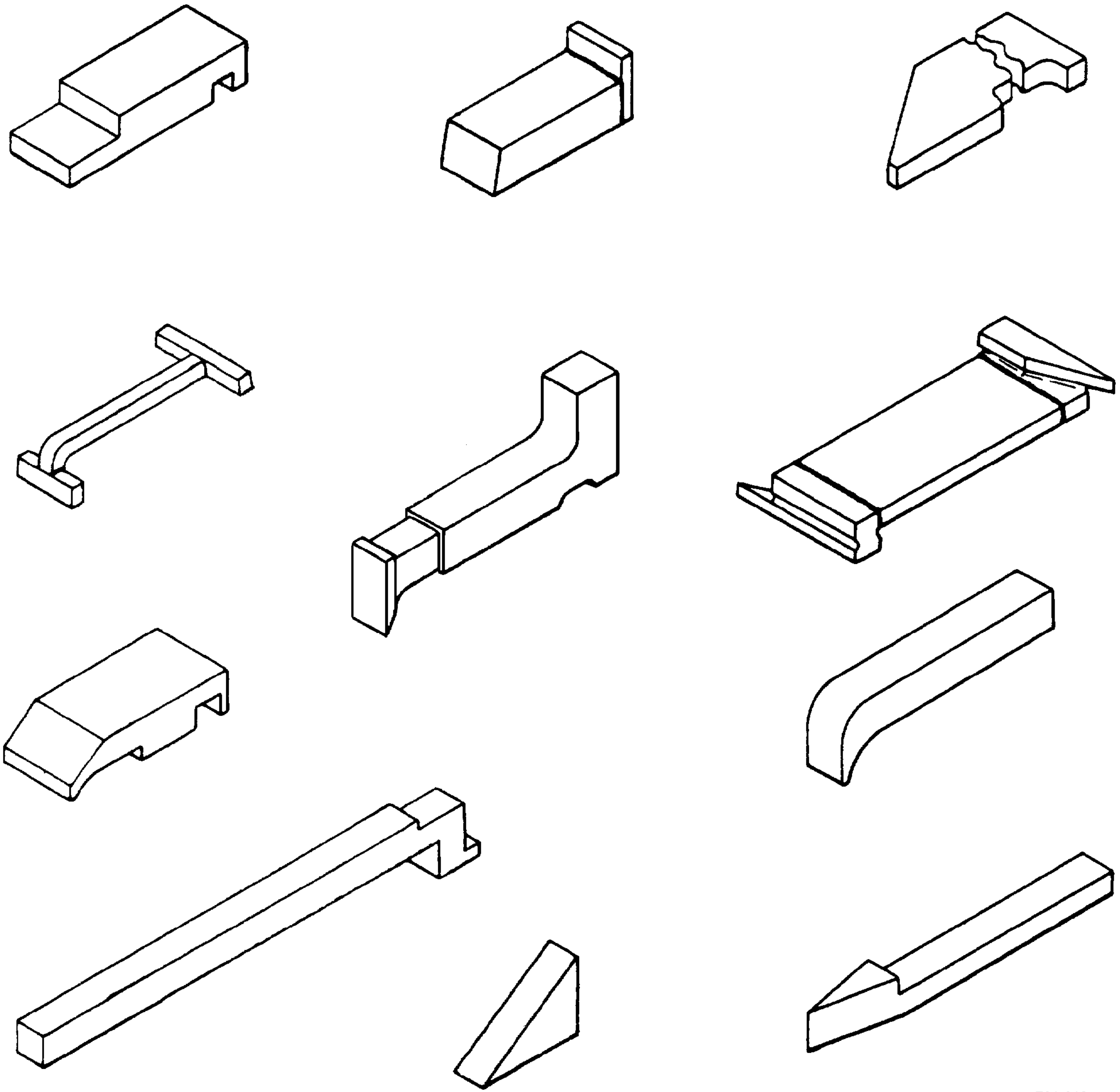


Figure 1-13. Types of Bucking Bars

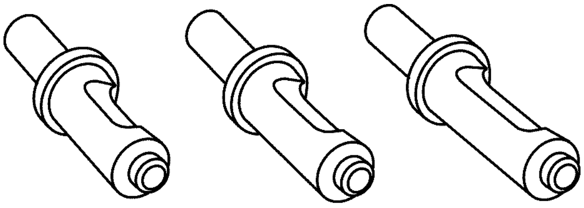


Figure 1-14. Draw Sets

1.3.6 Selection of Pin Rivets. The proper length rivet may be determined by the code or by trial. The last dash number gives the rivet grip length in sixteenths of an inch. In determining the correct length, the straight portion of the shank should not extend more than 1/16 inch through the work. If necessary, a washer may be placed under the collar or under the head of the stud as an adapter to give the proper shank protrusion.

1.3.7 Spotfacing for Installation of Pin Rivets. Spotfacing should be used under the head of a rivet where the surface is not level, but need not be used under the collar unless the angle of the surface is not perpendicular to the centerline of the rivet hole by more than five degrees. The size of the spotface for the head need not be much greater than the rivet diameter, but in the case of the collar, the spotface must often be large enough to allow for riveting tool clearance. (See Figure 1-5.)

Table 1-22. Correctly and Incorrectly Driven Rivets

Imperfection		Cause	Remedy	Action
A	None.	None.	None.	None.
B	Cut head.	Improperly held tools.	Hold riveting tools firmly against work.	Replace rivet.
C	Excessively flat head, resultant head cracks.	Excessive driving, too much pressure on bucking bar.	Improve riveting technique.	Replace rivet.
D	Sheet separation.	Work not held firmly together and rivet shank swelled.	Fasten work firmly together to prevent slipping.	Replace rivet.
E	Sloping head.	a. Bucking bar not held firmly. b. Bucking bar permitted to slide and bounce over the rivet.	Hold bucking bar firmly without too much pressure.	Replace rivet.
F	Buckled shank.	Improper rivet length, and E above.	E above and rivet of proper length.	Replace rivet.

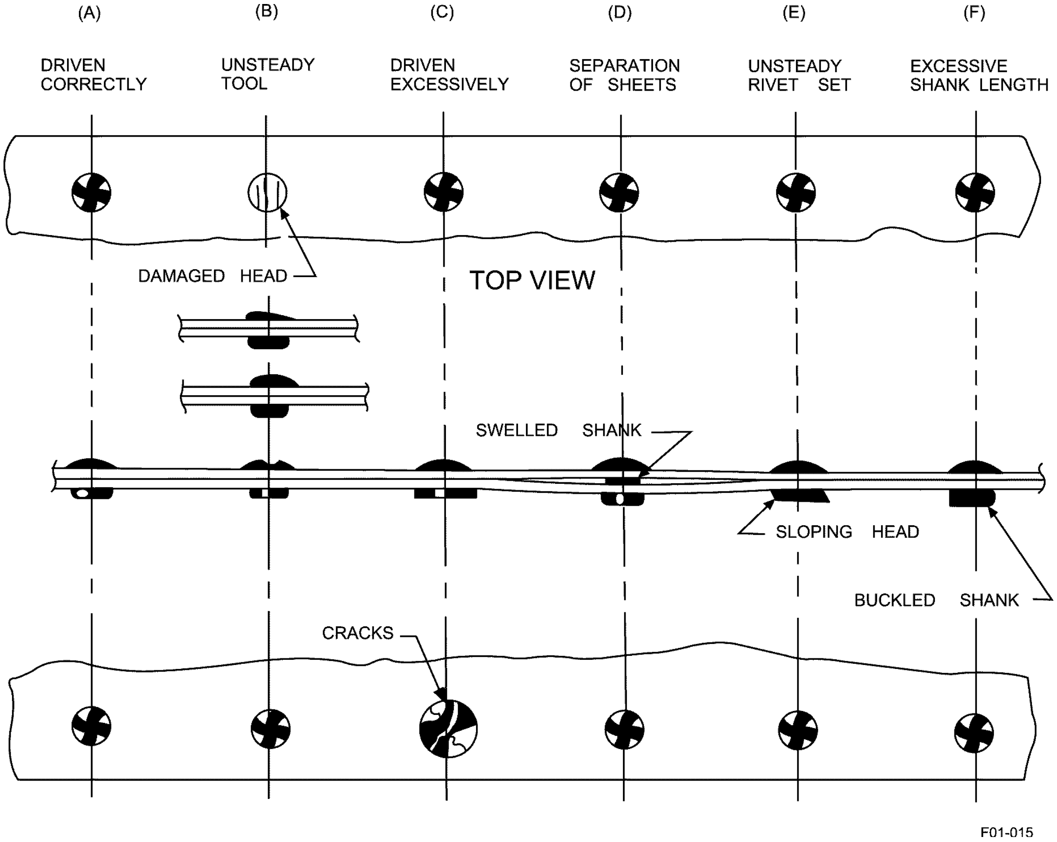
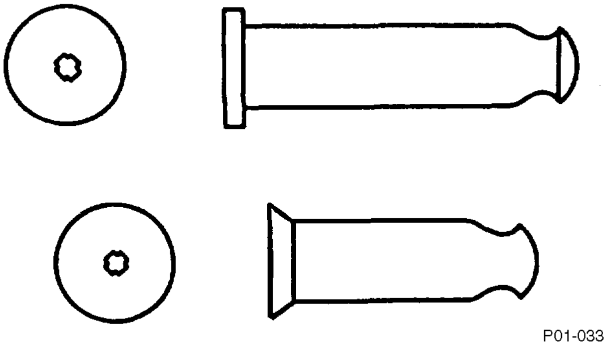


Figure 1-15. Correctly and Incorrectly Driven Rivets

Table 1-23. NAS177 100-Degree Countersunk Head, Pin Rivet ANS NAS178 Flathead Pin Rivet



First Dash Number	Shank Diameter	
	Min	Max
-4	.1215	.1240
-6	.1865	.1890
-8	.2460	.2490
-10	.3085	.3115

Table 1-23. NAS177 100-Degree Countersunk Head, Pin Rivet ANS NAS178 Flathead Pin Rivet - Continued

First Dash Number	Shank Diameter	
	Min	Max
-12	.3710	.3740
-14	.4330	.4365
-16	.4955	.4990
-18	.5575	.5615
-20	.6200	.6240
-24	.7440	.7490
-28	.8690	.8740
-32	.9930	.9990

Code:
First dash number indicates nominal diameter in 1/32 inch.
Second dash number indicates maximum grip in 1/16 inch when NAS179 collar is used.
Example of part number:
NAS177-14-17 = pin rivet, 7/16-inch diameter, 1-1/16 inch maximum grip.
Material:
Steel, Military Specifications MIL-S-5626, MIL-S-6049, MIL-S-6050, MIL-S-6098, MIL-S-6758, and MIL-S-8695.
Heat treatment:
125,000 to 150,000 PSI, Military Specification MIL-H-6875.
Finish:
Cadmium plating, Federal Specification QQ-P-416, Type I, Class C.

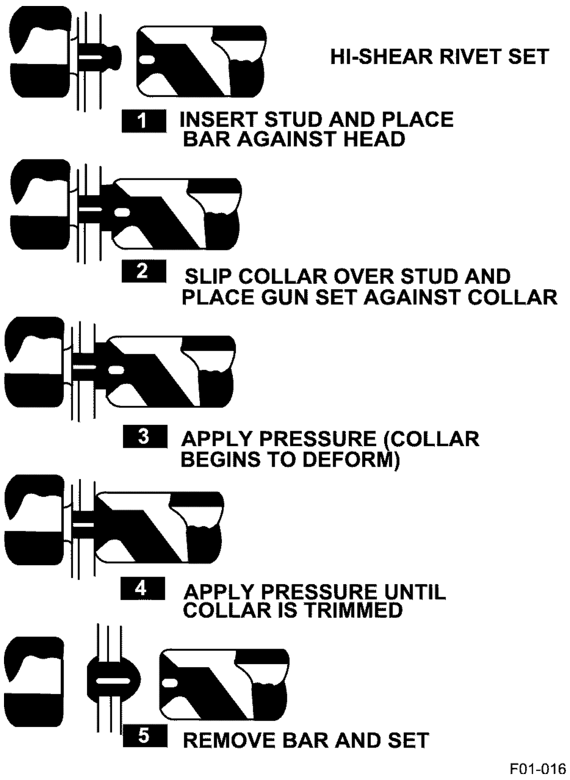


Figure 1-16. Using Pin Rivet Set

1.3.8 Tools for Installation of Pin Rivets. The special tools required for use with pin rivets differ from conventional sets only in the design of the collar swaging and trimming features and the discharge port through which excess collar material is ejected. (See Figure 1-16.) Various tools and combinations of tools are available for installing rivets in limited-access areas.

1.3.9 Installation of Pin Rivets. Pin rivets may be driven from either end. With the exception of slipping the collar over the stud, and the use of the special rivet set, the general driving procedure is similar to that of common, solid shank rivets. (See Figure 1-17.)

1.3.10 Driving Pin Rivet from Collar End.

a. Insert pin rivet into hole.

b. Place bucking bar against rivet head.

c. Slip the collar over end of protruding rivet end.

d. Place rivet set over collar and align with rivet.

e. Apply pressure on rivet set. Collar will form in locking groove on rivet.

f. Continue applying pressure until collar is properly formed, and excess collar material is trimmed off. (See Figure 1-18).

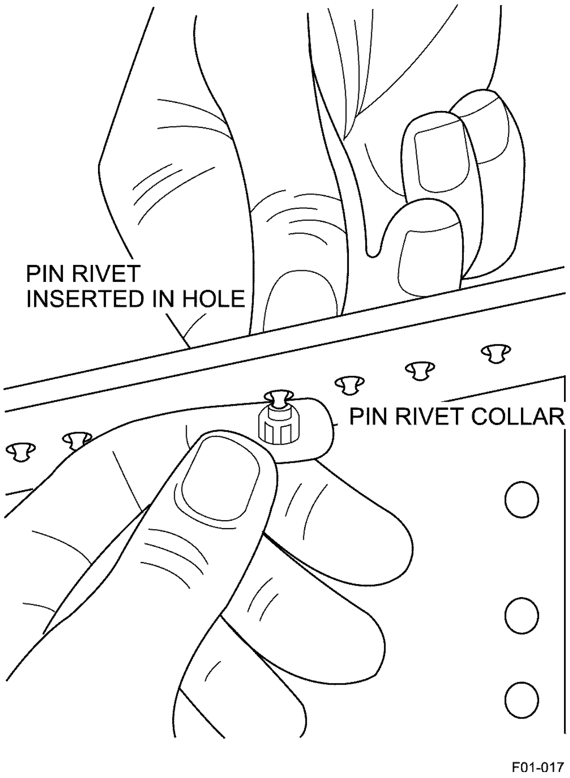


Figure 1-17. Inserting Pin Rivet

1.3.11 Driving Pin Rivet from Head End.

a. Insert rivet in hole.

b. Slip collar over protruding end of rivet and place bucking bar, with a rivet set insert into it, against the collar.

c. Apply pressure with a rivet gun and flush rivet set from the head end until the collar is formed in the rivet groove.

d. Continue applying pressure until excess collar material is trimmed off. (See Figure 1-19.)

1.3.12 Precautions in Using Pin Rivets. Use of pin rivets requires observance of certain precautions not associated with common, solid shank rivets. Those listed below, with examples shown in Figure 1-21, are those most frequently encountered.

a. Be sure sheets are clamped together firmly to avoid selecting a stud that is too long.

b. To assure that correct length stud is used, drive a few test rivets into a material of thickness equal to that of the actual work. The straight portion of the shank should not protrude more than 1/16 inch through the work.

c. Be sure rivet fits snugly in the hole. Pin rivets do not expand to fill oversize holes.

d. Keep rivet set aligned with rivet stud so that the collar will seat evenly, shear off evenly, and be uniform around the rivet.

e. Be sure the holes are properly aligned. Pin rivets are used where shear loads are high and the amount of bearing surface is critical.

f. Do not overdrive the rivet more than 1/32 inch, or the tensile strength of the collar-formed head will be reduced.

g. Do not underdrive the rivet. An underdriven rivet indicates that the collar has not been swaged completely into the rivet groove, and the rivet may fail under full tension loads.

Table 1-24. NAS525 100-Degree Countersunk Head, Close-Tolerance Head and Shank, Pin Rivet and NAS529 Flathead, Close-Tolerance Shank, Pin Rivet

First Dash Number	Shank Diameter		Head Diameter		
				NAS529	
	Min	Max	NAS525 (Min)	Min	Max
-6	.1893	.1904	.2578	.295	.315
-8	.2491	.2502	.3504	.387	.412

Table 1-24. NAS525 100-Degree Countersunk Head, Close-Tolerance Head and Shank, Pin Rivet and NAS529 Flathead, Close-Tolerance Shank, Pin Rivet - Continued

First Dash Number	Shank Diameter		Head Diameter		
				NAS529	
	Min	Max	NAS525 (Min)	Min	Max
-10	.3116	.3127	.4289	.475	.505
-12	.3741	.3752	.5149	.565	.600
-14	.4366	.4377	.6047	.641	.676
-16	.4990	.5001	.6901	.735	.770
-18	.5615	.5626	.7655	.829	.864
-20	.6238	.6250	.8518	.918	.953

Dash numbers 6 through 12 are used with NAS528 collars.

Dash numbers 14 through 20 are used with NAS179 collars.

Code:

Second dash number indicates maximum grip in 1/16 inch.

Example of part number:

NAS529-12-16 = flathead, pin rivet, 1-inch maximum grip.

Material:

Steel, Military Specifications MIL-S-6098, MIL-S-6049, MIL-S-5626, MIL-S-5000, MIL-S-6758, MIL-S-8695, and MIL-S-8503.

Heat treatment:

160,000 to 180,000 PSI, Military Specification MIL-H-6875.

Finish:

Cadmium plating, Federal Specification QQ-P-416, Type I, Class C.

Table 1-25. NAS1054 Protruding Head, Pin Rivet and NAS1055 100-Degree, Flush, Close-Tolerance Head, Pin Rivet


P01-035

First Dash Number	Shank Diameter		Head Diameter		
			NAS1054		NAS1055 (Min)
	Min	Max	Min	Max	
-4	.1215	.1240	.188	.208	.1787
-5	.1535	.1560	.242	.262	.2203
-6	.1870	.1895	.295	.315	.2578
-8	.2470	.2495	.387	.412	.3504
-10	.3095	.3120	.475	.505	.4289
-12	.3720	.3745	.565	.600	.5149

Table 1-25. NAS1054 Protruding Head, Pin Rivet and NAS1055 100-Degree, Flush, Close-Tolerance Head, Pin Rivet - Continued

NAS1054 and NAS1055 pin rivets are used with NAS179 or NAS528 collars.

Code:

Second dash number indicates maximum grip in 1/16 inch.

Example of part number:

NAS1054-6-8 = protruding head, pin rivet, 1/2-inch maximum grip.

Material:

Steel, Military Specifications MIL-S-6098, MIL-S-6049, MIL-S-8503, MIL-S-5626, MIL-S-5000, MIL-S-8695, and MIL-S-6758.

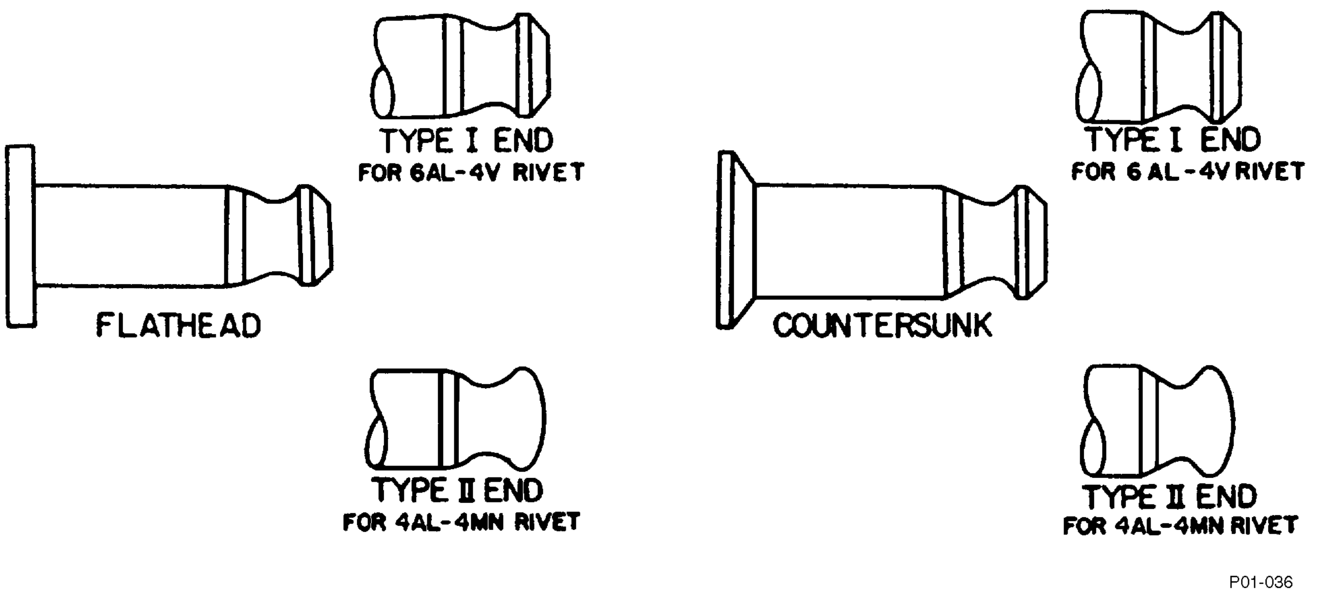
Heat treatment:

160,000 to 180,000 PSI, Military Specification MIL-H-6875.

Finish:

Cadmium plating, Federal Specification QQ-P-416, Type II, Class C.

Table 1-26. NAS1806 through NAS1816, Titanium Alloy, Flathead, Interference Fit, Pin Rivets and NAS1906 through NAS1916, Titanium Alloy 100-Degree Head, Interference Fit, Pin Rivets



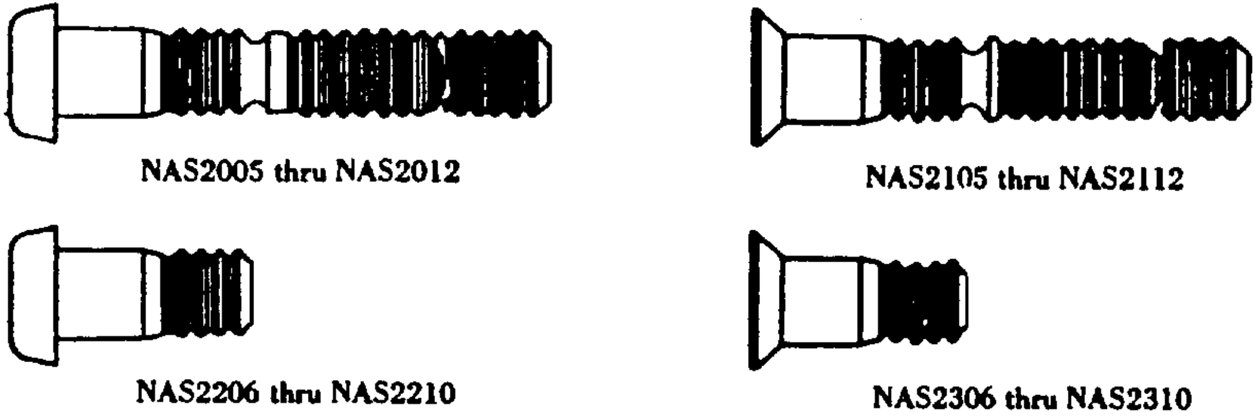
	Shank Diameter		Head Diameter		
			NAS1806 Through NAS1816		NAS1906 Through NAS1916 (Min)
Basic Part Number	Min	Max	Min	Max	
1806	.1890	.1895	.295	.315	.258
1906					
1808					
1908	.2490	.2495	.387	.412	.350
1810					
1910	.3115	.3120	.475	.505	.429
1812					

Table 1-26. NAS1806 through NAS1816, Titanium Alloy, Flathead, Interference Fit, Pin Rivets and NAS1906 through NAS1916, Titanium Alloy 100-Degree Head, Interference Fit, Pin Rivets - Continued

Basic Part Number	Shank Diameter		Head Diameter		
			NAS1806 Through NAS1816		NAS1906 Through NAS1916 (Min)
	Min	Max	Min	Max	
1912	.3740	.3745	.565	.600	.515
1814					
1914	.4365	.4370	.641	.676	.605
1816					
1916	.4990	.4995	.735	.770	.690

NAS1806 through NAS1812 and NAS1906 through NAS1912 are used with NAS528 collars.
NAS1814, NAS1816, NAS1914, and NAS1916 are used with NAS179 collars.
Code:
Last two digits of basic part number indicate nominal diameter in 1/32 inch.
Dash number indicates maximum grip in 1/16 inch.
V after basic part number indicates 6A1-4V titanium alloy rivet.
Example of part number:
NAS1808-12 = flathead, 4A1-4Mn titanium alloy, pin rivet, 1/4-inch diameter, 3/4-inch maximum grip.
NAS1908V12 = 100-degree head, 6A1-4V titanium alloy, pin rivet, 1/4-inch diameter, 3/4-inch maximum grip.
Material:
4A1-4Mn titanium alloy, National Aircraft Standard NAS621.
6A1-4V titanium alloy, National Aircraft Standard NAS621.

Table 1-27. NAS2005 through NAS2012 Pin, Rivet, Swage Locking, Titanium Alloy, Protruding Head, Tension, Pull Type; NAS2105 through NAS2112 Pin, Rivet, Swage Locking, Titanium Alloy, 100 Degree Head, Tension, Pull Type; NAS2206 through NAS2210 Pin, Rivet, Swage Locking, Titanium Alloy, Protruding Head, Tension, Stump Type; NAS2306 through NAS2310 Pin, Rivet, Swage Locking, Titanium Alloy, 100 Degree Head, Tension Stump Type



NAS2005 thru NAS2012

NAS2105 thru NAS2112

NAS2206 thru NAS2210

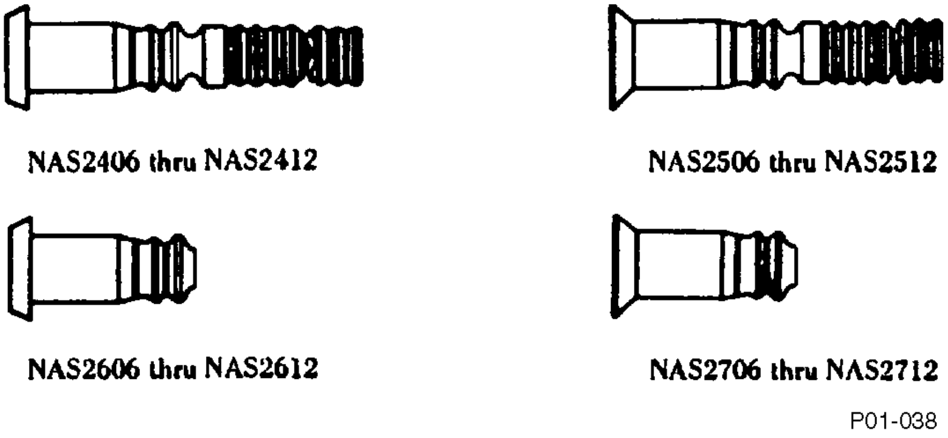
NAS2306 thru NAS2310

P01-037

Basic Part Number	Shank Diameter		Head Diameter				
			NAS2005 Through NAS2012		NAS2105 Through NAS2112 and NAS2306 Through NAS2310 (Min)	NAS2206 Through NAS2210	
	Min	Max	Min	Max		Min	Max
NAS2005 NAS2105	.1635	.1640	.258	.282	.298		
NAS2006 NAS2106 NAS2206 NAS2306	.1890	.1895	.297	.327	.344	.302	.317
NAS2008 NAS2108 NAS2208 NAS2308	.2490	.2495	.390	.430	.454	.396	.411
NAS2010 NAS2110 NAS2210 NAS2310	.3115	.3120	.485	.535	.574	.500	.515
NAS2012 NAS2112	.3740	.3745	.595	.655	.693		

NAS2005 and NAS2105 are used with NAS1080-5 collars.
NAS2006, NAS2106, NAS2206, and NAS2306 are used with NAS1080-6 collars.
NAS2008, NAS2108, NAS2208, and NAS2308 are used with NAS1080-8 collars.
NAS2010, NAS2110, NAS2210, and NAS2310 are used with NAS1080-10 collars.
NAS2012 and NAS2112 are used with NAS1080-12 collars.
Code:
Last two digits of basic part number indicate nominal diameter in 1/32 inch.
Dash number indicates nominal grip in 1/16 inch.
V after basic part number indicates 6A1-4V titanium alloy rivet.
Example of part number:
NAS2206-8 = protruding head, 4A1-4Mn titanium alloy, pin rivet, 3/16-inch diameter, 1/2-inch nominal grip.
NAS2306VB = 100-degree head, 6A1-4V titanium alloy, pin rivet, 3/16-inch diameter, 1/2-inch nominal grip.
The above is also available with sealant escape groove; and ''H'' in place of NAS to part number, example H2306V8.
Material:
4A1-4Mn titanium alloy, National Aircraft Standard NAS621.
6A1-4V titanium alloy, National Aircraft Standard NAS621.

Table 1-28. NAS2406 through NAS2412 Pin, Rivet, Swage Locking, Titanium Alloy, Protruding Head, Shear, Pull Type; NAS2506 through NAS2512 Pin, Rivet, Swage Locking, Titanium Alloy, 100 Degree Shear Head, Pull Type; NAS2606 through NAS2612 Pin, Rivet, Swage Locking, Titanium Alloy, Protruding Head, Shear, Stump Type; NAS2706 through NAS2712 Pin, Rivet, Swage Locking, Titanium Alloy, 100 Degree Shear Head, Stump Type



Basic Part Number	Shank Diameter		Head Diameter			
			NAS2406 Through NAS2412 and NAS2606 Through NAS2612		NAS2506 Through NAS2512 and NAS2706 Through NAS2712	
	Min	Max	Min	Max	Min*	Max*
NAS2406 NAS2506 NAS2606 NAS2706	.1890	.1895	.288	.302	.262	.305
NAS2408 NAS2508 NAS2608 NAS2708	.2490	.2495	.363	.377	.344	.399
NAS2410 NAS2510 NAS2610 NAS2710	.3115	.3120	.455	.471	.416	.479
NAS2412 NAS2512 NAS2612 NAS2712	.3740	.3745	.549	.565	.494	.566

*For Engineering reference only.

NAS2406, NAS2506, NAS2606, and NAS2706 are used with NAS1080-C6 collars.

NAS2408, NAS2508, NAS2608, and NAS2708 are used with NAS1080-C8 collars.

NAS2410, NAS2510, NAS2610, and NAS2710 are used with NAS1080-C10 collars.

NAS2412, NAS2512, NAS2612, and NAS2712 are used with NAS1080-C12 collars.

Code:

Last two digits of basic part number indicate nominal diameter in 1/32 inch.

Table 1-28. NAS2406 through NAS2412 Pin, Rivet, Swage Locking, Titanium Alloy, Protruding Head, Shear, Pull Type; NAS2506 through NAS2512 Pin, Rivet, Swage Locking, Titanium Alloy, 100 Degree Shear Head, Pull Type; NAS2606 through NAS2612 Pin, Rivet, Swage Locking, Titanium Alloy, Protruding Head, Shear, Stump Type; NAS2706 through NAS2712 Pin, Rivet, Swage Locking, Titanium Alloy, 100 Degree Shear Head, Stump Type - Continued

Dash number indicates maximum grip in 1/16 inch.

V after basic part number indicates 6A1-4V titanium alloy rivet.

Example of part number:

NAS2406-8 = protruding head 4A1-4Mn titanium alloy, pin rivet, 3/16-inch diameter, 1/2-inch maximum grip.

NAS2506V8 = 100-degree head, 6A1-4V titanium alloy, pin rivet, 3/16-inch diameter, 1/2-inch maximum grip.

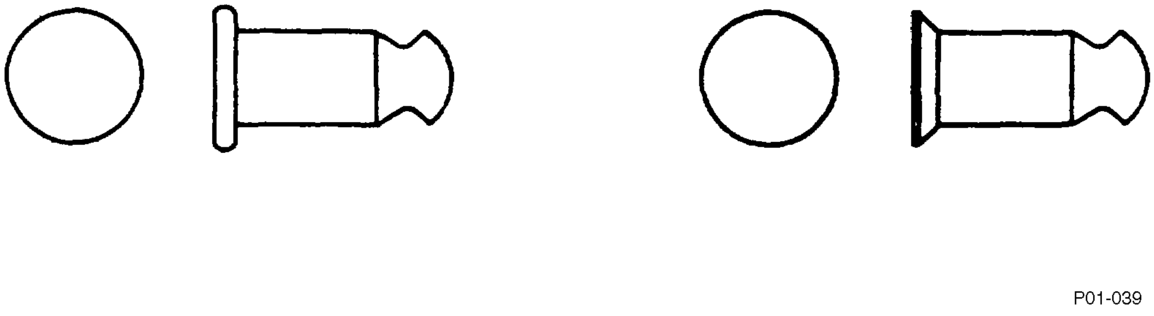
The above is also available with sealant escape groove: add ‘‘H’’ instead of NAS to part number, example H2506V8.

Material:

4A1-4Mn titanium alloy, National Aircraft Standard NAS621.

6A1-4V titanium alloy, National Aircraft Standard NAS621.

Table 1-29. MS21000 Flathead, Oversize, Pin Rivet and MS21001 100-Degree Countersunk Head, Oversize, Pin Rivet



First Dash Number	Shank Diameter		Head Diameter			
			MS21000		MS21001	
	Min	Max	Min	Max	Min	Max
-7	.2197	.2186	.315	.295	.3016	.2966
-9	.2822	.2811	.412	.387	.3948	.3898
-11	.3447	.3436	.505	.475	.4739	.4689
-13	.4072	.4061	.600	.565	.5604	.5554
-15	.4697	.4686	.676	.641	.668	.662
-17	.5322	.5311	.770	.735	.754	.748

Code:

First dash number indicates nominal diameter in 1/32 inch.

Second dash number indicates maximum grip in 1/16 inch.

Example of part number:

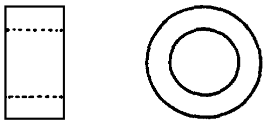
MS21000-7-3 = flathead, oversize, pin rivet, 7/32-inch nominal diameter, 3/16 inch maximum grip.

Material:

Table 1-29. MS21000 Flathead, Oversize, Pin Rivet and MS21001 100-Degree Countersunk Head, Oversize, Pin Rivet - Continued

Steel, Military Specification MIL-S-8695, MIL-S-5626, MIL-S-6049, MIL-S-6050, MIL-S-6098 or MIL-S-6758.
Heat treatment:
160,000 to 180,000 PSI, Military Specification MIL-H-6875.
Finish:
Cadmium plate, Military Specification QQ-P-416, Type I, Class C

Table 1-30. NAS179 Pin Rivet Collar

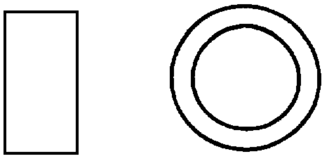


P01-040A

Dash Number	Inside Diameter	
	Min	Max
-4	.1240	.1280
-6	.1890	.1930
-8	.2490	.2530
-10	.3115	.3155
-12	.3740	.3780
-14	.4370	.4410
-16	.4990	.5030
-18	.5620	.5660
-20	.6240	.6280
-24	.7490	.7530
-28	.8740	.8780
-32	.9990	1.0030

Code:
Dash number indicates nominal rivet diameter in 1/32 inch.
Example of part number:
NAS179-8 = pin rivet collar for 1/4-inch diameter rivet.
Material:
2117 aluminum alloy, Military Specification MIL-W-7986.
Heat treatment:
In accordance with Military Specification MIL-H-6088.
Finish:
Anodize, Military Specification MIL-A-8625.

Table 1-31. NAS528 Pin Rivet Collar

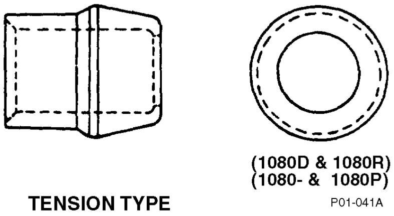


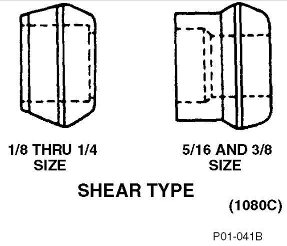
P01-040B

Dash Number	Inside Diameter	
	Min	Max
-6	.1895	.1930
-8	.2495	.2530
-10	.3120	.3160
-12	.3745	.3785
-14	.4370	.4415
-16	.5000	.5050
-18	.5620	.5670
-20	.6250	.6300

Code:
Dash number indicates nominal rivet diameter in 1/32 inch.
A before dash number indicates aluminum alloy collar.
Example of part number:
NAS528-A6 = aluminum alloy, pin rivet collar, for 3/16-inch diameter rivet.
Material:
2024-T4 aluminum alloy, Military Specification MIL-W-7986.
Heat treatment:
In accordance with Military Specification MIL-H-6088.
Finish:
Anodize, Military Specification MIL-A-8625.

Table 1-32. NAS1080 Pin Rivet Collar





Dash Number	Inside Diameter	
	Min	Max
NAS1080-5	.164	.169
NAS1080-6	.187	.193
NAS1080-8	.246	.254
NAS1080-10	.304	.312
NAS1080-12	.371	.378
NAS1080C4	.124	.127
NAS1080C5	.155	.160
NAS1080C6	.187	.191
NAS1080C8	.248	.252
NAS1080C10	.305	.309
NAS1080C12	.373	.377
NAS1080D5	.164	.169
NAS1080D6	.193	.199
NAS1080D8	.259	.265
NAS1080D10	.304	.312
NAS1080D12	.371	.378
NAS1080P10	.310	.316
NAS1080P12	.372	.380
NAS1080R6	.187	.193
NAS1080R8	.259	.265

Code:

Dash number indicates nominal rivet diameter in 1/32 inch.

No letter before dash number indicates 2024-T4 aluminum alloy, tension collar.

P or no letter before dash number indicates 2024-T4 aluminum alloy, tension collar.

R before dash number indicates carbon steel, tension collar.

Example of part number:

NAS1080-C6 = 2024-T4 aluminum shear collar for 3/16-inch diameter pin rivet.

Material:

Aluminum Alloy, Carbon Steel and Alloy Steel, National Aerospace Standard NAS1413.

1.3.13 Removal of Pin Rivets. The conventional method of removing rivets by drilling off the head may be utilized on either end of the pin rivet. (See Figure 1-20.) Center punching is recommended prior to applying drilling pressure. In some cases, the alternate methods listed below may be more desirable for particular instances.

a. Grind a chisel edge on a small pin punch to a blade width of 1/8 inch. Place this tool at right angles to collar and drive with a hammer to split collar down one side. Repeat operation on opposite side, and with chisel blade, pry collar from rivet. Tap rivet out of hole.

b. Use a special, hollow punch having one or more blades placed so as to split collar. Pry collar from groove and tap out rivet.

c. Grind a pair of nippers so that cutting blades will cut collar in two pieces, or use nippers at right angles to rivet and cut through small neck.

d. A hollow-mill collar cutter can be used in a power hand drill to cut away enough of collar material to permit rivet to be tapped out of work.

1.3.14 Self-Plugging Rivets (Friction Lock). (Refer to Table 1-33 through Table 1-35.) This self- plugging rivet (friction lock) retains the stem in position by friction. The stem is drawn up into the rivet shank and the mandrel portion of stem upsets the shank on the blind side, forming a plug in the hollow center of the rivet. The excess portion of the stem breaks off at a groove due to the continued pulling action of the rivet gun. The two styles of rivet heads are 100-degree countersunk, and universal. These correspond to AN426 and AN470 rivet types, respectively. Materials used are 2117-T4 and 5056-F aluminum alloys, and Monel for special applications. The shank diameter and grip length are designated by dash numbers after the basic part number. (See Table 1-36.)

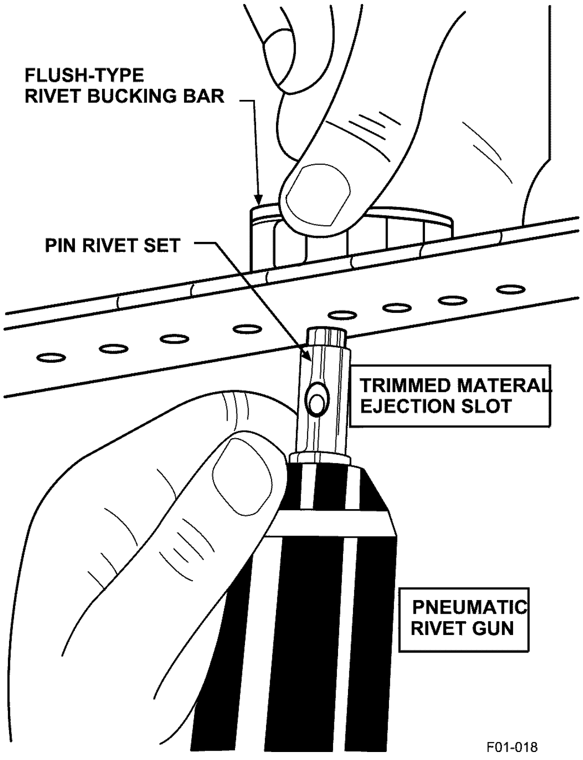
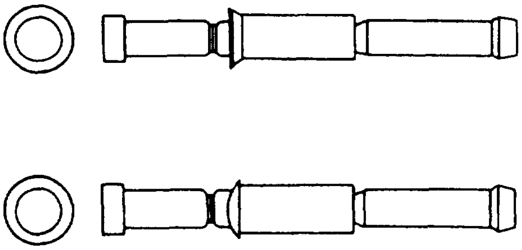


Figure 1-18. Driving Pin Rivet from Collar End

Table 1-33. NAS454-162C Blind, Countersunk Head, Self-Plugging Rivet (Friction Lock) and NAS455-163C Blind, Brazier Head, Self-Plugging Rivet (Friction Lock)



First Dash Number	Shank Diameter	Head Diameter
-4	1/8	.216/+.002 -.006
-5	5/32	.278/+.002-.006
-6	3/16	.344/+.003 -.007
-7	7/32	.406/+.003 -.007

Table 1-33. NAS454-162C Blind, Countersunk Head, Self-Plugging Rivet (Friction Lock) and NAS455-163C Blind, Brazier Head, Self-Plugging Rivet (Friction Lock) - Continued

First Dash Number	Shank Diameter	Head Diameter
-8	1/4	.467/+.003 -.007
-9	9/32	.510/+.003 -.007

Code:

Second dash number indicates nominal grip in 1/32 inch.

Example of part number:

NAS454-162C-4-2 = self-plugging rivet, 1/6-inch nominal grip.

Material:

Hollow barrel, 2117T aluminum alloy, Military Specification MIL-W-7986.

Stem, 2017 aluminum alloy, Military Specification MIL-W-7986.

Finish:

Anodize, Military Specification MIL-A-8625.

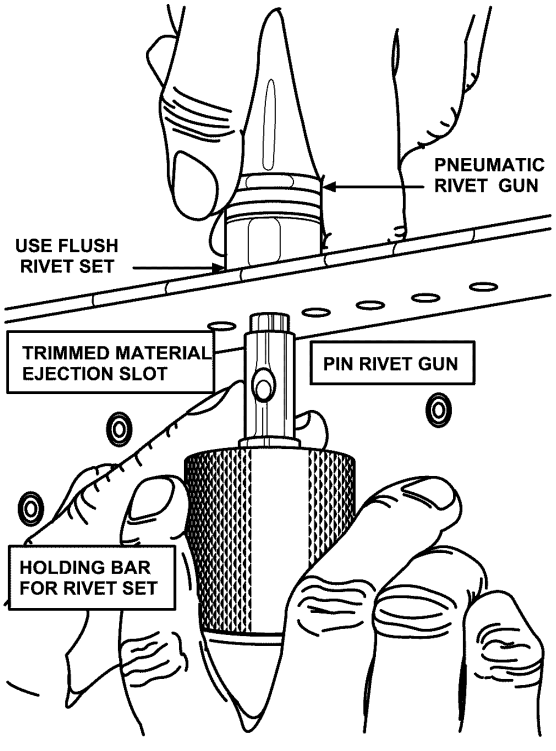


Figure 1-19. Driving Pin Rivet from Head End

1.3.15 Substitution of Self-Plugging Rivets (Friction Lock) for Common, Solid Shank Rivets. Self-plugging rivets (friction lock) should not be used on control surface hinge brackets, wing attachment fittings, landing gear fittings, fixed tail surface attachment fittings, or in other similar heavily stressed locations. These rivets also should not be used in hulls, floats, or tanks where a fluid-tight joint is required. Self-plugging rivets (friction lock) should not be used to replace solid shank rivets unless absolutely necessary. The self-plugging rivet (friction lock), when properly installed, may be used to replace 2117-T4 solid shank rivets, size for size. When used to replace 2017-T4 rivets driven in the heat-treated and aged condition, or 2024-T31 solid rivets, the next size self-plugging rivet (friction lock) should be used. In replacement of solid shank rivets, the size of the hole must be checked. If the hole diameter, after removal of the solid shank rivet, exceeds the maximum allowable hole size, the next larger size self-plugging rivet (friction lock) should be used. Self-plugging rives (friction lock) shall not be used in a given joint to replace such a considerable number of solid rivets that overstressing of the remaining solid rivets may result. Table 1-37 covers the single shear strength of protruding head, self-plugging rivets (friction lock) when used in sheet thickness equal to, or greater than, those listed. Countersunk head rivets in dimpled sheets develop practically the same shear strength as the protruding head. The rivet holes should be drilled after the sheets are dimpled at the pilot holes. Countersunk rivets in machine countersunk sheets develop considerably lower shear strength. In thin gage sheets, the single shear strength for both protruding and countersunk heads will vary with the thickness of the sheets.

1.3.16 Selection of Self-Plugging Rivets (Friction Lock). This type of self-plugging rivet permits rather broad tolerances from .004 to .006 inch in the hole sizes. The grip length is dependent upon the thickness of the material being riveted, with a desired protrusion of from 3/64 to 1/8 inch before drawing.

1.3.17 Installation Tools for Self-Plugging Rivets (Friction Lock). The guns used for installing this type of self-plugging rivet are the G-10 hand gun, and the G-15 and G-40 power guns. The G-15 power gun uses G-6H pulling heads as does the G-11 hand gun. The G-40 power gun uses the H-40 pulling heads primarily; however, through the use of a 226 adapter, G-6H heads may be used. Extensions are available for all guns using G-6H heads. There is also a small hand gun, type G-20, to which a ratchet wrench is attached at the butt end and turned to pull the gun head and rivet stem. (See Figure 1-22.) The pulling heads are essentially an outer sleeve and a draw bolt. The heads are manufactured in three different sizes to accommodate the different rivet diameters. For ease of selection, the sizes are stamped on the parts of the pulling head.

1.3.18 Installation of Self-Plugging Rivets (Friction Lock). It is important that the proper drawbolt and sleeve be used for the rivet being installed. The drawbolt should correspond to the diameter of the rivet, and the sleeve should correspond to the rivet diameter and head style. Speed of installation may be increased by inserting a number of rivets in the work and then applying the gun. In other instances, such as overhead work, it is apparent that this method would be impractical and the rivet should be loaded into the gun and then inserted into the prepared hole. The rivet must be completely inserted into the slot in the drawbolt, because improper seating of the rivet may permit the head to break off before the rivet is properly set. (See Figure 1-23.) When using a hand gun, hold the rigid handle of the gun parallel to the rivet axis. Open the movable handle as far as it will go, then partially close. Repeat this operation until the rivet stem breaks, then release the gun by completely closing the movable handle. When using the power gun, hold the head of the gun parallel to the axis of the rivet. Push the gun against the work with enough force to seat the head of the rivet firmly, and to insure contact between the parts being riveted. Pull the trigger until the stem breaks. The stem will be ejected through the rubber tube at the back of the gun head. It is important that this tube be in place in order to prevent stems from getting into the gun mechanisms.

1.3.19 Self-Plugging Rivet (Friction Lock) Cutoff Tools. There are three types of cutoff tools. (See Figure 1-24.) The most common cutoff tool is the flat-ground hand nippers. The type 220 and 225 trimmers attach to a power drill for rolling a locking burr on the rivet as it is trimmed. The type 220 accommodates diameters of 1/8, 5/32, and 3/16 inch, while the type 225 trims 7/32, 1/4, and 9/32-inch diameters. The third type of trimmer is the type 301 stem saw, which attaches to a power drill for sawing off the stem flush with the rivet head.

1.3.20 Inspection of Self-Plugging Rivets (Friction Lock). When the blind side of the rivet is visible, some variation in the rivet head characteristics will be noted. See Figure 1-25 for examples of satisfactory and unsatisfactory installations. If the blind side of the rivet is not visible, the rivet may be tested by applying force to the rivet pin. Table 1-38 shows the forces to be applied for different diameter rivets.

NOTE

> The values contained in Table 1-38 were taken from Procurement Specification MIL-R-7885. Since these values were intended for qualification testing of the rivets, no spindle testing tools are available from Air Force stock. If these rivets have been correctly installed, especially in regards to the grip length and hole diameter, it is not considered necessary to perform this test. However, if an incorrect rivet installation is suspected, it may be tested by applying the force shown in the table.

1.3.21 The rivet is satisfactory if the pin is firm and the head is seated tightly on the face of the material. Occasionally, the head will rise slightly in the area which was under the slot of the pulling head. This condition is acceptable if the head is not loo badly deformed and the tension characteristics of the joint are not made critical by the deformation of the head.

1.3.22 Removal of Self-Plugging Rivets (Friction Lock). These rivets are removed in much the same manner as the common, solid shank rivets, except the preliminary step of driving out the rivet stem. (See Figure 1-26.)

a. Punch out the rivet stem with a pin punch.

b. Drill out the rivet head, using a drill the size of the rivet shank.

c. Pry off the weakened rivet head with a pin punch.

d. Push out the remainder of the rivet shank with a punch. If the shank will not push out, drill the shank, taking care not to enlarge the hole in the material. If the hole should be enlarged, finish-drill for an oversize rivet.

Table 1-34. 460 Blind, 100-Degree Countersunk Head, Self-Plugging Rivet (Friction Lock) and 461 Blind, Brazier Head, Self-Plugging Rivet (Friction Lock)

First Dash Number	Shank Diameter +.004/-.000	AN460 Head Diameter +.002/-.006	AN461 Head Diameter ±.010
-4	.125	.216	.235
-5	.156	.278	.312
-6	.187	.344	.390
-7	.218	.420	.437
-8	.250	.468	.468

Code: First dash number indicates nominal diameter in 1/32 inch.

Second dash number indicates nominal minimum grip in 1/100 inch.

Example of part number: 461-4-16 = self-plugging rivet (friction lock), 1/8-inch nominal diameter, 16/100-inch nominal minimum grip.

Material: Aluminum alloy.

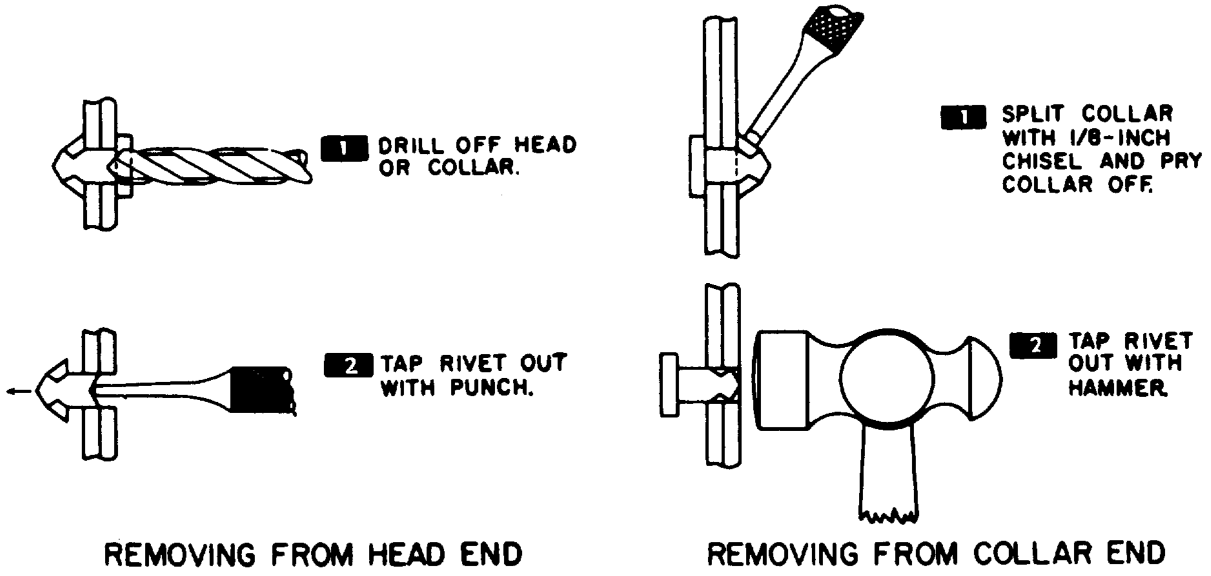


Figure 1-20. Removing Pin Rivet

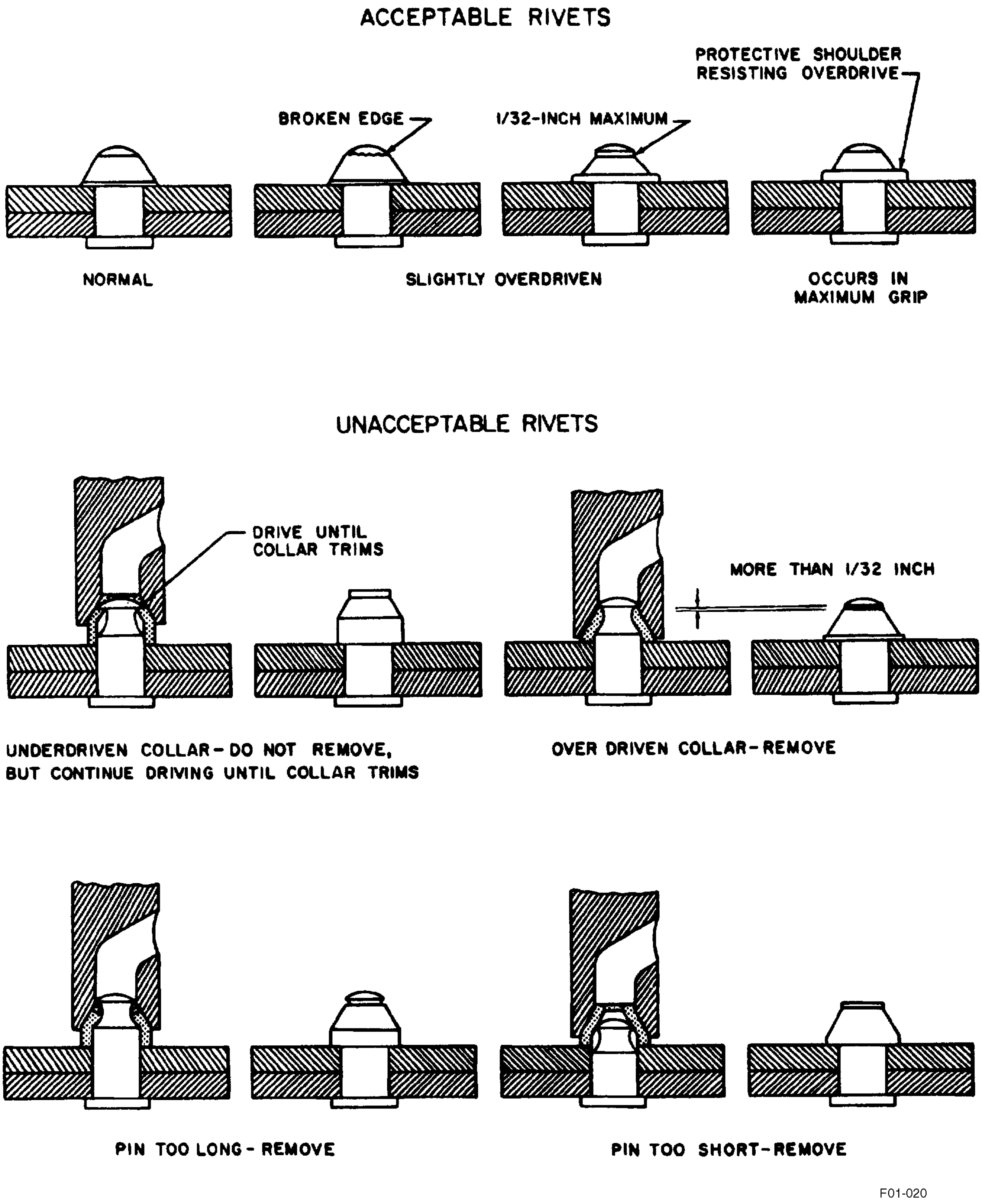
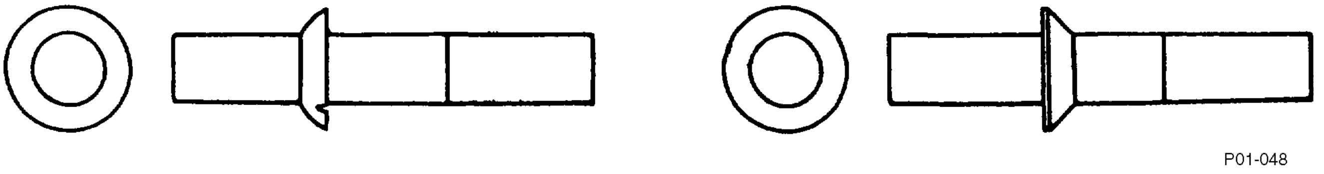


Figure 1-21. Pin Rivet Inspection

Table 1-35. MS20600 Blind, Mechanically Expanding, Protruding Head, Self-Plugging Rivet (Friction Lock) and MS20601 100-Degree Countersunk Head, Self-Plugging Rivet (Friction Lock)



First Dash Number	Shank Diameter +.003/-.001	MS20600 Head Diameter	
		Brazier Head ±.010	Universal Head
-AD4	.125	.235	.250 ±.012
-AD5	.156	.312	.312 ±.016
-AD6	.187	.390	.375 ±.019
-AD8	.250	.468	.500 ±.025

Code:
AD after basic part number indicates 2117-T4 aluminum alloy rivet.
B after basic part number indicates 5056-H32 aluminum alloy rivet.
Second dash number indicates maximum grip in 1/16 inch.
Example of part number:
MS20600AD5-5 = self-plugging rivet, 5/16-inch maximum grip.
Material:
2117-T4 and 5056-H32 aluminum alloy, Federal Specification MIL-W-7986.
Finish:
Anodize, Military Specification MIL-A-8625, or surface treat, Military Specification MIL-C-5541.

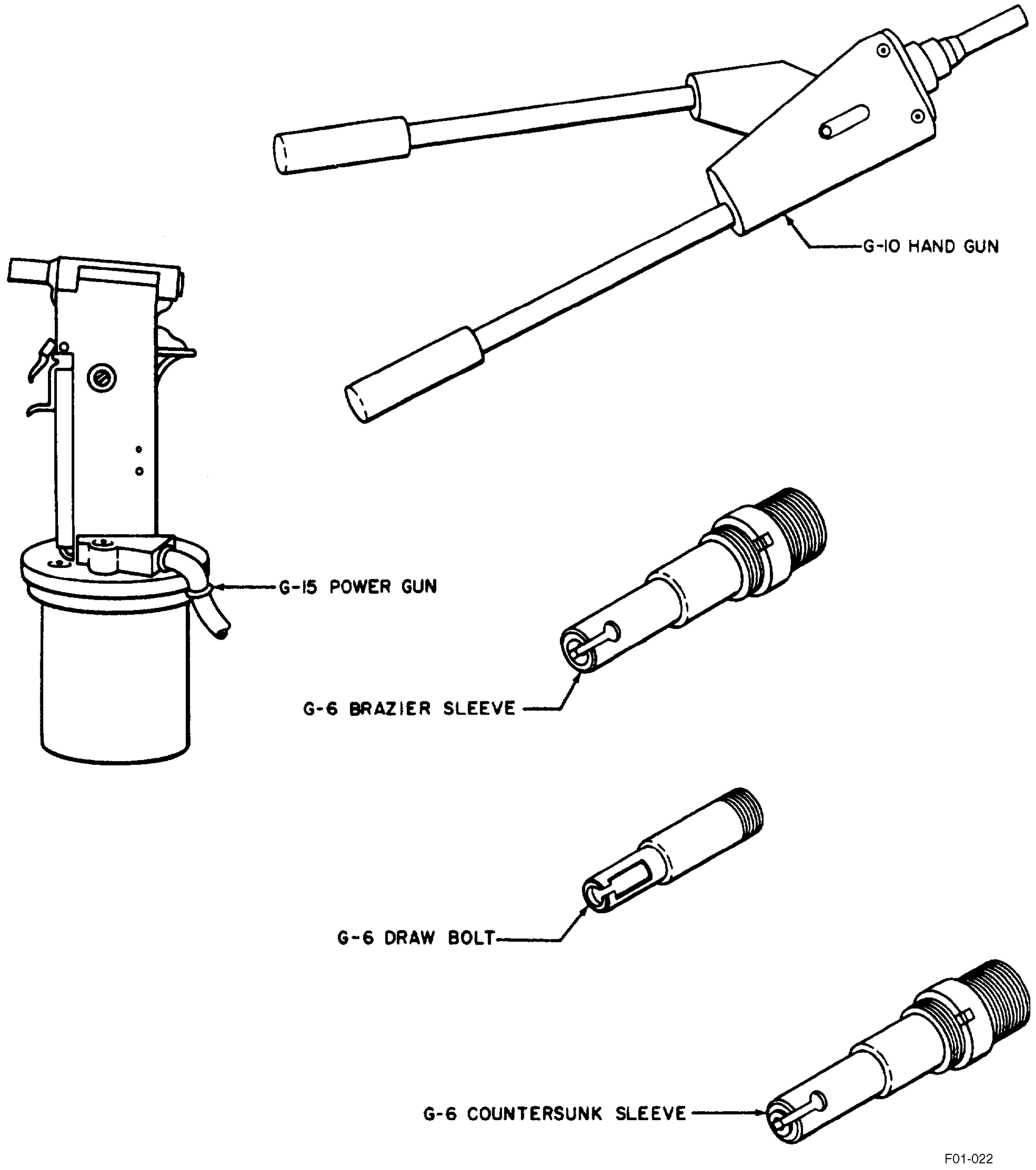


Figure 1-22. Self-Plugging Rivet (Friction Lock) Installation Tools

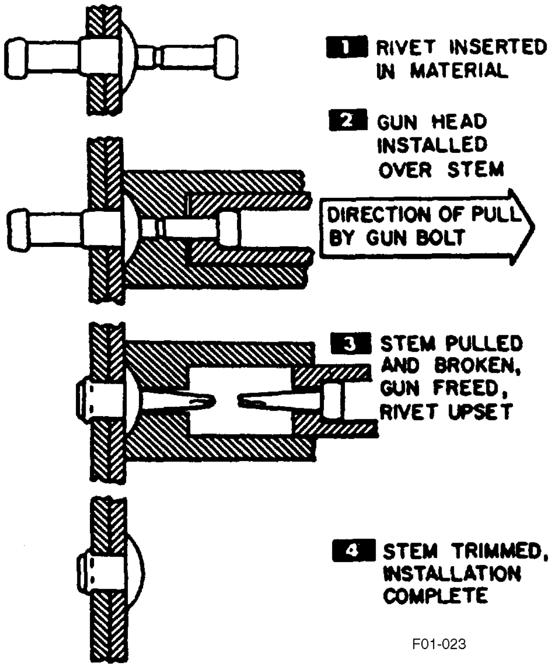


Figure 1-23. Self-Plugging Rivet (Friction Lock) Installation

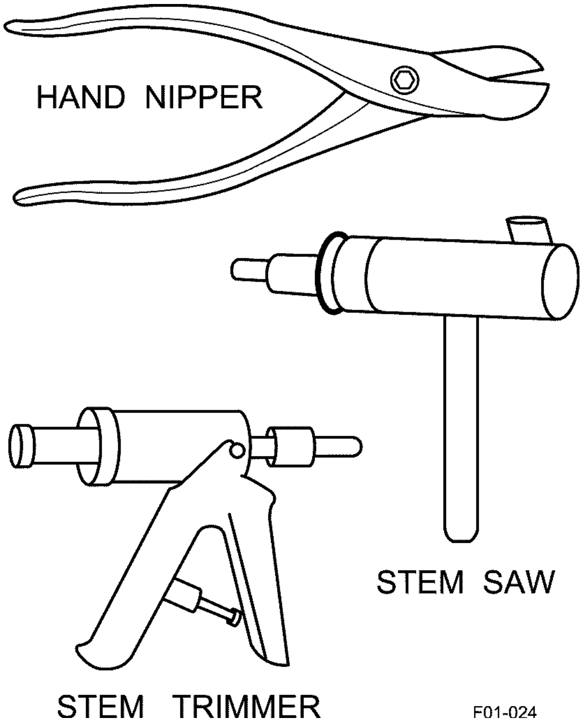


Figure 1-24. Self-Plugglng Rivet (Friction Lock) Cutoff Tools

Table 1-36. Self-Plugging Rivet (Friction Lock) Part Numbers

MS Number	Material	Head Style
MS20600AD4-1	2117-T4 aluminum alloy	Universal head
MS20600B4-1	5056-aluminum alloy	Universal head
MS20601AD4-1	2117-T4 aluminum alloy	Countersunk head
MS20601B4-1	5056-aluminum alloy	Countersunk head

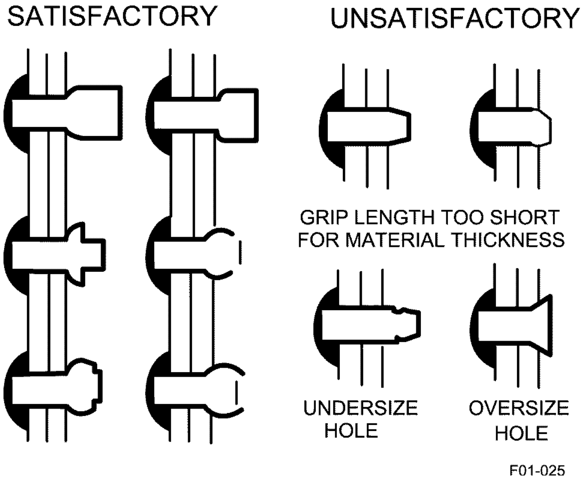


Figure 1-25. Inspection of Self-Plugging Rivets (Friction Lock)

Table 1-37. Single Shear Strength for Self-Plugging Rivets (Friction Lock)

Rivet Diameter	Rivet Hole Diameter	Sheet Thickness	Shear Strength In Pounds
1/8	.129	.040	387
5/32	.160	.050	598
3/16	.192	.064	858
7/32	.220	.072	1152
1/4	.257	.081	1556

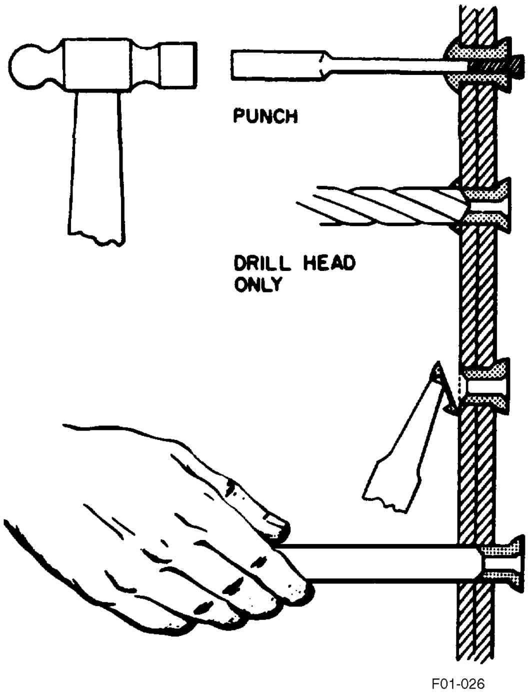


Figure 1-26. Removal of Self-Plugging Rivets (Friction Lock)

1.3.23 Self-Plugging Rivets (Mechanical Lock). Rivet B in Figure 1-1 is a blind rivet that operates on the same principal as rivet A, both employing a mandrelled stem and hollow shank. The main difference in A and B is in the method of pin retention: rivet A relies on friction for pin retention, while the rivet B employs a mechanical lock between the head of the rivet and the pull stem. The rivet is made of 5056 aluminum alloy sleeve with 2024 aluminum alloy pin or a monel sleeve with 17-4 PH stainless steel pin or an A286 sleeve and pin. The blind end portion of the stem incorporates a head and a land with an extruding angle which expands the rivet shank.

Table 1-38. Testing Self-Plugging Rivets (Friction Lock)

Rivet Diameter (Inch)	Pin Force (Pounds)
1/8	15
5/32	25
3/16	35
1/4	50

1.3.24 Substitution of Self-Plugging Rivets (Mechanical Lock) for Common, Solid Shank Rivets. The loads allowable for the self-plugging rivets are comparable to those for solid shank rivets of the same shear strength, regardless of sheet thickness. The composite ultimate shear strength of the 5056-H14 shank and the 2024-T36 pin exceeds 38,000 PSI on standard rivet hole diameter; their tensile strength is in excess of 28,000 PSI. Pin retention characteristics are excellent in these rivets and the possibility of the pin working out is minimized by the lock formed in the rivet head. Table 1-39 covers the single shear strength for these rivets when used in sheet thicknesses equal to, or greater than, those listed. In thin sheets, the shear strength will be different for each thickness. On countersunk head rivets used in dimpled sheets, the shear strength is approximately the same as for protruding head rivets the shear strength will be considerably less. (See Table 1-51 and Table 1-52 for substitutability.)

1.3.25 Selection of Self-Plugging Rivets (Mechanical Lock). The B rivets in Figure 1-1 are manufactured in 1/8, 5/32, 3/16, and 1/4 inch diameters in brazier head and countersunk head styles. Grip ranges are shown in Table 1-40.

1.3.26 Installation Tools for Self-Plugging Rivets (Mechanical Lock). Tools and nose assemblies for installing these rivets are shown in Table 1-41. The nose of the tool includes: a set of chuck jaws which fit the pull grooves in the rivet pin and pull it through the rivet shank to drive the rivet; an outer anvil which bears against the outer part of the manufactured head during the driving operation; and, an inner anvil which advances automatically to drive the locking collar home after the blind head is formed. A short nose assembly, interchangeable with the standard nose assembly, is available for use in areas where there is not sufficient clearance for the standard nose.

1.3.27 Driving Self-Plugging Rivets (Mechanical Lock). Proper driving procedures are vital to obtain a firm joint. The recommended procedures are as follows:

NOTE

The driving cycle and tooling are the same for like diameters and materials.

a. Material to be joined must be secured firmly in position. Cleco or other temporary fasteners may be used.

b. Determine thickness of material to be joined.

c. Select diameter and proper length fastener.

d. Insert proper fastener in prepared hole.

e. Select proper installation tool and nose assembly for diameter of fastener to be installed.

f. Place the nose assembly of the installation tool over the serrated pull grooves of the blind rivet pin.

g. Installation tool and nose assembly must be aligned with the fastener and held firmly against the head of the fastener.

h. Actuate the tool by depressing the trigger, the head of the serrated pin is pulled up to contact the end of the sleeve. The sleeve is then squeezed between the head of the pin and the nose assembly of the installation tool. The head of the pin upsets the sleeve to form a strong bulbed head on the blind side of the joint. When the blind head has been formed, the tool automatically forces the locking collar (at the pin-tail end of the sleeve) into the conical space between the recess in the head and the locking groove in the pin. The tool continues to pull breaking the pin-tail from the installed fastener. The pin-tail is ejected from the tool.

1.3.28 Driving Sequence for Self-Plugging Rivets (Mechanical Lock). The rivet is actually cold-squeezed by the action of the pin head drawing against the hollow shank end. Shank expansion through the action of the extruding angle, blind head formation, and setting of the mechanical lock in the rivet head all follow in automatic sequence and require but a fraction of a second.

NOTE

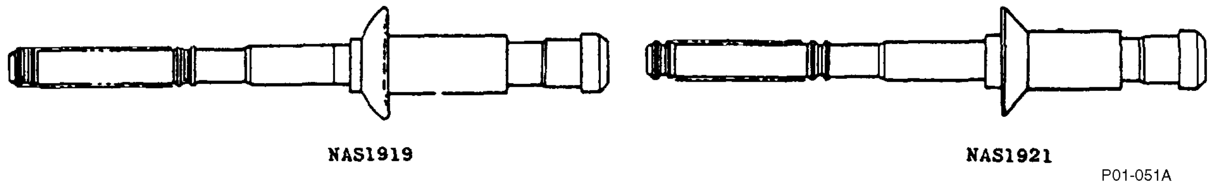
In some places, such as near the trailing edge of a control surface, there may not be sufficient space between the two surfaces to insert the rivet. In such cases, the pin may be forced into the hollow shank until the head of the pin just touches the end of the shank. Since no further shank expansion will result, the drill hole should not be enlarged to provide a free fit of the already expanded rivet. To insert the rivet, use a hollow drift pin which will accommodate the rivet pin and the locking collar. (See Figure 1-27.) This allows a driving force to be exerted on the head of the rivet. Drive the head into firm contact with the sheet and then apply the rivet pull tool in the usual manner to upset the rivet.

1.3.29 Due to the mechanical lock feature of the pin and sleeve, the driven rivet is substantially the mechanical equivalent of a one-piece solid rivet. The mechanical lock feature increases the load-carrying capacity in single shear from about 10.3 percent in the case of thick sheets where joint strength is considered critical in rivet shear, to as much as 63.3 percent in thin sheets where sheet bearing is considered critical.

Table 1-39. Single Shear Strength for Self-Plugging Rivets (Mechanical Lock)

Rivet Diameter	Rivet Hole Diameter	Shear Strength		
		Alum	Monel	A286
1/8	.129/.132	495	1020	1090
5/32	.160/.164	755	1565	1670
3/16	.192/.196	1090	2260	2400
1/4	.256/.261	1970	4000	4250

Table 1-40. Self-Plugging Mechanical Locked Spindle Blind Rivet - Rivet B

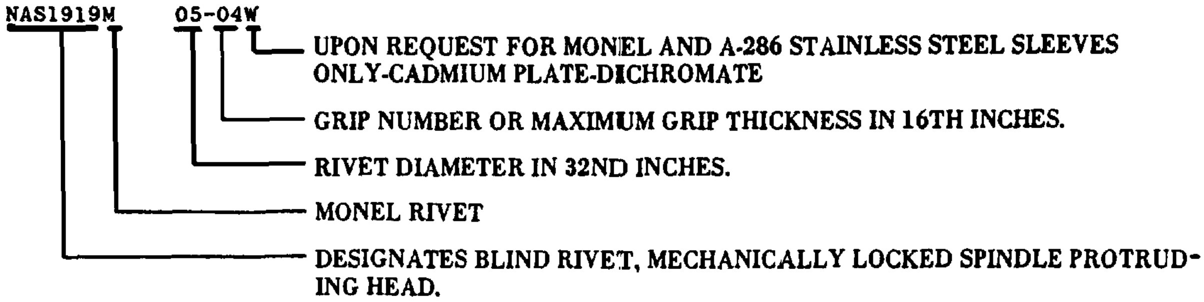


Basic Part No.	Shank Diameter		Head Diameter			
			NAS1919		NAS1921	
	Min	Max	Min	Max	Min	Max
NAS1919*04 NAS1921*04	.124	.128	.238	.262	.221	.229
NAS1919*05 NAS1921*05	.155	.159	.296	.328	.282	.290
NAS1919*06 NAS1921*06	.186	.190	.356	.394	.349	.357
NAS1919*08 NAS1921*08	.249	.253	.475	.525	.472	.480

***RIVET COMPOSITION CODE LETTER**

CODE:
FIRST DASH NUMBER DESIGNATES DIAMETER IN .0312 INCREMENTS.
SECOND DASH NUMBER DESIGNATES MAXIMUM GRIP IN .0625 INCREMENTS.
ADD "B" AFTER BASIC NUMBER FOR COMPOSITION B ALUMINUM RIVET.
ADD "C" AFTER BASIC NUMBER FOR COMPOSITION C A286 CRES RIVET.
ADD "M" AFTER BASIC NUMBER FOR COMPOSITION M MONEL RIVET.
ADD "W" AFTER SECOND DASH NUMBER FOR CADMIUM PLATED RIVET SLEEVE.
ADD "O" (ZERO) BEFORE SINGLE DIGIT DASH NUMBERS FOR COMPUTER PRINTOUT.

EXAMPLE OF PART NUMBER:



UPON REQUEST FOR MONEL AND A-286 STAINLESS STEEL SLEEVES ONLY-CADMIUM PLATE-DICHROMATE

GRIP NUMBER OR MAXIMUM GRIP THICKNESS IN 16TH INCHES.

RIVET DIAMETER IN 32ND INCHES.

MONEL RIVET

DESIGNATES BLIND RIVET, MECHANICALLY LOCKED SPINDLE PROTRUDING HEAD.

P01-051B

PROCUREMENT SPECIFICATION NAS 1900

NOTE

Rivet ‘‘B’’ in Figure 1-1 is a Self-Plugging Mechanical Locked Spindle Blind Rivet. These are available in 5056 Aluminum Alloy, Monel and A286 Stainless Steel in both Protruding Head and 100 Degree Head Styles

Table 1-41. Self-Plugging Blind Rivet Mechanical Lock Installation Tool and Nose Assembly Selection

Fastener	Dia.	Model 200 Installation Tool	Model 350 Installation Tool
		Nose Assembly Part No.	Nose Assembly Part No.
NAS1919B NAS1919C NAS1919M	1/8 inch	78975	78975
	5/32 inch	99-454	78976*
	3/16 inch	99-455	78977*
	1/4 inch	99-789*	
NAS1921B NAS1921C NAS1921M	1/8 inch	78972	78972
	5/32 inch	99-458	78973*
	3/16 inch	99-459	78974*
	1/4 inch	99-740*	
*Aluminum only			

1.3.30 Self-Plugging Rivet (Mechanical Lock) Removal. Removal of this rivet is accomplished easily without damage to the work by use of the following procedure. (See Figure 1-28.)

a. Shear the lock by driving out the pin, using a tapered steel drift pin not over 3/32-inch diameter at the small end. If working on thin material, back up the material while driving out the pin. If inaccessibility prohibits this, partially remove the rivet head by filing, or with a rivet shaver. An alternative would be to file the pin flat, center punch the flat, and carefully drill out the tapered part of the pin forming the lock.

b. Pry the remainder of the locking collar out with a drift pin.

c. Use the proper size drill to drill nearly through the rivet head. For a 1/8-inch diameter rivet, use a number 31 drill; for a 5/32, use a number 24; and, for a 3/16, use a number 15.

d. Break off the drilled head, using a drift pin as a pry.

e. Drive out the remainder of the rivet with a pin having a diameter equal to, or slightly less than, the rivet diameter.

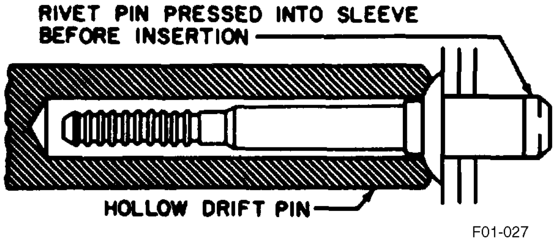


Figure 1-27. Inserting Self-Plugging Rivet (Mechanical Lock)

1.3.31 Inspection of Self-Plugging Rivet (Mechanical Lock). Visual inspection of the seating of the pin in the manufactured head is the most reliable and simple means of inspection. (See Figure 1-30.) If the proper grip length has been used and the locking collar and broken end of the pin are approximately flush with the manufactured head, the rivet has been properly upset and the lock formed. Insufficient grip length would be indicated by the pin breaking below the surface of the manufactured head, and excessive grip length would be indicated by the pin breaking off well above the manufactured head. In either case, the locking collar might not be properly seated, thus forming an unsatisfactory lock. Figure 1-29 gives limits for proper pin seating.

1.3.32 Explosive Rivets.

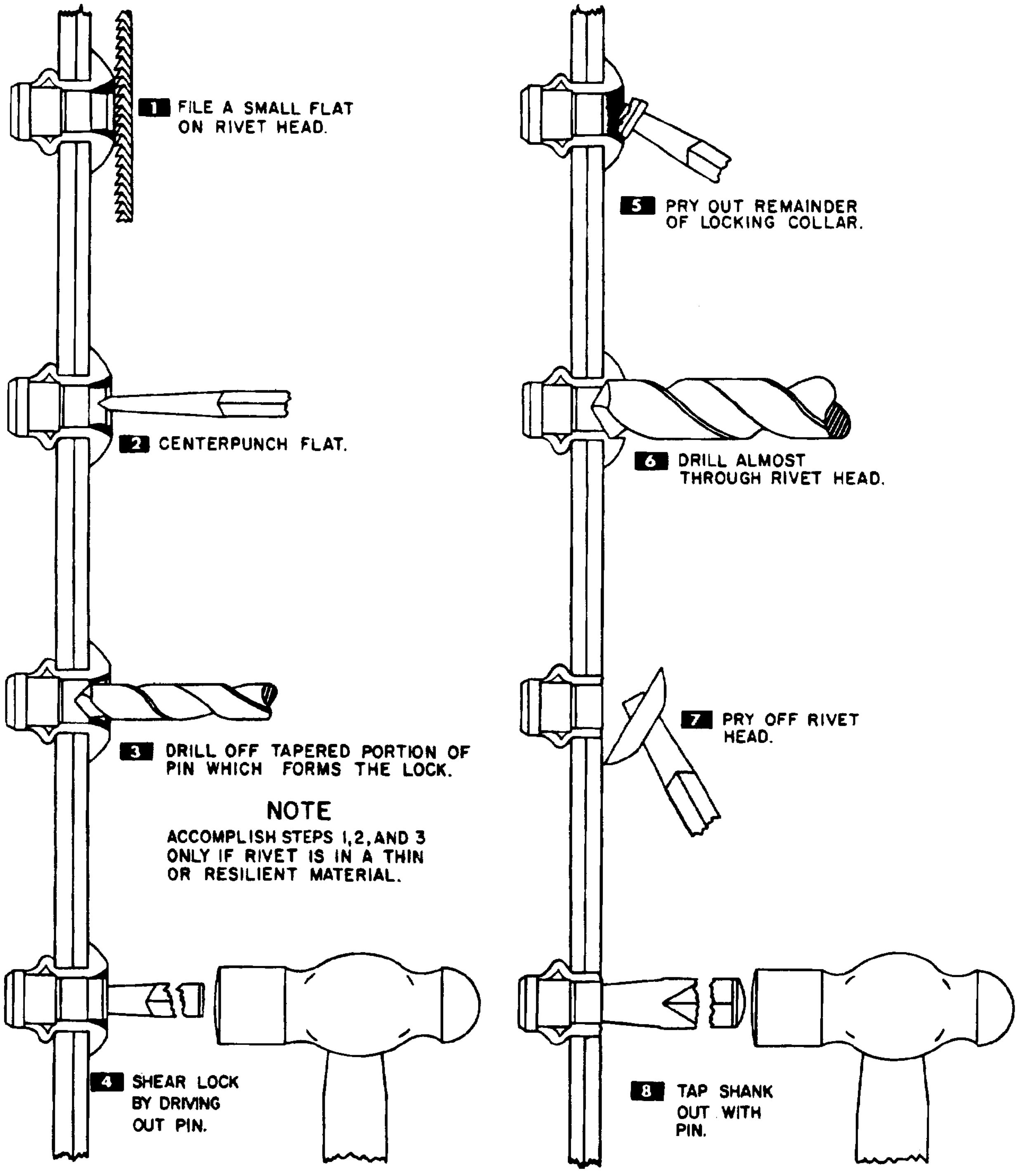
WARNING

Since the explosive rivet presents a fire hazard, it must not be driven in locations where gasoline or other flammable vapors are likely to be present.

(Refer to Table 1-42.) Explosive rivets are blind, expansion rivets used in areas of limited access. The rivets have a cavity in the shank which contains a small explosive charge. The explosive charge is detonated by the application of heat to the rivet head. Upon detonation of the charge, the shank expands in the material and forms a bulbed head on the blind side. Figure 1-31 shows various types of explosive rivets. The blast-free rivets are safer to use in that the fire hazard has been greatly reduced by the development of the plug for the shank explosive cavity. Explosive blind rivets are manufactured in brazier head and countersunk head types.

1.3.33 Substitution of Explosive Rivets for Common, Solid Shank Rivets. Explosive rivets shall not be used on control surface hinge brackets, wing attachment fittings, landing gear fittings, fixed tail surface attachment fittings, or in other similar heavily stressed locations. The rivets should be used only in applications where it is possible to hold the sheets or materials to be fastened by clamps or other suitable means while the rivets are expanded. In cases of dimpled assembly, the rivet holes should be drilled after the sheets are dimpled at the pilot holes. Explosive rivets should not be used in the manufacture or repair of fuel tanks or oil tanks. These rivets should only be used on all-metal or noninflammable materials. Explosive rivets may be used for patching hulls and floats, provided that a suitable seam-sealing material or compound can be used. Explosive rivets may be used as replacement for 2017-T4 and 2117-T4 solid shank rivets, size for size. Explosive rivets one size larger must be used for 2024-T4 solid shank rivets. Explosive rivets shall not be used in a given joint to replace such a considerable number of solid rivets that overstressing of the remaining solid rivets may result. Table 1-43 covers the single shear strength for protruding head, explosive rivets when used in sheet thickness equal to, or greater than, those listed. In thin sheets, the shear strength will be lower and different for each thickness. Countersunk rivets in dimpled sheets develop practically the same shear strength as the protruding head rivets, while the shear strength of countersunk head rivets in machine countersunk sheets is considerably lower than that of the protruding head rivets.

1.3.34 Selection of Explosive Rivets. The selection of the proper explosive rivet should be based on required shank diameter, head type, grip length, and location of installation. Figure 1-32 may be used as an aid in determining the grip length requirement.



1 FILE A SMALL FLAT ON RIVET HEAD.

2 CENTERPUNCH FLAT.

3 DRILL OFF TAPERED PORTION OF PIN WHICH FORMS THE LOCK.

NOTE

ACCOMPLISH STEPS 1,2,AND 3 ONLY IF RIVET IS IN A THIN OR RESILIENT MATERIAL.

4 SHEAR LOCK BY DRIVING OUT PIN.

5 PRY OUT REMAINDER OF LOCKING COLLAR.

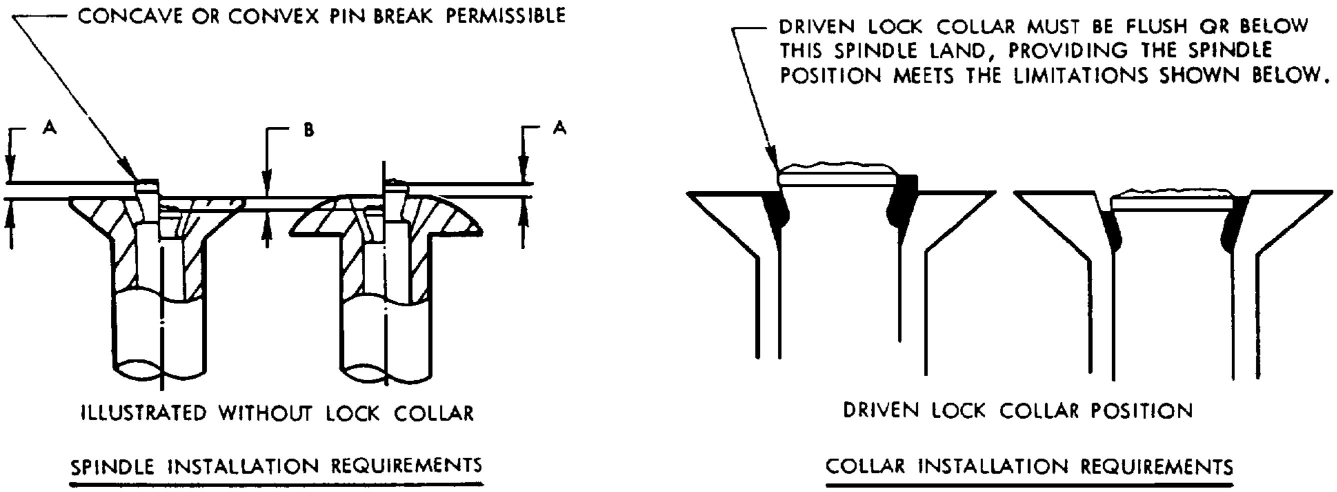
6 DRILL ALMOST THROUGH RIVET HEAD.

7 PRY OFF RIVET HEAD.

8 TAP SHANK OUT WITH PIN.

F01-028

Figure 1-28. Removing Self-Plugging Rivet (Mechanical Lock)



SPINDLE INSTALLATION REQUIREMENTS

COLLAR INSTALLATION REQUIREMENTS

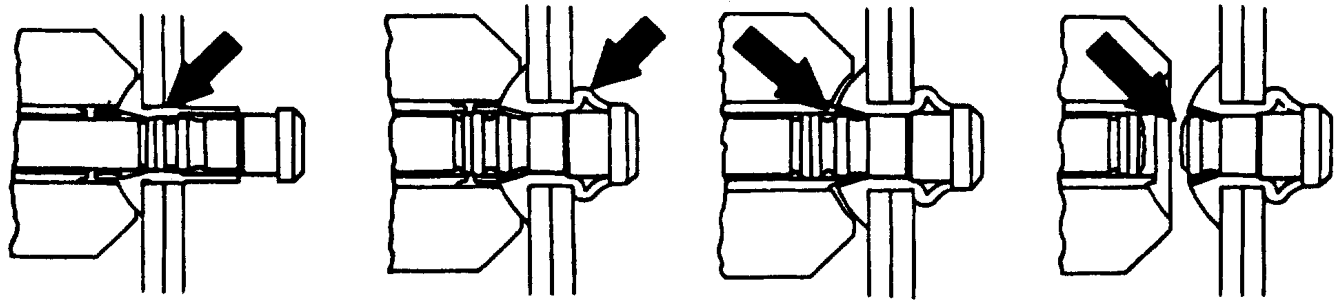
NOMINAL RIVET DIA	A DIM	B DIM	
.125	.018	.008	"A" MAX ALLOWABLE DISTANCE OF TOP OF LAND OF SPINDLE ABOVE RIVET HEAD.
.156	.022	.010	
.190	.025	.012	"B" MAX ALLOWABLE DISTANCE OF TOP OF LAND OF SPINDLE BELOW RIVET HEAD
.250	.032	.016	

DIMENSIONS IN INCHES

SPINDLE AND COLLAR FLUSHNESS LIMITS

F01-099

Figure 1-29. Inspection Criteria for Self-Plugging Rivets (Mechanical Lock)



1 EXPANDING SHANK

2 FORMING BLIND HEAD

3 MAKING POSITIVE MECHANICAL LOCK

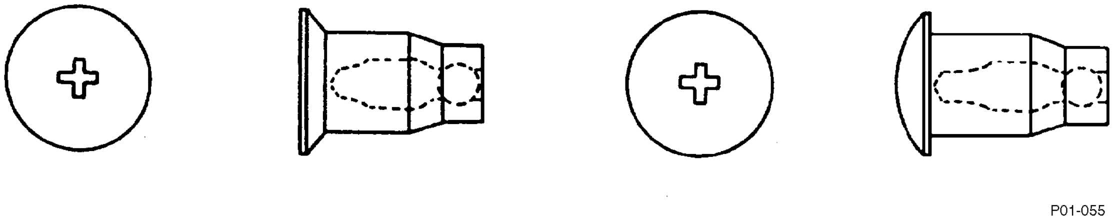
4 BREAKING PIN

(BRAZIER HEAD)

F01-029

Figure 1-30. Forming of Self-Plugging Rivet (Mechanical Lock) Head

Table 1-42. MS20602 Blind, Brazier Head, Explosive Rivet and MS20603 100-Degree Countersunk Head, Explosive Rivet



First Dash Number	Shank Diameter ±0.001	MS20602 Head Diameter ±0.010	MS20603 Head Diameter ±0.004
-4	.134	0.250	0.225
-5	.171	0.312	0.286
-6	.202	0.375	0.353

Code:
Second dash number indicates nominal maximum grip in 1/100 inch.
D after basic part number indicates 2017-T4 aluminum alloy rivet.
B after basic part number indicates 5056-H32 aluminum alloy rivet.
Example of part number:
MS20602D4-32 = 2017-T4 aluminum alloy explosive rivet, brazier head, 32/100-inch nominal maximum grip.
Material:
2017-T4 and 5056-H32 aluminum alloy, Federal Specification MIL-W-7986.
Finish:
Anodize, Military Specification MIL-A-8625, or surface treat, Military Specification MIL-C-5541.

Table 1-43. Single Shear Strength for Explosive Rivets

Rivet Diameter	Rivet Hole Diameter	Sheet Thickness	Shear Strength
1/8 Inch	0.135 Inch	0.040 Inch	440 Pounds
5/32 Inch	0.173 Inch	0.050 Inch	780 Pounds
3/16 Inch	0.204 Inch	0.064 Inch	1085 Pounds

1.3.35 Special Tools for Explosive Rivets. A number of tools are available for installing explosive rivets. Riveting iron numbers 7, 8, and 9A are soldering iron types and are most commonly used in repair work. (See Figure 1-33.) The number 7 iron is most frequently used for all regular diameter rivets up to 3/16 inch. There are several interchangeable iron tips for use with the different rivet head styles. Special tips with 45 and 90-degree offsets are available for riveting in difficult locations. A heater control unit is used with the riveting irons to control the iron heat and to insure uniform rivet expansion time. There are various types of heater control units. Each has a rating of 860 volt-amperes, a rated current of 5 amperes, a maximum current of 75 amperes, an input of 115 volts AC, and an output voltage of from 0 to 135 volts.

1.3.36 Operation of Riveting Irons.

a. Plug heater control unit into proper electrical outlet and plug riveting iron into heater control.

b. Set heater control knob to setting for rivet being expanded, and allow iron to heat up.

c. To prevent damaging the tip by overheating, heat the iron for 15 minutes at the low setting. Then press the tip firmly against a small rivet in a 0.190 to 0.204-inch thick aluminum alloy test sheet. If expansion does not take place in three seconds, advance heater control knob. Wait ten minutes then try expanding another rivet. Repeat the operation until expansion takes place in from 1.5 to 3 seconds.

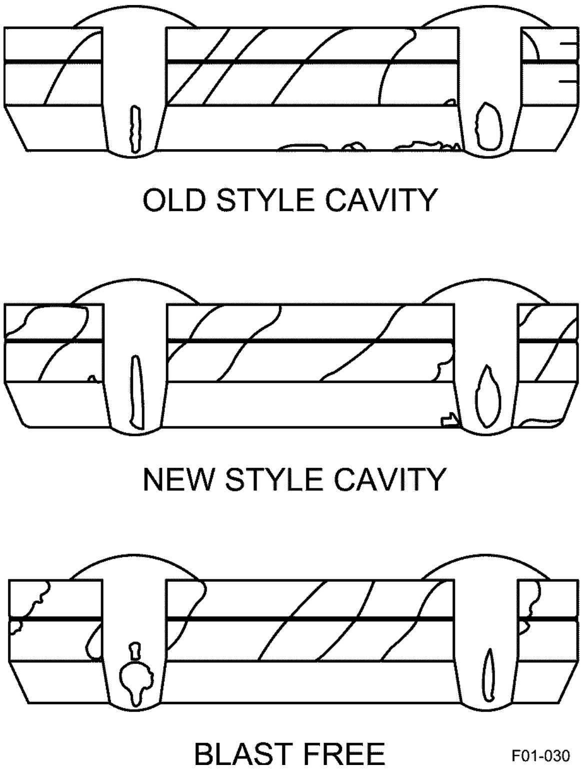


Figure 1-31. Types of Explosive Rivets

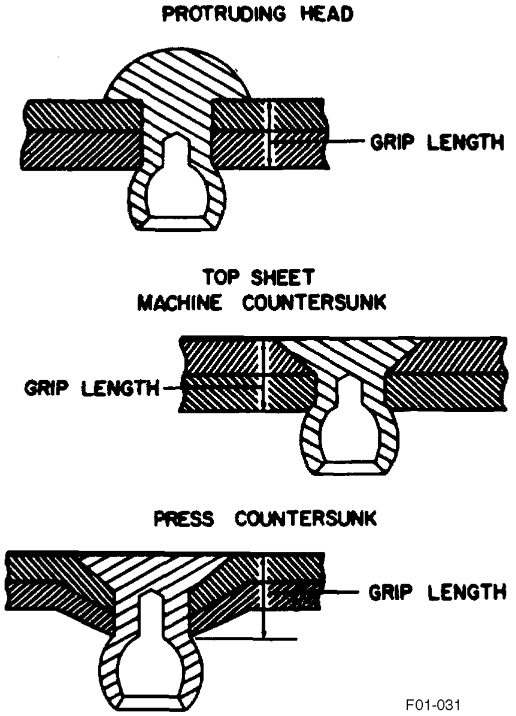


Figure 1-32. Explosive Rivet Grip Lengths

1.3.37 Maintenance of Riveting Irons and Tips.

a. Handle with care to prevent damage to heating elements and tips.

b. Keep all stud screws tight.

c. Keep heater head recess threads and bevel clean.

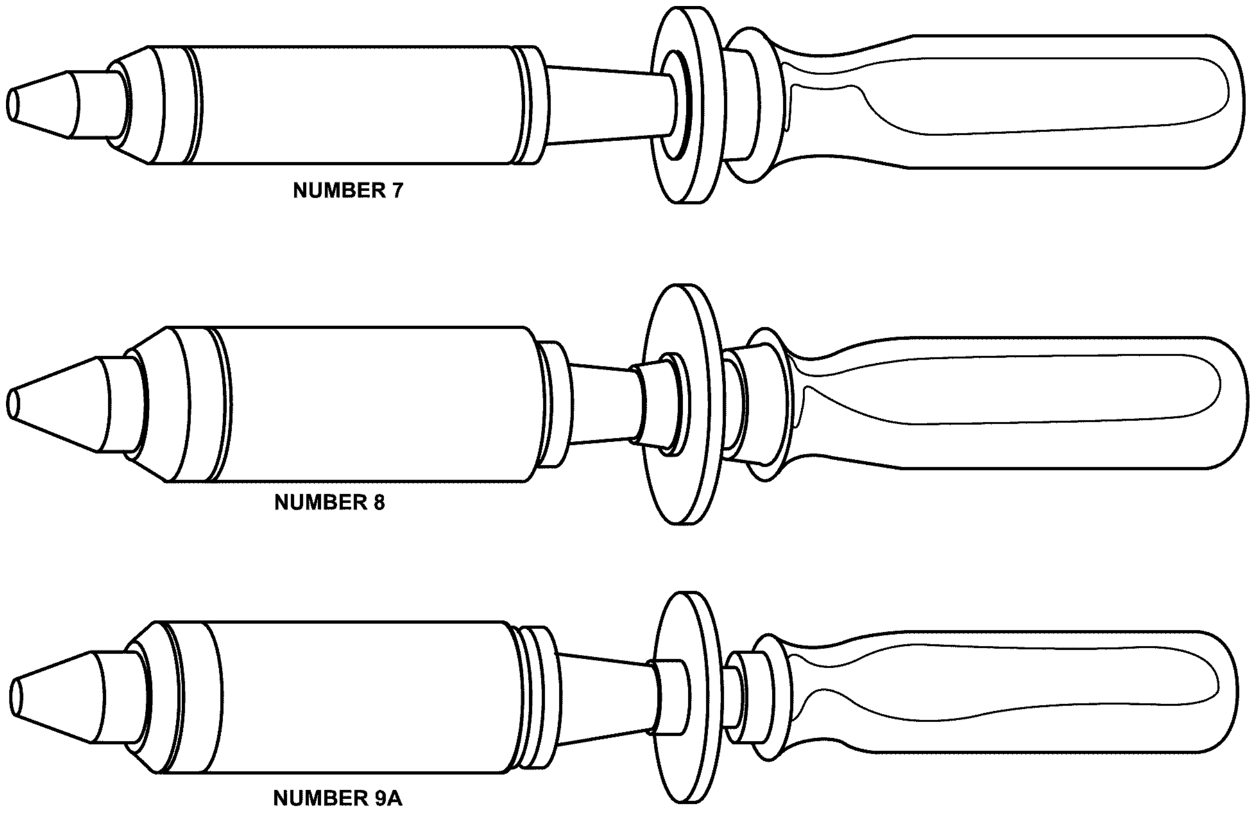
d. Riveting iron tips are made of special metal and should not be filed. The points of the tips should be reshaped with a wire brush periodically to assure satisfactory rivet expansion.

1.3.38 Installation of Explosive Rivets.

a. Insert the rivet. A push fit by hand is desirable, but a wooden mallet may be used to tap the rivet lightly to ensure a satisfactory seat. Be careful not to damage the protective coating on the shank and head.

b. After the rivet iron has reached the proper temperature, apply firmly to rivet head. Avoid contact between the surrounding sheet and the rivet head. (See Figure 1-34.)

c. The rivet should expand in from 1.5 to 6 seconds. Remove the riveting iron from the rivet immediately after expansion.



RIVETING IRON NUMBER	WATTS	VOLTS (AC)	WEIGHT OF IRON AND TIP
7	200	110-115	1 POUND - 11 OUNCES
8	300	110-115	2 POUNDS- 5 OUNCES
9A	675	110-115	3 POUNDS- 1 OUNCE

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Figure 1-33. Explosive Rivet Riveting Irons

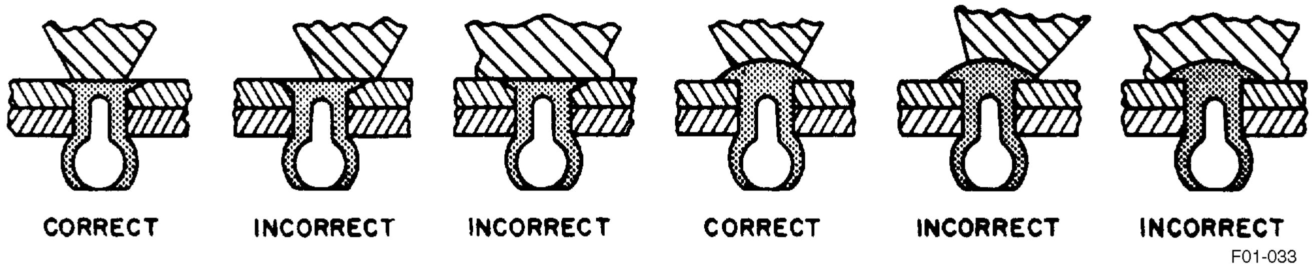


Figure 1-34. Explosive Rivet Installation

1.3.39 Precautions in Using Explosive Rivets.

a. Explosive rivets must be handled with care and kept in the original, properly marked containers.

b. Explosive rivets must be expanded with manufacturer approved riveting irons only.

c. Explosive rivets are not to be installed in holes exceeding the maximum diameters given in Table 1-6.

d. Unexpanded rivets must not be thrown in trash. If the rivets are misshapen and unfit for use, place in a suitable sturdy container and destroy by heating over a forge or open fire.

e. Rivets spilled from containers should not be used until inspected and found serviceable. Serviceable rivets should be replaced in their proper boxes.

WARNING

Do not expand explosive rivets in the presence of flammable vapors. Wings or other structures containing gasoline vapors must have inspection covers removed for circulation of free air or should be purged with carbon dioxide, when available, before riveting is started. If liquid gasoline is present, the structure must be thoroughly dried and ventilated until all traces of gasoline vapors have been removed.

f. Explosive rivets must be kept cool and dry, and should not be exposed to temperatures in excess of 52°C (125°F) while in storage.

g. Where riveting is totally blind and expansion cannot be checked, it is recommended that rivets be expanded periodically in open sheets to check for proper expansion.

1.3.40 Internally Threaded Rivets (Two Piece).

Internally threaded rivets (two piece) are blind riveting devices consisting of a barrel and a head. The rivet is made in 100 degree countersunk or flat-head styles with the heads fabricated from either aluminum or steel. The barrels are made of aluminum alloy and have either open or closed blind ends. When installed, the barrel screws up over an enlarged segment of the head shank and expands to grip the metal on the blind side. (See Figure 1-35.)

1.3.41 Selection of Internally Threaded Rivets (Two Piece).

Internally threaded rivets (two piece) are made in three diameters. Table 1-44 lists the diameters and part numbers for various metal thicknesses.

1.3.42 Installation Tools for Internally Threaded Rivets (Two Piece).

The component parts of the hand driving tool are shown in Figure 1-36. Adapter information is given in Table 1-44.

1.3.43 Installation of Internally Threaded Rivets (Two Piece).

(See Figure 1-37.)

a. Attach the correct head driver and barrel blade on the tool.

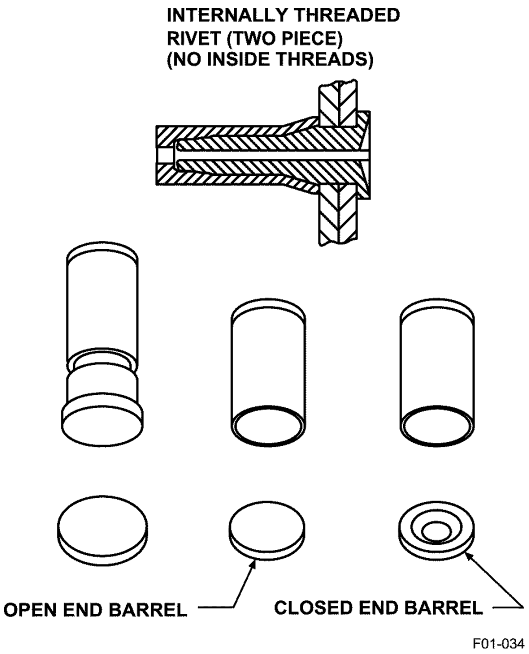


Figure 1-35. Internally Threaded Rivet (Two Piece)

b. Place the internally threaded rivet (two piece) over the barrel blade and against the head driver. Align head slots with the driving teeth on the head driver. Align the barrel blade with the rectangular hole in end of barrel.

c. Adjust pawl lever on the ratchet handle for proper ratchet direction for tightening the barrel.

d. Insert the rivet in the hole, holding the head of the rivet against the driving head.

e. Apply pressure and turn blade handle counterclockwise. The barrel blade will turn the rivet barrel and draw it against the head shoulder and sheet.

f. Take a one-eighth to one-quarter turn on the ratchet to tighten the barrel firmly, then remove the tool.

1.3.44 Rivnuts.

(Refer to Table 1-45 and Table 1-47.) Rivnuts are internally threaded and counterbored tubular rivets that can be headed blind and are used where bucking access is impossible. Rivnuts are made of 6053 aluminum alloy or steel, with either a flat or countersunk head. (See Figure 1-38.) The blind end of the rivet shank is manufactured in both open and closed ends. Special tools are required for installation. Rivnuts may be used as attaching plates in thin-walled material, or if no attachments are incorporated, the hole in the rivnut may be plugged with a steel screw.

Table 1-44. Sizes and Part Numbers for Internally Threaded Rivets (Two Piece)

Metal Thickness	Aluminum Flathead Part Number			Steel Flathead Part Number		
	.187 Dia	.234 Dia	.265 Dia	.187 Dia	.234 Dia	.265 Dia
.010 - .045	6811	6875	6915	6816	6870	6910
.045 - .080	6812	6876	6916	6817	6871	6911
.080 - . 115	6813	6877	6917	6818	6872	6912
.115 - .150	6814	6878	6918	6819	6873	6913
.150 - .185	6815	6879	6919	6820	6874	6914
Use Adapter Number	18	16	16	18	15	15
Metal Thickness	**Aluminum 100-Degree Countersunk Head Part Number**			**Steel 100-Degree Countersunk Head Part Number**		
.045 - .085	6935	6905	6925	6930	6900	6920
.085 - .120	6936	6906	6926	6931	6901	6921
.120 - .155	6937	6907	6927	6932	6902	6922
.155 - .190	6938	6908	6928	6933	6903	6923
.190 - .225	6939		6929	6934		
Use Adapter Number	18	16	16	18	15	15

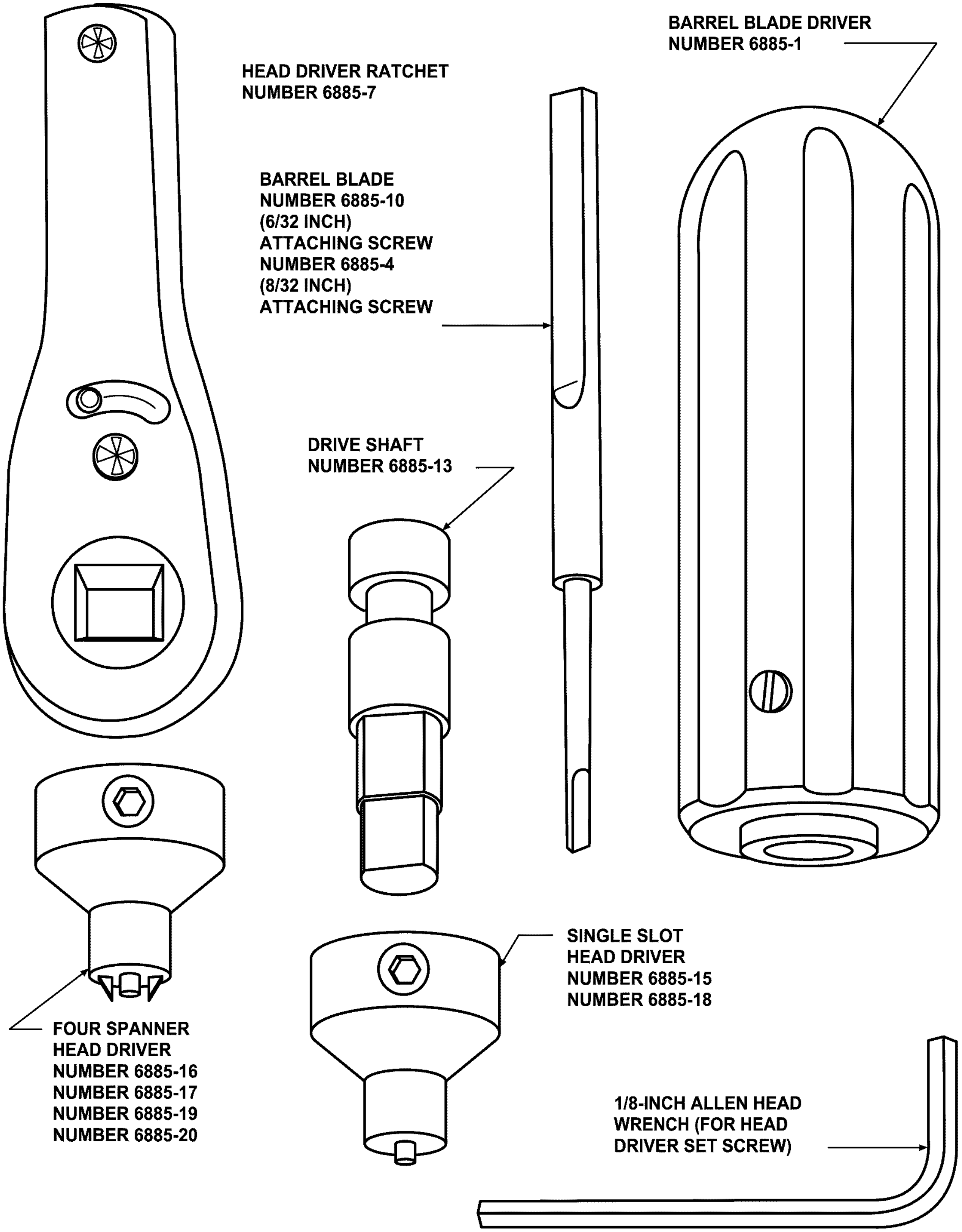


Figure 1-36. Hand Driving Tool for Internally Threaded Rivets (Two Piece)

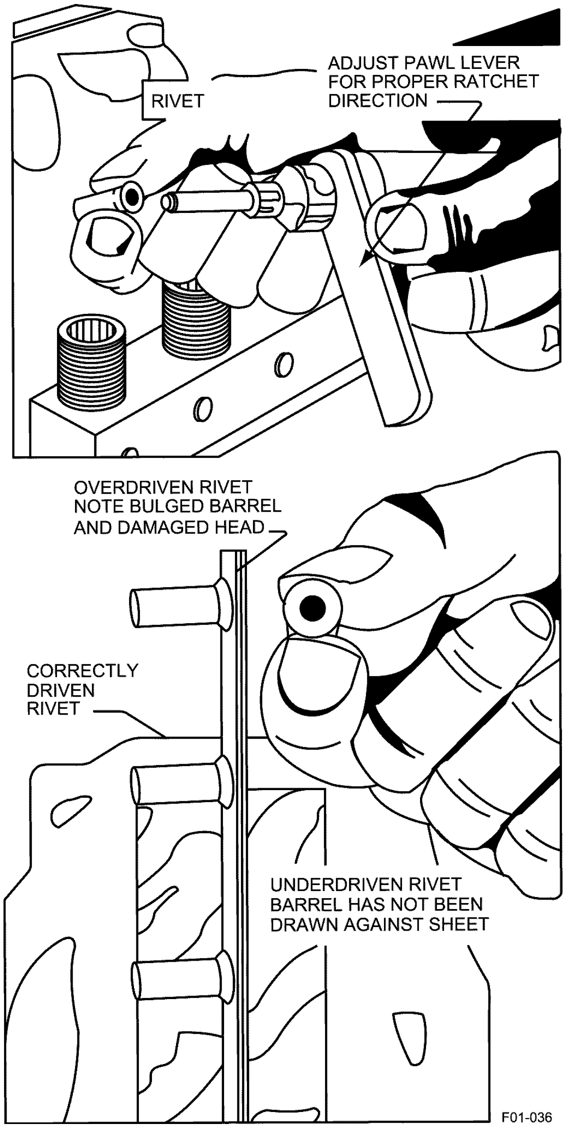


Figure 1-37. Installation of Internally Threaded Rivets (Two Piece)

1.3.45 Selection of Rivnuts. Table 1-49 gives grip lengths for all sizes and types of rivnuts. Each of the types is made in three thread sizes: number 6-32 (3/16-inch shank); number 8-32 (7/32-inch shank); and, number 10-32 (1/4-inch shank). Each type is also available in six grip ranges, shown in Table 1-45. The number at the left in each column indicates the machine screw size of the thread. The number at the right in each column indicates the maximum grip in thousandths of an inch. A dash between the two numbers indicates open end keyless; a B, closed end keyless; a K, open end with key; and a KB, closed end with key. If the figures at the right in each column are divisible by 5, the rivnut is the flathead type; if not divisible by 5, the rivnut is a countersunk type. Figure 1-39 gives information useful in determining the correct grip length for a particular job.

1.3.46 Installation Tools for Rivnuts. Both power and hand-operated tools are used to install rivnuts. The tools incorporate a threaded mandrel which is threaded into the rivnut prior to insertion of the rivnut into the material. Hand tools are made for straight, 45 degree, and 90 degree installations. A special tool is provided for forming keyways for keyed rivnuts. The keyway tool will not accommodate the heavier gage sheets. In these cases, a keyway can be made with a small round file.

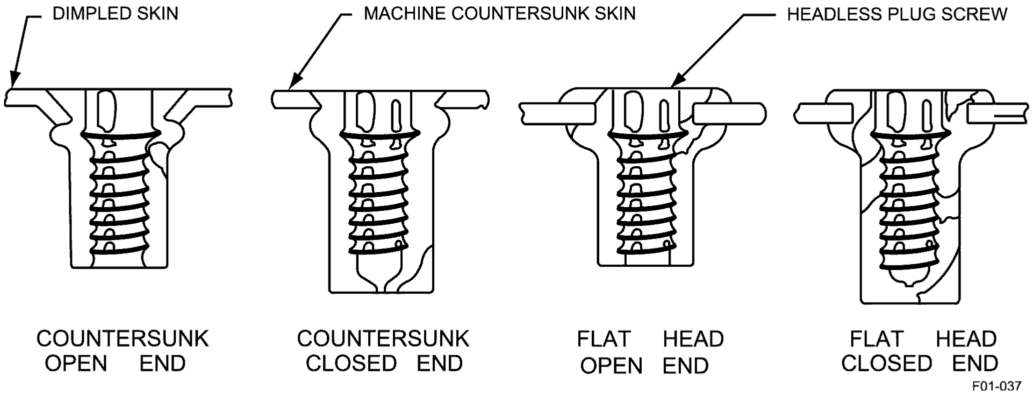
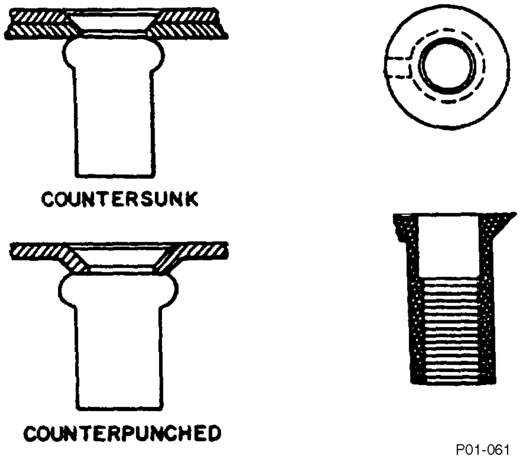


Figure 1-38. Types of Rivnuts

Table 1-45. NAS452 100-Degree Countersunk Head, Rivnut Rivet



Dash Number	Shank Diameter ±.0015	Attachment Screw Size
-6-106	.189	6-32 NC-2
-6-161		
-6-201		
-6-221		
-8-106	.221	8-32 NC-2
-8-161		
-8-221		
-10-136	.251	10-32 NF-2
-10-201		
-10-221		
-10-261		

Code:
Second dash number indicates maximum grip in 1/1000 inch.
K after first dash number indicates rivnut rivet with key.
L after first dash number indicates self-locking, rivnut rivet.
S after second dash number indicates cadmium-plated, steel, rivnut rivet.
If attachment screws are not used with rivnut rivets, they may be filled with plug screws.
Example of part number:
NAS452-6K-106-S = rivnut rivet, cadmium-plated steel, .106-inch maximum grip, with a key.
Material:
6063W aluminum alloy.
AISI 1108 steel.
Finish:
Cadmium Plating, Federal Specification QQ-P-416.
Anodize, Military Specification MIL-A-8625

Table 1-46. Nut, Blind Rivet - Countersunk Head, Internal Thread, Non-Locking (Free Running) or Self-Locking (Prevailing Torque)

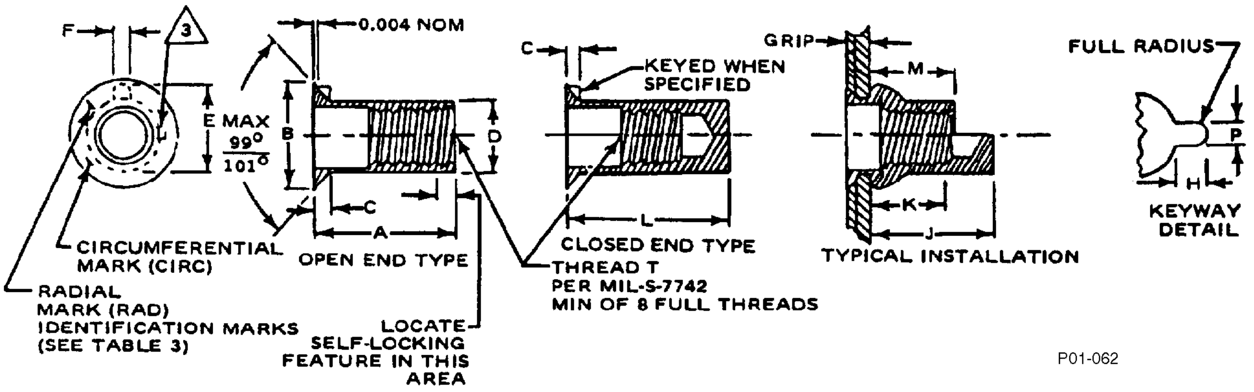


Table 1

First Dash No	Thread Size	B Nom	C Max	D +.000/ -.004	E Max	F +.005 / -.000	Install Drill Size (Ref)	Install Hole Size Min	Install Hole Size Max	Keyway Dimensions P +.003/ -.000	Keyway Dimensions H
-04	.1120-40 UNC-3B	.263	.051	.155	.198	.054	5/32	.155	.157	.062	.046 - .048
-06	.1380-32 UNC-3B	.323	.063	.189	.240	.054	NO. 12	.189	.193	.062	.056 - .058
-08	.1640-32 UNC-3B	.355	.063	.221	.271	.054	NO. 2	.221	.226	.062	.056 - .058
-3	.1900-32 UNF-3B	.391	.065	.250	.302	.054	E	.250	.256	.062	.056 - .058
-4	.2500-28 UNF-3B	.529	.089	.332	.382	.054	Q	.332	.338	.062	.056 - .058
-5	.3125-24 UNF-3B	.656	.104	.413	.505	.120	Z	.413	.423	.128	.097 - .102
-6	.3750-24 UNF-3B	.770	.124	.490	.597	.120	12.5MM	.490	.500	.128	.110 - .115
-8	.5000-20 UNF-3P	.990	.154	.640	.772	.151	41/64	.640	.650	.159	.135 - .140

Table 1-46. Nut, Blind Rivet - Countersunk Head, Internal Thread, Non-Locking (Free Running) or Self-Locking (Prevailing Torque) - Continued

Table 2				
Dash No	Axial Tensile Strength Lb - - Min			
	Al	Carbon Steel	Cres	Alloy Steel
-04	510	910	1270	1170
-06	650	1330	1670	1590
-08	800	1660	1950	2570
-3	1070	1850	3150	4130
-4	1820	3500	4760	6590
-5	2290	4330	6870	9040
-6	3340	6840	8450	12700
-8	5550	12590	*	*

* Not Available

MATERIAL:	ALUMINUM ALLOY-6053-T4 PER MIL-R-1150 (EXCEPT TEMPER) (NON-LOCKING NUTS ONLY)
	STEEL-CARBON PER QQ-W-405 STEEL NO. 1108 OR 1110 (NON-LOCKING NUTS ONLY)
	ALLOY STEEL PER QQ-W-405 STEEL NO. 4037 (SEAM FREE)
	CRES - PER QQ-W-423 FORM 1 COMP. 430 (NON-LOCKING NUTS ONLY)
FINISH:	ALUMINUM ALLOY - ANODIZE PER MIL-A-8826, TYPE II STEEL - CADMIUM PLATE PER QQ-P-416, TYPE II, CLASS 2
	PARTS WITH CLASS 3 PLATING MAY BE FURNISHED FROM SUPPLIER'S STOCK UNTIL 15 SEPT. 1977.
	CRES - PICKLED AND PASSIVATED, QQ-P-35 TYPE II
CODE:	DIAMETER AND GRIP RANGE AS TABULATED. LETTER BETWEEN BASIC NUMBER AND DASH NUMBER INDICATES MATERIAL AND FINISH; ''A'' FOR ALUMINUM ALLOY, ''S'' FOR CARBON STEEL, ''H'' FOR ALLOY STEEL, AND ''C'' FOR CORROSION RESISTANT STEEL. LETTER BETWEEN DASH NUMBERS INDICATES TYPE: ''-'' FOR KEYLESS OPEN END, ''K'' FOR KEYED OPEN END, ''B'' FOR KEYLESS CLOSED END, ''KB'' FOR KEYED CLOSED END. ADD ''L'' TO PART NUMBER TO INDICATE THREAD LOCKING PER MIL-N-25027 ON OPEN END, KEYED, ALLOY STEEL NUTS ONLY.
EXAMPLE OF PART NUMBER:	NAS1330A3K166 = ALUMINUM ALLOY KEYED OPEN END 10-32 INTERNAL THREAD .116 TO .166 GRIP RANGE
	NAS1330C6KB296 = CRES KEYED CLOSED END 3/8-24 INTERNAL THREAD .211 TO .296 GRIP RANGE.
	NAS1330H3K166L = ALLOY STEEL KEYED, OPEN END 10-32 INTERNAL THREAD .116 TO .166 GRIP RANGE, THREAD LOCKING FEATURE.
NOTES:	1. DIMENSIONS IN INCHES.
	2. THREAD LOCKING TYPE MUST BE INSTALLED WITH A MODIFIED STUD (REDUCED PITCH DIAMETER AND O.D. ON FIRST FEW THREADS)
	△3 IDENTIFY SELF-LOCKING TYPE NUT WITH ''L'' DEPRESSED .010 MAX. (LOCATION OPTIONAL)

Table 1-46. Nut, Blind Rivet - Countersunk Head, Internal Thread, Non-Locking (Free Running) or Self-Locking (Prevailing Torque) - Continued

4. PROCUREMENT SPECIFICATION: MIL-N-25027 FOR SELF-LOCKING NUTS APPLICABLE.

Part Number	Grip Range	Ident Mark	Open End Keyed and Keyless		Closed End Keyless			Closed End Keyed		
			A ±0.015	M Nom	L ±0.015	J Nom	K Nom	L ±0.015	J Nom	K Nom
NAS1330-04-81	.050 -.081	BLANK	.370	.235	.525	.390	.235	.525	.390	.235
NAS1330-04-106	.081 -.106	1 RAD	.395	.235	.550	.390	.235	.550	.390	.235
NAS1330-04-131	.106 -.131	2 RAD	.420	.235	.575	.390	.235	.575	.390	.235
NAS1330-04-156	.131 -.156	3 RAD	.450	.235	.600	.390	.235	.600	.390	.235
NAS1330-04-181	.156 -.181	4 RAD	.475	.235	.625	.390	.235	.625	.390	.235
NAS1330-06-106	.065 -.106	BLANK	.500	.325	.687	.510	.325	.812	.635	.425
NAS1330-06-161	.106 -.161	2 RAD	.500	.280	.687	.465	.280	.812	.590	.380
NAS1330-06-201	.161 -.201	4 RAD	.562	.295	.687	.420	.260	.812	.545	.335
NAS1330-06-241	.201 -.241	1 CIRC	.625	.315	.812	.505	.295	.812	.505	.295
NAS1330-06-281	.241 -.281	2 CIRC	.625	.270	.812	.465	.265	.812	.465	.265
NAS1330-08-106	.065 -.106	BLANK	.500	.325	.687	.510	.325	.812	.635	.425
NAS1330-08-161	.106 -.161	2 RAD	.500	.280	.687	.465	.280	.812	.590	.380
NAS1330-08-201	.161 -.201	4 RAD	.562	.290	.687	.415	.255	.812	.540	.330
NAS1330-08-241	.201 -.241	1 CIRC	.625	.310	.875	.560	.290	.875	.560	.290
NAS1330-08-281	.241 -.281	2 CIRC	.687	.325	.875	.515	.290	.875	.515	.290
NAS1330-3-116	.065 -.116	BLANK	.578	.395	.828	.645	.395	.828	.645	.395

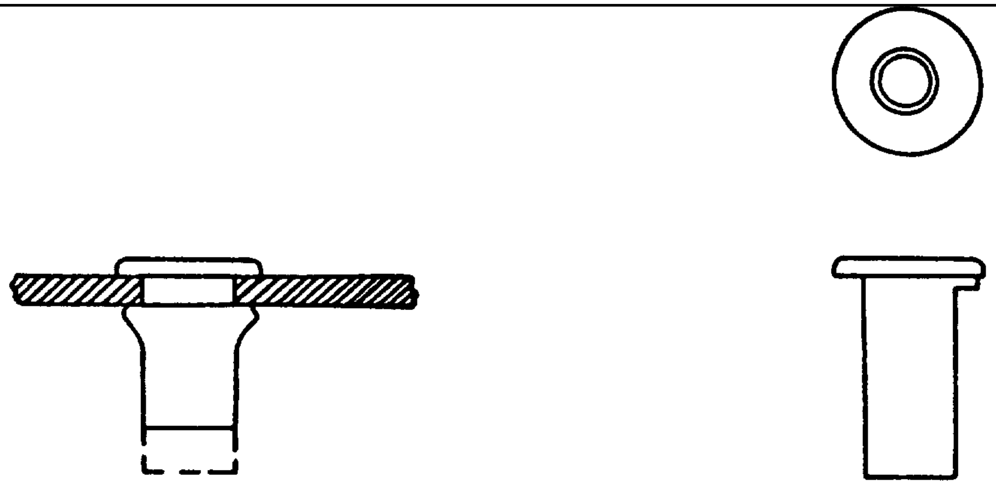
Table 1-46. Nut, Blind Rivet - Countersunk Head, Internal Thread, Non-Locking (Free Running) or Self-Locking (Prevailing Torque) - Continued

			Open End Keyed and Keyless		Closed End Keyless			Closed End Keyed		
Part Number	Grip Range	Ident Mark	A ±0.015	M Nom	L ±0.015	J Nom	K Nom	L ±0.015	J Nom	K Nom
NAS1330-3-166	.116 -.166	1 RAD	.625	.385	.875	.635	.385	.875	.635	.385
NAS1330-3-216	.166 -.216	2 RAD	.687	.400	.938	.650	.400	.938	.650	.400
NAS1330-3-266	.216 -.266	3 RAD	.734	.390	.984	.640	.390	.984	.640	.390
NAS1330-3-316	.266 -.316	4 RAD	.781	.385	1.031	.635	.385	1.031	.635	.385
NAS1330-4-151	.089 -.151	BLANK	.687	.440	1.000	.750	.435	1.000	.750	.435
NAS1330-4-211	.151 -.211	1 RAD	.750	.440	1.062	.750	.435	1.062	.750	.435
NAS1330-4-271	.211 -.271	2 RAD	.812	.440	1.125	.750	.435	1.125	.750	.435
NAS1330-4-331	.271 -.331	3 RAD	.875	.435	1.187	.750	.435	1.187	.750	.435
NAS1330-4-391	.331 -.391	4 RAD	.937	.435	1.250	.750	.435	1.250	.750	.435
NAS1330-5-181	.106 -.181	BLANK	.844	.540	1.218	.915	.540	1.218	.915	.540
NAS1330-5-256	.181 -.256	1 RAD	.937	.560	1.312	.935	.560	1.312	.935	.560
NAS1330-5-331	.256 -.331	2 RAD	1.000	.550	1.406	.955	.550	1.406	.955	.550
NAS1330-5-406	.331 -.406	3 RAD	1.093	.565	1.468	.940	.565	1.458	.940	.565
NAS1330-6-211	.125 -.211	BLANK	.938	.580	1.375	1.020	.655	1.375	1.020	.655
NAS1330-6-296	.211 -.296	1 RAD	1.031	.590	1.468	1.030	.655	1.468	1.030	.655
NAS1330-6-381	.296 -.381	2 RAD	1.125	.600	1.562	1.040	.675	1.562	1.040	.675
NAS1330-6-466	.381 -.466	3 RAD	1.219	.615	1.656	1.050	.690	1.656	1.050	.690

Table 1-46. Nut, Blind Rivet - Countersunk Head, Internal Thread, Non-Locking (Free Running) or Self-Locking (Prevailing Torque) - Continued

Part Number	Grip Range	Ident Mark	Open End Keyed and Keyless		Closed End Keyless			Closed End Keyed		
			A ±0.015	M Nom	L ±0.015	J Nom	K Nom	L ±0.015	J Nom	K Nom
NAS1330-8-276	.156 -.276	BLANK	1.188	.725	1.781	1.320	.850	1.781	1.320	.850
NAS1330-8-396	.276 -.396	1 RAD	1.312	.730	1.906	1.325	.865	1.906	1.325	.865
NAS1330-8-516	.396 -.516	2 RAD	1.438	.735	2.031	1.330	.880	2.031	1.330	.880
NAS1330-8-636	.516 -.636	3 RAD	1.578	.750	2.172	1.350	.890	2.172	1.350	.890

Table 1-47. NAS453 Flathead, Rivnut Rivet



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Dash Number		Shank Diameter	Attachment Screw Size	Grip Range	
Keyless	With Key			Min	Max
-22	-12	.189	6-32 NC-2	.010	.075
-24	-14			.075	.120
-26	-16			.120	.160
-62	-63			.160	.200
-66	-67			.200	.240
-70	-71			.240	.280
-74	-75			.280	.320
-79	-80			.320	.360
-83	-84			.360	.400
-87	-88			.400	.440
-34	-28	.221	8-32 NC-2	.010	.075
-36	-30			.075	.120
-39	-40			.120	.180
-10-75	-10K-75	.251	10-32 NC-2	.020	.075
-10-140	-10K-140			.075	.140
-10-190	-10K-190			.140	.190

Code:
S after dash number indicates steel, rivnut rivet.
If attachment screws are not used with rivnut rivets, they may be filled with plug screws.
Example of part number:
NAS453-12S = rivnut rivet, steel.
Material:
6063W aluminum alloy.
AISI 1108 steel.

Table 1-48. Nut, Blind Rivet - Flathead, Internal Thread, Non-Locking (Free Running) and Self-Locking (Prevailing Torque)

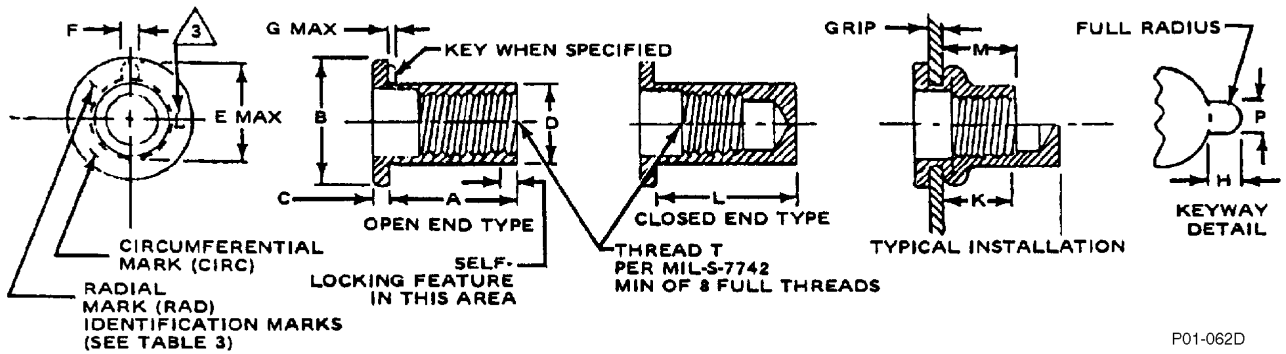


Table 1

		B	C	D	E	F	G		Install Hole Size		Keyway Dimensions	
First Dash No	Thread Size	±.015	Nom	+.000/ -.004	Max	+.005/ -.000	Max	Install Drill Size (Ref)	Min	Max	P +.003/ -.000	H
-04	.1120-40 UNC-3B	.270	.025	.155	.198	.054	.023	5/32	.155	.157	.062	.046 - .048
-06	.1380-32 UNC-3B	.325	.032	.189	.240	.054	.023	NO 12	.189	.193	.062	.056 - .058
-08	.1640-32 UNC-3B	.357	.032	.221	.271	.054	.023	NO 2	.221	.226	.062	.056 - .058
-3	.1900-32 UNF-3B	.406	.038	.250	.302	.054	.023	E	.250	.256	.062	.056 - .058
-4	.2500-28 UNF-3B	.475	.058	.332	.382	.054	.035	Q	.332	.338	.062	.056 - .058
-5	.3125-24 UNF-3B	.665	.062	.413	.505	.120	.040	Z	.413	.423	.128	.097 - .102
-6	.3750-24 UNF-3B	.781	.088	.490	.597	.120	.040	12.5MM	.490	.500	.128	.110 - .115
-8	.5000-20 UNF-3B	1.000	.125	.640	.772	.151	.040	41/64	.640	.650	.159	.135 - .140

Table 1-48. Nut, Blind Rivet - Flathead, Internal Thread, Non-Locking (Free Running) and Self-Locking (Prevailing Torque) - Continued

Table 2

Dash No.	Axial Tensile Strength Lb - - Min			
	AL	Carbon Steel	Cres	Alloy Steel
-04	510	910	1270	1170
-06	650	1330	1670	1590
-08	800	1660	1950	2570
-3	1070	1850	3150	4130
-4	1820	3500	4760	6590
-5	2290	4330	6870	9040
-6	3340	6840	8450	12700
-8	5550	12590	*	*

* Not Available

MATERIAL:	ALUMINUM ALLOY-6053-T4 PER MIL-R-1150 (EXCEPT TEMPER) (NON-LOCKING NUTS ONLY)) STEEL-CARBON PER QQ-W-405 STEEL NO. 1108 OR 1110 (NON-LOCKING NUTS ONLY ALLOY STEEL PER QQ-W-405 STEEL NO. 4037 (SEAM FREE) CRES - PER QQ-W-423 FORM 1 COMP. 430 (NON-LOCKING NUTS ONLY)
FINISH:	ALUMINUM ALLOY - ANODIZE PER MIL-A-8625, TYPE II. STEEL - CADMIUM PLATE PER QQ-P-416, TYPE II, CLASS 2 PARTS WITH CLASS 3 PLATING MAY BE FURNISHED FROM SUPPLIER'S STOCK UNTIL 15 SEPT. 1977 CRES - PICKLED AND PASSIVATED, QQ-P-35 TYPE II
CODE:	DIAMETER AND GRIP RANGE AS TABULATED. LETTER BETWEEN BASIC NUMBER AND DASH NUMBER INDICATES MATERIAL AND FINISH; ''A'' FOR ALUMINUM ALLOY, ''S'' FOR CARBON STEEL, ''H'' FOR ALLOY STEEL, AND ''C'' FOR CORROSION RESISTANT STEEL. LETTER BETWEEN DASH NUMBERS INDICATES TYPE: ''-'' FOR KEYLESS OPEN END, ''K'' FOR KEYED OPEN END, ''B'' FOR KEYLESS CLOSED END, ''KB'' FOR KEYED CLOSED END. ADD ''L'' TO PART NUMBER TO INDICATE THREAD LOCKING PER MIL-N-25027 ON OPEN END, KEYED, ALLOY STEEL NUTS ONLY.
EXAMPLE OF PART NUMBER:	NAS1329A3K130 = ALUMINUM ALLOY KEYED OPEN END 10-32 INTERNAL THREAD 0.080 TO 0.130 GRIP RANGE. NAS1329C6KH200 = CRES KEYED CLOSED END 3/8-24 INTERNAL THREAD 0.115 TO 0.200 GRIP RANGE. NAS1329H3K130L = ALLOY STEEL KEYED, OPEN END 10-32 INTERNAL THREAD 0.080 - 0.130 GRIP RANGE, THREAD LOCKING FEATURE.
NOTES:	1. DIMENSIONS IN INCHES. 2. THREAD LOCKING TYPE MUST BE INSTALLED WITH A MODIFIED STUD (REDUCED PITCH DIAMETER AND O.D. ON FIRST FEW THREADS) △3 IDENTIFY SELF-LOCKING TYPE NUT WITH ''L'' DEPRESSED 0.010 MAX. (LOCATION OPTIONAL)

Table 1-48. Nut, Blind Rivet - Flathead, Internal Thread, Non-Locking (Free Running) and Self-Locking (Prevailing Torque) - Continued

4. PROCUREMENT SPECIFICATION:
MIL-N-25027 FOR SELF-LOCKING NUTS APPLICABLE.

			Open End Keyed and Keyless		Closed End Keyless			Closed End Keyed		
			A	M	L	J	K	L	J	K
Part Number	Grip Range	Ident Mark	±.015	Nom	±.015	Nom	Nom	±.015	Nom	Nom
NAS1329-04-60	.010 - 0.060	BLANK	.345	.230	.500	.385	.230	.500	.385	.230
NAS1329-04-85	.060 -0.085	1 RAD	.370	.230	.525	.385	.230	.525	.385	.230
NAS1329-04-110	.085 -0.110	2 RAD	.400	.230	.555	.390	.230	.555	.390	.230
NAS1329-04-135	.110 -0.135	3 RAD	.425	.230	.580	.385	.230	.580	.385	.230
NAS1329-04-160	.133 -0.160	4 RAD	.450	.230	.605	.385	.230	.605	.385	.230
NAS1329-06-75	.010 -0.075	1 RAD	.438	.300	.625	.490	.305	.750	.615	.405
NAS1329-06-120	.075 -0.120	3 RAD	.500	.315	.625	.440	.255	.750	.565	.355
NAS1329-06-160	.120 -0.160	5 RAD	.500	.270	.750	.520	.260	.750	.520	.310
NAS1329-06-200	.160 -0.200	1 CIRC	.562	.290	.750	.480	.260	.750	.480	.260
NAS1329-06-240	.200 -0.240	2 CIRC	.625	.310	.750	.435	.260	.750	.435	.260
NAS1329-08-75	.010 -0.075	1 RAD	.438	.300	.625	.490	.305	.750	.615	.405
NAS1329-08-120	.075 -0.120	3 RAD	.500	.315	.625	.440	.255	.750	.565	.355
NAS1329-08-160	.120 -0.160	5 RAD	.500	.270	.750	.520	.260	.750	.520	.310
NAS1329-08-200	.160 -0.200	1 CIRC	.625	.350	.750	.475	.265	.750	.475	.265
NAS1329-08-240	.200 -0.240	2 CIRC	.625	.305	.875	.555	.310	.875	.555	.310

Table 1-48. Nut, Blind Rivet - Flathead, Internal Thread, Non-Locking (Free Running) and Self-Locking (Prevailing Torque) - Continued

			Open End Keyed and Keyless		Closed End Keyless			Closed End Keyed		
			A	M	L	J	K	L	J	K
Part Number	Grip Range	Ident Mark	±.015	Nom	±.015	Nom	Nom	±.015	Nom	Nom
NAS1329-3-80	.010 -0.080	BLANK	.531	.380	.781	.630	.380	.781	.630	.380
NAS1329-3-130	.080 -0.130	1 RAD	.594	.390	.843	.640	.390	.843	.640	.390
NAS1329-3-180	.130 -0.180	2 RAD	.641	.390	.891	.640	.390	.891	.640	.390
NAS1329-3-230	.180 -0.230	3 RAD	.703	.395	.953	.645	.395	.953	.645	.395
NAS1329-3-280	.230 -0.280	4 RAD	.750	.395	1.000	.645	.395	1.000	.645	.395
NAS1329-4-80	.020 -0.080	BLANK	.625	.450	.937	.760	.440	.937	.760	.440
NAS1329-4-140	.080 -0.140	1 RAD	.687	.450	1.000	.760	.440	1.000	.760	.440
NAS1329-4-200	.140 -0.200	2 RAD	.750	.450	1.062	.760	.440	1.062	.760	.440
NAS1329-4-260	.200 -0.260	3 RAD	.812	.445	1.125	.755	.445	1.125	.755	.445
NAS1329-4-320	.260 -0.320	4 RAD	.875	.445	1.187	.755	.445	1.187	.755	.445
NAS1329-5-125	.050 -0.125	BLANK	.750	.505	1.187	.940	.550	1.187	.940	.550
NAS1329-5-200	.125 -0.200	1 RAD	.875	.555	1.281	.960	.555	1.281	.960	.555
NAS1329-5-275	.200 -0.275	2 RAD	.937	.540	1.343	.950	.560	1.343	.950	.560
NAS1329-5-350	.275 -0.350	3 RAD	1.032	.560	1.437	.965	.570	1.437	.965	.570
NAS1329-6-115	.030 -0.115	BLANK	.844	.585	1.281	1.020	.660	1.281	1.020	.660
NAS1329-6-200	.115 -0.200	1 RAD	.938	.595	1.375	1.030	.670	1.375	1.030	.670

Table 1-48. Nut, Blind Rivet - Flathead, Internal Thread, Non-Locking (Free Running) and Self-Locking (Prevailing Torque) - Continued

			Open End Keyed and Keyless		Closed End Keyless			Closed End Keyed		
			A	M	L	J	K	L	J	K
Part Number	Grip Range	Ident Mark	±.015	Nom	±.015	Nom	Nom	±.015	Nom	Nom
NAS1329-6-285	.200 -0.285	2 RAD	1.031	.605	1.468	1.040	.680	1.468	1.040	.680
NAS1329-6-370	.285 -0.370	3 RAD	1.125	.615	1.562	1.050	.690	1.562	1.050	.690
NAS1329-8-145	.025 -0.145	BLANK	1.062	.730	1.656	1.325	.855	1.656	1.325	.855
NAS1329-8-265	.145 -0.265	1 RAD	1.188	.735	1.781	1.330	.865	1.781	1.330	.865
NAS1329-8-385	.265 -0.385	2 RAD	1.312	.740	1.906	1.335	.875	1.906	1.335	.875
NAS1329-8-505	.385 -0.505	3 RAD	1.453	.765	2.156	1.465	.895	2.156	1.465	.895

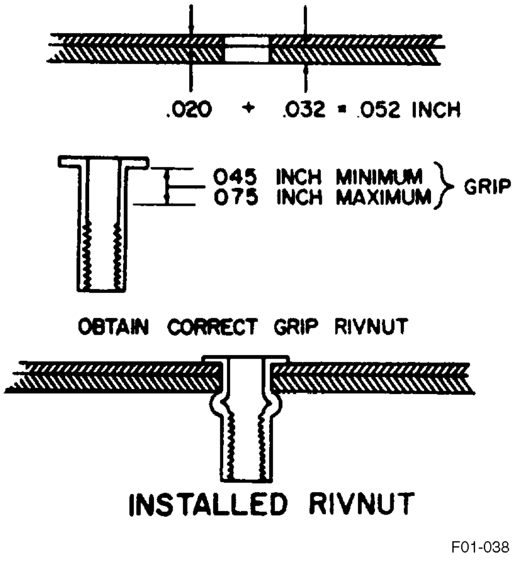


Figure 1-39. Rivnut Grip Length

1.3.47 Installation of Rivnuts. (See Figure 1-40.)

a. Thread the proper rivnut on the mandrel of the tool until the head is against the anvil of the heading tool.

b. If using a keyed rivnut, place in hole so that key fits into keyway.

c. Hold tool so that mandrel is at 90 degrees to work, and actuate heading tool. If using a hand tool, retract the mandrel until solid resistance is felt.

d. Unthread mandrel and remove tool.

1.3.48 MS20450 Tubular Rivet. (Refer to Table 1-50.) The MS20450 tubular rivet is a partially hollow, shank rivet made in three styles. Style A is a deep-drilled, shank rivet used for fastening leather, heavy fabric, and copper; style C is an oval head rivet; and style D is a countersunk head rivet. The last two styles are shallow drilled and used on metals other than copper. Tubular rivets are not used in structural applications and their use on aircraft is limited.

1.4 NONSTANDARD RIVETS.

1.4.1 Jo-Bolts. Jo-Bolt fasteners are used on difficult riveting jobs when access to one side of the work is impossible. The fastener consists of three parts: an aluminum alloy or alloy steel nut, a threaded alloy steel bolt, and a corrosion resistant steel sleeve, which are factory preassembled. As the Jo-Bolt is installed, the bolt is turned while the nut is held, causing the sleeve to expand over the end of the nut, forming the blind head and clamping against the work. When driving is complete, the bolt wrenching end breaks off from flush to below the head. The head styles available for Jo-Bolts are the 100° flush head, hexagon protruding head, and the 100° flush millable head.

1.4.2 Identification. Each Jo-Bolt is identified by a standard code number which represents the type and style of rivet, the nominal diameter, and the grip range of the fastener. The type of Jo-Bolt and nominal diameter, in thousandths of an inch, is represented by the basic code number; the dash number represents the grip range. Figure 1-41 shows the basic code number for standard size and 1/64 inch oversize repair fasteners. The dash number can be obtained from the chart giving the grip length ranges. An example of the standard code number would be NAS1670-3-5. This represents an alloy steel 100° flush head Jo-Bolt. The nominal diameter would be 3/16 and the fastener could be used in material ranging in thickness from 0.282 to 0.344. The 1987 National Aerospace Standards (NAS) revision has added a D prefix to the L code to identify those Jo-Bolt fasteners that drive nuts. The DL and L coded fasteners are functionally equivalent.

1.4.3 Fastener Layout. The following will outline the requirements and procedures for correct fastener location.

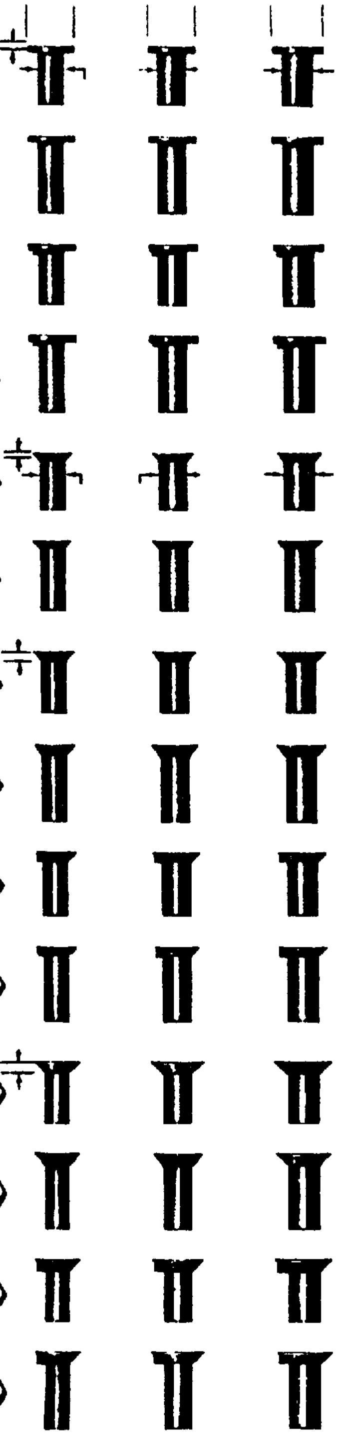
1.4.4 Edge Distance. Fastener edge distance is measured from the centerline of the fastener to the nearest edge of the part through which it passes. The recommended minimum edge distance for flush and protruding head Jo-Bolts is two times the nominal diameter plus 0.06. This minimum edge distance may be used except when specified differently on a repair procedure or when replacing Jo-Bolts.

1.4.5 Spacing. Spacing for Jo-Bolts is measured between the centerlines of adjacent fasteners. The minimum spacing between protruding, hex head Jo-Bolts shall not be less than three and one-half times the nominal fastener diameter. The minimum spacing between flush head and millable head Jo-Bolts shall not be less than four times the nominal diameter of the fastener. These dimensions shall be used as the minimum spacing except when specified differently in a specific repair procedure or when replacing existing Jo-Bolts.

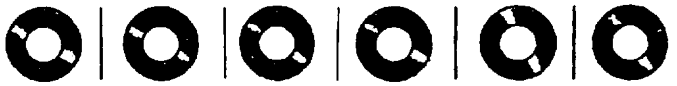
Table 1-49. Rivnut Data

HEAD TYPES

SIZE 6-32 **SIZE 8-32** **SIZE 10-32**



Grip Range Identified by Marks on Head



MAXIMUM GRIP—Figure at right indicates maximum grip in thousandths of an inch.
MINIMUM GRIP— is the same as maximum grip of preceding side.

	0.32 HEAD THICKNESS					
OPEN END KEYLESS	6-45	6-75	6-100	6-120	6-140	6-160
	8-45	8-75	8-100	8-120	8-140	8-160
	10-45	10-75	10-100	10-120	10-140	10-160
CLOSED END KEYLESS	6B45	6B75	6B100	6B120	6B140	6B160
	8B45	8B75	8B100	8B120	8B140	8B160
	10B45	10B75	10B100	10B120	10B140	10B160
OPEN END WITH KEY	6K45	6K75	6K100	6K120	6K140	6K160
	8K45	8K75	8K100	8K120	8K140	8K160
	10K45	10K75	10K100	10K120	10K140	10K160
CLOSED END WITH KEY	6KB45	6KB75	6KB100	6KB120	6KB140	6KB160
	8KB45	8KB75	8KB100	8KB120	8KB140	8KB160
	10KB45	10KB75	10KB100	10KB120	10KB140	10KB160
	100° – 0.48 HEAD THICKNESS					
OPEN END KEYLESS	6-91	6-121	6-146	6-166	6-186	6-206
	8-91	8-121	8-146	8-166	8-186	8-206
	10-91	10-121	10-146	10-166	10-186	10-206
CLOSED END KEYLESS	6B91	6B121	6B146	6B166	6B186	6B206
	8B91	8B121	8B146	8B166	8B186	8B206
	10B91	10B121	10B146	10B166	10B186	10B206
	100°—0.63 HEAD THICKNESS					
OPEN END KEYLESS	6-106	6-136	6-161	6-181	6-201	6-221
	8-106	8-136	8-161	8-181	8-201	8-221
	10-106	10-136	10-161	10-181	10-201	10-221
CLOSED END KEYLESS	6B106	6B136	6B161	6B181	6B201	6B221
	8B106	8B136	8B161	8B181	8B201	8B221
	10B106	10B136	10B161	10B181	10B201	10B221
OPEN END WITH KEY	6K106	6K136	6K161	6K181	6K201	6K221
	8K106	8K136	8K161	8K181	8K201	8K221
	10K106	10K136	10K161	10K181	10K201	10K221
CLOSED END WITH KEY	6KB106	6KB136	6KB161	6KB181	6KB201	6KB221
	8KB106	8KB136	8KB161	8KB181	8KB201	8KB221
	10KB106	10KB136	10KB161	10KB181	10KB201	10KB221
	115°—0.63 HEAD THICKNESS					
OPEN END KEYLESS	6-107	6-137	6-162	6-182	6-202	6-222
	8-107	8-137	8-162	8-182	8-202	8-222
	10-107	10-137	10-162	10-182	10-202	10-222
CLOSED END KEYLESS	6B107	6B137	6B162	6B182	6B202	6B222
	8B107	8B137	8B162	8B182	8B202	8B222
	10B107	10B137	10B162	10B182	10B202	10B222
OPEN END WITH KEY	6K107	6K137	6K162	6K182	6K202	6K222
	8K107	8K137	8K162	8K182	8K202	8K222
	10K107	10K137	10K162	10K182	10K202	10K222
CLOSED END WITH KEY	6KB107	6KB137	6KB162	6KB182	6KB202	6KB222
	8KB107	8KB137	8KB162	8KB182	8KB202	8KB222
	10KB107	10KB137	10KB162	10KB182	10KB202	10KB222

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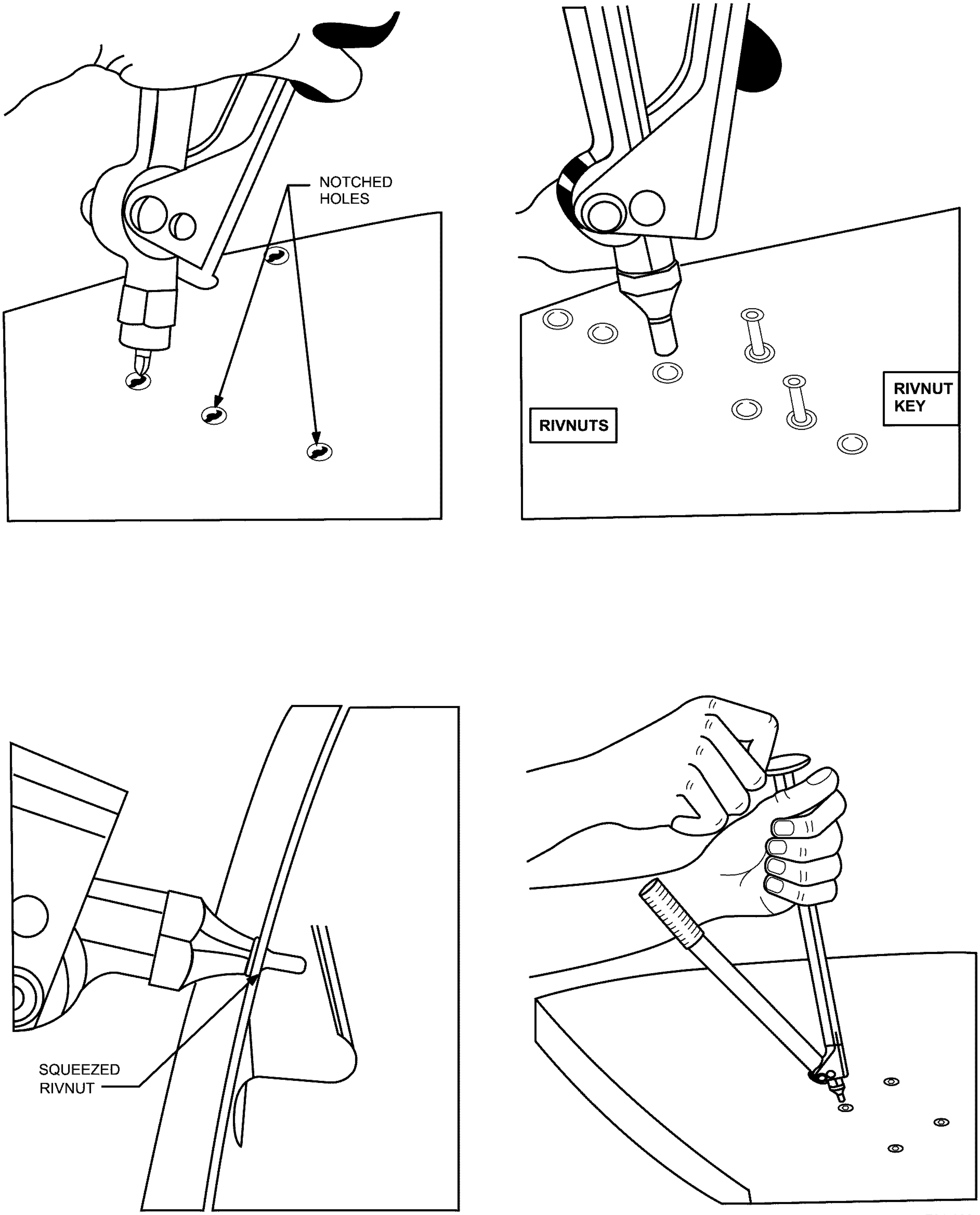
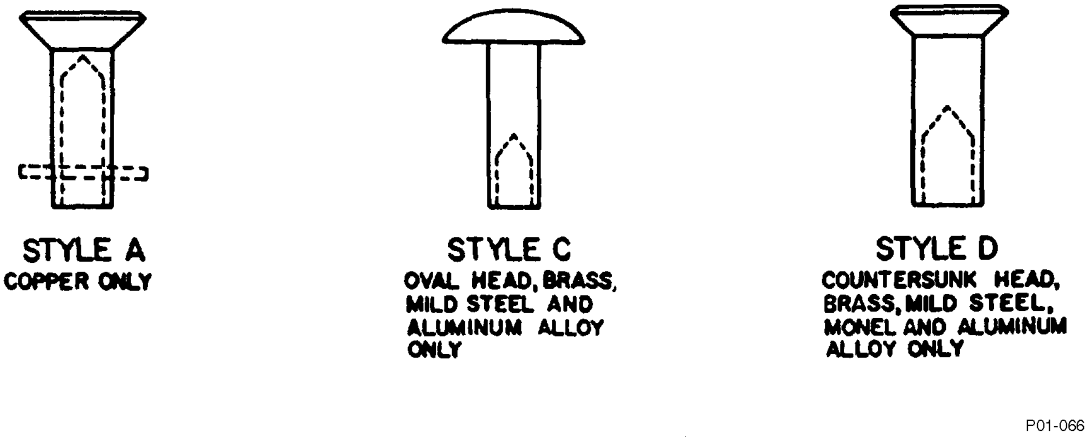


Figure 1-40. Installation of Rivnuts

1.4.6 Hole Preparation. The size hole and countersink diameter used when installing Jo-Bolts are given in Table 1-51. Exceptions to this are, where specified differently in repair procedures, or when replacing existing fasteners. For the installation of flush head Jo-Bolts, the sheet shall be dimpled or machine countersunk. Machine countersinks and dimples that receive the head of the Jo-Bolt shall have a 100° included angle and shall be deep enough so the head fits flush with the surrounding surface. Countersinks in material that fall within the limits given in Table 1-51 will permit the flush head fasteners to seat flush with plus or minus 0.005. The dimensions of flush head, nonmillable Jo-Bolts are approximately the same as the AN509 screw and the same dimpling tools may be used. Dimpled parts that receive flush head Jo-Bolts shall have undersize pilot holes for the dimpling operation. The holes shall be redrilled and reamed to bring them to final size. Extreme care shall be exercised in the preparation of the holes for Jo-Bolts. It is recommended the holes be drilled undersize and then brought up to final size by reaming.

1.4.7 Tools and Equipment. See Figure 1-43. Special tools are required for the installation of Jo-Bolts. In no case shall power screwdrivers or drill tools used in conjunction with a 1/4 inch socket and ratchet wrench be used for installing Jo-Bolt fasteners. The hand tool consists of a tool body, nose adapter, and wrench adapter. The nose adapter is secured in the tool body and prevents the nut portion of the Jo-Bolt from turning during installation. The wrench adapter rides free inside the nose adapter and gets turning action from the ratchet wrench. Millable head Jo-Bolts may be shaved flush using a standard rivet shaver equipment with a carbide cutter turning at least 10,000 rpm. The diameter of the cutter must be large enough to permit the steel core of the bolt to be at least 3/16 of an inch from the center of the cutter. A one-inch diameter cutter is required for most fasteners.

Table 1-50. MS20450 Tubular Rivet



First Dash Number	Shank Diameter ±.005	Head Diameter		
		Style A ±.016	Style C ±.016	Style D ±.016
-6	.088		.141	
-8	.121		.219	.250
-9	.146	.312		.312
-12	.186	.359	.312	.359

Code:

First dash number indicates nominal diameter in 1/64 inch.

Second dash number indicates length in 1/32 inch.

A after basic part number indicates style A.

C after basic part number indicates style C.

D after basic part number indicates style D.

Table 1-50. MS20450 Tubular Rivet - Continued

C after first dash number indicates copper rivet.
B after first dash number indicates brass rivet.
AD after first dash number indicates aluminum alloy rivet.
M after first dash number indicates Monel rivet.
No letter after first dash number indicates mild steel rivet.
Example of part number:
MS20450C12-8 = mild steel rivet, style C, 3/16-inch nominal diameter, 1/4-inch long.
Material:
Brass, Federal Specification QQ-W-321, grade B.
Monel, Federal Specification QQ-N-281.
1010 or 1015 mild steel, Federal Specification QQ-W-409.
Copper, Federal Specification QQ-W-341.
Aluminum alloy.
Finish:
Cadmium plating, Federal Specification QQ-P-416 or zinc plating, Federal Specification QQ-Z-325 (applicable to mild steel rivets only).

Style	Description	Temperature Limitations (Degree Fahrenheit)	Nominal Diameter	Basic Code Number (Standard Size)	Basic Code Number (1/64 Oversize)
	ALLOY STEEL 100° FLUSH HEAD	450 MAX	5/32	NAS1670-08L() PLT 110-5-()	NAS1750-08L()
		3/16	NAS1670-3L() PLT 110-6-()	NAS1750-3L()	
		1/4	NAS1670-4L() PLT 110-8-()	NAS1750-4L()	
			5/16	NAS1670-5L() PLT 110-10-()	NAS1750-5L()
			3/8	NAS1670-6L()	NAS1750-6L()
	HIGH TEMPERA-TURE 100° FLUSH HEAD	1200 MAX	5/32	NAS1672-08L() PLT 120-5-()	NAS1752-08L()
			3/16	NAS1672-3L() PLT 120-6-()	NAS1752-3L()
			1/4	NAS1672-4L() PLT 120-8-()	NAS1752-4L()
			5/16	NAS1672-5L() PLT 120-10-()	NAS1752-5L()
			3/8	NAS1672-6L() PLT 120-12-()	NAS1752-6L()

Figure 1-41. Jo-Bolt Identification (Sheet 1 of 3)

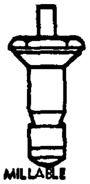
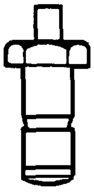
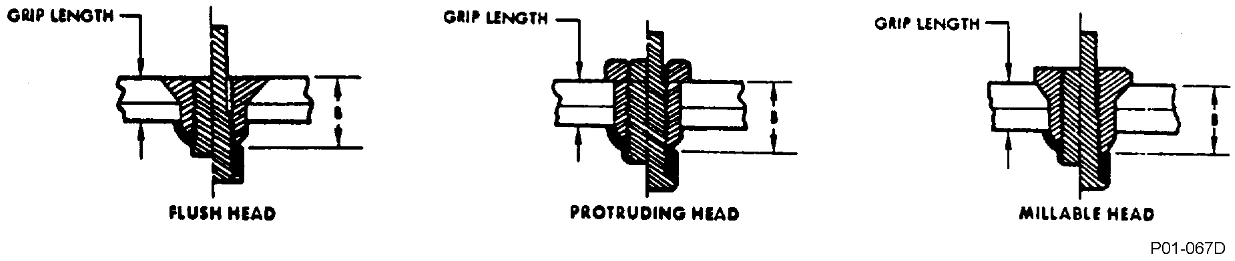
Style	Description	Temperature Limitations (Degree Fahrenheit)	Nominal Diameter	Basic Code Number (Standard Size)	Basic Code Number (1/64 Oversize)
 MILLABLE HEAD (FLUSH)	ALUMINUM ALLOY 100° MILLABLE HEAD	250 MAX	5/32	NAS1674-08L() PLT 130-5-()	NAS1754-08L()
		3/16	ST3M687-08L() PLT 130-5-1.5	NAS1754-3L()	
		1/4	NAS1674-3L() PLT 130-6-()	NAS1754-4L()	
				NAS1674-4L() PLT 130-8-()	
 HEX HEAD (PROTRUDING)	ALLOY STEEL HEX HEAD	450 MAX	5/32	NAS1669-08L() PLT 210-5-()	NAS1751-08L()
		3/16	NAS1669-3L() PLT 210-6-()	NAS1751-3L()	
		1/4	NAS1669-4L() PLT 210-8-()	NAS1751-4L()	
			5/16	NAS1669-5L() PLT 210-10-()	NAS1751-5L()
			3/8	NAS1669-6L() PLT 210-12-()	NASI751-6L()
	HIGH TEMPERATURE HEX HEAD	1200 MAX	5/32	NAS1671-08L() PLT 220-5-()	NAS1753-08L()
			3/16	NAS1671-3L() PLT 220-6-()	NAS1753-3L()
			1/4	NAS1671-4L() PLT 220-8-()	NAS1753-4L()
			5/16	NAS1671-5L() PLT 220-10-()	NAS1753-5L()
			3/8	NAS1671-6L() PLT 220-12-()	NAS1753-6L()
	ALUMINUM ALLOY HEX HEAD	250 MAX	5/32	NAS1673-08L() PLT 230-5-()	NAS1755-08L()
			3/16	NAS1673-3L() PLT 230-6-()	NAS1755-3L()
			1/4	NAS1673-4L() PLT 230-8-()	NAS1755-4L()

Figure 1-41. Jo-Bolt Identification (Sheet 2)



Jo-Bolt Grip Lengths

Length Dash No	Grip Length Range	Dimension "B" Non-Millable Head Jo-Bolts					Dimension "B" Millable Head Jo-Bolts		
		NAS1670 NAS1671 NAS1672 NAS1673 NAS1669			NAS1670 NAS1669 NAS1671 NAS1672		NAS1674 ST3M687		
		5/32	3/16	1/4	5/16	3/8	5/32	3/16	1/4
1	0.031 -0.093	0.17							
2	0.094 -0.156	0.23	0.23	0.26			0.31	0.31	0.34
3	0.157 -0.219	0.29	0.29	0.32	0.34	0.42	0.37	0.37	0.40
4	0.219 -0.281	0.36	0.35	0.38	0.41	0.48	0.43	0.43	0.46
5	0.281 -0.344	0.42	0.42	0.44	0.47	0.54	0.49	0.50	0.52
6	0.344 -0.406	0.48	0.48	0.51	0.53	0.60	0.56	0.56	0.59
7	0.406 -0.469	0.54	0.54	0.57	0.59	0.67	0.62	0.62	0.65
8	0.469 -0.531	0.61	0.60	0.63	0.66	0.73	0.68	0.68	0.71
9	0.531 -0.594	0.67	0.67	0.69	0.72	0.79	0.74	0.75	0.77
10	0.594 -0.656	0.73	0.73	0.76	0.78	0.85	0.81	0.81	0.84
11	0.656 -0.719	0.79	0.79	0.82	0.84	0.92	0.87	0.87	0.90
12	0.719 -0.781	0.86	0.85	0.88	0.91	0.98	0.93	0.93	0.96
13	0.781 -0.844	0.92	0.92	0.94	0.97	1.04	0.99	1.00	1.02
14	0.844 -0.906	0.98	0.98	1.01	1.03	1.10	1.06	1.06	1.09
15	0.906 -0.969	1.04	1.04	1.07	1.09	1.17	1.12	1.12	1.15
16	0.969 - 1.031	1.11	1.10	1.13	1.16	1.23	1.18	1.18	1 21

NOTE

Dimension B and grip length are measured from bearing surface of head for protruding head types.

Figure 1-41. Jo-Bolt Identification (Sheet 3)

Table 1-51. Jo-Bolt Hole Sizes and Countersink Diameters

Nominal Diameter	Standard Hole Size	1/64 Oversize	Countersink Diameter Nonmillable Head	Countersink Diameter Millable Head
5/32	0.165 +.003/-.000	0.180 +.002/-.000	0.323 - 0.333	0.270 - 0.280
3/16	0.199 +.003/-.000	0.215 +.002/-.000	0.376 - 0.386	0.325 - 0.335
1/4	0.230 +.003/-.000	0.276 +.002/-.000	0.498 - 0.508	0.450 - 0.460
5/16	0.312 +.003/-.000	0.327 +.002/-.000	0.626 - 0.636	
3/8	0.375 +.003/-.000	0.390 +.002/-.000	0.752 - 0.762	

1.4.8 Installation. After holes are brought up to size, see Figure 1-42 and the following steps to install Jo-Bolts.

a. Material to be joined must be secured firmly in position. Sheet metal holders, C-clamp, or temporary fasteners may be used.

b. Using a hook gauge, measure the thickness of the material and select a Jo-Bolt having the correct grip range.

NOTE

When fasteners are installed with wet sealant in the faying surface or under the fastener head, the requirements of paragraph 1.4.9 will apply, except that 5/32 inch diameter fasteners are required to withstand only 2 inch-pounds of torque. Refer to T.O. 1F-4C-3-1-6 for sealant application.

c. Insert Jo-Bolt in the hole. The fastener can be pushed easily into a properly prepared hole and in no case shall fastener be driven forcibly into the hole. A very light tap fit is permissible in aluminum alloy parts but not in steel.

d. Use hand or power gun.

(1) Hand gun. Select the correct nose and wrench adapter for the fastener and secure them in the hand tool body.

(2) Power gun. Select the correct nose and wrench adapter for the fastener and secure them in the power tool body. Power gun and hand gun nose and wrench adapters are not interchangeable. Use applicable adapter for DL coded fasteners.

e. Place the nose adapter of the driving tool over the slabbed portion of the bolt shank so that it engages the head of the Jo-Bolt.

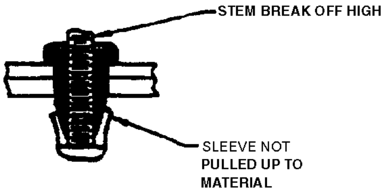
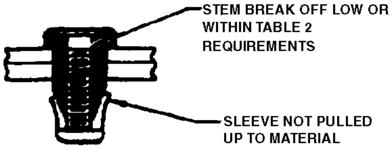
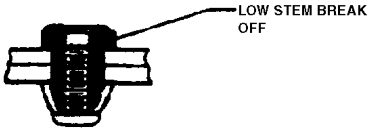
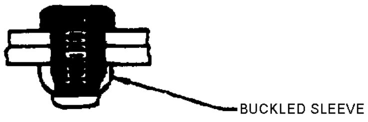
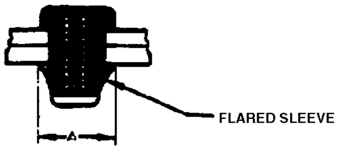
NOTE

On flush head Jo-Bolts, the dogs on the nose adapter shall fit into the slots of the fastener heads. On protruding and millable head fasteners, the nose adapter will fit over the fastener head.

f. Hold the tool firmly against the Jo-Bolt head and perpendicular to the surface of the work. Failure to hold the tool perpendicular may result in stem break off before the Jo-Bolt is tight.

g. If the hand gun is used, hold the handle of the tool stationary and turn the ratchet handle. As power is applied, the bolt is turned while the nut is held. The sleeve, compressed between the bolt head and tapered end of the nut, is drawn over the end of the nut and is expanded forming the blind head against the inner surface of the part. When the sleeve is drawing up tight, the slabbed portion of the stem is snapped off completing the driving operation.

h. Jo-Bolts shall be inspected for looseness per paragraph 1.4.9. Millable head Jo-Bolts shall be inspected before they are shaved.

CONDITION	PROBABLE CAUSE
	GRIP LENGTH OF FASTENER TOO LONG. DISPOSITION: REJECT
	PREMATURE STEM BREAK-OFF RESULTING FROM DIRTY OR IMPROPERLY LUBRICATED FASTENER. DISPOSITION: REJECT
	GRIP LENGTH OF FASTENER TOO SHORT. DISPOSITION: REJECT
	FAULTY FASTENER, SLEEVES TOO SOFT. DISPOSITION: REJECT
	FAULTY FASTENER, SLEEVES TOO SOFT. DISPOSITION: REJECT OF DIMENSION A EXCEEDS THE FOLLOWING: 5/32 - 0.244 5/16 - 0.427 3/16 - 0.300 3/8 - 0.516 1/4 - 0.384

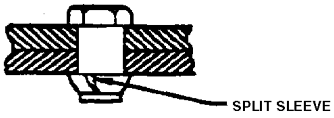
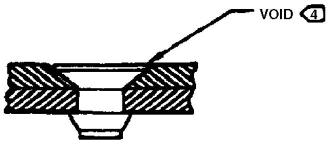
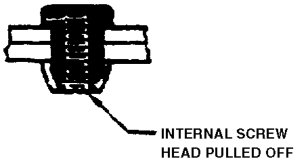
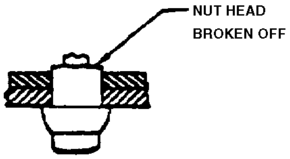
CONDITION	PROBABLE CAUSE
	POOR SLEEVE MATERIAL OR SLEEVES SCRATCHED OR NICKED. DISPOSITION: REJECT
	DISPOSITION: ACCEPTABLE WHEN PRODUCED BY A DIMENSIONALLY ACCEPTABLE FASTENER INSTALLED WITHIN SPECIFIED FLUSHNESS LIMITS. NOTE: THIS VOID WILL NOT BE CONCENTRIC WHEN THE FASTENERS ARE INSTALLED ON A CONTOURED SURFACE.
	FAULTY FASTENER DISPOSITION: REJECT
	FAULTY FASTENER DISPOSITION: REJECT

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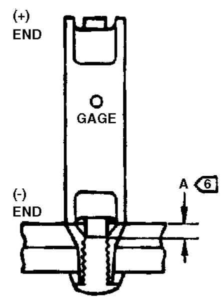
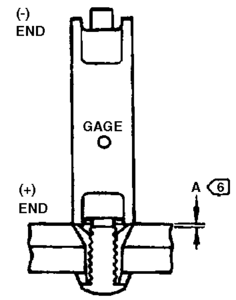
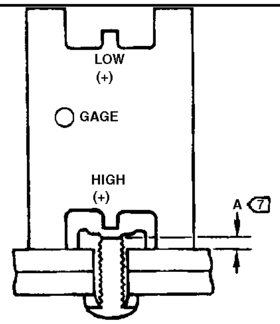
Figure 1-42. Jo-Bolt Installation and Inspection (Sheet 1 of 2)



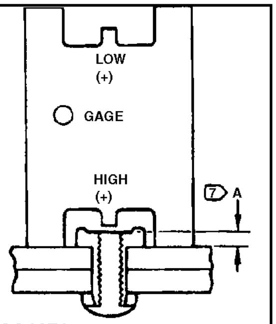
NAS1670



NAS1672

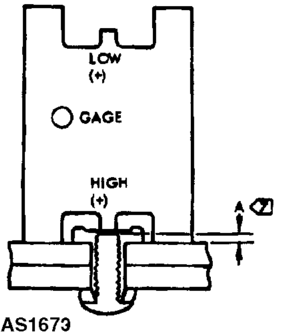


NAS1669

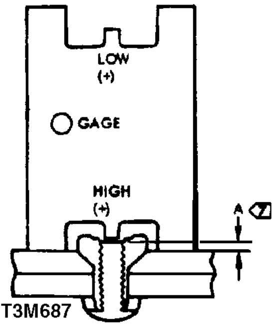


NAS1671

JO-BOLT SIZE	JO-BOLT	A	GAGE NO.	JO-BOLT	A	GAGE NO.	JO-BOLT	A	GAGE NO.	JO-BOLT	A	GAGE NO.
-08 5/32	1670-08L PLT110-5	+0.020 -0.068	4F5	1672-08L PLT120-5	+0.082 -0.006	A4F5LS	1669-08L PLT210-5	+0.000 +0.088	3P5	1671-08L PLT220-5	+0.000 +0.088	A3P5
-3 6/16	1670-3L PLT110-6	+0.015 -0.073	4F6	1672-3L PLT120-6	+0.072 -0.016	A4F6LS	1669-3L PLT210-5	+0.010 +0.098	3P6	1671-3L PLT220-6	+0.015 +0.103	A3P6
-4 1/4	1670-4L PLT110-8	+0.010 -0.078	4F8	1672-4L PLT120-8	+0.072 -0.026	A4F8LS	1669-4L PLT210-8	+0.047 +0.135	3P8	1671-4L PLT220-8	+0.032 +0.130	A3P8
-5 5/16	1670-5L PLT110-10	+0.010 -0.083	4F10	1672-5L PLT120-10	+0.072 -0.031	A4F10LS	1669-5L PLT210-10	+0.043 +0.146	3P10	1671-5L PLT220-10	+0.027 +0.130	A3P10
-6 3/8	1670-6L PLT110-12	+0.010 -0.093	4F12	1672-6L PLT120-12	+0.072 -0.031	A4F12LS	1669-6L PLT210-12	+0.049 +0.152		1671-6L PLT220-12	+0.027 +0.130	A3P12



NAS1673



ST3M687
NAS1674 (MILLABLE HEAD)

JO-BOLT SIZE	JO-BOLT	A [5]	GAGE NO.	JO-BOLT	A [5]	GAGE NO.
-08 3/32	1673-08L PLT230-5	+0.000 +0.088	3P5	ST3M687-08L 1674-08L PLT130-5-1.5 PLT130-5	+0.000 +0.088	3P5
-3 3/16	1673-3L PLT230-6	+0.015 +0.103	3PA6	1674-3L PLT130-6	+0.010 +0.198	3P6
-4 1/4	1673-4L PLT230-8	+0.047 +0.135	3P8	1674-4L PLT130-8	+0.010 +0.198	3P6
-5 5/16						

NOTE

1. IN THESE AREAS WHERE FASTENER COLLARS CAN BE SEEN, THEY SHALL BE INSPECTED PER TABLE 1.
2. WHEN TESTED WITH DRIVING TOOL (NOSE ADAPTED TO A TORQUE WRENCH) THE FASTENERS SHALL BE CAPABLE OF WITHSTANDING THE FOLLOWING TORQUE WITHOUT ROTATION: 5/32 FASTENER 4 IN-LB; 3/16 FASTENERS, 6 IN-LB, 1/4 FASTENERS, 10 IN-LB 5/16 FASTENERS, 20 IN-LB, 3/8 FASTENERS, 30 IN-LB EXCEPTION, 5/32 FASTENER, WHEN INSTALLED WITH SEALING COMPOUND, MAXIMUM TORQUE REQUIREMENT IS 2 IN-LB.

CAUTION

DO NOT APPLY TORQUE IN EXCESS OF THE ABOVE VALUES.

3. IN ALL CASES, PLUS (+) INDICATES STEM PROTRUSION ABOVE THE REFERENCE SURFACE AND MINUS (-) INDICATES STEM RELEASE BELOW THE REFERENCE SURFACE.

[5] PROTRUDING HEAD AND FLUSH HEAD FASTENERS HAVING A GAP UNDER ONE SIDE OF THE HEAD WHICH WILL PERMIT INSERTION OF A 0.005 FEELER GAGE TO THE SHANK SHALL BE REJECTED. GAPS WHICH WILL PERMIT INSERTION OF A 0.004 FEELER ARE ACCEPTABLE PROVIDED NO MORE THAN 40 PERCENT OF THE CIRCUMFERENCE HAS A GAP.

[5] INSTALLED BOLTS SHALL BE REJECTED IF STEM BREAK-OFF IS NOT WITHIN LIMITS OF TABLE II.

[6] MEASURED FROM TOP OF HEAD OF NUT.

[7] MEASURED FROM SKIN SURFACE.

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Figure 1-42. Jo-Bolt Installation and Inspection (Sheet 2)

1.4.9 Inspection. See Figure 1-42. Before installation of new or replacement fasteners, check for proper grip length. Refer to paragraph 1.4.8. In areas where the Jo- Bolt collars can be seen after installation, they shall be visually inspected. Fasteners having split or buckled collars shall be rejected. (Check stem break-off per limitations in Table 2, Figure 1-42.) If the stem breaks off outside the limits shown, the fastener is out of grip range or not drive properly. If stem breaks above limits shown, the fastener is either too long or loose. If the stem breaks off below the limits shown, the grip is too short. The fastener shall be removed and replaced if limitations are not met. On Flush Head Jo-Bolts the protrusion of the fastener head above the skin surface shall not be greater than allowed by applicable system technical data and in no case shall it be greater than 0.010. The maximum that Flush Heads can fall below flush is 0.006. Protrusion Head and Flush Head fasteners having a gap under one side of the head which permits the insertion of a 0.005 feeler gage to the shank shall be rejected. Gaps which permit insertion of a 0.004 feeler gage are acceptable provided not more than 40 percent of the circumference has the gap. Jo-Bolts shall be individually checked for looseness. Use of the driving tool nose adapter between the thumb and the forefinger or with a torque wrench, the fastener shall be capable of withstanding the light torque requirements per the following and in no case shall torque values tested be exceeded.

NOTE

Apply torque in a counterclockwise direction only. When fasteners are installed wet with sealant, the resistance to rotation values specified must be met whether tested on wet or cured sealant, except that 5/32 inch fasteners are required to withstand only 2 inch pounds maximum torque. If the Jo-Bolt turns when the light torque load is applied, it shall be removed and replaced.

Jo-Bolt Series	Nominal Diameter	Torque Limits (inch-pounds)
164	5/32	4
200	3/16	6
260	1/4	10
312	5/16	20
375	3/8	30

1.4.10 Removal. See Figure 1-44. The procedure for the removal of Jo-Bolt depends on whether the fastener is clamped up tight or is loose. If the Jo-Bolt is clamped up tight in the hole, it can be removed by drilling just through the fastener head and then driving out the shank portion with a hammer and punch. If the Jo-Bolt is loose in the hole, it must be prevented from turning by using a drill bushing which has dogs to engage the head slots and a handle or other device to hold it. While holding the Jo-Bolt to prevent from turning, drill the bolt portion of the fastener completely out, removing the bolt head and fastener sleeve. After the bolt head and sleeve are removed, pick out the nut portion of the fastener. For all drilling operations on Jo-Bolts, select a drill motor that does not turn over 500 rpm.

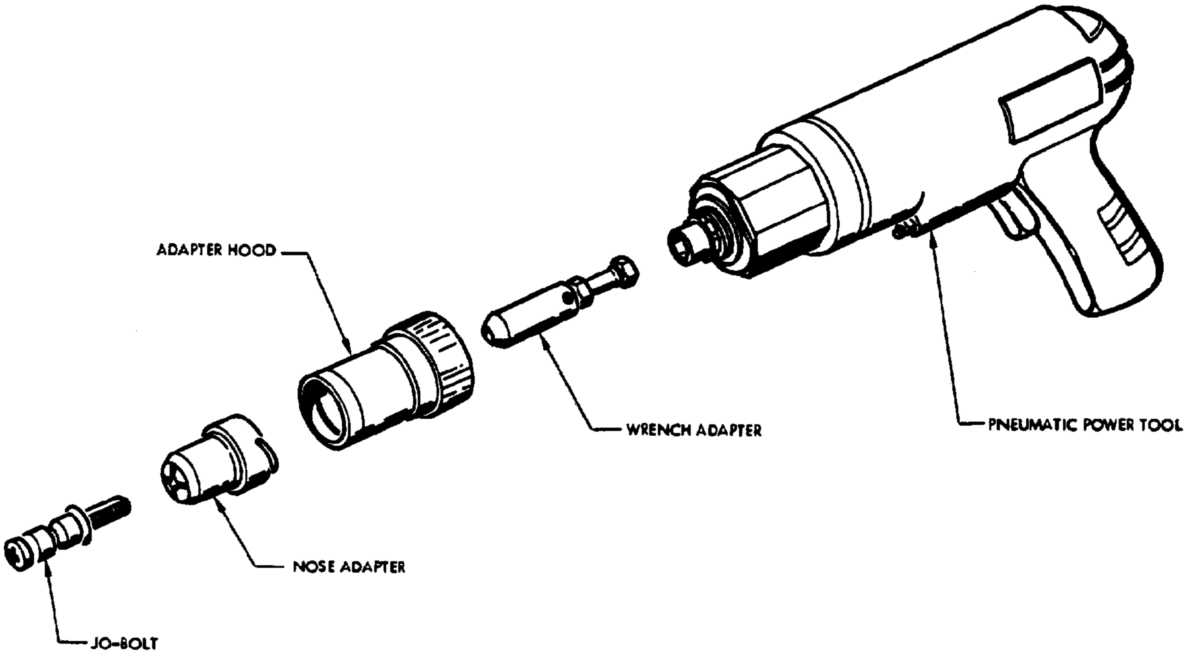
1.4.11 Special Handling of Jo-Bolts. Jo-Bolts are prelubricated unless specified on a specific repair procedure. No paint or primer shall be applied to Jo-Bolts before they are installed unless called out in a specific repair procedure.

1.4.12 Internally Threaded Rivets (Three Piece). (See Figure 1-45.) The internally threaded rivets (three piece) have not had a military designation assigned to them. These rivets are installed blind and can be driven with standard pneumatic drivers. (See Figure 1-46.) Internally threaded rivets (three piece) are available in flush, millable, and protruding hex head types. The shear strength for steel, internally threaded rivets (three piece) is 95,000 PSI minimum; 57,000 PSI minimum for aluminum rivets. Use of internally threaded rivets (three piece) saves weight by eliminating nuts.

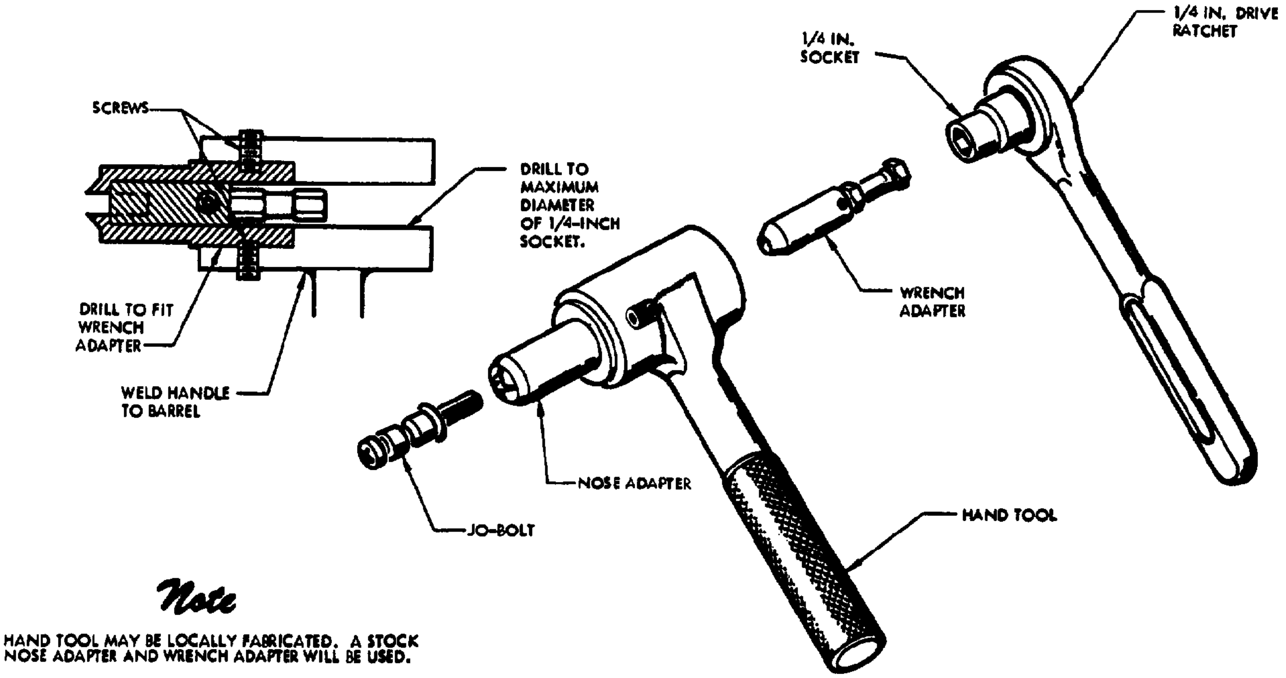
1.5 SWAGE LOCKED PIN AND COLLAR FASTENERS.

Each unit consists of a headed pin (bolt) secured by a swaged collar. (See Figure 1-47.) The headed pin or collar cannot be reused. Replace a swage lock fastener with unit of comparable size, type and material. Special tools are required for the replacement or installation operation. In the removal operation, take care not to damage or enlarge the hole.

1.5.1 Installation of Pull Type Fasteners (Figure 1-47). Installation of pull type fasteners requires the use of special tools as specified in Table 1-58. The mechanical procedure for installing pull type Huckbolt fasteners is shown in Figure 1-47.



PNEUMATIC DRIVER



Note

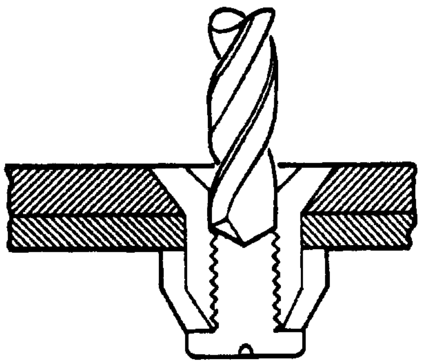
HAND TOOL MAY BE LOCALLY FABRICATED. A STOCK NOSE ADAPTER AND WRENCH ADAPTER WILL BE USED.

HAND TOOL

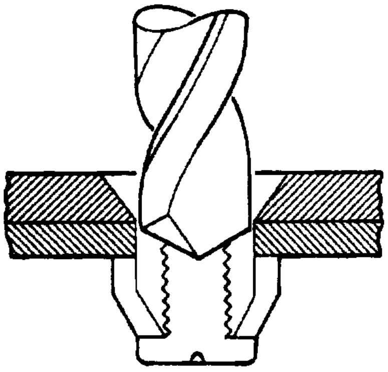
F01-042

Figure 1-43. Jo-Bolt Installation Tools

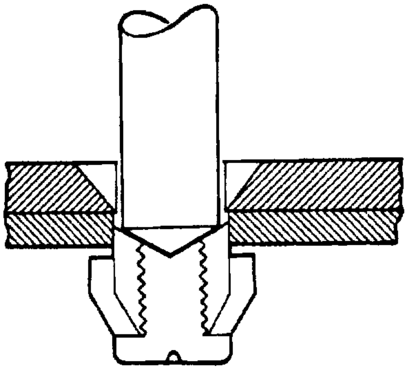
REMOVAL WHEN BOLT IS CLAMPED UP TIGHT



STEP 1 SELECT DRILL IN ACCORDANCE WITH TABLE 1, DRILL TO BELOW HEAD-SHANK JUNCTURE.

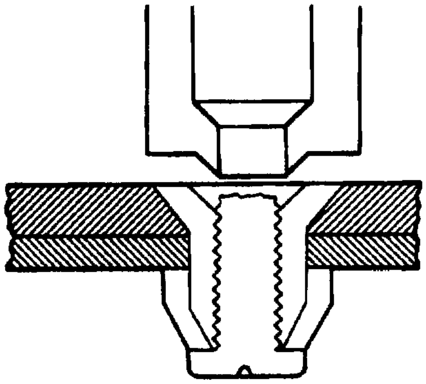


STEP 2 SELECT DRILL IN ACCORDANCE WITH TABLE II. DRILL TO DEPTH OF PILOT HOLE.

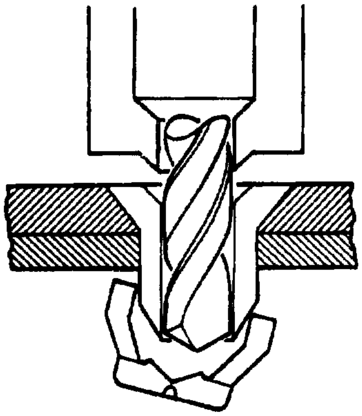


STEP 3 WITH HAMMER AND NOMINAL SIZE PUNCH, SEVER HEAD AND DRIVE OUT SHANK AND BLIND HEAD.

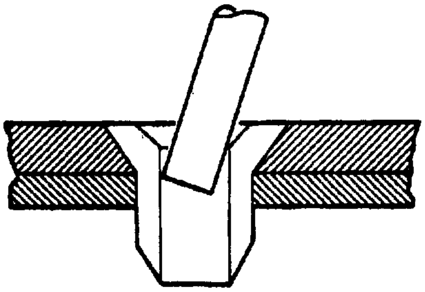
REMOVAL WHEN BOLT TURNS IN HOLE WHILE DRILLING



STEP 1 PREVENT NUT FROM TURNING BY ENGAGING DRIVING TOOL NOSE ADAPTER. HOLD NOSE ADAPTER WITH HAND TOOL HANDLE OR VISE-GRIP PLIERS.



STEP 2 SELECT DRILL IN ACCORDANCE WITH TABLE 1. DRILL THROUGH SHANK. SEVERING BOLT HEAD.



STEP 3 PICK NUT OUT OF HOLE WITH PUNCH.

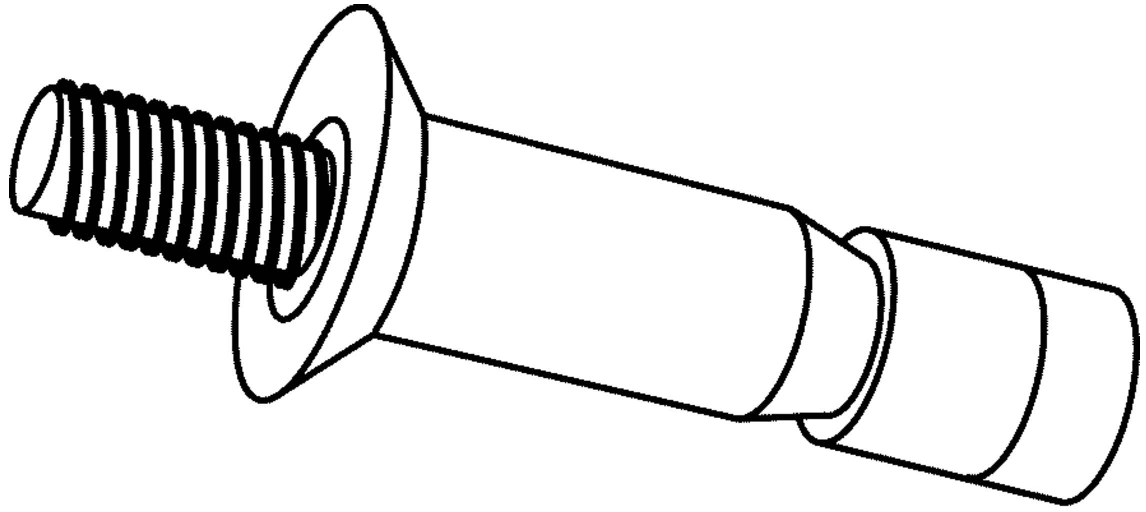
JO-BOLT SERIES		TABLE 1		TABLE 11	
		DRILL NO.	DRILL SIZE	DRILL NO.	DRILL SIZE
NAS1670-08L NAS1669-08L NAS1673-08L NAS1674-08L NAS1672-08L NAS1671-08L	PLT 110-5 PLT 210-5 PLT 230-5 PLT 130-5 PLT 120-5 PLT 220-5	40	0.0980	23	0.1540
NAS1670-3L NAS1669-3L NAS1673-3L NAS1674-3L NAS1672-3L NAS1671-3L	PLT 110-6 PLT 210-6 PLT 230-6 PLT 130-6 PLT 120-6 PLT 220-6	30	0.1285	12	0.1890
NAS1670-4L NAS1669-4L NAS1673-4L NAS1674-4L NAS1672-4L NAS1671-4L	PLT 110-8 PLT 210-8 PLT 230-8 PLT 130-8 PLT 120-8 PLT 220-8	21	0.1590	D	0.2460
NAS1670-5L NAS1669-5L NAS1672-5L NAS1671-5L	PLT 110-10 PLT 210-10 PLT 120-10 PLT 220-10	17	0.173	M	0.2950
NAS1670-6L NAS1669-6L NAS1672-6L NAS1671-6L	PLT 110-12 PLT 210-12 PLT 120-12 PLT 220-12	5	0.2055	23/64	0.3594

NOTE

SELECT DRILL WITH 500 RPM MAXIMUM

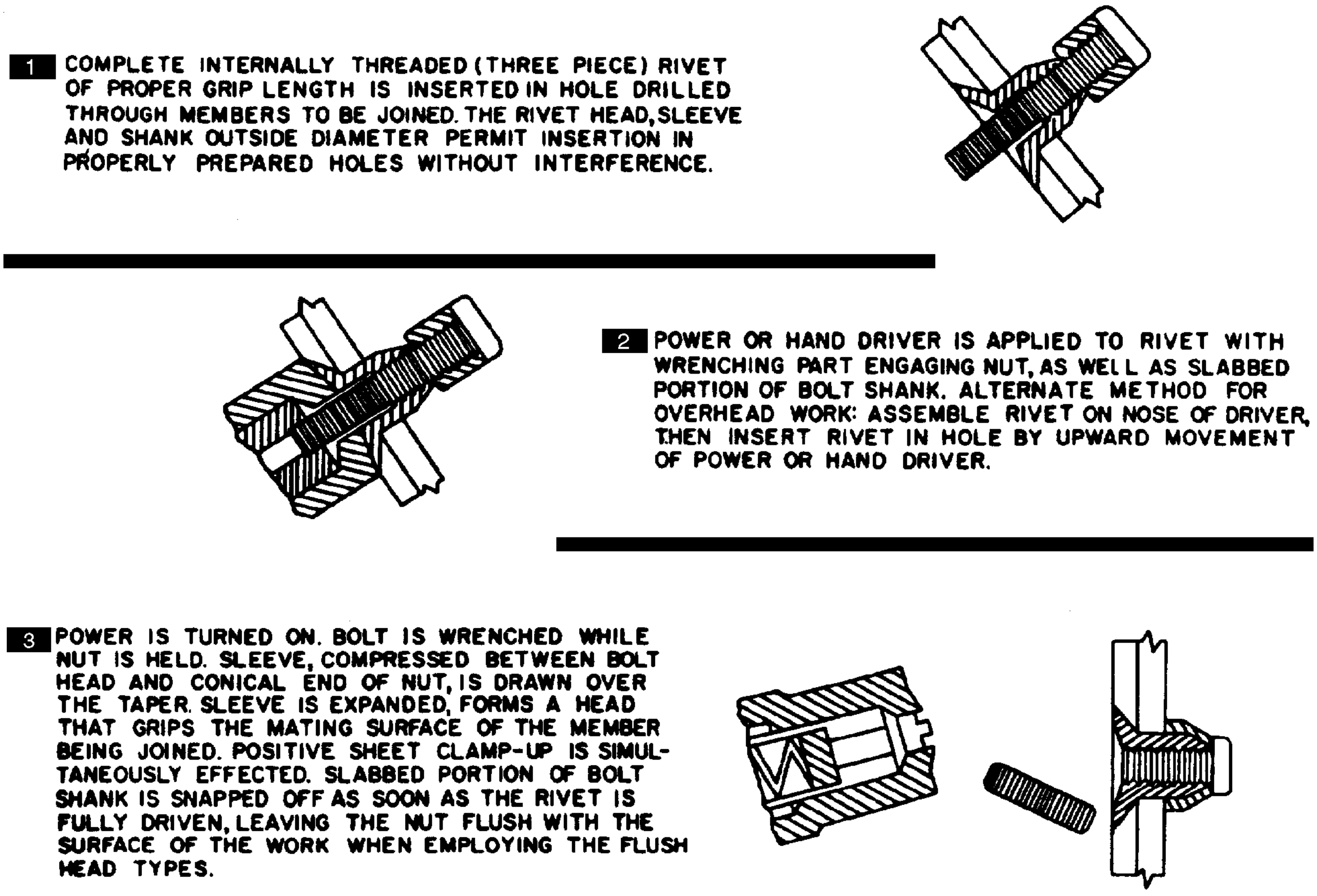
F01-043

Figure 1-44. Jo-Bolt Removal



F01-044

Figure 1-45. Internally Threaded Rivet (Three Piece)



1 COMPLETE INTERNALLY THREADED (THREE PIECE) RIVET OF PROPER GRIP LENGTH IS INSERTED IN HOLE DRILLED THROUGH MEMBERS TO BE JOINED. THE RIVET HEAD, SLEEVE AND SHANK OUTSIDE DIAMETER PERMIT INSERTION IN PROPERLY PREPARED HOLES WITHOUT INTERFERENCE.

2 POWER OR HAND DRIVER IS APPLIED TO RIVET WITH WRENCHING PART ENGAGING NUT, AS WELL AS SLABBED PORTION OF BOLT SHANK. ALTERNATE METHOD FOR OVERHEAD WORK: ASSEMBLE RIVET ON NOSE OF DRIVER, THEN INSERT RIVET IN HOLE BY UPWARD MOVEMENT OF POWER OR HAND DRIVER.

3 POWER IS TURNED ON. BOLT IS WRENCHED WHILE NUT IS HELD. SLEEVE, COMPRESSED BETWEEN BOLT HEAD AND CONICAL END OF NUT, IS DRAWN OVER THE TAPER. SLEEVE IS EXPANDED, FORMS A HEAD THAT GRIPS THE MATING SURFACE OF THE MEMBER BEING JOINED. POSITIVE SHEET CLAMP-UP IS SIMULTANEOUSLY EFFECTED. SLABBED PORTION OF BOLT SHANK IS SNAPPED OFF AS SOON AS THE RIVET IS FULLY DRIVEN, LEAVING THE NUT FLUSH WITH THE SURFACE OF THE WORK WHEN EMPLOYING THE FLUSH HEAD TYPES.

F01-045

Figure 1-46. Installation of Internally Threaded Rivet (Three Piece)

1.5.2 Installation of Stump Type Fasteners. (See Figure 1-47.) Stump type of fasteners are installed with a conventional rivet hammer and a special swaging set. The swaging set is required for installing the collar. The mechanical procedure for installing stump type fasteners is shown in Figure 1-47.

1.5.3 Inspection. Normally, visual inspection of the swaged collar is adequate. However, if in doubt or if a controversy arises, use the appropriate gage shown in Table 1-57.

1.5.4 Removal. (See Figure 1-47.) One of the better methods to remove a swage locked fastener is to split the swaged collar with a collar splitter tool as illustrated in Figure 1-47. An alternate method is to split the collar lengthwise with a narrow chisel. When using this method, extreme care must be used to prevent damage to the hole and surrounding structure.

CAUTION

When splitting a collar with a chisel, always support, with a heavy bucking bar, the collar on the side opposite the chisel. Never try to use a chisel on the manufactured head.

1.5.5 Remove pull type and stump type Huckbolt fasteners as follows:

a. Remove collar by splitting it shankwise with a collar splitter. (See Figure 1-47.) Be sure to use the tool in the correct size for the collar being split.

b. Drive out the pin with a punch. Be sure the diameter of punch is smaller than the hole.

1.6 MILITARY STANDARD BLIND BOLTS.

M.S. blind bolts are high strength, positive lock fasteners for use in areas where access is available to only one side of the work.

1.6.1 Installation. (See Figure 1-51.) Driving of the fastener shall be accomplished by the action of the spindle being pulled into the sleeve forming a large bulbed blind head on the back side of the assembly, installing the positive mechanical lock and removing the pulling portion of the spindle. (For selection of installation tools required see Table 1-60.)

1.6.2 Inspection. MIL-F-8975 and MIL-F-81177 blind fasteners are self-inspecting since they will meet full specification requirements when spindle and collar protrusion are within the limits shown in Figure 1-51. Locking collar and spindle position within limits shown assure proper blind head formation.

1.6.3 Removal. M.S. blind fasteners are removed by drilling. (See Table 1-61 for proper tools and method.)

1.6.4 Substitution Charts for Blind Fasteners.

CAUTION

The blind fasteners listed in the substitution charts of Table 1-62 and Table 1-63 must be used, exclusively, to replace those blind fasteners which succeed the listed item.

(ALLOY STEEL AND A-286 STAINLESS STEEL.) The substitution of alloy steel and A-286 stainless steel blind fasteners, which are used in structural applications, depends on these items design considerations. The replacement of these blind fasteners therefore must follow the requirements given in Table 1-62 and Table 1-63.

PULL TYPE FASTENER INSTALLATION SEQUENCE

PIN IS INSERTED FROM ONE SIDE OF WORK THROUGH PREPARED HOLE. METAL COLLAR IS THEN PLACED OVER THE PINTAIL. WHEN TOOL NOSE IS APPLIED, CHUCK JAWS GRIP PULL GROOVES.

TOOL PULLS ON PIN AND STARTS DRAWING SHEETS TOGETHER.

AS THE PULL ON THE PIN INCREASES, TOOL ANVIL SWAGES COLLAR INTO LOCKING GROOVES AND. A PERMANENT LOCK IS FORMED.

TOOL CONTINUES TO PULL UNTIL PIN BREAKS AT THE BREAKNECK GROOVE AND IS EJECTED. TOOL ANVIL DISENGAGES FROM SWAGED COLLAR.

STUMP TYPE FASTENER INSTALLATION SEQUENCE

STUMP IS FIRST INSERTED THROUGH PREPARED HOLES. FOR INTERFERENCE FIT STUMP IS DRIVEN IN WITH HAMMER OR AIR HAMMER.

COLLAR IS APPLIED OVER END OF STUMP. A BUCKING BAR IS USED AGAINST HEAD OF STUMP WHILE SWAGING SET IS ACTUATED BY AIR HAMMER.

SWAGING SET IS FORCED OVER COLLAR, SWAGING METAL MATERIAL INTO FASTENER LOCKING GROOVES.

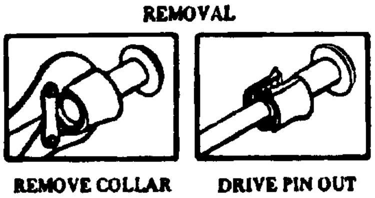
SWAGING SET IS REMOVED LEAVING HUCKBOLT COLLAR AND STUMI LOCKED IN A PERMANENI INTEGRAL UNIT.

NOTE:

- PULL TYPE AND STUMP TYPE FASTENERS ARE INTERCHANGEABLE.
- WASHERS MAY BE USED UNDER HEAD WHEN CORRECT BOLT LENGTH IS UNAVAILABLE.
- DO NOT RE-USE PINS THAT HAVE BEEN DRIVEN OUT.

REMOVAL OF PULL-TYPE OR STUMP-TYPE FASTENER

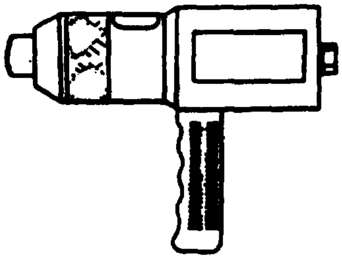
COLLAR REMOVAL TOOLS	
DIAMETER	TOOL PART NUMBER
3/16	105-6
1/4	105-8
5/16	105-10
3/8	105-12



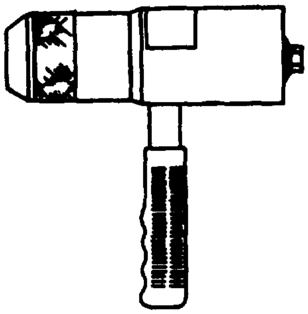
F01-046

Figure 1-47. Installation Sequence of Pull and Stump Type Fastener

HAND POWERED TOOLS

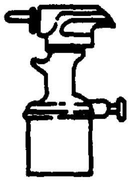


MODEL 115
FSN 5120-792-3571



MODEL 116
FSN 5120-969-9236

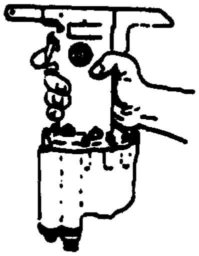
AIR POWER TOOLS
90 PSI



MODEL 200
FSN 5130-908-3262

41600

41600



MODEL 352
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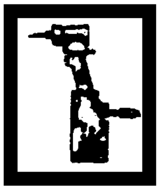

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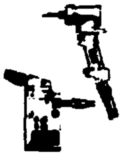

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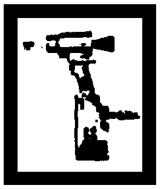

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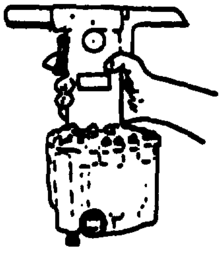
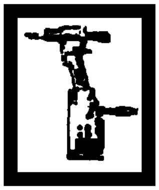
44800



MODEL 353
FSN 5130-772-7803



44800

45900

F01-047

Figure 1-48. Hand and Air Powered Tools

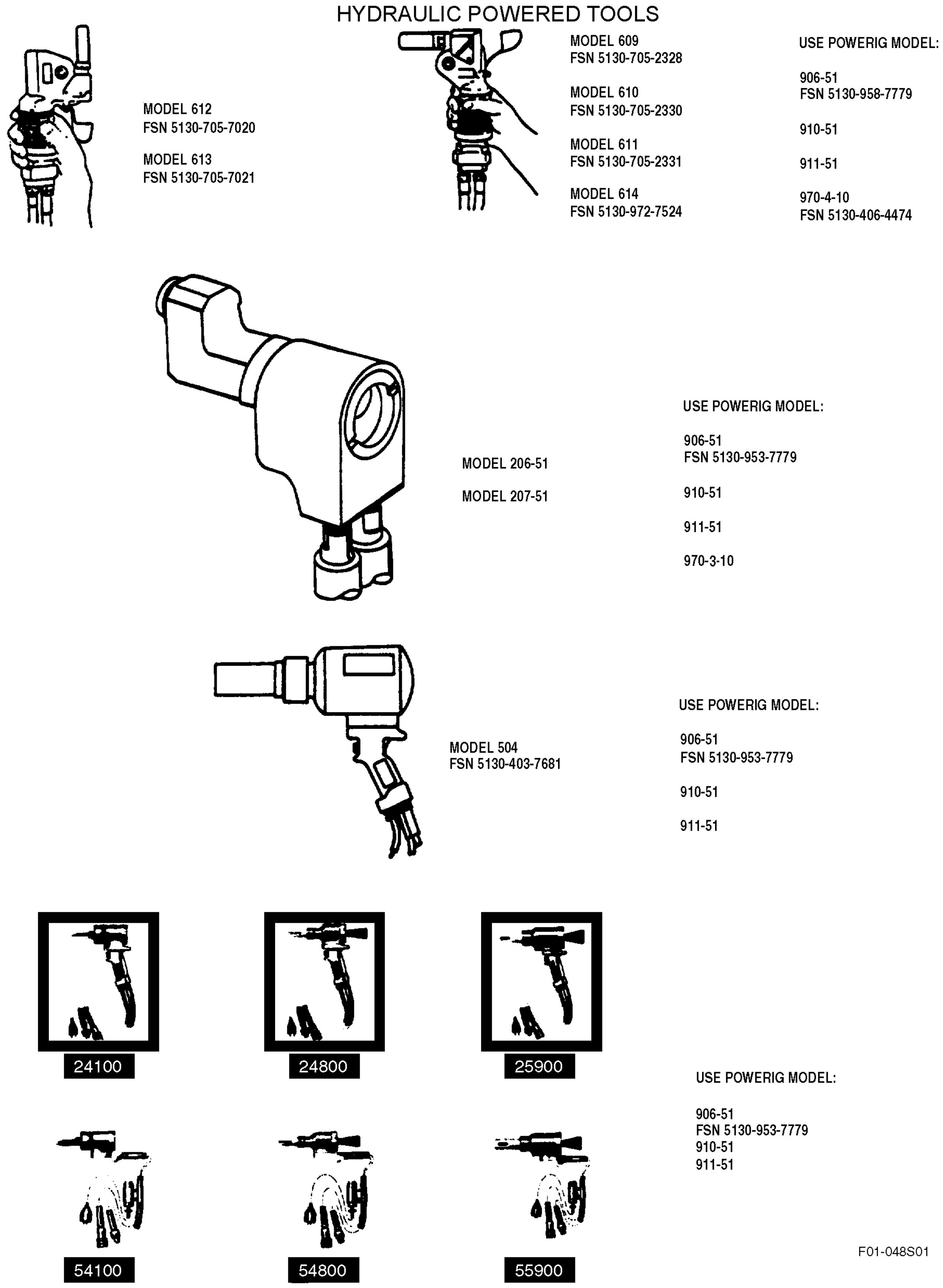
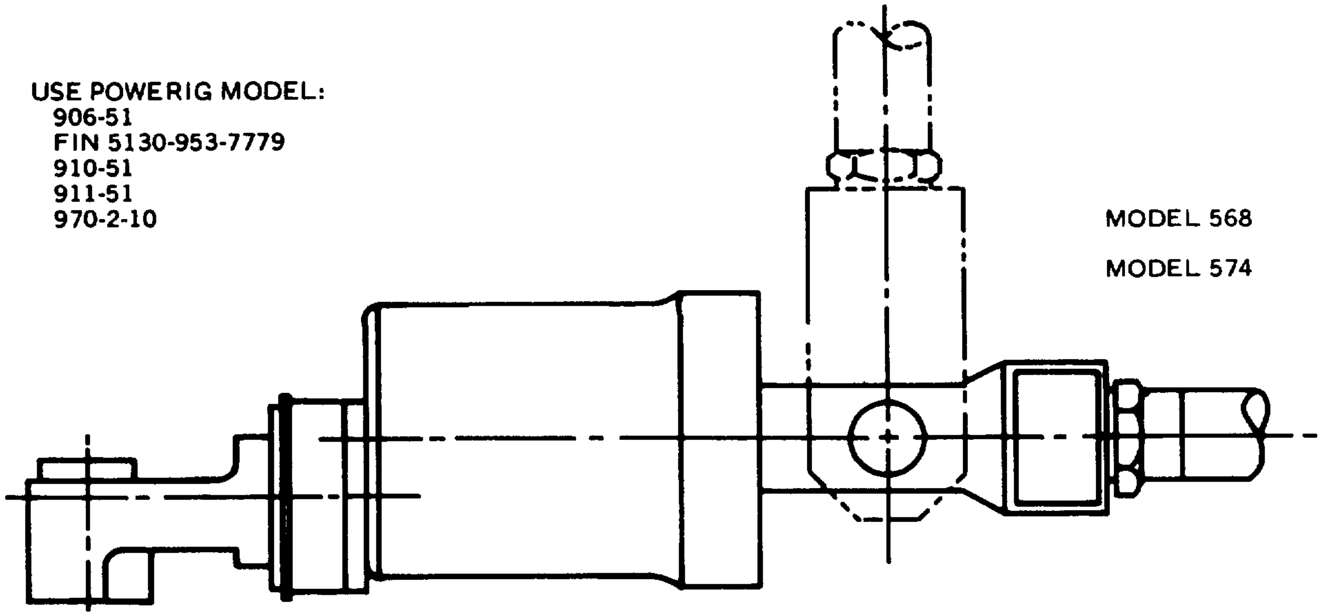
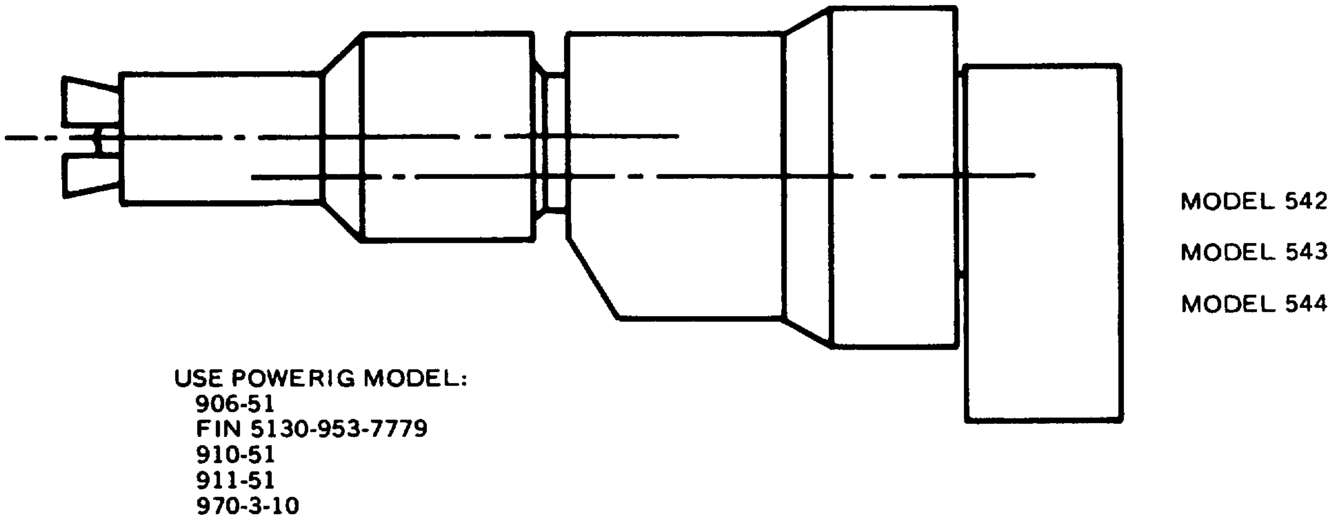


Figure 1-49. Hydraulic Powered Tools (Sheet 1 of 2)

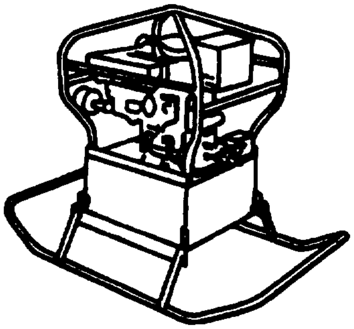




F01-048S02

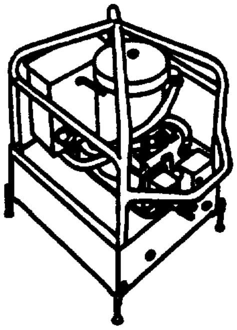
Figure 1-49. Hydraulic Powered Tools (Sheet 2)

HYDRAULIC POWERIGS



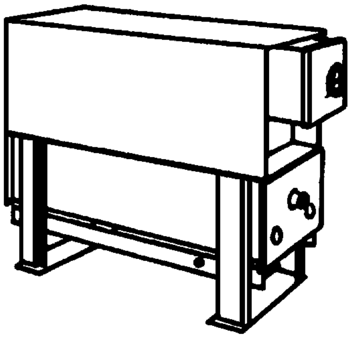
MODEL
911-51

GASOLINE ENGINE



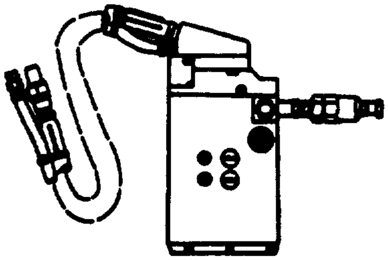
MODEL
910-51

SINGLE PHASE 230V ELECTRIC



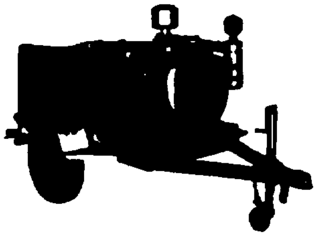
MODEL
906-51
FSN5130-953-7779

THREE PHASE 220-440V
ELECTRIC



MODEL
970

90 PSI AIR PRESSURE



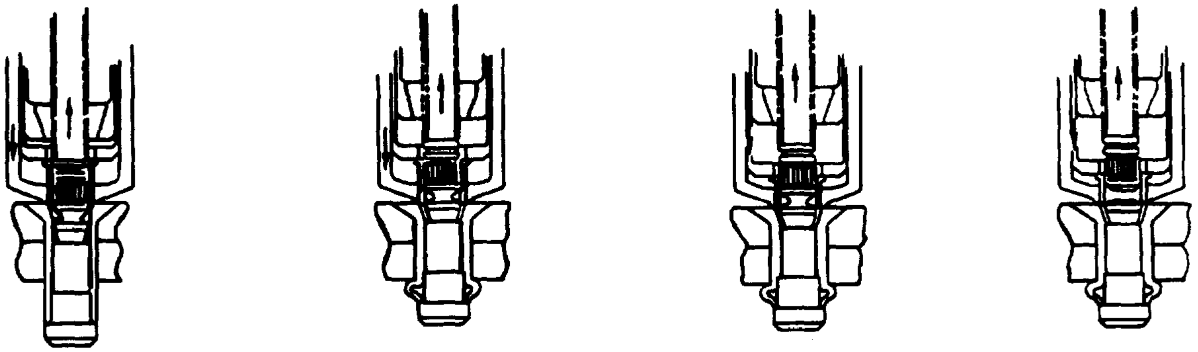
MODEL 916

GASOLINE ENGINE

F01-049

Figure 1-50. Hydraulic Powerigs

DRIVING OF THE FASTENER SHALL BE ACCOMPLISHED BY THE ACTION OF THE SPINDLE BEING PULLED INTO THE SLEEVE, FORMING A BLIND HEAD ON THE BACK SIDE OF THE ASSEMBLY, AND REMOVING THE PULLING PORTION OF THE SPINDLE.



BLIND HEAD FORMATION-DURING THE INITIAL PART OF THE DRIVING OPERATION, THE SLEEVE IS SQUEEZED BETWEEN THE HEAD OF THE PIN AND THE NOSE OF THE RIVET TOOL. THE HEAD OF THE PIN UPSETS THE SLEEVE TO FORM A STRONG, BULBED HEAD ON THE BLIND SIDE.

POSITIVE MECHANICAL LOCK-WHEN THE BLIND HEAD HAS BEEN FORMED, THE TOOL AUTOMATICALLY FORCES THE LOCKING COLLAR (AT THE PINTAIL END OF THE SLEEVE) INTO THE CONICAL SPACE BETWEEN THE RECESS IN THE HEAD AND THE LOCKING GROOVE IN THE PIN. THIS LOCKS THE PARTS TOGETHER PERMANENTLY.

PIN BREAK-PIN IS BROKEN OFF IN TENSION AT THE BREAKNECT GROOVE, SUBSTANTIALLY FLUSH WITH THE HEAD OF THE SLEEVE. THERE IS NO PROJECTING PIN LEFT TO BE CUT OFF IN A SEPERATE OPERATION.

INSTALLED FASTENER

F01-050

Figure 1-51. Driving Cycle

Table 1-52. Substitution Chart for Hole-Filling, Aluminum and Aluminum-Alloy-Type Rivets Maximum Recommended Temperature 250°F

			MS33522 Blind Rivet Hole Sizes					
			.129 inch -.132 inch Dia. 1/8 inch Dia.		.160 inch -.164 inch Dia. 5/32 inch Dia.		.192 inch -.196 inch Dia. 3/16 inch Dia.	
Type Rivet	Applicable Specification	Type Material	Shear (Pounds)	Tensile (Pounds)	Shear (Pounds)	Tensile (Pounds)	Shear (Pounds)	Tensile (Pounds)
MS20426DD*	MIL-R-5674C	2024	531		815		1180	
MS20470DD								
NAS1919B#	NAS1900	5056						
NAS1921B#			495	325	755	490	1090	715
NAS1399D#	NAS1400	2017	494	230	755	375	1090	540
NAS1398D#								
MS20426DF*	MIL-R-5674	2017	442		675		977	
MS20470DC*								
NAS1399B#	NAS1400	5056	388	230	596	375	862	540
NAS1398B#								
MS20426AD*	MIL-R-5674	2117	388		596		862	
MS20600ADE#	MIL-R-7885B	2117	370	227	580	375	840	537
MS20601ADE#								
MS20602D#	MIL-R-7885	2017	370	227	580	375	840	537
MS20603D#								
MS20426B*	MIL-R-5674	5056	363		556		802	
MS20470B*								
MS20600B#	MIL-R-7885	5056	360	227	560	375	810	537
MS20601B#								
MS20602B#	MIL-R-7885	5056	360	227	560	375	810	537
MS20603B#								
MS20426A*	MIL-R-5674	1100	129		201		290	
MS20470AC*								
*Solid Rivet								
#Blind Rivet								

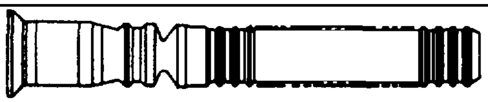
Table 1-53. Substitution Chart for Hole-Filling Stainless Steel and Monel-Type Rivets

			.129 inch -.132 inch Dia. 1/8 inch Dia.		.160 inch -.164 inch Dia. 5/32 inch Dia.		.192 inch -.196 inch Dia. 3/16 inch Dia.		.256 inch -.261 inch Dia. 1/4 inch Dia.		
Type Rivet	**Applicable Specification**	**Type Material**	**Shear (Lbs)**	**Ten-sile (Lbs)**	**Shear (Lbs)**	**Ten-sile (Lbs)**	**Shear (Lbs)**	**Ten-sile (Lbs)**	**Shear (Lbs)**	**Ten-sile (Lbs)**	**Temperature Max. Operation °F**
NAS1919C# NAS1921C#	NAS1900	A-286	1090	675	1670	1050	2400	1500	4250	2600	1200
NAS1919M# NAS1921M#	NAS1900	Monel	1020	675	1565	1050	2260	1500	4000	2600	900
NAS1398C# NAS1399C#	NAS1400	A-286	970	640	1490	1000	2150	1500	3890	2700	1200
MS20427FC* MS20615MD*	None	FS302 FS304	800		1248		1794		3192	800	800
NAS1398M# NAS1399M#	NAS1400	Monel	710	340	1090	550	1580	780	2840	1450	900
MS20600ML# MS20601ML#	MIL-R-7885	Monel	670	227	1050	375	1520	537	2710	985	900
MS20427M* MS20615M*	None	Monel	603		941		1352		2406		800

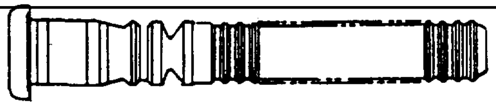
*Solid rivet calculated shear strengths. All strengths are based on MS33522 blind rivet diameter holes shown.

#Blind rivets.

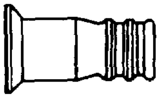
Table 1-54. NAS1414 through NAS1422 Pin, Rivet, Swage Locking, Alloy Steel, 100 Degree Shear Head, Stump Type, Close Tolerance; NAS1424 Through NAS1432 Pin, Rivet, Swage Locking, Alloy Steel, Protruding Head, Shear, Stump Type, Close Tolerance; NAS1436 Through NAS1442 Pin, Rivet, Swage Locking, Alloy Steel, 100 Degree Shear Head, Pull Type, Close Tolerance; NAS1446 Through NAS1452 Pin, Rivet, Swage Locking, Alloy Steel, Protruding Head, Shear, Pull Type, Close Tolerance



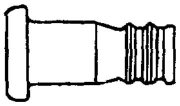
NAS1436 thru NAS1442



NAS1446 thru NAS1452



NAS1414 thru NAS1422



NAS1424 thru NAS1432

P01-078A

				Head Diameter			
		Shank Diameter		NAS1414 Through NAS1422 NAS1436 Through NAS1442		NAS1424 Through NAS1432 NAS1446 Through NAS1452	
Basic Part Number		Min.	Max.	Min.*	Max.*	Min.	Max.
NAS1414	NAS1424	.1235	.1250	.180	.211	.181	.195
NAS1415	NAS1425	.1550	.1565	.220	.256	.235	.249
NAS1416 NAS1426	NAS1436 NAS1446	.1880	.1895	.262	.305	.288	.302
NAS1418 NAS1428	NAS1438 NAS1448	.2480	.2495	.344	.399	.363	.377
NAS1420 NAS1430	NAS1440 NAS1450	.3105	.3120	.416	.479	.455	.471
NAS1422	NAS1442	.3730	.3745	.494	.566	.549	.565

* For Engineering reference only

***For Engineering reference only**

NAS1414 and NAS1424 are used with NAS1080C4 Collars.
NAS1415 and NAS1425 are used with NAS1080C5 Collars.
NAS1436, NAS1446, NAS1416 and NAS1426 are used with NAS1080C6 Collars.
NAS1438, NAS1448, NAS1418 and NAS1428 are used with NAS1080C8 Collars.
NAS1440, NAS1450, NAS1420 and NAS1430 are used with NAS1080C10 Collars.
NAS1442, NAS1452, NAS1422 and NAS1432 are used with NAS1080C12 Collars.

Example of part number: NAS1438-9

Maximum grip in 1/16th inch.
Pin, rivet, swage locking, alloy steel, 100 degree shear head, pull type. 1/4 inch nominal shank diameter.
The above is also available with sealant escape groove; add prefix "H" to part number

Example: H1438-9

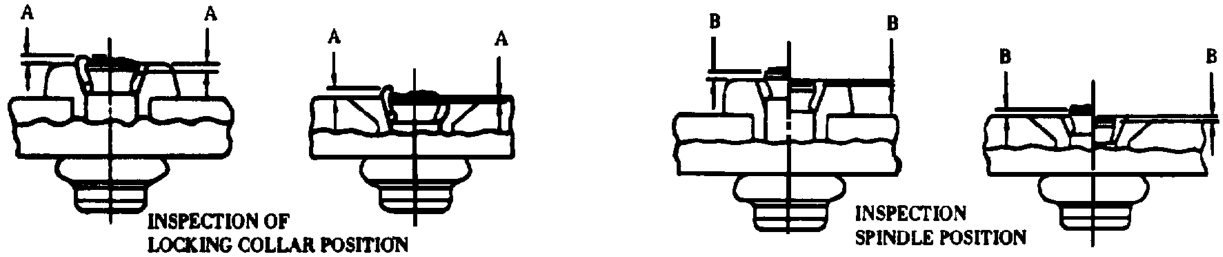
Material: Alloy Steel, National Aerospace Standard NAS1413.

P01-078B

VISUAL INSPECTION TABULATION

RIVET DIAMETER (INCH)	COLLAR POSITION "A" (MAX.) (INCH)	LOCK POSITION "B" (MAX.) (INCH)
5/32	0.017	0.010
3/16	0.022	0.012
1/4	0.029	0.015
5/16	0.037	0.019
3/8	0.045	0.023
7/16	0.050	0.027
1/2	0.056	0.031

VISUAL INSPECTION ILLUSTRATION



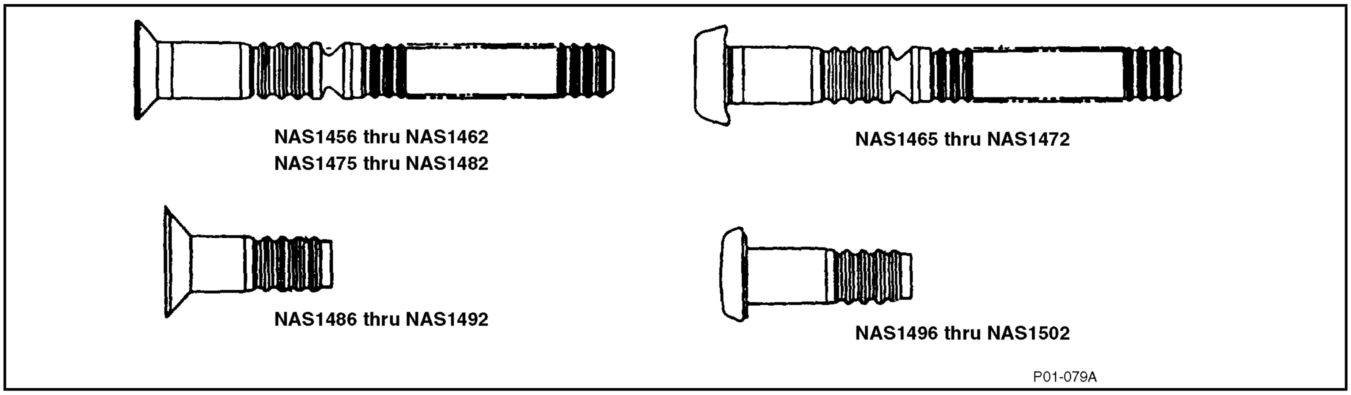
A. . . . .MAXIMUM ALLOWABLE DISTANCE OF LOCKING COLLAR ABOVE OR BELOW FASTENER HEAD.

B. . . . .MAXIMUM ALLOWABLE DISTANCE OF TOP OF LAND ON PIN ABOVE OR BELOW FASTENER HEAD.

F01-051

Figure 1-52. Inspecting Installed Blind Bolt Fastener

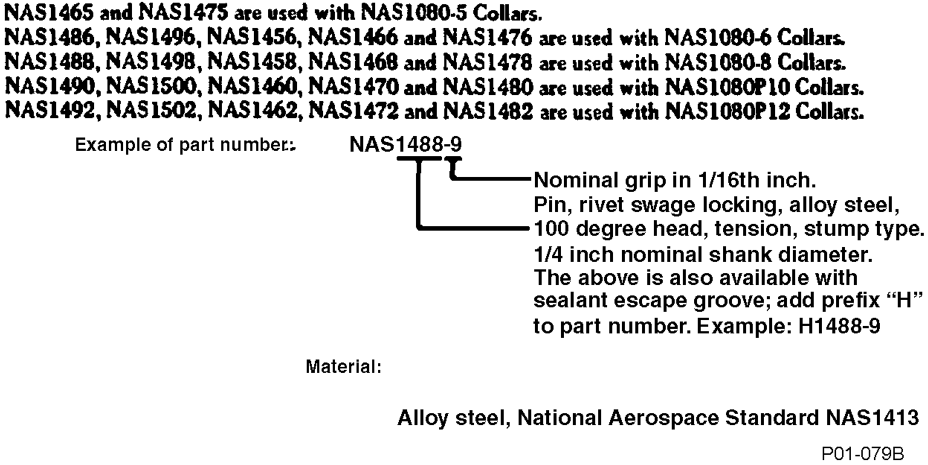
Table 1-55. NAS1456 Through NAS1462 and NAS1475 Through NAS1482 Pin, Rivet, Swage Locking, Alloy Steel, 100 Degree Head, Tension, Pull Type, Close Tolerance; NAS1465 Through NAS1472 Pin, Rivet, Swage Locking, Alloy Steel, Protruding Head, Tension, Pull Type, Close Tolerance; NAS1486 Through NAS1492 Pin, Rivet, Swage Locking, Alloy Steel, 100 Degree Head, Tension, Stump Type, Close Tolerance; NAS1486 Through NAS1492 Pin, Rivet, Swage Locking, Alloy Steel, Protruding Head, Tension, Stump Type, Close Tolerance



			Head Diameter							
	Shank Diameter		NAS1456 Through NAS1462 NAS1486 Through NAS1492		NAS1475 Through NAS1482		NAS1465 Through NAS1472		NAS1496 Through NAS1502	
Basic Part Number	Min	Max	Min*	Max*	Min*	Max*	Min	Max	Min	Max
NAS1465 NAS1475	.1635	.1650			.263	.292	.258	.282		
NAS1456 NAS1466 NAS1476 NAS1486 NAS1496	.1880	.1895	.344	.386	.316	.357	.297	.327	.302	.317
NAS1458 NAS1468 NAS1478 NAS1488 NAS1498	.2480	.2495	.454	.507	.428	.480	.390	.430	.396	.411
NAS1460 NAS1470 NAS1480 NAS1490 NAS1500	.3105	.3120	.574	.634	.508	.568	.485	.535	.500	.515
NAS1462 NAS1472 NAS1482 NAS1492 NAS1502	.3730	.3745	.693	.762	.629	.698	.595	.655	.613	.628

Table 1-55. NAS1456 Through NAS1462 and NAS1475 Through NAS1482 Pin, Rivet, Swage Locking, Alloy Steel, 100 Degree Head, Tension, Pull Type, Close Tolerance; NAS1465 Through NAS1472 Pin, Rivet, Swage Locking, Alloy Steel, Protruding Head, Tension, Pull Type, Close Tolerance; NAS1486 Through NAS1492 Pin, Rivet, Swage Locking, Alloy Steel, 100 Degree Head, Tension, Stump Type, Close Tolerance; NAS1486 Through NAS1492 Pin, Rivet, Swage Locking, Alloy Steel, Protruding Head, Tension, Stump Type, Close Tolerance - Continued

*For engineering reference only.



NAS1465 and NAS1475 are used with NAS1080-5 Collars.
NAS1486, NAS1496, NAS1456, NAS1466 and NAS1476 are used with NAS1080-6 Collars.
NAS1488, NAS1498, NAS1458, NAS1468 and NAS1478 are used with NAS1080-8 Collars.
NAS1490, NAS1500, NAS1460, NAS1470 and NAS1480 are used with NAS1080P10 Collars.
NAS1492, NAS1502, NAS1462, NAS1472 and NAS1482 are used with NAS1080P12 Collars.

Example of part number: NAS1488-9

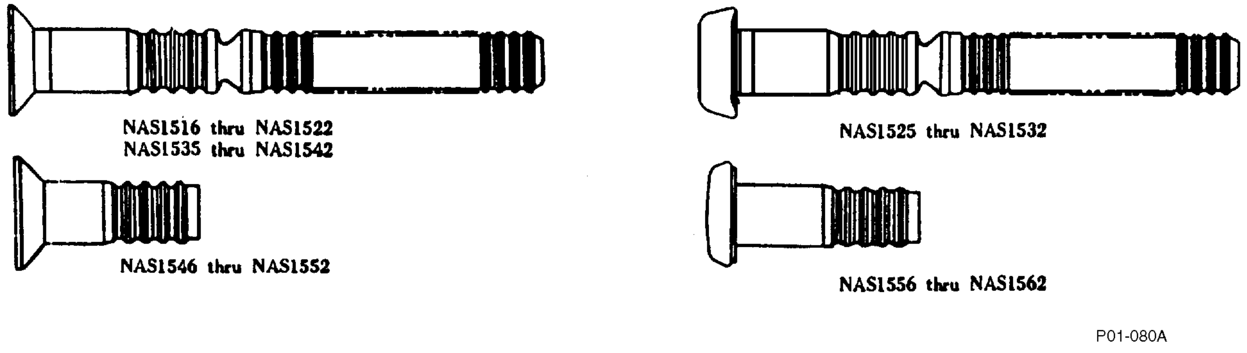
Nominal grip in 1/16th inch.
Pin, rivet swage locking, alloy steel, 100 degree head, tension, stump type. 1/4 inch nominal shank diameter.
The above is also available with sealant escape groove; add prefix “H” to part number. Example: H1488-9

Material:

Alloy steel, National Aerospace Standard NAS1413

P01-079B

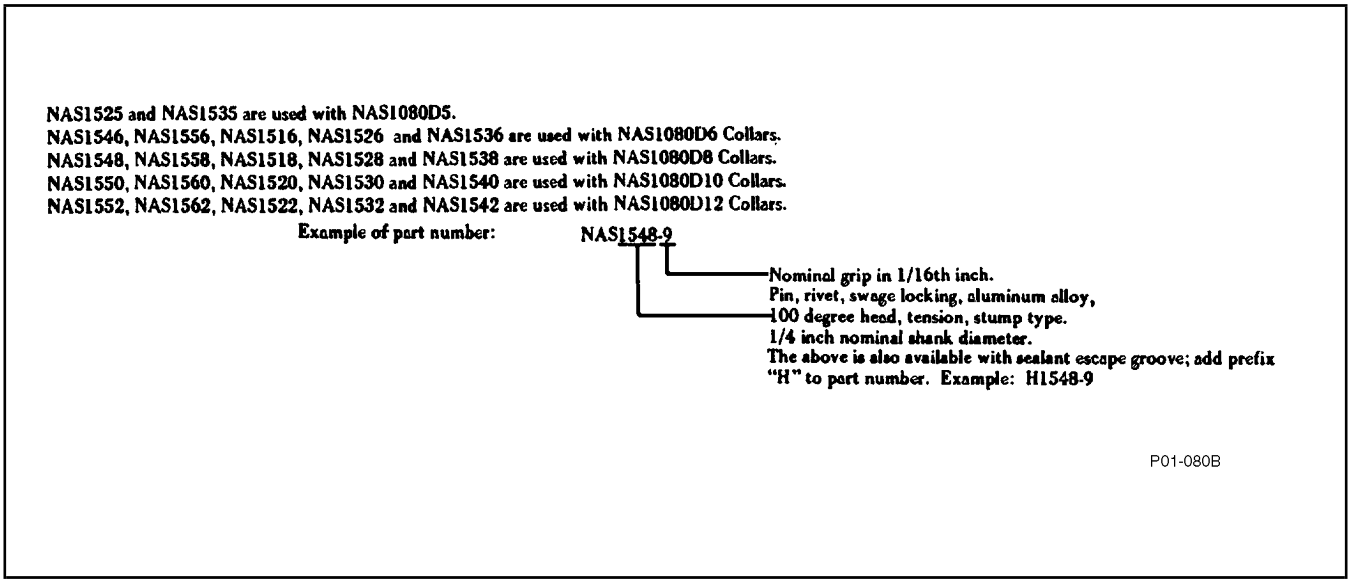
Table 1-56. NAS1516 Through NAS1522 and NAS1535 Through NAS1542 Pin, Rivet, Swage Locking, Aluminum Alloy, 100 Degree Head, Tension Pull Type, Close Tolerance; NAS1525 Through NAS1532 Pin, Rivet, Swage Locking, Aluminum Alloy, Protruding Head, Tension, Pull Type, Close Tolerance; NAS1546 Through NAS1552 Pin, Rivet, Swage Locking, Aluminum Alloy, 100 Degree Head, Tension, Stump Type, Close Tolerance; NAS1556 Through NAS1562 Pin, Rivet, Swage Locking, Aluminum Alloy, Protruding Head, Tension, Stump Type, Close Tolerance



			Head Diameter							
	Shank Diameter		NAS1516 Through NAS1522 NAS1546 Through NAS1552		NAS1535 Through NAS1542		NAS1525 Through NAS1532		NAS1556 Through NAS1562	
Basic Part Number	**Min**	**Max**	**Min***	**Max***	**Min***	**Max***	**Min**	**Max**	**Min**	**Max**
NAS1525 NAS1535	.1630	.1640			.263	.292	.258	.282		
NAS1516 NAS1526 NAS1536 NAS1546 NAS1556	.1880	.1895	.344	.386	.316	.357	.297	.327	.302	.317
NAS1518 NAS1528 NAS1538 NAS1548 NAS1558	.2480	.2495	.454	.507	.428	.480	.390	.430	.396	.411
NAS1520 NAS1530 NAS1540 NAS1550 NAS1560	.3105	.3120	.574	.634	.508	.568	.485	.535	.500	.515
NAS1522										

Table 1-56. NAS1516 Through NAS1522 and NAS1535 Through NAS1542 Pin, Rivet, Swage Locking, Aluminum Alloy, 100 Degree Head, Tension Pull Type, Close Tolerance; NAS1525 Through NAS1532 Pin, Rivet, Swage Locking, Aluminum Alloy, Protruding Head, Tension, Pull Type, Close Tolerance; NAS1546 Through NAS1552 Pin, Rivet, Swage Locking, Aluminum Alloy, 100 Degree Head, Tension, Stump Type, Close Tolerance; NAS1556 Through NAS1562 Pin, Rivet, Swage Locking, Aluminum Alloy, Protruding Head, Tension, Stump Type, Close Tolerance - Continued

			Head Diameter							
	Shank Diameter		NAS1516 Through NAS1522 NAS1546 Through NAS1552		NAS1535 Through NAS1542		NAS1525 Through NAS1532		NAS1556 Through NAS1562	
Basic Part Number	Min	Max	Min*	Max*	Min*	Max*	Min	Max	Min	Max
NAS1532 NAS1542 NAS1552 NAS1562	.3730	.3745	.693	.762	.629	.698	.595	.655	.613	.628
*For engineering reference only.										



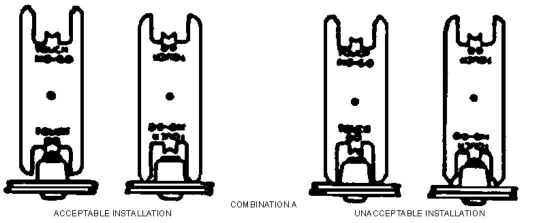
NAS1525 and NAS1535 are used with NAS1080D5.
NAS1546, NAS1556, NAS1516, NAS1526 and NAS1536 are used with NAS1080D6 Collars.
NAS1548, NAS1558, NAS1518, NAS1528 and NAS1538 are used with NAS1080D8 Collars.
NAS1550, NAS1560, NAS1520, NAS1530 and NAS1540 are used with NAS1080D10 Collars.
NAS1552, NAS1562, NAS1522, NAS1532 and NAS1542 are used with NAS1080D12 Collars.

Example of part number: NAS1548-9

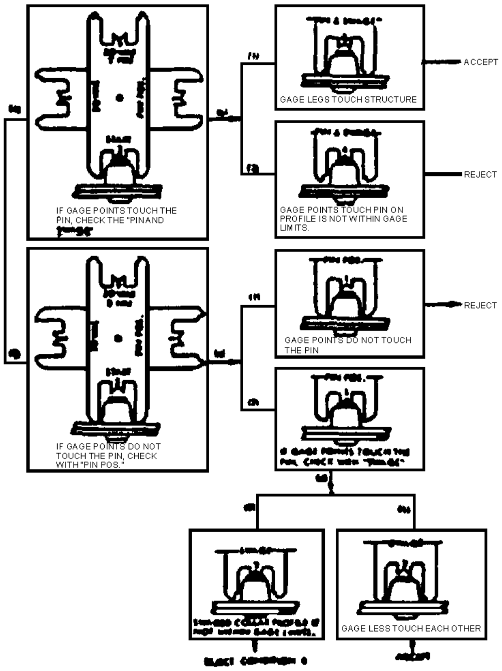
Nominal grip in 1/16th inch.
Pin, rivet, swage locking, aluminum alloy,
100 degree head, tension, stump type.
1/4 inch nominal shank diameter.
The above is also available with sealant escape groove; add prefix "H" to part number. Example: H1548-9

P01-080B

Table 1-57. Gages, Pins, and Collar Inspection



NORMAL DIAMETER	PINS	COLLAR TO BE USED IN IN COMBINATION WITH PINS	GAGES TO BE USED FOR CHECKING INSTALLATION
	NAS BASIC PART NO.	NAS PART NO.	HUCK GAGE NO.
1/8	NAS1414 NAS1424	NAS1080C4 NAS1080E4	HG75-6
5/32	NAS1415 NAS1425	NAS1080C5 NAS1080E5	HG75-5
	NAS1465 NAS1475 NAS2005V NAS2105V	NAS1080R5 NAS1080-5	HG85-12
	NAS1525 NAS1535	NAS1080D5	HG85-7
3/16	NAS1416 NAS1426 NAS2606V NAS2706V	NAS1080C6	HG75-1
	NAS1436 NAS1446 NAS2406V NAS2506V	NAS1080C6 NAS1080E6	HG76-1
	NAS1456 NAS1466 NAS1476 NAS2006V NAS2106V	NAS1080-6	HG85-10
	NAS1486 NAS1496 NAS2206V NAS2306V	NAS1080R6 NAS1080-6	HG34D-3
	NAS1516 NAS1526 NAS1536	NAS1080D6	HG85-10
	NAS1546 NAS1556	NAS1080D6	HG34D-1
1/4	NAS1418 NAS1428 NAS2608V NAS2708V	NAS1080C8	HG75-2
	NAS1438 NAS1448	NAS1080E8	HG76-2
	NAS2408V NAS2508V	NAS1080C8	
	NAS1458 NAS1468 NAS1478	NAS1080-8	HG85-2
	NAS1488 NAS1498	NAS1080R8	HG34D-4
	NAS2208V NAS2308V	NAS1080-8	
	NAS1518 NAS1528 NAS1538	NAS1080D8	HG85-2
	NAS1548 NAS1558	NAS1080D8	HG34D-3
	NAS2008V NAS2108V	NAS1080-8	HG85-18



NORMAL DIAMETER	PINS	GAGES TO BE USED IN COMBINATION WITH PINS	COLLAR TO BE USED FOR CHECKING INSTALLATION
	NAS BASIC PART NO.	NAS PART NO.	HUCK GAGE NO.
5/16	NAS1420 NAS1430 NAS2610V NAS2710V	NAS1080C10	HC75-3
	NAS1440 NAS1450	NAS1080E10	HG76-3
	NAS2410V NAS2510V	NAS1080C10	
	NAS1460 NAS1470 NAS1480 NAS2010V NAS2110V	NAS1080P10 NAS1080R10	HG85-8
	NAS1490 NAS1500 NAS2210V NAS2310V	NAS1080-10	HG34D-6
	NAS1520 NAS1530 NAS1540	NAS1080D10	HG85-3
	NAS1550 NAS1560	NAS1080D10	HG34D-5
3/8	NAS1422 NAS1432 NAS2612 NAS2712	NAS1080C12	HG75-4
	NAS1442 NAS1452	NAS1080E12	HG76-4
	NAS2412 NAS2512	NAS1080C12	
	NAS1462 NAS1472 NAS1482 NAS2012 NAS2112	NAS1080P12 NAS1080R12	HG85-9
	NAS1492 NAS1502	NAS1080-12	HG34D-8
	NAS1522 NAS1532 NAS1542	NAS1080D12	HG85-4
	NAS1552 NAS1562	NAS1080D12	HG34D-7

P01-081

Table 1-58. Pull Type Installation Tools and Nose Assembly Section

		Tool Model Numbers									
		609	610 613	611 612	614	206	207	200 352 21600 41600 51600	14100 24100 44100 54100	115 353 14800 24800 44800 54800	116 504 15900 25900 45900 55900
Fastener	Dia.	Nose Assembly Numbers (Use With Tools In Same Column Above)									
	1/8							99-614			
NAS 1436 thru 1442	5/32					99-870		99-620	99-642		
1446 thru 1452	3/16	99-541	99-395	99-156		99-871		99-608	99-636	92231	
		99-215	99-116	99-158				99-666			
1456 thru 1462		99-84	99-118	99-215				99-389		99-69	
		99-179	99-225	99-225				99-926			
1465 thru 1472			99-226	99-226				99-955			
				99-157				99-956			
1475 thru 1482				99-255				92221			
								92223			
1516 thru 1522								92224			
	1/4		99-126	99-165			99-891		99-637	99-609	
1525 thru 1532			99-129	99-167						99-667	
			99-227	99-257						92234	
1535 thru 1542			99-228	99-258						92235	
										92236	
2005 thru 2012											
	5/16			99-135					99-638	99-622	H99-664
2105 thru 2112				99-137						99-668	99-664
				99-265						79584	
2406 thru 2512				99-266						92230	
										99-99	
										99-957	
										99-958	
										99-926	

Table 1-58. Pull Type Installation Tools and Nose Assembly Section - Continued

		Tool Model Numbers									
	3/8			99-138 99-145 99-267 99-269	99-410				99-639	99-613 99-100 92386	

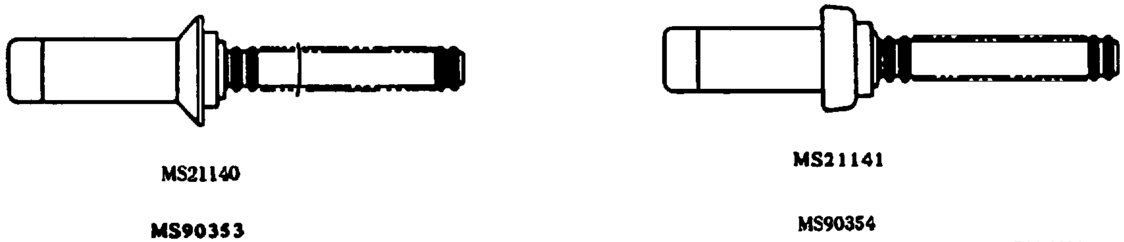
Stump Type Collar Swage Tool Selection				
		Swage Tool		
Fastener	Dia.	Squeeze Type	Hammer	
NAS				
1414 thru 1422	1/8	915-5-4	915-1-4	915-1-4C (LONG)
		.401 Shank Dia.	.401 Shank Dia.	.401 Shank Dia.
1424 thru 1432	5/32	915-5-5	915-1-5	915-1-5C (LONG)
		.187 Shank Dia.	.401 Shank Dia.	.401 Shank Dia.
1486 thru 1492	3/16	915-5-6A	915-1-6A	915-1-6F (LONG)
1496 thru 1502		249 Shank Dia.	.401 Shank Dia.	.401 Shank Dia
1546 thru 1562	1/4	915-5-8A	915-1-8A	915-1-8E (LONG)
		.249 Shank Dia.	.498 Shank Dia.	.498 Shank Dia.
2206 thru 2210				
2306 thru 2310				
2606 thru 2712				

115 And 353 Tool Will Not Install These Diameters

116 and 504 Only

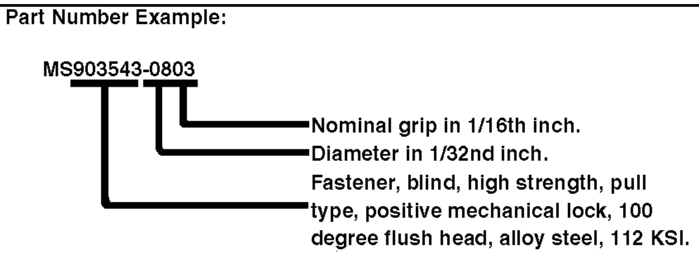
NOTE : For Tool Identification See Figure 1-48 and Figure 1-49.

Table 1-59. MS90353 Fastener, Blind High Strength, Pull Type, Positive Mechanical Lock, 100 Degree Head Alloy Steel; MS90354 Fastener, Blind, High Strength, Pull Type, Positive Mechanical Lock, Protruding Head Alloy Steel; MS21140 Fastener, Blind, High Strength, Pull Type, Positive Mechanical Lock, 100 Degree Head Corrosion Resisting Steel and MS21141 Fastener, Blind, High Strength, Pull Type, Positive Mechanical Lock, Protruding Head, Corrosion Resisting Steel



			Head Diameter		
	Shank Diameter		MS21140 and MS90353	MS21141 and MS90354	
Basic Part Number	Min	Max	Max	Min	Max
MS90353S05 and MS90354S05 MS21140-05 and MS90353-05 MS21141-05 and MS90354-05	.162	.164	.333	.250	.272
MS90353S06 and MS90354S06 MS21140-06 and MS90353-06 MS21141-06 and MS90354-06	.197	.199	.386	.305	.332
MS21140-08 and MS90353-08 MS21141-08 and MS90354-08	.258	.260	.507	.400	.432
MS21140-10 and MS90353-10 MS21141-10 and MS90354-10	.310	.312	.634	.480	.522
MS21140-12 and MS90353-12 MS21141-12 and MS90354-12	.372	.374	.762	.580	.627
MS90353-14 and MS90354-14	.435	.437	.890	.675	.727
MS90353-16 and MS90354-16	.496	.499	1.017	.770	.832

Table 1-59. MS90353 Fastener, Blind High Strength, Pull Type, Positive Mechanical Lock, 100 Degree Head Alloy Steel; MS90354 Fastener, Blind, High Strength, Pull Type, Positive Mechanical Lock, Protruding Head Alloy Steel; MS21140 Fastener, Blind, High Strength, Pull Type, Positive Mechanical Lock, 100 Degree Head Corrosion Resisting Steel and MS21141 Fastener, Blind, High Strength, Pull Type, Positive Mechanical Lock, Protruding Head, Corrosion Resisting Steel - Continued



Alloy steel sizes “05" and “06" insert “S” in place of (-) to designate fastener installed with single action tool. Sizes “05" and “06" with (-) in part number are installed with a double action tool. All other alloy steel sizes with (-) in the part number are installed with a single action tool.

Material:

Alloy steel, MIL-F-8177
A-286 Corrosion resistance steel MIL-F-8975.

P01-089B

1.7 HUCKRIMP FASTENERS.

The HUCKRIMP FASTENER is a two piece threaded fastener consisting of a pin (or bolt) having a modified radiused root, fatigue resistant thread form and a cylindrical nut fitted with a wrenching section. The nut, at installation is a free running fit on the thread of the pin.

1.7.1 Installation of Huckrimp Fasteners. Special tools are required for the installation of HUCKRIMP fasteners as indicated in Table 1-64. Tools are selected on the basis of nut diameter and material.

a. The pin is inserted in a hole through a joint. The free running nut is threaded on the pin. Only sufficient torque need be applied to make up the joint; that is to take out any gap which may exist.

b. At this point, the nut is crimped on the pin with a crimping tool. This crimping action displaces a controlled volume of the nut material and induces an axial pull on the pin which results in a predictable, high residual clamping force on the joint.

c. Since each fastener is installed under the same conditions, the clamping force exerted on the joint by each fastener will be very close to the same as that of each of the other like fasteners. The fastened joint is more reliable because the possibility is materially reduced of one fastener taking more of the load than the rest and thereby becoming the weakest link in the chain.

d. When the crimping jaws of the tool are impressed into the nut, the nut material flows into the locking feature built into the threads of the pin forming a mechanical lock between the crimped nut and the pin. This mechanical lock resists the tendency of the nut to loosen under vibration. The effectiveness of this anti-rotation feature is evidenced by a resulting high break-loose torque. After the mechanical lock is broken, high back-off torque remains to further resist rotation between the nut and the pin. In short, the crimping action has also converted the free-running nut at installation into a prevailing-torque type of lockout (See Figure 1-53.)

Table 1-60. Blind Bolt Installation Tool and Nose Assembly Selection

	Tool Model Numbers						
		115					
	200	353		116	610	611	
		14800	15900				
	21600	24800	25900				207-51
	41600	44800	45900	504	613	612	
	51600	54800	55900				

Fastener	Dia.	Nose Assembly Numbers (Use With Tools In Same Column Above)						
MS21140-05								
MS21141-05	5/32	99-600						
MS90353-05								
MS90354-05								
MS21140-06								
MS21141-06								
MS90353-06	3/16	99-589						
MS90354-06								
MS21140-08						99-838		
MS21141-08								
MS90353-08						99-685		
MS90354-08	1/4		99-591	H99-662	99-662	99-679	99-682	99-906
MS21140-10								
MS21141-10	5/16			H99-663	99-663			
MS90353-10								
MS90354-10								
MS21140-12								
MS21141-12	3/8			H99-599	99-599			
MS90353-12								
MS90354-12								

Table 1-60. Blind Bolt Installation Tool and Nose Assembly Selection - Continued

Fastener	Dia.	Nose Assembly Numbers (Use With Tools In Same Column Above)						
MS90353-14 MS90354-14	7/16			H99-738	99-738			
MS90353-16 MS90354-16	1/2			H99-678	99-678			

Single Action Blind Bolt Installation Tool and Nose Assembly Selection			
	Tool Model Numbers		
	206-51	609	352 200 21600 41600 51600 2700

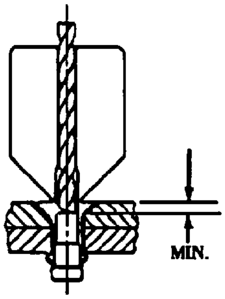
Fastener	Dia.	Nose Assembly Numbers (Use With Tools In Same Column Above)		
MS90353S05 MS90354S05	5/32	99-904	99-853	99-680
MS90353S06 MS90354S06	3/16	99-905	99-854 99-826	99-681

NOTE

For Tool Identification See Figure 1-48 and Figure 1-49.

Table 1-61. Blind Bolt Fastener Removal

DRILL PIN



NOM. SIZE	PART NO.	SIZE	MIN. DEPTH*	BUSHING
5/32"	502999	.0980	.050	103615
3/16"	503000	.1200	.070	103616
1/4"	503001	.1562	.090	103617
5/16"	503003	.1875	.105	103618
3/8"	503005	.2280	.130	103619

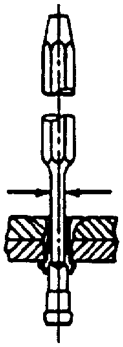
*MAX. DEPTH - .020

PLACE THE DRILL BUSHING OVER THE PIN SO THAT IT RESTS SQUARELY ON THE LOCK COLLAR.

USING A DRILL WITH A MAXIMUM OF 1250 RPM, DRILL TO LOCK COLLAR DEPTH.

KNOCK OUT PIN

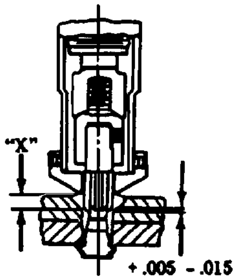
NOM. SIZE	PART NO.	SIZE
5/32"	503010	3/32"
3/16"	503010	3/32"
1/4"	503012	5/32"
5/16"	503013	3/16"
3/8"	503014	7/32"



POSITION PIN PUNCH ON THE FASTENER AND DRIVE FASTENER PIN OUT.

REMOVE REMAINING PORTION OF PIN AND LOCK COLLAR WITH ANY SHARP POINTED INSTRUMENT.

COUNTERBORE SLEEVE



HEAD HEIGHT

NOM. SIZE	HOLDER	PART NO.	SIZE	ANTI-ROTATION CAP
5/32"	103610	103605	5/32"	103620
3/16"	103611	103606	3/16"	103620
1/4"	103611	103607	1/4"	103621
5/16"	103613	103608	5/16"	103621
3/8"	103613	103609	3/8"	103622

HEAD HEIGHT		
PROTRUDING HEAD		C/SUNK HEAD
5/32"	.070	.070
3/16"	.135	.080
1/4"	.140	.105
5/16"	.140	.135
3/8"	.205	.165

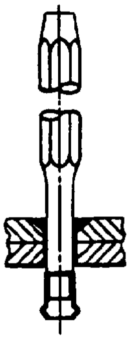
ADJUST MICRO-LIMIT TOOL TO WITHIN .005 TO .015 LESS THAN DIMENSION "X".

PLACE ANTI-ROTATION CAP FIRMLY AGAINST HEAD OF FASTENER.

COUNTERBORE TO DESIRED DEPTH.

KNOCK OUT SLEEVE

NOM. SIZE	PART NO.	SIZE-
5/32"	503012	5/32"
3/16"	503013	3/16"
1/4"	503015	1/4"
5/16"	503016	5/16"
3/8"	503017	3/8"



POSITION THE SLEEVE PUNCH IN THE SLEEVE AND DRIVE OUT LOWER PORTION OF THE SLEEVE.

TIP THE SLEEVE PUNCH SLIGHTLY AND LIFT OUT THE HEAD OF THE FASTENER.

P01-093

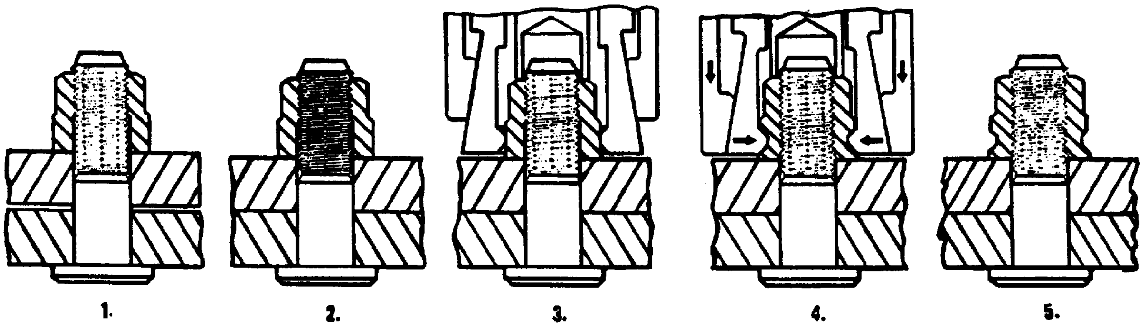
Table 1-62. Substitution Chart for Nonhole Filling Alloy Steel Blind Fasteners

Fastener Standard	Applicable Specification	5/32 inch Dia.		3/16 inch D1A.		1/4 inch Dia.		5/16 inch Dia.	
		Shear Pounds	Tensile Pounds	Shear Pounds	Tensile Pounds	Shear Pounds	Tensile Pounds	Shear Pounds	Tensile Pounds
MS90353	MIL-F-81177	2340	1350	3450	2100	5900	3650	8500	5200
MS90354	MIL-F-81177	2340	1350	3450	2100	5900	3650	8500	5200
NAS1059P	NAS1058	2005		2690	1900	4650	3630	7300	4635
NAS1059F	NAS1058	2005		2690	1900	4650	3630	7300	4635
NAS1669	NAS1675	1678	900	2620	1400	4500	2100	6000	3600
NAS1670	NAS1675	1678	900	2620	1400	4500	2100	6000	3600

Fastener Standard	Applicable Specification	3/8 inch Dia.		7/16 inch Dia.		1/2 inch Dia.	
		Shear Pounds	Shear Pounds	Shear Pounds	Shear Pounds	Shear Pounds	Shear Pounds
MS90353	MIL-F-81177	12200	7500	16700	10150	21800	13500
MS90354	MIL-F-81177	12200	7500	16700	10150	21800	13500
NAS1059P	NAS1058	10500	6560	14300	8160	18650	11100
NAS1059F	NAS1058	10500	6560	14300	8160	18650	11100
NAS1669	NAS1665	9750	5600				
NAS1670	NAS1665	9750	5600				

Table 1-63. Substitution Chart for Nonhole Filling A-286 Stainless Steel Blind Fasteners

Fastener Standard	Applicable Specification	5/32 inch DIA.		3/16 inchDIA.		1/4 inchDIA.		5/16 inchDIA.		3/8 inchDIA.	
		Shear Lbs.	Tensile Lbs.	Shear Lbs.	Tensile Lbs.	Shea Lbs.	Tensile Lbs.	Shear Lbs.	Tensile Lbs.	Shear Lbs.	Tensile Lbs.
MS21140	MIL-F-8975	1980	1150	2925	1690	5005	2900	7215	4170	10380	5970
MS21141	MIL-F-8975	1980	1150	2925	1690	5005	2900	7215	4170	10380	5970
NAS1761	NAS1675	1300	820	2265	1400	3600	2100	5175	3600	7875	5600
NAS1672	NAS1675	1300	820	2265	1400	3600	2100	5175	3600	7875	5600



HUCKRIMP fastening system: 1. Pin is inserted in hole, a free-running nut is mated with pin and torqued finger-tight to eliminate gap. 2. Additional light torque is applied to nut, sufficient to draw sheets together and remove looseness from joint. 3. Installation tool is placed on nut, integral stop automatically positions crimp jaws. 4. Installation tool is actuated and crimp jaws are impressed into nut. 5. Installation tool is removed from assembled fastener, completing cycle.

F01-052

Figure 1-53. Huckrimp Fastener Installation Sequence

Table 1-64. Huckrimp Fastener Installation Tool and Nose Assembly Section

	OKN-EU and KN-2C Krimpnut Diameters				
Installation Tool	**5/32 inch**	**3/16 inch**	**1/4 inch**	**5/16 inch**	**3/8 inch**
200	99-833	99-834			
352		99-834-1			
2700		99-834-2			
		99-834-3			
		99-990	99-799		
		99-990-1	99-799-1		
354		99-990-2	99-799-2		
		99-990-3	99-799-3		
	99-897	99-898			
		99-898-1			
		99-898-2			
		99-898-3			
542		99-991			
		99-991-1			
		99-991-2			
		99-991-3			
543			99-899		
			99-899-1		
			99-899-2		
			99-992		
			99-992-1		
			99-992-2		
			99-992-3		
544				99-990	99-901*

Table 1-64. Huckrimp Fastener Installation Tool and Nose Assembly Section - Continued

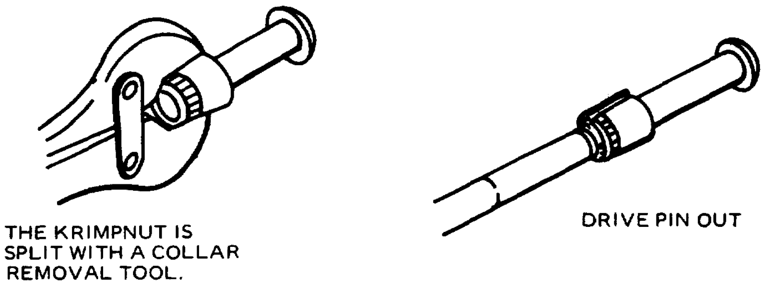
Installation Tool	OKN-EU and KN-2C Krimpnut Diameters				
	5/32 inch	3/16 inch	1/4 inch	5/16 inch	3/8 inch
568	99-881* 99-882*	99-883* 99-883-1 99-884*	99-885* 99-886*		
574			99-885-1	99-887* 99-888*	99-889* 99-890*
4800		99-990 99-990-1 99-990-2 99-990-3	99-799 99-799-1 99-799-2 99-799-3	99-798*	99-797*

*Will Install Aluminum Nuts Only

1.7.2 Inspection of Huckrimp Fasteners. For appropriate inspection gages see Table 1-65.

1.7.3 Removal of Huckrimp Fasteners. (See Figure 1-54.) Two methods of removal may be used. The KRIMPNUT may be split with a collar removal tool as shown in Figure 1-54. If the removal tool is not available a narrow chisel may be used to split the KRIMPNUT lengthwise. During removal of fasteners, special care should be taken so as not to damage or enlarge the hole. Replace a HUCKRIMP fastener with a unit of comparable size, type and material.

1.7.4 Blind Fasteners. Blind fasteners are used when access to one side of the work is impractical. The type of blind fastener selected depends on location, material, and strength requirements. The following outlines the requirements and installation procedure for various types of blind fasteners.

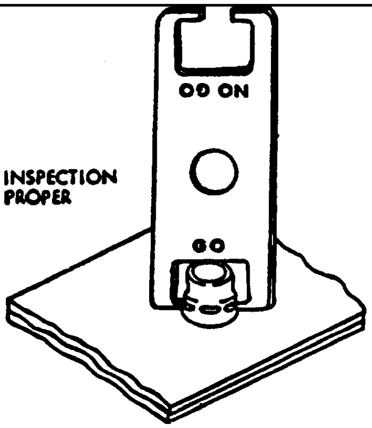


KRIMPIN DIA.	TOOL PART NUMBER	FEDERAL STOCK NUMBER
3/16"	105-6	5120-942-6898
1/4"	105-8	5120-942-6899
5/16"	105-10	5120-677-5706
3/8"	105-12	5120-677-5707

F01-0053

Figure 1-54. Removal of Huckrimp Fasteners

Table 1-65. Huckrimp Fastener Inspection

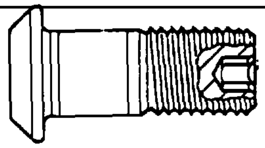


USE GO-NO-GO INSPECTION GAGE TO ASSURE PROPER CRIMPING.

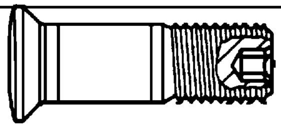
P01-095

Krimpnut Part Number	Nominal Diameter	Crimp Inspection Gage Part Number
KN-2C05	5/32 inch	HG91-05
KN-EU05C	5/32 inch	HG93-05
KN-2C06	3/16 inch	HG91-06
OKN-EU06C	13/64 inch	HG93-06
KN-2C08	1/4 inch	HG91-08
OKN-EU08C	17/64 inch	HG93-08
KN-2C10	5/16 inch	HG91-10
OKN-EU10C	21/64 inch	HG93-10
KN-2C12	3/8 inch	HG91-12
OKN-EU12C	25/64 inch	HG93-12

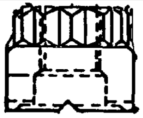
Table 1-66. Huckrimp Fastening System (108 K.S.I. Shear) Krimpin and Krimpnut for Shear/Tension Applications, 100 Degree Flush Crown HEAD or Protruding Head, 1/64 Inch Oversize Shank and Huckrimp Nut. AISI 8740 Alloy Steel Krimpin and A-286 Stainless Steel Krimpnut



3KSP
PROTRUDING HEAD



OKS200 100°
FLUSH CROWN HEAD



OKN-EU
STAINLESS STEEL NUT

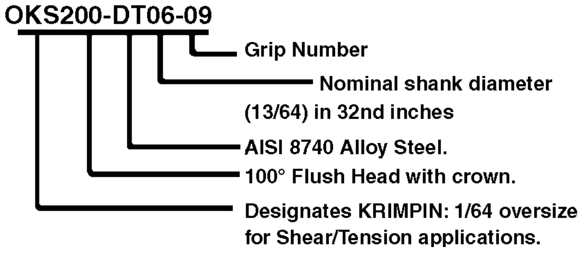
				Shear
Part Number Head Style Material	Nom. Dia.	Head Dia.	D Shank Dia.	Min. Ultimate Single Shear Pounds
xxxxxx-DT05 xxxx-DT05	Not Available See KS200-DT06 or 3KSP-DT06			
0KS200-DT06	13/64 Crown Hd.	.301 Ref.	.2025	3425
03KSP-DT06	Prot. Hd.	.312/298	.2010	

Table 1-66. Huckrimp Fastening System (108 K.S.I. Shear) Krimpin and Krimpnut for Shear/Tension Applications, 100 Degree Flush Crown HEAD or Protruding Head, 1/64 Inch Oversize Shank and Huckrimp Nut. AISI 8740 Alloy Steel Krimpin and A-286 Stainless Steel Krimpnut - Continued

				Shear
Part Number Head Style Material	Nom. Dia.	Head Dia.	D Shank Dia.	Min. Ultimate Single Shear Pounds
0KS200-DT08	17/64 Crown Hd.	.400 Ref.	.2650	5890
03KSP-DT08	Prot. Hd.	.413/.398	.2635	
0KS200-DT10	21/64 Crown Hd.	.484 Ref.	.3275	9090
03KSP-DT10	Prot. Hd.	.503/.483	.3260	
0KS200-DT12	25/64 Crown Hd.	.579 Ref.	.3900	12900
03KSP-DT12	Prot. Hd.	.583/.563	.3885	

	Krimpnuts With Installed Mechanical Properties				
PIN Part No.	A-286 CRES Stainless "EU"	Min. Ult. Tension Strength Pounds	Min. Clamping Force Pounds	Min. Break-Away Torque Inch-Lbs.	Min. Back-Off Torque Inch-Lbs.
xxxxx-DT05	Not Available See 3KSP-DT06				
03KSP-DT06	OKN-EU06C	2850	1850	35	7
03KSP-DT08	OKN-EU08C	4800	2600	100	20
03KSP-DT10	OKN-EU10C	7300	5100	225	50
03KSP-DT12	OKN-EU12C	10350	7250	430	100
xxxxx-DT05	Not Available See KS200-DT06				
OKS200-DT06	OKN-EU06C	2850	1850	35	7
OKS200-DT08	OKN-EU08C	4800	2600	100	20
OKS200-DT10	OKN-EU10C	7300	5100	225	50
OKS200-DT12	OKN-EU12C	10350	7250	430	100

PIN PART NUMBER EXAMPLE:



KRIMPNUT Part Number (and Example:

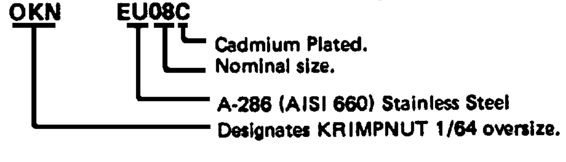
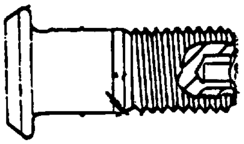
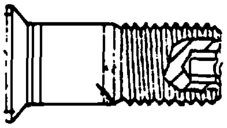


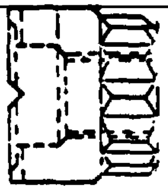
Table 1-67. Huckrimp Fastening System, (108 K.S.I. Shear), 100 Degree Countersunk or Protruding Head and Huckrimp Nuts for Shear Applications. AISI 8740 Alloy Steel and 6AL-4V Pins with 2024 Aluminum Alloy Nuts



KSP-DT & KSP-V
PROTRUDING HEAD



KS100-DT & KS100-V
100° FLUSH HEAD



KN-2C
ALUMINUM NUT

Part Number Head Style Material	Nom. Dia.	Head Diameter	D Shank Dia.	Shear
				Ultimate Single Shear Pounds
KS100-DT05	5/32 Flush Hd.	.256 Ref.	.1635/.1620	2280
KS100-V05			.1635/.1630	2010
KSP-DT05	5/32 Prot. Hd.	.257/.245	.1635/.1620	2280
KSP-V05			.1635/.1630	2010
KS100-DT06	3/16 Flush Hd.	.305 Ref.	.1895/.1880	3060
KS100-V06			.1895/.1890	2690
KSP-DT06	3/16 Prot. Hd.	.312/.298	.1895/.1880	3060
KSP-V06			.1895/.1890	2690
KS100-DT08	1/4 Flush Hd.	.399 Ref.	.2495/.2480	5300
KS100-V08			.2495/.2490	4660
KSP-DT08	1/4 Prot. Hd.	.413/.398	.2495/.2480	5300
KSP-V08			.2495/.2490	4660
KS100-DT10	5/16 Flush Hd.	.492 Ref.	.3120/.3105	8280
KS100-V10			.3120/.3115	7290
KSP-DT10	5/16 Prot. Hd.	.503/.483	.3120/.3105	8280
KSP-V10			.3120/.3115	7290
KS100-DT12	3/8 Flush Hd.	.588 Ref.	.3745/.3730	11950
KS100-V12			.3745/.3740	10490
KSP-DT12	3/8 Prot. Hd.	.583/.563	.3745/.3730	11950
KSP-V12			.3745/.3740	10490

Krimpins	Krimpnuts with Installed Mechanical Properties				
Part No.	2024 Alum. Alloy “2C”	Min. Ult. Tension Strength Pounds	Min. Clamping Force Pounds	Min. Break-Away Torque Inch-Lbs.	Min. Back-Off Torque Inch-Lbs.
KSP-DT05	KN-2C05	1500	1050	20	4
KSP-DT06	KN-2C06	2000	1400	35	7
KSP-DT08	KN-2C08	3500	2450	100	20
KSP-DT10	KN-2C10	5475	3850	225	50
KSP-DT12	KN-2C12	7925	5550	430	100
KS100-DT05	KN-2C05	1500	1050	20	4
KS100-DT06	KN-2C06	2000	1400	35	7
KS100-DT08	KN-2C08	3500	2450	100	20

Table 1-67. Huckrimp Fastening System, (108 K.S.I. Shear), 100 Degree Countersunk or Protruding Head and Huckrimp Nuts for Shear Applications. AISI 8740 Alloy Steel and 6AL-4V Pins with 2024 Aluminum Alloy Nuts - Continued

Krimpins	Krimpnuts with Installed Mechanical Properties				
Part No.	2024 Alum. Alloy "2C"	Min. Ult. Tension Strength Pounds	Min. Clamping Force Pounds	Min. Break-Away Torque Inch-Lbs.	Min. Back-Off Torque Inch-Lbs.
KS100-DT10	KN-2C10	5475	3850	225	50
KS100-DT12	KN-2C12	7925	5550	430	100
KSP-V05	KN-2C05	1500	1050	20	4
KSP-V06	KN-2C06	2000	1400	35	7
KSP-V08	KN-2C08	3500	2450	100	20
KSP-V10	KN-2C10	5475	3850	225	50
KSP-V12	KN-2C12	7925	5550	430	100
KS100-V05	KN-2C05	1500	1050	20	4
KS100-V06	KN-2C06	2000	1400	35	7
KS100-V08	KN-2C08	3500	2450	100	20
KS100-V10	KN-2C10	5475	3850	225	50
KS100-V12	KN-2C12	7925	5550	430	100

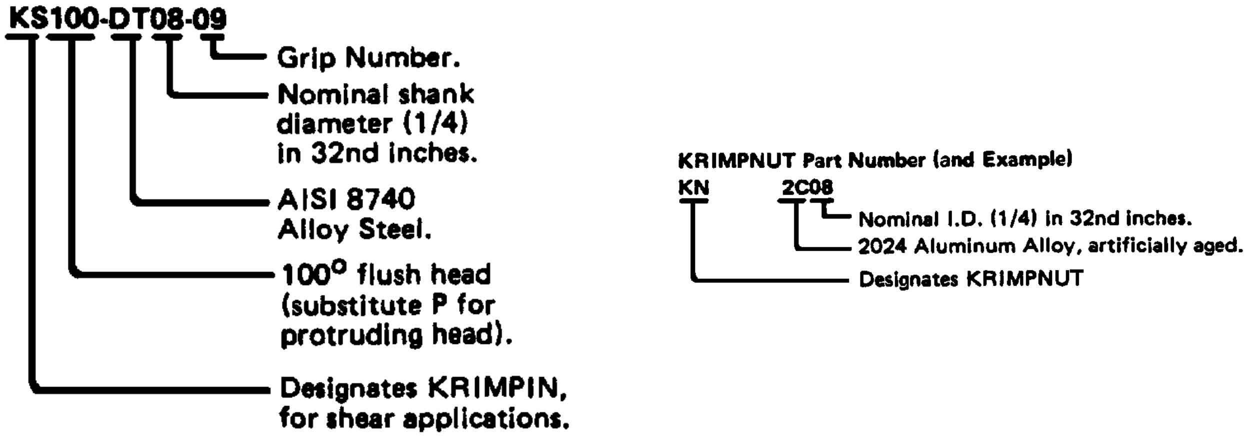
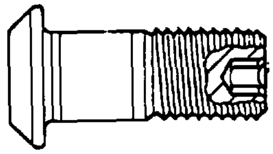
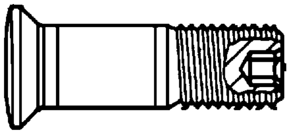


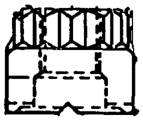
Table 1-68. Huckrimp Fastening System (108 K.S.I. Shear) Krimpin and Krimpnut for Shear/Tension Applications, 100 Degree Flush Crown Head or Protruding Head. AISI 8740 Alloy Steel Krimpin and A-286 Stainless Steel Krimpnut



3KSP
PROTRUDING HEAD



OKS200 100°
FLUSH CROWN HEAD

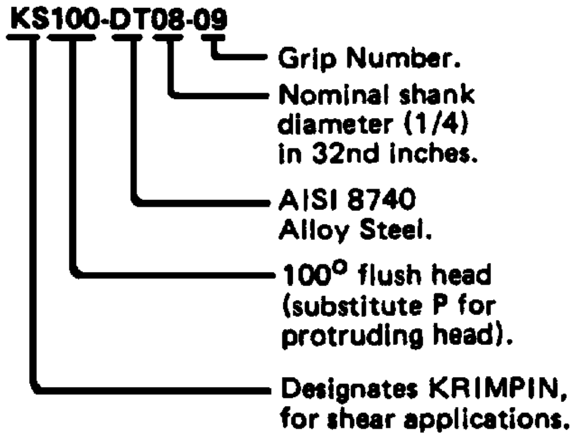


OKN-EU
STAINLESS STEEL NUT

				Shear
Part Number Head Style Material	Nom. Dia.	Head Dia.	D Shank Dia.	Min. Ultimate Single Shear Pounds
KS200-DT05	5/32 Crown Hd.	.252 Ref.	.1635/.1620	2280
3KSP-DT05	Prot. Hd.	.257/.245		
KS200-DT06	3/16 Crown Hd.	.301 Ref.	.1895/.1880	3060
3KSP-DT06	Prot. Hd.	.312/.298		
KS200-DT08	1/4 Crown Hd.	.400 Ref.	.2495/.2480	5300
3KSP-DT08	Prot. Hd.	.413/.398		
KS200-DT10	5/16 Crown Hd.	.484 Ref.	.3120/.3105	8280
3KSP-DT10	Prot. Hd.	.503/.483		
KS200-DT12	3/8 Crown Hd.	.579 Ref.	.3745/.3730	11950
3KSP-DT12	Prot. Hd.	.583/.563		

Krimpnuts With Installed Mechanical Properties					
Pin Part No.	A-286 CRES Stainless "EU"	Min. Ult. Tension Strength Pounds	Min. Clamping Force Pounds	Min. Break-Away Torque Inch-Lbs.	Min. Back-Off Torque Inch-Lbs.
3KSP-DT05	KN-EU05C	2000	1300	20	4
3KSP-DT06	OKN-EU06C	2850	1850	35	7
3KSP-DT08	OKN-EU08C	4800	2600	100	20
3KSP-DT10	OKN-EU10C	7300	5100	225	50
3KSP-DT12	OKN-EU12C	10350	7250	430	100
KS200-DT05	KN-EU05C	2000	1300	20	4
KS200-DT06	OKN-EU06C	2850	1850	35	7
KS200-DT08	OKN-EU08C	4800	2600	100	20
K200-DT10	OKN-EU10C	7300	5100	225	50
KS200-DT12	OKN-EU12C	10350	7250	430	100

Table 1-68. Huckrimp Fastening System (108 K.S.I. Shear) Krimpin and Krimpnut for Shear/Tension Applications, 100 Degree Flush Crown Head or Protruding Head. AISI 8740 Alloy Steel Krimpin and A-286 Stainless Steel Krimpnut - Continued



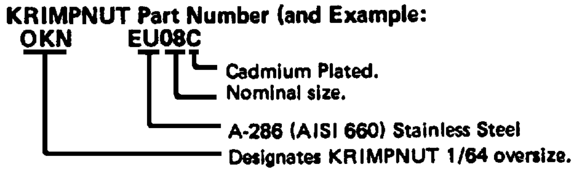
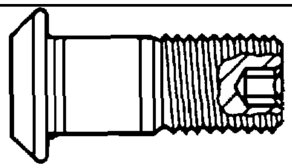
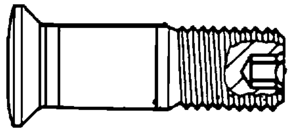


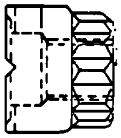
Table 1-69. Huckrimp Fastening System (108 K.S.I.), Krimpin and Krimpnut for Shear/Tension Applications, 100 Degree Flush Crown Head or Protruding Head, 1/32 Inch Oversize Shank and Huckrimp Nut. AISI 8740 Alloy Steel Krimpin and A-286 Stainless Steel Krimpnut



OOKSP
PROTRUDING



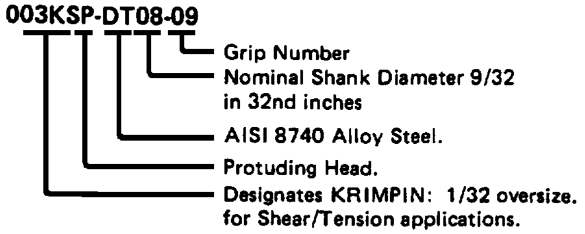
OOKS290 100
FLUSH CROWN HEAD



OKN-EU
STAINLESS STEEL NUT

Part Number	Nominal Diameter	Head Diameter	Shank Diameter	Minimum Ult. Shear
003KSP-DT06	7/32	.329/.343	.2167/.2182	3425
00KS200-DT06	7/32	.301 ref.	.2167/.2182	3425
003KSP-DT08	9/32	.429/.444	.2792/.2827	5890
00KS200-DT08	9/32	.400 ref.	.2792/.2827	5890

1/32 inch Oversize Krimpin Part Number	Krimpnuts With Installed Mechanical Properties				
	Krimpnut Part Number	Min. Ult. Tension Strength Pounds	Min. Clamping Force Pounds	Min. Break-Away Torque Inch-Lbs.	Min. Back-Off Torque Inch-Lbs.
003KSP-DT06	OKN-EU06C	2850	1850	35	7
00KS200-DT06	OKN-EU06C	2850	1850	35	7
003KSP-DT08	OKN-EU08C	4800	2600	100	20
00KS200-DT08	OKN-EU08C	4800	2600	100	20



KRIMPNUT Part Number (and Example)

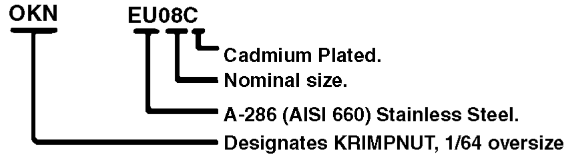


Table 1-70. Krimpnut Torque Installation Tools

Krimpnuts	Dia.	Torque Tools	
		Crowfoot	Flat
OKN-EU KN-2C	05	10602F05B	10608F05B
	06	10603C06B	10609C06B
KN-EU	08	10604C08B	10610C08B
	10	10605E10D	10611E10D
	12	10606E12B	10612E12B

1.8 BLIND FASTENER SUBSTITUTION REQUIREMENTS FOR CONVENTIONAL RIVETS.

The blind fasteners now available have an inherently lower level of reliability than most conventional aircraft fasteners, particularly when the blind side of the installed fastener cannot be inspected. For this reason, they shall only be used when absolutely necessary and more specifically, their use shall be consistent with the following general rules. See Table 1-71 for additional blind fastener substitution information.

Table 1-71. Conventional Rivet Substitution with Blind Fasteners

Installed Fastener	Substitute Fastener	Notes
1/8 Inch Fastener		
MS20426AD4	NAS1399D4	3
	CR3212-4	3
	NAS1769D4	3
	NAS1739B4	3
	CR3242-4	3
MS20426B4	NAS1399B4	3
	CR3212-4	3
	NAS1769D4	3
	NAS1739B4	3
	CR3242-4	3
MS20427M4	NAS1769MW4	5
	NAS1399MW4	5
	CR3522P-4	5
	NAS1739MW4	5
	CR3552P-4	5
MS20470AD4	MS20600AD4	3
	NAS1398D4	3
	CR3213-4	3
	NAS1768D4	3
	NAS1738D4	3
	CR3243-4	3
MS20470B4	MS20600B4	3
	NAS1398B4	3
	CR3213-4	3
	NAS1768D4	3
	NAS1738B	
	NAS1738B4	3
	CR3243-4	3
MS20615-4M	MS20600M4	4
	MS20600MP4	5
	NAS1398MW4	5
	CR3523P-4	5
	CR3553P-4	5
3/16 Inch Fastener		
MS20426AD6	CR3212-6	3
MS20426B6	NAS1399B6	3
	CR3212-6	3
	NAS1769B6	3
	NAS1739B6	3
	CR3242-6	3
MS20426DD6	NAS1769D6	3
	NAS1739B6	3
	CR3242-6	3
MS20427M6	NAS1769MW6	5
	NAS1399MW6	5
	CR3522P-6	5
	NAS1739MW6	5
	CR3552P-6	5
MS20470AD6	CR3213-6	3
MS20470DD6	NAS1768D6	3
	NAS1738B6	3
	CR3243-6	3
MS20470B6	MS20600B6	3
	NAS1399B6	3
	CR3213-6	3
	NAS1769D6	3
	NAS1739B6	3
	CR3243-6	3
MS20615-6M	MS20600M6	4
	MS20600MP6	5

Table 1-71. Conventional Rivet Substitution with Blind Fasteners - Continued

Installed Fastener	Substitute Fastener	Notes
	NAS1398MW6	5
	CR3523P-6	5
	CR3553P-6	5
MS20426AD5	NAS1769D5	3
	NAS1399D5	3
	CR3212-5	
	NAS1739B5	3
	CR3242-5	3
5/32 Inch Fastener		3
MS20426B5	NAS1769D5	3
	NAS1399B5	3
	CR3212-5	3
	NAS1739B5	3
	CR3242-5	3
MS20427M5	NAS1769MW5	5
	NAS1399MW5	5
	CR3522P-5	5
	NAS1739MW5	5
	CR3552P-5	5
MS20470AD5	MS20600AD5	3
	NAS1398D5	3
	CR3213-5	3
	NAS1768D5	3
	NAS1738D5	3
	CR3243-5	3
MS20470B5	MS20600B5	3
	NAS1399B5	3
	CR3212-5	3
	NAS1769D5	3
	NAS1739B5	3
	CR3242-5	3
MS20615-5M	MS20600M5	4
	MS20600MP5	5
	NAS1398MW5	5
	CR3242-5	3
MS20615-5M	MS20600M5	4
	MS20600MP5	5
	NAS1398MW5	5
	CR3523P-5	5
	CR3553P-5	5
1/4 Inch Fastener		
MS20426B8	NAS1399B8	3
	CR3212-8	3
MS20470B8	MS20600B8	3
	NAS1398B8	3
	CR3213-8	3
MS20615-8M	MS20600M8	4
	MS20600MP8	5

1. Refer to paragraph 1.7.4 for general rules to apply in use of blind fasteners.
2. Refer to paragraph 1.9.12 for additional information on interchangeability of blind fasteners.
3. Limited to 250°F.
4. Limited to 900°F. Do not use in aluminum alloy.
5. Limited to 400°F.
6. CR3242/3; NAS1738/9 and NAS1768/9 are 1/64 inch oversize diameter fasteners.

1.8.1 Requirements. Blind fasteners may be substituted for conventional aircraft fasteners in accordance with the following:

a. Blind fasteners shall be used in nonstructural applications only when access to one of the working sides of the assembly is impossible, or the cost and effort to gain access for installation of conventional aircraft fasteners is not practical. Examples of nonstructural application are: attaching tank liners, rubber seals, name plates, anchor nuts, and gang channels.

b. Blind fasteners shall be used in structural applications only where lack of access precludes the use of conventional aircraft fasteners. In structural applications considerable effort is justified to enable the use of conventional-nonblind fasteners. Only blind fasteners with design allowables interchangeable with the fastener to be replaced should be used.

c. Blind fasteners shall not be used for primary tension applications.

d. In cases where blind side of the work is visible, though not accessible, the blind head shall be visually inspected and replaced if not properly seated and/or formed.

e. Blind fasteners shall not be used in any of the following applications.

  (1) Areas requiring a fluid tight seam.

  (2) Control systems, operating devices, or mechanisms.

  (3) Primary structure fittings.

(4) Any item or assembly that must be periodically removed.

f. Hi-shear rivets may be replaced with Hi-shear blind bolts with limits in accordance to steps a. thru e.

1.9 CHERRYLOCK AND OLYMPIC-LOK RIVETS.

Cherrylock and Olympic-Lok rivets are used where access to one side of the work area is impossible. Rivets can be installed by one operator using a riveter designed specifically for installation of blind rivets. See paragraph 1.9.12 for interchangeability of Cherry and Olympic rivets.

1.9.1 Types of Rivets.

The four types of rivets and their basic makeup are listed below.

a. Pull-thru: Consists of a hollow sleeve and a spindle with an increased diameter in the plug section.

b. Standard Self-plugging: Consists of a hollow sleeve and a spindle with an increased diameter in the plug section. As the spindle is pulled into the sleeve and lodges into the rivet sleeve, the blind head is also formed.

c. Self-plugging Mechanical Locked Spindle: Consists of a multiple piece construction, but must be an integral assembly and shall include a means, other than friction, of mechanically locking the spindle to the rivet sleeve.

d. Self-Plugging, Mechanical Locked Spindle, Bulbed Type: Has the same installation characteristics as the self-plugging mechanical locked spindle rivets, but differs because large blind side head provides higher strength in thinner sheets. Available in nominal diameter and 1/64 inch oversize. Some bulbed type rivets can be installed in applications where the blind head is formed against a dimpled sheet.

1.9.2 Identification.

Each rivet can be identified by a standard code number. This number represents style, material, diameter, and maximum grip length of each rivet. Figure 1-55 shows each type of rivet with its basic code number. The basic types of identification are:

a. Military Standard - MS.

b. National Aerospace Standard - NAS.

c. Cherry Rivet - CR.

d. Olympic Rivet - RV.

1.9.2.1 An example of a standard code number is MS20600AD5W3. This represents a self-plugging, 100° countersunk head, 2117 aluminum alloy, serrated system, having a diameter of 5/32 inch. This rivet may be installed in material ranging in thickness from 0.126 to 0.187.

1.9.3 Rivet Pattern Layout.

When possible, rivet patterns shall have the same configuration as the original installation or as called out for repair. Specific repair procedures are prescribed for all types of repairs; however, there are some general procedures which will apply in all instances.

1.9.4 Edge Distance.

Rivet edge distance is measured from the centerline of the rivet to the nearest edge of the part through which it passes. The recommended minimum edge distance for rivets is two times the rivet diameter plus 0.06. This minimum edge distance may be used except where specified differently in a specific repair procedure or when replacing existing rivets.

1.9.5 Rivet Spacing.

Rivet spacing is measured between the centerline of adjacent rivets. The minimum spacing between protruding head rivets shall not be less than three and one-half times the rivet diameter. The minimum spacing between flush head rivets shall not be less than four times the diameter of the rivet. These dimensions may be used as the minimum spacing except when specified differently in a specific repair procedure or when replacing existing rivet.

1.9.6 Hole Preparation.

When installing Cherry and Olympic rivets, it is important that the rivet holes be the correct size, shape and free from burrs. Refer to step c for hole size and recommended drill size. Holes shall be drilled as follows:

NOTE

Nominal diameter locked spindle rivets are not interchangeable with bulb type rivets due to differences in diameters and strength.

a. Drilling.

(1) Drill or ream holes to the diameter specified in step c. Use a clean, sharp drill. Center the drill in the chuck so that drill will run true.

(2) To ensure proper hole alignment and to prevent burrs and chips from lodging between the sheets, the material to be drilled should be clamped tightly together. Before clamping the material, remove any foreign matter that may be lodged between the metal sheets.

(3) Check holes with a Cherrylock T172 Go/No-Go gage.

b. Machine countersink and dimpling.

(1) For installation of flush head rivets, the sheets shall be dimpled or machine countersunk. Holes shall have 100° incline and be deep enough so the head of the rivet fits flush with surrounding surface.

(2) Dimpled parts that receive flush head rivets shall have undersized pilot holes for dimpling operation. After dimpling, the holes shall then be drilled or reamed to proper size.

c. The following hole sizes shall be used when installing all Cherry and Olympic rivets, except when specified differently in a specific repair procedure or when replacing existing fasteners.

Non-Bulb Type - Locked Spindle

Rivet Dia	Hole Size (Min) (Max)	Size Drill	Drill Dia
1/8	0.129	30	0.1285
	0.132		
5/32	0.160	21	0.1590
	0.164		
3/16	0.192	11	0.1910
	0.196		
1/4	0.256	F	0.2570

Bulb Type - Locked Spindle

Rivet Dia	Hole Size (Min) (Max)	Size Drill	Drill Dia
1/8	0.143	27	0.1440
	0.146		
5/32	0.176	16	0.1770
	0.180		
3/16	0.205	5	0.2055
	0.209		

1.9.7 Equipment. Special rivet guns and pulling heads are required for the installation of Cherry and Olympic rivets.

a. Rivet Guns. Rivet Guns are available in the following types: hand operated, pneumatic and pneumatic-hydraulic. Some of the guns used for Cherry rivets may be adapted for Olympic-Lok rivets. Refer to Chapter 7 for information on gun conversion.

b. Pulling Heads. Pulling heads are furnished to accommodate standard rivet diameters and head styles. A different pulling head is required for each rivet diameter except for the CherryMAX system. The flush head style pulling head may be used to install either universal or flush head rivets. Types of pulling heads required are listed below:

(1) Pulling head for self-plugging serrated stem rivets (MS20600/01 Series). Cherry pulling heads (H9015 and H9040 Series) and Olympic pulling heads (RV355 and RV3355 Series) are required to install the ‘‘MS’’ serrated stem series rivets.

(2) Pulling heads for Cherrylock rivets (NAS1398/9 and NAS1738/9). Cherrylock pulling heads (H681 Series) are required to install Standard Cherrylock (NAS1398/9) and Bulbed Cherrylock (NAS1738/9) rivets.

(3) Pulling heads for Olympic-Lok rivets (NAS1398/9 ‘‘A’’ Code and NAS1768/9). Olympic pulling heads (RV812 Series) are required to install Olympic-Loc (NAS1398/9 ‘‘A’’ Code) and Olympic Bulb-Lok (NAS1768/9) rivets.

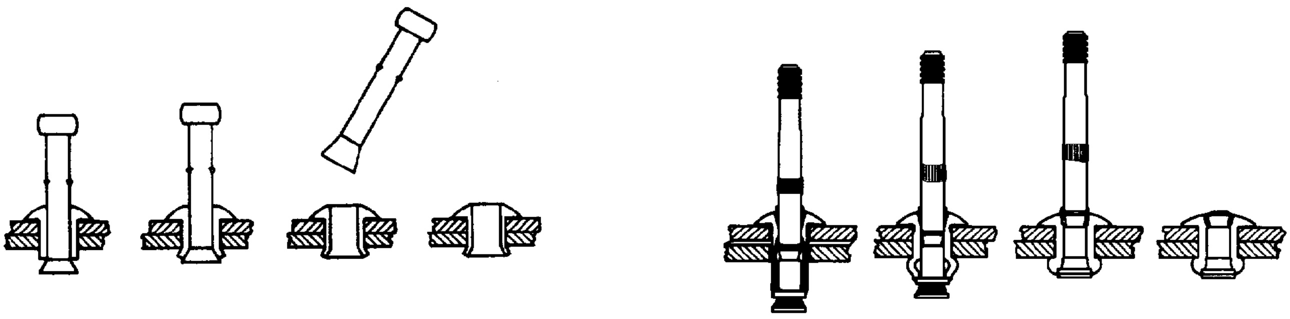
(4) Pulling heads for CherryMAX rivets (CR3242/3 and CR3552/3). CherryMAX pulling heads (H701A456, H763 and H753) are recommended to install CherryMAX rivets. Installations can be accomplished by using ‘‘MS’’ serrated stem pulling heads.

c. Trimming of Rivets.

(1) The tools used for removing the exposed ‘‘MS rivet’’ spindle after installation can be a power stem trimmer or a flush ground, side cutting, nipper. The Cherry Fasteners, Part No. 220, 225, or 301B power trimmer may be used. For hand use, the Cherry Fasteners, Part No. 209 trimmer may be used. An acceptable substitute is a pair of diagonal cutting pliers with the cutting jaws ground flush on one side.

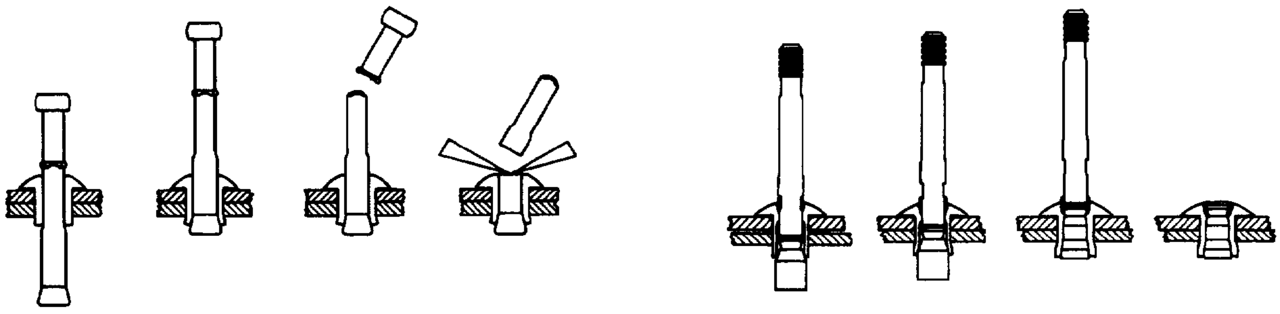
(2) No special equipment is required for trimming mechanical locked spindle rivets. The installation tool is adjusted to fracture the spindle approximately flush with rivet head. If trimming is required, the above equipment may be used. Sanding disc or grinding wheels will not be used to trim rivet stems.

(3) Trimming of all rivets must be held within the limits of paragraph 1.9.8.



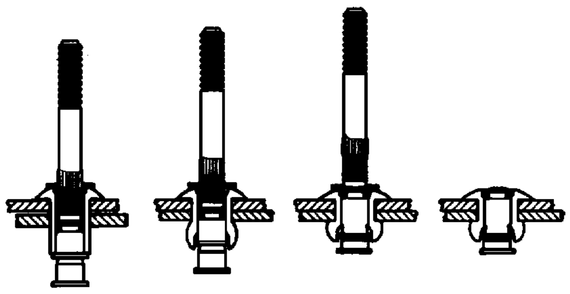
PULL-THRU RIVETS

BULBED CHERRYLOCK



SELF-PLUGGING RIVETS

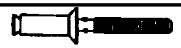
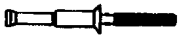
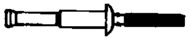
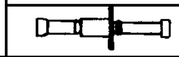
STANDARD CHERRYLOCK



CHERRYMAX - OVERSIZE

F01-054S01

Figure 1-55. Cherry and Olympic-Lok Rivet Identification and Installation (Sheet 1 of 3)

Standard Type	Configuration	Head Identification	Basic Number
Hollow Pull Thru		100 Degree Countersunk	MS20605
		Large Flat Head	CR148
Self Plugging		100 Degree Countersunk	MS20601
		Universal Head	MS20600
		Large Flat Head	CR198C
Standard Cherrylock		100 Degree Countersunk	NAS1399 (No Code)
		Universal Head	NAS1398 (No Code)
Bulbed Cherrylock		100 Degree Countersunk	NAS1739
		Universal Head	NAS1738
CherryMAX		100 Degree Countersunk	CR3212 CR3522 CR3242 CR3552
		Universal Head	CR3213 CR3523 CR3243 CR3553
Olympic-Lok		100 Degree Countersunk	NAS1399 "A" Code
		Universal Head	NAS1398 "A" Code
Bulbed Olympic-Lok		100 Degree Countersunk	NAS1769
		Universal Head	NAS1768

CHERRY, CHERRYMAX, CHERRYLOCK AND OLYMPIC-LOK RANGE

Dash Numbers				Grip Range	
NAS1738 NAS1739	NAS1398/9 NAS1398A/9A CR3212/3 CR3522/3 NAS1738/9 CR3242/3 CR3552/3	MS20600 MS20601 MS20605	CR148 CR198C	Minimum	Maximum
-1	-1	-1	-2	(*)	0.062
-2	-2	-2	-4	0.063	0.125
-3	-3	-3	-6	0.126	0.187
-4	-4	-4	-8	0.188	0.250
-5	-5	-5	-10	0.251	0.312
-6	-6	-6	-12	0.313	0.375
-7	-7	-7	-14	0.376	0.437
-8	-8	-8	-16	0.438	0.500
-9	-9	-9	-18	0.501	0.562
-10	-10	-10	-20	0.563	0.625
-11	-11	-11	-22	0.626	0.687
-12.	-12	-12	-24	0.688	0.750

(*) Minimum Grip for Short Rivets

Diameter	Universal Head			100° Countersink		
	NAS1398 NAS1398A CR3213 CR3523	NAS1738 CR3243 CR3553	MS20600	NAS1399 NAS1399A CR3212 CR3522	NAS1739 CR3242 CR3552	MS20601 MS20605 CR148 CR198C
1/8 (-4)	.025 (-1)	.020 (-1)	.025 (-2)	.063 (-2)	.045 (-2)	.052 (-2)
5/32 (-5)	.031 (-1)	.025 (-1)	.031 (-2)	.075 (-2)	.063 (-2)	.065 (-4)
3/16 (-6)	.037 (-1)	.030 (-1)	.037 (-2)	.090 (-2)	.073 (-2)	.080 (-4)
1/4 (-8)	.063 (-2)	- -	.050 (-2)	.126 (-3)	- -	.105 (-4)

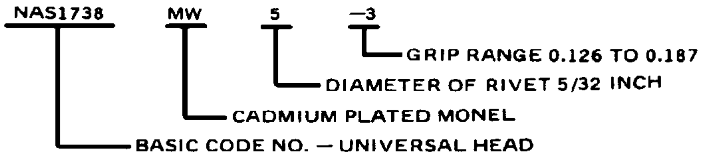
F01-054S02

Figure 1-55. Cherry and Olympic-Lok Rivet Identification and Installation (Sheet 2)

BREAKDOWN OF RIVET CODE NUMBERS

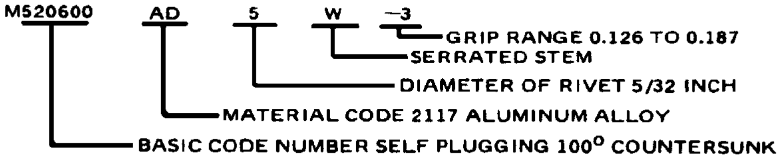
BULBED SERIES RIVETS

MATERIAL	MATERIAL CODE NO.		
	CHERRY	CHERRYMAX	OLYMPIC
ALUMINUM	NAS1738B&E	CR3243	NAS1768D
MONEL CADMIUM PLATED	NAS1738MW	CR3553P	NAS1768MW
MONEL UNPLATED	NAS1738M	CR3553	NAS1768M
ALUMINUM	NAS1739B&E	CR3242	NAS1769D
MONEL CADMIUM PLATED	NAS1739MW	CR3552P	NAS1769MW
MONEL UNPLATED	NAS1739M	CR3552	NAS1769M



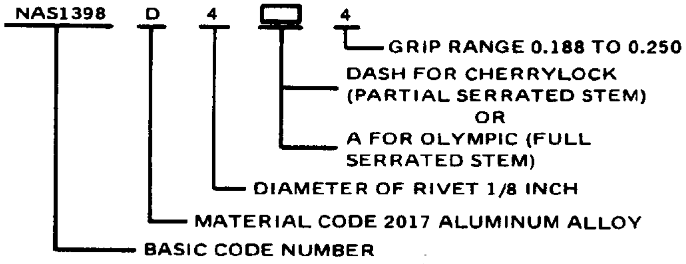
MILITARY STANDARD MS

MATERIAL	MATERIAL CODE NO.
5056 ALUMINUM ALLOY ◁3	B
2117 ALUMINUM ALLOY ◁3	AD
MONEL ◁5	M



NATIONAL AEROSPACE STANDARD NAS

MATERIAL	MATERIAL CODE NO.
2017 ALUMINUM ALLOY ◁3	D
5056 ALUMINUM ALLOY ◁3	B
CAD. PLATED MONEL ◁4	MW
MONEL UNPLATED ◁5	M
A-286 CRES ◁6	C



NOTES

1. MONEL CADMIUM PLATED RIVETS SHALL BE USED ONLY WHERE RIVETS WILL BE USED IN CONJUNCTION WITH ALUMINUM SKIN OR STRUCTURE.

2.▷ WHEN INSTALLING NAS1398/9 RIVETS GRIP -1 THRU -2, BULBED SERIES, NAS1738/9 OR CHERRYMAX SHALL BE USED IN LIEU OF NAS1398/9 RIVETS.

3.▷ TEMPERATURE LIMITATION - 250°F MAXIMUM.

4.▷ TEMPERATURE LIMITATION - 400°F MAXIMUM.

5.▷ TEMPERATURE LIMITATION - 900°F MAXIMUM.

6.▷ TEMPERATURE LIMITATION - 1200°F MAXIMUM.

F01-054S03

Figure 1-55. Cherry and Olympic-Lok Rivet Identification and Installation (Sheet 3)

1.9.8 Installation. When replacing existing rivets or installing repairs, paragraph 1.9.5 will be used in conjunction with this paragraph. The following steps shall be used to install rivets.

a. Material to be joined must be secured firmly in position. Sheet metal holders, C-clamp, or temporary fasteners may be used.

b. Select correct diameter and length rivet. Insert rivet in hole but do not force.

c. Completely insert stem of rivet in slot of draw bolt.

NOTE

It is recommended that both the hand and power guns be checked for proper operation before use and adjustments be made as required.

d. Use hand or power gun.

(1) Hand gun. When using hand gun, hold handle rigid and straight in line with axis of the rivet. Operate gun by making several short strokes. Keep gun pushed firmly against rivet head and work so rivet head is snug against the surface. When rivet becomes snug, continue movement of handle until stem breaks. Release stem by bringing handles together.

(2) Power gun. When using power gun to install rivets, follow same basic procedure as outlined for hand guns. Hold power gun in proper position and pull trigger. The spindle will be pulled, fractured, and ejected. On Cherrylock rivets, during this sequence, the lock ring will be inserted automatically.

e. Before trimming operation, rivets shall be inspected per paragraph 1.9.9.

1.9.9 Inspection. The following test and visual inspections shall be used to determine minimum requirements for rivets.

a. Cherry Rivet Inspection.

(1) Before trimming operation, compare spindle stems. Rivets not having spindles properly pulled can be detected by comparing the height of broken spindle with adjacent spindle heights.

(2) If blind side of rivet is visible, the expanded shank portion shall be visually inspected. The plugged end of the spindle shall extend into the rivet shank, forming the shop head. The shop head shall be pulled up tight against the material.

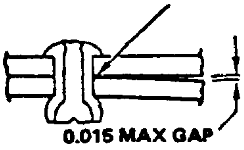
(3) Stem push out test shall be performed. A push of approximately 10 pounds shall be applied on the fractured spindle. Push steadily on the stem. Do not strike. Cherry stem gauge 352B1 (NSN 5220-01-034-2430), or the end of a pencil may be used for this purpose. Replacement of the rivet is required if the stem is removed.

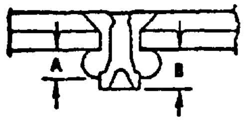
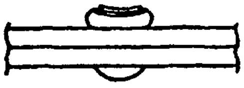
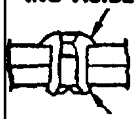
(4) Fit of Rivet Head. Flat head rivets may have a gap of 0.008 maximum one side only. Opposite side of rivet must be seated. Brazer head rivets may have 0.004 maximum gap, one side only. Gap may not extend to rivet shank. Countersunk rivets may have 0.003 gap, provided no more than forty percent of the circumference has a gap. It is acceptable for countersunk rivets if recession does not exceed 0.004 below surface. Countersunk rivets may not protrude more than 0.011 above surface. If any one of these limits are exceeded, rivet shall be replaced. Closer limits shall apply to meet contour and smoothness requirements.

b. Trimmed Stem Inspection. Trimmed stems of countersunk or brazer head rivets shall not protrude more than 0.010 above the head for exterior installations, and 0.030 for interior installations. If a sharp edge remains after trimming, the remaining portion may be milled or filed. In no case shall more than 0.005 be milled or filed from rivet head. Closer limits shall apply to meet contour smoothness requirements.

c. Cherrylock, CherryMAX and Olympic-Lok Rivet Inspection. See Figure 1-56.

(1) Check rivet head for proper fracture of the spindle (stem) and lock ring insertion. For countersunk and brazer head rivets the spindle may fracture 0.020 above or 0.015 below rivet head. The lock ring must also be within these limits.

<table>
<tr><th>CONDITION</th><th>ACCEPTABILITY LIMITS</th></tr>
<tr><td>NO GAP AT RIVET SHANK
0.015 MAX GAP
SHEET GAP</td><td>ACCEPTABLE WITHIN LIMITS SHOWN</td></tr>
<tr><td>MINIMUM PROTRUSION OF SLEEVE AND SPINDLE.

PROTRUSION NAS1398, 1399, CR3242, CR3243</td><td>ACCEPTABLE IF A OR B EXCEEDS THESE VALUES
<table>
<tr><th>DIA</th><th>"A" MIN</th><th>"B" MIN</th></tr>
<tr><td>1/8"</td><td>0.093</td><td>0.063</td></tr>
<tr><td>5/32"</td><td>0.093</td><td>0.063</td></tr>
<tr><td>3/16"</td><td>0.093</td><td>0.063</td></tr>
<tr><td>1/4"</td><td>0.156</td><td>0.093</td></tr>
</table></td></tr>
<tr><td>
MAXIMUM PROTRUSION OF SPINDLE AND MINIMUM PROTRUSION OF SLEEVE APPLICABLE ONLY TO BULBED-LOK RIVETS.
BULBED-LOK PROTRUSION</td><td>ACCEPTABLE IF A EXCEEDS THE VALUES AND B STAYS WITHIN THE VALUES SHOWN.
<table>
<tr><th>DIA</th><th>"A" MIN</th><th>"B" MAX</th></tr>
<tr><td>1/8"</td><td>0.040</td><td>0.200</td></tr>
<tr><td>5/32"</td><td>0.060</td><td>0.220</td></tr>
<tr><td>3/16"</td><td>0.060</td><td>0.240</td></tr>
</table></td></tr>
<tr><td>SPLIT IN SHEAR RING
SPINDLE (BULBED PORTION)
MANUFACTURED HEAD
SPLIT SHEAR RING BULBED-LOK</td><td>ACCEPTABLE WHETHER SHEAR RING IS SPLIT OR NOT.</td></tr>
<tr><td>BULBED-LOK RIVET IN MINIMUM GRIP</td><td>ACCEPTABLE WHETHER THE BULB COVERS THE SPINDLE UNIFORMLY OR NOT.</td></tr>
<tr><td>BULBED-LOK RIVET IN MAXIMUM GRIP</td><td>ACCEPTABLE AS SHOWN.</td></tr>
<tr><td>ACCEPTABLE APPEARING VISIBLE HEAD
STRUCTURALLY INADEQUATE BLIND HEAD
TOO SHORT GRIP LENGTH</td><td>NOT ACCEPTABLE. RIVET GRIP LENGTH TOO SHORT FOR MATERIAL THICKNESS.</td></tr>
</table>

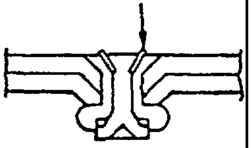
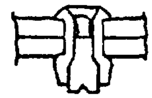
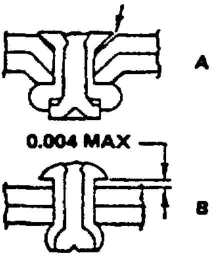
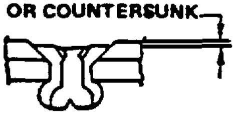
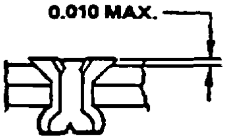
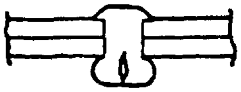
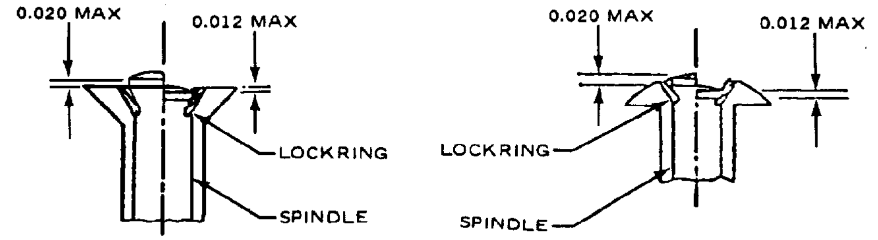
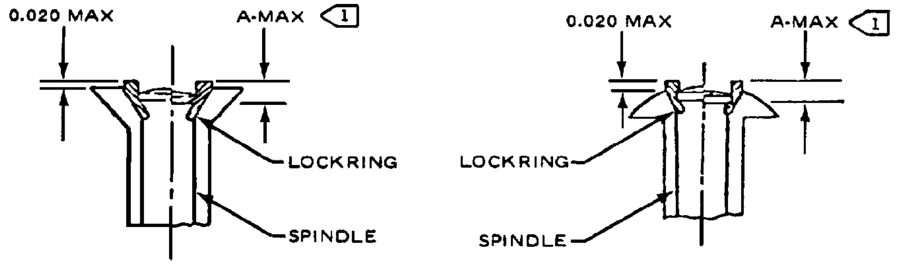
<table>
<tr><th>CONDITION</th><th>ACCEPTABILITY LIMITS</th></tr>
<tr><td>LOOSE LOCKING RING
LOOSE OR MISSING LOCK RING.
BULBED-LOK</td><td>NOT ACCEPTABLE. REMOVE AND REPLACE RIVET.</td></tr>
<tr><td>LOCKING RING MISSING AFTER PREMATURE BREAK.
PLUG SECTION OF STEM NOT THRU HEAD.</td><td>NOT ACCEPTABLE. RIVETS NOT PROPERLY LUBRICATED OR LUBRICATION DRIED OUT. SPINDLE DIRTY. UNDERSIZE HOLE. HOLES SLANTED OR MISALIGNED. RIVET GRIP LENGTH TOO SHORT. PULLING HEAD NOT FAR ENOUGH DOWN ON SPINDLE. PULLING HEAD CROOKED.</td></tr>
<tr><td>INSERT FEELER GAGE HERE.

SPACE UNDER HEAD</td><td>A. GAPS UNDER THE HEAD, WHICH PERMIT INSERTION OF A 0.004 FEELER GAGE TO THE SHANK ARE NOT ACCEPTABLE. GAPS WHICH WILL PERMIT INSERTION OF A 0.003 FEELER GAGE ARE ACCEPTABLE PROVIDED NO MORE THAN 40% OF THE CIRCUMFERENCE HAS A GAP.
B. ACCEPTABLE IF PORTION OF HEAD IS SEATED AND CLEARANCE ON OPPOSITE SIDE DOES NOT EXCEED THAT SHOWN. IF GAP EXCEEDS LIMITS SHOWN, REMOVE RIVET AND CLEAN HOLE AND SURFACE CAREFULLY.</td></tr>
<tr><td>0.004 MAX DIMPLE OR COUNTERSUNK
COUNTERSINK OR DIMPLE TOO DEEP.</td><td>NOT ACCEPTABLE IF RECESSION EXCEEDS 0.004" AS SHOWN.</td></tr>
<tr><td>0.010 MAX.
FLUSH HEAD PROTRUDING ABOVE MATERIAL</td><td>NOT ACCEPTABLE IF PROTRUSION EXCEEDS 0.010.
CLOSER LIMIT SHALL APPLY IF SPECIFIED ON DRAWING.</td></tr>
<tr><td>SHANK SPLIT</td><td>NOT ACCEPTABLE.
F01-055S01</td></tr>
</table>

Figure 1-56. Cherrylock, CherryMAX and Olympic-Lok Rivet Inspection (Sheet 1 of 2)

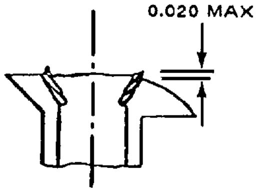


SPINDLE LIMITS



RIVET SIZE	-4 DIA.	-5 DIA.	-6 DIA.	-8 DIA.
A MAX	0.015	0.020	0.025	0.030

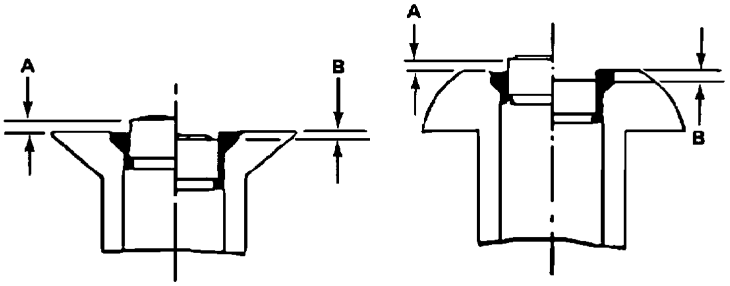
LOCKRING LIMIT



A SLIGHT LOCKRING "FLASH" CAUSED BY THE PRESSURES NECESSARY TO DRIVE THE LOCKRING IS ACCEPTABLE WITHIN THE LIMIT SHOWN.

LEGEND

1 LOCKRING SHOULD NEVER BE HIGHER THAN 0.020 FROM TOP OF RIVET HEAD WHEN SPINDLE IS ABOVE RIVET HEAD. IF SPINDLE IS FLUSH OR BELOW FLUSH WITH RIVET HEAD, LOCKRING SHOULD NEVER BE MORE THAN "A" HIGHER THAN SPINDLE.



SPINDLE FLUSHNESS LIMITS (INCH)		
RIVET DIAMETER	A MAX. (ABOVE)	B MAX. (BELOW)
1/8	0.010	0.015
5/32	0.010	0.020
3/16	0.010	0.020

NOTE: COLLAR TO BE FLUSH WITH TOP SURFACE OF RIVET HEAD. COLLAR FLASH PERMISSABLE (0.020 MAX.).

F01-055S02

Figure 1-56. Cherrylock, CherryMAX and Olympic-Lok Rivet Inspection (Sheet 2)

(2) Spindles and lock rings may be milled flush with rivet head. But in no case shall more than 0.020 be milled from lock ring or spindle, and rivet head must not be shaved more than 0.005 during milling operations.

(3) If blind side of rivet is visible, the same requirements listed in step a. (2) will apply. Also in minimum grip installations using bulbed Cherrylock it is acceptable if the shear ring will not shear from spindle, but shop head is formed. If shear ring is split but remains firmly attached to the spindle and shop head has formed, the rivet is acceptable.

1.9.10 Removal. Rivets can be easily removed by knocking out the rivet stem with a small punch and then drilling through the rivet head. The drill diameter shall be slightly smaller than the rivet shank diameter. Drill to a depth just past the thickness of the rivet head. The head may then be removed easily with a punch and the shank driven out.

1.9.11 Micro Stop Countersink Units. Holders: Countersink, Adjustable, Micrometer Stop and Cutters, Countersink: MIL-H-4081B. A precision tool for production countersinking with skirt and locking collar designed to permit fast and accurate adjustment in increments of 0.001. A positive lock eliminates the possibility of accidental adjustment change when tool is in use and absolute depth control is maintained by a thrust ball bearing. Has 1/4 inch travel and uses cutters with 5/8 inch maximum diameter, 1/4-28 male threaded shank and 120° seating angle. See Figure 1-57.

1.9.12 Interchangeability of Cherry and Olympic Rivets.

a. The following information will govern the replacement of existing MS blind fasteners in all areas except engine intake ducts and engine compartments. However, blind fastener substitutions in engine intake ducts, engine compartments and airframe areas are permissible where the system manager has authorized substitution by part number, specified in TCTO's and manuals for the specific aerospace vehicle. When replacing rivets, the preferred rivets are Cherrylock, CherryMAX or Olympic-Lok rivets; however, MS rivets may be used, providing the structure is not subject to high vibration and that hole size permits.

NOTE

Olympic no longer manufactures NAS 1738/9 rivets.

CAUTION

MS20600/1 and NAS1398/9 series rivet shall not be used for replacements for NAS1738/9, NAS1768/9 or CherryMAX bulbed series rivets due to the oversize hole requirements and higher strength.

(1) When an MS20600 standard Cherry is installed, the replacement rivet can be either MS20600, NAS1398, or NAS1399; all require the same hole size. NAS1738/9, NAS1768/9 or CherryMAX bulbed series may be used if hole size is enlarged per paragraph 1.9.6, step c to accommodate increased shank diameter.

(2) When NAS1738/9, NAS1768/9 or CherryMAX bulbed series are installed, regardless of the type MS fasteners in surrounding structure, replacement rivet shall be NAS1738/9, NAS1768/9 or CR3242/3 series Bulbed CherryMAX. This is due to the enlarged shank of bulb series and higher strength.

(3) See Figure 1-58 for Cherrylock and Olympic-Lok rivet conversion charts.

(4) Special Handling of Rivets. The rivet stems are prelubricated at the factory and shall not be wiped off or any relubrication attempted. If the rivet stems appear to be dry, the rivets shall not be used where inspection of the blind side of the rivet, when installed, is impossible. Rivets shall not be carried in pockets, but may be carried in a container with seperate compartments and covered with a lid. Rivets maintained in shop bench stocks must be stored in the original package to retain lot identity.

1.9.13 Cherrylock Tooling. Cherrylock rivets (NAS1398/9 and NAS1738/9) are installed with hydroshift or mechanical shift tooling system. The hydroshift system is a newer design and when available should be used in place of the mechanical system.

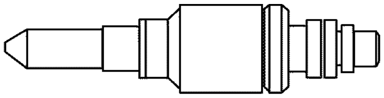
1.9.14 Cherrylock Mechanical Tooling. Most existing Cherry riveters, either hand or power operated, may be used to install Cherrylock rivets when equipped with the proper mechanical pulling head. Cherrylock mechanical pulling heads are of two types: the H615 and H640 series. They differ only in their method of attachment to the riveter. The H615 series is for the smaller screw-on type tools and the H640 is for the larger snap-on type. Both pulling heads will install standard and bulbed Cherrylock rivets.

a. H615 Series.

(1) A separate pulling head is required to install each diameter Cherrylock rivet. Separate pulling

heads are recommended for universal and countersunk head rivets but countersunk pulling heads may be used for both styles.

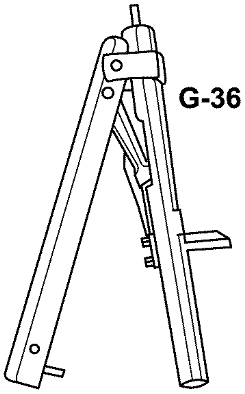
(2) To attach pulling head to riveter, engage threaded portion of pulling head sleeve cap and drawbolt to the tool head and drawbolt and screw on tight. Tighten jam nut to prevent loosening.



RIVET DIAMETER	PULLING HEAD NUMBER	NSN
1/8"	H615-4U UNIVERSAL HEAD H615-4C COUNTERSUNK HEAD H615-4S UNI-SINK HEAD	5130-00-570-5427 5130-00-570-5403
5/32"	H615-5U UNIVERSAL HEAD H615-5C COUNTERSUNK HEAD H615-5S UNI-SINK HEAD	5130-00-570-5444 5130-00-570-5433
3/16"	H615-6U UNIVERSAL HEAD H615-6C COUNTERSUNK HEAD H615-6S UNI-SINK HEAD	5130-00-570-5451 5130-00-570-5448

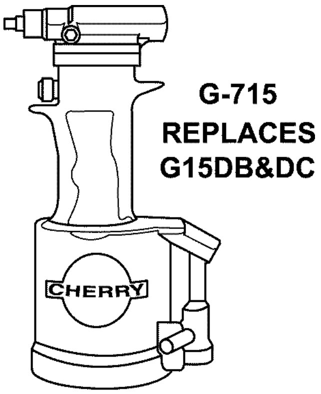
P01-110A

(3) H615 Series pulling head is used on these riveters:



NSN 5120-00-771-5644

P01-117A

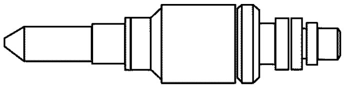


NSN 5130-00-758-8656

P01-117B

H615 Series pulling head can be used on G-40, G-55, G-86, G-88, and G740 tools by using a 226 adapter.

b. H640 Series.

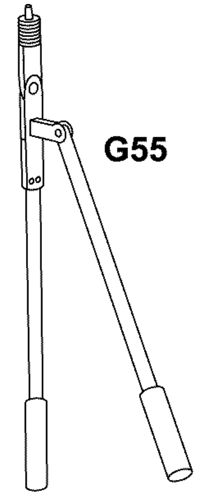


RIVET DIAMETER	PULLING HEAD NUMBER	NSN
1/8"	H640-4U UNIVERSAL HEAD H640-4C COUNTERSUNK HEAD H640-4S UNI-SINK HEAD	5130-00-910-0614 5130-00-570-5466
5/32"	H640-5U UNIVERSAL HEAD H640-5C COUNTERSUNK HEAD H640-5S UNI-SINK HEAD	5130-00-570-5479 5130-00-045-9785
3/16"	H640-6U UNIVERSAL HEAD H640-6C COUNTERSUNK HEAD H640-6S UNI-SINK HEAD	5130-00-570-5490 5130-00-056-7118
1/4"	H640-8U UNIVERSAL HEAD H640-8C COUNTERSUNK HEAD	5130-00-570-5505 5130-00-570-5498

P01-117C

(1) To attach pulling head to riveter, engage internal threads of drawbolt to external threads of head piston. Align holes in pulling head with those on tool adapter and tighten one set screw.

(2) H640 Series pulling head is used on these riveters:

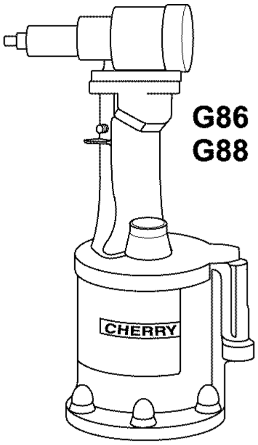


NSN 5120-00-251-1105

P01-117D

NSN 5130-00-755-9826

P01-117F



P01-117E

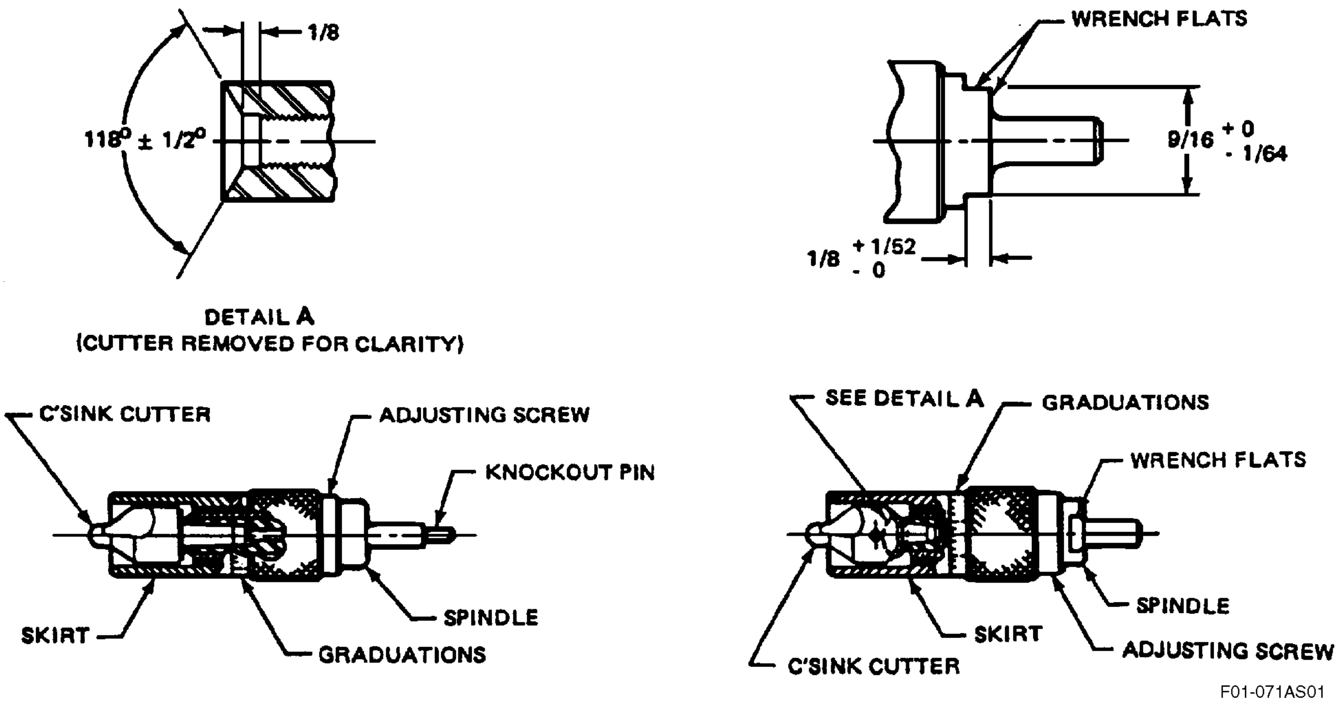


Figure 1-57. Micro Stop Countersink Units (Sheet 1 of 2)

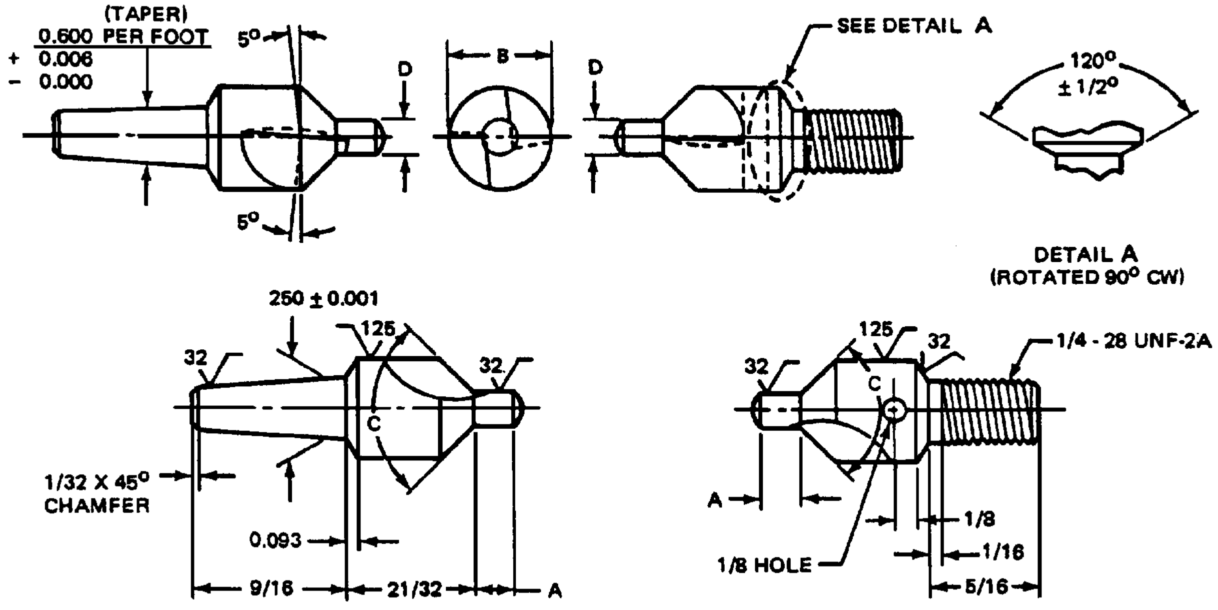


FIGURE 3
CLASS I

FIGURE 4
CLASS 2

	Size	A - Pilot Exposed Length (Inches) ± 1/64	B - Body Diam. (Inches) ± 0.005	D - Pilot Diam. (Inches) ± 0.000 - 0.001	C - Cutter angle ± 0° 30'
A	3/32	0.437	0.093		60°, 78°, 82°, 100°, 110°, 115°
B	1/8	0.437	0.125		
C	5/32	0.437	0.156		
D	3/16	0.437	0.187		
E	1/8	0.500	0.125		
F	5/16	0.500	0.250		
G	5/16	0.625	0.312		
H	3/32	0.375	0.093		
I	1/8	0.375	0.125		
J	5/32	0.375	0.156		
K	3/16	0.375	0.187		
L	1/4	0.500	0.156		
M	1/4	0.875	0.250		
N	1/4	0.875	0.312		
O	5/16	0.875	0.375		

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Figure 1-57. Micro Stop Countersink Units (Sheet 2)

RIVET — BLIND, PROTRUDING HEAD, LOCKED SPINDLE, 2017 ALUMINUM ALLOY

Nominal Diameter	National Aerospace Standard Part No.	Cherry Part No. Cherrylock Rivets	National Aerospace Standard Part No.	Olympic Part No. Olympic-Lok Rivets	Grip Range		Superseded Part No.
					Minimum	Maximum	
1/8 ①	NAS1398D4-1	CR2163-4-1	NAS1398D4A1	RV1200-4-1	0.025	0.062	MS20600AD4-1
5/32 ②	NAS1398D5-1	CR2163-5-1	NAS1398D5A1	RV1200-5-1	0.031	0.062	MS20600AD5-1
3/16 ③	NAS1398D6-1	CR2163-6-1	NAS1398D6A1	RV1200-6-1	0.031	0.062	MS20600AD6-1
1/4 ④	NAS1398D8-2	CR2163-8-2	NAS1398D8A2	RV1200-8-2	0.063	0.125	MS20600AD8-2

RIVET — BLIND, PROTRUDING HEAD, LOCKED SPINDLE, 5056 ALUMINUM ALLOY

Nominal Diameter	Cherry Part No. Nominal CherryMAX Rivet	National Aerospace Standard Part No.	Cherry Part No. Cherrylock Rivets	National Aerospace Standard Part No.	Olympic Part No. Olympic-Lok Rivets	Grip Range		Superseded Part No.
						Minimum	Maximum	
1/8 ①	CR3213-4-1	NAS1398B4-1	CR2263-4-1	NAS1398B4A1	RV1250-4-1	0.025	0.062	MS20600B4-1
5/32 ②	CR3213-5-1	NAS1398B5-1	CR2263-5-1	NAS1398B5A1	RV1250-5-1	0.031	0.062	MS20600B5-1
3/16 ③	CR3213-6-1	NAS1398B6-1	CR2263-6-1	NAS1398B6A1	RV1250-6-1	0.037	0.062	MS20600B6-1
1/4 ④		NAS1398B8-2	CR2263-8-2	NAS1398B8A2	RV1250-8-2	0.063	0.125	MS20600B8-2

RIVET — BLIND, PROTRUDING HEAD, LOCKED SPINDLE, MONEL, CADMIUM PLATE

Nominal Diameter	Cherry Part No. Nominal CherryMAX Rivet	National Aerospace Standard Part No.	Cherry Part No. Cherrylock Rivets	National Aerospace Standard Part No.	Olympic Part No. Olympic-Lok Rivets	Grip Range	
						Minimum	Maximum
1/8 ①	CR3523P4-1	NAS1398MW4-1	CR2563-4-1	NAS1398MW4A1	RV1290-4-1	0.025	0.062
5/32 ②	CR3523P5-1	NAS1398MW5-1	CR2563-5-1	NAS1398MW5A1	RV1290-5-1	0.031	0.062
3/16 ③	CR3523P6-1	NAS1398MW6-1	CR2563-6-1	NAS1398MW6A1	RV1290-6-1	0.037	0.062
1/4 ④		NAS1398MW8-2	CR2563-8-2	NAS1398MW8A2	RV1290-8-2	0.063	0.125

F01-056S01

Figure 1-58. Cherrylock and Olympic-Lok Rivet Conversion Chart (Sheet 1 of 6)

RIVET — BLIND, PROTRUDING HEAD, LOCKED SPINDLE, A-286 CORROSION RESISTANT STEEL

Nominal Diameter	National Aerospace Standard Part No.	Cherry Part No. Cherrylock Rivets	National Aerospace Standard Part No.	Olympic Part No. Olympic-Lok Rivets	Grip Range	
					Minimum	Maximum
1/8 [1]	NAS1398C4-1	CR2663-4-1	NAS1398C4A1	RV1240-4-1	0.025	0.062
5/32 [2]	NAS1398C5-1	CR2663-5-1	NAS1398C5A1	RV1240-5-1	0.031	0.062
3/16 [3]	NAS1398C6-1	CR2663-6-1	NAS1398C6A1	RV1240-6-1	0.037	0.062
1/4 [4]	NAS1398C8-2	CR2663-8-2	NAS1398C8A2	RV1240-8-2	0.063	0.125

Nominal Diameter	Cherry Part No. Nominal CherryMAX Rivet	National Aerospace Standard Part No.	Cherry Part No. Cherrylock Rivets	National Aerospace Standard Part No.	Olympic Part No. Olympic-Lok Rivets	Grip Range		Superseded Part No.
						Minimum	Maximum	
1/8 [1]	CR3523-4-1	NAS1398M4-1	CR2563M4-1	NAS1398M4A1	RV1290M4-1	0.025	0.062	MS20600M4-1
5/32 [2]	CR3523-5-1	NAS1398M5-1	CR2563M5-1	NAS1395M5A1	RV1290M5-1	0.031	0.062	MS20600M5-1
3/16 [3]	CR3523-6-1	NAS1398M6-1	CR2563M6-1	NAS1398M6A1	RV1250M6-1	0.037	0.062	MS20600M6-1
1/4 [4]		NAS1398M8-2	CR2563M8-2	NAS1398M8A2	RV1290M8-2	0.063	0.125	MS20600M8-2

RIVET — BLIND, 100° FLUSH HEAD, LOCKED SPINDLE, 2017 ALUMINUM ALLOY

Nominal Diameter	National Aerospace Standard Part No.	Cherry Part No. Cherrylock Rivets	National Aerospace Standard Part No.	Olympic Part No. Olympic-Lok Rivets	Grip Range		Superseded Part No.
					Minimum	Maximum	
1/8 [1]	NAS1399D4-2	CR2162-4-2	NAS1399D4A2	RV1201-4-2	0.063	0.125	MS20601AD4-2
5/32 [2]	NAS1399D5-2	CR2162-5-2	NAS1399D5A2	RV1201-5-2	0.065	0.125	MS20601AD5-2
3/16 [3]	NAS1399D6-2	CR2162-6-2	NAS1399D6A2	RV1201-6-2	0.080	0.125	MS20601AD6-2
1/4 [4]	NAS1399D8-3	CR2162-8-3	NAS1399D8A3	RV1201-8-3	0.126	0.187	MS20601AD8-3

F01-056S02

Figure 1-58. Cherrylock and Olympic-Lok Rivet Conversion Chart (Sheet 2)

Nominal Diameter	Cherry Part No. Nominal CherryMAX Rivet	National Aerospace Standard Part No.	Cherry Part No. Cherrylock Rivets	National Aerospace Standard Part No.	Olympic Part No. Olympic-Lok Rivets	Grip Range		Superseded Part No.
						Minimum	Maximum	
1/8 [1]	CR3212-4-2	NAS1399B4-2	CR2262-4-2	NAS1399B4A2	RV1251-4-2	0.063	0.125	MS20601B4-2
5/32 [2]	CR3212-5-2	NAS1399B5-2	CR2262-5-2	NAS1399B5A2	RV1251-5-2	0.065	0.125	MS20601B5-2
3/16 [3]	CR3212-6-2	NAS1399B6-2	CR2262-6-2	NAS1399B6A2	RV1251-6-2	0.080	0.125	MS20601B6-2
1/4 [4]		NAS1399B8-3	CR2262-8-3	NAS1399B8A3	RV1251-8-3	0.126	0.187	MS20601B8-3

RIVET — BLIND 100° FLUSH HEAD, LOCKED SPINDLE A-286 CORROSION RESISTANT STEEL

Nominal Diameter	National Aerospace Standard Part No.	Cherry Part No. Cherrylock Rivets	National Aerospace Standard Part No.	Olympic Part No. Olympic-Lok Rivets	Grip Range	
					Minimum	Maximum
1/8 [1]	NAS1399C4-2	CR2662-4-2	NAS1399C4A2	RV1241-4-2	0.063	0.125
5/32 [2]	NAS1399C5-2	CR2662-5-2	NAS1399C5A2	RV1241-5-2	0.065	0.125
3/16 [3]	NAS1399C6-2	CR2662-6-2	NAS1399C6A2	RV1241-6-2	0.090	0.125
1/4 [4]	NAS1399C8-3	CR2662-8-3	NAS1399C8A3	RV1241-8-3	0.126	0.187

RIVET — BLIND, 100° FLUSH HEAD, LOCKED SPINDLE, MONEL, CADMIUM PLATE

Nominal Diameter	Cherry Part No. Nominal CherryMAX Rivet	National Aerospace Standard Part No.	Cherry Part No. Cherrylock Rivets	National Aerospace Standard Part No.	Olympic Part No. Olympic-Lok Rivets	Grip Range	
						Minimum	Maximum
1/8 [1]	CR3522P4-2	NAS1399MW4-2	CR2562-4-2	NAS1399MW4A2	RV1291-4-2	0.063	0.125
5/32 [2]	CR3522P5-2	NAS1399MW5-2	CR2562-5-2	NAS1399MW5A2	RV1291-5-2	0.065	0.125
3/16 [3]	CR3522P6-2	NAS1399MW6-2	CR2562-6-2	NAS1399MW6A2	RV1291-6-2	0.080	0.125
1/4 [4]		NAS1399MW8-3	CR2562-8-3	NAS1399MW8A3	RV1291-8-3	0.126	0.187

F01-056S03

Figure 1-58. Cherrylock and Olympic-Lok Rivet Conversion Chart (Sheet 3)

RIVET — BLIND, 100° FLUSH HEAD, LOCKED SPINDLE, MONEL, UNPLATED

Nominal Diameter	Cherry Part No. Nominal CherryMAX Rivet	National Aerospace Standard Part Number	Cherry Part Number Bulbed Cherrylock Rivet	National Aerospace Standard Part Number	Olympic Part No. Olympic Bulb-Lok Rivet	Grip Range		Superseded Part Number
						Minimum	Maximum	
1/8 [1]	CR3522-4-2	NAS1399M4-2	CR2562M-4-2	NAS1399M4A2	RV1291M4-2	0.063	0.125	MS20601M4-2
5/32 [2]	CR3522-5-2	NAS1399M5-2	CR2562M-5-2	NAS1399M5A2	RV1291M5-2	0.065	0.125	MS20601M5-2
3/16 [3]	CR3522-6-2	NAS1399M6-2	CR2562M-6-2	NAS1399M6A2	RV1291M6-2	0.080	0.125	MS20601M6-2
1/4 [4]		NAS1399M8-3	CR2562M-8-3	NAS1399M8A3	RV1291M8-3	0.124	0.187	MS20601M8-3

RIVET — BLIND, UNIVERSAL HEAD, LOCKED SPINDLE, 5056 ALUMINUM ALLOY

Nominal Diameter	Cherry Part No. Bulbed CherryMAX Rivet	National Aerospace Standard Part No.	Cherry Part No. Bulbed Cherrylock Rivet	National Aerospace Standard Part No.	Olympic Part No. Olympic Bulb-Lok Rivet	Grip Range		Superseded Part No. McDonnell Douglas Std. Part No.
						Minimum	Maximum	
1/8 [5]	CR3243-4-1	NAS1738B4-1	CR2249-4-1	NAS1768D4-1	RV1100-4-1	0.020	0.062	3M266B4-1
5/32 [6]	CR3243-5-1	NAS1738B5-1	CR2249-5-1	NAS1768D5-1	RV1100-5-1	0.025	0.062	3M266B5-1
3/16 [7]	CR3243-6-1	NAS1738B6-1	CR2249-6-1	NAS1768D6-1	RV1100-6-1	0.030	0.062	3M266B6-1

RIVET — BLIND, UNIVERSAL HEAD, LOCKED SPINDLE, MONEL, CADMIUM PLATED

Nominal Diameter	Cherry Part No. Bulbed CherryMAX Rivet	National Aerospace Standard Part No.	Cherry Part No. Bulbed Cherrylock Rivet	National Aerospace Standard Part No.	Olympic Part No. Olympic Bulb-Lok Rivet	Grip Range		Superseded Part No. McDonnell Douglas Std. Part No.
						Minimum	Maximum	
1/8 [5]	CR3553P4-1	NAS1738MW4-1	CR2539P4-1	NAS1768MW4-1	RV1190-4-1	0.020	0.062	3M266M4P1
5/32 [6]	CR3553P5-1	NAS1738MW5-1	CR2539P5-1	NAS1768MW5-1	RV1190-5-1	0.025	0.062	3M266M5P1
3/16 [7]	CR3553P6-1	NAS1738MW6-1	CR2539P6-1	NAS1768MW6-1	RV1190-6-1	0.030	0.062	3M266M6P1

F01-056S04

Figure 1-58. Cherrylock and Olympic-Lok Rivet Conversion Chart (Sheet 4)

Nominal Diameter	Cherry Part No. Bulbed CherryMAX Rivet	National Aerospace Standard Part No.	Cherry Part No. Bulbed Cherrylock Rivet	National Aerospace Standard Part No.	Olympic Part No. Olympic Bulb-Lok Rivet	Grip Range		Superseded Part No. McDonnell Douglas Std. Part No.
						Minimum	Maximum	
1/8 [5]	CR3553-4-1	NAS1738M4-1	CR2539-4-1	NAS1768M4-1	RV1190M4-1	0.020	0.062	3M266M4-1
5/32 [6]	CR3553-5-1	NAS1738M5-1	CR2539-5-1	NAS1768M5-1	RV1190M5-1	0.025	0.062	3M266M5-1
3/16 [7]	CR3553-6-1	NAS1738M6-1	CR2539-6-1	NAS1768M6-1	RV1190M6-1	0.030	0.062	3M266M6-1

RIVET — BLIND, 100° FLUSH HEAD, LOCKED SPINDLE, 5056 ALUMINUM ALLOY

Nominal Diameter	Cherry Part No. Bulbed CherryMAX Rivet	National Aerospace Standard Part No.	Cherry Part No. Bulbed Cherrylock Rivet	National Aerospace Standard Part No.	Olympic Part No. Olympic Bulb-Lok Rivet	Grip Range		Superseded Part No. McDonnell Douglas Std. Part No.
						Minimum	Maximum	
1/8 [5]	(*)	NAS1739B4-1	CR2248-4-1	NAS1769D4-1	RV1101-4-1	0.020	0.062	3M267B4-1
5/32 [6]	(*) CR3242-5-2	NAS1739B5-1 NAS1739B5-2	CR2248-5-1 CR2248-5-2	NAS1769D5-1 NAS1769D5-2	RV1101-5-1 RV1101-5-2	0.025 0.063	0.062 0.125	3M267B5-1 3M266B5-2
3/16 [7]	(*) CR3242-6-2	NAS1739B6-1 NAS1739B6-2	CR2248-6-1 CR2248-6-2	NAS1769D6-1 NAS1769D6-2	RV1101-6-1 RV1101-6-2	0.030 0.063	0.062 0.125	3M267B6-1 3M267B6-2

RIVET — BLIND, 100° FLUSH HEAD, LOCKED SPINDLE, MONEL

Nominal Diameter	Cherry Part No. Bulbed CherryMAX Rivet	National Aerospace Standard Part No.	Cherry Part No. Bulbed Cherrylock Rivet	National Aerospace Standard Part No.	Olympic Part No. Olympic Bulb-Lok Rivet	Grip Range		Superseded Part No. McDonnell Douglas Std. Part No.
						Minimum	Maximum	
1/8 [5]	(*) CR3552-4-2	NAS1739M4-1 NAS1739M4-2	CR2538-4-1 CR2538-4-2	NAS1769M4-1 NAS1769M4-2	RV1191M4-1 RV1191M4-2	0.045 0.063	0.062 0.125	3M267M4-1 3M267M4-2
5/32 [6]	CR3552-5-2	NAS1739M5-2	CR2538-5-2	NAS1769M5-2	RV1191M5-2	0.063	0.125	3M267M5-2
3/16 [7]	CR3552-6-2	NAS1739M6-2	CR2538-6-2	NAS1769M6-2	RV1191M6-2	0.073	0.125	3M267M6-2

F01-056S05

Figure 1-58. Cherrylock and Olympic-Lok Rivet Conversion Chart (Sheet 5)

RIVET — BLIND, 100° FLUSH HEAD, LOCKED SPINDLE, MONEL, CADMIUM PLATED

Nominal Diameter	Cherry Part No. Bulbed CherryMAX Rivet	National Aerospace Standard Part No.	Cherry Part No. Bulbed Cherrylock Rivet	National Aerospace Standard Part No.	Olympic Part No. Olympic Bulb-Lok Rivet	Grip Range		Superseded Part No. McDonnell Douglas Std. Part No.
						Minimum	Maximum	
1/8 [5]	(*) CR3552P4-2	NAS1739MW4-1 NAS1739MW4-2	CR2538P4-1 CR2538P4-2	NAS1769MW4-1 NAS1769MW4-2	RV1191-4-1 RV1191-4-2	0.046 0.063	0.062 0.125	3M267M4P1 3M267M4P2
5/32 [6]	CR3552P5-2	NAS1739MW5-2	CR2539P5-2	NAS1769MW5-2	RV1191-5-2	0.063	0.125	3M267M5P2
3/16 [7]	CR3552-6-2	NAS1739MW6-2	CR2539P6-2	NAS1769MW6-2	RV1191-6-2	0.073	0.125	3M267M6P2

NOTES

[1] Use Drill Size Number 30 Hole Size 0.129 to 0.132

[2] Use Drill Size Number 20 Hole Size 0.160 to 0.164

[3] Use Drill Size Number 10 Hole Size 0.192 to 0.196

[4] Use Drill Size Number F Hole Size 0.256 to 0.261

[5] Use Drill Size Number 27 Hole Size 0.143 to 0.146

[6] Use Drill Size Number 16 Hole Size 0.176 to 0.180

[7] Use Driil Size Number 5 Hole Size 0.205 to 0.209

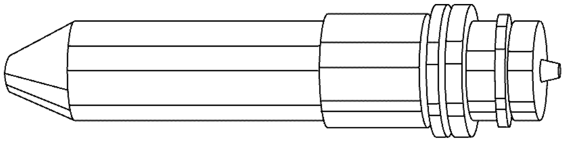
F01-056S06

Figure 1-58. Cherrylock and Olympic-Lok Rivet Conversion Chart (Sheet 6)

1.9.15 Cherrylock Hydroshift Tooling.

a. The hydroshift tooling system is an advanced design in which the sequence of operations necessary to install the rivet is accomplished hydraulically within the hydroshift tool rather than by means of a mechanical pulling head. Cherrylock hydroshift pulling heads are of one type only: the H681.

b. A separate H681 pulling head is required to install each diameter Cherrylock rivet. Countersunk pulling heads are recommended to install both universal and countersunk head styles.

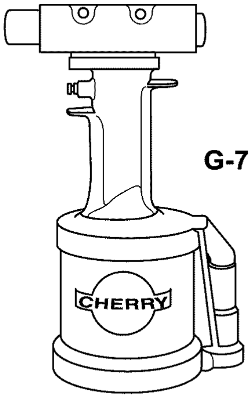


H681
SERIES

RIVET DIAMETER	PULLING HEAD NUMBER	DIMENSIONS		NSN
		A	B	
3/32"	H681-3U UNIVERSAL HEAD	.188	.348	
	H681-3C Countersunk Head (MS20426)	.163	.332	
1/8"	H681-4U Universal Head	.250	.359	5130-00-083-6626
	H681-4C Countersunk Head (MS20426)	.208	.341	5130-00-083-6625
	H681-4F Countersunk Head (156*)	.430	.358	
	H681-4S Countersunk Head (NAS 1097)	.174	.341	
	H681-B166-4 Uni-Sink Head	.250	.359	
5/32"	H681-5U Universal Head	.313	.377	5130-00-083-6628
	H681-5C Countersunk Head (MS20426)	.269	.352	5130-00-083-6627
	H681-5F Countersunk Head (156*)	.535	.338	
	H681-5S Countersunk Head (NAS 1097)	.225	.352	
	H681-B166-5 Uni-Sink Head	.313	.377	
3/16"	H681-6U Universal Head	.375	.418	5130-00-083-6633
	H681-6C Countersunk Head (MS20426)	.335	.386	5130-00-083-6631
	H681-6F Countersunk Head (156*)	.625	.367	
	H681-6S Countersunk Head (NAS 1097)	.281	.386	
	H681-B166-6 Uni-Sink Head	.375	.419	
1/4"	H681-8U Universal Head	.500	.452	5130-00-083-6635
	H681-8C Countersunk Head (MS20426)	.458	.398	5130-00-083-6634
	H681-8F Countersunk Head (NAS 1097)	.374	.398	

P01-117G

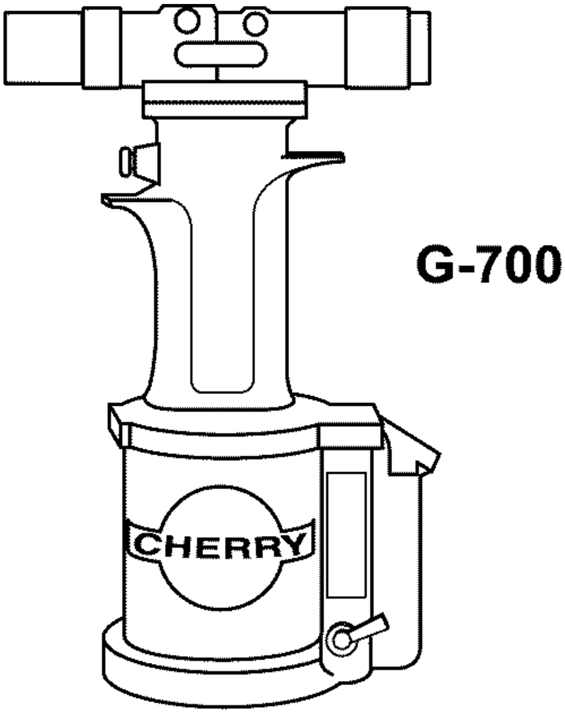
c. The H681 pulling head is used on these riveters:



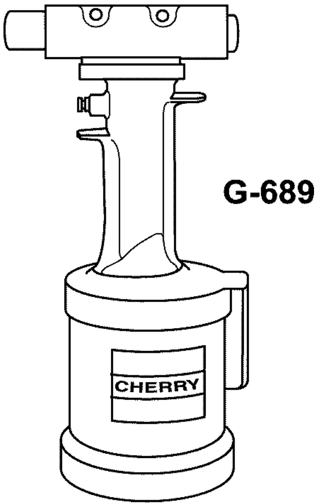
G-784

NSN 5130-00-935-4681

P01-118A



P01-118B



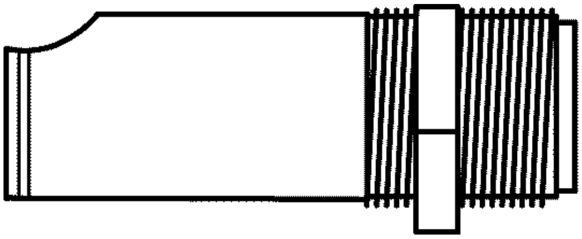
P01-118C

1.9.16 Cherrymax Tooling. CherryMAX hand and pneumatic-hydraulic tools have been specifically designed for installing CherryMAX fasteners. These tools incorporate features that provide a simple, quick system with superior limited access capabilities.

1.9.17 Existing Tooling Systems. Most existing tooling systems, either hand or power operated, may be used to install CherryMAX rivets providing tools have sufficient power and stroke.

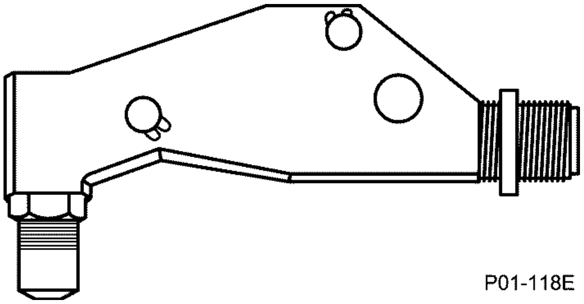
1.9.18 Cherrymax Tools.

a. H701A456 Pulling Head. This single pulling head will install -4, -5, and -6 diameter rivets of any material, head style and grip without adjustments or changing of pulling heads for each diameter. To attach the H701A456 pulling head to the riveter, engage collet assembly and spring to the threaded portion of the riveter drawbolt, then engage the outer sleeve assembly (with jam nut) threads to the female threads on the riveter housing and screw on tight. Tighten jam nut to prevent loosening.



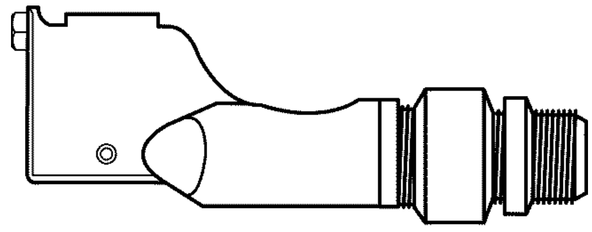
P01-118D

b. H753-456 Right Angle Pulling Head. This single pulling head will install -4, -5, and -6 diameter rivets of any material, head style and grip without adjustments or changing of pulling heads for each diameter. To attach the H753-456 pulling heads to riveter, engage the threaded portion of the pulling head with the drawbolt and head assembly and screw on tight. Tighten jam nut to prevent loosening.



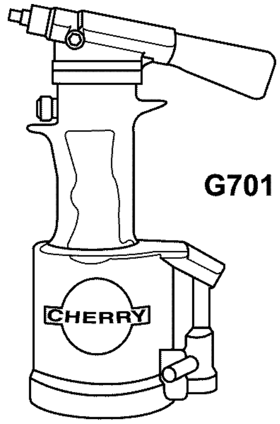
P01-118E

c. H763-456 Offset Pulling Head. This single pulling head will install -4, -5, and -6 diameter rivets of any material, head style and grip without adjustments or changing of pulling heads for each diameter. To attach the H763-456 pulling heads to riveter, engage the threaded portion of the pulling head with the drawbolt and head assembly and screw on tight. Tighten jam nut to prevent loosening.



P01-118F

d. The H701A456, H753-456 or the H763-456 are used on these rivets:



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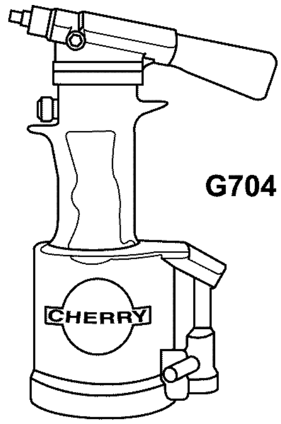

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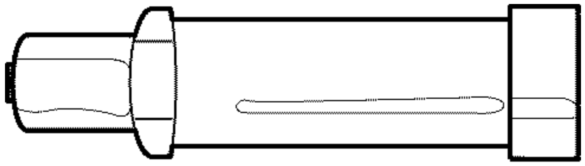
P01-118H

e. H680B200 Pulling Head. This single pulling head will install -4, -5, and -6 diameter rivets of any material, head style and grip without adjustments or changing of pulling heads for each diameter. The H680B200 pulling head can be attached to all Cherry hydroshift riveters (G700, G684, and G784, etc.) for installation of CherryMAX rivets. Attachment procedures are as follows:

(1) Remove knurled cap from front of riveter head.

(2) Take collet adapter assembly and screw onto head piston threads. Turn assembly until adapter bottoms on shoulder of piston. Hand tightening is sufficient.

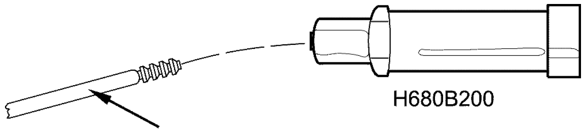


NSN 5130-01-044-7198

P01-119A

(3) Screw on sleeve to sleeve adapter and tighten sleeve with jam nut.

(4) After installing the rivet, the fractured stem will eject from the front of pulling head, the same as the hydroshift H681 pulling heads.



P01-119B

1.10 HI-LOK AND HI-LOK/TIGUE FASTENERS.

The patented, high strength Hi-Lok or Hi-Lok/Hi-Tigue is basically a threaded fastener which combines the best features of a rivet and bolt. Three primary design advantages include:

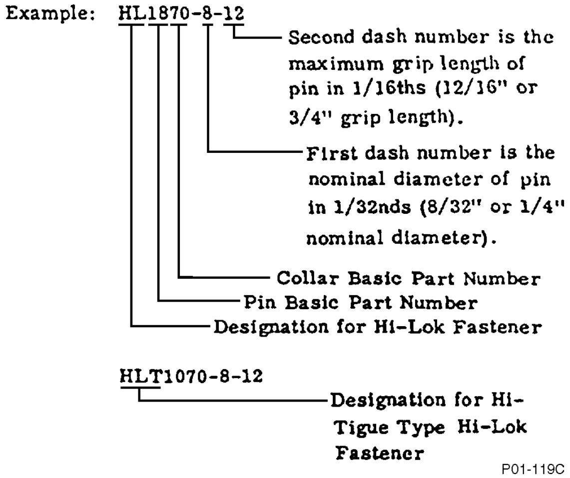
a. A controlled preload of clamp-up consistent with ±10% designed into the fastener.

b. Minimum size and weight.

c. Simple, quiet and rapid installation, done from one side of the work by one worker.

1.10.1 Selecting the Fastener Assembly.

The basic part number indicates the assembly of the pin and the collar part numbers.

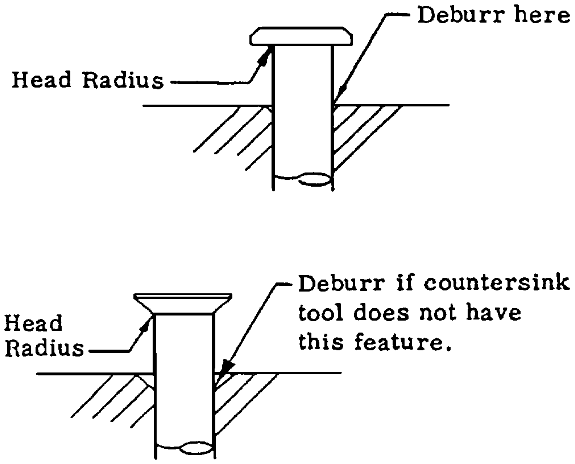


P01-119C

1.10.2 Hole Preparation.

a. The straight wall drilled holes shall be prepared in accordance with NAS618. For standard Hi-Lok pins, it is generally recommended that the maximum interference fit shall not exceed 0.002 inch. The Hi-Tigue type Hi-Lok pin is normally installed in a hole at 0.002 to 0.004 inch diametral interference.

b. The Hi-Lok pin has a slight radius under its head. After drilling, deburr the edge of the hole. This permits the head to fully seat in the hole. See appropriate Hi-Lok Standards Pages for head radius dimension. For instance, the 3/16 protruding head has a 0.015/.025 radius while the 3/16 flush head has a 0.025/.030 radius.



P01-119D

1.10.3 Tooling.

a. Hi-Loks are rapidly and quietly installed by one person working from one side of the work using standard power or hand tools and Hi-Lok adaptor tools. (See Figure 1-60.)

b. Hi-Lok adaptors tools are fitted to high speed, pistol grip and ratchet wrench drivers in straight, 90°, offset, extension and automatic collar-feed configurations. Refer to Hi-Shear Corporation's. Hi-Lok/Hi-Tigue Tool Catalog 2-1573 for a complete description of a wide variety of Hi-Lok drivers and accessories.

1.10.4 Fastener Installation.

Installation of Hi-Lok pin is accomplished by using the following procedures (see Figure 1-61).

a. The threaded end of the Hi-Lok pin contains a hexagonal shaped recess. The hex wrench tip of the Hi-Lok driving tool engages the recess to prevent rotation of the pin while the collar is being installed. The pin recess also offers a secondary benefit, weight savings.

b. The pin is designed in two basic head styles. For shear applications, the pin is made in the lightweight, ''Hi-Shear'' countersunk style and in a compact protruding head style. For tension applications, the MS24694 (AN509) flush and protruding head styles are available.

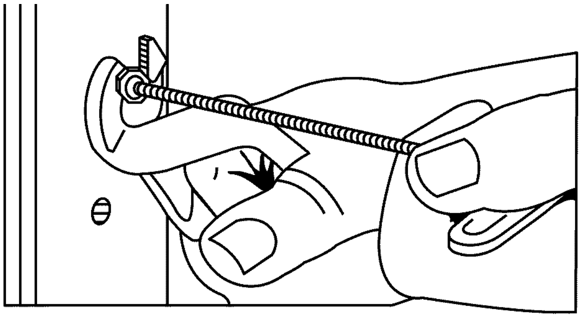
c. The self-locking, threaded Hi-Lok collar has an internal counterbore at the base to accommodate variations in material thickness. At the opposite end of the collar is a wrenching device which is torqued by the driving tool until its shears off during installation; this shear-off point occurs when a predetermined preload or clamp-up is attained in the fastener during installation. Removal of the collar wrenching surfaces after installation saves additional weight.

d. The Hi-Lok/Hi-Tigue type interference fit pin provides improved fatigue benefits to the air-frame structure. The Hi-Tigue feature on the end of the pin shank makes it possible to use a straight shank interference fit fastener in a standard straight drilled hole to obtain the maximum fatigue life of the structure.

1.10.5 Inspection After Installation. Hi-Lok fasteners are visually inspected. No inspection tools or torque wrenches are required. (See Gap Acceptance Criteria, Figure 1-59.)

1.10.6 Removal of Installed Fastener.

a. In non-interference fit holes, Hi-Loks can be removed with common hand tools in a manner similar to removing a nut from a bolt. Use an Allen hex wrench to prevent the pin from rotating while the collar is being unscrewed with pliers. If not damaged during collar removal, the Hi-Lok pin can be reused.



P01-120BA

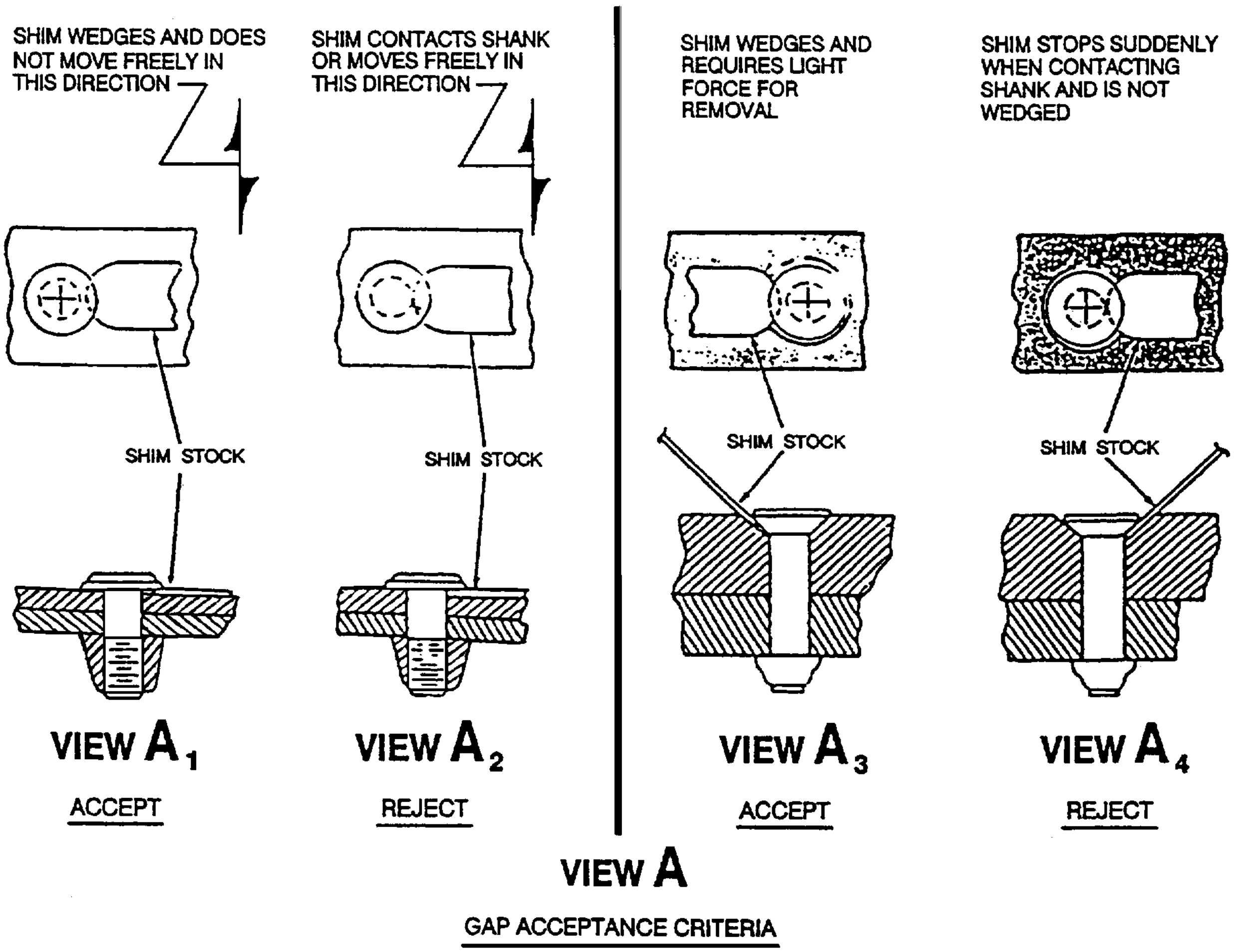
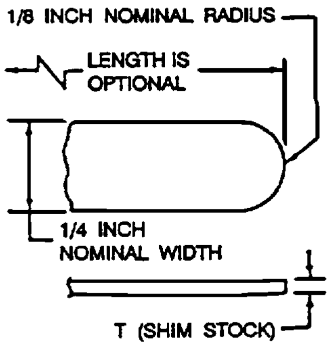


TABLE 4 - PIN PROTRUSION LIMITS	
FASTENER NOMINAL DIAMETER	P= PIN PROTRUSION (INCH)
5/32	0.302 TO 0.384
3/16	0.315 TO 0.397
1/4	0.385 TO 0.467
5/16	0.490 TO 0.572
3/8	0.535 TO 0.617

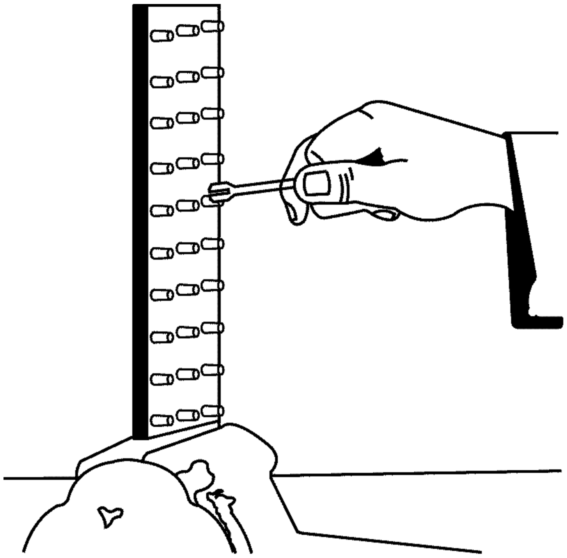
TABLE 5 - GAP LIMIT FOR ALL PROTRUDING HEAD PINS AND ALL COLLARS	
FASTENER NOMINAL DIAMETER	MAXIMUM GAP LIMITS
5/32	0.004
3/16	0.004
1/4	0.005
5/16	0.006
3/8	0.006

TABLE 6 - SHIM DIMENSIONS		
FASTENER NOMINAL DIAMETER	T +0.0005 - 0.0000	
5/32	0.004	
3/16	0.004	
1/4	0.005	
5/16	0.006	
3/8	0.006	

F01-056A

Figure 1-59. Gap Acceptance Criteria

b. To more easily remove Hi-Lok collars from pins installed in interference fit holes and in limited access areas, the HLH128 series of hand tools are available in individual sizes or in sets as in the HLK10 Hi-Lok/Hi-Tigue Collar Removal Tool Kit. The Hi-Lok pin can be reused.



HLH128 Collar Removal Tool

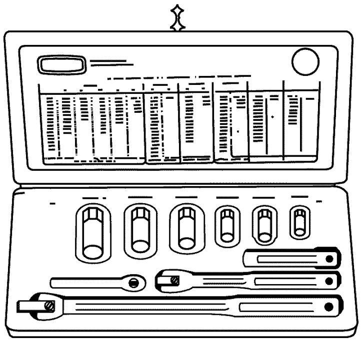
P01-120BB

c. In interference fit holes, ALUMINUM Hi-Lok/Hi-Tigue collars can be removed with an HLC1 Hi-Lok Collar Removal Tool fitted to a 3/8 square socket drive and companion air motor. The tool is pressed firmly over the Hi-Lok Collar and rotated until the tool teeth bite sufficiently into the collar material to grip and unscrew the collar from the pin.

NOTE

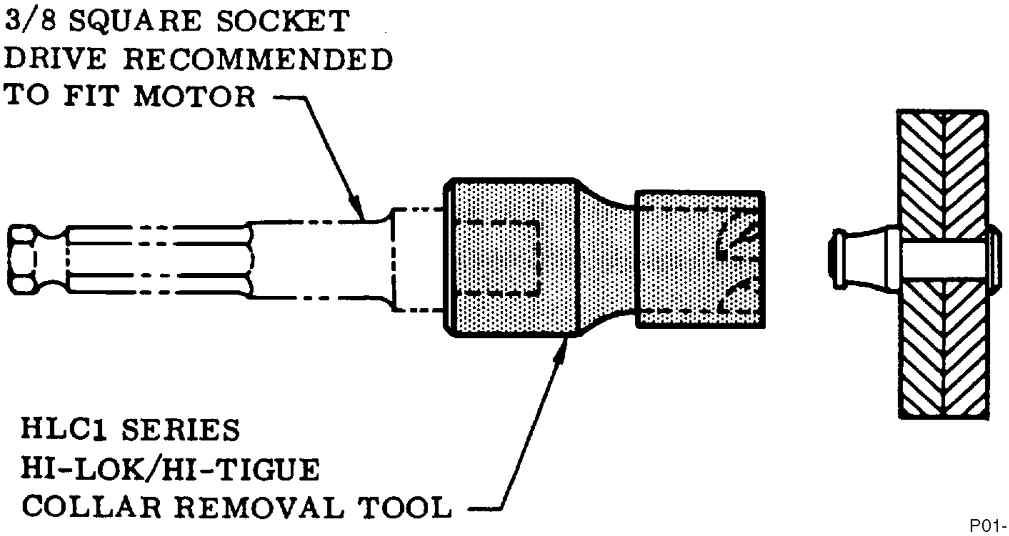
Initial loosening of the -8 and larger Hi-Lok collars with HLH128 Removal Tool is recommended.

d. COLLAR REMOVAL DRIVERS. Designed for production use to remove Hi-Lok collars from pins, pistol grip power drivers with cutter-type nose-pieces are available. The Hi-Lok pin can be reused.

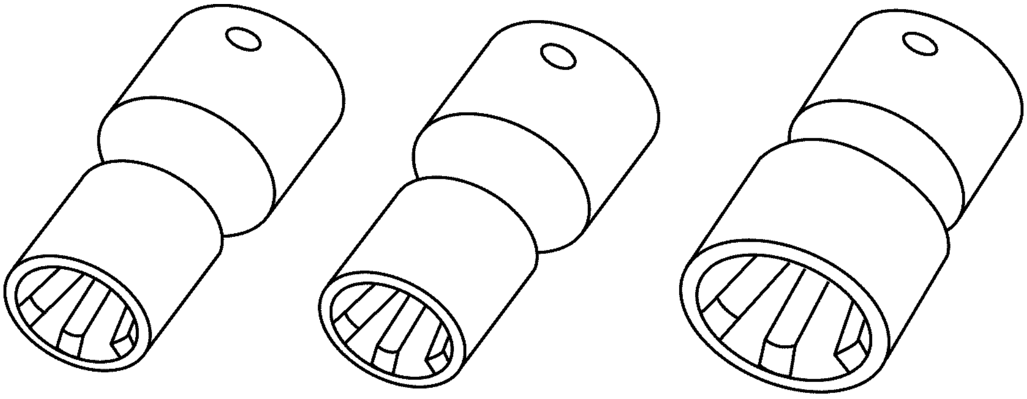


HLK10 Kit

P01-120BC



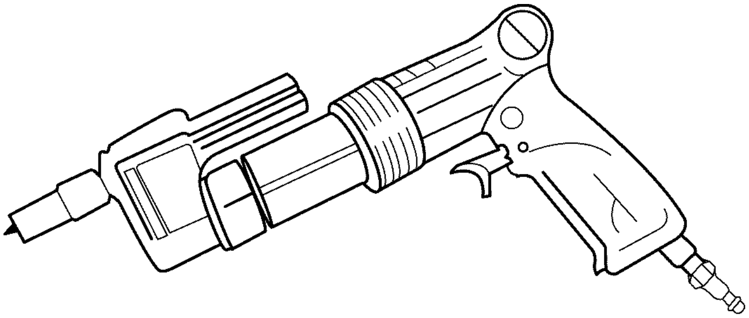
P01-124



HLC1 HI-LOK/HI-TIGUE COLLAR REMOVAL TOOLS
From left, -5, -6, and -8 sizes shown. Tools are available for -10 and -12 collar sizes. For dimensional data, refer to HLC1 tool in HI-LOK/HI-TIGUE Tool Catalog.

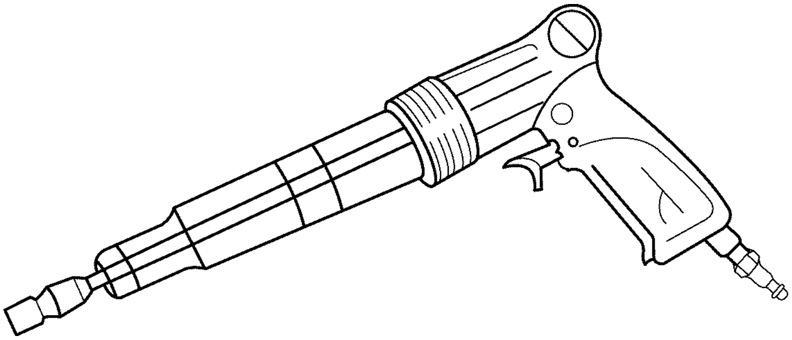
The Hi-Lok/Hi-Tigue pin can be reused.

P01-125A



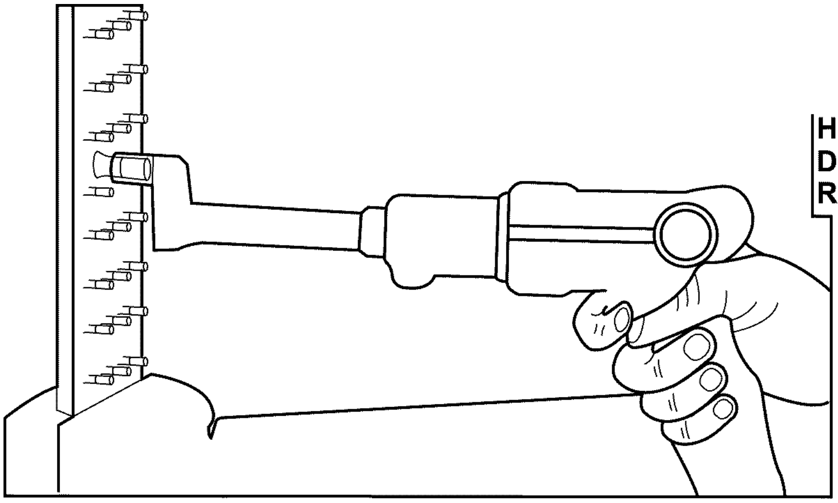
HLA6000 Hi-Lok/Hi-Tigue Straight Air Driver Collar Removal Assembly.
Removes aluminum Hi-Lok/Hi-Tigue collars from pins installed in non-interference fit holes. Remove 5/32, 3/16 and 1/4 diameter Hi-Lok collars. Check Tool Catalog 2-1573 for the Hi-Lok pin hex recess sizes accommodated by the Driver's hex wrench.

P01-125B



HLA6005 Hi-Lok/Hi-Tigue Straight Air Driver Collar Removal Assembly.
Removes aluminum Hi-Lok/Hi-Tigue collars from pins installed in interference fit holes. Removes 5/32, 3/16 and 1/4 diameter Hi-Lok collars. On steel collars, initial loosening of the collar with the HLH128 Hand Tool is required.

P01-125C



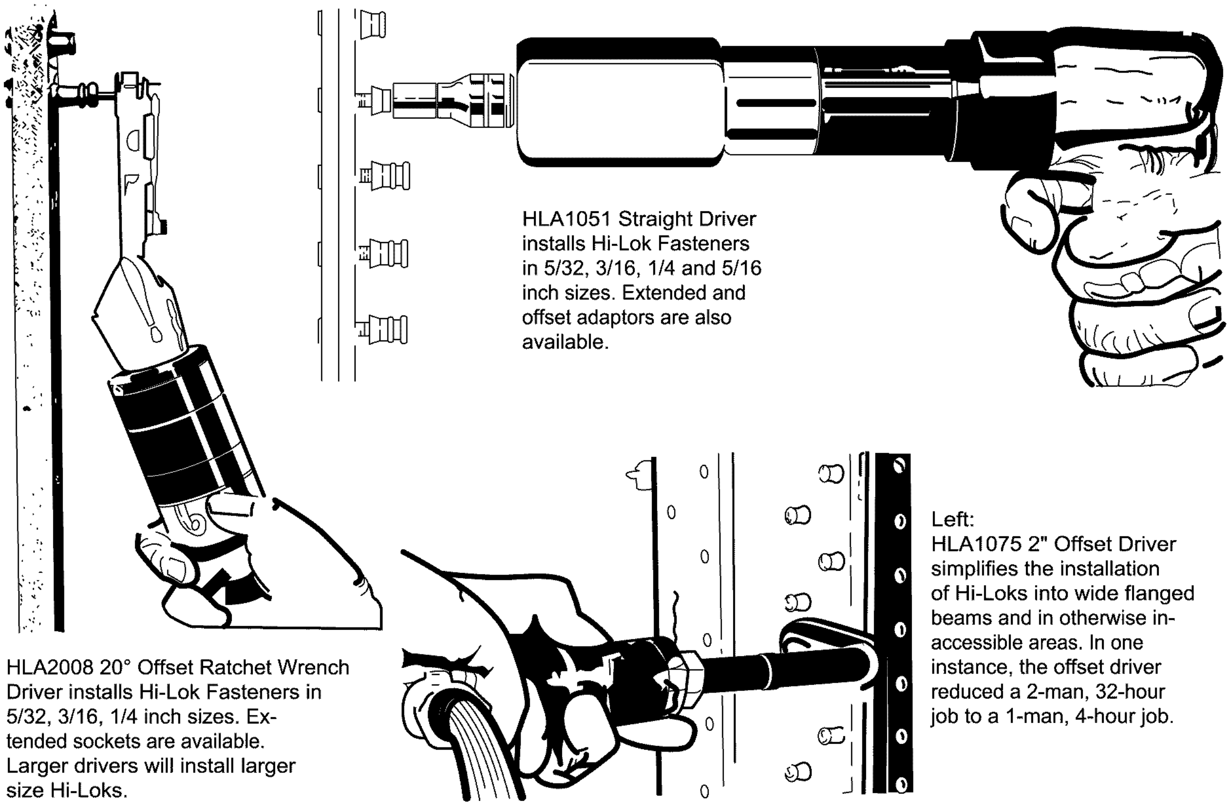
HLA6007 Hi-Lok/Hi-Tigue Offset Air Driver with an HLC13-6 or -8 Removal Tool.

Removes Hi-Lok/Hi-Tigue collars from pins installed in interference fit holes. Offset design permits access under flanges or in restricted areas. Removes 3/16 and 1/4 diameter Hi-Lok collars. Initial loosening of the collars with the HLH128 Hand Tool is recommended to break the high residual preload.

P01-126

STANDARD POWER DRIVERS

With light weight, compact tooling, HI-LOKS are easily installed and require the minimum of employee training. HI-LOK adaptor tools can be fitted to high speed power air drivers. The installation is fast and quiet without conventional riveting noise.



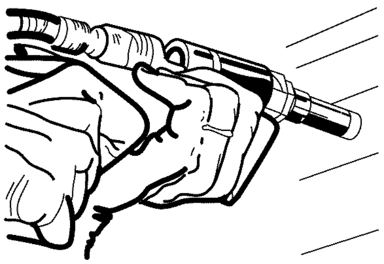
HLA1051 Straight Driver installs Hi-Lok Fasteners in 5/32, 3/16, 1/4 and 5/16 inch sizes. Extended and offset adaptors are also available.

HLA2008 20° Offset Ratchet Wrench Driver installs Hi-Lok Fasteners in 5/32, 3/16, 1/4 inch sizes. Extended sockets are available. Larger drivers will install larger size Hi-Loks.

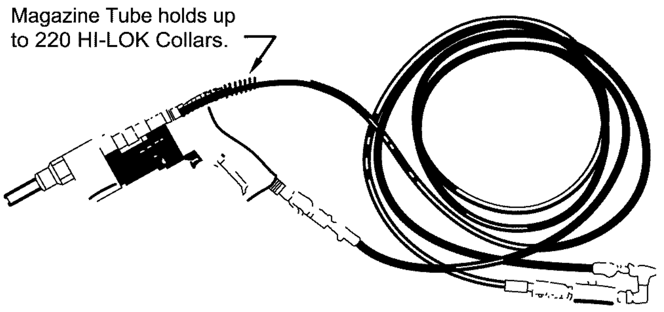
Left:
HLA1075 2" Offset Driver simplifies the installation of Hi-Loks into wide flanged beams and in otherwise inaccessible areas. In one instance, the offset driver reduced a 2-man, 32-hour job to a 1-man, 4-hour job.

AUTOMATIC COLLAR-FEEDING DRIVERS

The HI-LOK Automatic Feed Driver assembles HI-LOK collars (3/16 and 1/4 dia.) onto HI-LOK pins without reloading and at an assembly rate of up to 45 per minute.



Above:
Automatic Driver assembles HI-LOK Collar on Pins. Interference fit holes can be prepared and HI-LOK Pins inserted by Drivmatic Riveter method.

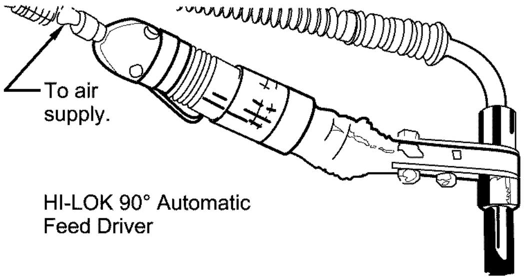


Magazine Tube holds up to 220 HI-LOK Collars.

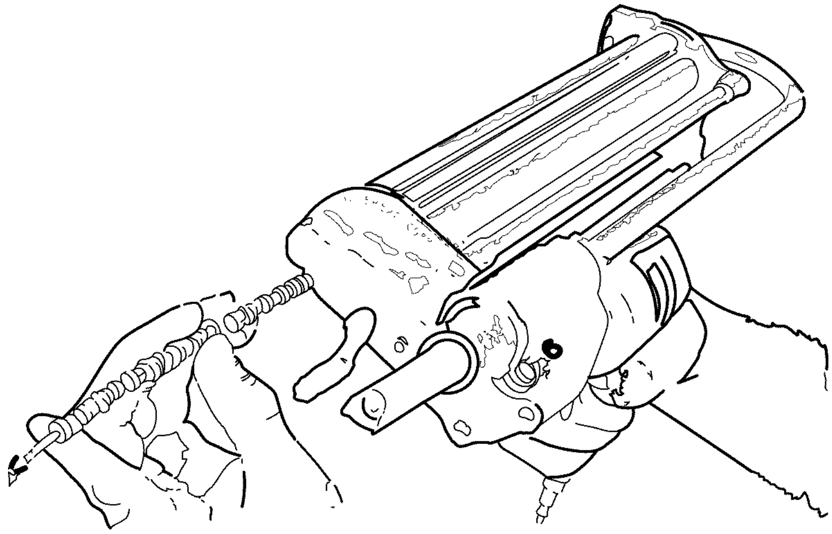
HLA1008 Straight Collar Automatic-Feed Driver

F01-057S1

Figure 1-60. HI-LOK/HI-TIGUE Tools (Sheet 1 of 2)



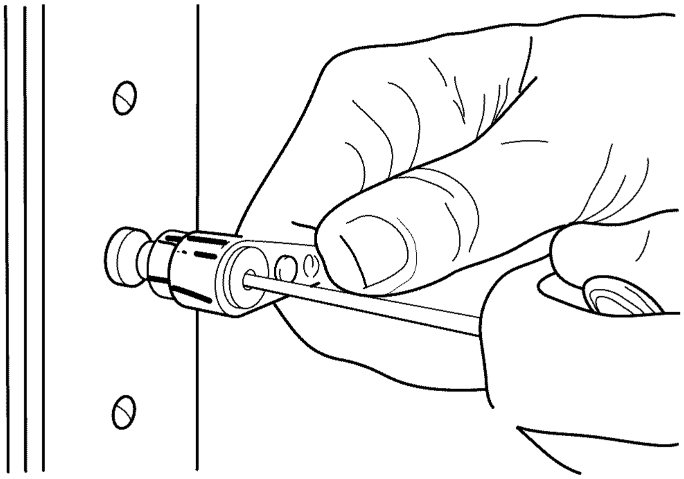
Left:
HLA2015 Automatic-Feed Ratchet Wrench Driver for interference fit Hi-Lok installation. Collars (3/16 or 1/4 dia.) are magazine tube feed through Driver.
Larger Drivers for larger Hi-Loks are available.



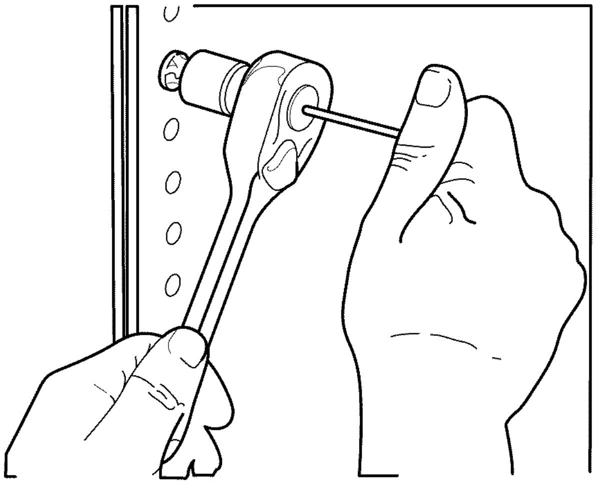
Left:
HLA1032 Automatic-Feed "Collar-Matic" Driver for interference fit Hi-Lok installation. Collars (5/32, 3/16, 1/4 and 5/16 dia.) are loaded and contained within "Gatling gun" designed tubes. Hose type magazine tube is not required.
Other "Collar-Matic" Drivers are available for non-interference fit Hi-Lok installations.

HAND TOOLS

The Hi-Lok fastener may be installed with hand tools, Allen hex keys and open-end or ratchet type wrenches. See photos below. Refer to Hi-Lok/ Hi-Tigue Tool Catalog 2-1573 for complete description of hand tools available.



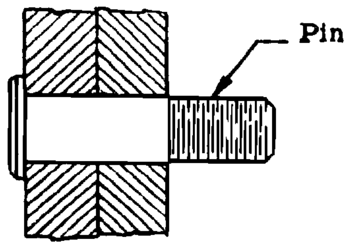
HLH311-HLH314
HAND TOOL ASSEMBLY



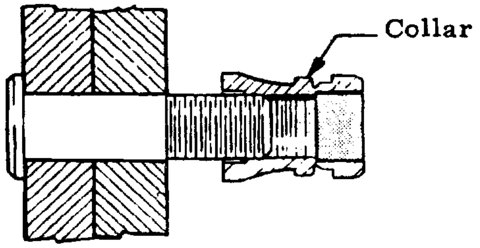
HLH110-HLH-111
HAND TOOL ASSEMBLY

F01-057S2

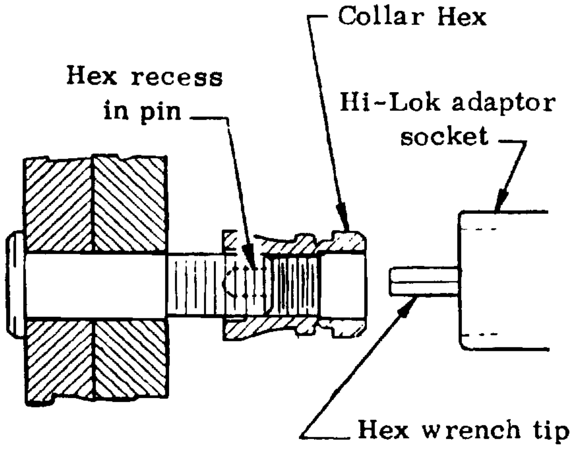
Figure 1-60. HI-LOK/HI-TIGUE Tools (Sheet 2)



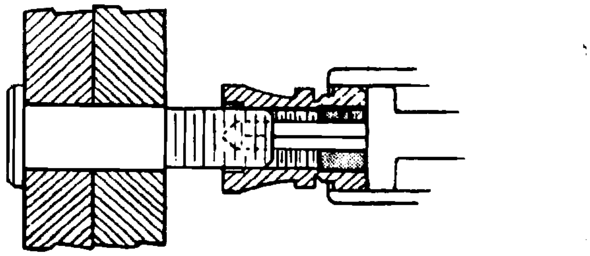
a. Insert the pin into the prepared non-interference fit hole.



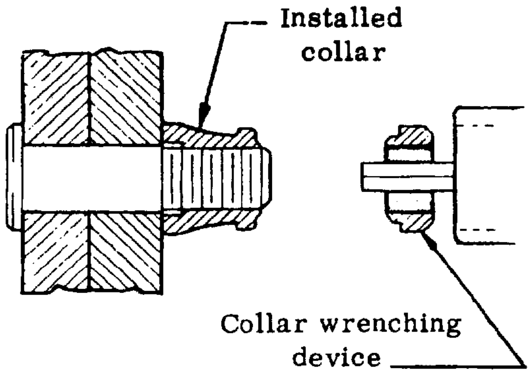
b. Manually thread the collar onto the pin.



c. Insert the hex wrench tip of the power driver into the pin's hex recess, and the socket over the collar hex. This prevents rotation of the pin while the collar is being installed.

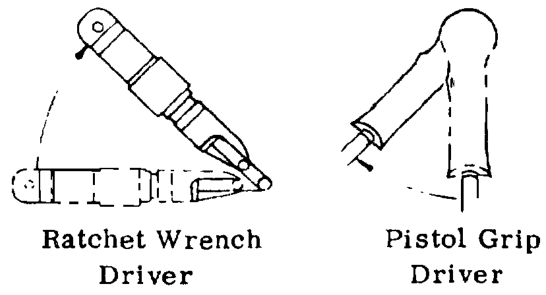


d. Firmly press the power driver against the collar, operate the power driver until the collar's wrenching device has been torqued off.



e. This completes the installation of the Hi-Lok Fastener Assembly.

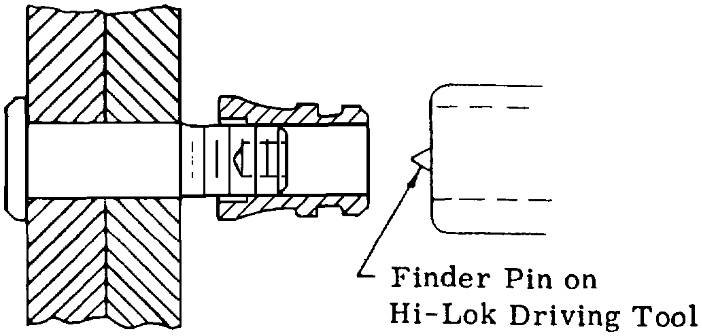
NOTE:



To ease the removal of the driving tool's hex wrench tip from the hex recess of the pin after the collar's wrenching device has sheared off, simply rotate the entire driver tool in a slight clockwise motion.

F01-058S01

Figure 1-61. Installation Steps (HI - LOK Pin in Non-interference Fit Hole) (Sheet 1 of 2)



When Hi-Lok pins are pressed or driven into interference fit holes, the fit is sufficiently tight to grip the pin to prevent it from rotating during assembly with the collar. This means that the driving tool hex wrench tip engagement is not required to keep the pin from rotating. Hi-Lok driver tools are available using a finder pin instead of the hex wrench tip to locate the tool on the collar and pin. Except for this difference, the fastener installation is the same as described in paragraph 1 above.

Refer to Hi-Lok Tool Catalog 2-1573 for further details.

F01-058S02

Figure 1-61. Installation Steps (HI - LOK Pin in Non-interference Fit Hole) (Sheet 2)

1.11 ASP® FASTENING SYSTEM.

1.11.1 Recommendations for Hole Preparation.

a. Holes for ASP® fasteners are “straight”. No potting, bushings, inserts or stepped holes are required.

b. There are three basic diameters. (Oversize diameters may be available.)

Table 1-72. Recommendations for Hole Preparation

Nom Dia	Hole Dia +.005”-.000”	Recommended Drill Size	Fillet Radius (Ref)	C’sink Dia Tension Head	C’sink Dia Shear Head
-06	.203”	13/64”	.020”	.386/.380	.302/.296
-08	.266”	Letter “H”	.025”	.507/.500	.399/.393
-10	.328”	21/64”	.030”	.634/.626	.479/.472

Notes to Table:

- Countersinks are 100°.
- The product is available in tension head (AN509; pin and sleeve), shear head (NAS1097; pin only) and protruding head (pin and sleeve) configuration.
- Countersink diameter limits shown in the table are theoretical and intended for reference. When countersinking thin face sheets on sandwich panels, care must be taken to c’sink no deeper than necessary.
- Fillet radius figures apply to protruding head and flush head fasteners.

1.11.2 Suggestions for Hole Preparation and Installation Practice.

1.11.2.1 Clamping of the structure with temporary devices is very helpful in avoiding sheet separation, burrs/chips between the sheets and hole misalignment.

1.11.2.2 Drill speeds are critical to achieve hole quality and productivity, while minimizing operator fatigue.

1.11.2.2.1 Aluminum structure 4,000 to 6,000 RPM are recommended.

1.11.2.2.2 For stainless or titanium 300 to 1,000 RPM are recommended.

1.11.2.2.3 For Composite structure, carbide drills and c'sink cutters are recommended.

1.11.2.2.4 Lubrication of drills is very helpful in reducing drill wear, burrs and effort. Each shop has its own favorite drill lubes.

1.11.2.2.5 Excessive "push" on the drill motor (dull drill) should be avoided as it can crate sheet separation, and burrs and chips between the sheets.

1.11.2.2.6 Hole normally is important. Angularity beyond 2° should be avoided.

1.11.2.2.7 Countersink concentricity is critical, particularly with thin honeycomb face sheets. Generally, countersinks are normal to the structural surface. Flushness or head seating problems are caused by hole angularity beyond the 2° limit. Undersize countersink pilots are the most common cause of eccentricity problems and resulting cosmetics issues.

1.11.2.2.8 These parts are commonly used in honeycomb panels with thin face sheets. Accuracy in countersink depth is critical in avoiding head pull through.

1.11.3 Basic Part Numbers. Basic Part Numbers are listed in Table 1-73.

Table 1-73. Basic Part Numbers

Description	Pin Configuration (specified)	Pin P/N	Sleeve Configuration (mating sleeve)	Sleeve P/N	Lock Collar P/N
Double Flush Full Shank	100° Tension	AspFF	100° Tension	AspF-S	Asp-LC
Double Flush Full Shank	100° Shear	Asp100F	100° Tension	AspF-S	Asp-LC
Double Flush Reduced Shank	100° Tension	2Asp509F	100° Tension	AspF-S	Asp-LC
Double Flush Reduced Shank	100° Shear	2AspFF	100° Tension	AspF-S	Asp-LC
Flush-Protr Full Shank	100° Tension	AspFP	Protr Head	2AspP-S	Asp-LC
Flush-Protr Full Shank	100° Shear	Asp100P	Protr Head	2AspP-S	Asp-LC
Flush-Protr Reduced Shank	100° Tension	2Asp509P	Protr Head	2AspP-S	Asp-LC
Flush-Protr Reduced Shank	100° Shear	2AspFP	Protr Head	2AspP-S	Asp-LC
Protr-Flush Reduced Shank	Protr Head	2AspPF	100° Tension	AspF-S	Asp-LC
Protr-Protr Full Shank	Protr Head	AspPP	Protr Head	2AspP-S	Asp-LC
Protr-Protr Reduced Shank	Protr Head	2AspPP	Protr Head	2AspP-S	Asp-LC
P/N Example for Pin: 2AspFF - DT08 - 06 P/N Example for Sleeve: AspF - S - DT08 P/N Example for Collar: Asp - LC - 2AC08					

1.11.4 Anatomy of ASP® Component.

1.11.4.1 Double Flush AspFF-EU06-16.

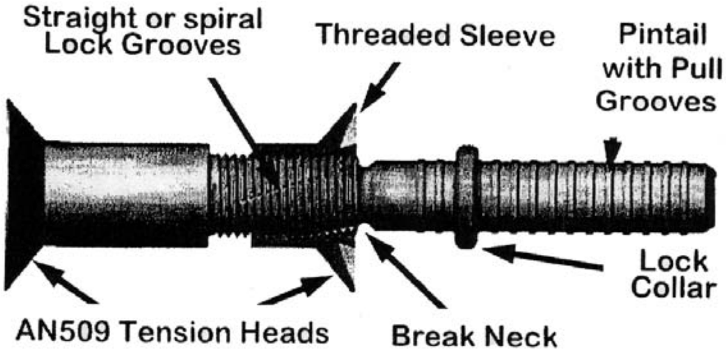
1.11.4.2 Identification Head Markings. Asp® pins carry the following identification head markings:

1.11.4.2.1 The Huck symbol ≍ serves as manufacturer's identification.

1.11.4.2.2 A letter "F" or "P" to identify the head style of the mating sleeve and a grip dash number (Full shank tension and protruding head only).

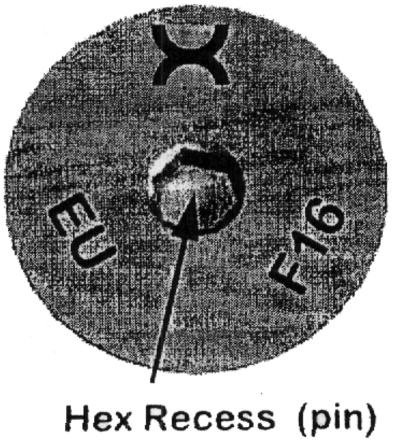
1.11.4.2.3 Pins and sleeves are identified with the letters "V" to indicate Titanium 6AL-4V or "EU" for A-286 Cres material. No material letter indicates alloy steel.

1.11.4.2.4 The Huck symbol ≍ is used for manufacturer's identification on the sleeves also.



H0702562

Figure 1-62. Double Flush AspFF-EU06-16



H0702563

Figure 1-63. Hex Recess (Pin)

H0702564

Figure 1-64. Driving Recesses (Sleeve)

1.11.5 Part Number Logic (Full Shank Pins).

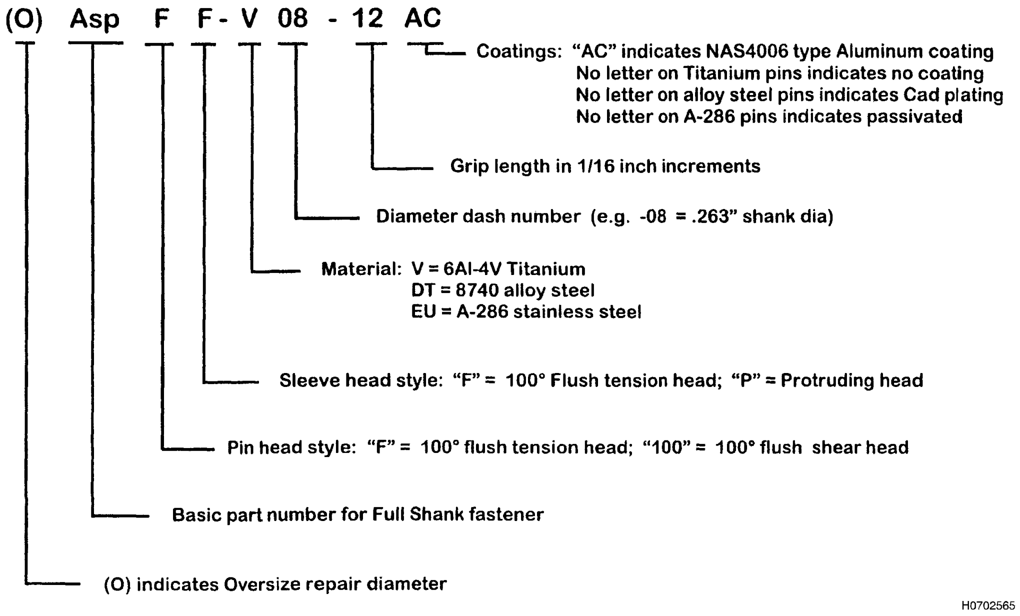


Figure 1-65. Part Number Logic (Full Shank Pins)

1.11.6 Part Number Logic (Reduced Shank Pins).

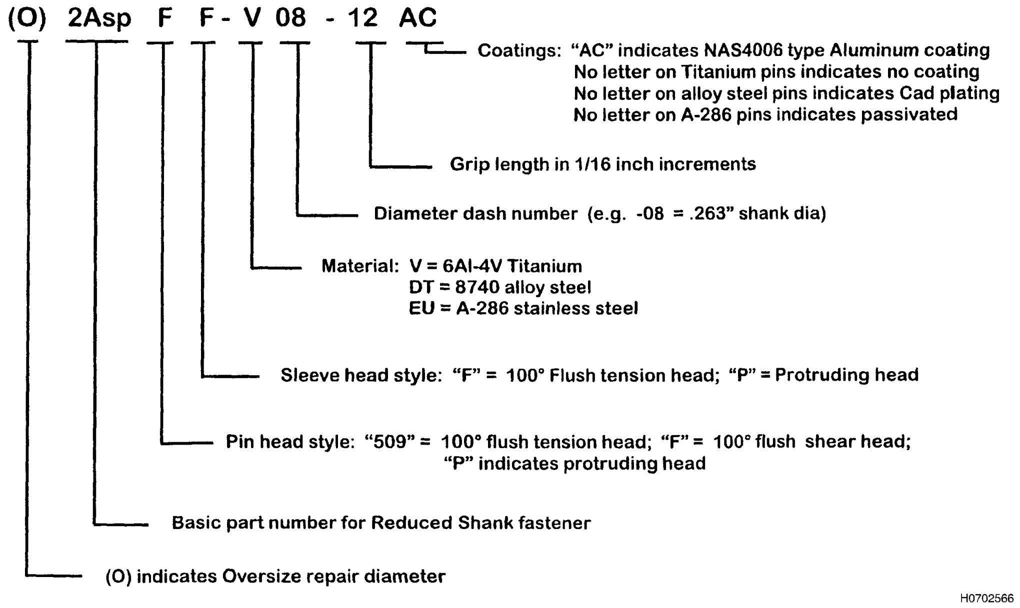


Figure 1-66. Part Number Logic (Reduced Shank Pins)

1.11.7 Part Number Logic (Sleeves).

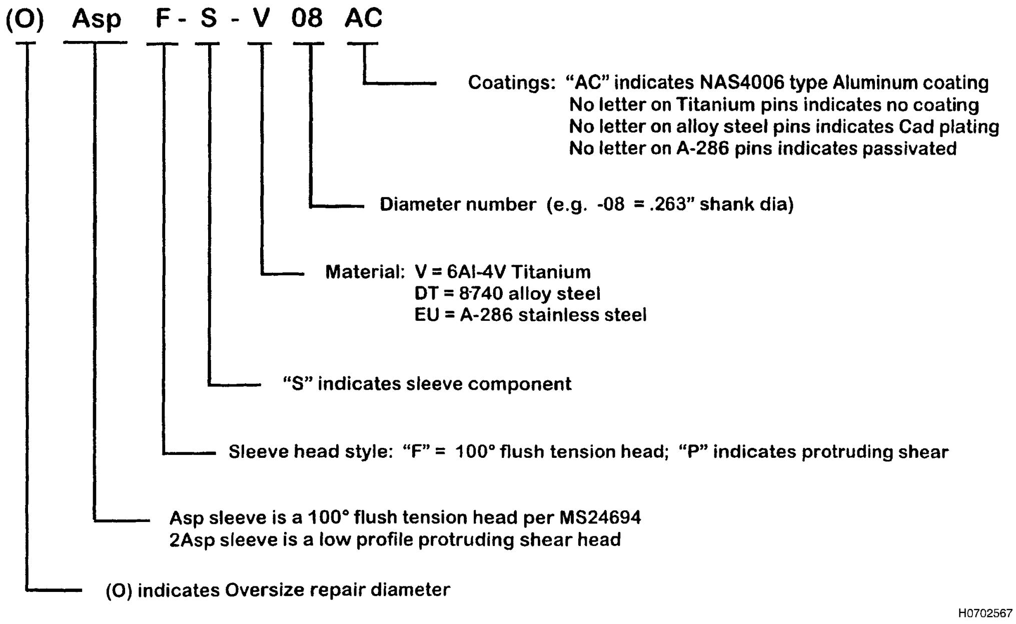


Figure 1-67. Part Number Logic (Sleeves)

1.11.8 Part Number Logic (Lock Collar).

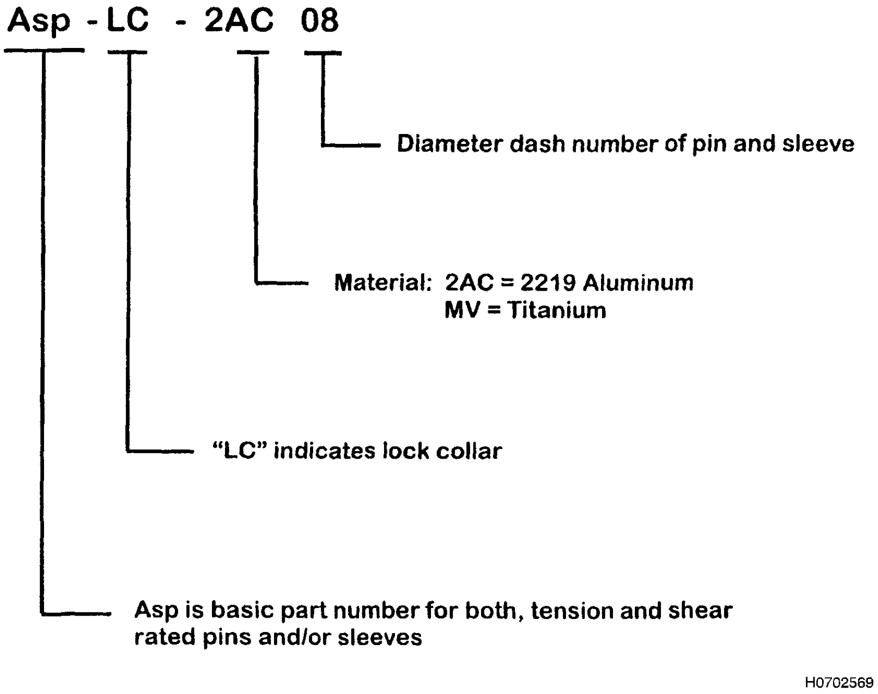
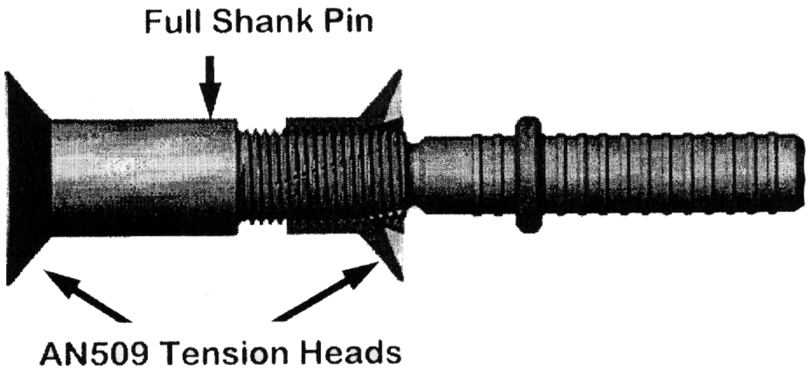


Figure 1-68. Part Number Logic (Lock Collar)

1.11.9 Configuration Options.

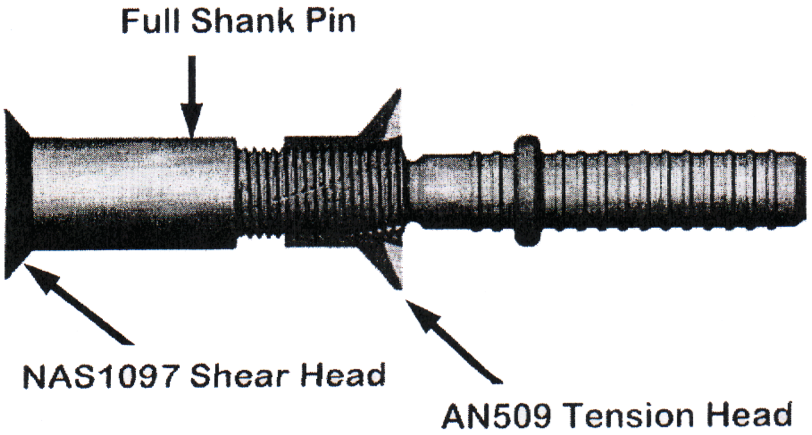
1.11.9.1 The figure shown below is Double Flush AN509 Tension Heads; Full Shank; P/N family AspFF.



H0702570

Figure 1-69. Double Flush AN509 Tension Heads; Full Shank; P/N Family AspFF

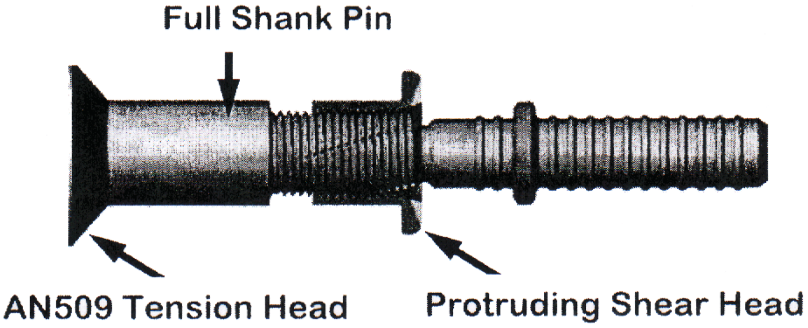
1.11.9.2 The figure shown below is the configuration option for a Double Flush NAS1097/AN509 Heads; Full Shank; P/N family Asp100F.



H0702571

Figure 1-70. Double Flush NAS1097/AN509 Heads; Full Shank; P/N Family Asp100F

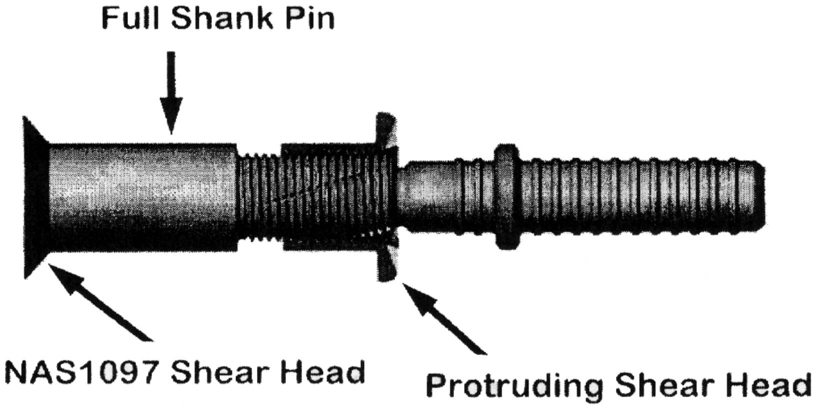
1.11.9.3 The figure shown below is the configuration option for a Flush AN509 Tension Head and Protruding Head; Full Shank; P/N family AspFP.



H0702572

Figure 1-71. Flush AN509 Tension Head and Protruding Head; Full Shank; P/N Family AspFP

1.11.9.4 The figure shown below is the configuration option for a Flush NAS1097 Shear Head and Protruding Head; Full Shank; P/N family ASP100P.



H0702573

Figure 1-72. Flush NAS1097 Shear Head and Protruding Head; Full Shank; P/N Family Asp100P

1.11.9.5 The figure shown below is the configuration option for Flush AN509 Tension Heads; Reduced Shank; P/N family 2Asp509F.

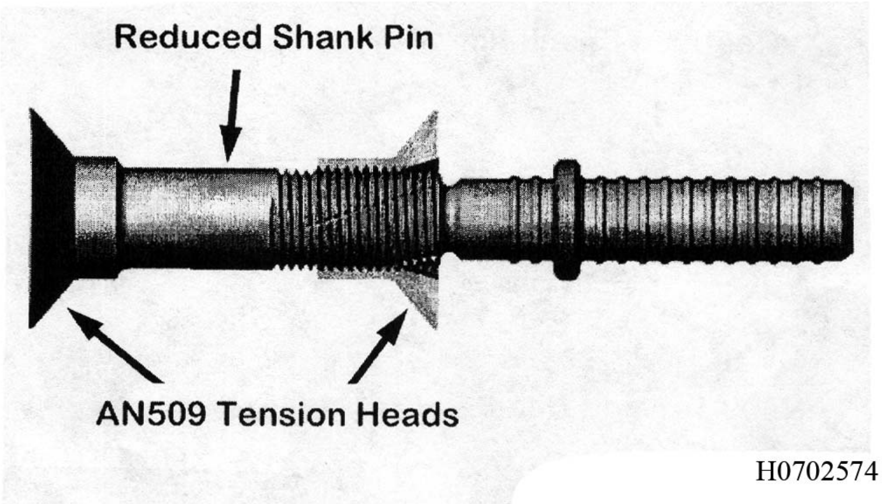


Figure 1-73. Flush AN509 Tension Heads; Reduced Shank; P/N Family 2Asp509F

1.11.9.6 The figure shown below is the configuration option for a Flush NAS1097 Shear Head and 509 Tension Head; Reduced Shank; P/N family 2AspFF.

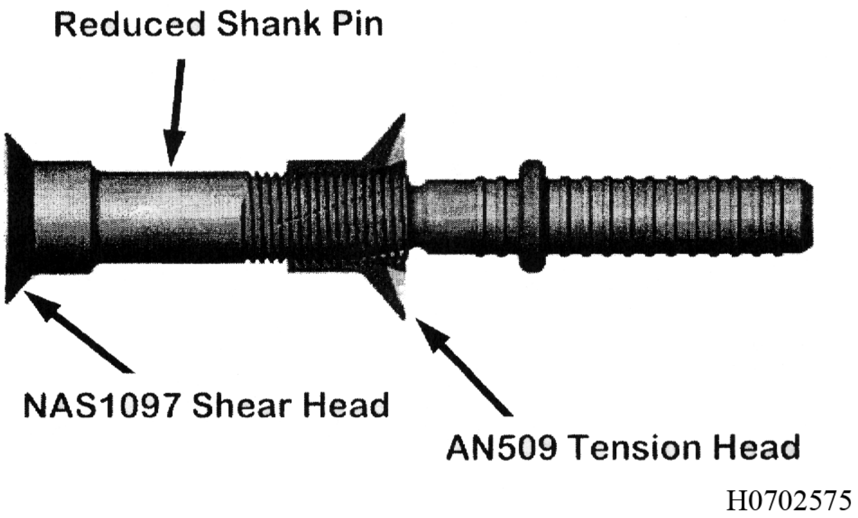


Figure 1-74. Flush NAS1097 Shear Head and 509 Tension Head; Reduced Shank; P/N Family 2AspFF

1.11.9.7 The figure shown below is the configuration option for a Flush AN509 Tension Head and Protruding Head; Reduced Shank; P/N family 2Asp509P.

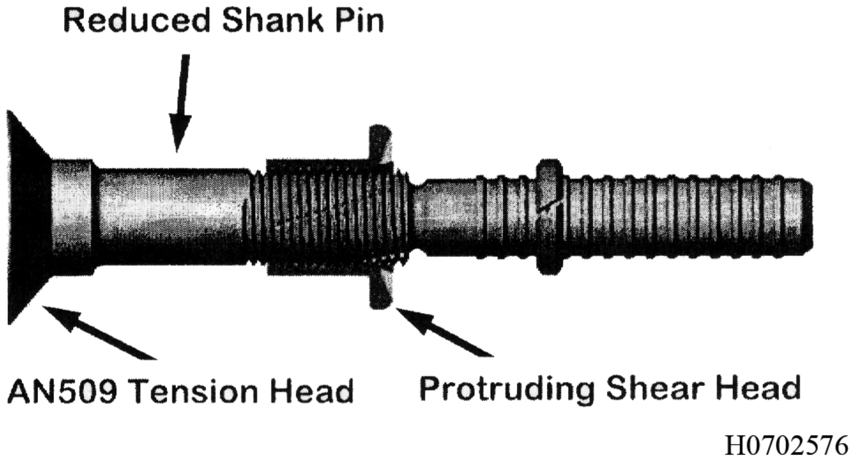


Figure 1-75. Flush AN509 Tension Head and Protruding Head; Reduced Shank; P/N Family 2Asp509P

1.11.9.8 The figure shown below is the configuration option for a Flush NAS1097 Shear Head and Protruding Head; Reduced Shank; P/N family 2AspFP.

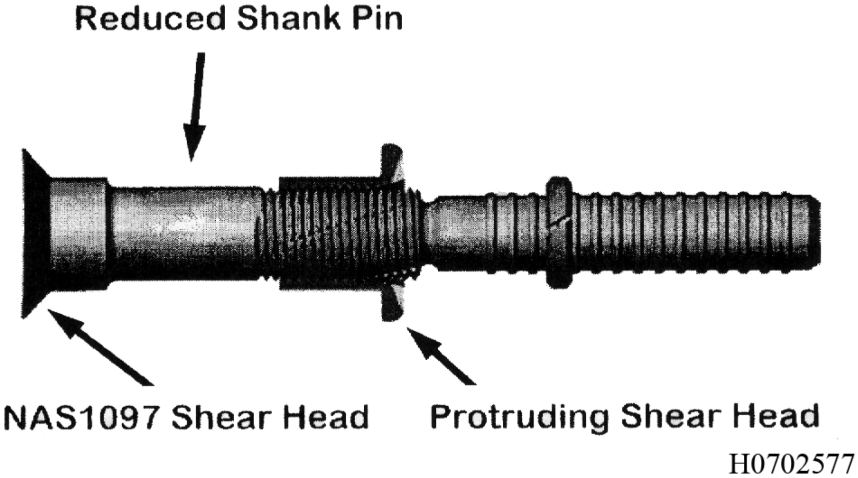


Figure 1-76. Flush NAS1097 Shear Head and Protruding Head; Reduced Shank; P/N family 2AspFP

1.11.9.9 The figure shown below is the configuration option for a Protruding Head and 509 Flush Tension Head; Reduced Shank; P/N family 2AspPF.

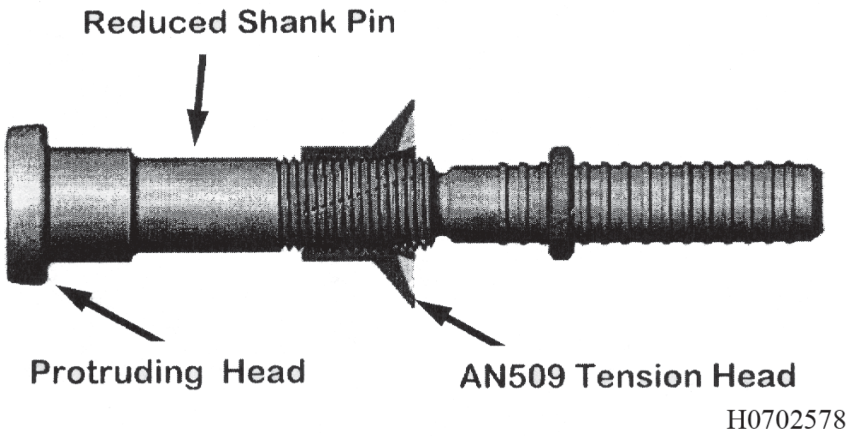


Figure 1-77. Protruding Head and 509 Flush Tension Head; Reduced Shank; P/N family 2AspPF

1.11.9.10 The figure shown below is the configuration option for a Protruding Head and Protruding Head; Reduced Shank; P/N famly 2AspPP.

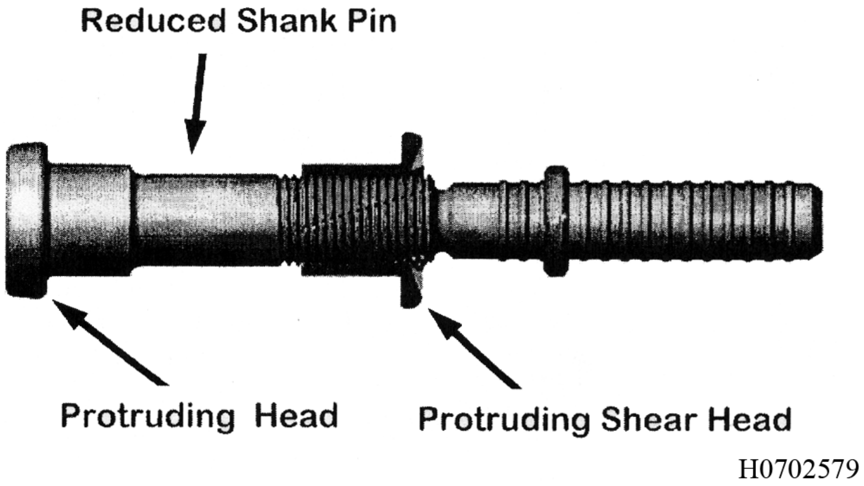


Figure 1-78. Protruding Head and Protruding Head; Reduced Shank; P/N family 2AspPP

1.11.10 Installation Sequence.

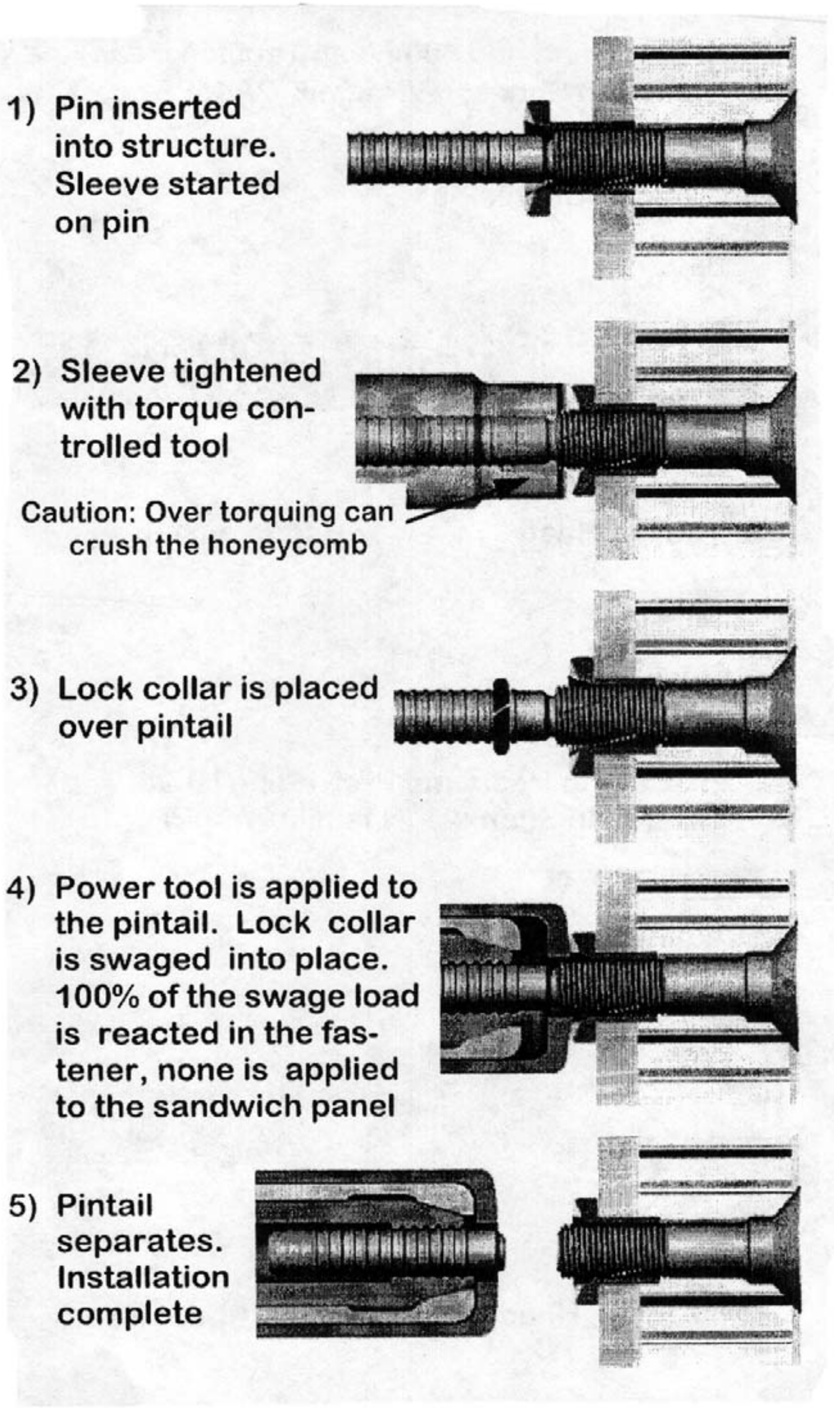


Figure 1-79. Installation Sequence

1.11.11 Installation Tooling.

1.11.11.1 Installing the sleeve component:

a. Sleeve will thread freely onto the pin.

b. Sleeve may be tightened using a driver but by hand or with a torque controlled power tool. Care must be taken not to over torque the sleeve to avoid crushing of soft cores or the honeycomb sandwich. AFS does not recommend specific tightening torque values. User determines torque based on desired compression of the specific joint geometry and materials.

c. The pin head may be retained against rotation with a hex key.

d. The screw driver bit is a special part as shown in the table below:

Dia	AFS P/N
-06	106524
-08	106525
-10	107735

CAUTION

Screw driver bit may cam out if over torqued.

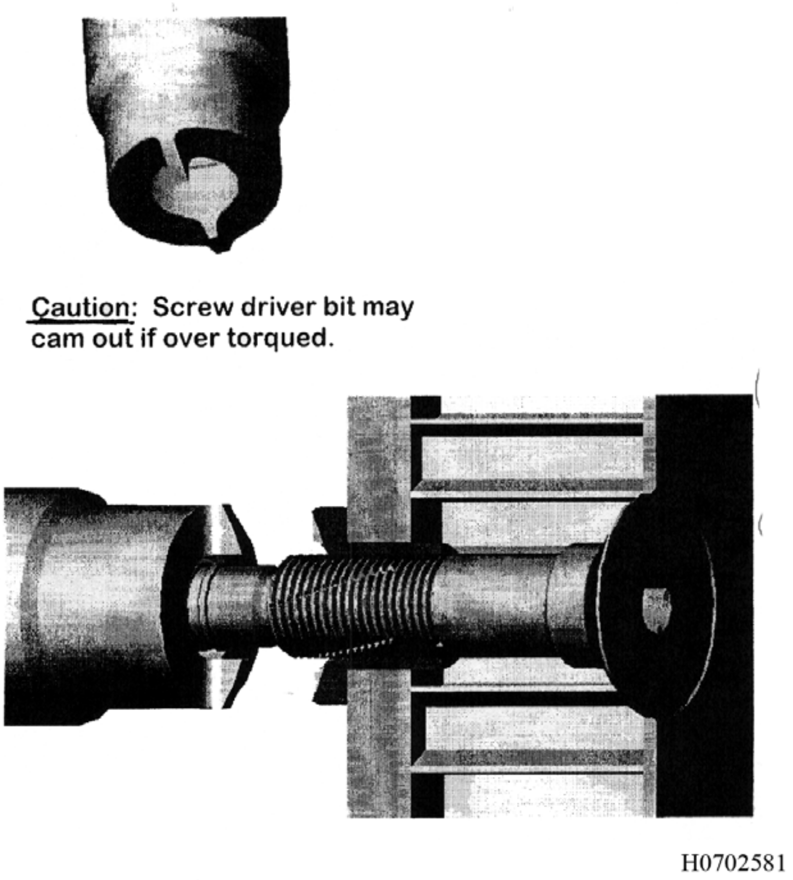


Figure 1-80. Installation of the Sleeve Component

1.11.11.2 Swaging the lock ring with straight on access:

a. After the sleeve component is tightened to the desired torque, the lock collar is placed onto the pintail, the pintail is engaged with a power tool and the lock collar is swaged in place. This locks the components together mechanically and assures that they function as a unit.

b. In 95% of all cases, there is access for straight on tools. Recommended power tools for straight access are AFS ergonomic Models 202, 2012 and 244.

CAUTION

Model 2012 pulls -06 and some -08 dia only!

c. Nose tools attaching to all these tools are shown in the table below. All of these nose attachments fit directly onto Models 202, 2012 and 244 without adapters.

Dia	Straight-On Nose Attach
-06	99-2642
-08	99-2645
-10	99-2648

NOTE

The tools and nose attachments shown on this page are only the most basic styles.

Figure 1-81. Model 244 - Pneudraulic Tool

1.11.11.3 Swaging the lock ring with limited access:

a. After the sleeve component is tightened to the desired torque and the lock collar is placed in position, the pintail is engaged with a power tool and the lock collar is swaged in place. This locks the components together mechanically and assures they function as a unit.

b. In some cases, off-set tools are required for limited access. Recommended power tools for off-set access are AFS ergonomic Model 244OS or all-hydraulic Model 206-375.

c. Nose tools attaching to all these tools are shown in the table below. All of these nose attachments fit directly onto Models 244OS and 206-375 without adapters.

Dia	Offset Nose Attach
-06	99-3728
-08	99-3729
-10	99-3730

NOTE

The tools and nose attachments shown on this page are only the most basic styles.

Figure 1-82. Model 244 OS Pneudraulic Tool

Figure 1-83. Model 206-375 Hydraulic Tool

1.11.12 Prior to Shave. The fastener must be checked for the limits in pin height, collar height and collar flash prior to shaving. After protrusion verification, pin and collar may be shaved flush to the top of the sleeve head.

Fastener Diameter	Pin Protrusion	
	Min	Max
-06 (13/64)	.020”	.107”
-08 (17/64)	.030”	.119”
-10 (21/64)	.035”	.129”

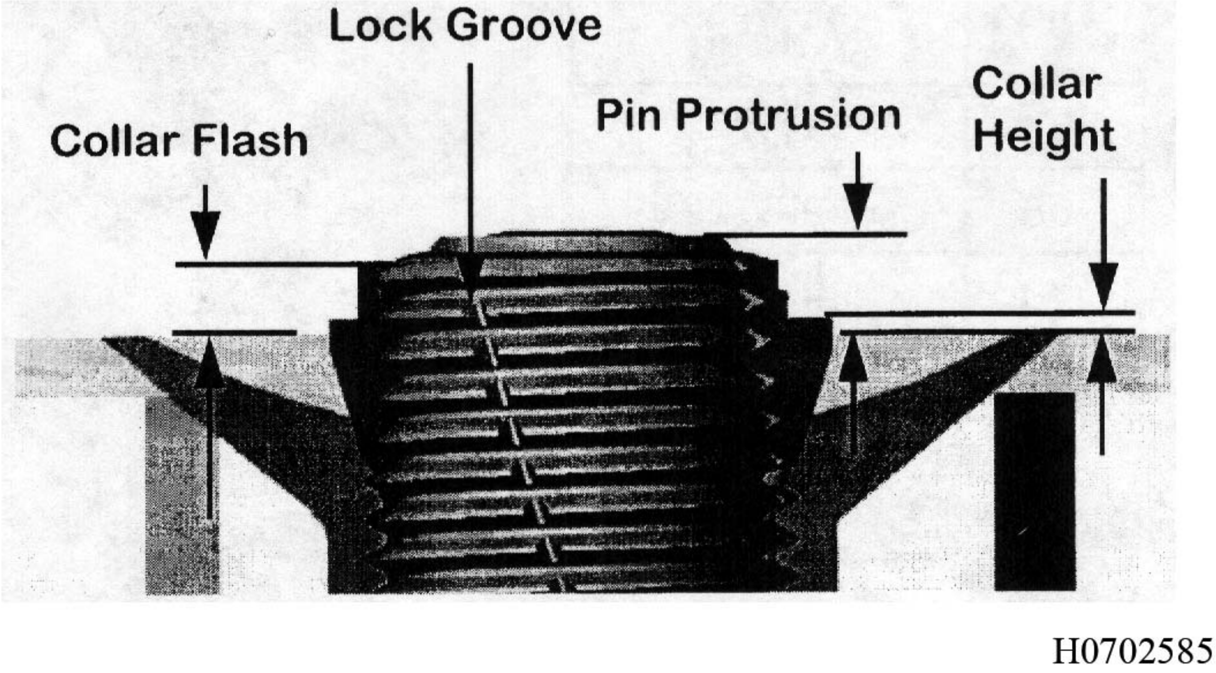


Figure 1-84. Fastener Prior to Shaving

Fastener Diameter	Collar Flash	
	Max Flash Height	Max Collar Height
-06 (13/64)	.020”	.010”
-08 (17/64)	.030”	.013”
-10 (21/64)	.040”	.016”

1.11.13 Clean Up Shave. The pin is designed to break approximately .030” to .090” above flush, depending on the actual thickness of he structure. On countersink head parts, where aerodynamic flushness is required, shaving of the protruding pin area is required. Since the pin material is hard, high speed rivet shavers (20,000 RPM) with carbide tipped cutters are most effective.

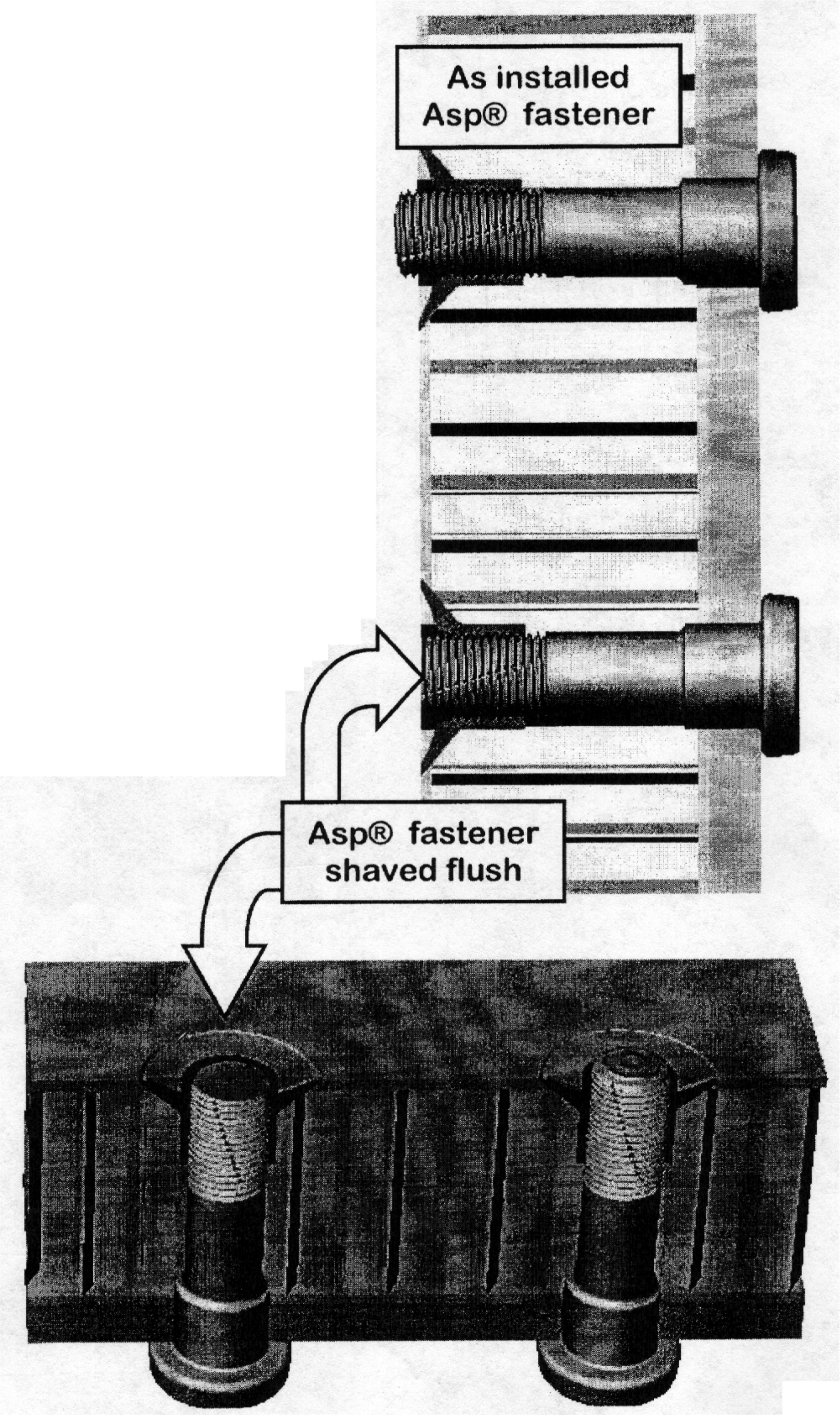


Figure 1-85. Asp® Installed and Shaved Flush

1.11.14 Fastener Removal. Since pin and sleeve are locked together with a swaged lock collar, drilling out of the lock collar is required.

a. Using a guide bushing and a drill slightly smaller than the hole diameter, the lock collar is drilled out.

b. Remnants of lock collar are pried out, sleeve is unthreaded, and pin is tapped out of the hole.

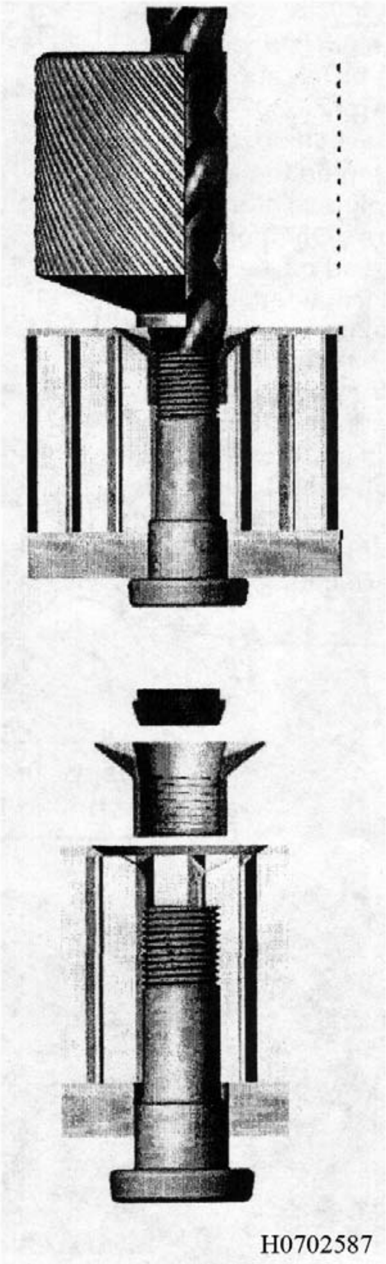


Figure 1-86. Fastener Removal

CHAPTER 2
SCREWS

2.1 SCREWS.

Screws are the most common type of threaded fasteners used on aircraft. They are similar to other types of threaded fasteners, such as bolts, but differ mainly by usually having a lower material strength, a looser thread fit, and shanks threaded along their entire length. However, several types of structural screws are available that differ from structural bolts only in the type of head; the material is equivalent and there is a definite grip. The countersunk, brazier, and roundhead screws have various types of slots or recesses, and each type requires a particular type of screwdriver. For proper performance and to prevent mutilation of the screw head and the screwdriver always use the proper type screwdriver. Screws may be divided into four main groups: structural screws, machine screws, self-tapping screws, and setscrews.

2.1.1 Screws are composed of three parts, with three additional combinations of these parts (see Figure 2-4).

- The head is that portion of the screw into which the screwdriver fits.
- The body is that portion from the bottom of the head to the beginning of the thread bevel
- The threads are the helical portion of the screw.
- The screw length is the combination of the three lengths above, extending from the top of the head to the bottom of the threads.
- The grip length is the distance from the underhead bearing surface to the beginning of the bevel just prior to the threads. On screws with no countersink to the heads, this is synonymous with the body of the screw. On countersunk screws, the griplength includes the beveled portion of the head.
- The shank is the combination of the body and threads.

2.1.2 Screw and Bolt Markings. Screws and bolts are designed and fabricated of different materials and with different tensile strengths for their individual beat and grip stresses. Screws and bolts are marked, as required, by the applicable AN, NAS, or Military Standard drawing with a code for identification and physical characteristics. Refer to Table 2-1 for these code markings. It is permissible for the vendor to place his trade mark on the head of these screws and bolts if he so desires.

2.1.3 Structural Screws. (Refer to Table 2-2 through Table 2-6.) Structural screws are used in the primary structure of aircraft as structural bolts or rivets are used. These screws are fabricated from a material with a high tensile strength and differ from structural bolts only in the type of head. They have a definite grip and the same shear strength as the equivalent size bolt.

2.1.4 Machine Screws.

2.1.5 Flathead, Machine Screws. (Refer to Table 2-7 through Table 2-12.) Flathead, machine screws are used in countersunk holes where a flush surface is desired. An 82-degree and a 100-degree countersunk flathead machine screw is available. These screws have various types of recesses and slots and are manufactured from different materials, such as carbon steel, corrosion- resistant steel, aluminum alloy, and brass.

2.1.6 Roundhead, Machine Screws. (Refer to Table 2-13 and Table 2-14.) AN508, AN515, and AN520 roundhead, machine screws are available. The AN508 screw is a brass screw designed for electrical use only and is available only with a slotted head. The AN515 coarse thread screw and AN520 fine thread screw are used as general purpose screws and are available with slotted or recessed heads and a class 2 thread fit. The AN515 and AN520 screws are manufactured from carbon steel, corrosion-resistant steel, and brass.

Table 2-1. Screw and Bolt Markings

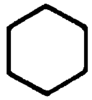
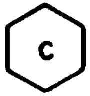
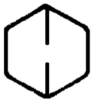
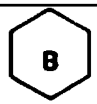
		Physical Characteristics		Material	Classification or Specification
	Grade 2 No Marking	Tensile Strength: 69,000 PSI Min Rockwell Hardness: B100 Max	Up to 1/2 Incl	Steel, Low Carbon	SAE Grade 2
		Tensile Strength: 64,000 PSI Min Rockwell Hardness: B100 Max	Over 1/2 to 3/4 Incl		
		Tensile Strength: 55,000 PSI Min Rockwell Hardness: B95 Max	Over 3/4		
		Yield Strength: 60,000 PSI Min		Steel, Low Carbon	
		Tensile Strength: 70,000 PSI Min Rockwell Hardness: B80-100		Steel, Low Carbon	AMS5061 - Cold Drawn
	Grade 3 2 Radial Dashes - 180° Apart	Tensile Strength: 110,000 PSI Min Rockwell Hardness: B95-104	Up to 1/2 Incl	Steel, Medium Carbon	SAE Grade 3
		Tensile Strength: 100,000 PSI Min Rockwell Hardness: B95-104	Over 1/2 to 5/8 Incl		
		Yield Strength: 75,000 PSI Min		Steel, Medium Carbon	
	Grade 5 3 Radial Dashes - 120° Apart	Tensile Strength: 120,000 PSI Min Rockwell Hardness: C23-30	Up to 3/4 Incl	Steel, Medium Carbon	FF-S-85 (Up to 2-1/2 Incl)
		Tensile Strength. 110,000 PSI Min Rockwell Hardness: C19-30	Over 3/4 to 1 Incl		
		Tensile Strength: 105,000 PSI Min	Over 1 to 1-1/2 Incl		SAE Grade 5 (Up to 1-1/2 Incl)

Table 2-1. Screw and Bolt Markings - Continued

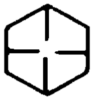
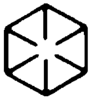
	Physical Characteristics	Material	Classification or Specification
	Rockwell Hardness: C19-30 Tensile Strength: 90,000 PSI Min Over 1-1/2 to 2-1/2 Incl Rockwell Hardness: C9-21		
	Yield Strength: 85,000 PSI Min	Steel, Medium Carbon	
 Grade 6 4 Radial Dashes - 90° Apart	Tensile Strength: 140,000 PSI Min Up to 5/8 Incl Rockwell Hardness: C30-36 Tensile Strength: 133,000 PSI Min Over 5/8 to 3/4 Incl Rockwell Hardness: C28-36	Steel, Medium Carbon	SAE Grade 6
	Yield Strength: 95,000 PSI Min	Steel, Medium Carbon	
 Grade 7 5 Radial Dashes - 72° Apart	Tensile Strength: 130,000 PSI Min Rockwell Hardness: C28-34	Steel, Alloy, Medium Carbon	SAE Grade 7
	Yield Strength: 110,000 PSI Min	Steel, Alloy	
 Grade 8 6 Radial Dashes - 60° Apart	Tensile Strength: 150,000 PSI Min To 1-1/2 Incl Rockwell Hardness: C32-38 Tensile Strength: 125,000 PSI Min Over 1-1/2 to 2-1/2 Incl Rockwell Hardness: C25 Min	Steel, Alloy, Medium Carbon	FF-S-85 (Up to 2-1/2 Incl) SAE Grade 8 (Up to 1-1/2 Incl)

Table 2-1. Screw and Bolt Markings - Continued

	Physical Characteristics	Material	Classification or Specification
	Yield Strength: 130,000 PSI Min	Steel, Alloy	
 Revised to ''H''	Yield Strength: 130,000 PSI Min	Steel, Alloy	
 Revised to ''E11''	Rockwell Hardness: C26-32	Steel, Alloy, Medium Carbon	AMS6320 for SAE8735
	Rockwell Hardness: C26-32	Steel, Alloy, Medium Carbon	AMS6320 for SAE8735
	Rockwell Hardness: C26-32	Steel, Alloy, Medium Carbon	AMS6322 for SAE8740
	Rockwell Hardness: C26-32	Steel, Alloy, Medium Carbon	AMS6322 for SAE8740
 Thread End	Rockwell Hardness: C32-36	Steel, Alloy, Medium Carbon	AMS6322 for SAE8740
 Single ''x''	Tensile Strength: 125,000 PSI Min Rockwell Hardness: C26-32	Steel, Alloy, Medium Carbon (Cr, Ni, Mo)	MIL-B-6812 includes: MIL-S-5626 for #4140 MIL-S-6049 for #8740 MIL-S-6050 for #8630 MIL-S-6098 for #8735 MIL-S-6758 for #4130

Table 2-1. Screw and Bolt Markings - Continued

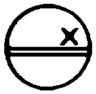
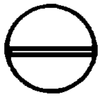
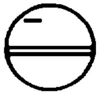
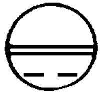
	Physical Characteristics	Material	Classification or Specification
		Steel, Alloy, Medium Carbon	MIL-S-8695 for #4037
	Tensile Strength: 125,000 PSI Min	Steel. Alloy, Medium Carbon (Cr, Ni, Mo)	MIL-S-7839 includes:
	Rockwell Hardness: C26-32		ML-S-6049 for #8740
			MIL-S-6050 for #8630
			MIL-S-6098 for #8735
			MIL-S-6758 for #4130
			MIL-S-8695 for #4037
	Tensile Strength: 62,000 PSI Min	Aluminum Alloy	
 Single Dash	Tensile Strength: 85,000 PSI Min	Steel, Corrosion Resistant	
		Steel, Corrosion Resistant	#410, Hardened
	Tensile Strength: 70,000 PSI Min	Steel, Corrosion Resistant	QQ-S-763
	Tensile Strength: 75,000 PSI Min	Steel, Corrosion Resistant	QQ-S-763, Class IV or (18-8)
 2 Radial Dashes - 90° Apart	Tensile Strength: 70,000 PSI Min	Steel, Corrosion Resistant	QQ-S-763
		Steel, Corrosion Resistant	QQ-S-763, Class 7, Grade A

Table 2-1. Screw and Bolt Markings - Continued

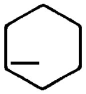
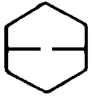
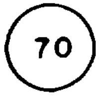
	Physical Characteristics	Material	Classification or Specification
 Single Dash		Steel, Corrosion Resistant	MIL-B-6812 (16 Cr, 2 Ni)
	Tensile Strength: 125,000 PSI Min	Steel, Corrosion Resistant	AMS7472 (17-20 Cr, 7-11 Ni) or AMS5637, SAE30302 (18 Cr, 8 Ni)
	Tensile Strength: 130,000 PSI Min Rockwell Hardness: 248-321	Steel, Corrosion and Heat Resistant	AMS5735 (15 Cr, 26 Ni; 1.3 Mo, 1.9 Ti, 0.32)
	Tensile Strength: 110,000 PSI Min	Steel, Corrosion and Heat Resistant	1200°F MIL-B-7874
	Tensile Strength: 62,000 PSI Min	Aluminum Alloy	MIL-B-6812 (Al-24)
 Double Dash	Tensile Strength: 85,000 PSI Min	Bronze, Coml	
			Close Tolerance
	Tensile Strength: 48,000 PSI Min	Steel, Coml	Bolt, Hexagon Head, Fine Thread
	Tensile Strength: 48,000 PSI Min	Steel, Coml	Bolt, Hexagon Head, Coarse Thread
	Tensile Strength: 48,000 PSI Min	Steel, Coml	Bolt, Carriage

Table 2-1. Screw and Bolt Markings - Continued

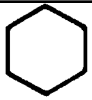
		Physical Characteristics		Material	Classification or Specification
	Grade	Tensile Strength: 55,000 PSI Min	0 to 4	Steel, Carbon, Free Machining	ASTM A-307, Grade A
		Rockwell Hardness: B66			
	Grade BO	Tensile Strength: 100,000 PSI Min	0 to 2	Steel, Carbon, Heat Treated	ASTM A-261
	Grade BB	Tensile Strength: 105,000 PSI Min	0 to 1-1/2	Steel, Alloy, Quenched and Tempered	ASTM A-354
		Tensile Strength: 105,000 PSI Min	Over 1-1/2 to 2-1/2		
		Tensile Strength: 100,000 PSI Min	Over 2-1/2 to 4		
	Grade	Tensile Strength: 120,000 PSI Min	0 to 3/4	Steel, Medium Carbon Quenched and Tempered	ASTM A-325
		Rockwell Hardness: C23-32			
		Tensile Strength: 115,000 PSI Min	7/8 to 1		
		Rockwell Hardness: C22-32			
		Tensile Strength: 105,000 PSI Min	1-1/8 to 1-1/2		
		Rockwell Hardness: C19-30			
		Tensile Strength: 90,000	1-3/4 to 3		
	Grade BC	Tensile Strength: 125,000 PSI Min	0 to 1-1/2	Steel, Alloy, Quenched and Tempered	ASTM A-354
		Tensile Strength: 125,000 PSI Min	Over 1-1/2 to 2-1/2		
		Tensile Strength: 115,000 PSI Min	Over 2-1/2 to 4		
	Grade BD	Tensile Strength: 150,000 PSI Min	0 to 1-1/2	Steel, Alloy, Quenched and Tempered	ASTM A-354
	Grade	Tensile Strength: 115,000 PSI Min		Steel, Alloy, Track Bolts	ASTM A-241

Table 2-1. Screw and Bolt Markings - Continued

		Physical Characteristics		Material	Classification or Specification
	Grade B5	Tensile Strength: 100,000 PSI Min	0 to 2-1/2	Steel, 5% Chromium	AISI 501
		Tensile Strength: 95,000 PSI Min	Over 2-1/2 to 4		
	Grade B6	Tensile Strength: 105,000 PSI Min	0 to 2-1/2	Steel, 12% Chromium	AISI 416
		Tensile Strength: 100,000 PSI Min	Over 2-1/2 to 4		
	Grade B7	Tensile Strength: 105,000 PSI Min	0 to 2-1/2	Steel, Chromium-Molybdenum	AISI 4140, 4142, 4145
		Tensile Strength: 105,000 PSI Min	Over 2-1/2 to 4		
		Tensile Strength: 90,000 PSI Min	Over 4 to 7		
	Grade B7A	Tensile Strength: 125,000 PSI Min	0 to 2-1/2	Steel, Chromium-High-Molybdenurn	
		Tensile Strength: 115,000 PSI Min	Over 2-1/2 to 4		
	Grade B14	Tensile Strength: 125,000 PSI Min	0 to 2-1/2	Steel, Chromium-Molybdenum-Vanadium	
			Over 2-1/2 to 4		
	Grade B16	Tensile Strength: 125,000 PSI Min	0 to 2-1/2	Steel, Chromium-Molybdenum-Vanadium	
		Tensile Strength: 110,000 PSI Min	Over 2-1/2 to 4		
		Tensile Strength: 100,000 PSI Min	Over 4 to 7		
	Grade B8	Carbide Treated		Steel, Corrosion esistant, 18 Cr 8 Ni	AISI 304
		Tensile Strength: 75,000 PSI Min	All Diameters		
	Grade B8	Cold Drawn		Steel, Corrosion Resistant, 18 Cr 8 Ni	

Table 2-1. Screw and Bolt Markings - Continued

		Physical Characteristics		Material	Classification or Specification
		Tensile Strength: 125,000 PSI Min	0 to 3/4		
		Tensile Strength: 115,000 PSI Min	Over 3/4 to 1		
		Tensile Strength: 105,000 PSI Min	Over 1 to 1-1/4		
		Tensile Strength: 100,000 PSI Min	Over 1-1/4 to 1-1/2		
	Grade B8C	Carbide Treated		Steel, Corrosion Resistant, 18 Cr 8 Ni, Columbium Stabilized	AISI 347
		Tensile Strength: 75,000 PSI Min	All Diameters		
	Grade B8C	Cold Drawn		Steel, Corrosion Resistant, 18 Cr 8 Ni, Columbium Stabilized	AISI 347
		Tensile Strength: 125,000 PSI Min	0 to 3/4		
		Tensile Strength: 115,000 PSI Min	Over 3/4 to 1		
		Tensile Strength: 105,000 PSI Min	Over 1 to 1-1/4		
		Tensile Strength: 100,000 PSI Min	Over 1-1/4 to 1-1/2		
	Grade B8T	Carbide Treated		Steel, Corrosion Resistant, 18 Cr 8 Ni, Titanium Stabilized	AISI 321
		Tensile Strength: 75,000 PSI Min	All Diameters		
	Grade B8T	Cold Drawn		Steel, Corrosion Resistant, 18 Cr 8 Ni, Titanium Stabilized	AISI 321
		Tensile Strength: 125,000 PSI Min	0 to 3/4		
		Tensile Strength: 115,000 PSI Min	Over 3/4 to 1		
		Tensile Strength: 105,000 PSI Min	Over 1 to 1-1/4		
		Tensile Strength: 100,000 PSI Min	Over 1-1/4 to 1-1/2		
	Grade B8F	Carbide Treated		Steel, Corrosion Resistant, 18 Cr 8 Ni, Free Machining	AISI 303
		Tensile Strength: 75,000 PSI Min	All Diameters		

Table 2-1. Screw and Bolt Markings - Continued

		Physical Characteristics		Material	Classification or Specification
 	Grade B8F	Cold Drawn		Steel, Corrosion Resistant, 18 Cr 8 Ni, Free Machining	AISI 303
		Tensile Strength: 125,000 PSI Min	0 to 3/4		
		Tensile Strength: 115,000 PSI Min	Over 3/4 to 1		
		Tensile Strength: 105,000 PSI Min	Over 1 to 1-1/4		
		Tensile Strength: 100,000 PSI Min	Over 1-1/4 to 1-1/2		
 	Grade L7	Tensile Strength: 125,000 PSI Min	0 to 2-1/2	Steel, Chromium-Molybdenum	AISI 4140, 4142, 4145
		Tensile Strength: 105,000 PSI Min	Over 2-1/2 to 4		
 	Grade L9	Tensile Strength: 125,000 PSI Min	0 to 2-1/2	Steel, Nickel	AISI 2340
		Tensile Strength: 105,000 PSI Min	Over 2-1/2 to 4		
 	Grade L10	Tensile Strength: 70,000 PSI Min	0 to 4	Steel, Nickel	AISI 2317
 	Grade L43	Tensile Strength: 125,000 PSI Min	0 to 4	Steel, Nickel-Chromium-Molybdenum	AISI 4340
 	Grade B8	Annealed		Steel, Corrosion Resistant, 18 Cr 8 Ni	AISI 304
		Tensile Strength: 75,000 PSI Min	All Diameters		
 	Grade B8	Cold Drawn		Steel, Corrosion Resistant, 18 Cr 8 Ni	AISI 304
		Tensile Strength: 125,000 PSI	Min 0 to 3/4		
		Tensile Strength: 115,000 PSI Min	Over 3/4 to 1		
		Tensile Strength: 105,000 PSI Min	Over 1 to 1-1/4		
		Tensile Strength: 100,000 PSI Min	Over 1-1/4 to 1-1/2		

Table 2-1. Screw and Bolt Markings - Continued

		Physical Characteristics		Material	Classification or Specification
	Grade B8C	Annealed		Steel, Corrosion Resistant, 18 Cr 8 Ni, Columbium Stabilized	AISI 347
		Tensile Strength: 75,000 PSI Min	All Diameters		
	Grade B8C	Cold Drawn		Steel, Corrosion Resistant, 18 Cr 8 Ni, Columbium Stabilized	AISI 347
		Tensile Strength: 125,000 PSI Min	0 to 3/4		
		Tensile Strength: 115,000 PSI Min	Over 3/4 to 1		
		Tensile Strength: 105,000 PSI Min	Over 1 to 1-1/4		
		Tensile Strength: 100,000 PSI Min	Over 1-1/4 to 1-1/2		
	Grade B8T	Annealed		Steel, Corrosion Resistant, 18 Cr 8 Ni, Titanium Stabilized	AISI 321
		Tensile Strength: 75,000 PSI Min	All Diameters		
	Grade B8T	Cold Drawn		Steel, Corrosion Resistant, 18 Cr 8 Ni, Titanium Stabilized	AISI 321
		Tensile Strength: 125,000 PSI Min	0 to 3/4		
		Tensile Strength: 115,000 PSI Min	Over 3/4 to 1		
		Tensile Strength: 105,000 PSI Min	Over 1 to 1-1/4		
		Tensile Strength: 100,000 PSI Min	Over 1-1/4 to 1-1/2		
	Grade B8F	Annealed		Steel, Corrosion Resistant, 18 Cr 8 Ni, Free Machining	AISI 303
		Tensile Strength: 75,000 PSI Min	All Diameters		
	Grade B8F	Cold Drawn		Steel, Corrosion Resistant, 18 Cr 8 Ni, Free Machining	AISI 303
		Tensile Strength: 125,000 PSI Min	0 to 3/4		
		Tensile Strength: 115,000 PSI Min	Over 3/4 to 1		
		Tensile Strength: 105,000 PSI Min	Over 1 to 1-1/4		

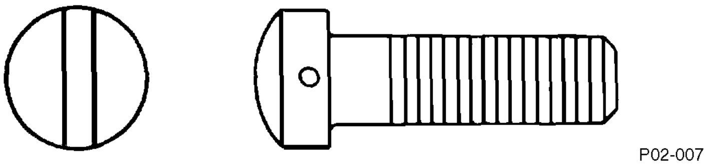
Table 2-1. Screw and Bolt Markings - Continued

		Physical Characteristics	Material	Classification or Specification
		Tensile Strength: 100,000 PSI Min Over 1-1/4 to 1-1/2		
BOLT STUDS 	Grade B7	Type 1 Tensile Strength: 125,000 PSI Min Rockwell Hardness: 255-321 or C25-35	Steel, Alloy	MIL-S-1222B
	Grade B7A	Tensile Strength: 125,000 PSI Min Rockwell Hardness: 255-321 or C25-35	Steel, Alloy	MIL-S-1222B
	Grade B14	Tensile Strength: 125,000 PSI Min Rockwell Hardness: 255-321 or C25-35	Steel Alloy	MIL-S-1222B
	Grade B16	Tensile Strength: 125,000 PSI Min Rockwell Hardness: 255-321 or C25-35	Steel, Alloy	MIL-S-1222B

National Aircraft Standard Head Markings - NAS380

—	Dash denotes corrosion-resistant steel.
⚌	Two staggered parallel dashes (only one need be visible after slotting head) denotes corrosion-resistant steel.
✚	Cross denotes alloy steel (125,000 - 145,000 PSI).
△	Recessed triangle denotes close-tolerance shank and/or head.
	Triangle with a dimple inside denotes close-tolerance shank and/or head, high strength (160,000 - 180,000 PSI).
	Triangle with an X inside denotes close-tolerance shank and/or head, alloy steel (125,000 - 145,000 PSI).
R	The letter R denotes rolled threads after heat treatment.
— —	Double dash denotes aluminum alloy.
═	This marking on screw and bolt heads denotes bronze material.

Table 2-2. AN502 and AN503, Fillister Head, Structural Screws



First Dash Number	Thread		Diameter	Head Height		Material Strength	
	Size	Class		Min	Max	Tensile Strength	Shear Strength
-6	6-32	NC-3A	.138	.118	.132	1120	1060
-8	8-32	NC-3A	.164	.141	.156	1740	1500
-10	10-32	NF-3A	.190	.165	.180	2490	2125
-416	1/4-28	UNF-3A	.250	.219	.237	4520	3650
-516	5/16-24	UNF-3A	.312	.276	.295	7240	5750

Code:

First dash number indicates screw size.

Second dash number indicates screw length.

Material:

Steel, Military Specification MIL-S-8695 or MIL-S-6050.

Example of part number:

AN502-10-10 = 10-32 screw, 5/8-inch long.

2.1.7 Fillister Head, Machine Screws. (Refer to Table 2-15 through Table 2-17.) Fillister head, machine screws are used as general purpose screws and also may be used as cap screws in light mechanics such as the attachment of cast aluminum gear box cover plates. Fillister head screws are usually drilled for safety wire and are available manufactured from steel and brass. Fillister head screws are available with coarse or fine threads. The coarse threaded screws are commonly used as cap screws in tapped aluminum alloy and magnesium castings because of the softness of the material.

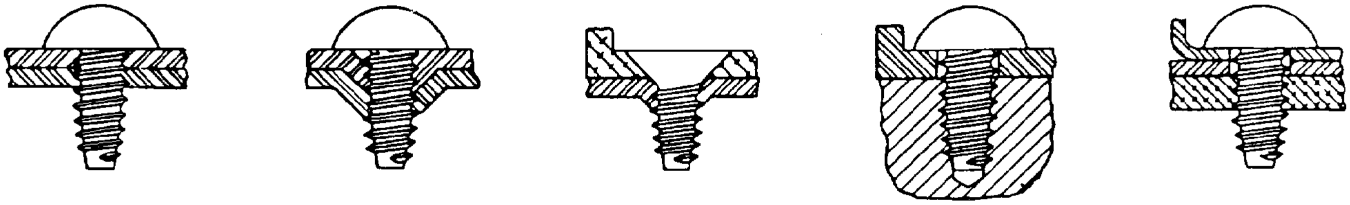
2.1.8 Socket Head, Machine Screws. (Refer to Table 2-18.) Socket head, machine screws are designed to be driven into tapped holes by means of internal wrenches. They are used in applications which require high strength precision products, compactness of the assembled parts, or sinking of heads below surfaces into fitted holes. Socket head, machine screws are manufactured from steel or corrosion-resistant steel.

2.1.9 Pan Head and Truss Head, Machine Screws. (Refer to Table 2-19 through Table 2-23.) Pan head and truss head screws are general purpose screws used where the head height is unimportant. They are available with cross-recessed heads only and are manufactured from steel, carbon steel, corrosion-resistant steel, and aluminum alloy.

2.1.10 Self-Tapping Screws. Self-tapping screws tap their own mating thread when driven into untapped drilled or punched holes slightly smaller than the outside diameter of the screw itself. These screws are made with a milled thread-cutting slot placed off the center of the screw at the entering end. This slot produces a thread-cutting edge similar to a tap. Chips are cleared through the slot so that driving is done with little effort and threads are cut perfectly.

2.1.11 Self-Tapping, Machine Screws (Table 2-24). These screws are usually used for attaching removable parts to castings. They are available in a flathead style and roundhead style. The threads of the screw cut threads in the casting after the hole has been underdrilled. (Refer to Table 2-25.)

2.1.12 Self-Tapping, Sheet Metal Screws. (Refer to Table 2-24, Table 2-26, and Table 2-27.) These screws are used for such purposes as temporarily attaching sheet metal for riveting and for permanent assembly of nonstructural assemblies where the ability to install the screws in a blind application is required. (See Figure 2-1.) The screw is installed by drilling a hole and inserting the screw, which cuts its own thread as it is screwed into the hole. (Refer to Table 2-28.) These screws are hardened for use on steel or aluminum alloy sheets but may be used on plastic also.



IN DRILLED OR CLEAN PUNCHED HOLES

IN PIERCE PUNCHED HOLES

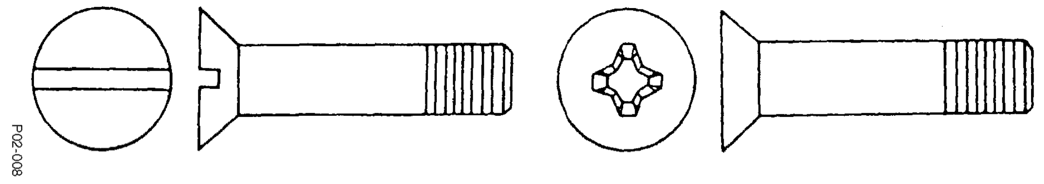
IN CUT COUNTERSUNK HOLES

IN CASTINGS PLASTICS, ETC.

IN CLEARANCE HOLES OF LINE CLAMPS, FAIRLEADS, ETC

Figure 2-1. Using Sheet Metal Screws

Table 2-3. AN509 100-Degree, Flathead, Structural Screws



First Dash Number	Thread		Diameter		Material Strength					
					Low Alloy Steel		Corrosion-Resistant Steel		Aluminum Alloy	
	Size	Class	Min	Max	Tensile Strength	Shear Strength	Tensile Strength	Shear Strength	Tensile Strength	Shear Strength
-8	8-32	NC-3A	.161	.164	1740	1500	1180	1050	860	770
-10	10-32	NF-3A	.186	.189	2490	2125	1690	1385	1230	1046
-416	1/4-28	UNF-3A	.246	.249	4520	3680	3080	2500	2240	1825
-516	5/16-24	UNF-3A	.308	.311	7240	5750	4920	3910	3590	2850
-616	3/8-24	UNF-3A	.371	.374	10,950	8280	7450	5650	5430	4125
-716	7/16-20	UNF-3A	.432	.436	14,800	11,250	10,070	7650	7350	5600
-816	1/2-20	UNF-3A	.495	.499	19,950	14,700	13,570	10,000	9900	7300
-916	9/16-18	UNF-3A	.557	.561	25,300	18,700	17,200	12,650	12,560	9250

Code:

First dash number indicates screw size.

Second dash number indicates screw length.

C before first dash number indicates corrosion-resistant steel screw.

DD before first dash number indicates aluminum alloy screw.

R before first and second dash number indicates recessed head screw.

Example of part number:

AN509-10-12 = 10-32 slotted head steel screw, 25/32-inch long.

AN509-10R12 = 10-32 recessed head steel screw, 25/32-inch long.

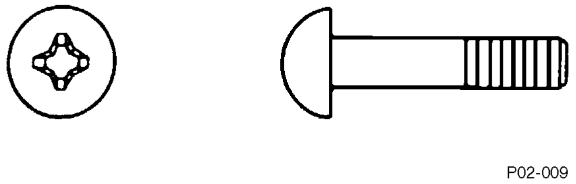
Material:

Steel, Military Specification MIL-S-8695.

Corrosion-resistant steel, Federal Specification QQ-S-763.

Aluminum alloy, Federal Specification QQ-A-267.

Table 2-4. NAS220 Through NAS227, Brazier Head, Structural Screws



					Material					
Part Number	Thread		Diameter		Aluminum Alloy		High Strength Bronze		Alloy Steel	
	Size	Class	Min	Max	Tensile Strength	Shear Strength	Tensile Strength	Shear Strength	Tensile Strength	Shear Strength
NAS220	8-32	NC-3	.161	.164	480	740	636	954	1150	1600
NAS221	10-32	NF-3	.186	.189	710	990	1014	1280	1690	2125
NAS222	1/4-28	NF-3	.246	.249	1310	1715	1753	2212	3130	3680
NAS223	5/16-24	NF-3	.308	.311	2080	2685	2815	3463	4980	5750
NAS224	3/8-24	NF-3	.371	.374	3240	3870	4370	4980	7740	8280
NAS225	7/16-20	NF-3	.432	.436	4350	5250	5890	6780	10,430	11,250
NAS226	1/2-20	NF-3	.495	.499	5920	6850	8084	8850	14,190	14,700
NAS227	9/16-18	NF-3	.557	.561	7550	8700	10,230	11,190	18,100	18,700

Code:

Dash number indicates screw length and grip.

DD following basic part number indicates aluminum alloy screw.

BZ following basic part number indicates bronze screw.

No letter following basic part number indicates alloy steel screw.

Example of part number:

NAS220DD7 = aluminum alloy screw, 15/32-inch long.

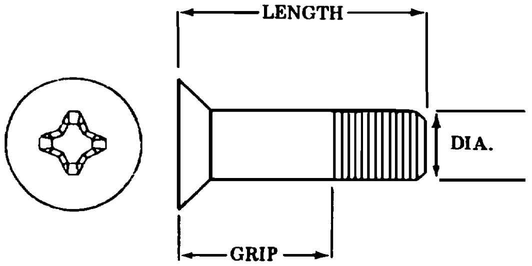
Material:

Aluminum alloy.

High strength bronze.

Steel.

Table 2-5. NAS560 100-Degree Flathead, Nonmagnetic, High Temperature, Structural Screw



P02-011

First Dash Number	Thread		Diameter		Head Height	Material Strength					
						Corrosion-Resistant Steel, Federal Specification QQ-S-763		Corrosion-Resistant Steel, Aeronautical Material Specification AMS5735		Corrosion-Resistant Steel, Aeronautical Material Specification AMs5668	
	Size	Class	Min	Max		Tensile Strength	Shear Strength	Tensile Strength	Shear Strength	Tensile Strength	Shear Strength
-2	8-32	NC-3	.161	.164	.068	1050	900	1800	1550	2250	1900
-3	10-32	NF-3	.186	.189	.080	1500	1200	2600	2100	3200	2700
-4	1/4-28	UNF-3	.246	.249	.106	2700	2100	4700	3700	5750	4550
-5	5/16-24	UNF-3	.308	.311	.133	4350	3350	7500	5800	9200	7100
-6	3/8-24	UNF-3	.371	.374	.159	6550	4850	11,400	8400	14,000	10,300
-7	7/16-20	UNF-3	.432	.436	.186	8850	6600	15,400	11,400	18,900	14,300
-8	1/2-20	UNF-3	.495	.499	.213	11,900	8600	20,700	14,900	25,500	18,300
-9	9/16-18	UNF-3	.557	.561	.240	15,100	11,000	26,300	19,000	32,400	23,500

Code:

First dash number indicates screw size in 16 (sixteen) inch increments.

Second dash number indicates screw grip and length in 16 (sixteen) inch increments.

C after basic part number indicates low strength screws, manufactured from corrosion-resistant steel, Federal Specification QQ-S-763.

H after basic part number indicates high temperature screws manufactured from corrosion-resistant steel, Aeronautical Material Specification, AMS5735.

X after basic part number indicates high strength screws manufactured from corrosion-resistant steel, Aeronautical Material Specification, AMS5668.

K after material code indicates cross recess.

P after first dash number indicates flash cadmium plating.

Example of part number:

Table 2-5. NAS560 100-Degree Flathead, Nonmagnetic, High Temperature, Structural Screw - Continued

NAS560CK3P12 = cross recess screw, low strength, flash cadmium-plated, 3/16-inch diameter, 3/4 inch grip.

NAS560 = basic screw; C = low strength; K = cross recess; 3 == first dash number, 3/16 inch diameter; P = flash cadmium plated; 12 = second dash number, 12/16 (3/4) inch grip length.

NAS560HK4-0:

NAS560 = basic screw; H = high temperature; K = cross recess; 4 = first dash number, 4/16 (1/4) inch diameter; -0 = second dash number, no grip length.

		Length For Sizes Indicated +0.030 - 0.015									
Second Dash No.	Grip ±0.015	8-32	10-32	1/4-28	5/16-24	3/8-24	7/16-20	1/2-20	9/16-18	Second Dash No.	Grip ±0.015
-00		0.348	0.400							-00	
-0		0.410	0.463	0.526	0.614					-0	
-1		0.472	0.526	0.589	0.677	0.708	0.790			-1	
-2	0.125	0.535	0.588	0.651	0.739	0.770	0.852	0.886	1.039	-2	0.125
-3	0.188	0.598	0.651	0.714	0.802	0.833	0.915	0.949	1.102	-3	0.188
-4	0.250	0.660	0.713	0.776	0.864	0.895	0.977	1.011	1.164	-4	0.250
-5	0.312	0.722	0.775	0.838	0.926	0.957	1.039	1.073	1.226	-5	0.312
-6	0.375	0.785	0.838	0.901	0.989	1.020	1.102	1.136	1.289	-6	0.375
-7	0.438	0.846	0.901	0.964	1.052	1.083	1.165	1.199	1.352	-7	0.438
-8	0.500	0.910	0.963	1.026	1.114	1.145	1.227	1.261	1.414	-8	0.500
-9	0.562	0.972	1.025	1.088	1.176	1.207	1.289	1.323	1.476	-9	0.562
-10	0.625	1.035	1.088	1.151	1.239	1.270	1.352	1.386	1.539	-10	0.625
-11	0.688	1.098	1.151	1.214	1.302	1.333	1.415	1.449	1.602	-11	0.688
-12	0.750	1.160	1.213	1.276	1.364	1.395	1.477	1.511	1.664	-12	0.750
-13	0.812	1.222	1.275	1.338	1.426	1.457	1.539	1.573	1.726	-13	0.812

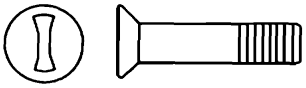
Material:

Corrosion-resistant steel, Federal Specification QQ-S-763.

Corrosion-resistant steel, Aeronautical Material Specification AMS5735.

Corrosion-resistant steel, Aeronautical Material Specification AMS5668.

Table 2-6. NAS583 Through NAS590, 100-Degree, Flathead, Structural Screws



P02-013

Part Number	Thread		Diameter		Material Strength	
	Size	Class	Min	Max	Tensile Strength	Shear Strength
NAS583	10-32	NF-3A	.188	.189	3180	2690
NAS584	1/4-28	UNF-3A	.248	.249	5790	4650
NAS585	5/16-24	UNF-3A	.311	.312	9260	7300
NAS586	3/8-24	UNF-3A	.373	.374	14,000	10,500
NAS587	7/16-20	UNF-3A	.436	.437	19,000	14,300
NAS588	1/2-20	UNF-3A	.498	.499	25,600	18,650
NAS589	9/16-18	UNF-3A	.560	.561	32,400	23,600
NAS590	5/8-18	UNF-3A	.623	.624	40,900	29,150

Code:

Dash number indicates grip in sixteenths.

Example of part number:

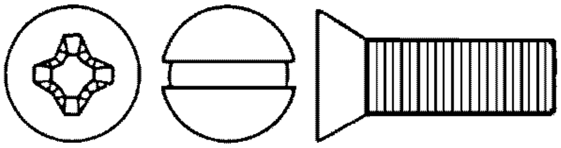
NAS584-5 = 1/4-28 steel screw, 5/16-inch grip.

Material:

Steel, Military Specification MIL-S-6758 for 3/8 inch and smaller.

Steel, Military Specifications MIL-S-5000, MIL-S-5626, MIL-S-6049, or MIL-S-6098.

Table 2-7. AN505 and AN510, 82-Degree, Flathead, Machine Screws



P02-014

Part Number	Thread		Diameter	Head Height				Material Strength	
				Full Head		Undercut Head			
	Size	Class		Min	Max	Min	Max	Tensile Strength	Shear Strength
AN510-0	0-80	NF-2A	.060	.026	.035	.018	.025	82	49
AN510-1	1-72	NF-2A	.073	.033	.043	.023	.030	132	79
AN505-2	2-56	NC-2A	.086	.040	.051	.028	.036	170	102
AN510-2	2-64	NF-2A	.086	.040	.051	.028	.036	187	112
AN505-3	3-48	NC-2A	.099	.048	.059	.034	.041	225	135
AN510-3	3-56	NF-2A	.099	.048	.059	.034	.041	247	148
AN505-4	4-40	NC-2A	.112	.055	.067	.039	.047	275	165
AN510-4	4-48	NF-2A	.112	.055	.067	.039	.047	313	188

Table 2-7. AN505 and AN510, 82-Degree, Flathead, Machine Screws - Continued

				Head Height					
	Thread			Full Head		Undercut Head		Material Strength	
Part Number	Size	Class	Diameter	Min	Max	Min	Max	Tensile Strength	Shear Strength
AN505-5	5-40	NC-2A	.125	.062	.075	.043	.053	370	222
AN510-5	5-44	NF-2A	.125	.062	.075	.043	.053	396	238
AN505-6	6-32	NC-2A	.138	.069	.083	.048	.058	410	246
AN510-6	6-40	NF-2A	.138	.069	.083	.048	.058	478	287
AN505-8	8-32	NC-2A	.164	.084	.100	.059	.070	660	396
AN510-8	8-36	NF-2A	.164	.084	.100	.059	.070	705	423
AN505-10	10-24	NC-2A	.190	.098	.116	.069	.081	800	480
AN510-10	10-32	NF-2A	.190	.098	.116	.069	.081	960	575
AN505-416	1/4-20	UNC-2A	.250	.131	.153	.092	.107	1480	890
AN510-416	1/4-28	UNF-2A	.250	.131	.153	.092	.107	1790	1075
AN505-516	5/16-18	UNC-2A	.313	.191	.165	.116	.134	2500	1500
AN505-616	3/8-16	UNC-2A	.375	.200	.230	.140	.161	3730	2240

Code:

R between first and second dash numbers indicates recessed head screw.

B before first dash number indicates brass screw with black oxide finish.

PB before first dash number indicates cadmium-plated brass screw.

UB before first dash number indicates plain brass screw.

C before first dash number indicates corrosion-resisting steel screw.

DD before first dash number indicates aluminum alloy screw.

Example of part number:

AN505PB4-8 = 4-40 cadmium plated brass screw, 1/2-inch long, slotted head.

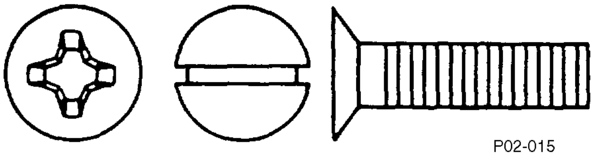
Material:

Carbon steel, Federal Specification QQ-S-633.

Corrosion-resistant steel, Federal Specification QQ-S-763.

Aluminum alloy, Federal Specification QQ-A-267.

Table 2-8. AN507 100-Degree, Flathead, Machine Screws



	Thread			Head Height		Material Strength	
First Dash Number	Size	Class	Diameter	Min	Max	Tensile Strength	Shear Strength
-440	4-40	NC-2A	.112	.040	.048	275	165
-632	6-32	NC-2A	.138	.051	.060	410	246

Table 2-8. AN507 100-Degree, Flathead, Machine Screws - Continued

First Dash Number	Thread		Diameter	Head Height		Material Strength	
	Size	Class		Min	Max	Tensile Strength	Shear Strength
-832	8-32	NC-2A	.164	.062	.072	660	396
-1032	10-32	NF-2A	.190	.072	.083	960	575
-428	1/4-28	UNF-2A	.250	.097	.110	1790	1075
-524	5/16-24	UNF-2A	.313	.123	.138	2880	1725
-624	3/8-24	UNF-2A	.375	.148	.165	4450	2660

Code:

First dash number indicates screw size.

Second dash number indicates screw length.

R between first and second dash numbers indicates recessed head screw.

B before first dash number indicates brass screw with black oxide finish.

PB before first dash number indicates cadmium-plated brass screw.

UB before first dash number indicates plain brass screw.

C before first dash number indicates corrosion-resistant steel screw.

DD before first dash number indicates aluminum alloy screw.

Example of part number:

AN507C428-8 = 1/4-28 corrosion-resistant steel screw, 1/2-inch long, slotted head.

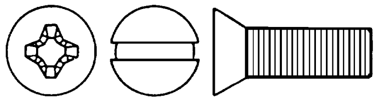
Material:

Carbon steel, Federal Specification QQ-S-633.

Corrosion-resistant steel, Federal Specification QQ-S-763.

Aluminum alloy, Federal Specification QQ-A-267.

Table 2-9. NAS200 100-Degree, Flathead and NAS202 Roundhead, Machine Screws



P02-014

Dash Number	Thread		Diameter		Head Height				Material Strength	
					Flathead		Roundhead			
	Size	Class	Min	Max	Min	Max	Min	Max	Tensile Strength	Shear Strength
-440	4-40	NF-3	.107	.112	.065	.075	.075	.086	201	316
-632	6-32	NC-3	.132	.138	.073	.083	.091	.103	302	483
-832	8-32	NC-3	.158	.164	.088	.098	.107	.119	489	691
-1032	10-32	NF-3	.184	.190	.103	.113	.124	.136	720	937
-428	1/4-28	NF-3	.243	.250	.122	.132	.161	.174	1343	1634

Code:

B prefixed to dash number indicates brass screw.

C prefixed to material letter indicates cadmium-plated screw.

Example of part number:

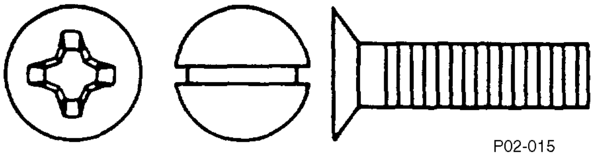
NAS200-632-18 = 6-32 steel screw, 1-1/8 inch long.

Material:

Steel, Society of Automotive Engineering 1010.

Brass, Federal Specification QQ-B-626.

Table 2-10. NAS514 100-Degree, Flathead, Machine Screw



P02-015

First Dash Number	Thread		Diameter		Head Height	Material Strength	
	Size	Class	Min	Max		Tensile Strength	Shear Strength
-440	4-40	NC-2A	.108	.111	.045	750	450
-632	6-32	NC-2A	.134	.137	.057	1120	670
-832	8-32	NC-2A	.160	.163	.068	1740	1040
-1032	10-32	NF-3A	.186	.189	.080	2490	1490
-428	1/4-28	UNF-3A	.246	.249	.106	4520	2710
-524	5/16-24	UNF-3A	.308	.311	.133	7240	4340
-624	3/8-24	UNF-3A	.371	.374	.159	10,950	6570

Code:

First dash number indicates screw size.

Second dash number indicates screw length.

P preceding first dash number indicates Phillips recessed head.

F preceding first dash number indicates Frearson recessed head.

No letter preceding first dash number indicates slotted head.

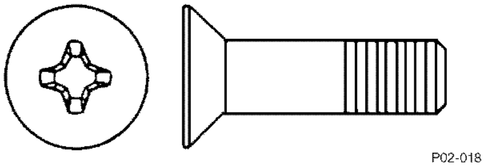
Example of part number:

NAS514P428-8 = 1/4-28 screw, Phillips recessed head, 1/2-inch long.

Material:

Steel, Military Specification MIL-S-8695 or MIL-S-6050.

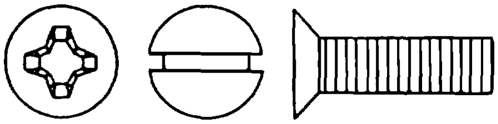
Table 2-11. NAS517 100-Degree, Flathead, Machine Screw



First Dash Number	Thread		Diameter		Head Height	Material Strength	
	Size	Class	Min	Max		Tensile Strength	Shear Strength
-2	8-32	NC-3A	.161	.164	.068	1740	2005
-3	10-32	NF-3A	.186	.189	.080	2490	2690
-4	1/4-28	UNF-3A	.246	.249	.106	4520	4650
-5	5/16-24	UNF-3A	.308	.311	.133	7240	7300
-6	3/8-24	UNF-3A	.371	.374	.159	10,950	10,500
-7	7/16-20	UNF-3A	.432	.436	.186	14,800	14,300
-8	1/2-20	UNF-3A	.495	.499	.213	19,950	18,650

Code:
First dash number indicates screw size.
Second dash number indicates screw length.
Example of part number:
NAS517-3-3 = 10-32 screw, 3/16-inch grip.
Material:
Steel, Military Specification MIL-S-8695.

Table 2-12. NAS662 100-Degree, Flathead, Machine Screw


P02-017

First Dash Number	Thread		Diameter	Head Height	
	Size	Class		Min	Max
-0	0-80	NF-2A	.060	.019	.025
-1	1-64	NC-2A	.073	.024	.030
-2	2-56	NC-2A	.086	.029	.036
-3	3-48	NC-2A	.099	.034	.042

Code:

First dash number indicates screw diameter.

Second dash number indicates screw length in sixteenths.

B before first dash number indicates brass screw.

C before first dash number indicates steel screw.

R before second dash number indicates cross recess.

Example of part number:

NAS662C3R4 = 3-48 corrosion-resistant steel screw, 1/4-inch long, with cross recess.

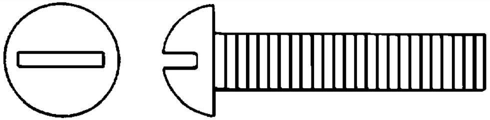
Material:

Carbon steel, Federal Specification QQ-S-633.

Corrosion-resistant steel, Federal Specification QQ-S-763.

Brass, Federal Specification QQ-B-626.

Table 2-13. AN508 Roundhead, Machine Screw



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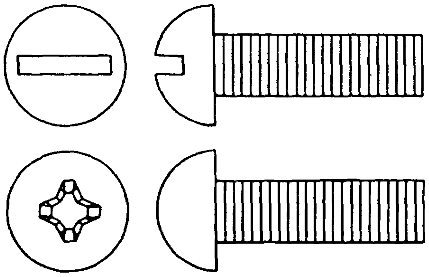
First Dash Number	Thread		Diameter	Head Height	
	Size	Class		Min	Max
-4	4-40	NC-2	.112	.075	.087
-6	6-32	NC-2	.138	.091	.103
-8	8-32	NC-2	.164	.107	.119
-10	10-32	NF-2	.190	.124	.136

Code:
First dash number indicates screw size.
Second dash number indicates screw length.
Example of part number:
AN508-6-3 = 6-32 plated brass screw, 3/16-inch long.
Material:
Brass, Federal Specification QQ-B-626.

Table 2-14. AN515 and AN520, Roundhead, Machine Screws

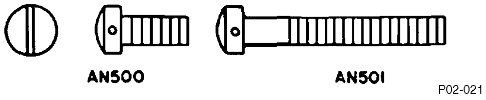


P02-020

Part Number	Thread		Diameter	Head Height	Material Strength	
	Size	Class			Tensile Strength	Shear Strength
AN515-2	2-56	NC-2A	.086	.069	170	102
AN515-4	4-40	NC-2A	.112	.086	275	165
AN515-6	6-32	NC-2A	.138	.103	410	246
AN515-8	8-32	NC-2A	.164	.120	660	396
AN520-10	10-32	NF-2A	.190	.137	960	575
AN520-416	1/4-28	UNF-2A	.250	.175	1790	1075

Code:
First dash number indicates screw size.
Second dash number indicates screw length.
B between first and second dash number indicates brass screw with black oxide finish.
PB before first dash number indicates brass screw with cadmium plating.
UB before first dash number indicates plain brass screw.
C before first dash number indicates corrosion-resistant steel screw.
DD before first dash number indicates aluminum alloy screw.
Plain first dash number indicates carbon steel.
R between first and second dash numbers indicate recessed head.
Example of part number:
AN515C4-4 = 4-40 corrosion-resistant steel screw, 1/2-inch long, slotted head.
Material:
Carbon steel, Federal Specification QQ-S-633.
Corrosion-resistant steel, Federal Specification QQ-S-763.
Brass, Federal Specification QQ-B-613.

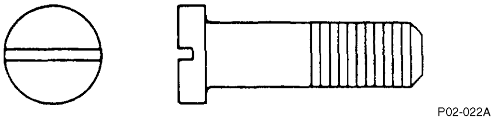
Table 2-15. AN500 and AN501, Fillister Head, Machine Screws



Part Number	Thread		Diameter	Head Height	
	Size	Class		Min	Max
AN500-2	2-56	NC-2	.086	.070	.083
AN500-3	3-48	NC-2	.099	.082	.095
AN500-4	4-40	NC-2	.112	.094	.107
AN500-5	5-40	NC-2	.125	.106	.120
AN500-6	6-32	NC-2	.138	.118	.132
AN500-8	8-32	NC-2	.164	.141	.156
AN501-10	10-32	NF-2	.190	.165	.180
AN501-416	1/4-28	NF-2	.250	.219	.237
AN501-516	5/16-24	NF-2	.312	.276	.295
AN501-616	3/8-24	NF-2	.375	.333	.355

Code:
Plain dash number indicates plain steel.
A before first dash number indicates drilled head.
B before first dash number indicates brass screw.
C before first dash number indicates corrosion-resistant steel screw.
Example of part number:
AN500A6-8 = 6-32 drilled carbon steel screw, 1/2-inch long.
Material:
Carbon steel, Federal Specification QQ-S-633.
Corrosion-resistant steel, Federal Specification QQ-S-763.
Brass, Federal Specification QQ-B-626.

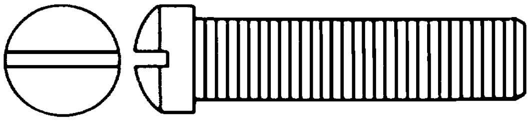
Table 2-16. AN115401 Through AN115600, Flat Fillister Head, Machine Screws; AN115601 Through AN115800, Flat Fillister Head, Drilled Shank Screws; and AN115801 Through AN116150, Flat Fillister Drilled Head, Machine Screws



Part Number	Thread		Diameter	
	Size	Class	Min	Max
AN115405 through AN115437 AN115605 through AN115634 AN115805 through AN115837	10-32	NF-3A	.186	.189
AN115855 through AN115887	1/4-20	UNC-3A	.246	.249
AN115455 through AN115485 AN115655 through AN115684 AN115905 through AN115937	1/4-28	UNF-3A	.246	.249
AN115955 through AN115988	5/16-18	UNC-3A	.309	.312
AN115505 through AN115535 AN115705 through AN115734 AN116005 through AN116038	5/16-24	UNF-3A	.309	.312
AN116055 through AN116087	3/8-16	UNC-3A	.371	.374
AN115555 through AN115583 AN115755 through AN115780 AN116105 through AN116137	3/8-24	UNF-3A	.371	.374

Material:
Steel, Aeronautical Material Specification AMS5061.

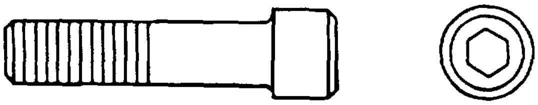
Table 2-17. AN116901 Through AN116912 and AN116925 Through AN117040, Oval Fillister Head, Machine Screws; AN116913 Through AN116924 and AN117041 Through AN117080, Oval Fillister Drilled Head, Machine Screws



Part Number	Thread		Diameter
	Size	Class	
AN116902 through AN116910 AN116914 through AN116924	4-40	NC-2A	.112
AN116926 through AN116954 AN116962 through AN116990	6-32	NC-2A	.138
AN117002 through AN117030 AN117042 through AN117070	8-32	NC-2A	.164

Material:
Steel, Aeronautical Material Specification AMS5061.

Table 2-18. NAS608 and NAS609, Socket Head, Machine Screws



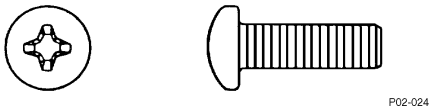
Thread		Diameter		Head Height		Material Strength	
Size	Class	Min	Max	Min	Max	Tensile Strength	Shear Strength
0-80	NF-3A	.058	.060	.057	.060	290	245
1-64	NC-3A	.071	.073	.070	.073	420	360
2-56	NC-3A	.084	.086	.083	.086	590	510
4-40	NC-3A	.109	.112	.109	.112	970	860
4-48	NF-3A	.109	.112	.109	.112	1060	860
6-32	NC-3A	.135	.138	.138	.221	1450	1310
6-40	NF-3A	.135	.138	.134	.138	1620	1310
8-32	NC-3A	.161	.164	.160	.164	2240	1865
8-36	NF-3A	.161	.164	.160	.164	2350	1865
10-24	NC-3A	.186	.190	.185	.190	2800	2495

Table 2-18. NAS608 and NAS609, Socket Head, Machine Screws - Continued

Thread		Diameter		Head Height		Material Strength	
Size	Class	Min	Max	Min	Max	Tensile Strength	Shear Strength
10-32	NC-3A	.186	.190	.185	.190	3200	2495
1/4-20	UNC-3A	.246	.250	.244	.250	5090	4350
1/4-28	UNF-3A	.246	.250	.244	.250	5820	4350
5/16-18	UNC-3A	.308	.312	.306	.313	8380	6815
5/16-24	UNF-3A	.308	.312	.306	.313	9280	6815
3/8-16	UNC-3A	.370	.375	.368	.375	12,400	9830
3/8-24	UNF-3A	.370	.375	.368	.375	14,050	9830
7/16-14	UNC-3A	.432	.437	.430	.438	17,010	13,405
7/16-20	UNF-3A	.432	.437	.430	.438	18,990	13,405
1/2-13	UNC-3A	.494	.500	.492	.500	22,700	17,535
1/2-20	UNF-3A	.494	.500	.492	.500	25,580	17,535
5/8-11	UNC-3A	.619	.625	.616	.625	36,200	27,450
5/8-18	UNF-3A	.619	.625	.616	.625	41,000	27,450

Code:
C before first dash number indicates corrosion-resistant steel.
P following second dash number indicates cadmium plating.
H between dash numbers indicate drilled head.
Example of part number:
NAS608-4-8P = socket head cap screw, 1/4-inch diameter, 1/2-inch long, cadmium-plated.
Material:
Steel, Federal Specification QQ-S-624.
Corrosion-resistant steel, Federal Specification QQ-S-763.

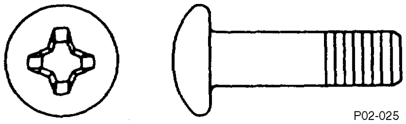
Table 2-19. NAS600 Through NAS606 and NAS610 Through NAS616, Pan Head, Machine Screws



Part Number	Thread		Diameter	Head Height		Tensile Strength
	Size	Class		Min	Max	
NAS600 NAS610	4-40	NC-2A	.112	.070	.080	960
NAS601 NAS611	6-32	NC-2A	.138	.087	.097	1430
NAS602 NAS612	8-32	NC-2A	.164	.105	.115	2230
NAS603 NAS613	10-32	NF-3A	.190	.139	.151	3180
NAS604 NAS614	1/4-28	UNF-3A	.250	.162	.175	5790
NAS605 NAS615	5/16-24	UNF-3A	.312	.203	.218	9260
NAS606 NAS616	3/8-24	UNF-3A	.375	.244	.261	14,000

Code:
First dash number indicates screw size.
Second dash number indicates screw length.
Example of part number:
NAS601-8 = 6-32 pan head, fully threaded machine screw, 1/2-inch long, cross recess.
Material:
Steel, Military Specification MIL-S-8695.

Table 2-20. NAS623 Pan Head, Short Thread, Machine Screw



First Dash Number	Thread		Diameter		Head Height		Material Strength	
	Size	Class	Min	Max	Min	Max	Tensile Strength	Shear Strength
-2	8-32	NC-2A	.161	.163	.105	.115	1740	2005
-3	10-32	NF-3A	.187	.189	.122	.133	2490	2690
-4	1/4-28	UNF-3A	.247	.249	.162	.175	4520	4600
-5	5/16-24	UNF-3A	.309	.312	.203	.218	7240	7300
-6	3/8-24	UNF-3A	.372	.374	.244	.261	10,950	10,500

Code:

First dash number indicates screw diameter.

Second dash number indicates screw grip and length.

W after second dash number indicates Type I plating.

F preceding first dash number indicates Frearson recess.

Example of part number:

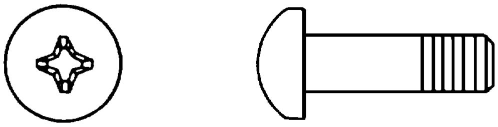
NAS623-4-10 = 1/4-inch diameter screw, .625 grip, Type II plating, Phillips recess.

NAS623F4-10W = 1/4-inch diameter screw, .625 grip, Type I plating, Frearson recess.

Material:

Steel, Military Specifications MIL-S-5000, MIL-S-5626, MIL-S-6049, or MIL-S-6098.

Table 2-21. NAS1402 Through NAS1406, Pan Head, Machine Screws



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Part Number	Thread		Diameter		Head Height		Material Strength	
	Size	Class	Min	Max	Min	Max	Tensile Strength	Shear Strength
NAS1402	8-32	NC-2A	.1610	.1635	.105	.115		
NAS1403	10-32	NF-3A	.1870	.1895	.122	.133		
NAS1404	1/4-28	UNF-3A	.2470	.2495	.162	.175	6190	4650
NAS1405	5/16-24	UNF-3A	.3095	.3120	.203	.218	9820	7300
NAS1406	3/8-24	UNF-3A	.3720	.3745	.244	.261	15,200	10,500

Code:

First dash number indicates screw size.

Second dash number indicates screw grip and length.

W added to dash number indicates Type I plating.

Example of part number:

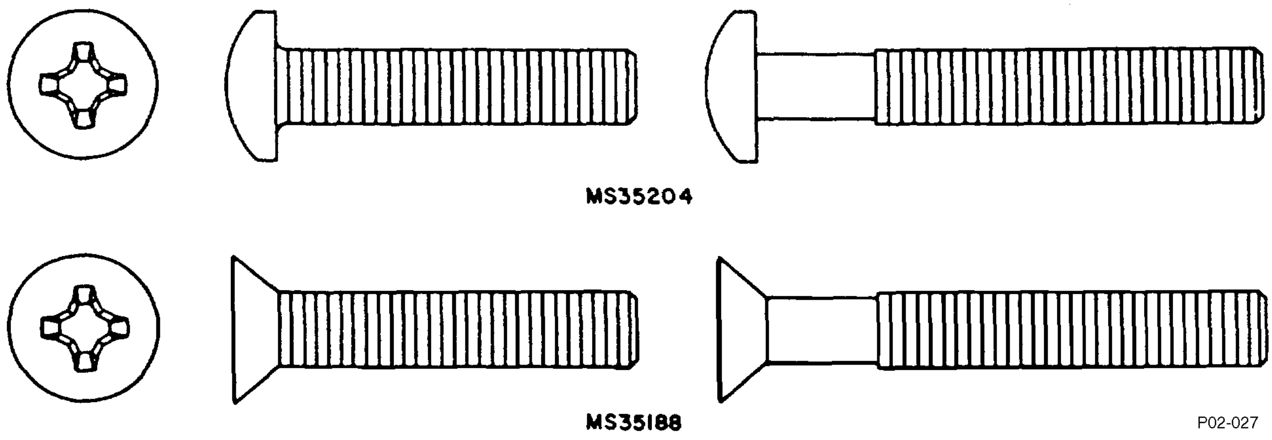
NAS1404-8 = 1/4-28 screw, 0.500 grip, pan head, cross-recessed, Type II plating.

NAS1404-8W = 1/4-28 screw, 0.500 grip, pan head, cross-recessed, Type I plating.

Material:

Steel, Military Specification MIL-S-6098.

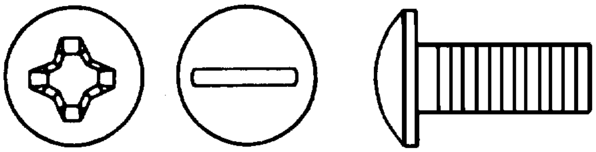
Table 2-22. MS35188 Through MS35203, Flathead, and MS35204 Through MS35219, Pan Head, Machine Screws



				Head Height			
Thread		Diameter		Full Head		Undercut Head	
Size	Class	Min	Max	Min	Max	Min	Max
2-56	NC	.071	.086	.040	.051	.028	.036
2-64	NF	.073	.086	.040	.051	.028	.036
4-40	NC	.092	.112	.055	.067	.028	.036
4-48	NF	.095	.112	.055	.067	.028	.036
6-32	NC	.114	.138	.069	.083	.048	.058
6-40	NF	.118	.138	.069	.083	.048	.058
8-32	NC	.139	.164	.084	.100	.059	.070
8-36	NF	.142	.164	.084	.100	.059	.070
10-24	NC	.158	.190	.098	.116	.069	.081
10-32	NF	.165	.190	.098	.116	.069	.081
1/4-20	UNC	.212	.250	.131	.153	.092	.107
1/4-28	NF	.222	.250	.131	.153	.092	.107
5/16-18	UNC	.271	.312	.165	.191	.116	.134
5/16-24	NF	.280	.312	.165	.191	.116	.134
3/8-16	UNC	.328	.375	.200	.230	.140	.161
3/8-24	NF	.343	.375	.200	.230	.140	.161

Code:
Dash number indicates size and length of screw.
Example of part number:
MS35188-51.
Material:
Carbon steel, Federal Specification QQ-S-633.

Table 2-23. AN526 Truss Head, Machine Screws



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Thread		Diameter	Head Height	Material Strength	
Size	Class			Tensile Strength	Shear Strength
6-32	NC-2A	.138	.086	410	246
8-32	NC-2A	.164	.102	660	396
10-32	NF-2A	.190	.118	960	575
1/4-28	UNF-2A	.250	.150	1790	1075

Code:

R between first and second dash number indicates recessed-head screw.

C before first dash number indicates corrosion-resistant steel screw.

DD before first dash number indicates aluminum alloy.

Example of part number:

AN526DD1032-8 = 10-32 aluminum alloy screw, 1/2-inch long, slotted head.

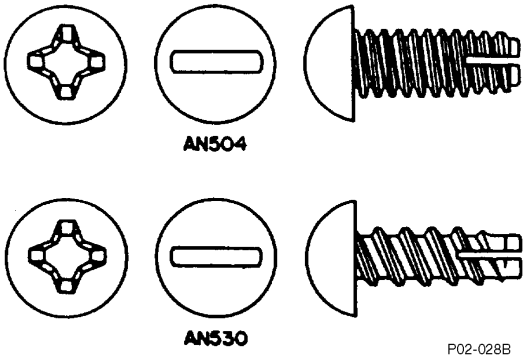
Material:

Carbon steel, Federal Specification QQ-S-633.

Corrosion-resistant steel, Federal Specification QQ-S-763.

Aluminum alloy, Federal Specification QQ-S-267.

Table 2-24. AN504 Roundhead, Self-Tapping, Machine Screws and AN530 Roundhead, Self-Tapping, Sheet Metal Screws



Part Number	Size	Diameter	Head Height
AN530	2-32	.088	.069
AN530	4-24	.114	.086
AN504	4-40	.112	.086
AN530	6-20	.139	.103
AN504	6-32	.138	.103
AN530	8-18	.166	.120
AN504	8-32	.164	.120
AN530	10-16	.189	.137
AN504	10-32	.190	.137
AN530	1/4-14	.246	.170
AN504	1/4-28	.250	.175

Code:
C before first dash number indicates corrosion-resistant steel screw.
R between first and second dash numbers indicates recessed-head screw.
Example of part number:
AN504-4-8 = 4-40, carbon steel, slotted-head screw, 1-1/2 inch long.
Material:
Carbon steel, Federal Specification QQ-S-633.
Corrosion-resistant steel, Federal Specification QQ-S-763.

Table 2-25. Hole Sizes for AN504 Roundhead, Self-Tapping, Machine Screws

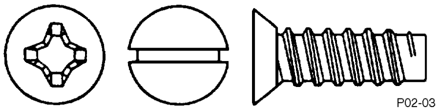
Hardest Material Tapped, (An, Aeronautical, Federal, or Military Specification; Steel or Alloy Number)	Screw Size Number	.015 through 0.018	.018 through 0.040	.041 through 0.056	.057 through 0.071	.072 through 0.089	.091 through 0.110	.103 through 0.115	.113 through 0.137	.132 through 0.148	Over 0.148
				Drill holes for screws to diameters specified below (inches).							
STEEL											
		Thickness of Hardest Material Tapped (Inches)									
Carbon mild, quarter- hard (55,000 PSI minimum tensile strength) Military Specification MIL-S-7952	4-40	.086	.086	.086	.093	.093		.096	.096	.096	
	6-32	.104	.104	.104	.113	.113		.113	.120	.120	
	8-32	.128	.128	.128	.140	.140		.140	.144	.144	
Chrome-molybde-num normalized (1) (90,000 PSI minimum tensile strength) Military Specification MIL-S-18729	4-40	.089	.089	.089	.089	.096	.098		.098		
	6-32	.110	.110	.110	.110	.116	.120		.120		
	8-32	.136	.136	.136	.136	.140	.144		.144		
Corrosion-resisting, half-hard (1) (150,000 PSI minimum tensile strength)	4-40	.093	.093	.096							
	6-32	.110	.110	.110	.116						
	8-32	.136	.136	.140	.140	.144					

Table 2-25. Hole Sizes for AN504 Roundhead, Self-Tapping, Machine Screws - Continued

Hardest Material Tapped, (An, Aeronautical, Federal, or Military Specification; Steel or Alloy Number)	Screw Size Number	.015 through 0.018	.018 through 0.040	.041 through 0.056	.057 through 0.071	.072 through 0.089	.091 through 0.110	.103 through 0.115	.113 through 0.137	.132 through 0.148	Over 0.148
				Drill holes for screws to diameters specified below (inches).							
ALUMINUM ALLOY											
Aluminum magnesium chrome, half-hard (34,000 PSI minimum tensile strength) Federal Specification QQ-A-318	4-40	.086	.086	.086	.086	.089			.093		
	6-32	.104	.104	.104	.104	.106			.106		
	8-32	.128	.128	.128	.128	.136			.140		
Aluminum copper magnesium manganese heat treated (52,000 PSI minimum tensile strength) Federal Specification QQ-A-362	4-40	.086	.086	.086	.086	.089	.089		.093		
	6-32	.104	.104	.104	.104	.106	.106		.106		
	8-32	.128	.128	.128	.128	.136	.140		.140		
Aluminum copper magnesium (1.5 percent manganese) heat treated (62,000 PSI minimum tensile strength) Federal Specification QQ-A-355	4-40	.086	.086	.086	.089	.089					
	4-40				.096	.096	.096	.096	.098	.098	.098
	6-32				.116	.116	.116	.116	.120	.120	.120
	8-32				.144	.144	.144	.144	.147	.147	.147
	6-32	.104	.104	.104	.109	.109					
	8-32	.129	.129	.129	.136	.136					

(1) Lubricate with heavy cutting oil.

Table 2-26. AN531 82-Degree, Flathead, Self-Tapping, Sheet Metal Screw



Size	Diameter	Head Height	
		Min	Max
4-24	.114	.055	.067
6-20	.139	.069	.083
8-18	.166	.084	.100
10-16	.189	.098	.116
1/4-14	.246	.127	.148

Code:

C before first dash number indicates corrosion-resistant steel screw.

F between first and second dash numbers indicates fluted or slotted end.

R between first and second dash number indicates recessed-head screw.

Example of part number:

AN531C6RF8 = 6-20 corrosion-resistant steel, recessed head, fluted end thread cutting screw, 1/2-inch long.

Material:

Carbon steel, Military Specification MIL-S-6033.

Corrosion-resistant steel, Military Specification MIL-S-6033.

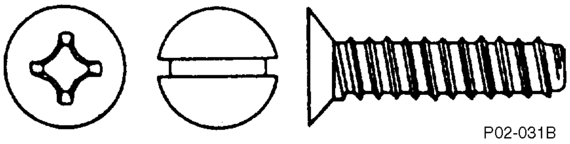
2.1.13 Drive Screws.

WARNING

Self-tapping screws should never be used to replace standard screws, nuts, bolts, or rivets in the original structure.

(Refer to Table 2-29.) Drive screws are self-tapping screws used to attach nameplates to castings and to seal drain holes in tubular structures. Drive screws differ from other self-tapping screws in that the heads are not formed to fit screwdrivers, and they are not intended to be removed after installation. Drive screws are installed by driving the screw into a drilled hole with a hammer.

Table 2-27. NAS548 100-Degree, Flathead, Self-Tapping, Sheet Metal Screw



Size	Diameter		Head Height	
	Min	Max	Min	Max
4-24	.082	.086	.040	.048
6-20	.099	.104	.051	.060
8-18	.116	.122	.062	.072
10-16	.135	.141	.072	.083
1/4-14	.185	.192	.097	.110

Code:

F after basic part number indicates Frearson recess.

P after basic part number indicates Phillips recess.

S after basic part number indicates slotted recess.

C after last dash number indicates chromium plate. No letter indicates cadmium plate.

Example of part number:

NAS548F8-8C = 8-18 chromium-plated, 100-degree head Type B tapping screw, with Frearson recess, 1/2-inch long.

Material:

Steel, Military Specification MIL-S-18729.

2.1.14 Wood Screws.

(Refer to Table 2-30 and Table 2-31.) Wood screws are self-tapping screws used in wood structures. Both a roundhead and an 82-degree countersunk, flathead screw are available manufactured from steel or brass.

Table 2-28. Hole Sizes for AN530 Roundhead and AN531 82-Degree, Flathead, Self-Tapping, Sheet Metal Screws

Hardest Material Tapped. (AN, Aeronautical, Federal, or Military Specification; Steel or Alloy Number)	Screw Size Number	Thickness of Hardest Material Tapped (Inches)									
		.015 through .018	.018 through .040	.041 through .056	.057 through .071	.072 through .089	.091 through .110	.103 through .115	.113 through .137	.132 through .148	Over .148
					Drill holes for screws to diameters specified below (inches).						
STEEL											
Carbon mild, quarter-hard (55,000 PSI minimum tensile strength) Military Specification MIL-S-7952	4-24	.086	.091	.096	.099	.101					
	1/4-14	.185	.185	.191	.199	.204		.209	.228	.228	.234
	10-16	.144	.144	.144	.152	.157		.161	.169	.169	.173
	6-20	.104	.106	.111	.116	.120		.128			
	8-18	.116	.116	.128	.136	.140		.149	.149	.152	
Chrome-molybdenum, normalized (1) (90,000 PSI minimum tensile strength) Military Specification MIL-S-18729	4-24	.089	.091	.096	.099	.101					
	6-20	.110	.110	.116	.120	.120	.128				
	8-18	.128	.128	.136	.136	.140	.144		.149		
	10-16	.154	.154	.154	.157	.161	.169		.169	.169	.173
	1/4-14	.191	.191	.191	.199	.204	.209		.228	.228	.234
Corrosion-resisting, half-hard (1) (150,000 PSI minimum tensile strength)	4-24	.091	.093	.099							

Table 2-28. Hole Sizes for AN530 Roundhead and AN531 82-Degree, Flathead, Self-Tapping, Sheet Metal Screws - Continued

Hardest Material Tapped. (AN, Aeronautical, Federal, or Military Specification; Steel or Alloy Number)	Screw Size Number	Thickness of Hardest Material Tapped (Inches)									
		.015 through .018	.018 through .040	.041 through .056	.057 through .071	.072 through .089	.091 through .110	.103 through .115	.113 through .137	.132 through .148	Over .148
					Drill holes for screws to diameters specified below (inches).						
	6-20	.110	.110	.116	.116						
	8-18	.128	.128	.136	.140	.144					
	10-16			.157	.161	.166	.169				
	1/4-14			.191	.199	.204	.209	.213	.228		
ALUMINUM ALLOY											
Aluminum magnesium chrome, half-hard (34,000 PSI minimum tensile strength) Federal Specification QQ-A-318	4-24	.086	.086	.091	.096	.099					
	6-20	.104	.104	.106	.111	.116					
	8-18	.116	.116	.116	.128	.136			.149		
	10-16	.144	.144	.144	.144	.152			.161	.169	
	1/4-14	.180	.185	.185	.191	.199			.209	.218	
Aluminum copper magnesium manganese heat treated (52,000 PSI minimum tensile strength) Federal Specification QQ-A-362	4-24	.086	.086	.091	.096	.096	.099				
	6-20	.104	.104	.106	.106	.111	.113		.116		
	8-18	.116	.116	.116	.128	.128	.136		.140		
	10-16	.144	.144	.144	.144	.152	.152		.157	.161	
	1/4-14	.185	.185	.185	.191	.199	.204		.209	.228	

Table 2-28. Hole Sizes for AN530 Roundhead and AN531 82-Degree, Flathead, Self-Tapping, Sheet Metal Screws - Continued

Hardest Material Tapped. (AN, Aeronautical, Federal, or Military Specification; Steel or Alloy Number)	Screw Size Number	Thickness of Hardest Material Tapped (Inches)									
		.015 through .018	.018 through .040	.041 through .056	.057 through .071	.072 through .089	.091 through .110	.103 through .115	.113 through .137	.132 through .148	Over .148
					Drill holes for screws to diameters specified below (inches).						
Aluminum copper magnesium (1.5 percent manganese) heat treated (62,000 PSI minimum tensile strength) Federal Specification QQ-A-355	4-24	.086	.086	.086	.091	.096					

Table 2-28. Hole Sizes for AN530 Roundhead and AN531 82-Degree, Flathead, Self-Tapping, Sheet Metal Screws - Continued

Hardest Material Tapped. (AN, Aeronautical, Federal, or Military Specification; Steel or Alloy Number)	Screw Size Number	Thickness of Hardest Material Tapped (Inches)									
		.015 through .018	.018 through .040	.041 through .056	.057 through .071	.072 through .089	.091 through .110	.103 through .115	.113 through .137	.132 through .148	Over .148
					Drill holes for screws to diameters specified below (inches).						
	6-20	.104	.104	.106	.106	.111					
	8-18	.116	.116	.116	.128	.128					
	10-16	.144	.144	.144	.149	.152					
	1/4-14	.185	.185	.185	.191	.199					
Castings, aluminum alloy or aluminum	4-24				.099	.101	.101				
	6-20				.116	.120	.120	.128			
	8-18				.144	.144	.144	.149	.149	.149	.152
	10-16				.157	.157	.157	.161	.169	.169	.173
	1/4-14				.191	.199	.204	.209	.221	.228	.234
(1) Lubricate with heavy cutting oil.											

2.1.15 Setscrews.

2.1.16 Hexagon and Fluted Socket, Headless Setscrews. (Refer to Table 2-32.) Setscrews are used to position and hold in place components such as gears on a shaft. These set-screws are available with many different point styles.

2.1.17 Self-Locking Setscrews. (Refer to Table 2-33.) These self-locking setscrews are similar to the hexagon socket setscrews except they have a strip type or a button type locking element built into the shank. This locking element when compressed by the threads of the hole locks the setscrew in place.

a. An effective aid in removing or tightening screws, use screw Grab Compound (NSN) 8030-01-361-0041).

2.1.18 Extracting Broken Screws. The screw extractor has become indispensable for quick and easy removal of broken screws. Screw extractors are easy to use.

a. Center Punch Screw.

b. Drill pilot hole in broken screw (see Figure 2-2). Drill fixture may be used to insure that hole follows the center of screw.

c. Select proper screw extractor for screw size (see Table 2-34).

d. Drive screw extractor into drilled hole in screw.

e. Remove stud, using tap wrench.

2.1.19 Always use the largest screw extractor possible. For ordinary condition it is recommended using the size drill shown opposite the screw extractor's size. Unusual conditions may, however, require the use of a smaller or larger drill, depending on the length of the broken part or its depth in the hole.

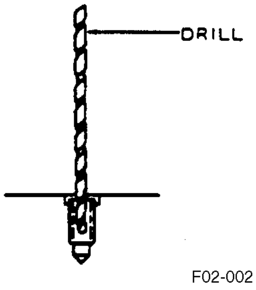


Figure 2-2. Drilling Pilot Hole in Broken Screw

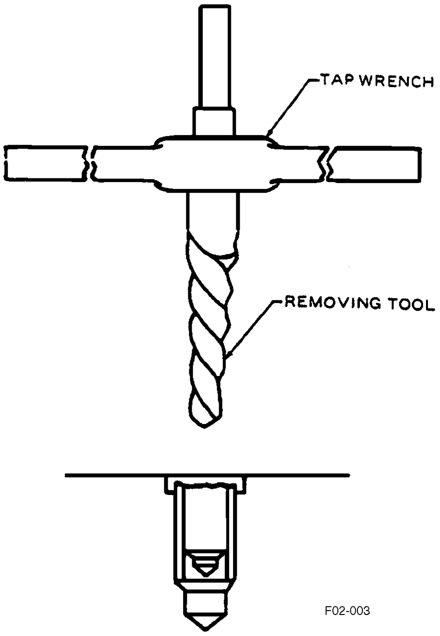
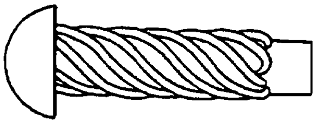


Figure 2-3. Removing Broken Screw

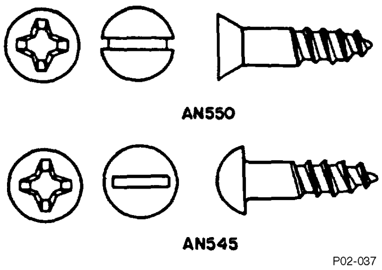
Table 2-29. AN535 Roundhead, Drive Screw



Size	Diameter		Head Height		Drill Size	
	Min	Max	Min	Max	Number	Diameter
00	.057	.060	.026	.034	55	.052
0	.072	.075	.041	.049	51	.067
2	.097	.100	.059	.069	44	.086
4	.112	.116	.075	.086	37	.104
6	.136	.140	.091	.103	31	.120
8	.162	.167	.107	.120	27	.144
10	.177	.182	.123	.137	20	.161
12	.206	.212	.139	.153	11	.191
14	.236	.242	.155	.170	2	.221

Code:
First dash number indicates screw size.
Second dash number indicates length in 1/16-inch increments.
Example of part number:
AN535-2-2 = size 2 screw, 1/8-inch long.
Material:
Steel, Military Specification MIL-S-18729.

Table 2-30. AN545 Roundhead, and AN550 Flathead, Wood Screws



Size	Threads Per Inch	Diameter		Head Height			
				Roundhead		Flathead	
		Min	Max	Min	Max	Min	Max
2	26	.079	.090	.059	.069	.040	.051
3	24	.092	.103	.067	.078	.048	.059
4	22	.105	.116	.075	.086	.055	.067
5	20	.118	.129	.083	.095	.062	.075
6	18	.131	.142	.091	.103	.069	.083
8	15	.157	.168	.107	.120	.084	.100
10	13	.183	.197	.123	.137	.098	.116
12	11	.209	.220	.139	.153	.112	.132
14	10	.235	.248	.155	.170	.127	.148
16	9	.261	.272	.171	.187	.141	.164

Code:

First dash number indicates screw size.

Second dash number indicates length of screw in 1/16-inch increments.

B before first and second dash number indicates brass screw.

R between first and second dash number indicates recessed-head screw.

Example of part number:

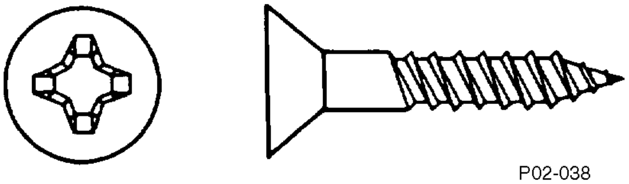
AN545B10R = 10-13 recessed-head, brass screw, 1-1/4 inches long.

Material:

Carbon steel, Federal Specification QQ-S-633.

Brass, Federal Specification QQ-B-613.

Table 2-31. MS35492 Flathead, and MS35493 Roundhead, Wood Screws



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Size	Threads Per Inch	Diameter		Head Height			
				Flathead		Roundhead	
		Min	Max	Min	Max	Min	Max
2	26	.079	.090			.059	.069
3	14	.092	.103	.048	.059	.067	.078
4	13	.105	.116	.055	.067	.075	.086
5	11	.118	.129	.062	.075	.083	.095
6	18	.131	.142	.069	.083	.091	.103
7	16	.144	.155	.076	.091	.099	.111
8	15	.157	.168	.084	.100	.107	.120
9	14	.170	.181	.091	.108	.173	.186
10	13	.183	.194	.098	.116	.123	.137
12	11	.209	.220	.112	.132	.139	.153
14	10	.235	.246	.127	.148	.155	.170
16	9	.171	.187	.141	.164	.261	.272

Code:

The MS part number consists of the Military Standard number plus the dash number.

Example of part number:

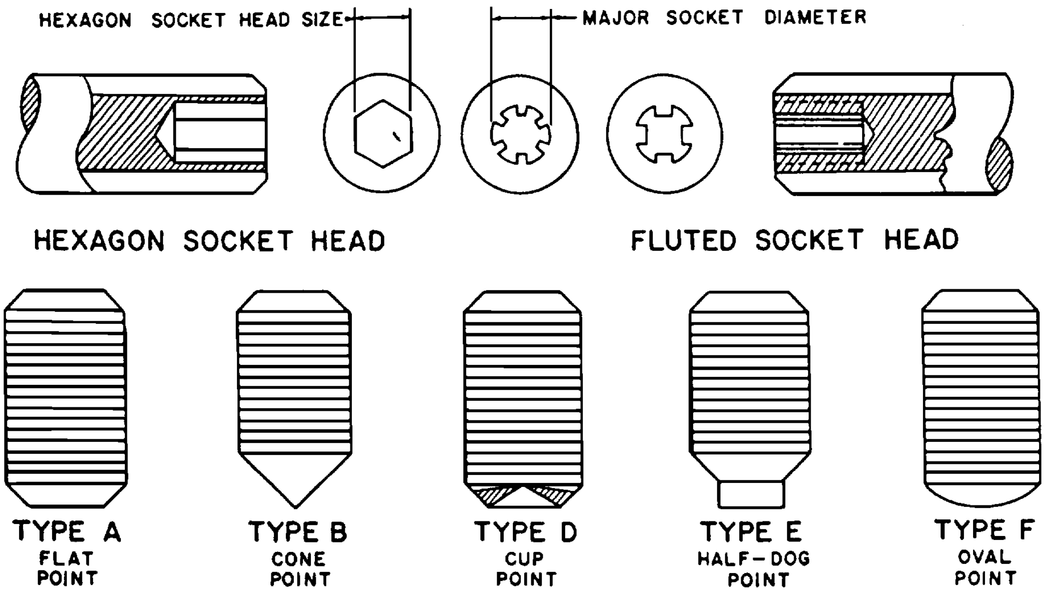
MS35492-1.

Material:

Carbon steel, Federal Specification QQ-S-633.

Brass, Federal Specification QQ-B-626.

Table 2-32. AN565 Hexagon and Fluted Socket, Headless Setscrew



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	Thread		Hexagon Socket Head Size		Fluted Socket Head		
First Dash Number	Size	Class	Max	Min	Number of Flutes	Socket Diameter (Major)	
-2	2-56	NC-3A	.0355	.0350	4	.050	.049
-4	4-40	NC-3A	.0510	.0500	6	.062	.061
-6	6-32	NC-3A	.0635	.0625	4	.079	.078
-8	8-32	NC-3A	.0791	.0781			
-10	10-32	NF-3A	.0947	.0937			
-416	1/4-20	UNF-3A	.1270	.1250			
-516	5/16-24	UNF-3A	.1582	.1562			
-616	3/8-24	UNF-3A	.1895	.1875			
-816	1/2-20	UNF-3A	.2520	.2500			

The fluted socket head setscrew is available in number 2, 4, and 6 sizes only.

Code:

First dash number indicates screw size.

Point style type before first dash number indicates type of point.

H between dash numbers indicates hexagon socket head.

Table 2-32. AN565 Hexagon and Fluted Socket, Headless Setscrew - Continued

L between dash numbers indicates fluted socket head.

C after point style type indicates corrosion resisting steel setscrew.

Example of part number:

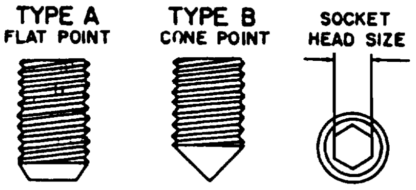
AN565B4H10 = Number 4-40 size (.112-inch diameter), 5/8-inch long, steel, hexagon socket head setscrew with type B point.

Material:

Steel, high grade alloy (4037, 4137, 8630, or 8740).

Corrosion-resistant steel, Military Specification MIL-S-7720.

Table 2-33. NAS1081 Self-Locking Setscrew



	Thread		Socket Head Size	
First Dash Number	Size	Class	Max	Min
-02	2-56	NC-3A	.0355	.0350
-04	4-40	NC-3A	.0510	.0500
-06	6-32	NC-3A	.0635	.0625
-08	8-32	NC-3A	.0791	.0781
-3	10-32	NF-3A	.0947	.0937
-4	1/4-28	UNF-3A	.1270	.1250
-5	5/16-24	UNF-3A	.1582	.1562
-6	3/8-24	UNF-3A	.1895	.1875
-8	1/2-20	UNF-3A	.2520	.2500

Code:

First dash number indicates screw size.

Second dash number indicates screw length.

Dash before first dash number indicates cadmium-plated steel setscrew.

Table 2-33. NAS1081 Self-Locking Setscrew - Continued

	Thread		Socket Head Size	
First Dash Number	**Size**	**Class**	**Max**	**Min**
C before first dash number indicates corrosion-resistant steel setscrew. A between dash numbers indicates flat point; B, cone point. L after last dash number indicates strip-type locking element; N, button type. Example of part number: NAS1081-4A12 = 1/4-28 UNF-3A x 3/4-inches long, cadmium-plated steel, flat point, self-locking setscrew. NAS1081C4B12L = 1/4-28 UNF-3A x 3/4-inches long, corrosion-resistant steel, cone point, self-locking setscrew with strip-type locking element. Material: Chrome-molybdenum steel, Military Specification MIL-S-6758. Corrosion-resistant steel, Military Specification MIL-S-7720.				

Table 2-34. Drill and Extractor Sizes

Extractor No.	Diam. at Small End	Diam. at Large End	Overall Length Inches	For Screws and Bolts Sizes Inches	For Pipe Sizes Inches	Size Drill to Use
1	.054	5/32	2	3/16 to 1/4		5/64
2	.080	3/16	2 3/8	1/4 to 5/16		7/64
3	1/8	1/4	2 11/16	5/16 to 7/16		5/32
4	3/16	21/64	2 7/8	7/16 to 9/16		1/4
5	1/4	7/16	3 3/8	9/16 to 3/4	1/8, 1/4	17/64
6	3/8	19/32	3 3/4	3/4 to 1	3/8	13/32
7	1/2	3/4	4 1/8	1 to 1 3/8	1/2	17/32
8	3/4	1	4 3/8	1 3/8 to 1 3/4	3/4	13/16
9	1	1 9/32	4 5/8	1 3/4 to 2 1/8	1	1 1/16
10	1 1/4	1 9/16	5	2 1/8 to 2 1/2	1 1/4	1 5/16
11	1 1/2	1 7/8	5 5/8	2 1/2 to 3	1 1/2	1 9/16
12	1 7/8	2 5/16	6 1/4	3 to 3 1/2	2	1 15/16

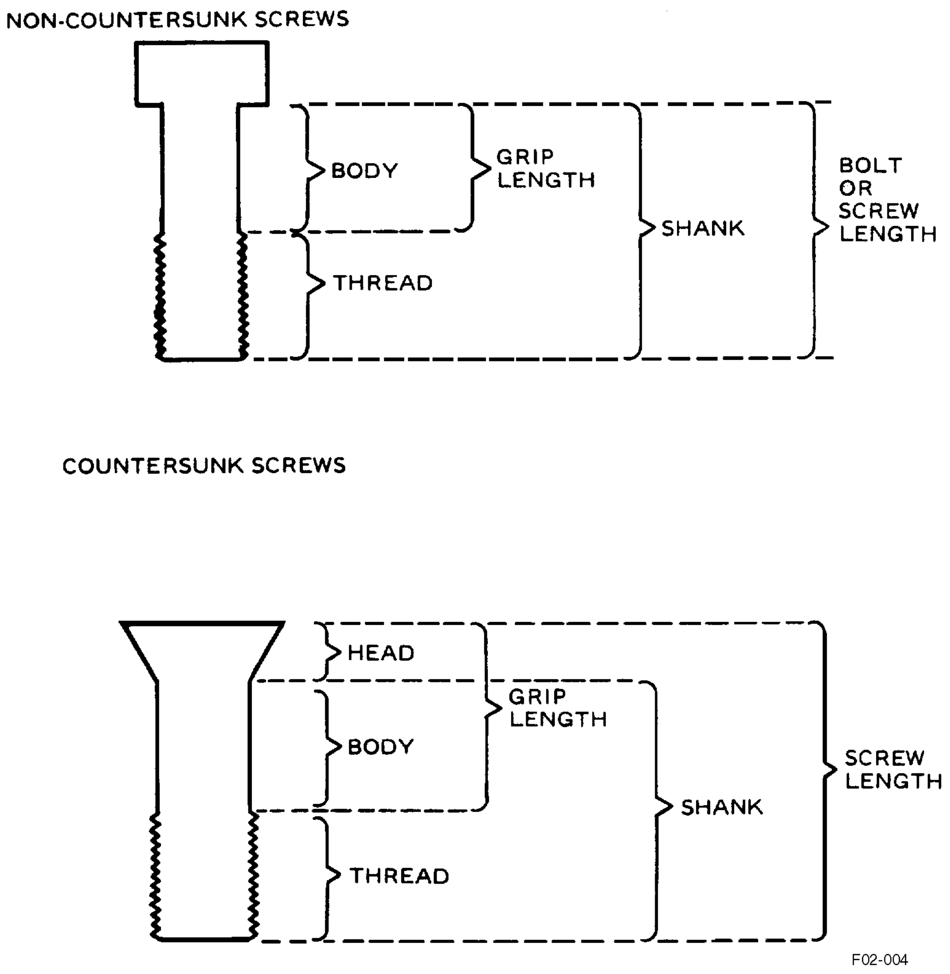


Figure 2-4. Parts of a Screw

CHAPTER 3
BOLTS

3.1 BOLTS.

Most bolts used in aircraft structures are either general purpose, internal wrenching, or close-tolerance AN (Air Force-Navy), NAS (National Aircraft Standard), or MS (Military Standard) bolts. In certain cases, aircraft manufacturers are compelled to make bolts of different dimensions or greater strength than the standard types. Such bolts are made for a particular application and it is of extreme importance to use like bolts in replacement. If such bolts are not available and must be fabricated locally, the identical material and heat treatment specified in the applicable drawings, or an authorized substitute material with its proper heat treatment, should be used. Such special bolts are usually identified by the letter S stamped on the head.

3.1.1 Grip Length. The distance from the under-head bearing surface to the start of the thread. Accordingly, the thickness of material held together by the bolt is called the grip. The ideal installation would have a bolt whose grip length would be a few thousands of an inch shorter than the actual grip to avoid bottoming the nut. All bolt installations which involve self-locking or plain nuts will have at least two complete threads protruding through the nut. These two threads include the chamfered end of the bolt. However, bolts of slightly greater grip length than that required may be used if washers are placed under the nut or bolt head, or, if plate nuts are used, shims are added under the plate. To prevent corrosion caused by dissimilar metal contacting surfaces, aluminum alloy washers (AN960) should be used with steel bolts on aluminum alloy parts and steel washers should be used on steel parts. In cases where high torque must be applied to the bolts, steel washers should be used regardless of whether the part is steel or aluminum alloy.

3.1.2 Shank. The shank is the portion of a bolt which lies between the underhead bearing surface and the opposite end.

3.1.3 Fitting Bolts.

3.1.3.1 Bolt Fit. All bolt holes should be drilled to get a good, mechanical fit. The first lettered drill size larger than the nominal bolt diameter is generally used except where AN hexagon bolts are used in light drive fit applications or when NAS close-tolerance or AN clevis bolts are used. Table 1-9 gives the drill sizes for general applications up to one-half inch. All drills above 1/2-inch diameter are requested by the inch-diameter size of the bolt used. Bolt holes must not be oversized or elongated. If they are, the bolt in such a hole will carry none of its shear load until the parts have yielded or deformed enough to allow the bearing surface of the oversized hole to come in contact with the bolt. (See Figure 3-1.) Bolts, unlike rivets, can not be swaged to fill up the hole. Loose bolts may actually cause failure of the other bolts, because the other bolts are forced to carry a load greater than intended. Oversized or elongated holes can be drilled or reamed to take the next larger bolt provided this does not weaken the part. A qualified engineering officer should be consulted before drilling or reaming is resorted to. All bolt holes must be perpendicular to the surface involved to provide full bearing surface for the bolt head and nut.

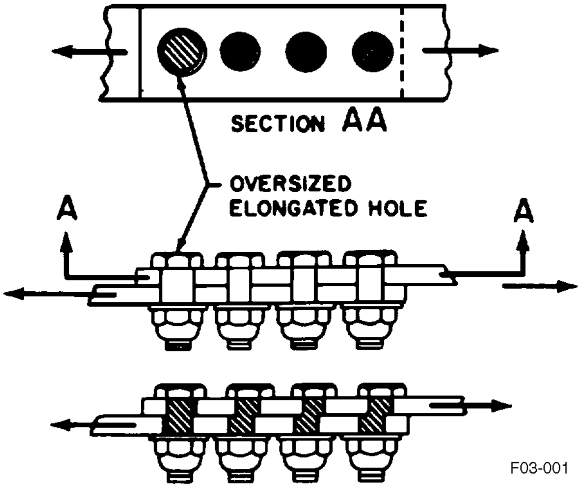


Figure 3-1. Bolted Joint with Oversize Hole

3.1.3.2 Light-Drive Fit. A light-drive fit is defined as an interference fit of 0.0006 inch for 5/8-inch diameter bolts, or a proportionate amount of interference for other size bolts. When drilling for a light-drive fit, particular care must be taken to avoid elliptical, eccentric, or otherwise untrue holes. Although such untrue holes may permit the bolt to be driven according to interference requirements, they will not provide the necessary hole contact along the entire bolt grip length. A light-drive fit can be obtained in this manner:

a. Measure several bolts of the correct nominal size with micrometer. Segregate them into large, medium, and small groups according to the micrometer readings.

b. Drill the initial holes in the material approximately 1/32-inch undersize, then redrill to 1/64-inch undersize.

NOTE

For holes 3/4 inch or larger, the initial holes may be drilled 1/8-inch undersize instead of 1/32 inch.

c. Select a reamer that is known to cut a hole that will give proper interference when using bolts in the small group. Ream one of two holes and try the fit of the small bolts in the reamed holes.

d. If the hole is too small, it can be made larger by using a reamer of the same nominal size, yet one that is known to cut a hole very slightly larger

e. If either of these first two holes is too large for light-drive fits with the small bolts, use the medium or large group of bolts to obtain light-drive fits.

3.1.4 Standard Bolts.

3.1.5 Standard Aircraft Machine Bolts (AN3 Through AN20). The AN3 through AN20 aircraft machine bolts are all purpose structural bolts used for general applications involving tension or shear loads. These bolts are either of cadmium- or zinc-plated, noncorrosion-resistant steel, or anodized aluminum alloy. The bolts conform to Military Specification MIL-B-6812, with rolled threads, NF-3 fit, conforming to Military Specification MIL-S-7742. Steel bolts smaller than 10-32 and aluminum alloy bolts smaller than 1/4-inch diameter are easily overstressed; therefore, they are not used in primary structures. (See Table 3-1.)

3.1.6 Drilled Head Bolts (AN73 Through AN81). These AN drilled head bolts are similar to the standard aircraft machine bolts, except for a deeper head that is drilled to receive wire for securing. These bolts were originally intended for use as engine bolts. Replacement with the AN3 through AN20 series of bolts (single drilled heads) is permissible, but should be done with discretion. (See Table 3-2.) The AN3 through AN20 and the AN73 through AN81 series of bolts are interchangeable from the standpoint of tension and shear strengths. The physical differences preventing direct interchangeability are the somewhat greater head height and the longer thread length of the AN73 through AN81 series. In replacing an engine bolt with the standard aircraft machine bolt, care must be used to prevent jamming the shank against the nut. Should this occur, add washers under the bolt head. When bolts are used as cap screws and the parts are drawn together tightly, spring lock washers may be used when specified. AN73 through AN81 drilled head bolts have been superseded by MS20073 for fine thread bolt; and MS20074 for coarse thread series bolts. AN73 through AN74 and MS20073 and MS20074 bolts of like thread and grip lengths are universally functionally and dimensionally interchangeable.

3.1.7 Stabilized, Nonmagnetic, Corrosion-Resistant Steel Bolts (NAS501). The NAS501 stabilized, nonmagnetic, corrosion-resistant steel bolt is similar to the standard aircraft machine bolt, but is manufactured from a different steel alloy. (See Table 3-3.)

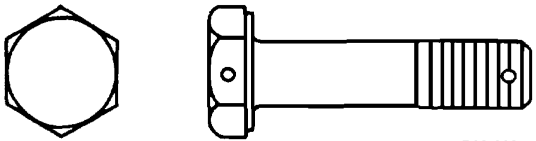
3.1.8 Hex Head, Nonmagnetic, Heat-Resistant, Machine Bolts (NAS1003 Through NAS1020). The NAS1003 through NAS1020 series of bolts is fabricated to Aeronautical Material Specification AMS7478. (See Table 3-4.)

3.1.9 Hex Head Bolts (AN101001 Through AN101900); Drilled Shank Hex Head Bolts (AN101901 Through AN102800); Drilled Hex Head (One Hole) Bolts (AN102801 Through AN103700); and, Drilled Hex Head (Six Holes) Bolts (AN103701 Through AN104600). These bolts are similar to each other except for the holes in the head and shank. These bolts are engine bolts and are manufactured in accordance with Aeronautical Material Specification AMS7452. (See Table 3-5.)

3.1.10 Corrosion-Resistant Steel, Hex Head Bolts (AN104601 Through AN105500); Corrosion-Resistant Steel, Drilled Shank, Hex Head Bolts (AN105501 Through AN106400); Corrosion-Resistant Steel, Drilled Hex Head (One Hole) Bolts (AN106401 Through AN107300); and, Corrosion-Resistant Steel, Drilled Hex Head (Six Holes) Bolts (AN107301 Through AN108200). This series of bolts is similar to the bolts described in paragraph 3.1.9, except that this series is manufactured from corrosion-resistant steel in accordance with Aeronautical Material Specification AMS7472. (See Table 3-6.)

3.1.11 Close-Tolerance, Hex Head, Machine Bolts (AN173 Through AN186); 100-Degree Countersunk Head, Close-Tolerance, High Strength Bolts (NAS333 Through NAS340); Hex Head, Close-Tolerance, Short Thread, 4Al-4Mn Titanium Alloy Bolts (NAS653 Through NAS658); 100-Degree Countersunk Flathead, Close-Tolerance, 4AL-4MN Titanium Alloy Bolts (NAS663 Through NAS668); and, Drilled Hex Head, Close-Tolerance, 4AL-4MN Titanium Alloy Bolts (NAS673 Through NAS678). These close-tolerance bolts are used in applications where the bolted joint is subject to severe load reversals and vibration. The shanks of these bolts have a close tolerance, permitting a very close fit with the use of reamers. The standard AN hex head bolts are otherwise identical, and may be used for the same applications as the steel-close-tolerance bolts, provided a light-drive fit is obtained as described in paragraph 3.1.3.2. The use of a close-tolerance bolt permits elimination of lost motion in landing gears, control systems, etc. They are available in two head types, the standard hex head and 100-degree countersunk head. The countersunk head has one of the following recesses: the cross, the slotted, or the hexagonal wrench type. The steel and aluminum close-tolerance bolts are identified by a raised or recessed triangle on top of the head, and the titanium close-tolerance bolts are identified by the complete part number and manufacturer's symbol on the head. (See Table 3-1, Table 3-7, and Table 3-8.)

Table 3-1. AN3 through AN20, Standard Aircraft Machine Bolt, and AN173 through AN186, Close-Tolerance Machine Bolts



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					Material			
	Thread		Diameter		Steel		Aluminum	
AN Number	Size	Class	Min	Max	Tensile Strength	Shear Strength	Tensile Strength	Shear Strength
AN3	10-32	NF-3A	.1860	.1890	2210	2125	1100	990
AN173			.1889	.1894				
AN4	1/4-28	UNF-3A	.246	.2490	4080	3680	2030	1715
AN174			.2487	.2492				
AN5	5/16-24	UNF-3A	.3090	.3120	6500	5750	3220	2685
AN175			.3112	.3117				
AN6	3/8-24	UNF-3A	.371	.3740	10,100	8280	5020	3870
AN176			.3737	.3742				
AN7	7/16-20	UNF-3A	.4330	.4370	13,600	11,250	6750	5250
AN177			.4362	.4367				
AN8	1/2-20	UNF-3A	.4950	.4990	18,500	14,700	9180	6850
AN178			.4986	.4991				
AN9	9/16-18	UNF-3A	.5580	.5620	23,600	18,700	11,700	8700
AN179			.5611	.5616				
AN10	5/8-18	UNF-3A	.6200	.6240	30,100	23,000	14,900	10,750
AN180			.6234	.6240				
AN12	3/4-16	UNF-3A	.7440	.7490	44,000	33,150	21,800	15,500
AN182			.7481	.7488				
AN14	7/8-14	UNF-3A	.8690	.8740	60,000	45,050	29,800	21,050
AN184			.8729	.8737				
AN16	1-14	NF-3A	.9930	.9990	80,700	58,900	40,000	27,500
AN186			.9975	.9985				
AN18	1-1/8-12	UNF-3A	1.1180	1.1240	101,800	73,750	50,500	34,500
AN20	1-1/4-12	UNF-3A	1.2430	1.2490	130,200	91,050	64,400	42,500

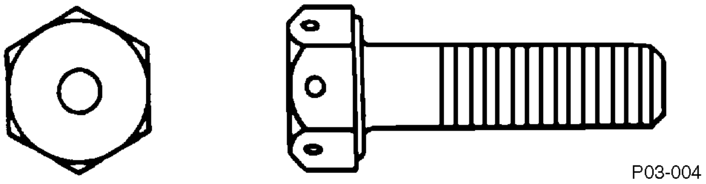
Code:

Dash number is used to designate grip and length.

Table 3-1. AN3 through AN20, Standard Aircraft Machine Bolt, and AN173 through AN186, Close-Tolerance Machine Bolts - Continued

C before dash number indicates corrosion-resistant steel bolt.
DD before dash number indicates aluminum alloy bolt.
A after dash number indicates undrilled bolt.
H before dash number indicates bolt with drilled head and shank.
H before dash number and A after dash number indicates bolt with drilled head only.
Example of part number:
AN6-10 = bolt, noncorrosion-resistant steel, 3/8-24, length 1-5/64, grip 7/16, drilled shank only.
AN6C10A = bolt, corrosion-resistant steel, 3/8-24, length 1-5/64, grip 7/16, undrilled shank and head.
AN6DDH10 = bolt, aluminum alloy, 3/8-24, length 1-5/64, grip 7/16, drilled head and shank.
AN6DDH10A = bolt, aluminum alloy, 3/8-24, length 1-5/64, grip 7/16, drilled head only.
Material:
Steel, Military Specifications MIL-S-6049, MIL-S-6050, MIL-S-6098, and MIL-S-18732 (ASG).
Steel, Military Specifications MIL-S-5626 and MIL-S-6758.
Steel, Military Specification MIL-S-8695.
Aluminum alloy, Federal Specifications QQ-A-267 and QQ-A-268.

Table 3-2. AN73 through AN81, Drilled Head, Standard Aircraft Machine Bolts



					Material	
	Thread		Diameter		Steel	
AN Number	Size	Class	Min	Max	Tensile Strength	Shear Strength
AN73	10-24	NC-3A	.186	.189	1800	2125
	10-32	NF-3A			2210	2125
AN74	1/4-20	UNC-3A	.246	.249	3360	3680
	1/4-28	UNF-3A			4080	3380
AN75	5/16-18	UNC-3A	.311	.314	5660	5750
	5/16-24	UNF-3A			6500	5750
AN76	3/8-16	UNC-3A	.371	.374	8800	8800
	3/8-24	UNF-3A			10,100	8470
AN77	7/16-14	UNC-3A	.433	.436	11,680	11,250
	7/16-20	UNF-3A			13,600	11,250
AN78	1/2-13	UNC-3A	.495	.499	15,410	14,720
	1/2-20	UNF-3A			18,350	14,720
AN79	9/16-12	UNC-3A	.558	.562	18,700	18,700
	9/16-18	UNF-3A			23,600	20,300

Table 3-2. AN73 through AN81, Drilled Head, Standard Aircraft Machine Bolts - Continued

AN Number	Thread		Diameter		Material	
					Steel	
	Size	Class	Min	Max	Tensile Strength	Shear Strength
AN80	5/8-11	UNC-3A	.620	.624	23,000	23,000
	5/8-18	UNF-3A			30,100	25,100
AN81	3/4-10	UNC-3A	.745	.749	33,150	33,150
	3/4-16	UNF-3A			44,000	37,800

Code:

Dash number is used to designate grip and length.

Plain dash numbers identify fine thread bolts; coarse thread bolts are identified by A inserted before dash number. Except for AN77, AN80, and AN81, fine thread bolts are identified by B inserted before dash number, and coarse thread bolts by H.

Example of part number:

AN73-7 = bolt, 10-32, fine thread.

AN73A7 = bolt, 10-24, coarse thread.

AN77B7 = bolt, 7/16-20, fine thread.

AN80H7 = bolt, 5/8-11, coarse thread.

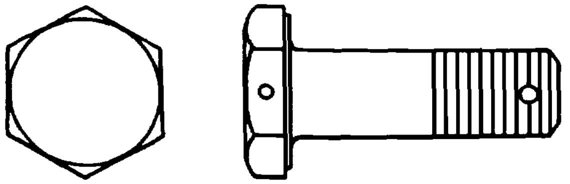
Material:

Steel, Military Specifications MIL-S-6049, MIL-S-6050, MIL-S-6098, and MIL-S-18732 (ASG).

Steel, Military Specifications MIL-S-5626 and MIL-S-6758.

Steel, Military Specification MIL-S-8695.

Table 3-3. NAS501 Stabilized, Nonmagnetic, Corrosion-Resistant Steel Bolt



P03-005A

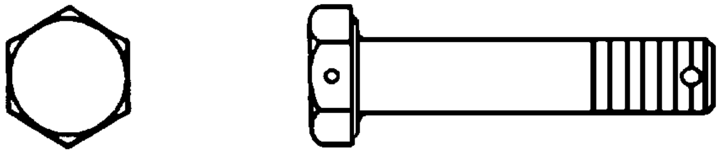
First Dash Number	Thread		Diameter	
	Size	Class	Min	Max
-3	10-32	NF-3A	.186	.189
-4	1/4-28	UNF-3A	.246	.249
-5	5/16-24	UNF-3A	.309	.312
-6	3/8-24	UNF-3A	.371	.374
-7	7/16-20	UNF-3A	.433	.437
-8	1/2-20	UNF-3A	.495	.499

Table 3-3. NAS501 Stabilized, Nonmagnetic, Corrosion-Resistant Steel Bolt - Continued

First Dash Number	Thread		Diameter	
	Size	Class	Min	Max
-9	9/16-18	UNF-3A	.558	.562
-10	5/8-18	UNF-3A	.620	.624
-12	3/4-16	UNF-3A	.744	.749
-14	7/8-14	UNF-3A	.869	.874
-16	1-14	NS-3A	.993	.999
-18	1-1/8-12	UNF-3A	1.118	1.124
-20	1-1/4-12	UNF-3A	1.243	1.249

Code:
Second dash number is used to designate grip and length.
A after dash number designates undrilled bolt.
H before dash number and A after dash number designates drilled head only.
Example of part number:
NAS501-6-10 = bolt, 1-5/64 long, 7/16 grip, drilled shank.
NAS501-6A-10 = bolt, 1-5/64 long, 7/16 grip, undrilled.
NAS501(H)12A-10 = bolt, 1-5/32 long, 1/16 grip, drilled head only.
Material:
Corrosion-resistant steel, type A, class B, Federal Specification QQ-S-763.

Table 3-4. NAS1003 through NAS1020, Hex Head, Nonmagnetic, Heat-Resistant Machine Bolts



P03-005B

NAS Number	Thread		Diameter	
	Size	Class	Min	Max
NAS1003	10-32	NF-3A	.1870	.1895
NAS1004	1/4-28	UNF-3A	.2470	.2495
NAS1005	5/16-24	UNF-3A	.3095	.3120
NAS1006	3/8-24	UNF-3A	.3720	.3745
NAS1007	7/16-20	UNF-3A	.4345	.4370
NAS1008	1/2-20	UNF-3A	.4970	.4995
NAS1009	9/16-18	UNF-3A	.5585	.5615
NAS1010	5/8-18	UNF-3A	.6210	.6240
NAS1012	3/4-16	UNF-3A	.7460	.7490

Table 3-4. NAS1003 through NAS1020, Hex Head, Nonmagnetic, Heat-Resistant Machine Bolts - Continued

NAS Number	Thread		Diameter	
	Size	Class	Min	Max
NAS1014	7/8-14	UNF-3A	.8410	.8440
NAS1016	1-12	UNF-3A	.9960	.9990
NAS1016A	1-14	NS-3A	.9960	.9990
NAS1018	1-1/8-12	UNF-3A	1.1200	1.1240
NAS1020	1-1/4-12	UNF-3A	1.2450	1.2490

Code:

Dash number indicates grip in sixteenths and is used to designate length also.

A after dash number designates undrilled bolt.

H after dash number designates drilled head only.

No code letter designates drilled shank only.

Example of part number:

NAS1003-8 = bolt, 3/16-inch diameter, 1/2 grip, drilled shank only.

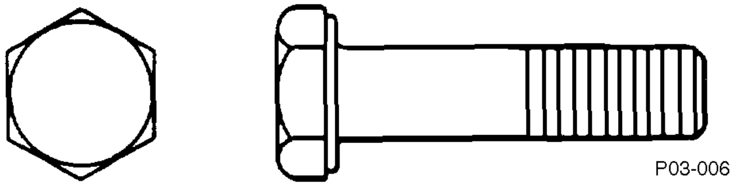
NAS1003-8A = bolt, 3/16-inch diameter, 1/2 grip, undrilled.

NAS1003-8H = bolt, 3/16-inch diameter, 1/2 grip, drilled head only.

Material:

Corrosion-resistant steel, A-286, Aeronautical Material Specification AMS5735 or Discaloy, Aeronautical Material Specification AMS5733, ultimate tensile strength 130,000 PSI minimum at room temperature, fabricated to Aeronautical Material Specification AMS7478.

Table 3-5. AN101001 through AN101900, Hex Head Bolts; AN101901 through AN102800, Drilled Shank, Hex Head Bolts; AN102801 through AN103700, Drilled Hex Head (One Hole) Bolts; and AN103701 through AN104600, Drilled Hex Head (Six Holes) Bolts



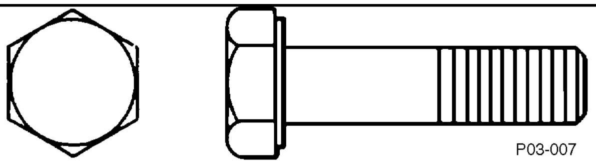
AN Number	Thread		Diameter	
	Size	Class	Min	Max
AN101001 through AN101100 AN101901 through AN102000 AN102801 through AN102900 AN103701 through AN103800	10-32	NF-3A	.186	.189
AN101101 through AN101200 AN102001 through AN102100 AN102901 through AN103000 AN103801 through AN103900	1/4-28	UNF-3A	.246	.249
AN101201 through AN101300 AN102101 through AN102200				

Table 3-5. AN101001 through AN101900, Hex Head Bolts; AN101901 through AN102800, Drilled Shank, Hex Head Bolts; AN102801 through AN103700, Drilled Hex Head (One Hole) Bolts; and AN103701 through AN104600, Drilled Hex Head (Six Holes) Bolts - Continued

	Thread		Diameter	
AN Number	Size	Class	Min	Max
AN103001 through AN103100 AN103901 through AN104000	5/16-24	UNF-3A	.309	.312
AN101301 through AN101400 AN102201 through AN102300 AN103101 through AN103200 AN104001 through AN104100	3/8-24	UNF-3A	.371	.374
AN101401 through AN101500 AN102301 through AN102400 AN103201 through AN103300 AN104101 through AN104200	7/16-20	UNF-3A	.433	.437
AN101501 through AN101600 AN102401 through AN102500 AN103301 through AN103400 AN104201 through AN104300	1/2-20	UNF-3A	.495	.499
AN101601 through AN101700 AN102501 through AN102600 AN103401 through AN103500 AN104301 through AN104400	9/16-18	UNF-3A	.558	.562
AN101701 through AN101800 AN102601 through AN102700 AN103501 through AN103600 AN104401 through AN104500	5/8-18	UNF-3A	.620	.624
AN101801 through AN101900 AN102701 through AN102800 AN103601 through AN103700 AN104501 through AN104600	3/4-16	UNF-3A	.744	.749

Example of part number:
AN101711 = bolt, 5/8-18, length 1.438, grip .438.
AN102128 = bolt, 5/16-24, length 2.250, grip 1.562, drilled shank.
AN103122 = bolt, 3/8-24, length 1.625, grip .625, drilled head (one hole).
AN104247 = bolt, 1/2-20, length 4.875, grip 3.625, drilled head (six holes).
Material:
Steel, Aeronautical Material Specification AMS6322.
Hardness:
Rockwell C26-C32.

Table 3-6. AN104601 through AN105500, CRES, Hex Head Bolts; AN105501 through AN106400, CRES, Drilled Shank, Hex Head Bolts; AN106401 through AN107300, CRES, Drilled Hex Head (One Hole) Bolts; and AN107301 through AN108200, CRES, Drilled Hex Head (Six Holes) Bolts



AN Number	Thread		Diameter	
	Size	Class	Min	Max
AN104601 through AN104700 AN105501 through AN105600 AN106401 through AN106500 AN107301 through AN107400	10-32	NF-3A	.186	.189
AN104701 through AN104800 AN105601 through AN105700 AN106501 through AN106600 AN107401 through AN107500	1/4-28	UNF-3A	.246	.249
AN104801 through AN104900 AN105701 through AN105800 AN106601 through AN106700 AN107501 through AN107600	5/16-24	UNF-3A	.309	.312
AN104901 through AN105000 AN105801 through AN105900 AN106701 through AN106800 AN107601 through AN107700	3/8-24	UNF-3A	.371	.374
AN105001 through AN105100 AN105901 through AN106000 AN106801 through AN106900 AN107701 through AN107800	7/16-20	UNF-3A	.433	.437
AN105101 through AN105200 AN106001 through AN106100 AN106901 through AN107000 AN107801 through AN107900	1/2-20	UNF-3A	.495	.499
AN105201 through AN105300 AN106101 through AN106200 AN107001 through AN107100 AN107901 through AN108000	9/16-18	UNF-3A	.558	.562
AN105301 through AN105400 AN106201 through AN106300 AN107101 through AN107200 AN108001 through AN108100	5/8-18	UNF-3A	.620	.624
AN105401 through AN105500 AN106301 through AN106400 AN107201 through AN107300	3/4-16	UNF-3A	.744	.749

Table 3-6. AN104601 through AN105500, CRES, Hex Head Bolts; AN105501 through AN106400, CRES, Drilled Shank, Hex Head Bolts; AN106401 through AN107300, CRES, Drilled Hex Head (One Hole) Bolts; and AN107301 through AN108200, CRES, Drilled Hex Head (Six Holes) Bolts - Continued

AN Number	Thread		Diameter	
	Size	Class	Min	Max
AN108101 through AN108200				

Example of part number:

AN104637 = bolt, 10-32, length 3.125, grip 2.562.

AN105734 = bolt, 5/16-24, length 3.000, grip 2.312, drilled shank.

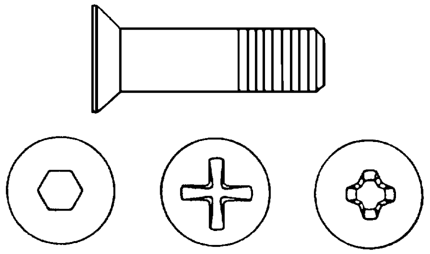
AN107017 = bolt, 9/16-18, length 1.812, grip .438, drilled head (one hole).

AN 107813 = bolt, 1/2-20, length 1.438, grip .188, drilled head (six holes).

Material:

Corrosion-resistant steel, Aeronautical Material Specification AMS7472.

Table 3-7. NAS333 through NAS340, 100-Degree Countersunk Head, Close-Tolerance, High Strength Bolts



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NAS Number	Thread		Diameter		Material
					Steel
	Size	Class	Min	Max	Shear Strength
NAS333	10-32	NF-3A	.1889	.1894	2690
NAS334	1/4-28	UNF-3A	.2487	.2492	4650
NAS335	5/16-24	UNF-3A	.3112	.3117	7300
NAS336	3/8-24	UNF-3A	.3737	.3742	10,500
NAS337	7/16-20	UNF-3A	.4362	.4367	14,300
NAS338	1/2-20	UNF-3A	.4986	.4991	18,650
NAS339	9/16-18	UNF-3A	.5611	.5616	23,600
NAS340	5/8-18	UNF-3A	.6414	.6420	29,150

Code:

Dash number is used to designate grip and length.

-5 after last dash number designates bolt with grip and length .062 longer than designated by length dash number.

C after basic part number designates bolt with cadmium-plated shank.

P after basic part number designates bolt with Phillips recess.

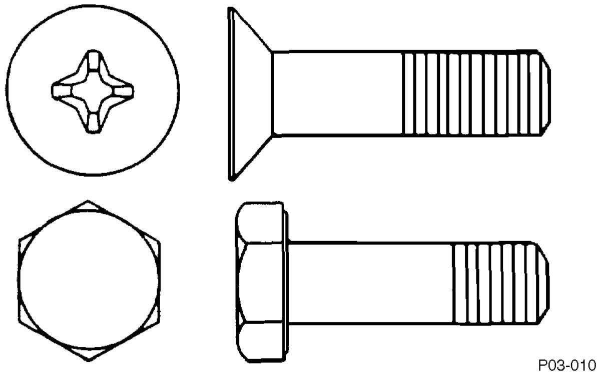
F after basic part number designates bolt with Frearson recess.

No letter indicates hexagon socket.

Table 3-7. NAS333 through NAS340, 100-Degree Countersunk Head, Close-Tolerance, High Strength Bolts - Continued

A after basic part number designates bolt without cotter pin hole.
Example of part number:
NAS334-10 = bolt, 1/4-28, .562 grip, hexagon socket, with cotter pin hole.
NAS334-10-5 = bolt, 1/4-28, .624 grip, hexagon socket, with cotter pin hole.
NAS334PA24 = bolt, 1/4-28, 2.062 grip, Phillips recess, without cotter pin hole.
NAS334CF24 = bolt, 1/4-28, 2.062 grip, plated shank, Frearson recess, with cotter pin hole.
Material:
Steel, Military Specifications MIL-S-5000, MIL-S-6049, and MIL-S-6098.
Steel, Military Specification MIL-S-5626.
Chrome-vanadium steel, Military Specification MIL-S-8503.
Steel, Military Specification MIL-S-8695.
Heat treatment:
160,000 to 180,000 PSI tensile strength.

Table 3-8. NAS653 through NAS658, Hex Head, Close-Tolerance, Short Thread, 4AL-4MN Titanium Alloy Bolts; NAS663 through NAS668, 100-Degree Flathead, Close-Tolerance, 4AL-4MN Titanium Alloy Bolts; and NAS673 through NAS678, Hex Head, Close-Tolerance, 4AL-4MN Titanium Alloy Bolts



	Thread		Diameter		Material	
					Titanium	
NAS Number	Size	Class	Min	Max	Tensile Strength	Shear Strength
NAS653 NAS663 NAS673	10-32	NF-3A	.1890	.1895	2980	2690
NAS654 NAS664 NAS674	1/4-28	UNF-3A	.2490	.2495	5430	4650
NAS655 NAS665 NAS675	5/16-24	UNF-3A	.3115	.3120	8680	7300
NAS656						

Table 3-8. NAS653 through NAS658, Hex Head, Close-Tolerance, Short Thread, 4AL-4MN Titanium Alloy Bolts; NAS663 through NAS668, 100-Degree Flathead, Close-Tolerance, 4AL-4MN Titanium Alloy Bolts; and NAS673 through NAS678, Hex Head, Close-Tolerance, 4AL-4MN Titanium Alloy Bolts - Continued

					Material	
	Thread		Diameter		Titanium	
NAS Number	**Size**	**Class**	**Min**	**Max**	**Tensile Strength**	**Shear Strength**
NAS666 NAS676	3/8-24	UNF-3A	.3740	.3745	13,100	10,500
NAS657 NAS667 NAS677	7/16-20	UNF-3A	.4365	.4370	17,800	14,300
NAS658 NAS668 NAS678	1/2-20	UNF-3A	.4990	.4995	24,000	18,650

Code:

Dash number indicates grip in sixteenths and is used to designate length also.

D after dash number indicates drilled shank (applicable to NAS653 through NAS658 and NAS673 through NAS678 only).

H after dash number indicates drilled head (applicable to NAS673 through NAS678 only).

Example of part number:

NAS664-10 = bolt, 1/4-inch diameter, .625 grip.

NAS654-10D = bolt, 1/4-inch diameter, .625 grip, drilled shank.

NAS674-10DH = bolt, 1/4-inch diameter, .625 grip, drilled shank, drilled head.

Material:

4 Mn-4A1 titanium alloy, Aeronautical Material Specification AMS4425.

3.1.12 Hex Head, Close-Tolerance, 160,000 PSI Tensile Bolts (NAS1303 Through NAS1320); Hex Head, Close-Tolerance, 160,000 PSI Tensile, Short Thread Bolts (NAS1103 Through NAS1120); 100-Degree, Close-Tolerance Head and Shank, 160,000 PSI Tensile, Short Thread Bolts (NAS1202 Through NAS1207); and, 100-Degree, Close-Tolerance Head and Shank, 160,000 PSI Tensile, Short Thread Bolts (NAS1503 Through NAS1510).

CAUTION

Caution must be exercised in use of close tolerance bolts for all critical applications, such as, landing gears, control systems and helicopter rotary controls. Maintenance personnel shall refer to specific aircraft maintenance technical order for special instructions for use of these bolts.

These steel, close-tolerance bolts are similar to the close-tolerance bolts described in paragraph 3.1.11, except that the shank tolerance is double. These bolts are identified by the full part number raised or depressed on the top of the head. (See Table 3-9 and Table 3-10.)

3.1.13 Steel, Internal Wrenching Bolts (NAS144 Through NAS158 and NAS172 Through NAS176).

CAUTION

- When installing a self-locking nut on a short thread length bolt be sure at least two thread pitches of length of bolt end extends beyond the nut and that there will be two thread pitches between the nut and the thread run out on the bolt shank.
- Caution must be exercised in use of close tolerance bolts for all critical applications, such as, landing gears, control systems and helicopter rotary controls. Maintenance personnel shall refer to specific aircraft maintenance technical order for special instructions for use of these bolts.

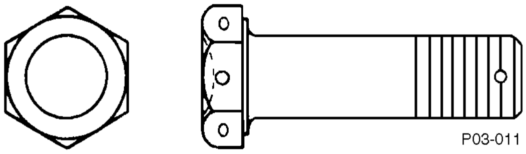
The internal wrenching bolt is a high strength steel bolt used primarily in tension applications. In steel parts, either the bolt hole must be countersunk to seat the large corner radius of the shank at the head, or, as in duralumin, a special heat-treated washer (NAS143C) must be used to fit the head and to provide adequate bearing area. A special, plain washer (NAS143), also heat treated, is used under the nut. Standard AN hex head bolts cannot be substituted for these bolts, as these are heat treated to 160,000 to 180,000 PSI. Special nuts, described in Chapter 5 paragraph 5.6.2, must be used on these bolts. (See Table 3-11.)

3.1.14 Internal Wrenching, 160,000 PSI Tensile Bolts (MS20004 Through MS20024), and Six Hole, Drilled Socket Head Bolts (AN148551 Through AN149350). These bolts are very similar to the internal wrenching bolts in paragrapah 3.1.13 above, except that these bolts are made from different alloys. (See Table 3-12 and Table 3-13). NAS144 through NAS158 and NAS172 through NAS176 are interchangeable with MS20004 through MS20024 in the same thread configuration and grip lengths. AN148551 through AN149350 are no longer active for new design and have been superseded by MS9088 through MS9094 with the exception of AN149251 through 149350 which has no superseding MS Standard.

3.1.15 Twelve Point, External Wrenching, 180,000 to 200,000 PSI Tensile Bolts (NAS624 Through NAS644). The twelve point external wrenching bolt is a high strength (180,000 to 200,000 PSI tensile strength) steel bolt used primarily in high tensile, high fatigue strength applications. A hole is drilled or formed in the head to lighten the bolt. Standard bolts cannot be substituted for these bolts. (See Table 3-14.)

3.1.16 Twelve Point Head, Heat-Resistant, Machine Bolts (MS9033 Through MS9039), and Drilled Twelve Point Head, Cadmium-Plated Steel, Machine Bolts (MS9088 Through MS9094) . These twelve point head machine bolts are similar to the twelve point external wrenching bolts discussed above except that these bolts are made from different steel alloys and their shanks have larger tolerances. (See Table 3-15 and Table 3-16.)

Table 3-9. NAS1303 through NAS1320, Hex Head, Close-Tolerance, 160,000 PSI Tensile Bolts

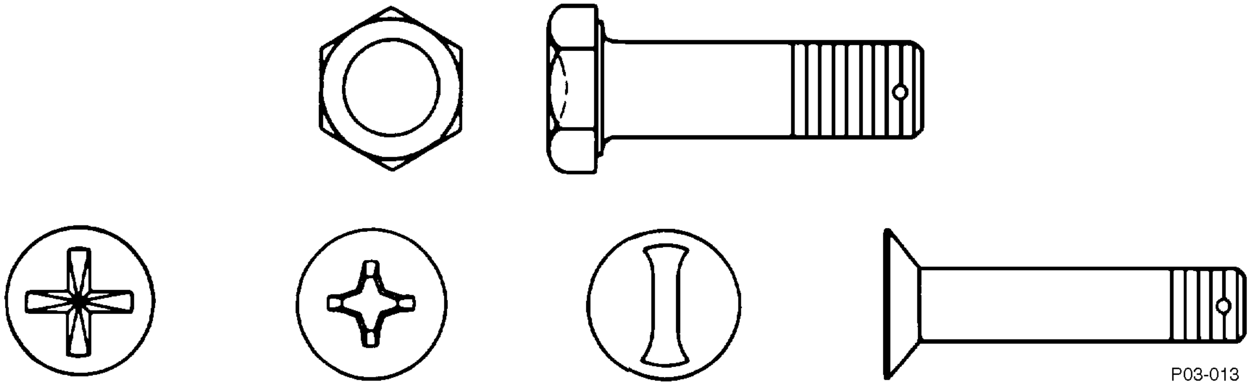


	Thread		Diameter		Material	
					Steel	
NAS Number	Size	Class	Min	Max	Tensile Strength	Shear Strength
NAS1303	10-32	NF-3A	.1885	.1895		
NAS1304	1/4-28	UNF-3A	.2485	.2495	6190	4650
NAS1305	5/16-24	UNF-3A	.3110	.3120	9820	7300
NAS1306	3/8-24	UNF-3A	.3735	.3745	15,200	10,500
NAS1307	7/16-20	UNF-3A	.4360	.4370	20,650	14,300
NAS1308	1/2-20	UNF-3A	.4985	.4995	27,400	18,650
NAS1309	9/16-18	UNF-3A	.5605	.5615	34,800	23,600
NAS1310	5/8-18	UNF-3A	.6230	.6240	43,600	39,150
NAS1312	3/4-16	UNF-3A	.7480	.7490	63,200	41,950
NAS1314	7/8-14	UNF-3A	.8730	.8740	86,100	57,100
NAS1316	1-12	UNF-3A	.9980	.9990	114,000	74,600
NAS1318	1-1/8-12	UNF-3A	1.225	1.240	144,000	94,450
NAS1320	1-1/4-12	UNF-3A	1.2475	1.2490	180,000	116,600

Table 3-9. NAS1303 through NAS1320, Hex Head, Close-Tolerance, 160,000 PSI Tensile Bolts - Continued

Code:
Dash number indicates grip in sixteenths and is used to designate length also.
D after dash number designates drilled shank.
H after dash number designates drilled head.
Example of part number:
NAS1308-10D = bolt, 1/2-20, 0.625 grip, drilled shank.
NAS1308-10H = bolt, 1/2-20, 0.625 grip, drilled head.
Material:
Steel, Military Specifications MIL-S-5000, MIL-S-6049, and MIL-S-6098.
Steel, Military Specification MIL-S-5626.
Chrome-vanadium steel, Military Specification MIL-S-8503.
Heat treatment:
160,000 to 180,000 PSI, Military Specification MIL-H-6875 (ASG).
Hardness:
Rockwell C36 - C40.

Table 3-10. NAS1103 through NAS1120, Hex Head, Close-Tolerance, 160,000 PSI, Short Thread Bolts; NAS1202 through NAS1207, 100-Degree, Close-Tolerance Head and Shank, 160,000 PSI, Short Thread Bolts; and NAS1503 through NAS1510, 100-Degree, Close-Tolerance Head and Shank, 160,000 PSI, Short Thread Bolts



NAS Number	Thread		Diameter		Material	
					Steel	
	Size	Class	Min	Max	Tensile Strength	Shear Strength
NAS1202	8-32	NC-3A	.1625	.1635	1740	2005
NAS1103 NAS1203 NAS1503	10-32	NF-3A	.1885	.1895	2490	2690
NAS1104 NAS1204 NAS1504	1/4-28	UNF-3A	.2485	.2495	4520	4650
NAS1105 NAS1205 NAS1505	5/16-24	UNF-3A	.3110	.3120	7240	7300
NAS1106 NAS1206 NAS1506	3/8-24	UNF-3A	.3735	.3745	10,950	10,500
NAS1107 NAS1207	7/16-20	UNF-3A	.4360	.4370	14,800	14,300

Table 3-10. NAS1103 through NAS1120, Hex Head, Close-Tolerance, 160,000 PSI, Short Thread Bolts; NAS1202 through NAS1207, 100-Degree, Close-Tolerance Head and Shank, 160,000 PSI, Short Thread Bolts; and NAS1503 through NAS1510, 100-Degree, Close-Tolerance Head and Shank, 160,000 PSI, Short Thread Bolts - Continued

					Material	
	Thread		Diameter		Steel	
NAS Number	Size	Class	Min	Max	Tensile Strength	Shear Strength
NAS1507						
NAS1108 NAS1508	1/2-20	UNF-3A	.4985	.4995	19,950	18,650
NAS1109 NAS1509	9/16-18	UNF-3A	.5605	.5615	25,300	23,600
NAS1110 NAS1510	5/8-18	UNF-3A	.6230	.6240	31,950	29,150
NAS1112	3/4-16	UNF-3A	.7480	.7490	46,550	41,450
NAS1114	7/8-14	UNF-3A	.8730	.8740	63,600	57,100
NAS1116	1-12	UNF-3A	.9980	.9990	82,800	74,600
NAS1118	1-1/8-12	UNF-3A	1.1225	1.1240	106,900	94,450
NAS1120	1-1/4-12	UNF-3A	1.2475	1.2490	134,000	116,000

Code:

Dash number indicates grip in sixteenths and is used to designate length also.

D after dash number designates drilled shank (applicable to NAS1103 through NAS1120 only).

F in place of dash designates Freason recess (applicable to NAS1202 through NAS1207 only).

Example of part number:

NAS1104-10D = bolt, hex head, 1/4-inch diameter, 0.625 grip, drilled shank.

NAS1204-8 = bolt, 1/4-inch diameter, 0.500 grip, Phillips recess.

NAS1204F8 = bolt, 1/4-inch diameter, 0.500 grip, Frearson recess.

NAS1504-8 = bolt, 1/4-inch diameter, 0.500 grip, hi-torque slot.

Material:

Steel, Military Specifications MIL-S-5000, MIL-S-6049, and MIL-S-6098.

Steel, Military Specification MIL-S-5626.

Chrome-vanadium steel, Military Specification MIL-S-8503.

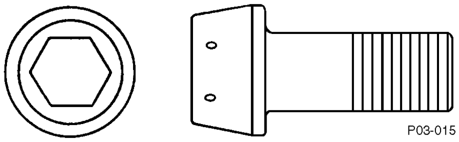
Steel, Military Specification MIL-S-8695.

Heat treatment:

Table 3-10. NAS1103 through NAS1120, Hex Head, Close-Tolerance, 160,000 PSI, Short Thread Bolts; NAS1202 through NAS1207, 100-Degree, Close-Tolerance Head and Shank, 160,000 PSI, Short Thread Bolts; and NAS1503 through NAS1510, 100-Degree, Close-Tolerance Head and Shank, 160,000 PSI, Short Thread Bolts - Continued

160,000 to 180,000 PSI, Military Specification MIL-H-6875 (ASG).

Table 3-11. NAS144 through NAS158, and NAS172 through NAS176, Steel, Internal Wrenching Bolts



NAS Number	Thread		Diameter		Material	
					Steel	
	Size	Class	Min	Max	Tensile Strength	Shear Strength
NAS144	1/4-28	UNF-3A	.246	.249	5000	4650
NAS145	5/16-24	UNF-3A	.3085	.3115	8200	7300
NAS146	3/8-24	UNF-3A	.371	.374	12,700	10,500
NAS147	7/16-20	UNF-3A	.4330	.4365	17,100	14,300
NAS148	1/2-20	UNF-3A	.4955	.4990	23,400	18,650
NAS149	9/16-18	UNF-3A	.5575	.5615	29,800	23,600
NAS150	5/8-18	UNF-3A	.620	.624	38,000	29,150
NAS152	3/4-16	UNF-3A	.7445	.7490	55,600	41,950
NAS154	7/8-14	UNF-3A	.869	.874	76,200	57,100
NAS156	1-14	NF-3A	.9935	.9990	102,500	74,600
NAS158	1-1/8-12	UNF-3A	1.118	1.124	128,800	94,450
NAS172	1-1/4-12	UNF-3A	1.243	1.249	162,600	116,600
NAS174	1-3/8-12	UNF-3A	1.368	1.374	200,300	141,050
NAS176	1-1/2-12	UNF-3A	1.493	1.499	241,600	167,900

Code:

Dash number indicates grip in sixteenths and is used to designate length also.

DH after part number designates drilled head.

A after part number designates drilled shank (applicable to NAS144 through NAS158 only).

Example of part number:

NAS145-25 = bolt, 1-9/16 long, not drilled.

NAS145DH-25 = bolt, 1-9/16 long, drilled head.

NAS145ADH-25 = bolt 1-9/16 long, drilled head, drilled shank.

Material.

Steel, Military Specifications MIL-S-5000 and MIL-S-6049.

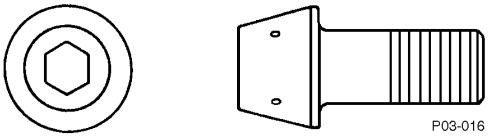
Chrome-vanadium steel, Military Specification MIL-S-8503.

Steel, Aeronautical Material Specifications AMS6332 and AMS6330.

Heat treatment:

160,000 to 180,000 PSI, National Aircraft Standards Committee Procurement Specification NAS159.

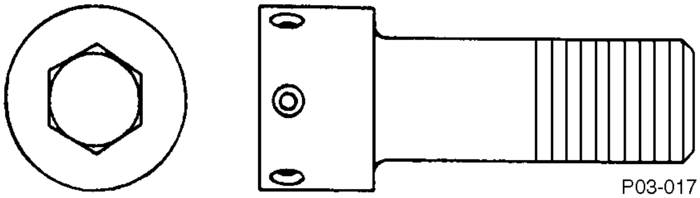
Table 3-12. MS20004 through MS20024, 160,000 PSI, Internal Wrenching Bolts



	Thread		Diameter		Material	
					Steel	
MS Number	Size	Class	Min	Max	Tensile Strength	Shear Strength
MS20004	1/4-28	UNF-3A	.2477	.2492	6190	4650
MS20005	5/16-24	UNF-3A	.3102	.3117	9820	7300
MS20006	3/8-24	UNF-3A	.3727	.3742	15,200	10,500
MS20007	7/16-20	UNF-3A	.4347	.4367	20,600	14,300
MS20008	1/2-20	UNF-3A	.4971	.4991	27,400	18,650
MS20009	9/16-18	UNF-3A	.5596	.5616	34,800	23,600
MS20010	5/8-18	UNF-3A	.6220	.6240	43,600	29,150
MS20012	3/4-16	UNF-3A	.7468	.7488	63,200	41,950
MS20014	7/8-14	UNF-3A	.8707	.8737	86,100	57,100
MS20016	1-14	NF-3A	.9955	.9985	114,000	74,600
MS20018	1-1/8-12	UNF-3A	1.121	1.124	144,000	94,450
MS20020	1-1/4-12	UNF-3A	1.246	1.249	180,000	116,600
MS20022	1-3/8-12	UNF-3A	1.370	1.374	219,000	141,050
MS20024	1-1/2-12	UNF-3A	1.495	1.499	263,000	167,900

Code:
Dash number indicates grip in sixteenths and is used to designate length also.
H before dash number designates drilled head.
Example of part number:
MS20004-8 = bolt, 1/4-inch diameter, 0.562 grip.
MS20004-H9 = bolt, 1/4-inch diameter, 0.562 grip, drilled head.
Material:
Steel, Military Specifications MIL-S-5000, MIL-S-6049, and MIL-S-6098.
Steel, Military Specification MIL-S-5626.
Chrome-vanadium steel, Military Specification MIL-S-8503.
Heat treatment:
160,000 to 180,000 PSI, Military Specification MIL-H-6875 (ASG).

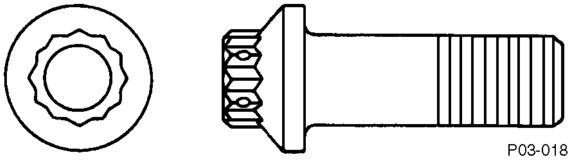
Table 3-13. AN148551 through AN149350, Six Hole, Drilled Socket Head Bolts



AN Number	Thread		Diameter	
	Size	Class	Min	Max
AN148551 through AN148650	10-32	NF-3A	.186	.189
AN148651 through AN148750	1/4-28	UNF-3A	.246	.249
AN148751 through AN148850	5/16-24	UNF-3A	.309	.312
AN148851 through AN148950	3/8-24	UNF-3A	.371	.374
AN148951 through AN149050	7/16-20	UNF-3A	.433	.437
AN149051 through AN149150	1/2-20	UNF-3A	.495	.499
AN149151 through AN149250	9/16-18	UNF-3A	.558	.562
AN149251 through AN149350	5/8-18	UNF-3A	.620	.624

Example of part number:
AN148974 = bolt, 7/16-20, drilled socket head (six holes), length 1.625, grip 0.500.
Material:
Steel, Aeronautical Material Specification AMS6322.
Hardness:
Rockwell C32 - C36.

Table 3-14. NAS624 through NAS644, Twelve Point, External Wrenching, 180,000 PSI Bolts



NAS Number	Thread		Diameter		Material	
					Steel	
	Size	Class	Min	Max	Tensile Strength	Shear Strength
NAS624	1/4-28	UNF-3A	.2485	.2495	6960	5350
NAS625	5/16-24	UNF-3A	.3110	.3120	11,050	8350
NAS626	3/8-24	UNF-3A	.3735	.3745	17,100	12,050
NAS627	7/16-20	UNF-3A	.4360	.4370	23,175	16,400
NAS628	1/2-20	UNF-3A	.4985	.4995	30,825	21,400
NAS629	9/16-18	UNF-3A	.5605	.5615	39,150	27,100

Table 3-14. NAS624 through NAS644, Twelve Point, External Wrenching, 180,000 PSI Bolts - Continued

NAS Number	Thread		Diameter		Material Steel	
	Size	Class	Min	Max	Tensile Strength	Shear Strength
NAS630	5/8-18	UNF-3A	.6230	.6240	49,050	33,450
NAS632	3/4-16	UNF-3A	.7480	.7490	71,100	48,100
NAS634	7/8-14	UNF-3A	.8730	.8740	96,860	66,600
NAS636	1-12	UNF-3A	.9980	.9990	126,250	85,600
NAS636A	1-14	NS-3A	.9980	.9990	128,250	85,600
NAS638	1-1/8-12	UNF-3A	1.1225	1.1240	162,000	106,000
NAS640	1-1/4-12	UNF-3A	1.2475	1.2490	202,500	133,800
NAS642	1-3/8-12	UNF-3A	1.3725	1.3740	246,375	162,000
NAS644	1-1/2-12	UNF-3A	1.4975	1.4990	295,875	192,500

Code:
Dash number indicates grip in sixteenths and is used to designate length also.
H after dash designates drilled head.
Example of part number:
NAS624-8 = bolt, 1/4-28 UNF-3A thread, 0.500 grip.
NAS628-H13 = bolt, 1/2-20 UNF-3A thread, 0.812 grip, drilled head.
Material:
Steel, Military Specifications MIL-S-5000, MIL-S-6049, and MIL-S-6098.
Steel, Military Specification MIL-S-5626.
Chrome-vanadium steel, Military Specification MIL-S-8503.
Steel, Aeronautical Material Specifications AMS6332 and AMS6330.
Heat treatment:
180,000 to 200,000 PSI, Military Specification MIL-H-6875 (ASG).
Hardness:
Rockwell C39 - C43.

Table 3-15. MS9033 through MS9039, Twelve Point Head, Heat-Resistant Machine Bolts

MS Number	Thread		Diameter	
	Size	Class	Min	Max
MS9033	10-32	NS	.1810	.1870
MS9034	1/4-28	NS	.2405	.2470
MS9035	5/16-24	NS	.3023	.3095
MS9036	3/8-24	NS	.3648	.3720
MS9037	7/16-20	NS	.4264	.4345
MS9038	1/2-20	NS	.4889	.4970
MS9039	9/16-18	NS	.5508	.5595

Code:
Dash number is used to designate grip and length.

Table 3-15. MS9033 through MS9039, Twelve Point Head, Heat-Resistant Machine Bolts - Continued

MS Number	Thread		Diameter	
	Size	Class	Min	Max

Example of part number:

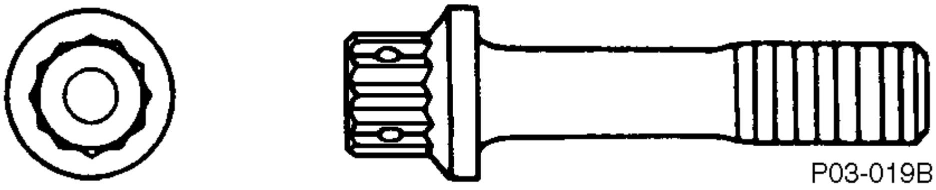
MS9033-18 = bolt, 10-32 NS, length 1.250, grip .625.

MS9039-14 = bolt, 9/16-18 NS, length 1.500, grip .125.

Material:

Corrosion and heat-resistant steel, Aeronautical Material Specification AMS5735.

Table 3-16. MS9088 through MS9094, Drilled Twelve Point Head, Cadmium-Plated Steel, Machine Bolts



MS Number	Thread		Diameter ±.010
	Size	Class	
MS9088(ASG)	10-32	NF-3A	.1900
MS9089(ASG)	1/4-28	UNF-3A	.2500
MS9090(ASG)	5/16-24	UNF-3A	.3125
MS9091(ASG)	3/8-24	UNF-3A	.3750
MS9092(ASG)	7/16-20	UNF-3A	.4375
MS9093(ASG)	1/2-20	UNF-3A	.5000
MS9094(ASG)	9/16-18	UNF-3A	.5625

Code:

Dash number is used to designate grip and length.

Example of part number:

MS9091-17 = bolt, 3/8-24 UNF-3A, length 1.438, grip .438.

MF9093-26 = bolt, 1/2-20 UNF-3A, length 2.625, grip 1.375.

Material:

Steel, Aeronautical Material Specification AMS6322.

Hardness:

Rockwell C26 - C32.

3.1.17 Close-Tolerance Shear Bolts (NAS464). These steel close-tolerance shear bolts are designed for use where stresses normally are in shear only. They have a relatively long grip and few threads. (See Table 3-17.)

3.1.18 Full Threaded, Fully Identified Head Bolts (NAS563 Through NAS572).

CAUTION

Caution must be exercised in use of close tolerance bolts for all critical applications, such as, landing gears, control systems and helicopter rotary controls. Maintenance personnel shall refer to specific aircraft maintenance technical order for special instructions for use of these bolts.

This full threaded bolt is fabricated from steel alloy, heat-treated to 160,000 to 180,000 PSI tensile strength. It is marked on top of the head by the complete NAS number. (See Table 3-18.)

3.1.19 Clevis Bolts (AN21 Through AN36). The clevis bolts are used in applications subject to shearing stress only, and are often used as mechanical pins in control systems, etc. The head is round and slotted. (See Table 3-19.)

3.1.20 Eyebolts (AN42 Through AN49). The eyebolt is used to carry external tension loads for the attachment of devices such as the fork of a turnbuckle, a clevis, or a cable shackle. (See Table 3-20.)

3.1.21 Nonstandard Bolts.

3.1.22 External Wrenching Bolts, EWB22 (220,000 PSI Minimum). The EWB22 (External Wrenching Bolt - Standard Pressed Steel Company Number 22) external wrenching bolt has not had a military designation assigned to it. This bolt has an increase over conventional bolts in fatigue resistance, tensile strength, and ductility. The diameter of the washer face under the head is increased to maintain the same bearing stress as the MS20004 series bolts. The across-flats dimension of the twelve point head is increased to provide greater wrenching service. (See Table 3-21.)

3.1.23 Hi-Torque Bolts. The Hi-Torque bolts have not had a military designation assigned to them. These bolts use a variety of steel alloys and titanium. The recess is a single slot, narrower at the center than the outer portions at either end. This, and the center dimple, make the recess readily identifiable by its ‘‘bow tie’’ appearance. The recess is undercut in a taper from the center of the recess to the outer boundaries, producing an inverted keystone shape in cross-section. (See Table 3-22.)

a. TOOLING. A solid head driver conforming to MS33750 shall be used for installation. The driver number will identify the proper driver size for standard 100° head bolts (HTS-5 driver; 5/16 diameter bolt). In addition, the proper driver for a particular bolt has approximately the same tip diameter as that of the bolt head. This is applicable to both the standard 100° flush head as well as the reduced 100° flush head. However, the reduced head has a recess one size smaller than the standard and requires the next size smaller driver. The dimple provides for self-engagement of the driver into the recess, and as torque is applied the driver tip locks into the recess walls eliminating the need for end thrust by the operator.

b. INSTALLATION. All installation, either by hand or with power tools, shall be accomplished with a torque limiting or torque measuring device to insure that the installation torques specified by the aircraft manufacturer are met. Over-torquing must be avoided. Any additional clockwise movement after the bolt has been properly seated can increase the torque required for removal by more than 50% in excess of normal requirements.

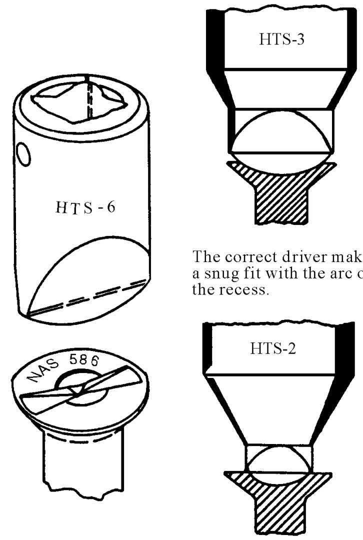
c. REMOVAL. Normal practice will remove most properly installed Hi-Torque bolts. However, sometimes as a result of increased sheet bearing on the shank, nut galling or over-torquing on installation, excessive removal. torque must be applied. If such is the case, the recess should be loaded in a smooth uniform motion as torque is increased, maintaining the solid driver ‘‘in-line’’ with the bolt centerline. End load may be applied. DO NOT SNAP LOAD!

NOTE

If the recess is cammed out during installation, the removal surfaces of the recess are still intact.

d. MAINTENANCE. The recess should be cleared of foreign material before installation or removal. The shallow, curved bottom of the recess facilitates cleaning with any narrow instrument. The solid Hi-Torque driver has a normal life of approximately 5,000 installations and removal cycles. If after normal usage the edge of the driver becomes burred, increasing the tip width (Dimension E, Sheet 3, MS33750) over the maximum allowed, the driver should be discarded. Flattening of the tip radius in excess of 1X-width will also be basis for replacement.

(1) A solid head Hi-Torque driver conforming to MS 33750 or MIL-B-9946/2 may be used for installation of the Hi-Torque fastener. The proper driver for a particular bolt has the same tip diameter as that of the bolt head.



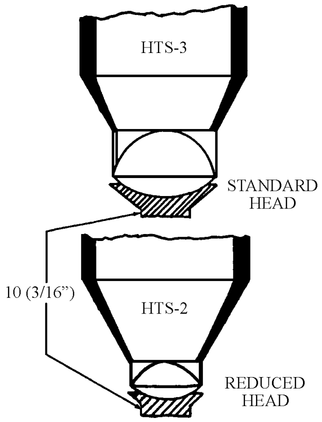
The correct driver makes a snug fit with the arc of the recess.

Too small a driver does not fit the recess arc which results in damage to recess, even at low torque values.

P03-022A

NOTE

Reduced flush head bolts require a driver one size smaller than the driver for the standard head bolt, as shown in diagram below. Installation torque should be reduced accordingly.

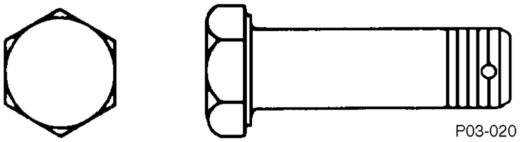


Driver Selection Chart
STANDARD HEAD

NOM. BOLT DIA.	DRIVER NO.	NOM. BOLT DIA.	DRIVER NO.
#8	**HTS-2	7/8	HTS-14
#10 (3/16)	**HTS-3	1	HTS-16
1/4	HTS-4	1-1/8	HTS-18
5/16	HTS-5	1-1/4	HTS-20
3/8	HTS-6	1-3/8	HTS-22
7/16	HTS-7	1-1/2	HTS-24
1/2	HTS-8	1-5/8	HTS-26
9/16	HTS-9	1-3/4	HTS-28
5/8	HTS-10	1-7/8	HTS-30
3/4	HTS-12	2	HTS-32

**The tip thickness of the HTS-2 and HTS-3 are the same but they do not have the same radius and are therefore not interchangeable.

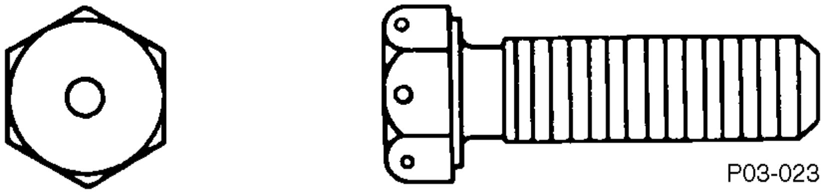
Table 3-17. NAS464 Close-Tolerance Shear Bolt



First Dash Number	Thread		Diameter		Material	
					Steel	
	Size	Class	Min	Max	Tensile Strength	Shear Strength
-3	10-32	NF-3	.1889	.1894	1105	2620
-4	1/4-28	NF-3	.2487	.2492	2040	4650
-5	5/16-24	NF-3	.3112	.3117	3250	7300
-6	3/8-24	NF-3	.3737	.3742	5050	10,500
-7	7/16-20	NF-3	.4362	.4367	6800	14,300
-8	1/2-20	NF-3	.4986	.4991	9250	18,650
-9	9/16-18	NF-3	.5611	.5616	11,800	23,600
-10	5/8-18	NF-3	.6234	.6240	15,050	29,150
-12	3/4-16	NF-3	.7481	.7488	22,000	41,950
-14	7/8-14	NF-3	.8729	.8737	30,000	57,100
-16	1-14	NF-3	.9975	.9985	40,350	74,600

Code:
A after first dash number designates bolt without cotter pin hole.
First dash number designates nominal diameter in sixteenths.
Second dash number designates grip in sixteenths and is used to designate length.
Example of part number:
NAS464-3-12 = bolt, 12/16 grip, with cotter pin hole.
NAS464-4A-16 = bolt, 1 grip, without cotter pin hole.
Material:
Steel, Military Specifications MIL-S-5000, MIL-S-6049, and MIL-S-6098.
Steel, Military Specification MIL-S-5626.
Chrome-vanadium steel, Military Specification MIL-S-8503.
Steel, Military Specification MIL-S-8695.
Heat treatment:
160,000 to 180,000 PSI, Military Specification MIL-H-6875 (ASG).
Use NAS6203 thru NAS6220 standard for future procurement.

Table 3-18. NAS563 through NAS572, Full Threaded, Fully Identified, Head Bolts



					Material
	Thread		Diameter		Steel
NAS Number	Size	Class	Min	Max	Tensile Strength
NAS563	10-32	NF-3A	.1670	.1900	3170
NAS564	1/4-28	UNF-3A	.2243	.2500	5790
NAS565	5/16-24	UNF-3A	.2827	.3125	9260
NAS566	3/8-24	UNF-3A	.3450	.3750	14,000
NAS567	7/16-20	UNF-3A	.4019	.4375	18,900
NAS568	1/2-20	UNF-3A	.4643	.5000	25,500
NAS569	9/16-18	UNF-3A	.5230	.5625	32,400
NAS570	5/8-18	UNF-3A	.5854	.6250	40,900
NAS572	3/4-16	UNF-3A	.7056	.7500	59,500

Code:

Last digit of basic number indicates nominal diameter in sixteenths (NAS563 through NAS570 only).

Dash number indicates length in thirty-seconds (NAS563 through NAS572 bolts are available in sixteenth increments only).

Example of part number:

NAS564-15 = bolt, full threaded, 1/4-28, length 15/32.

NAS570-49 = bolt, full threaded, 5/8-18, length 1-17/32.

Material:

Steel, Military Specifications MIL-S-6049, MIL-S-6050, MIL-S-6098, and MIL-S-18732 (ASG).

Steel, Military Specifications MIL-S-5626 and MIL-S-6758.

Steel, Military Specification MIL-S-8695.

Aluminum alloy, Federal Specifications QQ-A-267 and QQ-A-268.

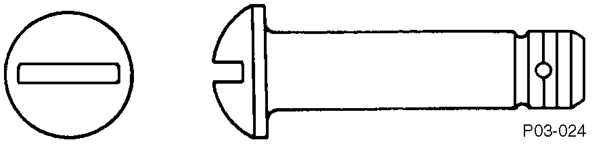
Heat treatment:

160,000 to 180,000 PSI, Military Specification MIL-H-6875 (ASG).

Hardness:

Rockwell C36 - C40.

Table 3-19. AN21 through AN36, Celvis Bolts



AN Number	Thread		Diameter	Material	
				Steel	
	Size	Class		Tensile Strength	Shear Strength
AN21	6-40	NF-3	.136	510	1060
AN22	8-36	NF-3	.162	760	1500
AN23	10-32	NF-3	.186	1105	2125
AN24	1/4-28	NF-3	.248	2040	3680
AN25	5/16-24	NF-3	.311	3250	5750
AN26	3/8-24	NF-3	.373	5050	8800
AN27	7/16-20	NF-3	.436	6800	11,250
AN28	1/2-20	NF-3	.497	9250	14,700
AN29	9/16-18	NF-3	.560	11,800	18,700
AN30	5/8-18	NF-3	.622	15,050	23,000
AN32	3/4-16	NF-3	.747	22,000	33,150
AN34	7/8-14	NF-3	.871	30,000	45,050
AN36	1-14	NF-3	.996	40,350	58,900

Code:

Dash number is used to designate grip and length.

A after dash number for bolt without drilled hole in shank.

Example of part number:

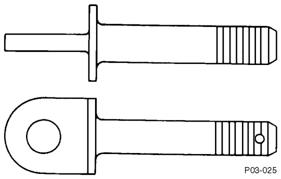
AN23-8 = bolt, 17/32 long, with cotter pin hole.

AN23-8A = bolt, 17/32 long, without cotter pin hole.

Material:

Noncorrosion-resistant steel, Military Specification MIL-B-6812.

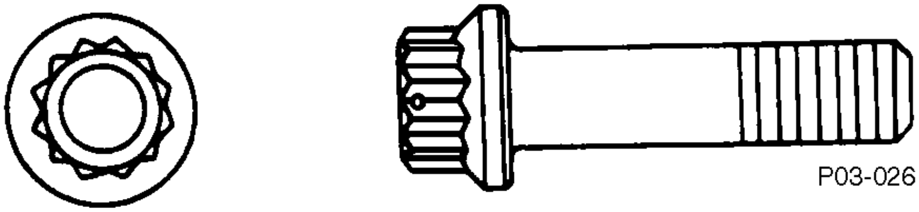
Table 3-20. AN42 through AN49, Eyebolts



	Thread		Diameter			Material	
						Steel	
AN Number	Size	Class	Min	Max	Eye Diameter	Tensile Strength of Eye	Yield Strength of Eye
AN42B	10-32	NF-3A	.1865	.1890	.190	1150	880
AN43B	1/4-28	UNF-3A	.246	.249	.190	2450	1880
AN44	5/16-24	UNF-3A	.309	.312	.250	3910	3000
AN45	5/16-24	UNF-3A	.309	.312	.313	5290	4055
AN46	3/8-24	UNF-3A	.371	.374	.375	7010	5375
AN47	7/16-20	UNF-3A	.4355	.4390	.375	9200	7055
AN48	1/2-20	UNF-3A	.4955	.4990	.438	14,375	11,020
AN49	9/16-18	UNF-3A	.558	.562	.500	20,125	15,430

Code:
Dash number is used to designate grip and length.
A after dash number for bolt without drilled hole in shank.
C before dash number for corrosion-resistant steel bolt.
Example of part number:
AN44-7 = bolt, 5/16-24, .250 eye, grip 7/16, length 31/32, noncorrosion-resistant steel, drilled hole in shank.
AN42BC-7A = bolt, 10-32, .190 eye, grip 1/2, length 29/32, corrosion-resistant steel, solid shank.
Material:
Steel, Military Specifications MIL-S-6049, MIL-S-6050, MIL-S-6098, and MIL-S-18732 (ASG).
Steel, Military Specifications MIL-S-5626 and MIL-S-6758.
Steel, Military Specification MIL-S-8695.
Aluminum alloy, Federal Specifications QQ-A-267 and QQ-A-268.

Table 3-21. EWB22, External Wrenching, 220,000 PSI Minimum, Bolt (Available by Manufacturer's Part Number) (SPS)



First Dash Number	Thread		Diameter		Material	
					Steel	
	Size	Class*	Min	Max	Tensile Strength	Shear Strength
-4	1/4-28		.2485	.2495	8800	6500
-5	5/16-24		.3110	.3120	14,000	9900
-6	3/8-24		.3735	.3745	20,500	14,000
-7	7/16-20		.4360	.4370	28,300	19,300
-8	1/2-20		.4985	.4995	37,200	25,200
-9	9/16-18		.5605	.5615	48,000	31,800
-10	5/8-18		.6230	.6240	60,000	39,100
-12	3/4-16		.7480	.7490	86,200	57,800
-14	7/8-14		.8730	.8740		
-16	1-14		.9980	.9990		
-18	1-1/8-12		1.1225	1.1240		
-20	1-1/4-12		1.2475	1.2490		
-22	1-3/8-12		1.3725	1.3740		
-24	1-1/2-12		1.4975	1.4990		

*All threads are UNF-3A modified with tabulated ''HiR'' root radius.

Code:

First dash number designates diameter in sixteenths.

Second dash number designates grip in sixteenths and is used to designate length also.

H after first dash number designates drilled head.

Example of part number:

EWB22-16-14 = bolt, 1-14, grip 0.875, length 2.563.

EWB22-16H-20 = bolt, 1-14, grip 1.250, length 2.938, drilled head.

Material:

Manganese-silicon-nickel steel, Military Specification MIL-S-7108 (ASG).

Table 3-22. Hi-Torque Bolts Available by Manufacturer's Part Number

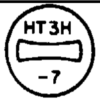
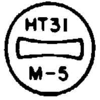
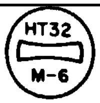
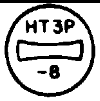
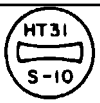
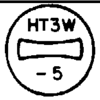
Hi-Torque Bolt Part Number	Head Marking	Material	Heat Treat	Tolerances		Suggested Maximum Temp For Use	Characteristics
				Head Height	Shank Diameter		
HT3D through HT10D		17-4PH Stainless steel	120,000 PSI Shear minimum	.002 to .003	.0005	800°F	Has good dynamic characteristics at room temperature and excellent physical properties up to a suggested maximum temperature.
HT3E through HT10E		Type-431 Stainless steel	125,000 PSI Shear minimum	.002 to .003	.0005	900°F	Compatible with 17-7PH and similar stainless steel materials currently being used in aircraft and missiles.
HT3H through HT6H		AM 350 Stainless steel	120,000 PSI Shear minimum	.002	.0005	900°F	Corrosion-resistant.
HT31M through HT101M		Steel	160,000 - 180,000 PSI Tensile	.002 to .003	.0009	450°F	Salvage 1/64 oversize for NAS58S series.
HT32M through HT102M		Steel	160,000 - 180,000 PSI Tensile	.002 to .003	.0009	450°F	Salvage 1/32 oversize for NAS583 series.
HT3N through HT6N		A-286 High temp alloy	95,000 PSI Shear minimum	.002	.0005	1100°F	Has excellent corrosion resistance and is compatible to stainless steel materials.
HT3P through HT8P		AMS5668 Inconel X	160,000 PSI Tensile minimum	.002 to .003	.0005	1200°F	Considered to be one of the few available materials useful to 1500°F.
HT3SA through HT8SA		Type 431 Stainless steel	125,000 PSI Shear minimum	.002 to .003	.001	Subject to O-ring limitation	Sealing bolt with general purpose aromatic fuel resistant O-ring.
HT31SA through HT81SA		Type 431 Stainless steel	125,000 PSI Shear minimum	.002 to .003	.001	Subject to O-ring limitation	Salvage 1/64 oversize for HT3SA through HT8SA.

Table 3-22. Hi-Torque Bolts Available by Manufacturer's Part Number - Continued

Hi-Torque Bolt Part Number	Head Marking	Material	Heat Treat	Tolerances		Suggested Maximum Temp For Use	Characteristics
				Head Height	Shank Diameter		
HT32SA through HT82SA		Type 431 Stainless steel	125,000 PSI Shear minimum	.002 to .003	.001	Subject to O-ring limitation	Salvage 1/32 oversize for HT3SA through HT8SA.
HT3T through HT10T		6-4 Titanium	95,000 PSI Shear minimum	.002 to .003	.0005	700°F	Used in high performance aircraft where weight conservation is critical. It has a short thread length and is a weight-saving direct substitute for the NAS1503 series in shear applications.
HT3W through HT10W		6-4 Titanium	95,000 PSI Shear minimum	.002 to .003	.0005	700°F	Like the HT3T through HT10T series, this titanium bolt is used where weight conservation is critical. It has a standard thread length and is a weight-saving direct substitute for the NAS583 and NAS333 series.

3.1.24 Self-Locking Bolts. These bolts are manufactured to regular standards such as MS20004 through MS20024, NAS333 through NAS340 and NAS1303 through NAS1320 except that they incorporate a nylon pellet or strip forced into a hole or slot in the body of the threads. (See Figure 3-2.) The nylon pellet or strip is compressed when the bolt is wrenched into a tapped hole. As a result of the nylon's resilient ''memory'' the pellet or strip constantly fights to return to its original shape. This action creates a pressure which locks the bolt. Used self-locking bolts will be suitable for reuse provided the bolt is in a serviceable condition and the nylon pellet is not loose or broken and extends at least to the outermost edge or apex of the threads and insures sufficient friction for locking capability. MS33648 provides design information for externally threaded fasteners incorporating self-locking elements. (See Figure 3-2.)

3.1.25 Impedance Self-Retaining Bolt.

CAUTION

These types of self-locking bolts are necessarily restricted to temperature applications not in excess of 250 degrees Fahrenheit.

If self-retaining impedance type bolt is required, reference should be made to MS 27576 for specified requirements. Procurement specifications are cited in MIL-B-83050.

3.1.26 Torq-Set Wrenching Recess. (See Figure 3-3.) The Torq-Set wrenching recess is incorporated in the head of some bolts and screws. These bolts and screws have not had a military designation assigned to them. The four driving wings of the recess are radial to the vertical axis of the bolt or screw, rather than tangent with respect to the axis. Also, there is no taper in the walls of the recess. This recess permits higher installation and removal torques with no tendency for the driver to slip or cam out.

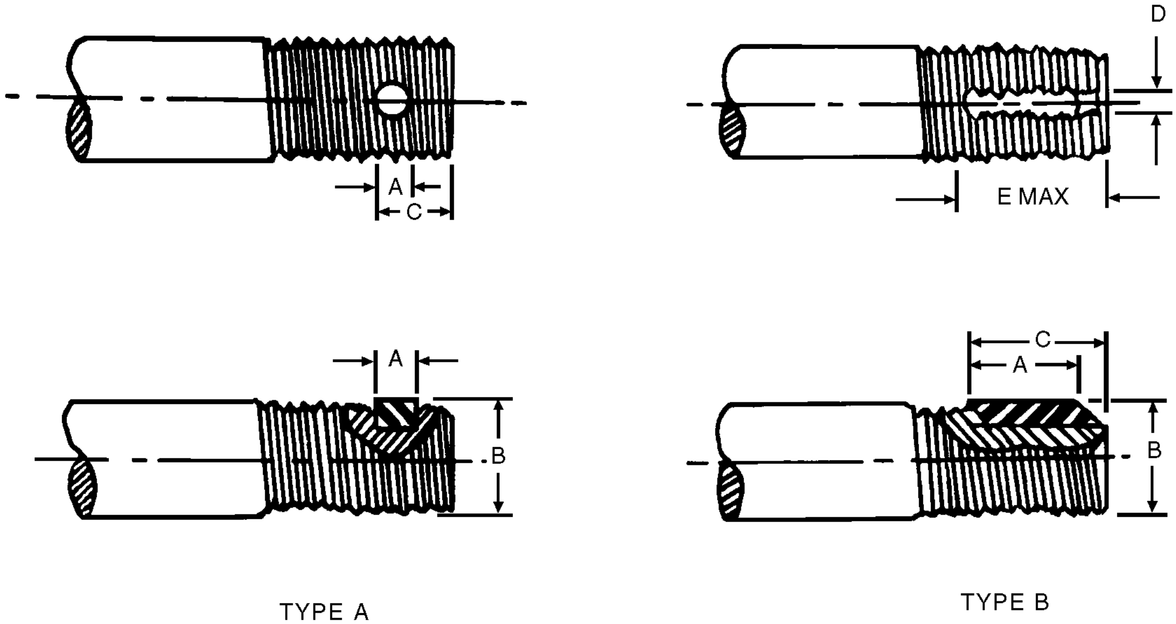
a. Tooling. A solid driver conforming to design standard MS33781 shall be used for installation and removal. The driver number will identify the proper driver size for all Torq-Set screw heads (10 driver size, 10 screw size). (See Figure 3-4.) However, the reduced 100° flush head has a recess one size smaller than the standard and requires the next size smaller driver (8 driver, 10 screw size).

b. Maintenance. The recess should be cleared of any foreign material before installation or removal. Discard screws and driver bits that show excessive wear. Worn drivers may cam out and ruin the recess making it difficult, if not impossible, to remove the screw even with a brand new driver.

c. Installation. All installation, either by hand or with power tools, shall be accomplished with a torque limiting or torque measuring device to insure that the installation torques specified by the aircraft manufacturer are met. Select the right size driver. Although one size larger driver will not enter a particular recess, a one size smaller will, but will not give the performance of the proper size driver. Keep the driver lined up with the recess. (No off angle driving.) Use moderate end pressure (15-20 lbs) to hold the driver in the recess and apply torque only when the driver is fully seated in the recess. Do not overtorque when installing screws. When using impact or power tools, make sure the torque control is accurately set, held the tool firmly and seat the driver bit firmly into the recess before turning on the tool. Do not attempt to engage the driver bit in the recess while the driver bit is running.

d. Removal. Normal practice will remove most properly installed Torq-Set screws. However, sometimes as a result of galling, oxidation, corrosion or over-torquing on installation, excessive removal torque must be applied. If such is the case, the recess should be loaded in a smooth uniform motion as torque is increased maintaining the solid drive ''in-line'' with the bolt centerline. End load may be applied. Do not snap load.

3.1.27 Hardness-Testing Aircraft Bolts. Since a relationship exists between the tested hardness, the tensile strength, and the specified heat treatment of the material, the heat treatment and consequent tensile strength of the bolt material can be checked by means of a hardness-testing machine, usually a Rockwell, Brinell, or Vickers type. Prepare bolts for hardness testing by filing, grinding, and polishing to remove the softer plating, decarburized material, and all scratches and variations that may affect the reading. If a bolt has been tested on the shank, it should be discarded. This does not give the actual strength of the bolt because head configuration and threads effect the loads a bolt can carry.



TYPE A

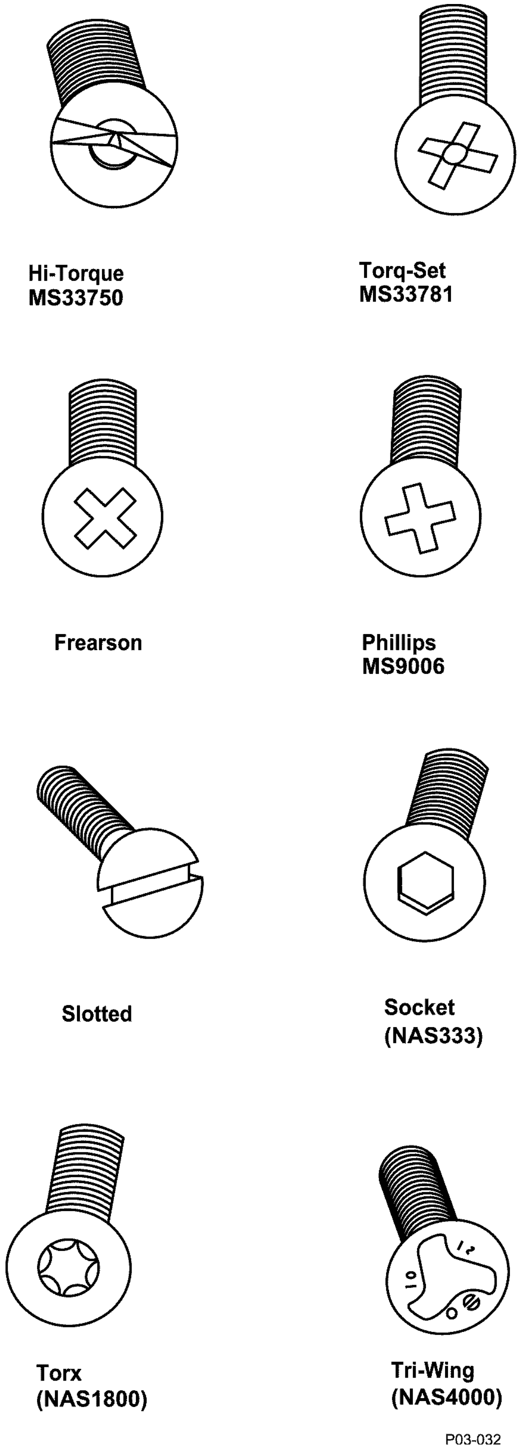
TYPE B

GOVERNMENT DESIGNATION	THREAD SIZE	TYPE	INSERT MATERIAL	A	B		C		D		E
					MAX	MIN					
1	4-40 NC	A	ZYTEL 101	0625 ± 0100	.115	.106	.141 ± .020				
2		B	PLASKON	2187 ± 0312			.2500± .0312		.035	.040	.2969
3	6-32 NC	A	ZYTEL 101	0781 ± 0100	.141	.131	.164 ± .020				
4		B	PLASKON	2500 ± 0312			.3125 ± .0312			.010	.3594
5	5-32 NC	A	ZYTEL 101	0625 ± 0100	.164	.157	.172	.010			
6				0937 ± 0100	.167			.020			
7		B	PLASKON	3125 ± 0312			.3750	.0312	.040	.010	.4375
8	10-32 NF-3	A	ZYTEL 101	0937 ± 0100	.193	.184	.188	.020			
9		B	PLASKON	3125 ± 0312			.3750	.0312	.040	.010	.4219
10	1/4-28 UNF-3	A	ZYTEL 101	1094 ± 0100	.253	.243	.211	.020			
11		B	PLASKON	2812 ± 0312			.3750	.0312	.035	.010	.4219
12	5/16-24 UNF-3	A	ZYTEL 101	1406 ± 0100	.315	.305	.242	.020			
13							.258				
14		B	PLASKON	3750 ± 0312			.4375	.0312	.035	.010	.5156
15	3/8-24 UNF-3	A	ZYTEL 101	1562 ± 0100	.378	.368	.250	.020			
16							.264	.020			
17					.385			.010			
18	7/16-20 UNF-3				.439	.42	.281	.020			
19					.448			.010			
20	1/2-20 UNF-3				.502	.492		.020			
21					.510			.010			

F03-002

Figure 3-2. Drawing MS33648(ASG)

3.1.28 Bolt Identification Markings. Bolts are marked with a code to identify their physical characteristics and contents. See Table 2-1 for these code markings.



3.1.29 Internal Wrenching Fasteners. A variety of externally threaded, internal wrenching fasteners are used in airframe manufacturing. Some have not, as yet, had a military designation assigned to them. Some examples of the various wrenching recesses are shown below.

3.1.30 The Hi-Torque recess is a single, curved-bottom slot, narrower at the center than at the ends. This, and the center dimple, make the recess readily identifiable by its ‘‘bow tie’’ appearance. The slot sides are undercut, producing an inverted keystone shape in the cross section.

3.1.31 The Torq-Set recess is distinctive in appearance in that the four driving wings are not centered on the vertical axis of the fastener, but, rather, are offset such that the installing side of the wing passes through the axis. Also, there is no taper to the sides of the driving wings.

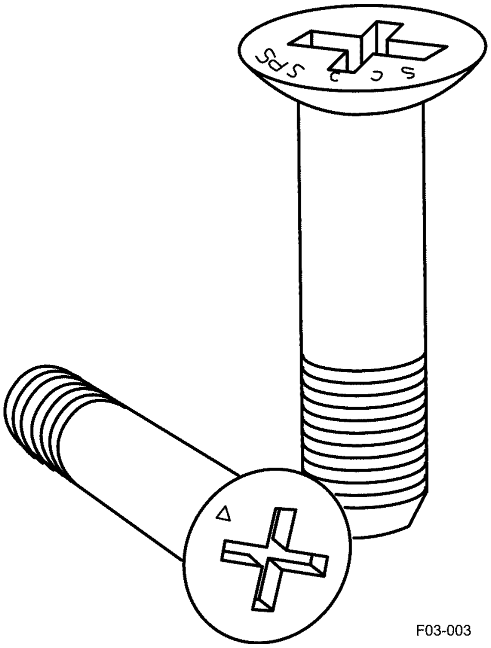
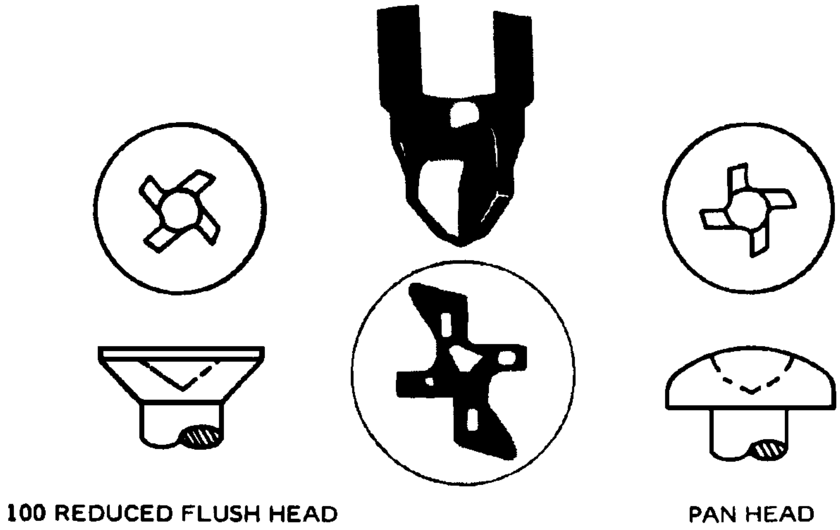


Figure 3-3. Torq-Set Wrenching Recess

3.1.32 The Frearson recess and the Phillips recess are similar in appearance (both have four driving wings). However, the Frearson recess has square-cut comers at the head surface and the comers of the Phillips recess are slightly chamfered.

a. The slotted or common is the most universally used recess and is distinctive because of its single, flat-bottomed groove or slot.

b. The socket recess is a normal six-sided hexagon (Allen wrench type recess).



SCREW SIZE	RECESS AND DRIVER SIZE	W WING DIA.	N WING THICK	T RECESS DEPTH	GAGE PENET
0					
1					
2					
3					
4					
5					
6					
8					
10	8	0.215 0.205	0.034 0.031	0.078 0.068	0.0595 0.0480
1/4	10	0.248 0.238	0.039 0.036	0.090 0.080	0.0685 0.0560
5/16	1/4	0.325 0.315	0.051 0.048	0.118 0.108	0.0890 0.0750
3/8	5/16	0.357 0.347	0.064 0.061	0.122 0.112	0.0860 0.0700
7/16	3/8	0.427 0.417	0.076 0.073	0.145 0.135	0.1030 0.0850
1/2	7/16	0.498 0.488	0.089 0.086	0.169 0.159	0.1205 0.1005
9/16	1/2	0.568 0.558	0.102 0.098	0.193 0.183	0.1375 0.1155
5/8	9/16	0.638 0.628	0.115 0.111	0.217 0.207	0.1545 0.1305

SCREW SIZE	RECESS AND DRIVER SIZE	W WING DIA.	N WING DIA.	T RECESS DEPTH	GAGE PENET
0	0	0.073 0.063		0.026 0.016	0.0180 0.0100
1	1	0.087 0.077	0.018 0.016	0.031 0.021	0.0215 0.0130
2	2	0.102 0.092		0.036 0.026	0.0250 0.0610
3	3	0.116 0.106	0.021 0.018	0.041 0.031	0.0285 0.0190
4	4	0.131 0.121	0.023 0.020	0.046 0.036	0.0320 0.0220
5	5	0.146 0.136	0.026 0.023	0.051 0.041	0.0355 0.0255
6	6	0.160 0.150	0.029 0.026	0.055 0.045	0.0390 0.0285
8	8	0.190 0.180	0.034 0.031	0.065 0.055	0.0470 0.0355
10	10	0.219 0.209	0.039 0.036	0.075 0.065	0.0540 0.0415
1/4	1/4	0.286 0.276	0.051 0.048	0.098 0.088	0.0695 0.0555
5/16	5/16	0.357 0.347	0.064 0.061	0.122 0.112	0.0860 0.0700
3/8	3/8	0.427 0.417	0.076 0.073	0.145 0.135	0.1030 0.0850
7/16	7/16	0.498 0.488	0.089 0.086	0.169 0.159	0.1205 0.1005
1/2	1/2	0.568 0.558	0.102 0.098	0.193 0.183	0.1375 0.1155
9/16	9/16	0.638 0.628	0.115 0.111	0.217 0.207	0.1545 0.1305
5/8	5/8	0.708 0.698	0.127 0.123	0.241 0.231	0.1710 0.1450

F03-004

Figure 3-4. Screw Head and Driver Size

c. The Torx recess is distinctive in appearance in that it has six short driving wings with rounded comers, similar to the impression of a six-tooth gear or sprocket.

d. The Tri-Wing recess is distinct because of its three driving wings.

3.1.33 Installation. All installations should be accomplished using the proper bit configuration.

CAUTION

OVER-TORQUING MUST BE AVOIDED

NOTE

Use only that driver bit which is designated for the recess involved. That is, do not use the following bits interchangeably within their groups: Phillips, Frearson, and Torq-Set; Socket (Hex) and Torx; Slotted and Hi-Torque.

a. The typical torque values shown in Table 3-23 are in accordance with NAS1737 for 160 ksi tensile strength fasteners; also, proper torque values can be found in the dash 3 of the applicable System Technical Order. Any additional clockwise movement after the fastener has been properly seated can increase the torque required for removal beyond normal requirements, which may be beyond the material capability of the fastener and result in cam-out.

b. Fasteners may be installed using screw drivers, ratchet, or speed wrenches as long as bits of the proper configuration are used. In all cases, sufficient end load must be applied, care must be taken to avoid ''wobble,'' and the driver must be kept ''in-line'' with the fastener centerline to prevent ''cam-out'' of the fastener recess and damage to the driver. When using speed wrenches, care must be exercised so that the bit does not become disengaged from the recess, thereby damaging the recesses and scratching or marring the surrounding structure.

3.1.34 Removal. Foreign material, including paint, must be cleared from the recess prior to attempted fastener removal. In general this may be accomplished with the aid of a scribe or awl. When this technique is employed, care must be exercised to insure that the tool does not slip, thereby damaging the recess or scratching or gouging adjacent surfaces. Once foreign material is removed from the recess areas, fasteners can be removed by the simultaneous application of end load and torque. Care should be exercised to insure that the end load is great enough to avoid driver bit ''cam-out'' and that the driver is ''in-line'' with the fastener. Torque should be applied in a smooth, uniform manner. DO NOT SNAP LOAD. As in the case of proper fastener installation, screw drivers, ratchet, and speed wrenches (with proper bits) may be used for fastener removal. However, extreme caution should be exercised to avoid tool ''wobble'' and bit ''cam- out.''

3.1.35 Occasionally it will be impossible to remove a fastener using normal practices. Generally this problem occurs when it is impossible to apply adequate end load and/or torque or when the fastener recess has been damaged due to bit ''cam-out.'' When these conditions occur, fastener removal tools, or fastener extractors may be used.

Table 3-23. Typical Installation Torque Values

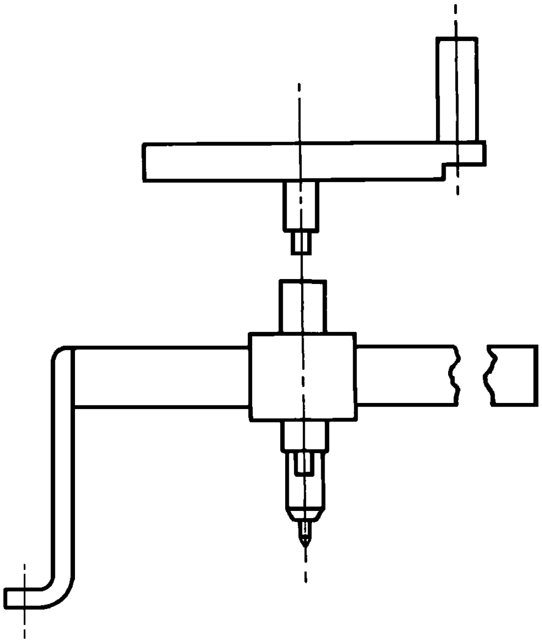
	Torque (Inch-Pounds)	
Nominal Size (Inch)	100° Flush and Protruding Head	100° Reduced Head
3/16	30 - 40	20 - 25
1/4	80 - 100	30 - 40
5/16	160 - 200	80 - 100
3/8	220 - 270	160 - 200
7/16	440 - 550	220 - 270
1/2	680 - 850	450 - 550
9/16	960 - 1200	680 - 850
5/8	1300 - 1620	960 - 1200

3.1.36 Fastener Removal Tool.

CAUTION

The use of impact procedures damages aircraft structure or skin. Use only an in-line screw removal tool or center drill the fastener and use an ‘‘easy out’’ to remove stuck fasteners.

These tools are available at some bases and provide a means of applying higher end loads and removal torques, while maintaining the tool ‘‘in-line’’ with the fastener. The foot of the tool is held in place at an adjacent fastener location and the span is adjusted so that the (proper) bit is located directly over, and in line with, the fastener to be removed. End load is applied at the handle and torque is applied through the ‘‘T’’ handle.



Fastener Removal Tool
(AF Drawing No. 77101-10 or Equivalent)
P03-034A

3.1.37 Fastener Extractor (Drill and Remove).

When the fastener recess is distorted to a degree that the above techniques cannot be employed, fastener extractors should be used. Proper removal can be accomplished by the following steps:

a. Locate and, if necessary, punch the center of the fastener.

b. Select the proper drill size from Table 3-24.

c. Drill pilot hole in screw. Drill fixtures should be used to insure that the hole follows the center of the screw.

d. Select the proper extractor from Table 3-24.

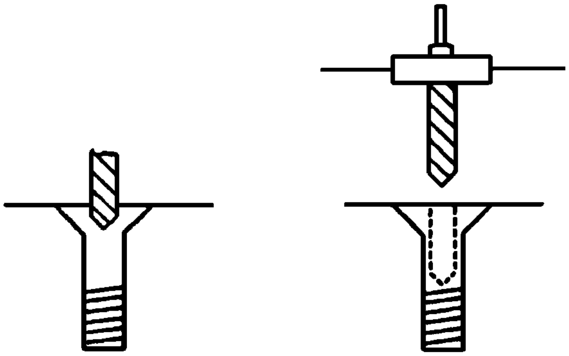
e. Drive the extractor into the drilled hole.

f. Turn extractor to remove fastener.

CAUTION

Avoid scratching or gouging adjacent structure.

g. Always use the largest extractor possible.



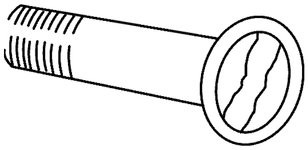
P03-034B

Table 3-24. Drill and Extractor Sizes

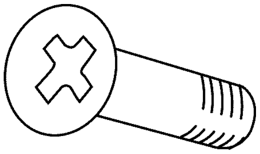
Extractor Number	For Fastener Sizes (Inches)	Size Drill to Use
1	3/16 to 1/4	5/64
2	1/4 to 5/16	7/64
3	5/16 to 7/16	5/32
4	7/16 to 9/16	1/4
5	9/16 to 3/4	17/64
6	3/4 to 1	13/32
7	1 to 1 3/8	17/32
8	1 3/8 to 1 3/4	13/16
9	1 3/4 to 2 1/8	1 1/16
10	2 1/8 to 2 1/2	1 5/16
11	2 1/2 to 3	1 9/16
12	3 to 3 1/2	1 15/16

3.2 MAINTENANCE.

The recess should be cleared of all foreign material (including paint) before installation or removal. If the driver or the fastener recess is burred, twisted, or damaged (see paragraph 3.3) due to overtorque or other reasons, it should be discarded.

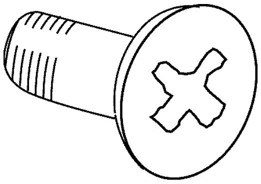


Damaged Hi-Torque Recess (Do Not Use)

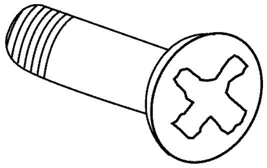


Damaged Torq-Set Recess (Do Not Use)

P03-035A

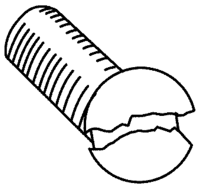


Damaged Phillips Recess (Do Not Use)

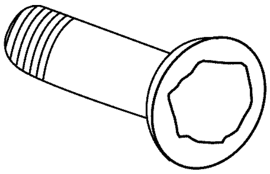


Damaged Frearson Recess (Do Not Use)

P03-035B

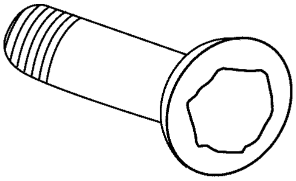


Damaged Slotted Recess (Do Not Use)

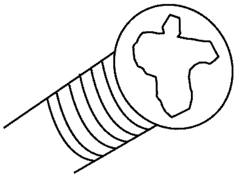


Damaged Socket Recess (Do Not Use)

P03-035C



Damaged Torx Recess (Do Not Use)

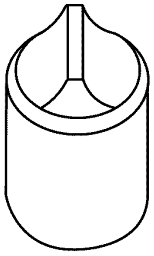


Damaged Tri-Wing Recess (Do Not Use)

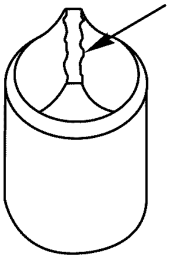
P03-035D

3.3 TOOLING.

Drivers conforming to the proper dimensions shall be used for installation and removal. The driver number will identify the proper driver size for standard protruding and 100° flush head fasteners. However, the reduced 100° flush head has a recess one size smaller than the standard head and requires the next size smaller driver.



Solid Head Hi-Torque Driver (MIL-B-9946/1)



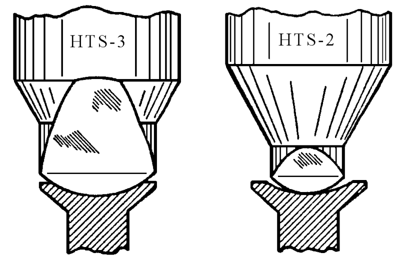
Damaged Solid Head Driver (Do Not Use)

P03-035E

CAUTION

Check tables for correct size driver.

a. The proper solid driver for a particular Hi-Torque recess has the same tip diameter as that of the standard 100° or protruding head outside diameter.



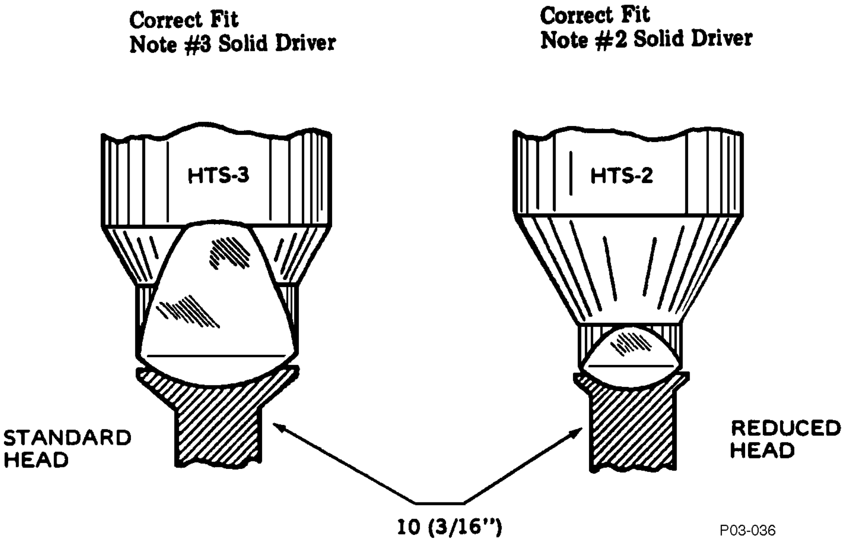
The correct driver makes a snug fit with the arc of the recess.

Too small a driver results in damage to recess, even at a low torque values.

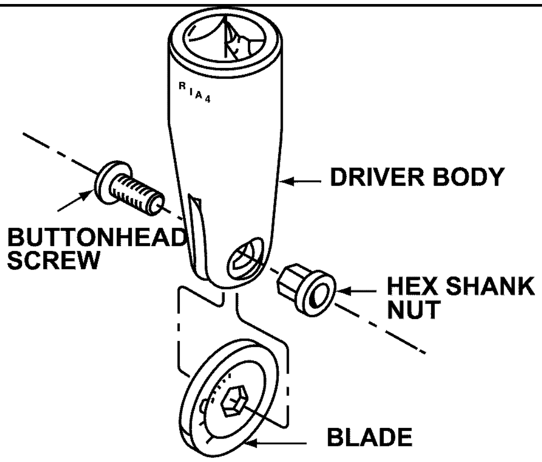
P03-035F

NOTE

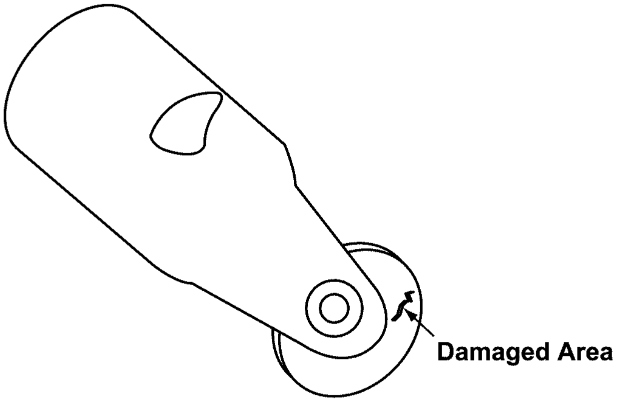
Reduced flush head fasteners require a driver one size smaller than the driver for the standard head fasteners, as shown in diagram below. Installation torque should be reduced accordingly.



P03-036



Wheel Driver
(MIL-B-9946/2)



Damaged Wheel Driver
(Do Not Use)

F03-004AS01

Hi-Torque Driver Selection Chart

Nominal Fastener Size	100° Flush and Protruding Head		100° Reduced Head	
	MIL-B-9946/1 Solid Driver	**MIL-B-9946/2 Wheel Driver**	**MIL-B-9946/1 Solid Driver**	**MIL-B-9946/2 Wheel Driver**
#4	HTS-1	- - -	- - -	- - -
#6	HTS-1	- - -	- - -	- - -
#8	HTS-2*	HTA2*	- - -	- - -
#10 (3/16)	HTS-3*	HTA3*	HTS-2*	HTA2*
1/4	HTS-4	HTA4	HTS-3*	HTA3*
5/16	HTS-5	HTA5	HTS-4	HTA4
3/8	HTS-6	HTA6	HTS-5	HTA5
7/16	HTS-7	- - -	HTS-6	HTA6
1/2	HTS-8	- - -	HTS-7	- - -
9/16	HTS-9	- - -	HTS-8	- - -
5/8	HTS-10	- - -	HTS-9	- - -

* The tip thickness of the -2 and -3 drivers is the same but the tip diameter is different. Do not interchange!

Figure 3-5. Driver Selection (Sheet 1 of 6)

Torq-Set

Torq-Set Driver Selection Chart

Nominal Fastener Size	100° Flush and Protruding Head Recess and Driver Size	100° Reduced Flush Head Recess and Driver Size
#0	0	-
#1	1	-
#2	2	-
#3	3	-
#4	4	-
#5	5	-
#6	6	-
#8	8	6
#10	10	8
1/4	1/4	10
5/16	5/16	1/4
3/8	3/8	5/16
7/16	7/16	3/8
1/2	1/2	7/16
9/16	9/16	1/2
5/8	5/8	9/16

Figure 3-5. Driver Selection (Sheet 2)

Phillips Recess

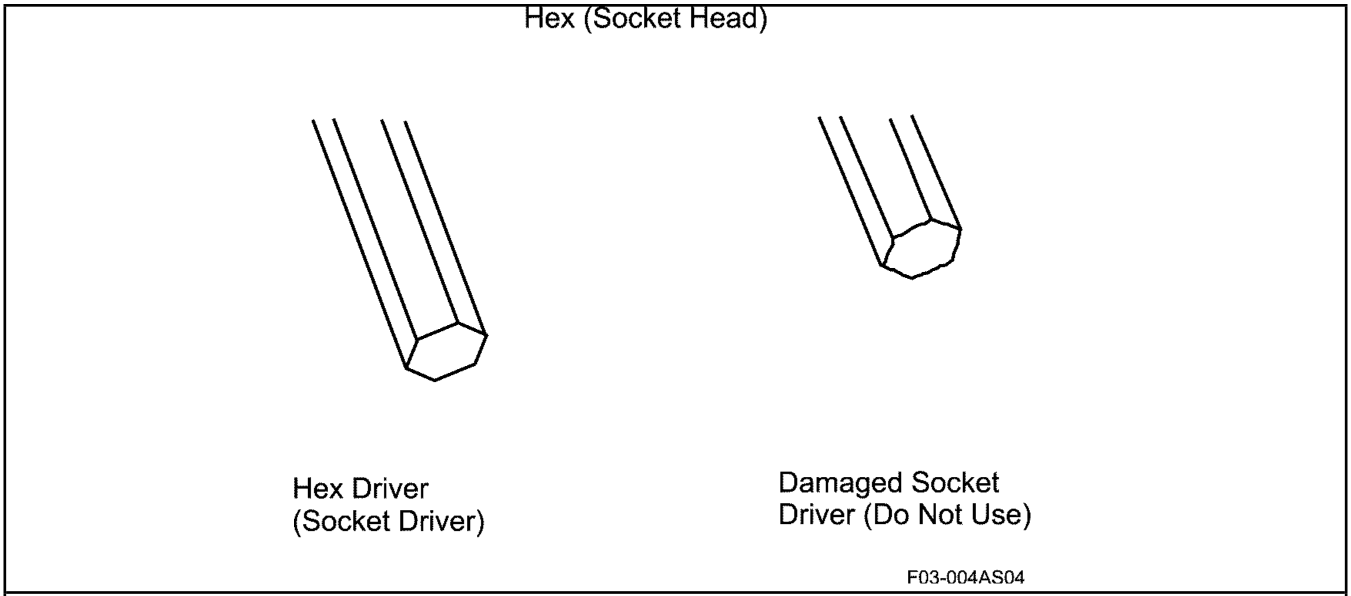
Phillips Driver
(MS9006)

Damaged Phillips
Driver (Do Not Use)

Phillips Driver Selection Chart

Nominal Fastener Size	Driver/Recess Number
#8	2
#10	2
1/4	3
5/16	4
3/8	4
7/16	4
1/2	4
9/16	4

Figure 3-5. Driver Selection (Sheet 3)

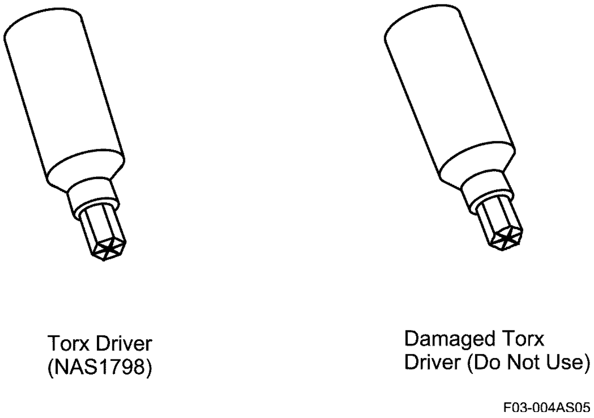


Hex Driver Selection Chart

Nominal Fastener Size	Driver/Recess Size
#10	7/32
1/4	7/32
5/16	1/4
3/8	5/16
7/16	3/8
1/2	7/16
9/16	1/2

Figure 3-5. Driver Selection (Sheet 4)

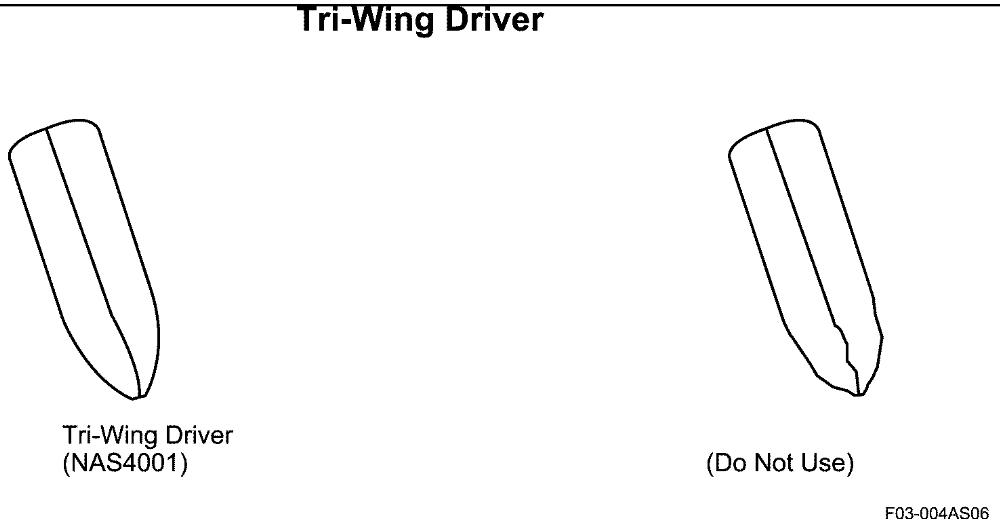
Torx



Torx Driver Selection Chart

Nominal Fastener Size	100° Flush and Protruding Head Driver Number	100° Reduced Head Driver Number
#2	T7	T7
#4	T10	T10
#6	T10	T10
#8	T20	T20
#10	T20	T20
1/4	T30	T20
5/16	T30	T30
3/8	T40	T30
7/16	T50	T40
1/2	T55	T55

Figure 3-5. Driver Selection (Sheet 5)



Tri-Wing Driver Selection Chart

Nominal Fastener Size	100° Flush and Protruding Head Driver/Recess Number	100° Reduced Head Driver/Recess Number
#4	2	- - -
#6	3	- - -
#5	4	- - -
#10	5	4
1/4	6	5
5/16	7	6
3/8	8	7
7/16	9	8
1/2	10	9
9/16	11	10
5/8	12	11
3/4	13	12
7/8	14	13
1	15	14

Figure 3-5. Driver Selection (Sheet 6)

CHAPTER 4
STUDS

4.1 STUDS.

(See Table 4-2 through Table 4-9.) The types of studs used in aircraft structure are coarse thread studs, fine thread studs, stepped studs, necked stepped studs, wrench pad necked stepped studs, lockring studs, and self tapping lockring studs. Studs are available either drilled or non-drilled on the nut end of the stud. For identification markings on studs, see Figure 4-9. Refer to Figure 4-10 for torque values for studs.

4.1.1 Installing New Stud (Figure 4-1).

CAUTION

Excessive amounts of lubricants shall be avoided, especially in blind holes. Use only sufficient lubricant to cover the sides of the threads with a thin coating.

NOTE

Unless otherwise specified, antiseize compound composed of (by weight) 75 percent petrolatum (melting point 120 to 140°F) and 25 percent graphite (powdered flake) shall be applied in the tapped hole.

a. Select proper size stud and install with driver and remover and collet and pin.

b. Use torque wrench to determine the torque at required height of stud.

c. If correct torque is not obtained at required stud height, remove stud with driver and remover and install another stud. Refer to Figure 4-10 for correct torque values.

4.1.2 Removing Bent or Damaged Stud (Figure 4-2).

a. Place adapter in stud remover.

b. Drive adapter down over threads of stud.

c. Remove stud by turning stud remover with a wrench. If threads in parent material pick up and stud remover cannot be turned, remove stud remover from adapter.

d. Place stud remover block and puller on adapter and remove adapter from stud.

e. Cut off stud close to parent material and remove stud as outlined in paragraph 4.1.4.

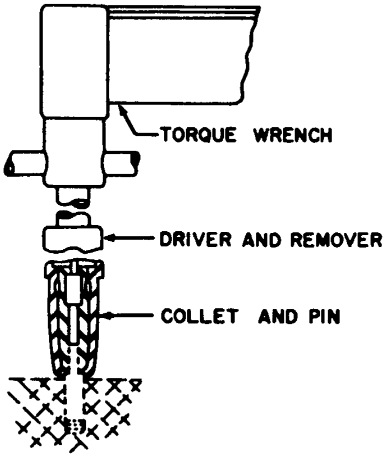


Figure 4-1. Installing New Stud

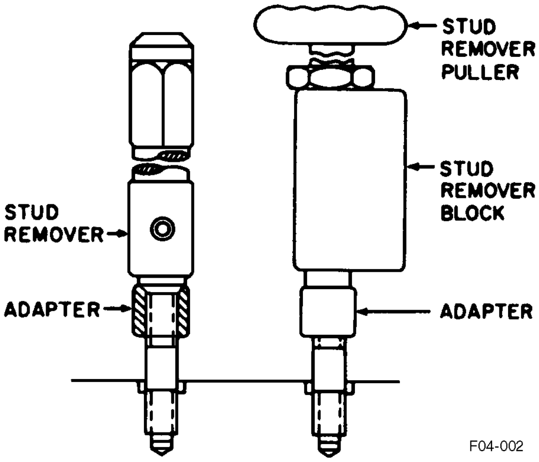


Figure 4-2. Removing Bent or Damaged Stud

4.1.3 Drilling Pilot Hole in Broken Stud (Figure 4-3).

NOTE

A drill jig is recommended for moderate use when drilling broken studs where it is impractical to have a complete set of stud replacement jigs.

a. Drill a pilot hole in stud, using 1/8-inch diameter by 5-1/8 inch drill.

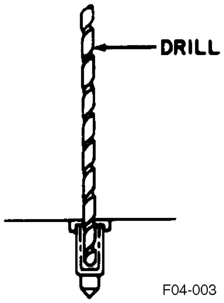


Figure 4-3. Drilling Pilot Hole in Broken Stud

b. If stud has a diameter of 7/16 inch or greater, enlarge pilot hole in stud, using 1/4-inch diameter drill.

c. Re-drill hole in stud, using proper drill for stud size.

4.1.4 Removing Broken Stud (Figure 4-4).

a. Select proper removing tool for stud size.

b. Drive removing tool into drilled hole in stud.

c. Remove stud, using tap wrench.

4.1.5 Retapping for New Stud (Figure 4-5).

a. When replacing a stud with another stud of the same size, run proper size tap into hole to clean up threads without removing any metal.

b. When retapping for next oversize stud, use proper tap for die-cut studs. If stud cannot be driven at torque specified in Figure 4-10, retap with tap for rolled thread studs of same size.

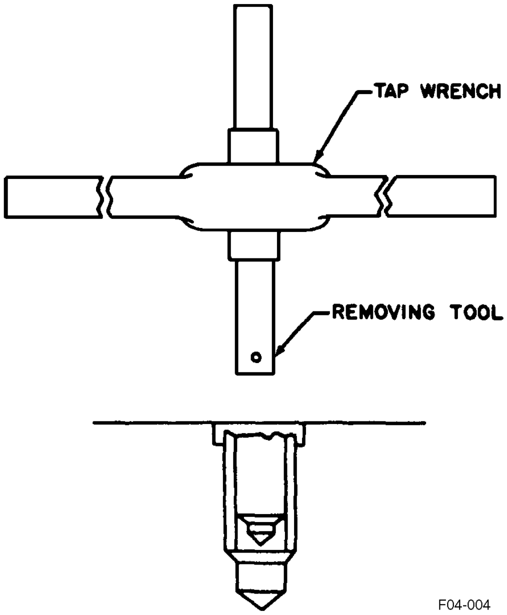


Figure 4-4. Removing Broken Stud

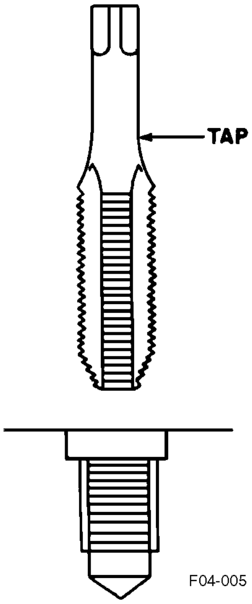


Figure 4-5. Retapping for New Stud

4.1.6 Lockring Studs (Figure 4-6). Locking standard and self-tapping studs can be installed in any material which can be drilled and tapped. Lockring studs eliminate the necessity of undersize and oversize studs commonly in use. The lockring prevents the stud from coming loose under any conditions, including vibrations, stress, and temperature change. Placing the lockring over the stud automatically engages the inner serrations of the lockring with those of the stud. When driven, the outer serrations accurately broach their way into the parent material without distortion or concentrated stress. This creates not only a secure lock, but also a perfect fit between the serrations of the lockring and the parent material. Although lockring studs have a special pitch diameter on the stud end threads, they require only a national class 3 tapped hole for installation. The special pitch diameter of the threads results in maximum incidence of line-to-line or slight interference fit between the stud and the parent material. Installation of the lockring stud can be accomplished with standard tools, although special installation and removal tools are available.

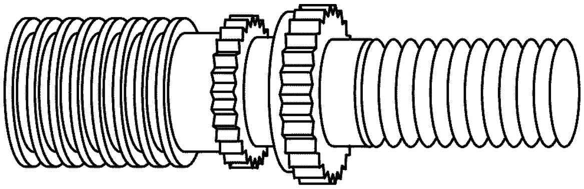


Figure 4-6. Lockring Threaded Stud

4.1.7 Installation of Lockring Stud (Figure 4-7).

a. Drill, counterbore, chamfer 45 degrees by outside diameter of counterbore, and tap a class 3 hole. (See A, Figure 4-7.)

b. Install stud with stud wrench. (See B, Figure 4-7.)

c. Press in lockring. Check that inner serrations of lockring align with serrations of stud. (See C, Figure 4-7.)

4.1.8 Removal of Lockring Stud (Figure 4-8).

a. Mill out inner serrations of lockring and serrated collar of stud. (See A, Figure 4-8.)

b. Unscrew stud from parent material. (See B, Figure 4-8.)

c. If lockring fails to come out, collapse remaining portion of ring with punch. (See C, Figure 4-8.)

4.2 STUD TOOLS.

Table 4-1 contains the nomenclature and Air Force special tool part number of tools commonly used in the installation and removal of studs.

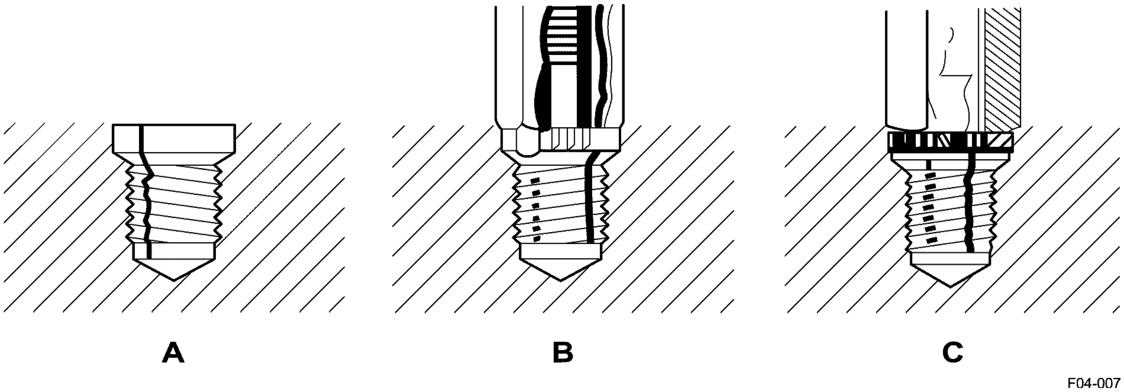


Figure 4-7. Installation of Lockring Stud

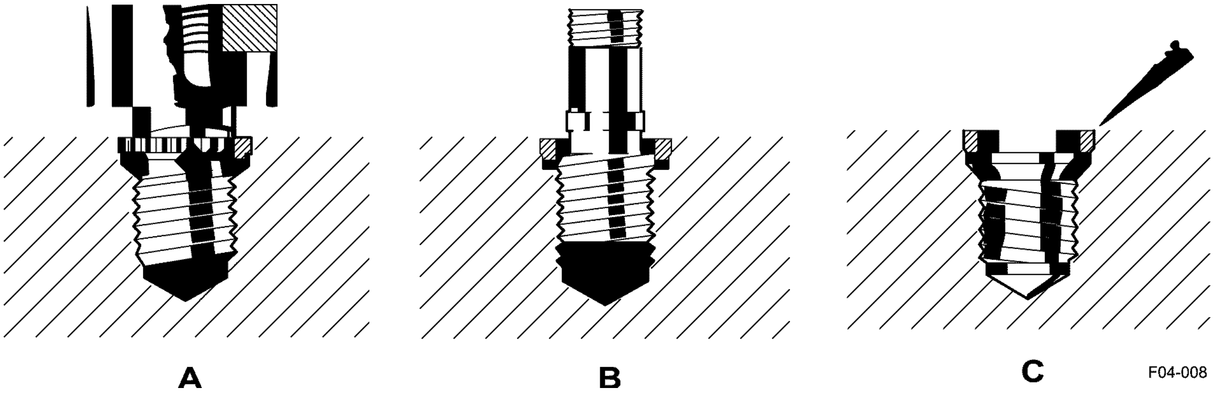


Figure 4-8. Removal of Lockring Stud

Table 4-1. Special Tools for Stud Installation and Removal

Tool Nomenclature	Special Tool Part Number
Drill (1/8 in. dia x 5-1/8 in., Cleveland Twist Drill Co., No. 950)	801550
Drill (No. 19, .166 in. dia, Cleveland Twist Drill Co., No. 918, or equivalent)	801151
Drill (No. 3, .213 in. dia, Cleveland Twist Drill Co., No. 918, or equivalent)	801152
Drill (1/4 in. dia, Cleveland Twist Drill Co., No. 917, or equivalent)	84277
Drill (9/32 in. dia, Cleveland Twist Drill Co., No. 917, or equivalent)	84904
Drill (5/16 in. dia, Cleveland Twist Drill Co., No. 917, or equivalent)	801155
Drill (3/8 in. dia, Cleveland Twist Drill Co., No. 917, or equivalent)	801157
Removing Tool (1/4 in. dia stud)	801158
Removing Tool (5/16 in. dia stud)	801159
Removing Tool (3/8 in. - 16 thd stud)	801160
Removing Tool (7/16 in. dia stud)	802150
Removing Tool (1/2 in. dia stud)	801163
Removing Tool (9/16 in. dia stud)	801165
Damaged Stud Remover	923247
Removing Puller	923460
Removing Adapter (1/4 in. dia stud)	803996
Removing Adapter (5/16 in. dia stud)	803997
Removing Adapter (3/8 in. dia stud)	803998
Removing Adapter (7/16 in. dia stud)	803999
Removing Adapter (1/2 in. dia stud)	806548
Tap (1/4 - 20 thd)	84510
Tap (1/4 - 20 thd, .003 in. OS)	84848
Tap (1/4 - 20 thd, .007 in. OS)	84231
Tap (1/4 - 20 thd, .012 in. OS)	84232
Tap (5/16 - 18 thd)	84444
Tap (5/16 - 18 thd, .003 in. OS)	84849
Tap (5/16 - 18 thd, .007 in. OS)	84233
Tap (5/16 - 18 thd, .012 in. OS)	84234
Tap (3/8 - 16 thd)	83717
Tap (3/8 - 16 thd, .003 in. OS)	84850
Tap (3/8 - 16 thd, .007 in. OS)	84505
Tap (3/8 - 17 thd, .012 in. OS)	84506
Tap (7/16 14 thd)	83851
Tap (7/16 - 14 thd, .003 in. OS)	801089
Tap (7/16 - 14 thd, .007 in. OS)	801090
Tap (7/16 - 14 thd, .012 in. OS)	801091
Tap (1/2 - 13 thd)	803527
Tap (1/2 - 13 thd, .003 in. OS)	803224
Tap (1/2 - 13 thd, .007 in. OS)	803225
Tap (1/2 - 13 thd, .012 in. OS)	803226
Tap (1/4 - 20 thd, .003 in. OS)	806438
Tap (1/4 - 20 thd, .007 in. OS)	806439
Tap (1/4 - 20 thd, .012 in. OS)	806440
Tap (5/16 - 18 thd, .003 in. OS)	806441
Tap (5/16 - 18 thd, .007 in. OS)	806442

Table 4-1. Special Tools for Stud Installation and Removal - Continued

Tool Nomenclature	Special Tool Part Number
Tap (5/16 - 18 thd, .012 in. OS)	806443
Tap (3/8 - 16 thd, .003 in. OS)	806444
Tap (3/8 - 16 thd, .007 in. OS)	806445
Tap (3/8 - 16 thd, .012 in. OS)	806446
Tap (7/16 - 14 thd, .003 in. OS)	806447
Tap (7/16 - 14 thd, .007 in. OS)	806448
Tap (7/16 - 14 thd, .012 in. OS)	806449
Tap (1/2 - 13 thd, .003 in. OS)	806450
Tap (1/2 - 13 thd, .007 in. OS)	806451
Tap (1/2 - 13 thd, .012 in. OS)	806452
Tap (9/16 - 12 thd)	806549
Tap (9/16 - 12 thd, .003 in. OS)	806550
Tap (9/16 - 12 thd, .007 in. OS)	806551
Tap (9/16 - 12 thd, .012 in. OS)	806552
Driver and Remover (1/4 - 28 thd and 5/16 - 24 thd, Service Tool Co., Bi-Way Studder No. 220, or equivalent)	805988
Driver and Remover (5/16 - 24 thd and 3/8 - 24 thd, Service Tool Co., Bi-Way Studder No. W-334, or equivalent)	805989
Driver and Remover (3/8 - 24 thd, 7/16 thd, and 1/2 - 20 thd, Service Tool Co., Bi-Way Studder No. 330, or equivalent)	805990
Installing Collet and Pin (1/4 - 28 thd, use with driver and remover 805988, Service Tool Co., Bi-Way Studder Collet and Pin No. C-21, or equivalent)	805991
Installing Collet and Pin (5/16 - 24 thd, use with driver and remove 805988; Service Tool Co., Bi-Way Studder Collet and Pin No. C-22, or equivalent)	805992
Installing Collet and Pin (5/16 - 24 thd, use with driver and remover 805989, Service Tool Co., Bi-Way Studder Collet and Pin No. C-35, or equivalent)	805993

Table 4-1. Special Tools for Stud Installation and Removal - Continued

Tool Nomenclature	Special Tool Part Number
Installing Collet and Pin (1/2 - 20 thd, use with driver and remover 805990, Service Tool Co., Bi-Way Studder Collet and Pin No. C-33, or equivalent)	805997
Installing Collet and Pin (7/16 - 20 thd, use with driver and remover 805990, Service Tool Co., Bi-Way Studder Collet and Pin No. C-32)	805996
Installing Collet and Pin (3/8 - 24 thd, use with driver and remover 805990, Service Tool Co., Bi-Way Studder Collet and Pin No. C-31, or equivalent)	805995
Installing Collet and Pin (3/8 - 24 thd, use with driver and remover 805989, Service Tool Co., Bi-Way Studder Collet and Pin No. C-36, or equivalent)	805994
Cleaning Tool (3/8 in. - 24 thd, 5/16 in. - 24 thd and 1/4 in. - 28 thd)	803203
Die (1/4 in. - 28 thd)	803204
Die (5/16 in. - 24 thd)	803205
Die (3/8 in. - 24 thd)	803206
Drill Jig	804640
Drill Bushing (1/8 in. dia)	804640D4
Drill Bushing (.166 in. dia)	804640D5
Drill Bushing (.213 in. dia)	804640D6
Drill Bushing (1/4 in. dia)	804640D7
Drill Bushing (9/32 in. dia)	804640D8
Drill Bushing (5/16 in. dia)	804640D9
Nut (1/4 in. dia)	804640D10
Nut (5/16 in. dia)	804640D11
Nut (3/8 in. dia)	804640D12

Table 4-2. NAS183 Coarse Thread Studs

P04-006

Thread (Nut End)		Diameter		Thread (Stud End)	
Size	Class	Min	Max	Size	Class
10-32	NF-3	.186	.189	10-24	NF-3
1/4-28	NF-3	.246	.249	1/4-20	NF-3
5/16-24	NF-3	.309	.312	5/16-18	NF-3
3/8-24	NF-3	.371	.374	3/8-16	NF-3
7/16-20	NF-3	.433	.437	7/16-14	NF-3
1/2-20	NF-3	.495	.499	1/2-13	NF-3

Code:
First dash number indicates diameter in 1/16-inch increments.
Second dash number indicates length in 1/8-inch increments.
Letter A following dash numbers indicates undrilled stud.
Example of part number:
NAS183-5-23 = stud, coarse thread, 5/16-inch diameter, 2-7/8 inches long, drilled hole in stud.
NAS183-5-23A = stud, coarse thread, 5/16-inch diameter, 2-7/8 kinches long, undrilled.
Material:
Steel - 2330, Military Specification MIL-S-18732 or Government approved equivalent.
Heat treatment:
125,000 to 145,000 PSI, Military Specification MIL-H-6875.
Finish:
Cadmium plating, Federal Specification QQ-P-416.

Table 4-3. NAS184 Fine Thread Studs

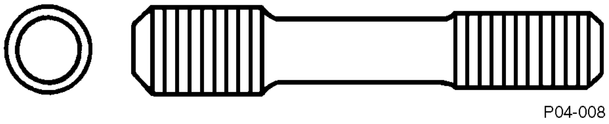
P04-007

Full Thread (Nut End)		Diameter		Full Thread (Stud End)	
Size	Class	Min	Max	Size	Class
10-32	NF-3	.186	.189	10-32	NF-3
1/4-28	NF-3	.246	.249	1/4-28	NF-3
5/16-24	NF-3	.309	.312	5/16-24	NF-3
3/8-24	NF-3	.371	.374	3/8-24	NF-3
7/16-20	NF-3	.433	.437	7/16	NF-3
1/2-20	NF-3	.495	.499	1/2-20	NF-3

Table 4-3. NAS184 Fine Thread Studs - Continued

Code:
First dash number indicates diameter in 1/16-inch increments.
Second dash number indicates length in 1/8-inch increments.
Letter A following dash number indicates undrilled stud.
Example of part number:
NAS184-5-23 = stud, fine thread, 5/16-inch diameter, 2-7/8 inches long, drilled hole in stud.
NAS184-5-23A = stud, fine thread, 5/16-inch diameter, 2-7/8 inches long, undrilled.
Material:
Steel - 2330, Military Specification MIL-S-18732 or Government approved equivalent.
Heat treatment:
125,000 to 145,000 PSI, Military Specification MIL-H-6875.
Finish:
Cadmium plating, Federal Specification QQ-P-416.

Table 4-4. Stepped Studs, 1.5 Diameter and 2.0 Diameter Engagement



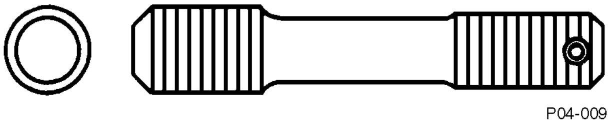
AN Number	Full Thread		Diameter		Min Full Thread	
	Size	Class	Min	Max	Size	Class
AN150501 through AN150800 AN154701 through AN155000	.250-20	NS	.164	.174	.190-32	NF-3A
AN150801 through AN151100 AN155001 through AN155300	.3125-18	NS	.221	.231	.250-28	UNF-3A
AN151101 through AN151400 AN155301 through AN155600	.375-16	NS	.279	.289	.3125-24	UNF-3A
AN151401 through AN151700 AN155601 through AN155900	.4375-14	NS	.342	.352	.375-24	UNF-3A
AN151701 through AN152000 AN155901 through AN156200	.500-13	NS	.399	.409	.4375-20	UNF-3A
AN152001 through AN152300 AN156201 through AN156500	.5625-12	NS	.461	.471	.500-20	UNF-3A
AN152301 through AN152600 AN156501 through AN156800	.625-11	NS	.520	.530	.5625-18	UNF-3A

Material:
Steel, Aeronautical Material Specification AMS6322.
Hardness:
Rockwell C26-32.

Table 4-4. Stepped Studs, 1.5 Diameter and 2.0 Diameter Engagement - Continued

Finish:
Cadmium plate, Aeronautical Material Specification AMS2400.

Table 4-5. Drilled Stepped Studs, 1.5 Diameter and 2.0 Diameter Engagement



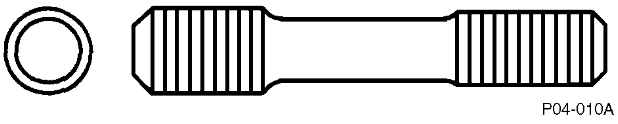
AN Number	Full Thread		Diameter		Min Full Thread	
	Size	Class	Min	Max	Size	Class
AN152601 through AN152900 AN156801 through AN157100	.250-20	NS	.164	.174	.190-32	NF-3A
AN152901 through AN153200 AN157101 through AN157400	.3125-18	NS	.221	.231	.250-28	UNF-3A
AN153201 through AN153500 AN157401 through AN157700	.375-16	NS	.279	.289	.3125-24	UNF-3A
AN153501 through AN153800 AN157701 through AN158000	.4375-14	NS	.342	.352	.375-24	UNF-3A
AN153801 through AN154100 AN158001 through AN158300	.500-13	NS	.399	.409	.4375-20	UNF-3A
AN154101 through AN154400 AN158301 through AN158600	.5625-12	NS	.461	.471	.500-20	UNF-3A
AN154401 through AN154700 AN158601 through AN158900	.625-11	NS	.520	.530	.5625-18	UNF-3A

Material:
Steel, Aeronautical Material Specification AMS6322.
Hardness:
Rockwell C26-32.
Finish:
Cadmium plate, Aeronautical Material Specification AMS2400.

Table 4-5. Drilled Stepped Studs, 1.5 Diameter and 2.0 Diameter Engagement - Continued

Hole size:
No. 51 (.065-.072).

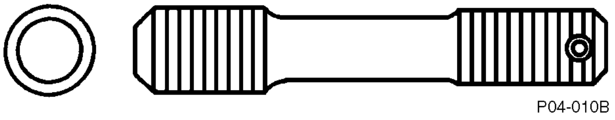
Table 4-6. Necked Stepped Studs, 1.5 Diameter and 2.0 Diameter Engagement



	Full Thread		Diameter		Min Full Thread	
AN Number	Size	Class	Min	Max	Size	Class
AN158901 through AN159200 AN161301 through AN161600	.4375-14	NS	.307	.311	.375-24	UNF-3A
AN159201 through AN159500 AN161601 through AN161900	.500-13	NS	.357	.361	.4375-20	UNF-3A
AN159501 through AN159800 AN161901 through AN162200	.5625-12	NS	.417	.421	.500-20	UNF-3A
AN159801 through AN160100 AN162201 through AN162500	.625-11	NS	.470	.474	.5625-18	UNF-3A

Material:
Steel, Aeronautical Material Specification AMS6322.
Hardness:
Rockwell C26-32.
Finish:
Cadmium plate, Aeronautical Material Specification AMS2400.

Table 4-7. Drilled Necked Stepped Studs, 1.5 Diameter and 2.0 Diameter Engagement



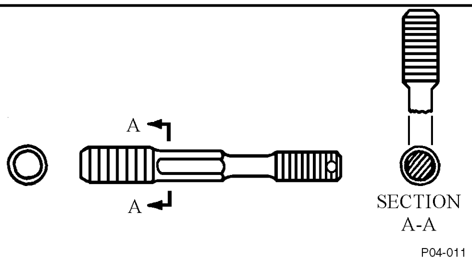
	Full Thread		Diameter		Min Full Thread	
AN Number	Size	Class	Min	Max	Size	Class
AN160101 through AN160400 AN162501 through AN162800	.4375-14	NS	.307	.311	.375-24	UNF-3A
AN160401 through AN160700 AN162801 through AN163100	.500-13	NS	.357	.361	.4375-20	UNF-3A
AN160701 through AN161000 AN163101 through AN163400	.5625-12	NS	.417	.421	.500-20	UNF-3A
AN161001 through AN161300	.625-11	NS	.470	.474	.5625-18	UNF-3A

Table 4-7. Drilled Necked Stepped Studs, 1.5 Diameter and 2.0 Diameter Engagement - Continued

	Full Thread		Diameter		Min Full Thread	
AN Number	Size	Class	Min	Max	Size	Class
AN163401 through AN163700						

Material:
Steel, Aeronautical Material Specification AMS6322.
Hardness:
Rockwell C26-32.
Finish:
Cadmium plate, Aeronautical Material Specification AMS2400.
Hole size:
No. 41 (.094-.101).

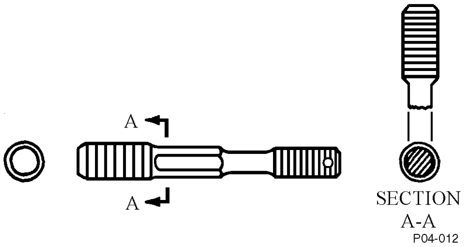
Table 4-8. Wrench Pad Necked Stepped Studs, 1.5 Diameter and 2.0 Diameter Engagement



	Full Thread (Wrench Pad End)		Diameter		Full Thread (Stud End)	
AN Number	Size	Class	Min	Max	Size	Class
AN163701 through AN164000 AN167301 through AN167600	.3125-18	NS	.180	.184	.250-28	UNF-3A
AN164001 through AN164300 AN167601 through AN167900	.375-16	NS	.229	.233	.3125-24	UNF-3A
AN164301 through AN164600 AN167901 through AN168200	.4375-14	NS	.285	.289	.375-24	UNF-3A
AN164601 through AN164900 AN168201 through AN168500	.500-13	NS	.331	.335	.4375-20	UNF-3A
AN164901 through AN165200 AN168501 through AN168800	.5625-12	NS	.387	.391	.500-20	UNF-3A
AN165201 through AN165500 AN168801 through AN169100	.625-11	NS	.437	.441	.5625-18	UNF-3A

Material:
Steel, Aeronautical Material Specification AMS6322.
Hardness:
Rockwell C26-32.
Finish:
Cadmium plate, Aeronautical Material Specification AMS2400.

Table 4-9. Wrench Pad Drilled Necked Stepped Studs, 1.5 Diameter and 2.0 Diameter Engagement



	Full Thread (Wrench Pad End)		Diameter		Full Thread (Stud End)	
AN Number	Size	Class	Min	Max	Size	Class
AN165501 through AN165800 AN169101 through AN169400	.3125-18	NS	.180	.184	.250-28	UNF-3A
AN165801 through AN166100 AN169401 through AN169700	.375-16	NS	.229	.233	.3125-24	UNF-3A
AN166101 through AN166400 AN169701 through AN170000	.4375-14	NS	.285	.289	.375-24	UNF-3A
AN166401 through AN166700 AN170001 through AN170300	.500-13	NS	.331	.335	.4375-20	UNF-3A
AN166701 through AN167000 AN170301 through AN170600	.5625-12	NS	.387	.391	.500-20	UNF-3A
AN167001 through AN167300 AN170601 through AN170900	.625-11	NS	.437	.441	.5625-18	UNF-3A

Material:

Steel, Aeronautical Material Specification AMS6322.

Hardness:

Rockwell C26-32.

Finish:

Cadmium plate, Aeronautical Material Specification AMS2400.

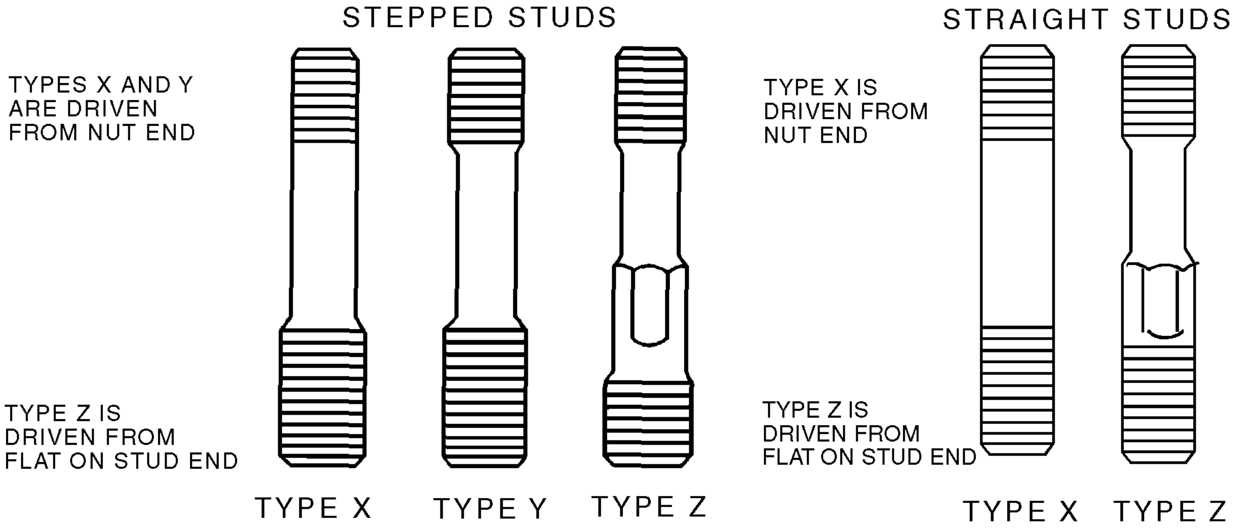
Hole size:

No. 30 (.126-.133).

MATERIAL MARKINGS	SIZE MARKINGS	PHYSICAL CHARACTERISTICS	MATERIAL	CLASSIFICATION OR SPECIFICATION
E I		Rockwell Hardness: C26-32	Steel, Alloy, Medium Carbon	AMS6320 for SAE8735
E I		Rockwell Hardness: C26-32	Steel, Alloy, Medium Carbon	AMS6322 for SAE8740
	UNDERSIZE AND OVERSIZE IDENTIFICATION MARKINGS USED ON THE ABOVE STUDS			
	-3 On the end of the stud opposite the Material Markings	.003 Undersize		
	○	Standard		
	3	.003 Oversize		
	6	.006 Oversize		
	9	.009 Oversize		
	12	.012 Oversize		

F04-099

Figure 4-9. Military Material Identification Markings on Studs



STUD SIZE		TORQUE VALUE INCH-POUNDS			STUD SIZE		TORQUE VALUE INCH-POUNDS	
STUD END	NUT END				STUD END	NUT END		
HAND DRIVEN								
					.112-40	.112-48	3-7.5	
					.138-32	.138-40	8-14	
					.164-32	.164-36	18-25	
.250-20	.190-32	25-50			.190-24	.190-32	25-35	
.3125-18	.250-28	50-110		50-165	.250-20	.250-28	50-95	50-105
.375-16	.3125-24	100-240	100-160	100-350	.3125-18	.3125-24	100-225	100-250
.4375-14	.375-24	175-475	175-375	175-600	.375-16	.375-24	175-375	175-400
.500-13	.4375-20	250-725	250-525	250-1000	.4375-14	.4375-20	250-650	250-700
.5625-12	.500-20	400-1150	400-850	400-1500	.500-13	.500-20	400-1000	400-1100
.625-11	.5625-18	600-1650	600-1150	600-2100	.5625-12	.5625-18	600-1450	600-1600
.6875-11	.625-18	900-2400	900-1700	900-3100	.625-11	.625-18	900-2000	900-2200
MACHINE DRIVEN								
					.112-40	.112-48	3-8	
					.138-32	.132-40	8-16	
					.164-32	.164-36	18-28	
.250-20	.190-32	25-55			.190-24	.190-32	25-40	
.3125-18	.250-28	50-125	100-180	50-165	.250-20	.250-28	50-105	50-105
.375-16	.3125-24	100-260	175-350	100-350	.3125-18	.3125-24	100-250	100-250
.4375-14	.375-24	175-525	175-350	175-600	.375-16	.375-24	175-400	175-400
.500-13	.4375-20	250-800	250-575	250-1000	.4375-14	.4375-20	250-700	250-700
.5625-12	.500-20	400-1300	400-925	400-1500	.500-13	.500-20	400-1100	400-1100
.625-11	.5625-18	600-1850	600-1300	600-2100	.5625-12	.5625-18	600-1600	600-1600
.6875-11	.625-18	900-2700	900-1900	900-3100	.625-11	.625-18	900-2200	900-2200

F04-098

Figure 4-10. Torque Values For Studs

CHAPTER 5
NUTS

5.1 NUTS.

The performance of a mechanically fastened joint depends upon the type of joint, the strength of the fastener and joint material, and the static and dynamic loads on the joint. The primary function of fasteners is to transmit the full design load to the joined members.

5.1.1 The purpose of any nut is to properly load the bolted assembly. To do this there must be a mating condition of the thread. While the thread form of a nut is accurate it cannot be made identical to that of the bolt. The nut must be plastic enough to allow the threads to slightly deform upon tightening and adjust to distribute the load over all threads rather than just the first few. A tough non-heat-treated nut can do this while a heat-treated nut cannot since it will not conform to the bolt threads. Hardened nuts can actually damage the bolt threads to which they are applied, resulting in low tension and loss of holding power vital to fastener performance. A nut should be no harder than is necessary to fully load the fastener assembly.

5.1.2 Loose assemblies often spell disaster both to man and equipment. Neglecting to apply or maintain enough of a preload leaves fasteners wide open to early fatigue. Using a strong bolt is not enough. Only when you tighten the bolt beyond the working load do you get a factor of safety. The greater the clamping force (pre-load) developed, the less will be the tendency of parts to creep or shift, also the possibility of a nut backing off or loosening in service is greatly reduced.

5.1.3 Therefore to increase performance of the fastener assembly, one simple rule must be observed: Tighten assemblies beyond their working loads and keep them tight, for if the preload applied is greater than the service load encountered there can be no fatigue failure.

5.1.4 The ideal point for tightening a fastener assembly is just below the yield strength. This provides a cushion for working load variations and prevents loosening.

5.2 FASTENER FATIGUE FAILURE.

Fatigue failures account for over 75% of all fastener problems. Fatigue breaks are caused by insufficient tightening and lack of proper preload or clamping force. This results in movement between the parts of the assembly in use, and bending back-and-forth or cyclic stressing of the screw. Eventually a tiny crack forms at the high stress point and as the vibration, movement and bending are continued, a second crack, then a third, fourth and so on are formed. These tiny cracks which occur progressively as the bending takes place, cause the part to become weaker until it can no longer support the load. At this point the screw or bolt breaks in tension or pulls apart.

5.3 TORQUE.

The correct torque to apply when tightening an assembly is a difficult decision because there are so many variables. The screw or bolt takes two stresses when it is tightened, (1) Torsion, and (2) Tension. Tension is the desired stress. Torsion is the necessary evil due to friction. A large percentage of applied torque goes to overcome friction, yet only tension remains after tightening. About 50% of the torque is absorbed in overcoming friction on the working faces of the bolt and nut while 40% is taken up by thread friction leaving only 10% to apply bolt tension (pre-load).

5.3.1 Standard torque charts have been established for average dry unplated conditions but surface variations such as thread roughness, scale, paint, lubrication, (oil, grease, etc.) hardening and plating may alter these values considerably. Also nuts that are reused will require higher torque reading. Torque values will also vary with manufacturers.

NOTE

When torque values are included in a technical manual for a specific end item, these values shall be used in lieu of information contained in this manual.

5.3.2 To obtain the correct recommended torque value on self-locking nuts, the nut must be run down until it is one turn from the beginning of seating. At this point, the prevailing torque should be noted. If the prevailing torque is less than one-third of the recommended torque, it should be disregarded and the nut tightened to the recommended torque value. If the prevailing torque is one-third or more than one-third of the recommended torque, it should be added to the recommended torque. Example: The recommended torque is 50 to 70 inch-pounds. The prevailing torque at one turn from the beginning of seating is 30 inch-pounds. The correct torque wrench reading would be 80 to 100 inch-pounds.

5.4 DEFINITIONS.

For the use of ''shall,'' ''will,'' ''should,'' and ''may'' in this section see Introduction.

5.4.1 Torque. The turning effort or force required to apply tension to a fastener assembly; normally expressed in inch-pounds or foot-pounds. A one pound weight suspended on a lever arm one foot long exerts one foot-pound of torque. Torquing is the act of tightening a fastener assembly to a specific value.

Table 5-1. Cross Reference on Nuts Replaced by MS21042

AN363	AN364		AN365		MS20364		MS20365		MS21040	NAS679			MS21042
Replaced Dash Numbers													Replacement Dash Numbers
			440	440C			440	440C	04	A04	A04W	X04	04
632	632	632C	632	632C	632	632C	632	632C	06	A06	A06W	X06	06
832	832	832C	832	832C	832	832C	832	832C	08	A08	A08W	X08	08
1032	1032	1032C	1032	1032C	1032	1032C	1032	1032C	3	A3	A3W	X3	3
428	428	428C	428	428C	428	428C	428	428C	4	A4	A4W	X4	4
524	524	524C	524	524C	524	524C	524	524C	5	A5		X5	5
624	624	624C	624	624C	624	624C	624	624C	6	A6		X6	6
									L04	C04M	C04MW		L04
									L06	C06M	C06MW		L06
									L08	C08M	C08MW		L08
									L3	C3M	C3MW		L3
									L4	C4M	C3MW		L4
									L5	C5M			L5
									L6	C6M			L6

5.4.2 Tension. The amount of clamping force developed in an assembly. When a bolt is tightened by torquing, it develops a ‘‘holding together’’ (tension) force on the assembly. The greater the tension, the greater the ‘‘holding together’’ effect.

5.4.3 Fatigue. The result of varying stresses or workloads. The simplest form of fatigue occurs when metal is bent back and forth until it is broken.

5.4.4 Pre-Loading. Tightening.

5.4.5 Tensile Strength. The amount of load required to break or fracture a material, usually expressed in pounds per square inch (P.S.I.) A 3/4-10 cap screw contains 0.3340 square inches of stress area. Made from a 150,000 (P.S.I.) material, it would have a strength of 150,000 x 0.3340 or 50,100 pounds of actual strength. Torque charts and ratings are based on actual minimum tensile strengths for given class of product.

5.4.6 Shear Strength. The opposite from tensile strength in that it is caused by push or pull 90 degrees from the axis while tensile strength is determined by longitudinal pull. In the fastener fields shear strength can be roughly calculated as 60 per cent of the ultimate tensile strength of the screw or bolt.

5.5 GENERAL.

The types of nuts used in aircraft structure are plain nuts, castle nuts, check nuts, plate nuts, channel nuts, barrel nuts, internal wrenching nuts, shear nuts, sheet spring nuts, and wing nuts. Many are available in either self-locking or nonself-locking style.

5.5.1 During the past few years the government has experienced a trend toward increased usage of lightweight self-locking nuts. The lightweight series nuts have come into prominence because of the increasing strength/weight ratio requirements of modem high-performance aerospace vehicles. When correctly applied, these nuts provide service equal to the old heavyweight nuts, with weight savings which can be substantial when the number of fasteners per aerospace vehicle are considered.

5.5.2 Field personnel have experienced numerous problems in the correct identification and application of self-locking nuts. These problems exist because of the multiple types of locking devices, sizes, materials of construction, temperature ratings and thread lubricants, added to the fact that most of the nuts do not have identification markings. These problems have been increased by the introduction of the lightweight series into the government inventory.

5.6 1200 DEGREE NUT IDENTIFICATION.

The purpose of this paragraph is to enable its reader to recognize 1200°F. hexagon, self-locking nuts on sight.

a. The temperature limit of a nut is the most critical of its parameters. Critical because the result of exceeding it is a failed nut and, more so, because this type of failure occurs, not at installation, but during system operation. It is very important that a 1200° nut be installed where one is specified. This also applies to the other temperature ratings.

b. 1200° nuts have certain family traits that help identify them as such.

    (1) Configuration: There are three somewhat different shapes. Two are in the MS20500 series and are illustrated in Figure 5-10 of this chapter. The third is a commercial series produced by several nut manufacturers. It is similar to the top illustration in Figure 5-10 but has much longer tines (slotted part). Among these the height of the tines is greater than the height of the hexagon flats.

    (2) Plating: Silver. The procurement Specification, MIL-N-7873 requires that the threads be silver plated and optionally allows the entire nut to be plated. This being more economical overall, the nuts are silver plated inside and out. The plating acts as a lubricant and prevents seizing. Silver plating alone is not an indication that the nut is 1200° rated. Nuts rated at 800° and above are also silver plated. One good purpose served is that any nut not silver plated is not a high temperature type.

    (3) Markings: One flat of the hexagon is stamped 12, H4, H4-R, or H19. The 12 represents MS20500 series nuts. The others represent commercial nuts.

5.6.1 It can readily be seen by referring to Table 5-1 through Table 5-6 that a considerable reduction in the number of items stocked will be attained through use of the new superseding standards. This reduction of items will provide greater overall efficiency and economy in the management, procurement, warehousing and storage, and cataloging of self-locking nuts.

5.6.2 Concurrent with the development of lightweight nuts, Military Standards (MS) were established to reflect supersedure of many of the old AN, MS, and NAS nuts used in application which do not require lightweight nuts. Cross reference standards are included in Table 5-3 through Table 5-6.

5.6.3 It should be noted that due to the reduced height of the lightweight nuts, installations originally designed for lightweight nuts have studs or bolts of shorter length than required for regular weight nuts. Thus, in these applications, regular weight nuts cannot be substituted for lightweight nuts because the locking element (usually near the top portion of the nut) might not engage. For this reason, the lightweight and regular weight nuts are not universally interchangeable; the lightweight nuts can replace the regular weight nuts, but the regular weight nuts cannot replace the lightweight nuts in all applications.

Table 5-2. Cross Reference on Nuts Replaced by MS21043

NAS679 Replaced Dash Numbers		MS21043 Replacement Dash Number
C04	C04W	04
C06	C06W	06
C08	C08W	08
C3	C3W	3
C4	C4W	4
C5	C5	5
C6	C6	6

NOTE

Although the lightweight series nuts are considered suitable replacement for the regular, weight nuts, this does not hold true for some critical engine applications. Regular weight nuts will be retained for these applications.

5.7 MILITARY STANDARDS (MS) NUTS.

These nuts have a one piece design except for the non-metallic locking feature in some 250°F. nuts and in the free spinning nuts. These standards leave the shape of the top of the nuts and specific locking design optional. Therefore, different manufacturers make nuts with various top shapes and locking designs which meet the same military standards. There are also numerous commercial nuts which do not conform to military standards but which are specified by the aerospace component manufacturers original design.

5.7.1 Due to the numerous MS drawings it is not considered practical to cover all these drawings in this technical manual. However, following subparagraphs are a partial listing of these MS drawings with a brief explanation.

NOTE

The following paragraph 5.7.1, step a through paragraph 5.7.1, step g are intended as general information only and are not intended to authorize substitution or inter-changeability between nuts. Consult I&S Group listings for authorized substitutes.

a. MS21042 is a lightweight 450°F. external wrenching hex nut having reduced height, reduced hex and a ring base which gives a bearing surface equal to the bearing surface of the nuts it replaces. MS21042 nuts can universally replace AN363, AN364, AN365, MS20365, MS20364, and MS21040 non-corrosion resistant steel nuts of like thread size, and which are either all metal or have non-metallic inserts (see Table 5-1 and Figure 5-2 for head styles).

b. MS21043 is a lightweight 800°F. nut having reduced height, reduced hex and a ring base which gives a bearing surface equal to the bearing surface of the nuts it replaces. It is available only in corrosion and heat resistant steel, silver plated with external type wrenching. MS21043 replaces NAS 679 nuts of similar material (800°F. temperature rating), both internal and external wrenching types (Table 5-2 and Figure 5-2).

c. MS21044 is a 250°F. regular series, regular height nut. It is available with non-metallic insert locking feature or in the all-metal series. It is available in carbon steel, aluminum alloy, copper base alloy, or corrosion resistant steel. The material determines the strength rating, which is 60,000 PSI or 125,000 PSI. Except for 7/16-20, 8-32, 10-32, and 1/4-28 sizes in AN365 and MS20365, MS21044 nuts can universally replace AN365, MS20365, and NAS1021 (original issue dated 31 July 1956) nuts of like material and plating, thread size and locking design (all metal or with non-metallic insert). See Table 5-3 and Figure 5-3.

Table 5-3. Cross Reference on Nuts Replaced by MS21044

AN365	MS20365 Replaced Dash Numbers	NAS1021	MS21044 Replacement Dash Number
440A	440A	N04	N04
632A	632A	N06	N06
		N08	N08
		N3	N3
		N4	N4

Table 5-3. Cross Reference on Nuts Replaced by MS21044 - Continued

AN365	**MS20365** **Replaced Dash Numbers**	**NAS1021**	**MS21044** **Replacement Dash Number**
524A	524A	N5	N5
624A	624A	N6	N6
		N7	N7
820A	820A	N8	N8
918A	918A	N9	N9
1018A	1018A	N10	N10
1216A	1216A	N12	N12
1414A	1414A	N14	N14
1614A	1614A	N16	N18
1812A	1812A	N18	N18
2012A	2012A	N20	N20
B440A	B440A	B04	B04
B632A	B632A	B06	B06
		B08	B08
		B3	B3
		B4	B4
B524A	B524A	BS	B5
B624A	B624A	B6	B6
		B7	B7
B820A	B820A	B8	B8
B918A	B918A	B9	B9
B1018A	B1018A	B10	B10
B1216A	B1216A	B12	B12
B1414A	B1414A	B14	B14
B1614A	B1614A	B16	B16
B1812A	B1812A	B18	B18
B2012A	B2012A	B20	B20
B440C	B440C	E04	E04
B632C	B632C	E06	E06
		E08	E08
		E3	E3
		E4	E4
B524C	B524C	E5	E5
B624C	B624C	86	E8
		E7	E7
B820C	B820C	E8	E8
B918C	B918C	E9	E9
B1018C	B1018C	E10	#10
B1216C	B1216C	E12	E12
B1414C	B1414C2	E14	#14
B1614C	B1614C	E16	#16
B1812C	B1812C	E18	E18

Table 5-3. Cross Reference on Nuts Replaced by MS21044 - Continued

AN365	MS20365 Replaced Dash Numbers	NAS1021	MS21044 Replacement Dash Number
B2012C	B2012C	E20	E20

Table 5-4. Cross Reference on Nuts Replaced by MS21044

AN365	MS20365 Replaced Dash Numbers	NAS1021	MS21044 Replacement Dash Number
D440A	D440A	D04	D04
D632A	D632A	D06	D06
		D08	D08
		D3	D3
		D4	D4
D524A	D524A	D5	D5
D624A	D624A	D6	D6
		D7	D7
D820A	D820A	D8	D8
D918A	D918A	D9	D9
D1018A	D1018A	D10	D10
D1216A	D1216A	D12	D12
D1414A	D1414A	D14	D14
D1614A	D1614A	D16	D16
D1812A	D1812A	D18	D18
D2012A	D2012A	D20	D20
D440C	D440C	H04	H04
D632C	D632C	H06	H06
		H08	H08
		H3	H3
		H4	H4
D524C	D524C	H5	H5
D624C	D624C	H6	H6
		H7	H7
D820C	D820C	H8	H8
D918C	D918C	H9	H9
D1018C	D1018C	H10	H10
D1216C	D1216C	H12	H12
D1414C	D1414C	H14	H14
D1614C	D1614C	H16	H16
D1812C	D1812C	H18	H18
D2012C	D2012C	H20	H20

d. MS21045 is a 450°F. regular height, regular series external wrenching hex nut having a 125,000 PSI strength rating. It is available in plain steel, cadmium plating or corrosion resisting steel. Except for the 7/16-20 thread size nuts in AN363, AN365, and MS20365, MS21045 nuts can universally replace the all-metal AN363, AN365, MS20365, and NAS1021 (original issue dated 31 July 1956) nuts of like material, plating and thread size (Table 5-5 and Figure 5-7).

e. MS21046 is a 800°F. regular series, regular height external wrenching hex nut available only in corrosion resistant steel, silver plated. MS21046 nuts replace AN363 and NAS1021 corrosion resistant steel nuts (Table 5-6 and Figure 5-8).

CAUTION

Self-locking castellated nuts require cotter pins or safety wire.

f. Self-locking castellated nuts MS17825 and MS17826 were developed to meet the need for an extra ‘‘fail safe’’ feature in certain critical applications such as joints in aircraft control systems, installation of bearings, bushing, pulleys, cranks, linkages, cam followers, etc., where an externally threaded part would serve as an axle or axis of rotation for another part. These nuts are briefly described as follows:

(1) MS17825 nuts (Figure 5-9 (A)) are self-locking, castellated, 250°F. external wrenching hex nuts of regular height and regular weight. They are available only in alloy steel, cadmium plated and have non-metallic inserts.

(2) MS17826 nuts (Figure 5-9) are similar to MS-17825 nuts except that MS17826 types are lightweight, lower torque, reduced height nuts.

g. MS20500 is a 1200° F. nut. These nuts are bought according to MS20500 (ASG) and its procurement Specification MIL-N-7873, ‘‘Nut, Self-Locking, 1200 Degrees Fahrenheit.’’ These are regular height, regular weight, external wrenching hex nuts. They are available only in corrosion resistant and heat resistant steel with silver plating or other approved coating or finish which will prevent nut - bolt seizure at 1200°F. They can be identified by the number 12 stamped on one side of each nut. (Figure 5-10).

h. MS21244 is a 450°F, nut castellated, hexagon counter bored assembled washer (Figure 5-9 (C)) is used with (self-retaining bolts) MS21244 specifies design requirements and procurement specification are cited in FF-N-836.

Table 5-5. Cross Reference on Nuts Replaced by MS21045

AN363	AN365	MS20365	NAS1021	MS21045
	Replaced Dash Numbers			Replacement Dash Number
	440C	440C	A04	04
632	632C	632C	A06	06
832	832C	832C	A08	08
1032	1032C	1032C	A3	3
428	428C	428C	A4	4
524	524C	524C	A5	5
624	624C	624C	A6	6
			A7	7
820	820C	820C	A8	8
918	918C	918C	A9	9
1018	1018C	1018C	A10	10
1216	1216C	1216C	A12	12
	1414C	1414C	A14	14
	1614C	1614C	A16	16
	1812C	1812C	A18	18
	2012C	2012C	A20	20
C632				C04
C832				C08

Table 5-5. Cross Reference on Nuts Replaced by MS21045 - Continued

AN363	AN365 Replaced Dash Numbers	MS20365	NAS1021	MS21045 Replacement Dash Number
C1032				C3
C428				C4
C524				C5
C624				C6
				C7
C820				C8
C918				C9
C1018				C10
C1216				C12
				C14
				C16
				C18
				C20

Table 5-6. Cross Reference on Nuts Replaced by MS21046

AN363	NAS1021	MS21046
Replaced Dash Numbers		Replacement Dash Number
	C04	C04
C632	C06	C06
C832	C08	C08
C1032	C3	C3
C428	C4	C4
C524	C5	C5
C624	C6	C6
C720	C7	C7
C820	C8	C8
C918	C9	C9
C1018	C10	C10
C1216	C12	C12
	C14	C14
	C16	C16
	C18	C18
	C20	C20

5.8 WRENCHING PROBLEMS.

Some manufacturers, Kaynar for example, produce nuts similar to certain MS nuts except for slightly smaller wrenching dimensions. When installation is attempted using standard tools, the corners of the nuts will become rounded off and full installation torque will not be attained. Figure 5-14 lists special Kaynar tools required for these nuts. Figure 5-14 also lists Kaynar internal wrenching tools required to install the internal/external wrenching nuts formerly procured under NAS679 and MS21040 when these nuts are installed in close corners where internal wrenching is required. These NAS679 and MS21040 nuts (Figure 5-11) are not longer procured by the Air Force. See Table 5-1 and Table 5-2 for replacement MS Standard Nuts. The replacement nuts are all external wrenching.

5.9 SELF-LOCKING NUTS.

These nuts provide tight connections which will not loosen under vibration. Self-locking nuts approved for use on aerospace vehicles meet critical specifications as to strength corrosion resistance and temperature.

5.9.1 Application of Self-Locking Nuts.

CAUTION

New self-locking nuts shall be used each time components are installed in critical areas throughout the aerospace vehicle. Self-locking nuts shall not be used with bolts or screws on jet engines aircraft in locations where the loose nut, bolt or screw could fall or be drawn into the engine air intake duct unless otherwise specified by engine manual.

Self-locking nuts shall not be used at joints in control systems of aerospace vehicle structure when movement of the joint may result in motion of the nut relative to the surface against which it is bearing. They may be used with antifriction bearings and control pulleys provided the inner race of the bearing is clamped to the supporting surfaces by the nut and bolt. The nuts which are attached to the structure shall be attached in a positive manner to eliminate the possibility of their rotating or misaligning when the tightening is to be accomplished by rotating the bolts or screws. The manner of attachment must permit removal without injury to the structure and the replacement of the nuts.

5.9.2 Thread Protrusion. In all installations, bolts, studs or screws must extend through nut for at least two threaded pitches. This applies to both self-locking and plain nuts, and includes any chamfer at the bolt end. The requirement for thread protrusion is based on a principle applicable to a bolt and nut assembly when overloaded to the point of failure. The principle is simply that the failure should not consist of thread stripping. The preferred mode of failure is separation of the shank. Accordingly, nuts are manufactured to the precise height (thickness) which provides the necessary length of thread engagement to develop a stripping strength slightly greater than the tensile strength of its intended bolt. The bolt on the other hand has a chamfered end which results in the first two threads being smaller than the rest. These lead threads are to provide easier mating of the nut and bolt but are not intended for engagement because they do not provide a proper fit with the nut threads. The significance of the two lead threads changes with nut size and thread pitch variations. A one inch, UNF thread regular height nut, for example, contains 10.5 threads. In this nut, two threads account for 19 percent of the available thread. A 1/4 inch, UNC, regular height nut has only 4.4 threads and two threads would constitute 45 percent of the threads available for engagement. In the case of non-metallic insert self-locking nut types, the two threads protrusion are required to insure that the thread lock engage only full size threads, as it is designed to do. The lead threads do not provide the proper locking torque. Although there is no set limit to the number of protruding threads in excess of two, these should be kept at a practical minimum. Excess bolt length adds weight, costs more, and contributes nothing to the strength or locking ability of the nut-bolt set. If a bolt is too long, the nut may bottom out against the grip length (unthreaded portion) of the bolt before reaching its proper load. Metal and non-metallic insert type locking nuts 3/8 inch and smaller may be checked by the ‘‘finger tight’’ method. If a nut can be run down with the fingers after the locking feature engages the bolt or stud, indicating the locking friction does not exist, it shall be replaced. The minimum prevailing torque values established for use with a standard torque wrench on used self-locking nuts over 3/8 inch are given in Table 5-7. Free-spinning nuts, which require pressure on the bearing face to effect the locking action, are not affected by the limits of torque values shown in Table 5-7.

NOTE

> Minimum prevailing torque reading is established when the bolt or stud fully engages the locking insert.

5.9.3 Types. There are two major types of self-locking nuts. These are the prevailing torque type and the free-spinning type. The free-spinning type turns freely until seated whereupon further tightening results in a locking action. The more widely used prevailing torque types require wrenching throughout the entire cycle after the bolt or screw has engaged the frictional part of the nut.

5.9.4 Prevailing Torque Nuts. These may have locking elements described as follows:

a. Non-metallic nuts (Figure 5-1 (A)). These nuts have a nylon insert of smaller inside diameter than bolt major diameter, which exerts a compressive locking force against the bolt. (Non-metallic nuts formerly had a fiber insert; however, fiber nuts are no longer procured for AF use.) If these nuts are reused, they shall be checked to see if the locking insert has lost its locking friction or become brittle. The non-metallic, locking insert shall never be tapped. Non-metallic insert, self-locking nuts shall not be subjected to temperatures in excess of 250°F in accordance with Military Specification MIL-N-25027.

b. Slotted or Beam Nuts (Figure 5-1 (B)). This type nut has a tapered and slotted (or split) top. Each portion between slots acts as a beam and is depressed inward to form a functional locking element.

c. Deformed Thread Type (Figure 5-2). This type nut has a portion of the threads formed in an oval, triangular or square shape rather than round; locking is accomplished by the frictional force developed when the bolt forces these threads into a round shape.

d. Interrupted Thread Type (Figure 5-3). This nut is basically two nuts combined. The lower portion carries the load while the top provides the locking. The top threads are offset axially downward so that they do not coincide exactly with an imaginary extension of the lower threads. When a bolt enters the top portion it springs these threads into the correct position and the springing action locks the nut.

5.9.5 Free-Spinning Nuts. The free-spinning nuts are divided in three types as follows:

a. Free-Spinning On-Off Type (Figure 5-4). This type consists of a split, tapered, threaded core keyed into a metal shell with mating tapered core. The small end of the taper is at the bottom of the nut. When the outer shell contacts the bearing surface of the mating part, further rotation of the nut (tightening) forces the core downward to produce collect-type locking action. It is free-spinning on until contact is made with the bearing surface and free-spinning off after being backed away from the bearing surface.

Table 5-7. Minimum Prevailing Torque Values for Reused Self-Locking Nuts

	Fine Thread Series		Course Thread Series
Nut Size	**Minimum Prevailing Torque**	**Nut Size**	**Minimum Prevailing Torque**
7/16-20	8 inch-pounds	7/16 - 14	8 inch-pounds
1/2 - 20	10 inch-pounds	1/2-13	10 inch-pounds
9/16 - 18	13 inch-pounds	9/16 12	14 inch-pounds
5/8-18	18 inch-pounds	5/8-11	20 inch-pounds
3/4 - 16	27 inch-pounds	3/4 - 10	27 inch-pounds
7/8-14	40 inch-pounds	7/8-9	40 inch-pounds
1-12	55 inch-pounds	1-8	51 inch-pounds
1-1/8-12	73 inch-pounds	1-1/8-7	68 inch-pounds
1-1/4 - 12	94 inch-pounds	1-1/4 - 7	88 inch-pounds

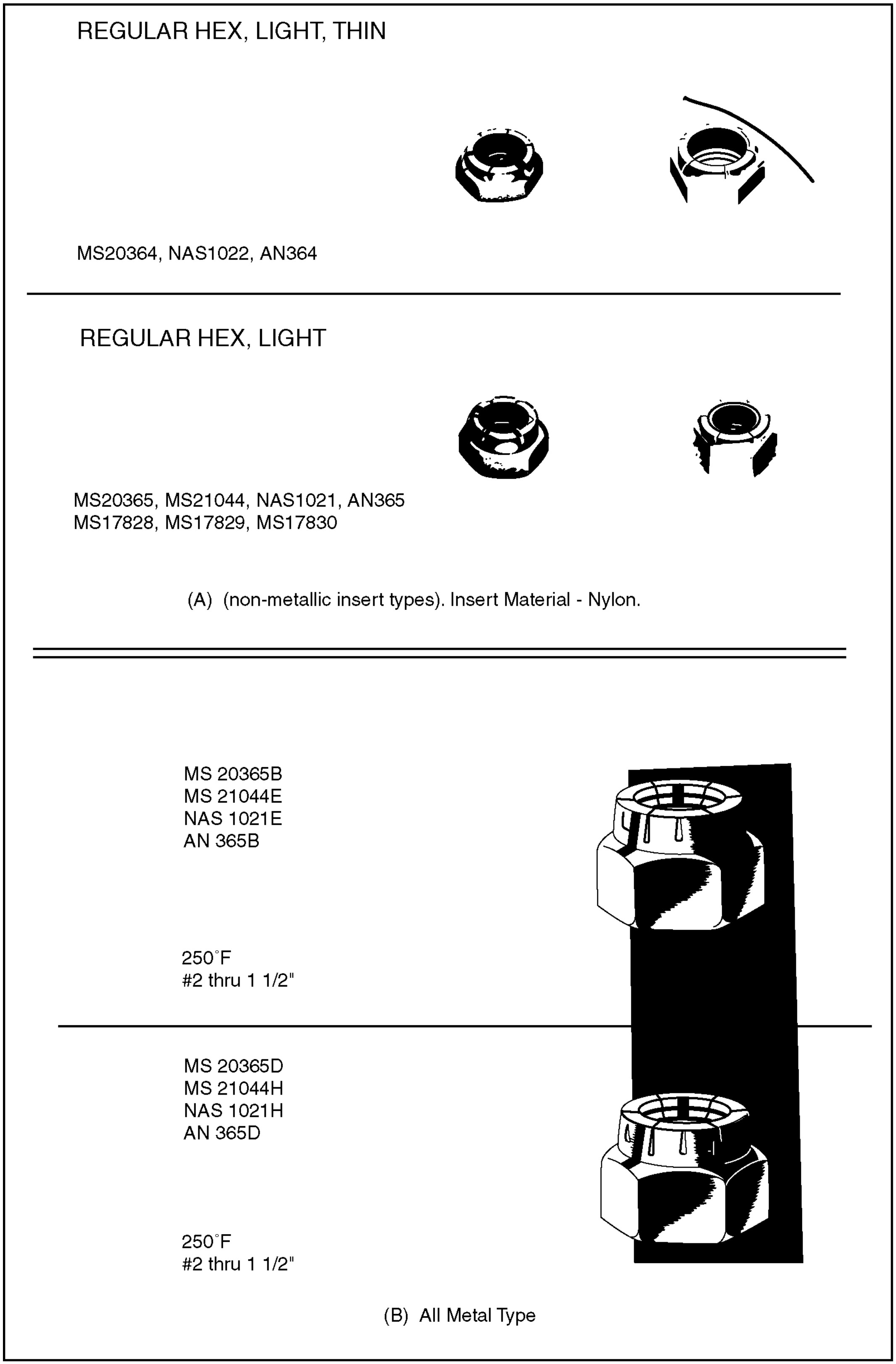


Figure 5-1. Non-Metallic and All-Metal Self-Locking Types

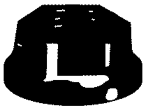
REDUCED DIMENSION HEX

MS21042, MS21043, NAS1291

6 POINT NUT, REDUCED HEIGHT

NAS1291

MS21042
MS21043

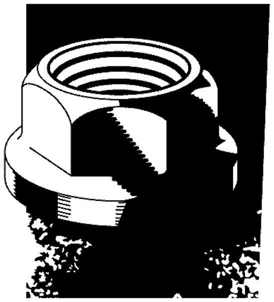


NOTE: Dished out area between wrenching points.

MS 21043
NAS 1291C

FEATHERWEIGHT -Steel

MS21042



F05-002

Figure 5-2. Typical Head Types

b. Free-spinning On Residual Torque off Type (Figure 5-5). This nut has a split core which floats inside a metal shell. The shell dimple seats in the core groove and the nut is free-spinning while being installed until the shell bottoms on the bearing surface. After the shell bottom, further rotation moves the core down and it is compressed into locking position by the shell dimples moving out of the shell groove. The nut retains high prevailing torque while being backed out until, after three turns, a firm blow on the nut will re-seat the shell dimple into the core groove, allowing free-spinning removal.

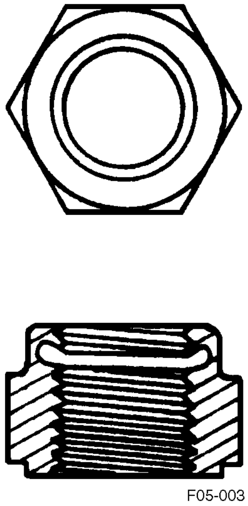


Figure 5-3. Interrupted Thread Type

c. Stressed Nuts (Figure 5-6). These are free-spinning on-off but have a higher seating torque than ordinary free-spinning nuts. These nuts have a ground washer at the bottom which is pressed around the outside circumference of the lower portion of the nut. When seated and torqued, the washer compresses causing a compressive locking force on the inner threaded section.

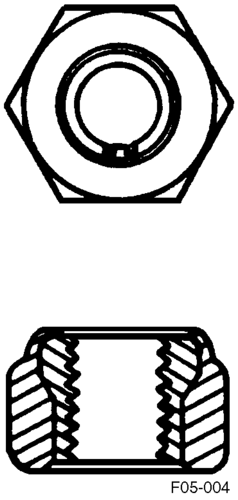


Figure 5-4. Free-Spinning On-Off Type

NOTE

- Free-spinning nuts were designed for exhaust flange attachments and shall be used only as specified in the applicable technical orders of the equipment affected. These nuts are not considered suitable for general aerospace vehicle use.
- The minimum acceptable torque required to remove a free-spinning nut when in the locked position is 10 inch-pounds. Any of these nuts that require less than 10 inch-pounds torque to break away when in the locked position shall be disposed of. If the nuts have been correctly torqued, they may be reused, provided there is no indication of internal or external deformation or damage.

5.10 FINISHES.

Several types of finishes are used on self-locking nuts. The particular type of finish is dependent on the requirement and temperature application. The most generally used types of finishes are described briefly as follows:

a. Cadmium plating is an electrolytically deposited silver-gray plating which provides exceptionally good protection against corrosion particularly in salt atmosphere. Additional finishes or refinements to the basic cadmium can be applied such as:

(1) Chromic Clear Dip - Cadmium surfaces are passivated and cyanide from the plating solution is neutralized. The protective film formed gives a bright, shiny appearance, resists staining and finger marks.

(2) Olive Drab Dichromate - Cadmium plated work is dipped in solution of chromic, nitric and acetric acid and a dye which produces corrosion resistance.

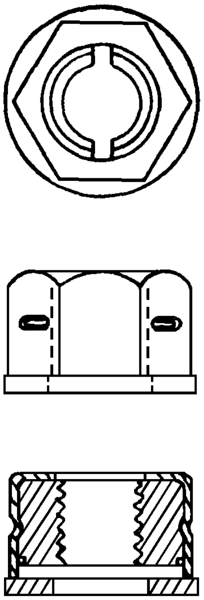

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Figure 5-5. Free-Spinning On Residual Torque Off Type

(3) Indescent Dichromate - Cadmium plated work is dipped in solution of sodium dichromate and takes on surface film of basic chromium chormate which resists corrosions. Finish is yellow to brown in color. It must be remembered that cadmium plated nuts are restricted for use in temperature applications not to exceed 450 degrees Fahrenheit. When used in temperatures in excess of 450 degrees fahrenheit, the cadmium will diffuse into the base material causing it to become very brittle and subject to early failure.

b. Silver Plating. Silver plating is applied to lock nuts for use at higher temperatures. Important advantages are its resistance to extreme heat (1400°F) and its excellent lubricating characteristics. Silver gives high load carrying capacity, resists galling and seizing of mating parts when they are subjected to heat or heavy pressure.

c. Anodizing for Aluminum. An inorganic oxide coating is formed on the metal by connecting the metals as anodes in a suitable electrolyte. The coating offers excellent corrosion resistance and can be dyed in a number of colors.

d. Solid Film Lubricant Coating. Lock nuts are also furnished with molybdenum disulphide for lubrication purposes. It provides a clean, dry, permanently bonded coating to prevent seizing and galling of threads. Molybdenum disulphide is applied to both cadmium and silver plated parts.

(1) Many other types of finishes are available but for the type of self-locking nuts described in this manual the aforementioned finishes are the most widely used.

5.11 STYLES.

5.11.1 Plain Nuts. These nuts are available as self-locking nuts or non self-locking. When the non self-locking plain nuts are used they shall be locked with an auxiliary locking device such as a checknut or lockwasher.

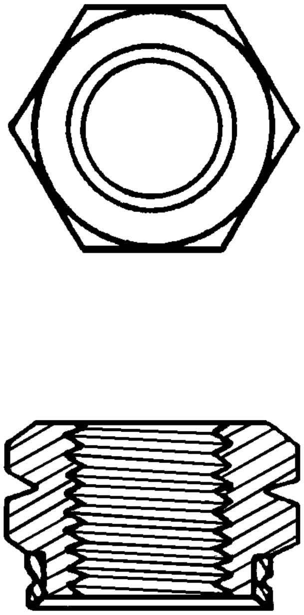
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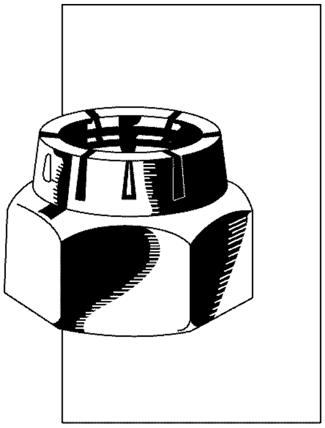
Figure 5-6. Stressed Nuts

Series

MS 20365
MS 21045
NAS 1021A
AN 363, AN 365



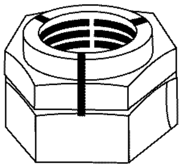
(A)

REGULAR HEX

MS20365,

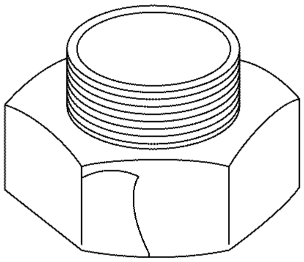
MS21045,

NAS1021, **AN363**



(B)

H55 Series

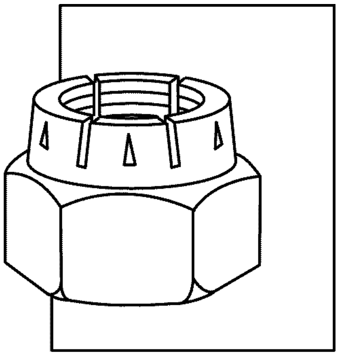


(C)

F05-007

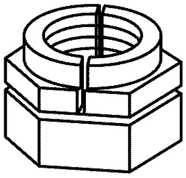
Figure 5-7. MS21045 Head Styles

NAS 1021C
AN 363C
MS 21045C
MS 21046C



REGULAR HEX

MS20365, MS21046, NAS1021, AN363



H56 Series

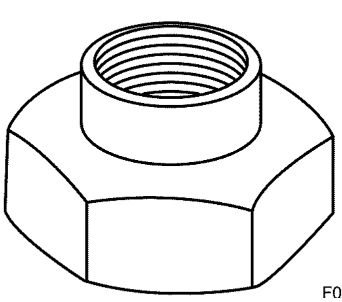
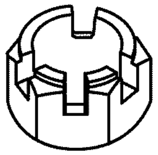


Figure 5-8. MS21046 Head Styles

CASTELLATED HEX, SELF-LOCKING

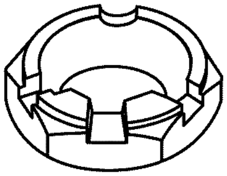
MS17825



(A)

CASTELLATED HEX, THIN, SELF-LOCKING

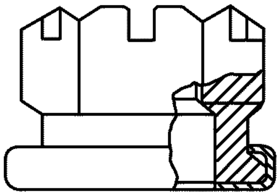
MS17826



(B)

CASTELLATED HEX, COUNTERBORED, ASSEMBLED WASHER

MS21244



(C)

F05-009

Figure 5-9. Castellated Self-locking and Counterbored Nuts

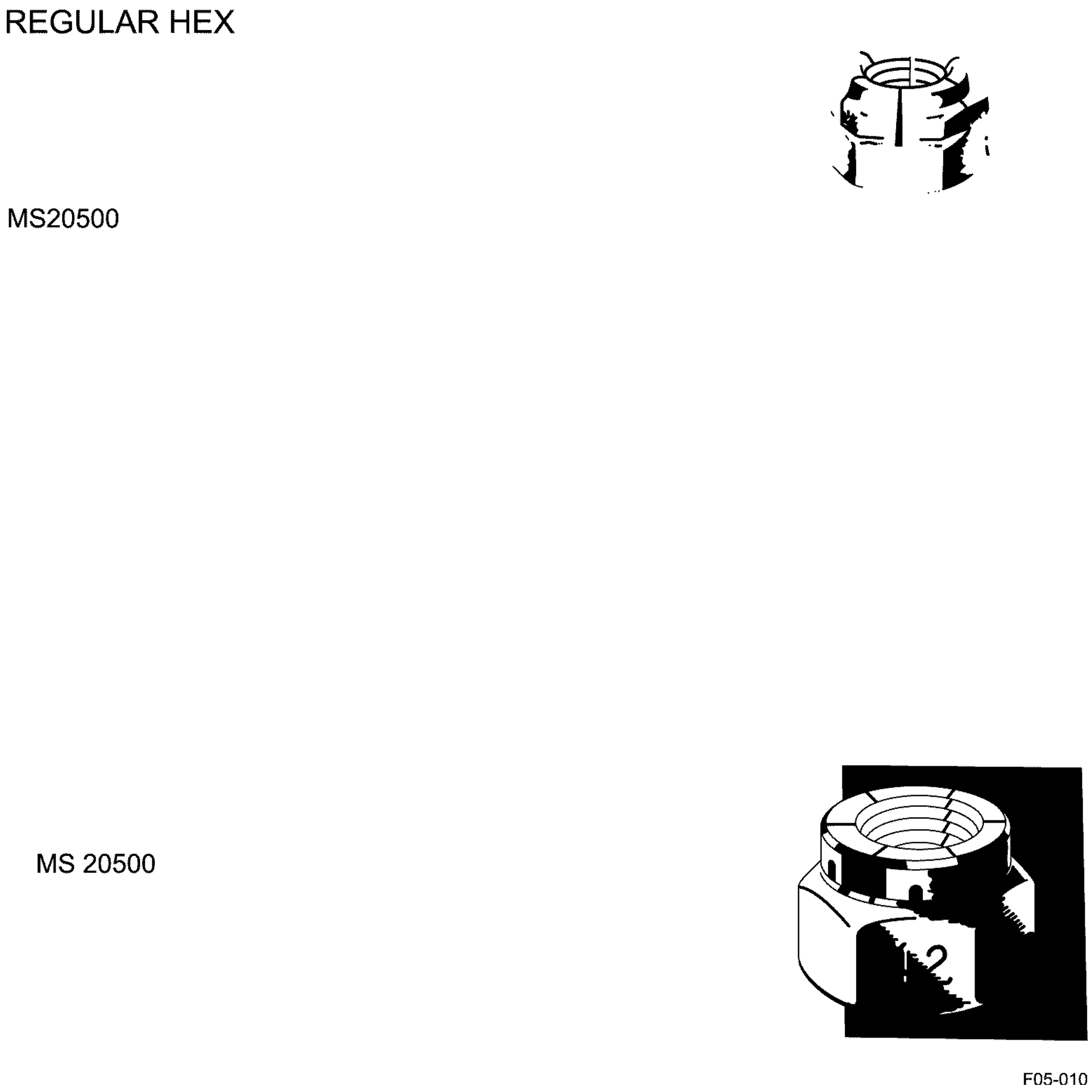
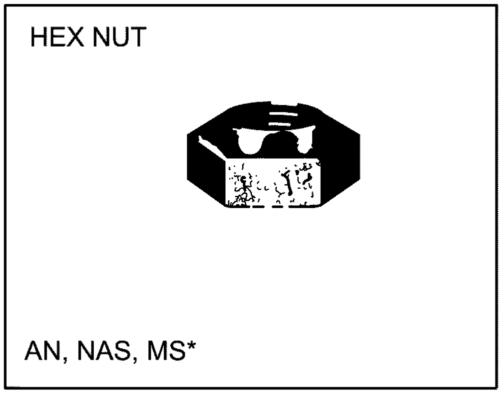


Figure 5-10. MS20500 Head Styles

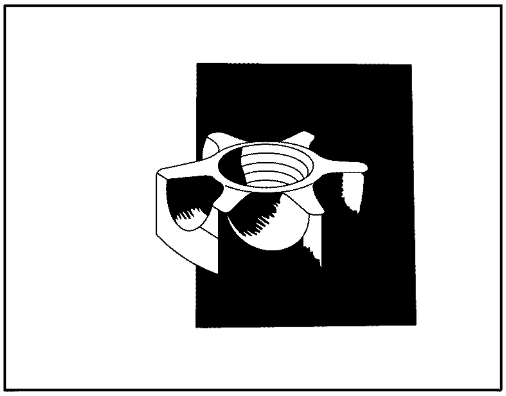
5.11.2 Castle Nuts. These nuts are used with drilled shank, hexhead bolts, cleavis bolts, and drilled head studs. These nuts are designed to be secured with cotter pins or safety wire.

5.11.3 Checknuts. These nuts are used as locking devices for non self-locking plain nuts, set-screws, and threaded rod ends.

5.11.4 Plate Nuts. These nuts are used for blind mounting in inaccessible locations and for easier maintenance. They are available in a wide range of sizes and shapes. One lug, two lug, and right-angle shapes are available to accommodate the specific physical requirements of the individual nut location. Floating-type nuts provide a controlled amount of nut movement to compensate for subas-sembly misalignment. They can be either self-locking or plain.



MS21040, NAS 679 Internal Wrenching



MS21040 - External Wrenching

F05-011

Figure 5-11. Internal and External Wrenching Types

5.11.5 Channel Nuts. These nuts are used in applications requiring anchored nuts equally spaced around openings such as access and inspection doors and removable leading edges. Straight or curved channel nut strips offer a wide range of nut spacings and provide a multiple nut unit that has all the advantages of float-type nuts. They are usually self-locking.

5.11.6 Barrel Nuts. These nuts are installed in regular, drilled holes. The round portion of the nut fits in the drilled hole providing a self-wrenching effect. They are usually self-locking.

5.11.7 Internal Wrenching Nuts. These nuts are generally used where a nut with a high tensile strength is required or where space is limited and the use of external wrenching nuts would not facilitate the use of conventional wrenches for installation and removal, usually where the bearing surface is counterbored. These nuts have a non-metallic insert which provides a locking action. They are usually self-locking.

5.11.8 Point Wrenching Nuts. These nuts are generally used where a nut with a high tensile strength is required. These nuts are installed with a smaller socket wrench than would normally be used for a hexagon nut. They are usually self-locking.

5.11.9 Shear Nuts. These nuts are designed for use with devices such as drilled clevis bolts and threaded taper pins which are normally subjected to shearing stress only. They are usually self-locking.

5.11.10 Sheet Spring Nuts. (See Figure 5-12.) These nuts are used with standard and sheet metal self-tapping screws to support line clamps, conduit clamps, electrical equipment, access doors, etc. The most common types are the flat, the two-lug anchor and the one-lug anchor type. The nuts have an arched spring lock which prevents the screw from working loose. They should be used only where originally used in the fabrication of the aircraft.

5.11.11 Wingnuts. These nuts are used where the desired tightness is obtained by the use of the fingers and where the assembly is frequently removed.

5.11.12 Klincher Locknuts. These locknuts are used to insure a permanent and vibration-proof, bolted connection that holds solidly and resists thread wear. It will withstand extremely high or low temperatures and exposure to lubricants, weather, and compounds without impairing the effectiveness of the locking element. The nut is installed with the end that looks like a double washer toward the metal being fastened. The end that looks like a double hexagon nut is away from the metal being fastened. (See Figure 5-13.)

5.12 SELF-LOCKING NUTS FOR AIRCRAFT ENGINES AND ACCESSORIES.

Self-locking nuts may be used to secure rocker box covers for all air-cooled engines. They are also used on any engine in locations that are specified by the manufacturer on his assembly drawings, parts lists and bills of material, or where their use is shown in the Illustrated Parts Breakdown for a particular type and model of engine or accesssory.

5.12.1 Non-metallic self-locking nuts may be used on engines to secure all engine-driven accessories except where applicable technical orders or other instructions require a specific nut.

5.12.2 Self-locking nuts of number 10 and 1/4-inch size shall not be used with drilled studs.

5.13 TIGHTENING NUTS AND BOLTS.

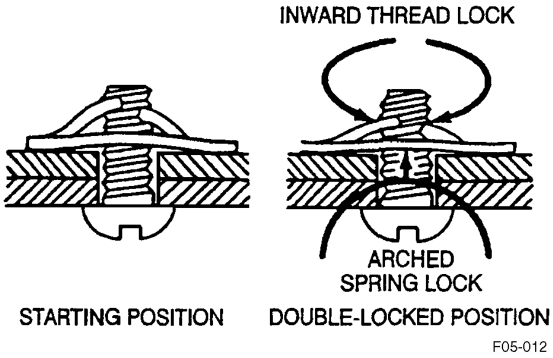


Figure 5-12. Using Sheet Spring Nut

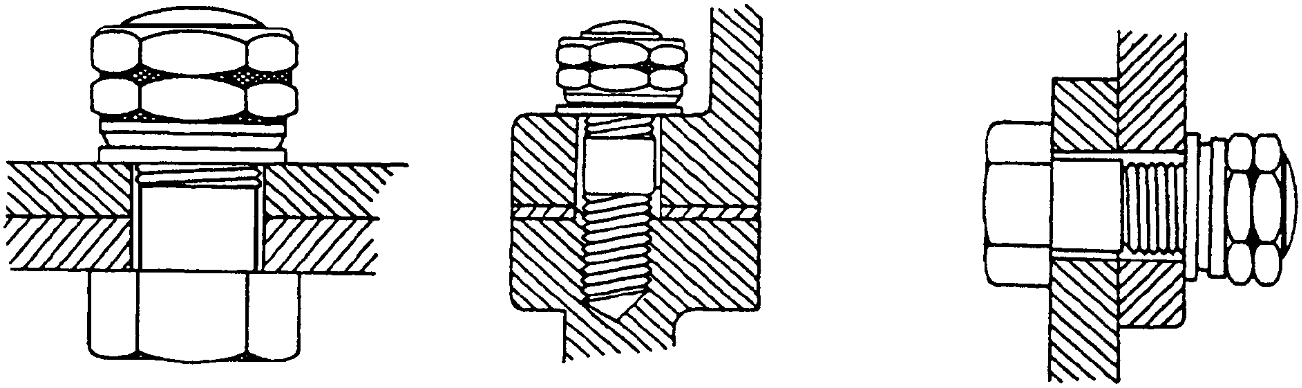


Figure 5-13. Typical Installation of the Klincher Locknut

Table 5-8. Torque Values For Free Spinning Self-Locking Plain Nut

Tap Size	Min (In. - Lb.)	Max (In. - Lb.)
No. 10 - 32	28	34
1/4 - 28	75	85
5/16 - 24	160	180
3/8 - 24	240	260
7/16 - 20	450	500
1/2 - 20	550	750
9/16 - 18	900	1100
5/8 - 18	1200	1400
3/4 - 16	2300	2700
7/8 - 14	2700	3300
1 - 14	5000	6000

Torque Values. These values are to be used when no values are given in the Maintenance Technical Manual of the specific aerospace vehicle.

5.13.1 Failure in aerospace equipment has occurred because of improper tightening of bolts and nuts. To avoid over stressing bolts, the nuts shall be torqued. Table 5-9 gives the recommended torque values for both the fine and coarse thread series of nuts. These values shall be followed unless Maintenance Technical Manual for a specific aircraft requires a specific torque value for a given nut

NOTE

Threads shall not be oiled, as the torque values of Table 5-9 were derived with oil-free threads.

5.13.2 When bolts are tightened, the high limit of the torque values of columns 2 and 3 of Table 5-9 shall be used.

5.13.3 MS, NAS, and AN Drawings. Drawings for these nuts are included in this Technical Manual for your information.

5.14 TORQUE WRENCHES.

When adapters or extensions are used on torque wrenches, the difference in mechanical value must be considered in determining the reading which will give the specified torque at the nut being tightened. The formula shown in Figure 5-15 is used to determine dial reading or torque setting to achieve desired torque:

S	equals Handle Setting
T	equals Torque Applied at End of Adapter
L_a	equals Length of Handle in Inches
E_a	equals Length of Extension in Inches

5.14.1 For example, if it is desired to exert 100 inch-pounds at the end of the wrench and extension, when L_a equals 12 inches and E_a equals 6 inches, it is possible to determine the handle setting by making the following calculation:

$$S = \frac{T \times L_a}{L_a + E_a}$$

$$S = \frac{100 \times 12}{(12 + 6)}$$

$$S = \frac{1200}{18}$$

$$S = 66.6 \text{ inch-pounds}$$

5.14.2 Whenever possible, attach the extension in line with the torque wrench. When necessary to attach the extension at an angle to the torque wrench as shown in Figure 5-16, the effective length of the assembly will be $L_a + E_b$ as shown in Figure 5-16. In this instance, length E_b must be substituted for length E_a in the formula.

NOTE

- An extension shall not be used on the grip end of a torque handle.
- Torque tools shall not be used to break loose previously tightened bolts.
- A torque tool shall not be used to apply a greater amount of torque than the rated capacity of the tool.
- Do not attempt to change setting when handleis in a locked position.
- Do not attempt to use an extension on the end of a torque wrench at an angle less than 90 degrees.
- A universal jointed adapter should not be used while using a torque wrench.

5.15 IDENTIFICATION MARKINGS ON NUTS.

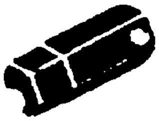
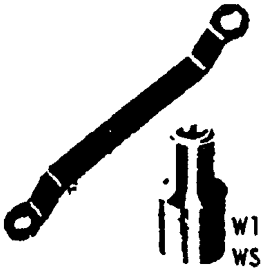
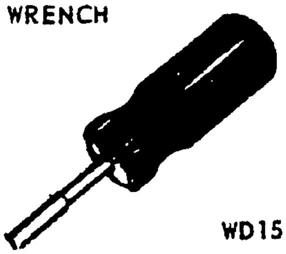
Table 5-11 contains the identification markings used on nuts. Location of markings will be as specified in procurement specifications.

5.15.1 In addition to these markings, temperature limitations of nuts can often be determined by visual inspection as follows:

a. Non-metallic insert nuts are limited to 250°F.

b. Cadmium plated nuts are limited to 450°F. These nuts have a whitish color and bright luster when new.

c. Corrosion resistant or stainless steel nuts are limited to 800°F. There should be no problem in recognizing stainless steel. This nut additionally may be coated with silver flashing, which gives the part a yellowish color and dull luster. Twelve hundred degrees fahrenheit nuts are also silver coated or plated. There is no general rule which can be followed in identifying the 800°F nut with silver coating from the 1200°F nut except in some cases the number 12 may be stamped on one hex.

NUT SIZE	WRENCH SIZE	WRENCH P/N	WRENCH ILLUSTRATIONS	WRENCH APPLICATIONS
#4-40UNC-3B	.188	W10-04-1	INTERNAL HEX WRENCH  W10	Used on H10, H01 and H31 internal wrench hex nuts. (NAS 679 and MS 21040 nut series)
#6-32UNC-3B	.233	W10-05-1		
8-32UNC-3B	.265	W10-08-1		
10-32UNF-3B	.296	W10-3-1		
1/4-28UNF-3B	.348	W10-4-1		
2-56UNC-3B	1/8	W14-046	BOX WRENCH SOCKET WRENCH  W14 WS14	Used on *reduced wrench hex nut H14-04 and H-14-06.
4-40UNC-3B	1/8	W14-046		
4-40UNC-3B	5/32	W14-046		
6-32UNC-3B	5/32	W14-046		
4-40UNC-3B	1/8	WS14-04		
6-32UNC-3B	5/32	WS14-06		
2-56UNC-3B	3/32	WD15-3	MINIATURE DRIVER WRENCH  WD15	Used on *Reduced wrench hex nuts H14, H42, HW14, HW41, HW42.
4-40UNC-3B	1/8	WD15-4		
6-32UNC-3B	5/32	WD15-5		
8-32UNC-3B	3/16	WD15-6		

SPECIAL WRENCHES REQUIRED FOR SOME KAYNAR.LOCKNUTS.

*Reduced wrench hex nuts are 1/32-in less across flats than similar nuts covered by the appropriate MS Standard.

F05-014A

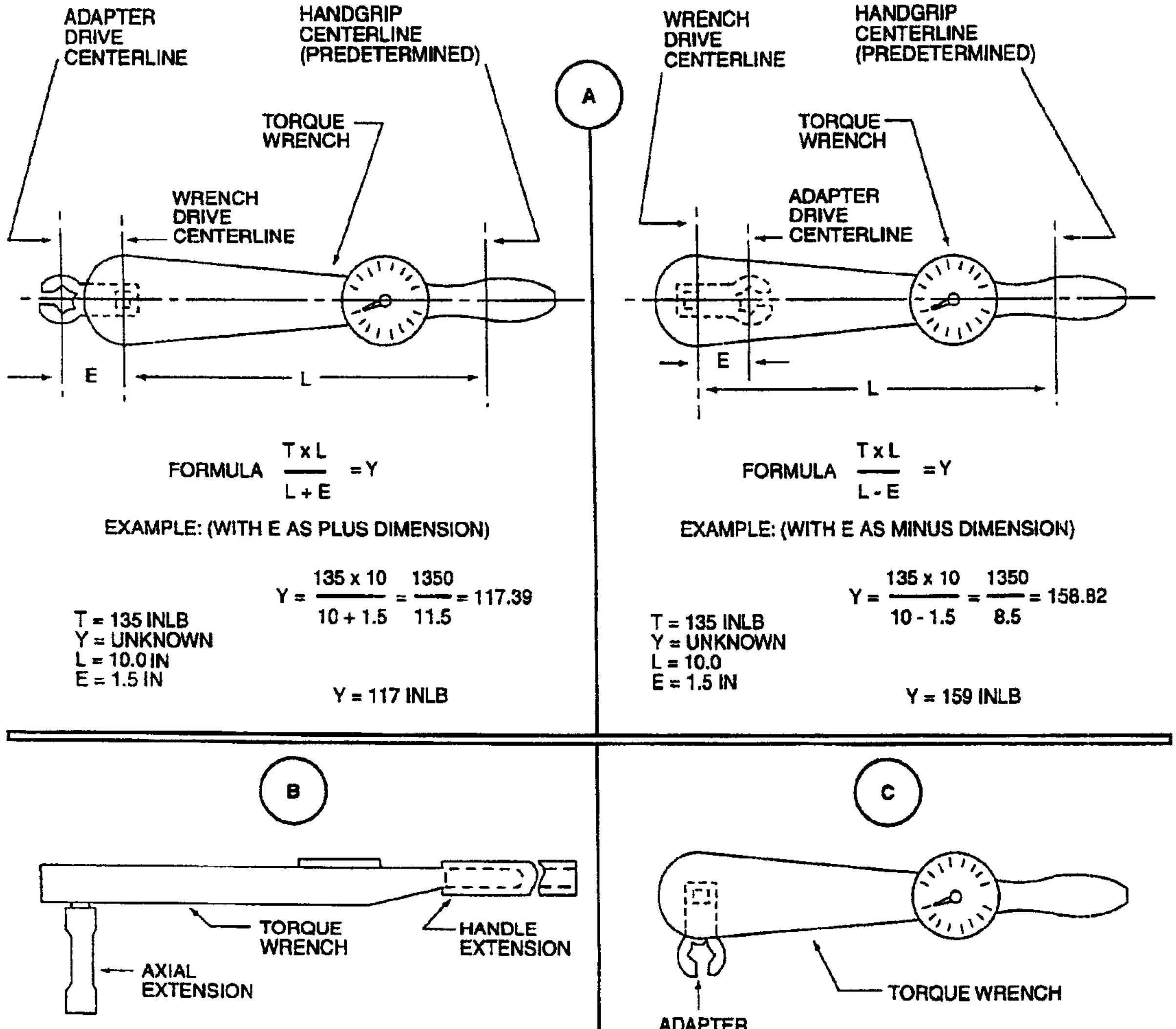
Figure 5-14. Special Wrenches Required for Some Kaynar Locknuts

NOTE

WHEN USING A TORQUE WRENCH ADAPTER WHICH CHANGES THE DISTANCE FROM THE TORQUE WRENCH DRIVE TO THE ADAPTER DRIVE APPLY THE FOLLOWING FORMULAS TO OBTAIN THE CORRECTED TORQUE READING.

LEGEND

T = ACTUAL (DESIRED) TORQUE
Y = APPARENT (INDICATED) TORQUE
L = EFFECTIVE LENGTH LEVER
E = EFFECTIVE LENGHT OF EXTENSION



FORMULA $\frac{T \times L}{L + E} = Y$

EXAMPLE: (WITH E AS PLUS DIMENSION)

$Y = \frac{135 \times 10}{10 + 1.5} = \frac{1350}{11.5} = 117.39$

T = 135 INLB
Y = UNKNOWN
L = 10.0 IN
E = 1.5 IN

Y = 117 INLB

FORMULA $\frac{T \times L}{L - E} = Y$

EXAMPLE: (WITH E AS MINUS DIMENSION)

$Y = \frac{135 \times 10}{10 - 1.5} = \frac{1350}{8.5} = 158.82$

T = 135 INLB
Y = UNKNOWN
L = 10.0
E = 1.5 IN

Y = 159 INLB

NOTE

A CORRECTION TORQUE READING IS NOT RQUIRED WHEN AN ADAPTER OR EXTENSION OR COMBINATION OF THESE ITEMS IS USED (SEE B AND C) WHICH DOES NOT CHANGE DIMENSION L. WHEN A STANDARD CROWFOOT ATTACHMENT IS USED ON A TORQUE WRENCH, NO TORQUE CORRECTION IS REQUIRED. TORQUE TO CENTER OF SPECIFIED RANGE.

H0501213

Figure 5-15. Using Torque Wrench Adapters (Sheet 1 of 3)

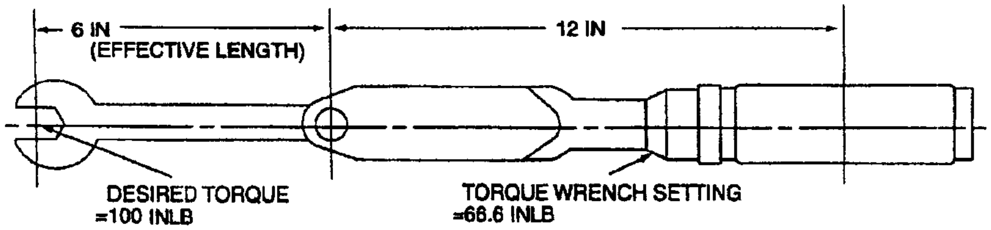
Ⓓ TORQUE WRENCH WITH ADAPTER ATTACHED IN LINE

EXAMPLE PROBLEM:

1. FIND TORQUE WRENCH SETTING TO APPLY 100 INLB ON NUT, BOLT, OR FITTING.
2. GIVEN: a. TORQUE WRENCH LENGTH = 12 IN
   b. ADAPTER EFFECTIVE LENGTH = 6 IN

$$\text{TORQUE WRENCH SETTING} = \frac{\text{TORQUE ON NUT} \quad \text{x} \quad \text{LENGTH OF WRENCH}}{\text{LENGTH OF WRENCH} \quad + \quad \text{EFFECTIVE LENGTH OF ADAPTER}}$$

$$= \frac{100\ \text{INLB} \times 12\ \text{IN}}{12\ \text{IN} + 6\ \text{IN}} = \frac{100 \times 12}{18} = 66.6\ \text{INLB}$$



Ⓔ TORQUE WRENCH WITH ADAPTER ATTACHED AT AN ANGLE

EXAMPLE PROBLEM:

1. FIND TORQUE WRENCH SETTING TO APPLY 100 INLB ON NUT, BOLT, OR FITTING.
2. GIVEN: a. TORQUE WRENCH LENGTH = 12 IN
   b. ADAPTER EFFECTIVE LENGTH = 5-1/2 IN

$$\text{TORQUE WRENCH SETTING} = \frac{\text{TORQUE ON NUT} \quad \text{x} \quad \text{LENGTH OF WRENCH}}{\text{LENGTH OF WRENCH} \quad + \quad \text{EFFECTIVE LENGTH OF ADAPTER}}$$

$$= \frac{100\ \text{INLB} \times 12\ \text{IN}}{12\ \text{IN} + 5\text{-}1/2\ \text{IN}} = \frac{100 \times 12}{6\text{-}1/2} = 183\ \text{INLB}$$

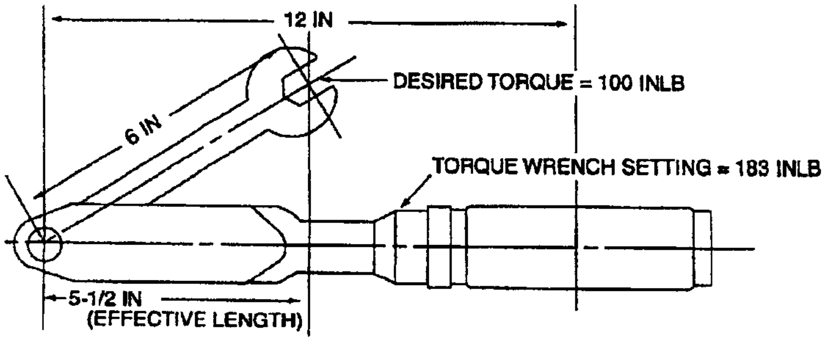


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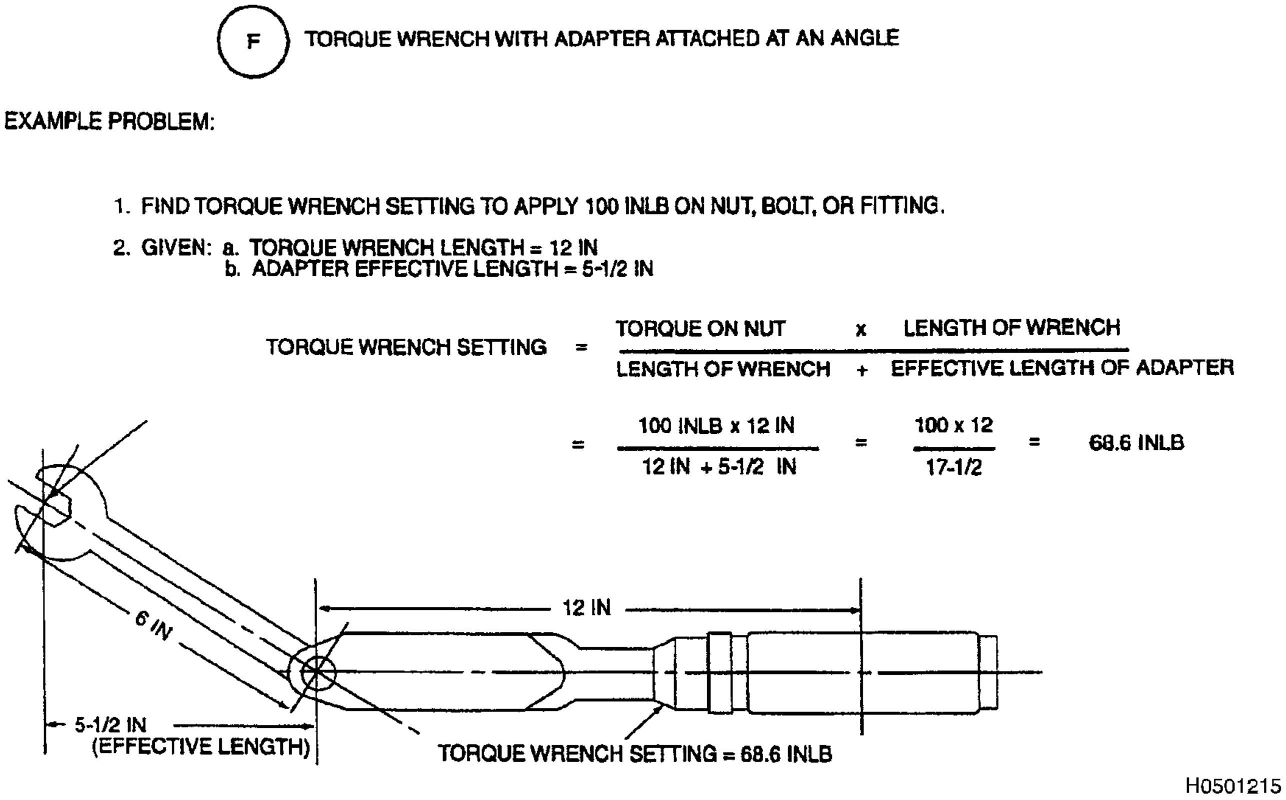
Figure 5-15. Using Torque Wrench Adapters (Sheet 2)



Ⓕ TORQUE WRENCH WITH ADAPTER ATTACHED AT AN ANGLE

EXAMPLE PROBLEM:

1. FIND TORQUE WRENCH SETTING TO APPLY 100 INLB ON NUT, BOLT, OR FITTING.
2. GIVEN: a. TORQUE WRENCH LENGTH = 12 IN
   b. ADAPTER EFFECTIVE LENGTH = 5-1/2 IN

$$\text{TORQUE WRENCH SETTING} = \frac{\text{TORQUE ON NUT} \quad \times \quad \text{LENGTH OF WRENCH}}{\text{LENGTH OF WRENCH} \quad + \quad \text{EFFECTIVE LENGTH OF ADAPTER}}$$

$$= \frac{100 \text{ INLB} \times 12 \text{ IN}}{12 \text{ IN} + 5\text{-}1/2 \text{ IN}} = \frac{100 \times 12}{17\text{-}1/2} = 68.6 \text{ INLB}$$

Figure 5-15. Using Torque Wrench Adapters (Sheet 3)

Table 5-9. Recommended Torque Values (Inch-Pounds)

CAUTION

THE FOLLOWING TORQUE VALUES ARE DERIVED FROM OIL FREE CADMIUM PLATED THREADS.

	Torque Limits Recommended For Installation (Bolts Loaded Primarily In Shear)		Maximum Allowable Tightening Torque Limits	
Tap Size	**Tension type nuts MS20365 and AN310 (40,000 PSI in bolts)**	**Shear type nuts MS20364 and AN320 (24,000 PSI in bolts)**	**Nuts MS20365 and AN310 (90,000 PSI in bolts)**	**Nuts MS20364 and AN320 (54,000 PSI in bolts)**
FINE THREAD SERIES				
8-36	12-15	7-9	20	12
10-32	20-25	12-15	40	25
1/4-28	50-70	30-40	100	60
5/16 - 24	100-140	60-85	225	140
3/8-24	160-190	95-110	390	240
7/16-20	450-500	270-300	840	500

Table 5-9. Recommended Torque Values (Inch-Pounds) - Continued

CAUTION

THE FOLLOWING TORQUE VALUES ARE DERIVED FROM OIL FREE CADMIUM PLATED THREADS.

	Torque Limits Recommended For Installation (Bolts Loaded Primarily In Shear)		Maximum Allowable Tightening Torque Limits	
Tap Size	**Tension type nuts MS20365 and AN310 (40,000 PSI in bolts)**	**Shear type nuts MS20364 and AN320 (24,000 PSI in bolts)**	**Nuts MS20365 and AN310 (90,000 PSI in bolts)**	**Nuts MS20364 and AN320 (54,000 PSI in bolts)**
1/2-20	480-690	290-410	1100	660
9/16-18	800-1000	480-600	1600	960
5/8-18	1100-1300	600-780	2400	1400
3/4-16	2300-2500	1300-1500	5000	3000
7/8-14	2500-3000	1500-1800	7000	4200
1-14	3700-5500	2200-3300*	10,000	6000
1-1/8-12	5000-7000	3000-4200*	15,000	9000
1-1/4 - 12	9000-11,000	5400-6600*	25,000	15,000
COARSE THREAD SERIES				
8-32	12-15	7-9	20	12
10-24	20-25	12-15	35	21
1/4-20	40-50	25-30	75	45
5/16-18	80-90	48-55	160	100
3/8-16	160-185	95-100	275	170
7/16-14	235-255	140-155	475	280
1/2-13	400-480	240-290	880	520
9/16-12	500-700	300-420	1100	650
5/8-11	700-900	420-540	1500	900
3/4-10	1150-1600	700-950	2500	1500
7/8-9	2200-3000	1300-1800	4600	2700

The above torque values may be used for all cadmium-plated steel nuts of the fine or coarse thread series which have approximately equal number of threads and equal face bearing areas.

*Estimated corresponding values.

Table 5-10. Torque Values for Sheet Spring Nuts

TYPE I

Screw Size	MIN (In. - Lb.)	MAX (In. - Lb.)
4	2	3
6	5	7
8	8	10
10	14	16
1/4	25	35

Table 5-10. Torque Values for Sheet Spring Nuts - Continued

TYPE II

4	6	8
6	10	12
8	14	18
10	25	30
1/4	50	60

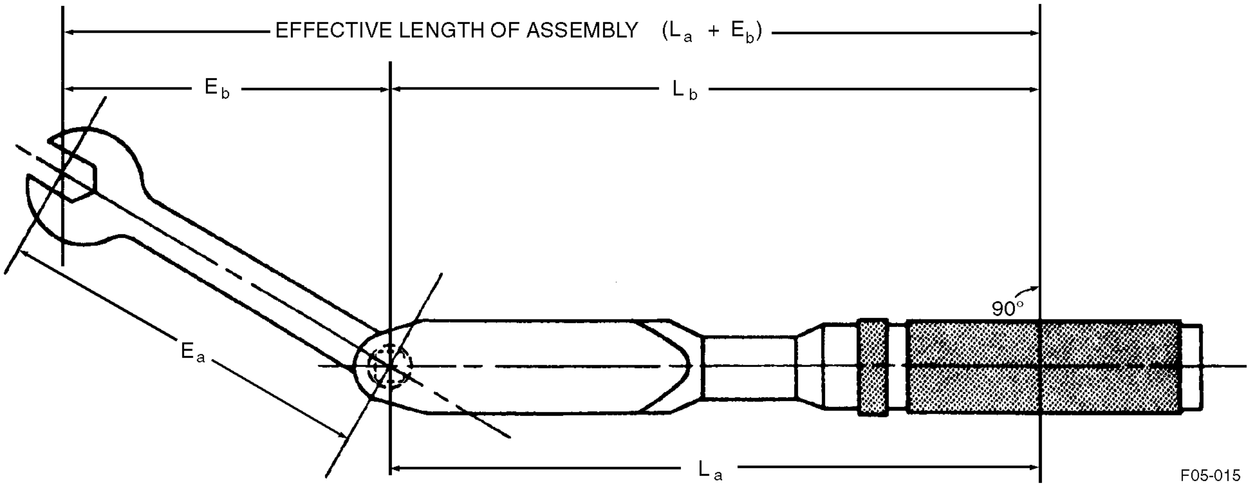


Figure 5-16. Typical Torque Wrench with Typical Extension Attached at an Angle

Table 5-11. Identification Markings on Nuts

Military Marking			
Marking	**Physical Characteristics**	**Material**	**Classification or Specification**
1	70,000 PSI Proof Load 120,000 PSI 150,000 PSI	Steel	
E1	RH: C19-26	Steel, Cr, N1	Aeronautical Material Specification AMS6320 for SAE 8735
	Heat Treated - TS: 105,000 PSI RH: C19-26		Aeronautical Material Specification AMS6325 for SAE 8740
E11	RH: C19-26	Steel, Cr, N1	Aeronautical Material Specification AMS6322 for SAE 8740
EC2		Steel, Con Res	Aeronautical Material Specification AMS5628 for SAE 51431
12		Steel, Corr and Ht Res	Military Specification MIL-B-7873, 1200°F
S12		Steel, Corr and Ht Res	Free Spinning, Military Specification MIL-N-8056, 1200°F
NONE			High Temperature, 550°F Self Locking, Military Specification MIL-N-25027

Table 5-11. Identification Markings on Nuts - Continued

Military Marking			
Marking	**Physical Characteristics**	**Material**	**Classification or Specification**
H	Type II 180 Brinell Hardness, Min or 89 Rockwell B Hardness Minimum Heat Treat	Steel, Carbon	Military Specification MIL-S-1222
4	200 Brinell Hardness Minimum or 94 Rockwell B Hardness Minimum (.40-. 500) Heat Treat	Steel, Carbon	Military Specification MIL-S-1222
ASTM Marking			
1	RH: B70 MIN	Steel, Carbon	(1) (.15 C-MIN)
1B	RH: B70 MIN	Steel, Carbon	(2) (.15 C-MIN)
2	RH: B84 MIN	Steel, Carbon	(1) (.40 C-MIN)
2B	RH: B84 MIN	Steel, Carbon	(2) (.40 C-MIN)
2H	RH: C24-37	Steel, Carbon	(3) (.40 C-MIN)
2HB	RH: C24-37	Steel, Carbon	(4) (.40 C-MIN)
3	RH: C24-37	Steel, Carbon	(3) (.35 C-MIN)
3B	RH: C24-37	Steel, Carbon	(4) (.35 C-MIN)
4	RH: C24-37	Steel, Carbon	(3) (.40-.50 C-MIN)
4B	RH: C24-37	Steel, Carbon	(4) (.40-.50 C-MIN)
6	RH: C24-37	Steel, CR	(3) A1S1-416 or 416 SE (.12 CK)
6B	RH: C24-37	Steel, CR	(4) A1S1-416 or 416 SE (.12 CR)
8	RH: B81 MIN	CRES	(5) A1S1-304 (.18 CR-.08 NI)
8F	RH: B81 MIN	CRES	(6) A1S1-304 (.18 CR-.08 NI)
8C	RH: B81 MIN	CRES	(5) CB Stabilized, A1S1-347 (18-8)
8CB	RH: B81 MIN	CRES	(6). CB Stabilized, A1S1-347 (18-8)
8T	RH: B81 MIN	CRES	(5) TI Stabilized, AlSl-321 (18-8)
8TB	RH: B81 MIN	CRES	(6) TI Stabilized, AlSl-321 (18-8)
8F	RH: B81 MIN	CRES	(5) Free cutting, A1S1-303 (18-8)
8FB	RH: B81 MIN	CRES	(6) Free cutting, A1S1-303 (18-8)

(1) - Nuts hot forged or cold punched

(2) - Nuts machined from bar stock

(3) - Nuts hot forged or cold punched, heat treated

(4) - Nuts machined from bar stock, heat treated

(5) - Nuts hot forged or cold punched, annealed

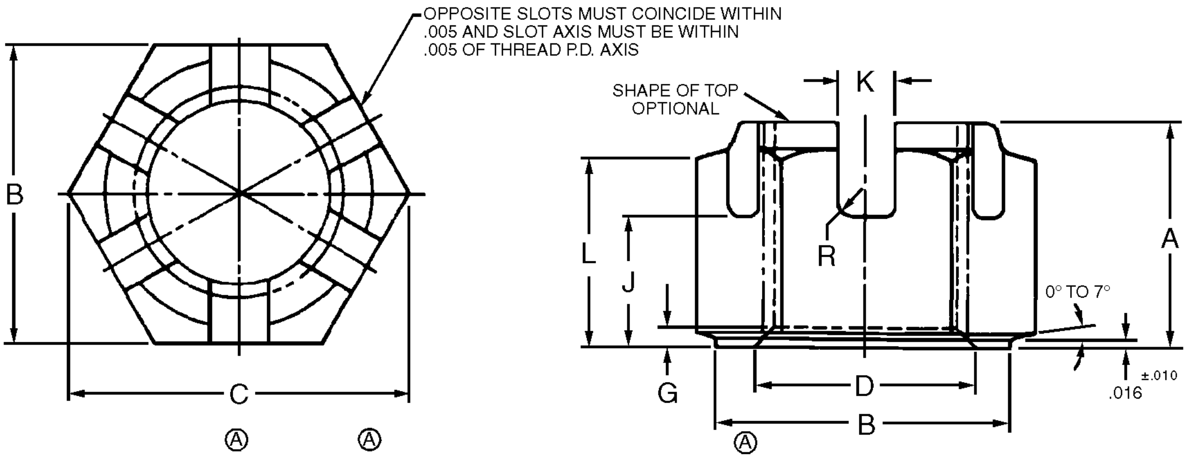
(6) - Nuts machined from bar stock, annealed

Table 5-11. Identification Markings on Nuts - Continued

Military Marking			
Marking	Physical Characteristics	Material	Classification or Specification

NOTE

Marking may be at any position on top of nut. Marking of nut on side is not permitted.



SIZE DASH NO.	(a) THREAD	A Ⓐ		B Ⓐ		C	D	G		J Ⓐ		K		L	R	ULTIMATE (b)TENSILE STRENGTH LB MIN	WEIGHT Ⓐ LBS/100 MAX
		MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX		
-3	10-32UNF-3B	.235	.265	.367	.376	.013	.215	.006	.020	.105	.125	.078	.108	.110	.035	2,210	.40
-4	1/4-28UNF-3B	.266	.296	.430	.43	.488	.275	.007	.022	.121	.141	.078	.108	.125	.035	4,080	.65
-5	5/16-24UNF-3B	.313	.343	.492	.502	.557	.338	.008	.024	.168	.188	.078	.108	.172	.035	6,500	1.00
-6	3/8-24UNF-3B	.391	.421	.553	.564	.628	.400	.008	.024	.215	.235	.125	.155	.218	.053	10,100	1.40
-7	7/16-20UNF-3B	.438	.468	.616	.627	.698	.463	.010	.031	.262	.282	.125	.155	.265	.053	13,600	2.00
-8	1/2-20 NF-3B	.548	.578	.741	.752	.840	.525	.010	.031	.355	.375	.125	.155	.358	.053	18,500	3.90

(a) THREADS IN ACCORDANCE WITH MIL-S-7742.
(b) ULTIMATE TENSILE STRENGTH FIGURES ARE NOT IN ACCORDANCE WITH MIL-N-25027(ASG). A

MATERIAL: BODY, L

(a) THREADS IN ACCORDANCE WITH MIL-S-7742.
(b) ULTIMATE TENSILE STRENGTH FIGURES ARE NOT IN ACCORDANCE WITH MIL-N-25027(ASG). A

MATERIAL: BODY, ALLOY STEEL (SEE PROCUREMENT SPECIFICATION).
INSERT, NYLON OR EQUIVALENT.

PLATING: CADMIUM PLATING IN ACCORDANCE WITH QQ-P-416, TYPE II, CLASS 3.

GENERAL: BREAK ALL SHARP EDGES AND REMOVE ALL HANGING BURRS AND SLIVERS WHICH MIGHT BECOME DISLODGED UNDER USAGE.
SURFACE ROUGHNESS IN ACCORDANCE WITH MIL-STD-10 SHALL NOT EXCEED 125 RHR.
DIMENSION IN INCHES

DESIGN INFORMATION: THESE NUTS MAY BE USED AT TEMPERATURES 250°F AND BELOW IN THOSE TYPES OF APPLICATIONS FOR WHICH SLOTTED OR CASTELLATED NUTS ARE APPROVED FOR USE; AND IF SUCH APPLICATIONS CONFLICT WITH ANY LIMITATIONS ON THE USE OF SELF-LOCKING NUTS, AS CITED BY MS33588, THIS STANDARD TAKES PRECEDENCE. NUTS ARE TO BE INSTALLED IN ACCORDANCE WITH MS33540.

EXAMPLE OF PART NUMBER:

MS17 25-4 - 1/4-28 NUT, CADMIUM PLATED, NON-METALLIC INSERT.

PERFORMANCE: PER MIL-N-25027 EXCEPT FOR;
1 - TABULATED ULTIMATE TENSILE STRENGTH VALUES.
2 - VIBRATION TIME FOR NUT SIZES SMALLER THAN 5/16 SHALL BE IN ACCORDANCE WITH MIL-N-25027
3 - VIBRATION TIME FOR NUT SIZES 5/16 AND LARGER SHALL BE 120 MINUTES MINIMUM.
4 - LOCKING TORQUE VALUES APPLICABLE FOR ONE CYCLE AT ROOM TEMPERATURE ONLY.
5 - WRENCH TORQUE TEST VALUES TO BE DIRECTLY PROPORTIONAL TO THE ULTIMATE TENSILE STRENGTH.
QUALIFIED PRODUCTS: ONLY NUTS FOR WHICH THERE ARE QUALIFIED PRODUCTS LISTED ON QPL25027 SHALL BE USED FOR DESIGN.

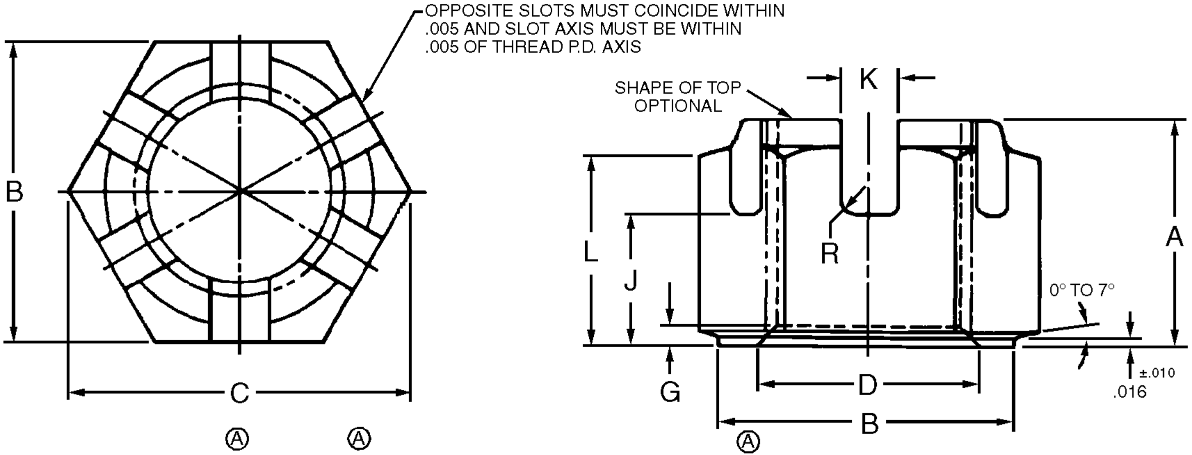
CERTAIN PROVISIONS TO APPLY TO THE ACROSS FLATS DIMENSION OF THIS STANDARD ARE THE SUBJECT OF INTERNATIONAL STANDARDIZATION AGREEMENT ABC AIR STD 17/2. WHEN REVISION OR CANCELLATION OF THIS STANDARD IS PROPOSED, THE DEPARTMENTAL CUSTODIAN WILL INFORM THEIR RESPECTIVE DEPARTMENTAL STANDARDIZATION OFFICE SO THAT APPROPRIATE ACTION WILL BE TAKEN RESPECTING THE INTERNATIONAL AGREEMENT CONCERNED.

FOR DESIGN FEATURE PURPOSES, THIS STANDARD TAKES PRECEDENCE OVER PROCUREMENT DOCUMENTS REFERENCED HEREIN.

REFERENCED DOCUMENTS SHALL BE OF THE ISSUE IN EFFECT ON DATE OF INVITATIONS FOR BID.

F05-016

Figure 5-17. Drawing MS17825(ASG)



SIZE DASH NO.	THREAD	(a) A Ⓐ		B Ⓐ		C	D	G		J Ⓐ		K		L	R	ULTIMATE (b)TENSILE STRENGTH LB MIN	WEIGHT LBS/100 MAX Ⓐ
		MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX		
-3	10-32UNF-3B	.173	.203	.367	.376	.413	.215	.006	.020	.094	.114	.078	.108	.110	.035	1,105	.35
-4	1/4-28UNF-3B	.173	.203	.430	.439	.488	.275	.007	.022	.094	.114	.078	.108	.125	.035	2,040	.40
-5	5/16-24UNF-3B	.173	.203	.492	.502	.557	.338	.008	.024	.094	.114	.078	.108	.125	.035	3,250	.55
-6	3/8-24UNF-3B	.204	.234	.553	.564	.628	.400	.008	.024	.110	.130	.125	.155	.140	.053	5,050	.75
-7	7/16-20UNF-3B	.204	.234	.616	.627	.698	.463	.010	.031	.110	.130	.125	.155	.130	.053	5,600	.85
-8	1/2-20UNF-3B	.235	.265	.741	.752	.840	.525	.010	.031	.141	.161	.125	.155	.150	.053	6,200	1.60

(a) THREADS IN ACCORDANCE WITH MIL-S-7742.
(b) ULTIMATE TENSILE STRENGTH FIGURES ARE NOT IN ACCORDANCE WITH MIL-N-25027(ASG). Ⓐ

MATERIAL: BODY, ALLOY STEEL (SEE PROCUREMENT SPECIFICATION).
INSERT, NYLON OR EQUIVALENT.

PLATING: CADMIUM PLATING IN ACCORDANCE WITH QQ-P-416, TYPE II, CLASS 3.

GENERAL: BREAK ALL SHARP EDGES AND REMOVE ALL HANGING BURRS AND SLIVERS WHICH MIGHT BECOME DISLODGED UNDER USAGE.
SURFACE ROUGHNESS IN ACCORDANCE WITH MIL-STD-10 SHALL NOT EXCEED 125 RHR.
DIMENSION IN INCHES.

DESIGN INFORMATION: THESE NUTS MAY BE USED AT TEMPERATURES 250°F AND BELOW IN THOSE TYPES OF APPLICATIONS FOR WHICH SLOTTED OR CASTELLATED NUTS ARE APPROVED FOR USE; AND IF SUCH APPLICATIONS CONFLICT WITH ANY LIMITATIONS ON THE USE OF SELF-LOCKING NUTS, AS CITED BY MS33588, THIS STANDARD TAKES PRECEDENCE. NUTS ARE TO BE INSTALLED IN ACCORDANCE WITH MS33540.

EXAMPLE OF PART NUMBER:

Ⓐ MS17826-4 - 1/4-28 NUT, CADMIUM PLATED, NON-METALLIC INSERT.

PERFORMANCE: PER MIL-N-25027 EXCEPT FOR;
1 - TABULATED ULTIMATE TENSILE STRENGTH VALUES.
2 - VIBRATION TIME FOR NUT SIZES SMALLER THAN 5/16 SHALL BE IN ACCORDANCE WITH MIL-N-25027.
3 - VIBRATION TIME FOR NUT SIZES 5/16 AND LARGER SHALL BE 120 MINUTES MINIMUM.
4 - LOCKING TORQUE VALUES APPLICABLE FOR ONE CYCLE AT ROOM TEMPERATURE ONLY.
5 - WRENCH TORQUE TEST VALUES TO BE DIRECTLY PROPORTIONAL TO THE ULTIMATE TENSILE STRENGTH.

QUALIFIED PRODUCTS: ONLY NUTS FOR WHICH THERE ARE QUALIFIED PRODUCTS LISTED ON QPL25027 SHALL BE USED FOR DESIGN.

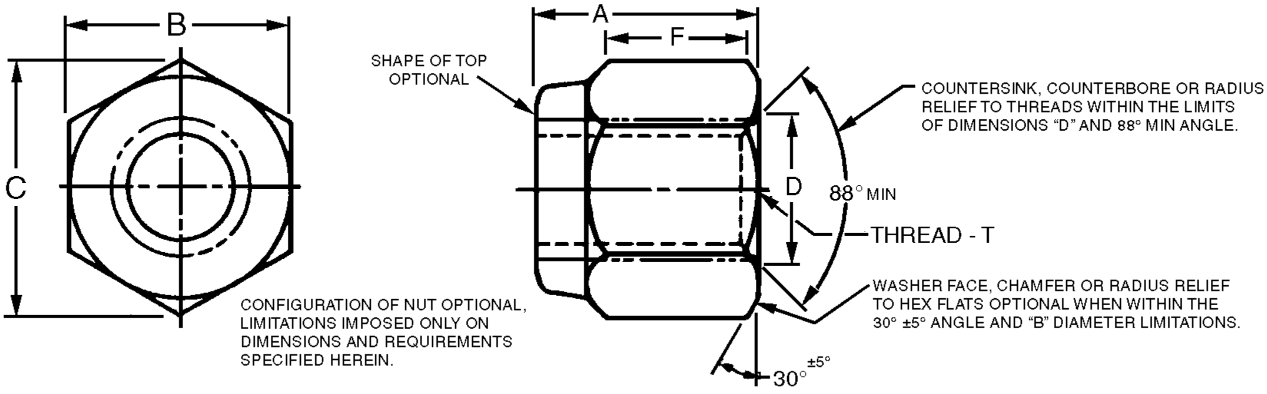
CERTAIN PROVISIONS TO APPLY TO THE ACROSS FLATS DIMENSION OF THIS STANDARD ARE THE SUBJECT OF INTERNATIONAL STANDARDIZATION AGREEMENT ABC AIR STD 17/2. WHEN REVISION OR CANCELLATION OF THIS STANDARD IS PROPOSED, THE DEPARTMENTAL CUSTODIAN WILL INFORM THEIR RESPECTIVE DEPARTMENTAL STANDARDIZATION OFFICE SO THAT APPROPRIATE ACTION MAY BE TAKEN RESPECTING THE INTERNATIONAL AGREEMENT CONCERNED.

FOR DESIGN FEATURE PURPOSES, THIS STANDARD TAKES PRECEDENCE OVER PROCUREMENT DOCUMENTS REFERENCED HEREIN.

REFERENCED DOCUMENTS SHALL BE OF THE ISSUE IN EFFECT ON DATE OF INVITATIONS FOR BID.

F05-017

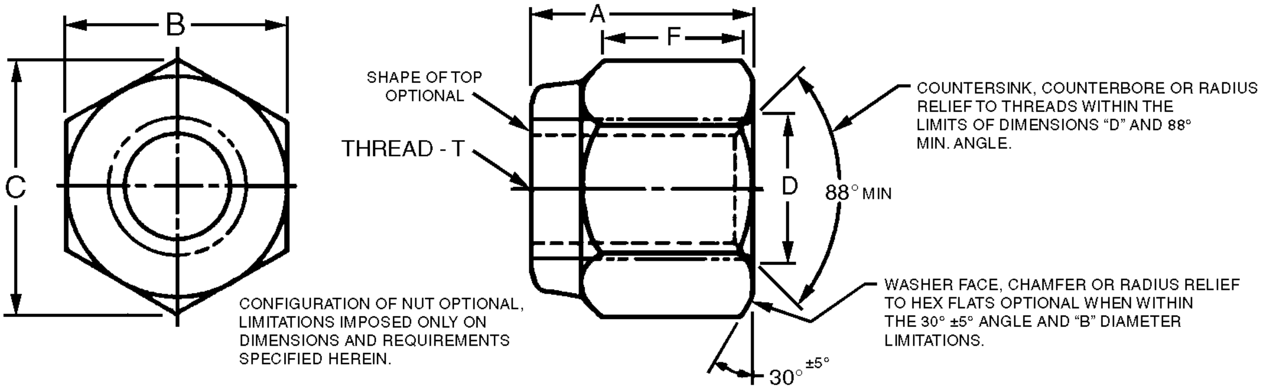
Figure 5-18. Drawing MS17826(ASG)



SIZE DASH NUMBER	THREAD T	A		B		C REF	D ±.020	F MIN	X	THREAD STRIPPING STRENGTH MINIMUM (POUNDS)	ULTIMATE WRENCH TORQUE MINIMUM (IN/LBS)	WEIGHT LB/100 MAX
		MAX	MIN	MAX	MIN							
-4C	1/4-20UNC-3B	0.360	0.240	0.440	0.428	0.506	0.273	0.116	0.007	3,900	40	0.90
-4F	1/4-28UNF-3B									4,000	50	
-5C	5/16-18UNC-3B	0.360	0.271	0.502	0.490	0.580	0.336	0.123	0.007	6,000	85	1.30
-5F	5/16-24UNF-3B									6,400	110	
-6C	3/8-16UNC-3B	0.469	0.318	0.565	0.553	0.650	0.398	0.153	0.008	9,600	140	1.95
-6F	3/8-24UNF-3B									10,750	190	
-7C	7/16-14UNC-3B	0.469	0.435	0.690	0.678	0.790	0.467	0.178	0.008	12,000	245	2.30
-7F	7/16-20UNF--3B									13,070	325	
-8C	1/2-13UNC-3B	0.610	0.575	0.752	0.740	0.870	0.531	0.221	0.009	19,100	440	4.35
-8F	1/2-20UNF-3B									19,600	500	
-9C	9/16-12UNC-3B	0.704	0.623	0.877	0.865	1.010	0.594	0.243	0.010	22,200	550	7.15
-9F	9/16-18UNF-3B									25,000	710	
-10C	5/8-11UNC-3B	0.766	0.732	0.940	0.928	1.080	0.656	0.274	0.010	28,900	750	8.73
-10F	5/8-18UNF-3B									30,300	1,000	
-12C	3/4-10UNC-3B	0.891	0.855	1.065	1.052	1.230	0.782	0.316	0.010	38,700	1,225	12.38
-12F	3/4-16UNF-3B									39,300	1,725	
-14C	7/8-9UNC-3B	1.016	0.965	1.252	1.239	1.440	0.918	0.570	0.011	56,700	2,225	19.46
-14F	7/8-14UNF-3B									61,300	2,775	
-16C	1-8UNC-3B	1.141	1.010	1.440	1.427	1.660	1.044	0.635	0.012	66,700	3,675	28.52
-16F	1-12UNF-3B									71,500	4,125	
-18C	1 1/8-7UNC-3B	1.266	1.130	1.627	1.614	1.880	1.171	0.710	0.013	81,900	5,350	41.95
-18F	1 1/8-12UNF-3B									90,400	5,975	
-20C	1 1/4-7UNC-3B	1.454	1.300	1.815	1.801	2.090	1.295	0.795	0.014	115,700	7,350	60.37
-20F	1 1/4-12UNF-3B									119,800	8,375	
-22C	1 3/8-6UNC-3B	1.609	1.547	2.008	1.973	2.310	1.447	0.890	0.015	137,300	9,900	80.00
-22F	1 3/8-12UNF-3B									143,400	11,200	
-24C	1 1/2-6UNC-3B	1.640	1.578	2.197	2.159	2.525	1.568	0.980	0.016	167,000	13,100	105.00
-24F	1 1/2-12UNF-3B									174,000	20,000	
-28C	1 3/4-5UNC-3B	2.376	2.250	2.762	2.715	3.175	1.818	1.250	0.018	255,000	20,000	250.00
-32C	2-4 1/2UNC-3B	2.469	2.343	3.137	3.086	3.610	2.065	1.350	0.020	290,000	20,000	325.00
-36C	2 1/4-4 1/2UNC-3B	2.876	2.750	3.514	3.457	4.040	2.328	1.800	0.020	390,000	20,000	500.00
-40C	2 1/2-4UNC-3B	3.204	3.078	4.015	3.875	4.620	2.578	1.600	0.020	500,000	20,000	700.00

F05-018

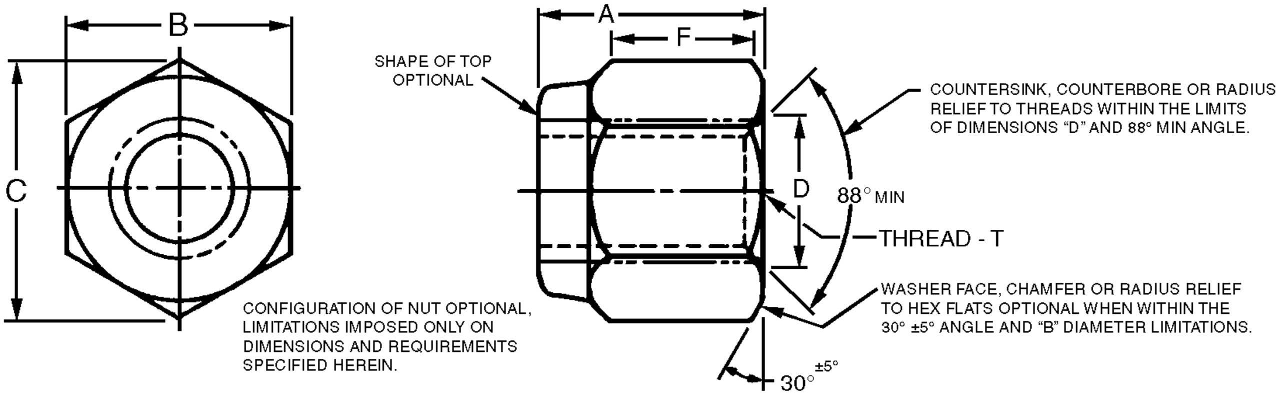
Figure 5-19. Drawing MS17828(SHIPS)



SIZE DASH NUMBER	THREAD T	A		B		C	D +.020	F MIN	X	STRIPPING MINIMUM STRENGTH	MINIMUM ULTIMATE WRENCH TORQUE	WEIGHT LB/100 MAX
		MAX	MIN	MAX	MIN	REF						
-4C	1/4-20UNC-3B	.360	.240	.440	.428	.506	.273	.116	.007	4,770	85	.90
-4F	1/4-28UNF-3B									5,460	115	
Ⓑ -5C	5/16-18UNC-3B	.360	.271	.502	.490	.580	.336	.123	.007	7,860	185	1.30
-5F	5/16-24UNF-3B									8,700	260	
-6C	3/8-16UNC-3B	.469	.318	.565	.553	.650	.398	.153	.008	11,620	315	1.95
-6F	3/8-24UNF-3B									13,170	450	
-7C	7/16-14UNC-3B	.469	.435	.690	.678	.790	.467	.178	.008	15,940	550	2.30
-7F	7/16-20UNF--3B									17,800	885	
-8C	1/2-13UNC-3B	.610	.575	.752	.740	.870	.531	.221	.009	21,300	1,000	4.35
-8F	1/2-20UNF-3B									24,000	1,250	
-9C	9/16-12UNC-3B	.704	.623	.877	.865	1.010	.594	.243	.010	27,300	1,300	7.15
-9F	9/16-18UNF-3B									30,400	1,850	
-10C	5/8-11UNC-3B	.766	.732	.940	.928	1.080	.656	.274	.010	33,900	1,725	8.73
-10F	5/8-18UNF-3B									38,400	2,725	
-12C	3/4-10UNC-3B	.891	.855	1.065	1.052	1.230	.782	.316	.010	50,100	2,875	12.38
-12F	3/4-16UNF-3B									56,000	4,775	
-14C	7/8-9UNC-3B	1.016	.965	1.252	1.239	1.440	.918	.570	.011	69,300	5,300	19.48
-14F	7/8-14UNF-3B									76,400	7,575	
-16C	1-8UNC-3B	1.141	1.010	1.440	1.427	1.660	1.044	.635	.012	90,900	8,750	28.52
-16F	1-12UNF-3B									99,400	10,900	
-18C	1 1/8-7UNC-3B	1.266	1.130	1.627	1.614	1.880	1.171	.710	.013	114,000	13,100	41.95
-18F	1 1/8-12UNF-3B									128,400	14,800	
-20C	1 1/4-7UNC-3B	1.454	1.300	1.815	1.801	2.090	1.295	.795	.014	145,000	17,600	60.37
-20F	1 1/4-12UNF-3B									161,000	20,000	
-22C	1 3/8-6UNC-3B	1.609	1.547	2.008	1.973	2.310	1.447	.890	.015	173,000	20,000	80.00
-22F	1 3/8-12UNF-3B									197,000	20,000	
-24C	1 1/2-6UNC-3B	1.640	1.578	2.197	2.159	2.525	1.568	.980	.016	211,000	20,000	105.00
-24F	1 1/2-12UNF-3B									237,200	20,000	
-28C	1 3/4-5UNC-3B	2.376	2.250	2.762	2.715	3.175	1.818	1.250	.018	285,000	20,000	250.00
-32C	2-4 1/2UNC-3B	2.469	2.343	3.137	3.086	3.610	2.065	1.350	.020	375,000	20,000	325.00
-36C	2 1/4-4 1/2UNC-3B	2.876	2.750	3.514	3.457	4.040	2.328	1.600	.020	487,500	20,000	500.00
-40C	2 1/2-4UNC-3B	3.204	3.078	4.015	3.875	4.620	2.578	1.800	.020	600,000	20,000	700.00

F05-019

Figure 5-20. Drawing MS17829(SHIPS)



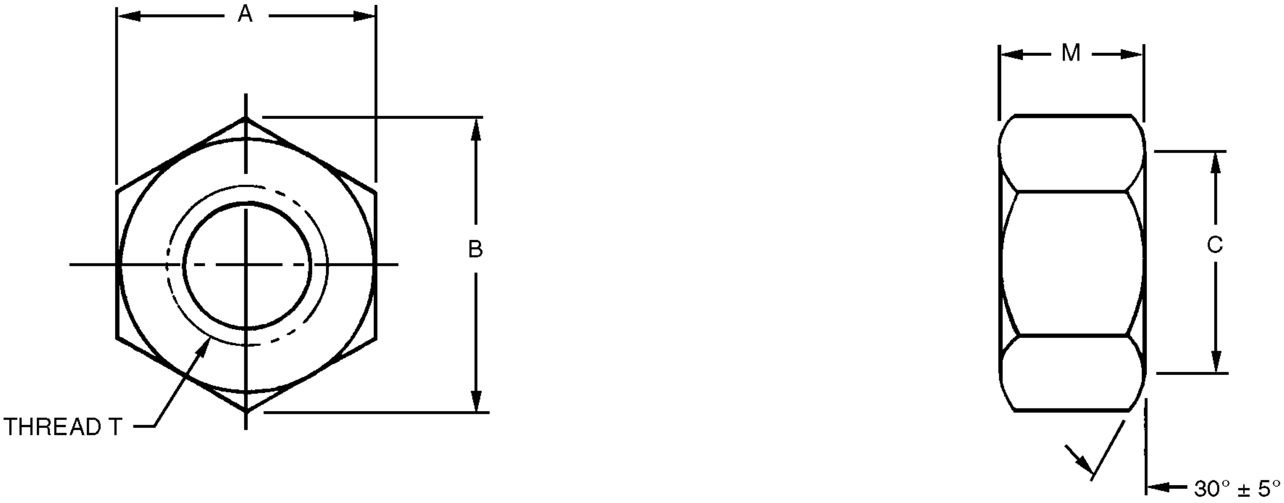
SIZE DASH NUMBER	THREAD (a) T	A		B		C	D	F	(b) X	(c) MINIMUM STRIPPING STRENGTH	MINIMUM (d) ULTIMATE WRENCH TORQUE	WEIGHT LB/100 MAX
		MAX	MIN	MAX	MIN	REF	±.020	MIN				
-4C	1/4-20UNC-3B	.360	.240	.440	.428	.506	.273	.116	.007	1,750	40	.90
-4F	1/4-28UNF-3B									2,000	50	
-5C	5/16-18UNC-3B	.360	.271	.502	.490	.580	.336	.123	.007	2,880	85	1.30
-5F	5/16-24UNF-3B									3,190	110	
-6C	3/8-16UNC-3B	.469	.318	.565	.553	.650	.398	.153	.008	4,260	140	1.95
-6F	3/8-24UNF-3B									4,830	190	
-7C	7/16-14UNC-3B	.469	.435	.690	.678	.790	.467	.178	.008	5,850	245	2.30
-7F	7/16-20UNF-3B									6,530	325	
-8C	1/2-13UNC-3B	.610	.575	.752	.740	.870	.531	.221	.009	7,800	440	4.35
-8F	1/2-20UNF-3B									8,790	500	
-9C	9/16-12UNC-3B	.704	.623	.877	.865	1.010	.594	.243	.010	10,010	550	7.15
-9F	9/16-18UNF-3B									11,160	710	
-10C	5/8-11UNC-3B	.766	.732	.940	.928	1.080	.656	.274	.010	12,400	750	8.73
-10F	5/8-18UNF-3B									14,100	1,000	
-12C	3/4-10UNC-3B	.891	.855	1.065	1.052	1.230	.782	.316	.010	18,400	1,225	12.38
-12F	3/4-16UNF-3B									20,500	1,725	
-14C	7/8-9UNC-3B	1.016	.965	1.252	1.239	1.440	.918	.570	.011	25,400	2,225	19.46
-14F	7/8-14UNF-3B									28,000	2,775	
-16C	1-8UNC-3B	1.141	1.010	1.440	1.427	1.660	1.044	.635	.012	33,300	3,675	28.52
1-16F	1-12UNF-3B									36,500	4,125	
-18C	1 1/8-7UNC-3B	1.266	1.130	1.627	1.614	1.880	1.171	.710	.013	42,000	5,350	41.95
-18F	1 1/8-12UNF-3B									47,100	5,975	
-20C	1 1/4-7UNC-3B	1.454	1.300	1.815	1.801	2.090	1.295	.795	.014	53,300	7,350	60.37
-20F	1 1/4-12UNF-3B									59,000	8,375	
-22C	1 3/8-6UNC-3B	1.609	1.547	2.008	1.973	2.310	1.447	.890	.015	63,500	9,900	80.00
-22F	1 3/8-12UNF-3B									72,300	11,200	
-24C	1 1/2-6UNC-3B	1.640	1.578	2.197	2.159	2.525	1.568	.980	.016	77,300	13,100	105.00
-24F	1 1/2-12UNF-3B									87,000	20,000	
-28C	1 3/4-5UNC-3B	2.376	2.250	2.762	2.715	3.175	1.818	1.250	.018	104,500	20,000	250.00
-32C	2-4 1/2UNC-3B	2.469	2.343	3.137	3.086	3.610	2.065	1.350	.020	137,500	20,000	325.00
-36C	2 1/4-4 1/2UNC-3B	2.876	2.750	3.514	3.457	4.040	2.328	1.600	.020	178,800	20,000	500.00
-40C	2 1/2-4UNC-3B	3.204	3.078	4.015	3.875	4.620	2.578	1.800	.020	220,000	20,000	700.00

Ⓐ NUTS SHALL CONFORM TO THE REQUIREMENT OF MIL-N-25027 EXCEPT AS FOLLOWS:

(a) THREADS IN ACCORDANCE WITH SCREW THREAD STANDARDS FOR FEDERAL SERVICES HANDBOOK H28 (1957) - PART I.
(b) BEARING SURFACE SHALL BE SQUARE WITH PITCH DIAMETER WITHIN X WHEN MEASURED IN ACCORDANCE WITH MIL-N-25027.
(c) MINIMUM STRIPPING STRENGTH VALUES SUPPLEMENT TABLE I OF MIL-N-25027.
(d) MINIMUM ULTIMATE WRENCH TORQUE VALUES SUPPLEMENT TABLE II OF MIL-N-25027.
(e) DIMENSIONAL AND LOAD DATA SUPPLEMENT TABLES III AND IX OF MIL-B-857.
(f) MINIMUM STRIPPING LOADS OF NUTS SHALL BE DETERMINED WITH BOLTS HEAT TREATED TO A MINIMUM ULTIMATE STRENGTH OF 160,000 PSI.

F05-020

Figure 5-21. Drawing MS17830



DASH NO.			THREAD T	A		B	C DIA		R	
BRASS TIN PLATED	BRASS SILVER PLATED	STEEL CADMIUM PLATED		MAX	MIN	MIN	MAX	MIN	MAX	MIN
-4A	-4B	-4S	NO. 4-40 UNC-2B	.250	.241	.275	.250	.225	.098	.087
-6A	-6B	-6S	NO. 6-32 UNC-2B	.313	.302	.344	.313	.282	.114	.102
-8A	-8B	-8S	NO.8-32 UNC-2B	.344	.332	.378	.344	.310	.130	.117
-10A	-10B	-10S	NO. 10-32 UNF-2B	.375	.362	.413	.475	.338	.130	.117
-416A	-416B	-416S	1/4-28 UNF-2B	.438	.423	.482	.438	.394	.193	.178
-516A	-516B	-516S	5/16-24 UNF-2B	.563	.545	.621	.563	.507	.225	.208
-616A	-616B	-616S	3/8-24 UNF-2B	.625	.607	.692	.625	.563	.257	.239
-816A	-816B	-816S	1/2-20 UNF-2B	.813	.788	.898	.813	.732	.442	.402
-1016A	-1016B	-1016S	5/8-18 UNF-2B	1.000	.969	1.104	1.000	.900	.553	.509

MATERIAL:
CARBON STEEL PER FED STD NO. 66, 55,000 PSI MIN., SULPHUR OR PHOSPHORUS SHALL

MATERIAL:
CARBON STEEL PER FED STD NO. 66, 55,000 PSI MIN., SULPHUR OR PHOSPHORUS SHALL NOT EXCEED 0.050% BY WEIGHT. BRASS PER QQ-B-626, COMPOSITION 22, 1/2 MARD.

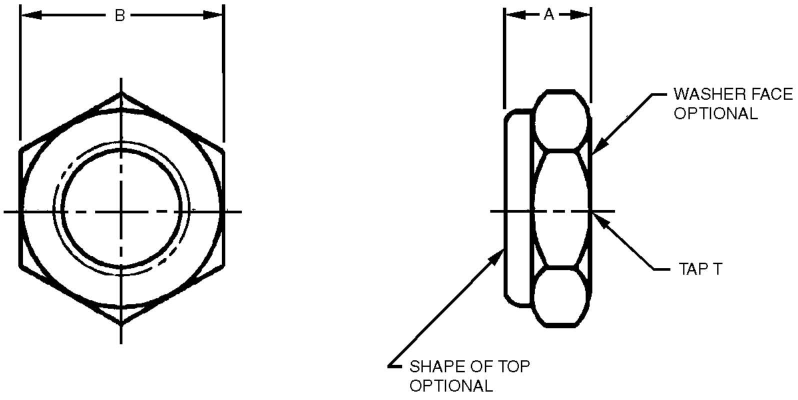
FINISH:
BRASS: TIN PLATE PER MIL-T-10727, TYPE I OR II, .0001 THICK; SILVER PLATE PER QQ-S-365, .0001 THICK.
STEEL: CADMIUM PLATE PER QQ-P-416, TYPE II, CLASS 3.

NOTES: NUTS SHALL BE FREE OF ALL LOOSE OR HANGING BURRS AND SLIVERS WHICH MIGHT BECOME DISLODGED UNDER USAGE. DIMENSIONS IN INCHES.

THREADS SHALL BE IN ACCORDANCE WITH MIL-S-7742.

F05-021

Figure 5-22. Drawing MS20341(ASG)



Ⓑ

FINE THREAD

DASH NUMBERS			TAP T	(a) A +.016	B +.002 -.010
STEEL	COPPER BASE ALLOY	ALUMINUM ALLOY			
-1032	B1032	D1032	NO. 10-32 NF-3B	.172	.375
- 428	B428	D428	1/4 -28UNF-3B	.203	.438
- 524	B524	D524	5/16-24UNF-3B	.250	.500
- 624	B624	D624	3/8 -24UNF-3B	.266	.563
- 720	B720	D720	7/16-20UNF-3B	.312	.625
- 820	B820	D820	1/2 -20UNF-3B	.312	.750
- 918	B918	D918	9/16-18UNF-3B	.359	.875
-1018	B1018	D1018	5/8 -18UNF-3B	.391	.938
-1216	B1216	D1216	3/4 -16UNF-3B	.406	1.063
-1414	B1414	D1414	7/8 -14UNF-3B	.469	1.250
-1614	B1614	D1614	1 -14 NF-3B	.562	1.438
-1812	B1812	D1812	1-1/8 -12UNF-3B	.656	1.625
-2012	B2012	D2012	1-1/4 -12UNF-3B	.750	1.813

COARSE THREAD

-632		D632	NO. 6-32 NC-2B	.125	.312
-832		D832	NO. 8-32 NC-2B	.172	.344

(a) MINIMUM A NOT SPECIFIED. LIMITED ONLY BY STRENGTH REQUIREMENT OF SPECIFICATION.

ADD A AFTER DASH NUMBER FOR NUTS HAVING NONMETALLIC INSERTS.

ADD C AFTER DASH NUMBER FOR NUTS FABRICATED ENTIRELY FROM METAL.

EXAMPLES OF PART NUMBERS: MS20364-428 - 1/4-28 STEEL NUT, EITHER ALL METAL OR WITH NONMETALLIC INSERT.
MS20364D428 - 1/4-28 ALUMINUM -ALLOY NUT, EITHER ALL METAL OR WITH NONMETALLIC INSERT.
MS20364B428A- 1/4-28 COPPER-BASE-ALLOY NUT WITH NONMETALLIC INSERT.
MS20364-428C - 1/4-28 STEEL, ALL METAL NUT.

DIMENSIONS IN INCHES.

FOR INSTALLATION, SEE STANDARD MS33588.

THIS STANDARD TAKES PRECEDENCE OVER DOCUMENTS REFERENCED HEREIN.

REFERENCED DOCUMENTS SHALL BE OF THE ISSUE IN EFFECT ON DATE OF INVITATIONS FOR BID.

Ⓑ INTERCHANGEABILITY RELATION WITH AN365 PARTS: MS20365 PARTS AN365 PARTS OF LIKE DASH NUMBER ARE UNIVERSALLY, FUNCTIONALLY AND DIMENSIONALLY INTERCHANGEABLE.

Ⓑ SHEET NO. 2 ADDED.

*SPECIFICATION AN-N-5 HAS BEEN SUPERSEDED BUT PRODUCTS HAVE NOT BEEN QUALIFIED UNDER THE SUPERSEDING DOCUMENT, SPECIFICATION MIL-N-25027

THIS DOCUMENT HAS BEEN PROMULGATED BY THE DEPARTMENT OF DEFENSE AS THE MILITARY STANDARD TO LIMIT THE SELECTION OF THE ITEM, PRODUCT, OR DESIGN COVERED HEREIN IN ENGINEERING, DESIGN, AND PROCUREMENT. THIS STANDARD SHALL BECOME EFFECTIVE NOT LATER THAN 90 DAYS AFTER THE LATEST DATE OF APPROVAL SHOWN.

Ⓑ FOR CHANGES SEE SHEET NO. 1.

F05-022S01

Figure 5-23. Drawing MS20364(ASG) (Sheet 1 of 2)

FINE THREAD

DASH NO.	FIIN	DASH NO.	FIIN	DASH NO.	FIIN	DASH NO.	FIIN	DASH NO.	FIIN	DASH NO.	FIIN
-1032		-1032A		-1032C		B1032		B1032A		B1032C	
-428		-428A		-428C		B428		B428A		B428C	
-524		-524A		-524C		B524		B524A		B524C	
-624		-624A		-624C		B624		B624A		B624C	
-720		-720A		-720C		B720		B720A		B720C	
-820		-820A		-820C		B820		B820A		B820C	
-918		-918A		-918C		B918		B918A		B918C	
-1018		-1018A		-1018C		B1018		B1018A		B1018C	
-1216		-1216A		-1216C		B1216		B1216A		B1216C	
-1414		-1414A		-1414C		B1414		B1414A		B1414C	
-1614		-1614A		-1416C		B1416		B1416A		B1416C	
-1812		-1812A		-1812C		B1812		B1812A		B1812C	
-2012		-2012A		-2012C		B2012		B2012A		B2012C	

COARSE THREAD

-632		-632A		-632C		B632		B632A		B632C	
-832		-832A		-832C		B832		B832A		B832C	

FINE THREAD

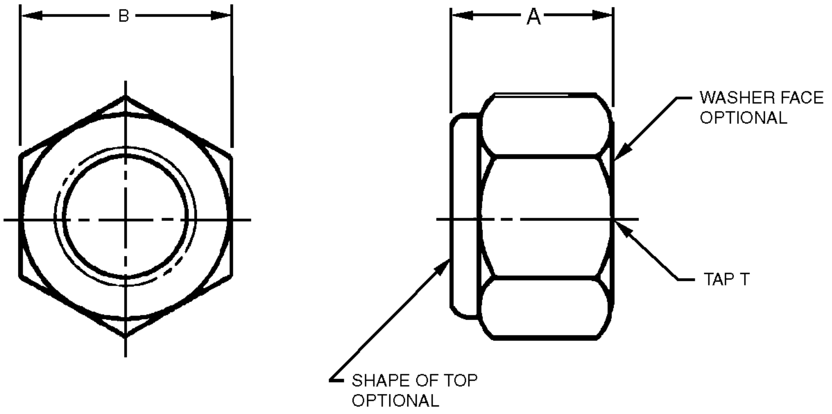
DASH NO.	FIIN	DASH NO.	FIIN	DASH NO.	FIIN
D1032		D1032A		D1032C	
D428		D428A		D428C	
D524		D524A		D524C	
D624		D624A		D624C	
D720		D720A		D720C	
D820		D820A		D820C	
D918		D918A		D918C	
D1018		D1018A		D1018C	
D1216		D1216A		D1216C	
D1414		D1414A		D1414C	
D1614		D1614A		D1614C	
D1812		D1812A		D1812C	
D2012		D2012A		D2012C	

COARSE THREAD

D632		D632A		D632C	
D823		D823A		D823C	

F05-022S02

Figure 5-23. Drawing MS20364(ASG) (Sheet 2)



Ⓒ

FINE THREAD

DASH NUMBERS			TAP T	(a) A +.016	B +.002 -.010
STEEL	COPPER BASE ALLOY	AL ALLOY			
-1032	B1032	D1032	NO. 10-32 NF-3B	.234	.375
- 428	B428	D428	1/4-28UNF-3B	.312	.438
- 524	B524	D524	5/16-24UNF-3B	.344	.500
- 624	B624	D624	3/8-24UNF-3B	.453	.563
- 720	B720	D720	7/16-20UNF-3B		.625
- 820	B820	D820	1/2-20UNF-3B	.594	.750
- 918	B918	D918	9/16-18UNF-3B	.688	.875
-1018	B1018	D1018	5/8-18UNF-3B	.750	.938
-1216	B1216	D1216	3/4-16UNF-3B	.875	1.063
-1414	B1414	D1414	7/8-14UNF-3B	1.000	1.250
-1614	B1614	D1614	1 -14 NF-3B	1.125	1.438
-1812	B1812	D1812	1- 1/8-12UNF-3B	1.250	1.625
-2012	B2012	D2012	1- 1/4-12UNF-3B	1.438	1.813

COARSE THREAD

-440	B440	D440	NO. 4-40 NC-2B	.141	.250
-632	B632	D632	NO. 6-32 NC-2B	.172	.312
-832	B832	D832	NO. 8-32 NC-2B	.234	.344

(a) MINIMUM A NOT SPECIFIED. LIMITED ONLY BY STRENGTH REQUIREMENT OF SPECIFICATION.

ADD A AFTER DASH NUMBER FOR NUTS HAVING NONMETALLIC INSERTS.

ADD C AFTER DASH NUMBER FOR NUTS FABRICATED ENTIRELY FROM METAL.

EXAMPLES OF PART NUMBERS: MS20365-42C - 1/4-28 STEEL NUT, EITHER ALL METAL OR WITH NONMETALLIC INSERT.
MS20365D428 - 1/4-28 ALUMINUM -ALLOY NUT, EITHER ALL METAL OR WITH NONMETALLIC INSERT.
MS20365B428A- 1/4-28 COPPER-BASE-ALLOY NUT WITH NONMETALLIC INSERT.
MS20365-428C - 1/4-28 STEEL, ALL METAL NUT.

DIMENSIONS IN INCHES.

FOR INSTALLATION, SEE STANDARD MS33588.

THIS STANDARD TAKES PRECEDENCE OVER DOCUMENTS REFERENCED HEREIN.

REFERENCED DOCUMENTS SHALL BE OF THE ISSUE IN EFFECT ON DATE OF INVITATIONS FOR BID.

C INTERCHANGEABILITY RELATION WITH AN365 PARTS: MS20365 PARTS AN365 PARTS OF LIKE DASH NUMBER ARE UNIVERSALLY, FUNCTIONALLY AND DIMENSIONALLY INTERCHANGEABLE.

C SHEET NO. 2 ADDED.

*SPECIFICATION AN-N-5 HAS BEEN SUPERSEDED BUT PRODUCTS HAVE NOT BEEN QUALIFIED UNDER THE SUPERSEDING DOCUMENT, SPECIFICATION MIL-N-25027

THIS DOCUMENT HAS BEEN PROMULGATED BY THE DEPARTMENT OF DEFENSE AS THE MILITARY STANDARD TO LIMIT THE SELECTION OF THE ITEM, PRODUCT, OR DESIGN COVERED HEREIN IN ENGINEERING, DESIGN, AND PROCUREMENT. THIS STANDARD SHALL BECOME EFFECTIVE NOT LATER THAN 90 DAYS AFTER THE LATEST DATE OF APPROVAL SHOWN.

C FOR CHANGES SEE SHEET NO. 1.

F05-023S01

Figure 5-24. Drawing MS20365(ASG) (Sheet 1 of 2)

FINE THREAD

DASH NO.	FIIN	DASH NO.	FIIN	DASH NO.	FIIN	DASH NO.	FIIN	DASH NO.	FIIN	DASH NO.	FIIN
-1032		-1032A		-1032C		B1032		B1032A		B1032C	
-428		-428A		-428C		B428		B428A		B428C	
-524		-524A		-524C		B524		B524A		B524C	
-624		-624A		-624C		B624		B624A		B624C	
-720		-720A		-720C		B720		B720A		B720C	
-820		-820A		-820C		B820		B820A		B820C	
-918		-918A		-918C		B918		B918A		B918C	
-1018		-1018A		-1018C		B1018		B1018A		B1018C	
-1216		-1216A		-1216C		B1216		B1216A		B1216C	
-1414		-1414A		-1414C		B1414		B1414A		B1414C	
-1614		-1614A		-1614C		B1614		B1614A		B1616C	
-1812		-1812A		-1812C		B1812		B1812A		B1812C	
-2012		-2012A		-2012C		B2012		B2012A		B2012C	

COARSE THREAD

-440		-440A		-440C		B440		B440A		B440C	
-632		-632A		-632C		B632		B632A		B632C	
-832		-832A		-832C		B832		B832A		B832C	

FINE THREAD

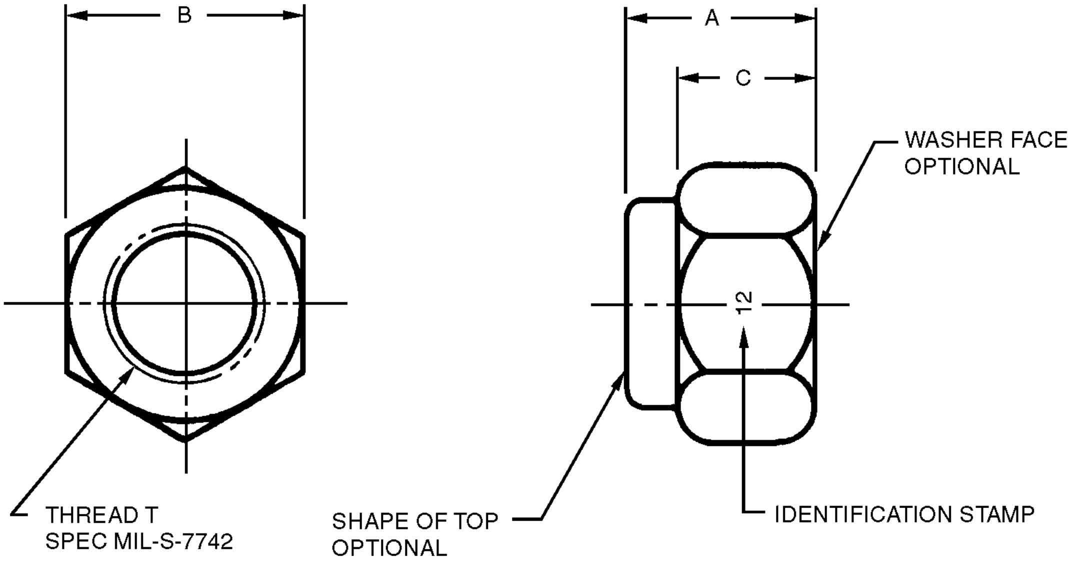
DASH NO.	FIIN	DASH NO.	FIIN	DASH NO.	FIIN
D1032		D1032A		D1032C	
D428		D428A		D428C	
D524		D524A		D524C	
D624		D624A		D624C	
D720		D720A		D720C	
D820		D820A		D820C	
D918		D918A		D918C	
D1018		D1018A		D1018C	
D1216		D1216A		D1216C	
D1414		D1414A		D1414C	
D1614		D1614A		D1614C	
D1812		D1812A		D1812C	
D2012		D2012A		D2012C	

COARSE THREAD

D440		D440A		D440C	
D632		D632A		D632C	
D832		D832A		D832C	

F05-023S02

Figure 5-24. Drawing MS20365(ASG) (Sheet 2)



DASH NO.	Ⓐ FIIN	Ⓐ THREAD T	A		B		Ⓐ C
			MAX	MIN	MAX	MIN	MIN
1032		NO. 10-32 NF-3B	.250	.202	.377	.365	.140
428		1/4 -28UNF-3B	.328	.280	.440	.428	.192
524		5/16-24UNF-3B	.360	.312	.502	.490	.200
624		3/8 -24UNF-3B	.469	.421	.565	.553	.278
720		7/16-20UNF-3B	.469	.421	.627	.615	.281
820		1/2 -20UNF-3B	.610	.562	.752	.740	.390
918		9/16-18UNF-3B	.704	.656	.877	.865	.515
1018		5/8 -18UNF-3B	.766	.718	.940	.928	.565
1216		3/4 -16UNF-3B	.891	.843	1.065	1.053	.655
1414		7/8 -14UNF-3B	1.016	.968	1.252	1.240	.750
1614		1 -14UNF-3B	1.141	1.093	1.440	1.428	.845

THE TAPER OF THE SIDES OF THE HEXAGON SHALL NOT EXCEED FOUR DEGREES TOTAL INCLUDED ANGLE.

EXAMPLE OF PART NUMBER: MS20500-428 = 1/4-28 NUT

DIMENSIONS IN INCHES.

Ⓐ INSTALLATION SHALL BE IN ACCORDANCE WITH STANDARD MS33588.

FOR USE WITH BOLTS SHOWN ON STANDARD MS20033 THRU MS20046.

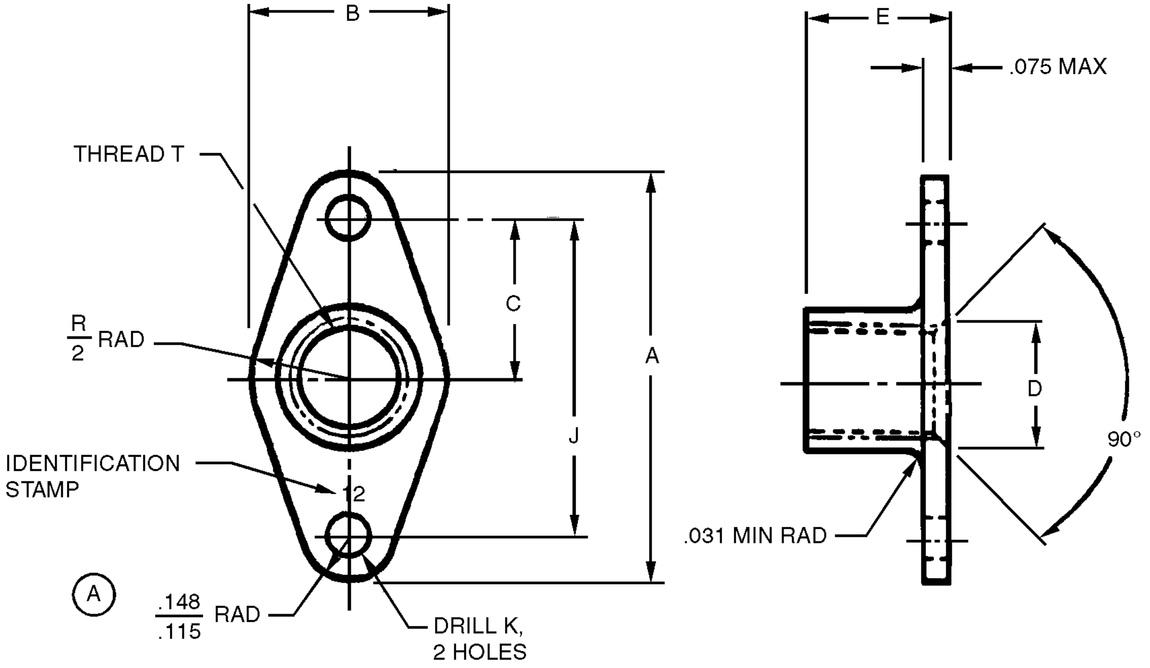
THIS STANDARD TAKES PRECEDENCE OVER DOCUMENTS REFERENCED HEREIN.

REFERENCED DOCUMENTS SHALL BE OF THE ISSUE IN EFFECT ON DATE OF INVITATIONS FOR BID.

THIS DOCUMENT HAS BEEN PROMULGATED BY THE DEPARTMENT OF DEFENSE AS THE MILITARY STANDARD TO LIMIT THE SELECTION OF THE ITEM, PRODUCT, OR DESIGN COVERED HEREIN ENGINEERING, DESIGN, AND PROCUREMENT. THIS STANDARD SHALL BECOME EFFECTIVE NOT LATER THAN 90 DAYS AFTER THE LATEST DATE OF APPROVAL SHOWN.

F05-024

Figure 5-25. Drawing MS20500(ASG)



DASH NO.	Ⓐ THREAD T	Ⓐ A MAX	Ⓐ B MAX	(a) C MAX	D DIA		Ⓐ E	J		K	
					MIN	MAX	MIN	MAX	MIN	MAX	MIN
632 832 1032	NO. 6-32 NC-2B NO 8-32 NC-2B NO. 10-32 NF 3B	.986 .986 .986	.407 .407 .407	.344 .344 .344	.148 .174 .200	.234 .251 .251	.187 .204 .202	.690 .690 .690	.686 .686 .686	.103 .103 .103	.098 .098 .098
428 524 624	1/4-28UNF-3B 5/16-24UNF-3B 3/8-24UNF-3B	1.298 1.298 1.298	.516 .532 .641	.500 .500 .500	.260 .322 .385	.329 .360 .469	.280 .312 .406	1.002 1.002 1.002	.998 .998 .998	.103 .135 .135	.098 .130 .130

(a) THE CENTER OF THE TAPPED HOLE SHALL NOT DEVIATE BY MORE THEN .005 IN ANY DIRECTION FROM THE CENTER OF THE PLATE NUT AS DETERMINED BY THE RIVET HOLES.

SHAPE OF TOP OPTIONAL TO SUIT LOCKING METHOD.
NUTS FOR USE BY WELDING TO BE MADE WITHOUT RIVET HOLES. SPACING OF WELDING PROJECTIONS MUST BE EQUAL TO DIMENSION J.
Ⓐ MATERIAL: COROSION-RESISTANT STEEL.
FINISH: SILVER PLATE, IN ACCORDANCE WITH PROCUREMENT SPECIFICATION.

ADD W BEFORE DASH NUMBERS FOR PLATE NUTS FOR USE BY WELDING.

EXAMPLES OF PART NUMBERS: MS20501-428 = 1/4-28 NUT WITH DRILLED LUGS.
MS20501W428 = 1/4-28 NUT FOR USE BY WELDING.
DIMENSIONS IN INCHES. UNLESS OTHERWISE SPECIFIED, TOLERANCES: DECIMALS ±.016.

FOR INSTALLATION INSTRUCTIONS, SEE DRAWING MS33588.

FOR USE WITH BOLTS SHOWN ON MS20033 THRU MS20046.

THIS STANDARD TAKES PRECEDENCE OVER DOCUMENTS REFERENCED HEREIN.
REFERENCED DOCUMENTS SHALL BE OF THE ISSUE IN EFFECT ON DATE OF INVITATIONS FOR BID.
Ⓐ SHEET NO. 2 ADDED.

Ⓐ FOR CHANGES SEE SHEET 1.

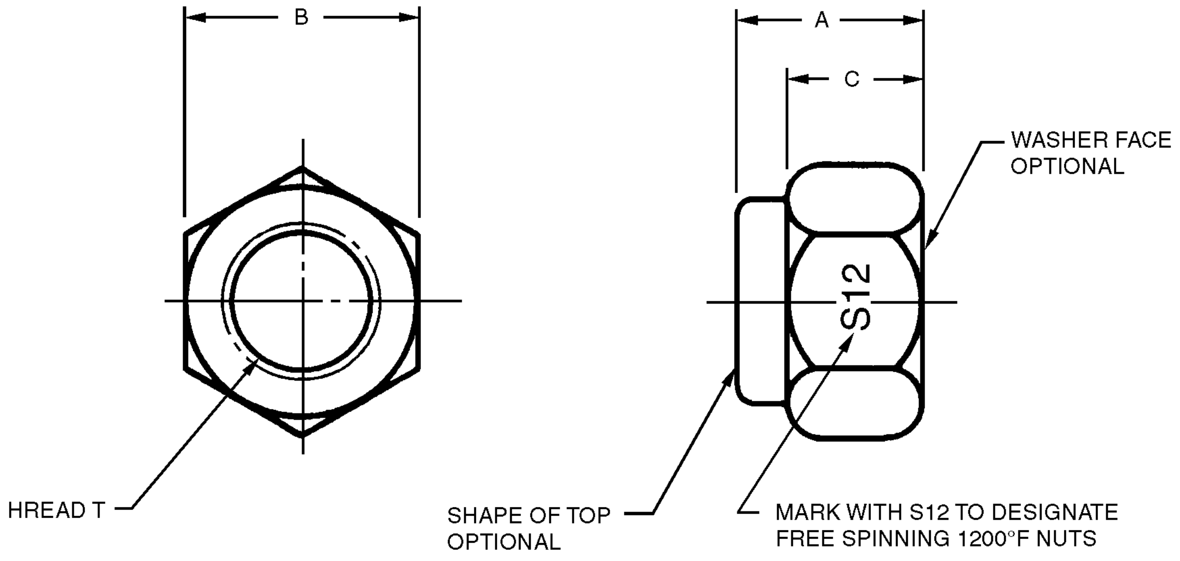
F05-025S01

Figure 5-26. Drawing MS20501(ASG) (Sheet 1 of 2)

DASH NO.	FIIN	DASH NO.	FIIN
632		W632	
832		W832	
1032		W1032	
428		W428	
524		W524	
624		W624	

F05-025S02

Figure 5-26. Drawing MS20501(ASG) (Sheet 2)



DASH NO.	THREAD T	A		B		C
		MAX	MIN	MAX	MIN	MIN
1032	NO. 10-32 NF-3B	0.250	0.202	0.377	0.365	0.125
428	1/4-28UNF-3B	0.328	0.280	0.440	0.428	0.175
524	5/16-24UNF-3B	0.360	0.312	0.520	0.490	0.185
624	3/8-24UNF-3B	0.469	0.421	0.565	0.553	0.260
720	7/16-20UNF-3B	0.469	0.421	0.627	0.615	0.260
820	1/2-20UNF-3B	0.610	0.562	0.752	0.740	0.375
918	6/16-18UNF-3B	0.704	0.656	0.877	0.865	0.500
1018	5/8-18UNF-3B	0.766	0.718	0.940	0.928	0.500
1216	3/4-16UNF-3B	0.891	0.843	1.065	1.053	0.570
1414	7/8 -14UNF-3B	1.016	0.968	1.252	1.240	0.650
1614	1 -14UNF-3B	1.141	1.093	1.440	1.428	0.730

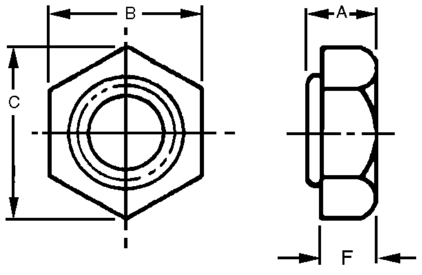
THE TAPER OF THE SIDES OF THE HEXAGON SHALL NOT EXCEED FOUR DEGREES TOTAL INCLUDED.
MATERIAL: SEE PROCUREMENT SPECIFICATION.
FINISH: SEE PROCUREMENT SPECIFICATION.
NUTS SHALL BE FREE FROM ALL HANGING BURRS AND SLIVERS WHICH MIGHT BECOME DISLODGED UNDER USAGE.
EXAMPLE OF PART NUMBER: 20503-428 = 1/4-28UNF-3B NUT.
DIMENSIONS IN INCHES.
FOR USE WITH BOLTS SHOWN ON DRAWING MS20033 THRU MS20046.
FOR INSTALLATION INSTRUCTIONS, SEE DRAWING AND 10068.

CANCELLED AFTER 8 DEC 64.
USE MS 20500 (ASG).

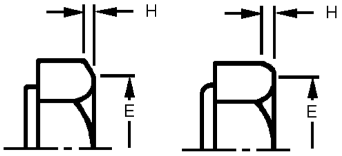
MS 20500 NUTS CAN UNIVERSALLY REPLACE
AF STD 20503 NUTS OF SAME DASH NUMBER.

F05-026

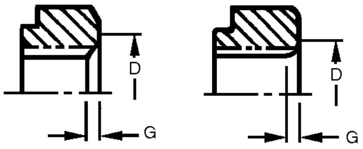
Figure 5-27. Drawing MS20503



CONFIGURATION OF NUT IS
OPTIONAL, LIMITATIONS IMPOSED
ONLY ON DIMENSIONS AND
REQUIREMENTS SPECIFIED HEREIN



WASHER FACE, CHAMFER OR
RADIUS RELIEF TO HEX OPTIONAL
WHEN WITHIN THE LIMITATIONS
OF DIMENSIONS E AND H



WASHER FACE, CHAMFER OR RADIUS
RELIEF TO THREAD OPTIONAL
WHEN WITHIN THE LIMITATIONS
OF DIMENSIONS D AND G

SIZE DASH NO.	(a) THREAD	A		B		C REF	D DIA		E MIN DIA	F MIN	G		H MAX	AXIAL STRENGTH LBS MIN	WEIGHT LBS/100 MAX
		MAX	MIN	MAX	MIN		MAX	MIN			MAX	MIN			
04	4-40 NC-3B	.125	.112	.252	.240	.289	.154	.112	.190	.081	.046	.039	.024	—	.13
06	6-32 NC-3B	.141	.126	.314	.302	.361	.178	.138	.252	.092	.049	.042	.027	—	.23
08	8-32 NC-3B	.188	.140	.346	.334	.390	.203	.173	.284	.122			.037	1,720	.28
3	10-32 NF-3B		.147	.377	.365	.430	.230	.199	.315					2,460	.35
4	1/4 -28 UNF-3B	.219	.177	.439	.430	.508	.293	.259	.380	.142	.055	.047	.042	4,580	.53
5	5/16-24 UNF-3B	.266	.239	.502	.493	.580	.356	.322	.452	.173	.059	.051	.052	7,390	.85
6	3/8 -24 UNF-3B	.282	.269	.564	.553	.650	.418	.385	.523	.183			.055	11,450	1.10
7	7/16-20 UNF-3B	.328	.315	.690	.679	.790	.482	.448	.629	.213	.066	.056	.064	15,540	1.95

(a) THREADS IN ACCORDANCE WITH MIL-S-7742, BEFORE LUBRICATION.

MATERIAL: STEEL, SEE PERFORMANCE SPECIFICATION.
PLATING: CADMIUM PLATE IN ACCORDANCE WITH QQ-P-416, TYPE II, CLASS 3.
LUBRICANT: DRY FILM, WHERE SPECIFIED BY THE CODE LETTER L.
FOR USAF APPLICATIONS, NUTS TREATED WITH DRY FILM LUBRICANTS SHALL NOT UTILIZED IN INTEGRAL FUEL TANKS.

DIMENSIONS IN INCHES.

LETTER L BEFORE FIRST DASH NUMBER DESIGNATES DRY FILM LUBRICANT COATED NUTS.

EXAMPLES OF PART NUMBER: MS21040-4 = 1/4-28 NUT, ALL METAL, CADMIUM PLATED.
MS2104L4 = 1/4-28 NUT, ALL METAL, CADMIUM PLATED, DRY FILM LUBRICATED.

ONLY NUTS FOR WHICH THERE ARE QUALIFIED PRODUCTS LISTED ON QPL25027 SHALL BE USED FOR DESIGN.
DESIGN INFORMATION: THESE NUTS ARE DESIGNED TO DEVELOP THE TENSILE STRENGTH OF BOLTS AND SCREWS WITH AN ULTIMATE TENSILE STRENGTH OF 125,000 PSI BASED ON THE AREA AT THE BASIC ROOT DIAMETER OF THE BOLT OR SCREW THREAD.

INTERCHANGEABILITY RELATIONSHIP: MS21040 NUTS CAN UNIVERSALLY REPLACE AN363, MS20364, AND MS20365 NON CORROSION RESISTANT STEEL NUTS OF LIKE THREAD SIZE, AND WHICH ARE EITHER ALL METAL OR HAVE NON-METALLIC INSERTS: BUT THESE AN363, MS20364, AND MS20365 NUTS CAN NOT UNIVERSALLY REPLACE THE MS21040 NUTS.

PROVISIONS OF THIS STANDARD ARE THE SUBJECT OF INTERNATIONAL STANDARDIZATION AGREEMENT. WHEN REVISION OR CANCELLATION OF THIS STANDARD IS PROPOSED, THE DEPARTMENTAL CUSTODIANS WILL INFORM THEIR RESPECTIVE DEPARTMENTAL STANDARDIZATION OFFICES SO THAT APPROPRIATE ACTION MAY BE TAKEN RESPECTING THE INTERNATIONAL AGREEMENT CONCERNED.

Ⓐ INACTIVE FOR DESIGN AFTER 23 SEPTEMBER 1960. USE MS21042

THIS STANDARD TAKES PRECEDENCE OVER DOCUMENTS REFERENCED HEREIN.
REFERENCED DOCUMENTS SHALL BE OF THE ISSUE IN EFFECT ON DATE OF INVITATIONS FOR BID.

F05-027S01

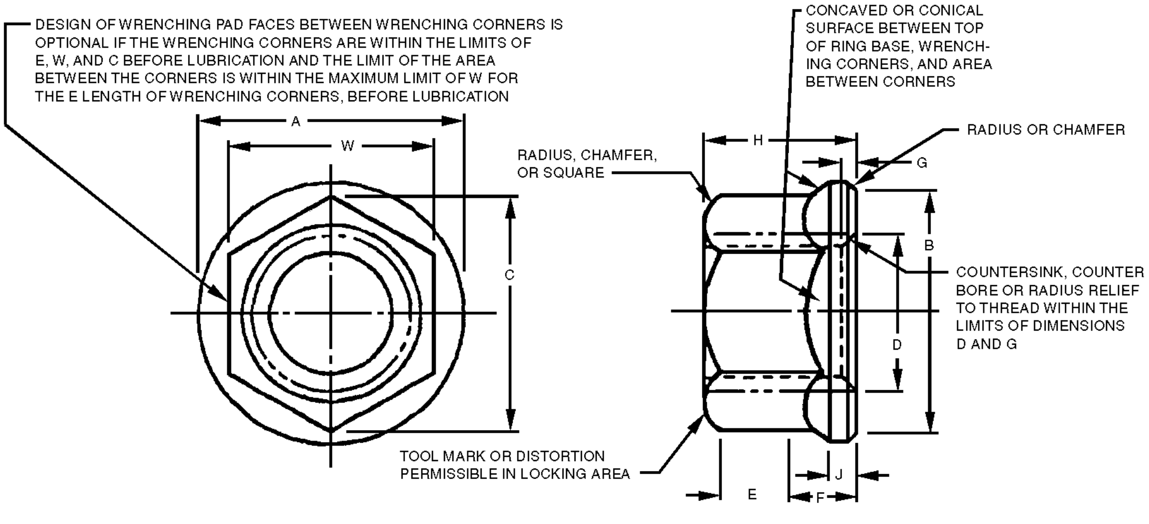
Figure 5-28. Drawing MS21040(ASG) (Sheet 1 of 2)

DASH NO.	FIIN	DASH NO.	FIIN
04		L04	
06		L06	
08		L08	
3		L3	
4		L4	
5		L5	
6		L6	
7		L7	

Ⓐ INACTIVE FOR DESIGN AFTER 23 SEPTEMBER 1960. USE MS21042

F05-027S02

Figure 5-28. Drawing MS21040(ASG) (Sheet 2)



SIZE DASH NO.	(a) THREAD	A MAX	B MIN	C MIN	D MAX	D MIN	(d) E MIN	(e) F MIN	G MAX	G MIN	H MAX	H MIN	J MIN	(c) W MAX	W MIN	(b) I	(f) AXIAL STRENGTH LBS MIN	WEIGHT LB/100 MAX	(f) WRENCHING TORQUE TEST VALUE IN LBS
02	2-56 UNC-3B	.167	.137	.138	.106	.086	.045	.019	.021	.004	.100	.080	.010	.127	.122	.0025	660	.020	5
04	4-40 UNC-3B	.206	.176	.171	.142	.112	.050	.028	.027	.005	.125	.103		.158	.150	.003	1 110	.050	10
06	6-32 UNC-3B	.244	.214	.207	.168	.138	.055	.039	.031	.006	.141	.115		.190	.181		1 670	.080	20
08	8-32 UNC-3B	.290	.260	.244	.194	.164	.060	.041			.188	.125	.015	.221	.213		2 490	.150	30
3	10-32 UNF-3B	.330	.290	.277	.220	.190	.065	.043				.154		.252	.243		3 470	.180	60
4	1/4 -28 UNF-3B	.420	.386	.347	.280	.250	.090	.057	.036	.007	.219	.204	.019	.316	.304		6 200	.350	150
5	5/16-24 UNF-3B	.520	.482	.419	.342	.312	.120	.077	.042	.008	.266	.251	.023	.378	.367	.004	9 820	.600	330
6	3/8 -24 UNF-3B	.620	.575	.491	.405	.375	.125	.089			.282	.267	.030	.440	.430		15 200	.800	530

(a) THREADS IN ACCORDANCE WITH MIL-S-7742 BEFORE LUBRICATION.
(b) BREAKING SURFACE SHALL BE SQUARE WITH PITCH DIA WITHIN I WHEN MEASURED IN ACCORDANCE WITH MIL-N-25027.
(c) DIMENSION ACROSS FLATS INCLUDES DEFORMATION OF SELF LOCKING DEVICE.
(d) MINIMUM LENGTH OF EACH WRENCHING CORNER.
(e) MINIMUM DISTANCE FROM THE WASHER FACE OF THE NUT TO THE BEGINNING OF THE MINIMUM LENGTH E OF EACH WRENCHING CORNER.
(f) NUT SHALL BE TESTED FOR WRENCHING TORQUE BY THE USE OF A BOX OR SOCKET WRENCH. TEST BOLTS SHALL BE 180,000 PSI MIN.

MATERIAL: NON-CORROSION RESISTANT STEEL. SEE PROCUREMENT SPECIFICATION.
PLATING: PLAIN CADMIUM PLATED NUTS IN ACCORDANCE WITH QQ-P-416, TYPE II, CLASS 3. DRY FILM LUBRICATED NUTS IN ACCORDANCE WITH QQ-P-416, TYPE AND CLASS ARE OPTIONAL IF THE NUTS WILL MEET THE SALT SPRAY REQUIREMENTS OF QQ-P-416, TYPE II.
LUBRICANT: DRY FILM LUBRICANT APPROVED IN ACCORDANCE WITH MIL-N-25027. OTHER LUBRICANTS SOLUBLE IN THE CLEANER SPECIFIED IN PROCUREMENT SPECIFICATION.

HARDNESS: ROCKWELL C49 MINIMUM.
BREAK ALL SHARP EDGES AND REMOVE ALL HANGING BURRS AND SLIVERS WHICH MIGHT BECOME DISLODGED UNDER USAGE.
SURFACE ROUGHNESS IN ACCORDANCE WITH MIL-STD-10. UNLESS OTHERWISE SPECIFIED THE SURFACE ROUGHNESS SHALL NOT EXCEED 125 MIN.
DIMENSIONS IN INCHES.
THESE NUTS SHALL BE USED IN ACCORDANCE WITH THE LIMITATIONS OF MS33588.

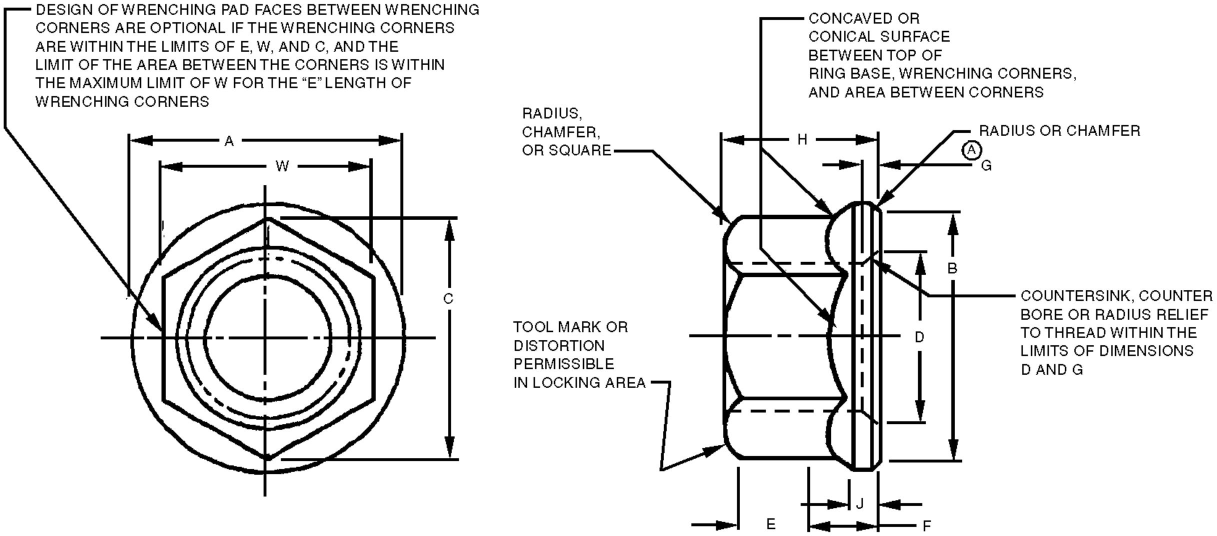
Ⓒ LETTER L BEFORE FIRST DASH NUMBER DESIGNATES DRY FILM LUBRICATED NUTS.
EXAMPLE OF PART NUMBERS: MS21042L4 = 1/4-28 NUT, CADMIUM PLATED , DRY FILM LUBRICATED.
MS21042-4 = 1/4-28 NUT, CADMIUM PLATED, NON-DRY FILM LUBRICATED.
QUALIFIED PRODUCTS: ONLY NUTS FOR WHICH THERE ARE QUALIFIED PRODUCTS LISTED ON QPL 25027 SHALL BE USED FOR DESIGN.
INTERCHANGEABILITY RELATIONSHIP: MS21042 NUTS CAN UNIVERSALLY REPLACE AN363, MS20364, MS20365 AND MS21040 NON-CORROSION RESISTANT STEEL NUTS OF LIKE THREAD SIZE, AND WHICH ARE EITHER ALL METAL OR HAVE NON-METALLIC INSERTS: BUT THESE AN363, MS20364, MS20365 AND MS21040 NUTS CANNOT UNIVERSALLY REPLACE THE MS21042 NUT.
IF THE REQUIREMENTS OF THIS DOCUMENT CONFLICT WITH ANY DOCUMENT REFERENCED WITHIN THIS DOCUMENT SHALL GOVERN.

CERTAIN PROVISIONS (THE DIMENSIONS ACROSS THE WRENCHING FLATS) OF THIS STANDARD ARE THE SUBJECT OF INTERNATIONAL STANDARDIZATION AGREEMENT ABC AIR STD 17/2. WHICH REVISION OR CANCELLATION OF THIS STANDARD IS PROPOSED, THE DEPARTMENTAL CUSTODIAN WILL INFORM THEIR RESPECTIVE DEPARTMENTAL STANDARDIZATION OFFICE SO THAT APPROPRIATE ACTION MAY BE TAKEN RESPECTING THE INTERNATIONAL AGREEMENT CONCERNED.

FOR DESIGN FEATURE PURPOSES, THIS STANDARD TAKES PRECEDENCE OVER PROCUREMENT DOCUMENTS REFERENCED HEREIN.
REFERENCED DOCUMENTS SHALL BE OF THE ISSUE IN EFFECT ON DATE OF INVITATIONS FOR BID.

F05-028

Figure 5-29. Drawing MS21042(ASG)



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SIZE DASH NO.	(a) THREAD	A MAX	B MIN	C MIN	D		(d) E MIN	(e) F MIN	G		H		J MIN	(c) W		(b) X	(f) WRENCHING TORQUE IN LBS	(f) AXIAL STRENGTH LBS MIN	WT LB/100 MAX
					MAX	MIN			MAX	MIN	MAX	MIN		MAX	MIN				
04	4-40 UNC-3B	.206	.176	.171	.142	.112	.050	.028	.027	.005	.125	.103	.010	.158	.150	.003	11	755	.050
06	6-32 UNC-3B	.244	.214	.207	.168	.138	.055	.039	.031	.006	.141	.115		.190	.181		17	1,136	.080
08	8-32 UNC-3B	.290	.260	.244	.194	.164	.060	.041			.188	.125	.015	.221	.213		23	1,720	.150
3	10-32 UNF-3B	.330	.290	.277	.220	.190	.065	.043				.154		.252	.243		46	2,460	.180
4	1/4 -28 UNF-3B	.420	.386	.347	.280	.250	.090	.057	.036	.007	.219	.204	.019	.316	.304		115	4,580	.350
5	5/16-24 UNF-3B	.520	.482	.419	.342	.312	.120	.077	.042	.008	.266	.251	.023	.378	.367	.004	260	7,390	.600
6	3/8 -24 UNF-3B	.620	.575	.491	.405	.375	.125	.089			.282	.267	.030	.440	.430		450	11,450	.800

(a) THREADS IN ACCORDANCE WITH MIL-S-7742.
(b) BREAKING SURFACE SHALL BE SQUARE WITH PITCH DIA WITHIN X WHEN MEASURED IN ACCORDANCE WITH MIL-N-25027.
(c) DIMENSIONS ACROSS FLATS INCLUDES DEFORMATION OF SELF-LOCKING DEVICE.
(d) MINIMUM LENGTH OF EACH WRENCHING CORNER.
(e) MINIMUM DISTANCE FROM THE WASHER FACE OF THE NUT TO THE BEGINNING OF THE MINIMUM LENGTH OF E OF EACH WRENCHING CORNER.
(f) NUTS SHALL BE TESTED FOR WRENCHING-TORQUE BY THE USE OF A BOX, OPEN END OR SOCKET WRENCH. TEST BOLTS SHALL BE 160,000 PSI MINIMUM.

MATERIAL: CORROSION AND HEAT RESISTANT STEEL, AMS 5525(A286) OR AMS 5735.
PLATING: SILVER PLATE IN ACCORDANCE WITH QQ-S-365, OR AMS 2410 WITH .0001 MIN THICKNESS OF ALL SURFACES INCLUDING THREADS.
MAGNETIC PERMEABILITY: SHALL BE LESS THAN 2.0 (AIR - 1.0) FOR A FIELD STRENGTH H-200 OERSTEDS USING A MAGNETIC PERMEABILITY INDICATOR PER MIL-I-17214 OR EQUIVALENT.
LUBRICANT: LUBRICANTS IF USED SHALL BE SOLUBLE IN THE CLEANER SPECIFIED IN THE PROCUREMENT SPECIFICATION.

BREAK ALL SHARP EDGES AND REMOVE ALL HANGING BURRS AND SLIVERS.
SURFACE ROUGHNESS IN ACCORDANCE WITH MIL-STD-10. UNLESS OTHERWISE SPECIFIED THE SURFACE ROUGHNESS SHALL NOT EXCEED 125 RHR.
DIMENSIONS IN INCHES.
DESIGN INFORMATION: THESE NUTS ARE DESIGNED TO DEVELOP THE TENSILE STRENGTH OF BOLTS AND SCREWS WITH AN ULTIMATE TENSILE STRENGTH OF 125,000 PSI AT ROOM TEMPERATURE, BASED ON THE AREA AT THE BASIC ROOT DIA OF THE BOLT OR SCREW THREAD.
THESE NUTS SHALL BE USED IN ACCORDANCE WITH THE LIMITATIONS OF MS33588.

EXAMPLE OF PART NUMBER: MS21043-4 = 1/4-28 NUT, SILVER PLATED.

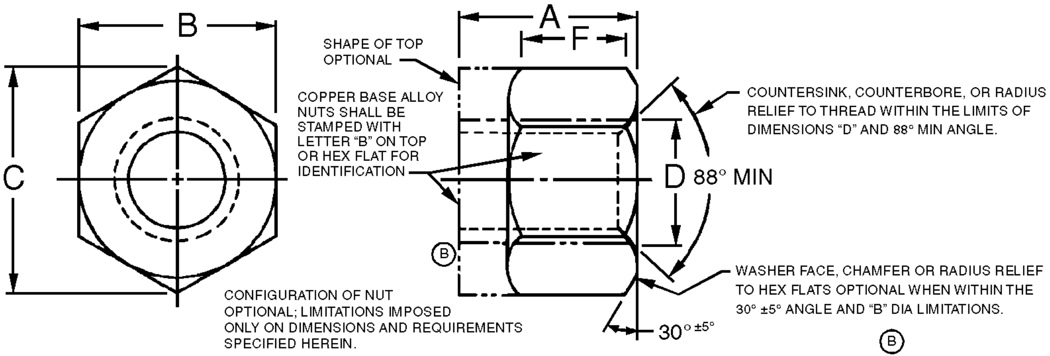
INTERCHANGEABILITY RELATIONSHIP: MS21043 NUTS CAN UNIVERSALLY REPLACE NAS679 (DATED DECEMBER 1957) CORROSION RESISTANT STEEL NUTS OF LIKE THREAD SIZE, PLATING, AND WHICH ARE ALL METAL. BUT THESE NAS679 (DATED DECEMBER 1957) NUTS CANNOT UNIVERSALLY REPLACE THE MS21043 NUTS.

Ⓐ CERTAIN PROVISIONS (THE DIMENSIONS ACROSS THE WRENCHING FLATS) OF THIS STANDARD ARE THE SUBJECT OF INTERNATIONAL STANDARDIZATION AGREEMENT ABC AIR STD 17/2. WHICH REVISION OR CANCELLATION OF THIS STANDARD IS PROPOSED, THE DEPARTMENTAL CUSTODIAN WILL INFORM THEIR RESPECTIVE DEPARTMENTAL STANDARDIZATION OFFICE SO THAT APPROPRIATE ACTION MAY BE TAKEN RESPECTING THE INTERNATIONAL AGREEMENT CONCERNED.

FOR DESIGN FEATURE PURPOSES, THIS STANDARD TAKES PRECEDENCE OVER PROCUREMENT DOCUMENTS REFERENCED HEREIN.
REFERENCED DOCUMENTS SHALL BE OF THE ISSUE IN EFFECT ON DATE OF INVITATIONS FOR BID.

F05-029

Figure 5-30. Drawing MS21043(ASG)



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DASH NUMBERS						(a) Ⓑ	A		(c) B		C	D	F	(b) X
NON-METALLIC INSERT				ALL METAL										
AL ALLOY	STEEL	COPPER BASE ALLOY	CRES	AL ALLOY (d) INACTIVE	COPPER BASE ALLOY (d) INACTIVE	THREAD MIL-S-8879/MOD	MAX	MIN	MAX	MIN	MAX	±.020	MIN	
D04	N04	B04	C04	~~H04~~	~~E04~~	4-40UNC-3B	.157	.133	.251	.243	.268	.136	.044	.004
D06	N06	B06	C06	~~H06~~	~~E06~~	6-32UNC-3B	.188	.160	.313	.305	.339	.161	.072	.004
D06	N08	B08	C08	~~H08~~	~~E08~~	8-32UNC-3B	.281	.219	.345	.336	.374	.188	.091	.004
D3	N3	B3	C3	~~H3~~	~~E3~~	10-32UNF-3B	.281	.208	.376	.367	.410	.210	.085	.004
D4	N4	B4	C4	~~H4~~	~~E4~~	1/4-28UNF-3B	.360	.240	.439	.430	.482	.273	.116	.005
D5	N5	B5	C5	~~H5~~	~~E5~~	5/16-24UNF-3B	.360	.271	.502	.492	.552	.336	.123	.006
D6	N6	B6	C6	~~H6~~	~~E6~~	3/8-24UNF-3B	.469	.318	.564	.553	.622	.398	.153	.006
D7	N7	B7	C7	~~H7~~	~~E7~~	7/16-20UNF-3B	.469	.435	.690	.679	.766	.467	.178	.007
D8	N8	B8	C8	~~H8~~	~~E8~~	1/2-20UNF-3B	.610	.575	.752	.741	.837	.531	.221	.007
D9	N9	B9	C9	~~H9~~	~~E9~~	9/16-18UNF-3B	.704	.623	.877	.865	.978	.594	.243	.008
D10	N10	B10	C10	~~H10~~	~~E10~~	5/8-18UNF-3B	.766	.732	.940	.928	1.051	.656	.274	.008
D12	N12	B12	C12	~~H12~~	~~E12~~	3/4-16UNF-3B	.891	.855	1.064	1.052	1.191	.787	.316	.009
D14	N14	B14	C14	~~H14~~	~~E14~~	7/8-14UNF-3B	1.016	.965	1.252	1.239	1.403	.918	.570	.010
D16	N16	B16	C16	~~H16~~	~~E16~~	1-12UNF-3B	1.141	1.010	1.440	1.427	1.615	1.044	.635	.011
D18	N18	B18	C18	~~H18~~	~~E18~~	1 1/8-12UNF-3B	1.266	1.130	1.627	1.614	1.826	1.171	.710	.012
D20	N20	B20	C20	~~H20~~	~~E20~~	1 1/4-12UNF-3B	1.454	1.300	1.815	1.801	2.038	1.295	.795	.013

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(a) THREADS IN ACCORDANCE WITH MIL-S-8879. THREADS IN ACCORDANCE WITH MIL-S-7742 ARE ACCEPTABLE UNTIL 31 DECEMBER 1969
(b) BEARING SURFACE SHALL BE SQUARE WITH PITCH DIAMETER WITHIN "X" WHEN MEASURED IN ACCORDANCE WITH MIL-N-25027.
(c) DIMENSION ACROSS FLATS INCLUDE DEFORMATION OF SELF-LOCKING DEVICE.
(d) INACTIVE FOR DESIGN AFTER 1 APRIL 1965.

MATERIAL: STEEL, ALUMINUM ALLOY, COPPER BASE ALLOY, CRES; SEE PROCUREMENT SPECIFICATION.
INSERT, NYLON OR EQUIVALENT.

Ⓑ PLATING: STEEL AND COPPER BASE ALLOY NUTS, CADMIUM PLATED IN ACCORDANCE WITH QQ-P-416, TYPE II, CLASS 3.

Ⓑ SURFACE TREATMENT: CORROSION RESISTANT STEEL NUTS. SEE PROCUREMENT SPECIFICATION
ALUMINUM ALLOY NUTS, ANODIZE OR CHEMICALLY SURFACE TREAT IN ACCORDANCE WITH PROCUREMENT SPECIFICATION.
ALUMINUM ALLOY NUTS IN SIZES THRU 1/4-28 DYED BLUE PER PROCUREMENT SPECIFICATION.

LUBRICANT: LUBRICANT, APPROVED IN ACCORDANCE WITH MIL-N-25027, LUBRICANTS SHALL BE SOLUBLE IN THE CLEANER SPECIFIED IN THE PROCUREMENT SPECIFICATION.

BREAK ALL SHARP EDGES AND REMOVAL ALL HANGING BURRS AND SLIVERS.
Ⓑ SURFACE ROUGHNESS IN ACCORDANCE WITH MIL-STD-10. UNLESS OTHERWISE SPECIFIED, THE SURFACE ROUGHNESS SHALL NOT EXCEED 125 MICRO INCHES.
DIMENSIONS IN INCHES.

Ⓑ MAGNETIC PERMEABILITY OF CORROSION RESISTANT STEEL NUTS SHALL BE LESS THAN 2.0 (AIR = 1.0) FOR A FIELD STRENGTH H = 200 OERSTEDS USING A MAGNETIC PERMEABILITY INDICATOR IN ACCORDANCE WITH MIL-I-17214 OR EQUIVALENT.

EXAMPLE OF PART NUMBERS:

Ⓑ MS21044N4 = 1/4-28 STEEL NUT, NON-METALLIC INSERT, CADMIUM PLATED.
MS21044H4 = 1/4-28 ALUMINUM ALLOY NUT, ALL METAL, ANODIZED.
MS21044B4 = 1/4-28 COPPER BASE ALLOY NUT, NON-METALLIC INSERT, CADMIUM PLATED.

Ⓑ SHEETS 3, 4 AND 5 ADDED.

Ⓑ FOR CHANGES SEE SHEETS 1, 2, 3, 4 AND 5.
F05-030S01

Figure 5-31. Drawing MS21044 (Sheet 1 of 5)

Ⓑ THREAD MIL-S-8879/MOD	AXIAL STRENGTH LB MIN			WEIGHT LB/100 MAX		
	STEEL	ALUM	CRES	AL ALLOY	STEEL	COPPER BASE ALLOY
4-40UNC-3B	750	750	750	.06	.15	.16
6-32UNC-3B	1,130	1,130	1,130	.11	.30	.32
8-32UNC-3B	1,720	1,720	1,720	.18	.50	.54
10-32UNF-3B	2,460	2,460	2,460	.21	.58	.63
1/4-28UNF-3B	4,580	4,580	4,580	.36	.99	1.10
5/16-24UNF-3B	7,390	3,670	7,390	.50	1.40	1.50
3/8-24UNF-3B	11,450	5,680	11,450	.78	2.15	2.30
7/16-20UNF-3B	15,450	7,660	15,450	1.20	3.40	3.70
1/2-20UNF-3B	21,110	10,470	21,110	1.70	4.70	5.10
9/16-18UNF-3B	26,810	13,300	26,810	2.80	7.80	8.50
5/8-18UNF-3B	34,130	16,930	34,130	3.40	9.50	10.30
3/4-16UNF-3B	50,020	24,810	50,020	5.00	13.60	15.00
7/8-14UNF-3B	68,440	33,950	68,440	7.60	21.00	23.00
1-12UNF-3B	92,180	45,720	92,180	11.00	31.00	33.00
1 1/8-12UNF-3B	116,700	57,880	116,700	17.00	46.00	50.00
1 1/4-12UNF-3B	147,940	73,380	147,940	24.00	65.00	70.00

DESIGN AND USAGE LIMITATIONS: THESE NUTS ARE DESIGNED TO DEVELOP THE TENSILE STRENGTH OF BOLTS AND SCREWS WITH AN ULTIMATE STRESS (Ftu) OF 125 KSI (60 KSI FOR ALUMINUM PARTS) BASED ON THE CROSS SECTIONAL AREA AT THE BASIC ROOT DIAMETER OF THE THREAD. THESE NUTS ARE DESIGNED TO BE USED ON 3A EXTERNAL THREADS PER MIL-S-7742. THESE NUTS SHALL BE USED IN ACCORDANCE WITH THE LIMITATIONS OF MS33588. ONLY NUTS FOR WHICH THESE ARE QUALIFIED PRODUCTS LISTED ON QPL25027 SHALL BE USED.

VIBRATION LIFE: MINIMUM VIBRATION LIFE REQUIREMENT FOR NON-METALLIC INSERT PARTS SHALL BE THREE TIMES AVERAGE VIBRATION LIFE LISTED IN MIL-N-25027.

INTERCHANGEABILITY RELATIONSHIP: MS21044 NUTS CAN UNIVERSALLY REPLACE AN365, MS20365 AND NAS1021 NUTS OF LIKE MATERIAL, PLATING AND THREAD SIZE, EXCEPT FOR AN365 AND MS20365 7/16-20 NUTS. NON-METALLIC INSERT LOCKING DESIGNS CAN BE SUBSTITUTED FOR THE INACTIVATED COPPER BASE OR ALUMINUM ALLOY ALL METAL LOCKING DESIGN NUTS. AN365, MS20365 AND NAS1021 NUTS CANNOT UNIVERSALLY REPLACE THE MS21044 NUTS. FOR DEFINITION AND APPLICATION OF DRAWING STATUS NOTES SEE MIL-STD-32.
(STATUE NOTE)

CERTAIN PROVISIONS (THE DIMENSIONS ACROSS THE WRENCHING FLATS) OF THIS STANDARD ARE THE SUBJECT OF INTERNATIONAL STANDARDIZATION AGREEMENT ABC AIR STD 17/2. WHEN REVISION OR CANCELLATION OF THIS STANDARD IS PROPOSED, THE DEPARTMENTAL CUSTODIAN WILL INFORM THEIR RESPECTIVE DEPARTMENTAL STANDARDIZATION OFFICE SO THAT APPROPRIATE ACTION MAY BE TAKEN RESPECTING THE INTERNATIONAL AGREEMENT CONCERNED.

THIS STANDARD TAKES PRECEDENCE OVER PROCUREMENT DOCUMENTS REFERENCED HEREIN. REFERENCED DOCUMENTS SHALL BE OF THE ISSUE IN EFFECT ON DATE OF INVITATIONS FOR BID.

F05-030S02

Figure 5-31. Drawing MS21044 (Sheet 2)

INTERCHANGEABILITY TABLE I

SELECT NUTS FROM THE FOLLOWING INTERCHANGEABILITY TABLE OF THIS STANDARD AND OF STANDARDS MS21045 AND MS21046 AS SUBSTITUTIVE PARTS FOR AN365, MS20365 AND NAS1021.

INACTIVATED PART NOS			SUBSTITUTIVE PART NOS
AN365	MS20365	NAS1021	MS21044
-448			NO REPLACEMENT
-448A			
-440	-440		N04
-440A	-440A	N04	
-640			NO REPLACEMENT
-640A			
-632	-632		N06
-632A	-632A	N06	
-836			NO REPLACEMENT
-836A			
-832	-832		N08
-832A	-832A	N08	
-1032	-1032		N3
-1032A	-1032A	N3	
-1024			NO REPLACEMENT
-1024A			
-428	-428		N4
-428A	-428A	N4	
-420			NO REPLACEMENT
-420A			
-524	-524		N5
-524A	-524A	N5	
-518			NO REPLACEMENT
-518A			
-624	-624		N6
-624A	-624A	N6	
-616			NO REPLACEMENT
-616A			
-720	-720		
-720A	-720A		
		N7	N7
-714			NO REPLACEMENT
-714A			
-820	-820		N8
-820A	-820A	N8	
-813			NO REPLACEMENT
-813A			
-918	-918		N9
-918A	-918A	N9	
-912			NO REPLACEMENT
-912A			
-1018	-1018		N10
-1018A	-1018A	N10	
-1011			NO REPLACEMENT
-1011A			
-1216	-1216		N12
-1216A	-1216A	N12	
-1210			NO REPLACEMENT
-1210A			
-1414	-1414		N14
-1414A	-1414A	N14	
-1409			NO REPLACEMENT
-1409A			
-1614	-1614		
-1614A	-1614A	N17	
		N16	N16
-1608			NO REPLACEMENT
-1608A			
-1812	-1812		N18
-1812A	-1812A	N18	
-1808			NO REPLACEMENT
-1808A			
-2012	-2012		N20
-2012A	-2012A	N20	
-2008			NO REPLACEMENT
-2008A			
B448			
B448A			
B440	B440		B04
B440A	B440A	B04	
B640			NO REPLACEMENT
B640A			
B632	B632		B06
B632A	B632A	B06	
B836			NO REPLACEMENT
B836A			
B832	B832		B08
B832A	B832	B08	
B1032	B1032		B3
B1032A	B1032A	B3	
B1024			NO REPLACEMENT
B1024A			
B428	B28		B4
B428A	B28A	B4	

F05-030S03

Figure 5-31. Drawing MS21044 (Sheet 3)

INTERCHANGEABILITY TABLE II

SELECT NUTS FROM THE FOLLOWING INTERCHANGEABILITY TABLE OF THIS STANDARD AND OF STANDARDS MS21045 AND MS21046 AS SUBSTITUTIVE PARTS FOR AN365, MS20365 AND NAS1021.

INACTIVATED PART NOS			SUBSTITUTIVE PART NOS
AN365	MS20365	NAS1021	MS21044
B420			NO REPLACEMENT
B420A			
B524	B524		B5
B524A	B524A	B5	
B518			NO REPLACEMENT
B518A			
B624	B624		B6
B624A	B624A	B6	
B616			NO REPLACEMENT
B616A			
B720	B720		
B720A	B720A		
		B7	B7
B714			NO REPLACEMENT
B714A			
B820	B820		B8
B820A	B820A	B8	
B813			NO REPLACEMENT
B813A			
B918	B918		B9
B918A	B918A	B9	
B912			NO REPLACEMENT
B912A			
B1018	B1018		B10
B1018A	B1018A	B10	
B1011			NO REPLACEMENT
B1011A			
B1216	B1216		B12
B1216	B1216A	B12	
B1210			NO REPLACEMENT
B1210A			
B1414	B1414		B14
B1414A	B1414A	B14	
B1409			NO REPLACEMENT
B1409A			
B1614	B1614		
B1614A	B1614A	B17	
		B16	B16
B1608			NO REPLACEMENT
B1608A			
B1812	B1812		B18
B1812A	B1812A	B18	
B1808			NO REPLACEMENT
B1808A			
B2012	B2012		B20
B2012A	B2012A	B20	
B2008			NO REPLACEMENT
B2008A			

INACTIVATED PART NOS				SUBSTITUTIVE PART NOS
AN365	MS20365	NAS1021	MS21044	MS21044
B448C				NO REPLACEMENT
B440C	B440C	E04	E04	B04
B640C				NO REPLACEMENT
B632C	B632C	E06	E06	B06
B836C				NO REPLACEMENT
B832C	B832C	E08	E08	B08
B1032C	B1032C	E3	E3	B3
B1024C				NO REPLACEMENT
B428C	B428C	E4	E4	B4
B420C				NO REPLACEMENT
B524C	B524C	E5	E5	B5
B518C				NO REPLACEMENT
B624C	B624C	E6	E6	B6
B616C				NO REPLACEMENT
B720C	B720C			
		E7	E7	B7
B714C				NO REPLACEMENT
B820C	B820C	E8	E8	B8
B813C				NO REPLACEMENT
B918C	B918C	E9	E9	B9
B912C				NO REPLACEMENT
B1018C	B1018C	E10	E10	B10
B1011C				NO REPLACEMENT
B1216C	B1216C	E12	E12	B12
B1210C				NO REPLACEMENT
B1414C	B1414C	E14	E14	B14
B1409C				NO REPLACEMENT
B1614C	B1614C	E17		
B1608C				
		E16	E16	B16
B1812C	B1812C	E18	E18	B18
B1808C				NO REPLACEMENT
B2012C	B2012C	E20	E20	B20
B2008C				NO REPLACEMENT

F05-030S04

Figure 5-31. Drawing MS21044 (Sheet 4)

INTERCHANGEABILITY TABLE III

SELECT NUTS FROM THE FOLLOWING INTERCHANGEABILITY TABLE OF THIS STANDARD AND OF STANDARDS MS21045 AND MS21046 AS SUBSTITUTIVE PARTS FOR AN365, MS20365 AND NAS1021.

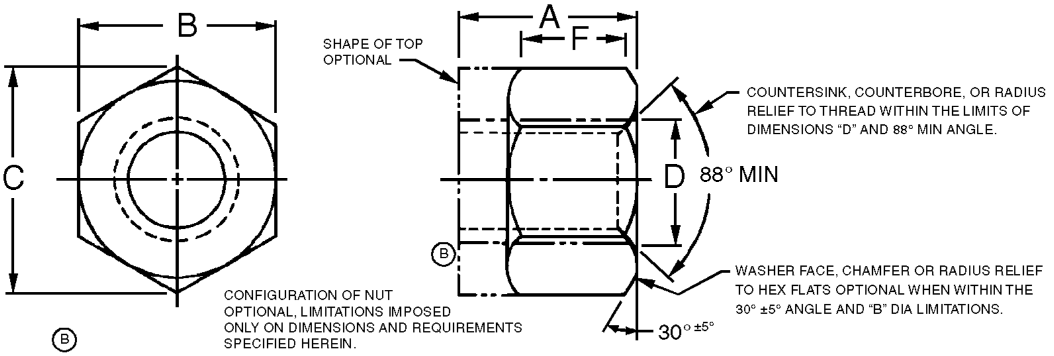
INACTIVATED PART NOS				SUBSTITUTIVE PART NOS
AN365	MS20365	NAS1021	MS21044	MS21044
D448C				NO REPLACEMENT
D440C	D440C	H04	H04	D04
D640C				NO REPLACEMENT
D632C	D632C	H06	H06	D06
D836C				NO REPLACEMENT
D832C	D832C	H08	H08	D08
D1032C	D1032C	H3	H3	D3
D1024C				NO REPLACEMENT
D428C	D428C	H4	H4	D4
D420C				NO REPLACEMENT
D524C	D524C	H5	H5	D5
D518C				NO REPLACEMENT
D624C	D624C	H6	H6	D6
D616C D720C	 D720C			NO REPLACEMENT
		H7	H7	D7
D714C				NO REPLACEMENT
D820C	D820C	H8	H8	D8
D813C				NO REPLACEMENT
D918C	D918C	H9	H9	D9
D912C				NO REPLACEMENT
D1018C	D1018C	H10	H10	D10
D1011C				NO REPLACEMENT
D1216C	D1216C	H12	H12	D12
D1210				NO REPLACEMENT
D1414C	D1414C	H14	H14	D14
D1409C D1614C D1608C	D1614C	H17		NO REPLACEMENT
		H16	H16	D16
D1812C	D1812C	H18	H18	D18
D1808C				NO REPLACEMENT
D2012C	D2012C	H20	H20	D20
D2008C				NO REPLACEMENT

INACTIVATED PART NOS			SUBSTITUTIVE PART NOS
AN365	MS20365	NAS1021	MS21044
D448			NO REPLACEMENT
D448A			
D440	D440		D04
D440A	D440A	D04	
D640			NO REPLACEMENT
D640A			
D632A	D632		D06
D632A	D632A	D06	
D836			NO REPLACEMENT
D836A			
D832	D832		D08
D832A	D832A	D08	
D1032	D1032		
D1032A	D1032A	D3	D3
D1024			
D1024A			NO REPLACEMENT
D428	D428		D4
D428A	D428A	D4	

INACTIVATED PART NOS			SUBSTITUTIVE PART NOS
AN365	MS20365	NAS1021	MS21044
D420			NO REPLACEMENT
D420A			
D524	D524		D5
D524A	D524A	D5	
D518			NO REPLACEMENT
D518A			
D624	D624		D6
D624	D624A	D6	
D616			NO REPLACEMENT
D616A			
D720	D720		
D720	D720A		
		D7	D7
D714			NO REPLACEMENT
D714A			
D820	D820		D8
D820A	D820A	D8	
D813			NO REPLACEMENT
D813A			
D918	D918		D9
D918A	D918A	D9	
D912			NO REPLACEMENT
D912A			
D11018	D1018		D10
D1018A	D1018A	D10	
D1011			NO REPLACEMENT
D1011A			
D1216	D1216		D12
D1216A	D1216A	D12	
D1210			NO REPLACEMENT
D1210A			
D1414	D1414		D14
D1414A	D1414	D14	
D1409			NO REPLACEMENT
D1409A			
D1614	D1614		
D1614A	D1614A	D17	
		D16	D16
D1608			NO REPLACEMENT
D1608A			
D1812	D1812		D18
D1812A	D1812A	D18	
D1808			NO REPLACEMENT
D1808A			
D2012	D2012		D20
D2012A	D2012A	D20	
D2008			NO REPLACEMENT
D2008A			

F05-030S05

Figure 5-31. Drawing MS21044 (Sheet 5)



Ⓑ

DASH NUMBERS			(a) Ⓑ THREAD MIL-S-8879/MOD	A		(c) B		Ⓑ C	D	F	(b) X	AXIAL STRENGTH LBS MIN		WEIGHT LBS/100 MAX
STEEL		CRES		MAX	MIN	MAX	MIN	MIN	±.020	MIN		STEEL	CRES	
NON DRY LUB.	DRY LUB.													
04	L04	C04	4-40UNC-3B	.157	.133	.251	.243	.268	.136	.044	.004	750	750	.15
06	L06	C06	6-32UNC-3B	.188	.160	.313	.305	.339	.161	.072	.004	1,130	1,130	.30
08	L08	C08	8-32UNC-3B	.250	.219	.345	.336	.374	.188	.091	.004	1,720	1,720	.50
3	L3	C3	10-32UNF-3B	.250	.208	.376	.367	.410	.210	.085	.004	2,460	2,460	.58
4	L4	C4	1/4-28UNF-3B	.328	.240	.439	.430	.482	.273	.116	.005	4,580	4,580	.99
5	L5	C5	5/16-24UNF-3B	.360	.271	.502	.492	.522	.336	.123	.006	7,390	7,390	1.40
6	L6	C6	3/8-24UNF-3B	.469	.318	.564	.553	.622	.398	.153	.006	11,450	11,450	2.15
7	L7	C7	7/16-20UNF-3B	.469	.435	.690	.679	.766	.467	.178	.007	15,450	15,450	3.40
8	L8	C8	1/2-20UNF-3B	.610	.575	.752	.741	.837	.531	.221	.007	21,110	21,110	4.70
9	L9	C9	9/16-18UNF-3B	.704	.623	.877	.865	.978	.594	.243	.008	26,810	26,810	7.80
10	L10	C10	5/8-18UNF-3B	.766	.732	.940	.928	1.051	.656	.274	.008	34,130	34,130	9.50
12	L12	C12	3/4-16UNF-3B	.891	.855	1.064	1.052	1.191	.787	.316	.009	50,020	50,020	13.60
14	L14	C14	7/8-14UNF-3B	1.016	.965	1.252	1.239	1.403	.918	.570	.010	68,440	68,440	21.00
16	L16	C16	1-12UNF-3B	1.141	1.010	1.440	1.427	1.615	1.044	.635	.011	92,180	92,180	31.00
18	L18	C18	1 1/8-12UNF-3B	1.266	1.130	1.627	1.614	1.826	1.171	.710	.012	116,700	116,700	46.00
20	L20	C20	1 1/4-12UNF-3B	1.454	1.300	1.815	1.801	2.038	1.295	.795	.013	147,940	147,940	65.00

Ⓑ (a) THREADS IN ACCORDANCE WITH MIL-S-8879 BEFORE LUBRICATION. THREADS IN ACCORDANCE WITH MIL-S-7742 ARE ACCEPTABLE UNTIL 31 DECEMBER 1969.

(b) BEARING SURFACE SHALL BE SQUARE WITH PITCH DIAMETER WITHIN "X" WHEN MEASURED IN ACCORDANCE WITH MIL-N-25027.

(c) DIMENSIONS ACROSS FLATS INCLUDES DEFORMATION OF SELF-LOCKING DEVICE.

MATERIAL: STEEL, SEE PROCUREMENT SPECIFICATION.
CORROSION RESISTANT STEEL, SEE PROCUREMENT SPECIFICATION.

Ⓑ PLATING: STEEL NUTS(WITHOUT DRY FILM LUBRICATION) CADMIUM PLATED IN ACCORDANCE WITH QQ-P-416, TYPE II, CLASS 3. DRY FILM LUBRICATED STEEL NUTS IN ACCORDANCE WITH QQ-P-416, TYPE AND CLASS OPTIONAL IF THE NUTS WILL MEET THE SALT SPRAY REQUIREMENTS OF QQ-P-416, TYPE II.
CORROSION RESISTANT STEEL NUTS: DRY FILM LUBRICATED.

Ⓑ LUBRICANT: LUBRICANT APPROVED IN ACCORDANCE WITH MIL-N-25027. LUBRICANTS, EXCEPT DRY FILM LUBRICANTS, SHALL BE SOLUBLE IN THE CLEANER SPECIFIED IN THE PROCUREMENT SPECIFICATION. FOR USAF APPLICATIONS NUTS TREATED WITH DRY FILM LUBRICANTS SHALL NOT BE UTILIZED IN INTEGRAL FUEL TANKS.

MAGNETIC PERMEABILITY OF CORROSION RESISTANT STEEL NUTS SHALL BE LESS THAN 2.0 (AIR = 1.0) FOR A FIELD STRENGTH H = 200 OERSTEDS USING A MAGNETIC PERMEABILITY INDICATOR IN ACCORDANCE WITH MIL-I-17214 OR EQUIVALENT.

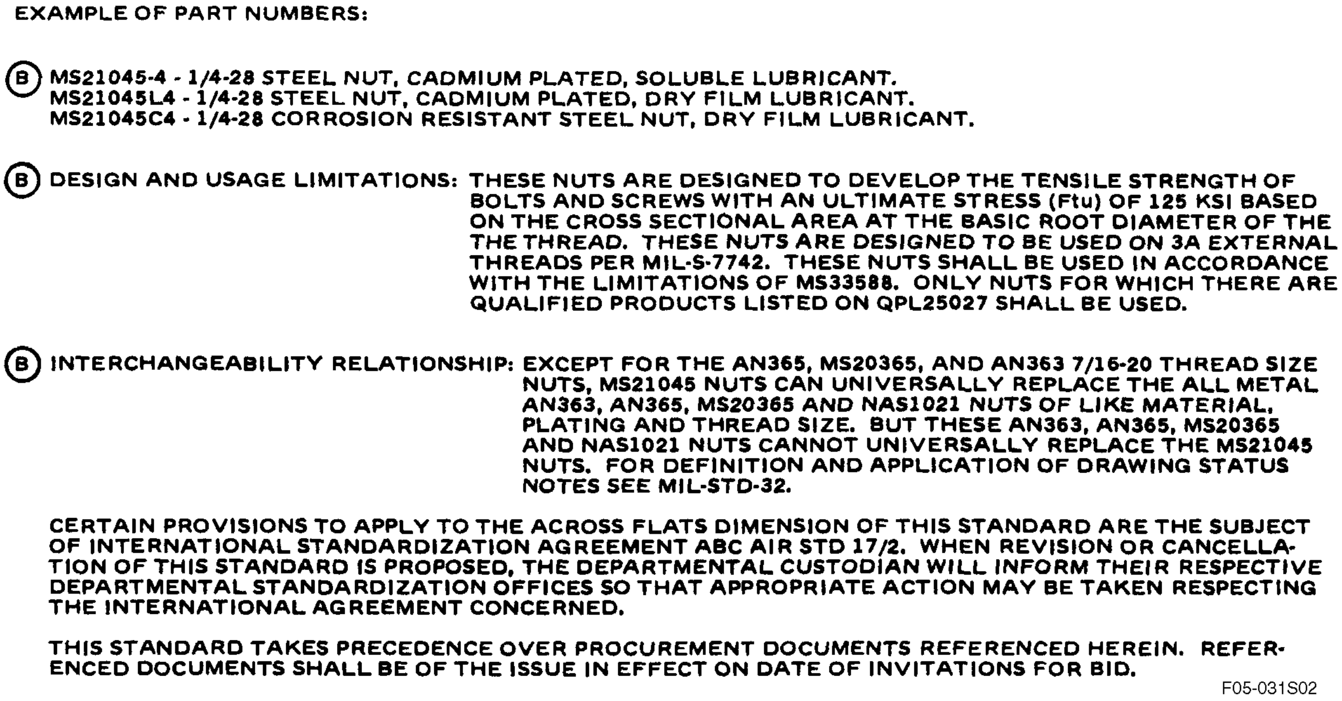
BREAK ALL SHARP EDGES AND REMOVE ALL HANGING BURRS AND SLIVERS.
Ⓑ SURFACE ROUGHNESS IN ACCORDANCE WITH MIL-STD-10. UNLESS OTHERWISE SPECIFIED, THE SURFACE ROUGHNESS SHALL NOT EXCEED 125 MICRO INCHES.
DIMENSIONS IN INCHES.

Ⓑ PERFORMANCE: SEE PROCUREMENT SPECIFICATION. EXCEPT DRY FILM LUBRICATED CRES NUTS LIMITED TO FIVE REUSE CYCLES.

Ⓑ SHEET 3 ADDED.

F05-031S01

Figure 5-32. Drawing MS21045 (Sheet 1 of 3)



EXAMPLE OF PART NUMBERS:

Ⓑ MS21045-4 - 1/4-28 STEEL NUT, CADMIUM PLATED, SOLUBLE LUBRICANT.
MS21045L4 - 1/4-28 STEEL NUT, CADMIUM PLATED, DRY FILM LUBRICANT.
MS21045C4 - 1/4-28 CORROSION RESISTANT STEEL NUT, DRY FILM LUBRICANT.

Ⓑ DESIGN AND USAGE LIMITATIONS: THESE NUTS ARE DESIGNED TO DEVELOP THE TENSILE STRENGTH OF BOLTS AND SCREWS WITH AN ULTIMATE STRESS (Ftu) OF 125 KSI BASED ON THE CROSS SECTIONAL AREA AT THE BASIC ROOT DIAMETER OF THE THE THREAD. THESE NUTS ARE DESIGNED TO BE USED ON 3A EXTERNAL THREADS PER MIL-S-7742. THESE NUTS SHALL BE USED IN ACCORDANCE WITH THE LIMITATIONS OF MS33588. ONLY NUTS FOR WHICH THERE ARE QUALIFIED PRODUCTS LISTED ON QPL25027 SHALL BE USED.

Ⓑ INTERCHANGEABILITY RELATIONSHIP: EXCEPT FOR THE AN365, MS20365, AND AN363 7/16-20 THREAD SIZE NUTS, MS21045 NUTS CAN UNIVERSALLY REPLACE THE ALL METAL AN363, AN365, MS20365 AND NAS1021 NUTS OF LIKE MATERIAL, PLATING AND THREAD SIZE. BUT THESE AN363, AN365, MS20365 AND NAS1021 NUTS CANNOT UNIVERSALLY REPLACE THE MS21045 NUTS. FOR DEFINITION AND APPLICATION OF DRAWING STATUS NOTES SEE MIL-STD-32.

CERTAIN PROVISIONS TO APPLY TO THE ACROSS FLATS DIMENSION OF THIS STANDARD ARE THE SUBJECT OF INTERNATIONAL STANDARDIZATION AGREEMENT ABC AIR STD 17/2. WHEN REVISION OR CANCELLATION OF THIS STANDARD IS PROPOSED, THE DEPARTMENTAL CUSTODIAN WILL INFORM THEIR RESPECTIVE DEPARTMENTAL STANDARDIZATION OFFICES SO THAT APPROPRIATE ACTION MAY BE TAKEN RESPECTING THE INTERNATIONAL AGREEMENT CONCERNED.

THIS STANDARD TAKES PRECEDENCE OVER PROCUREMENT DOCUMENTS REFERENCED HEREIN. REFERENCED DOCUMENTS SHALL BE OF THE ISSUE IN EFFECT ON DATE OF INVITATIONS FOR BID.

F05-031S02

Figure 5-32. Drawing MS21045 (Sheet 2)

INTERCHANGEABILITY TABLE I

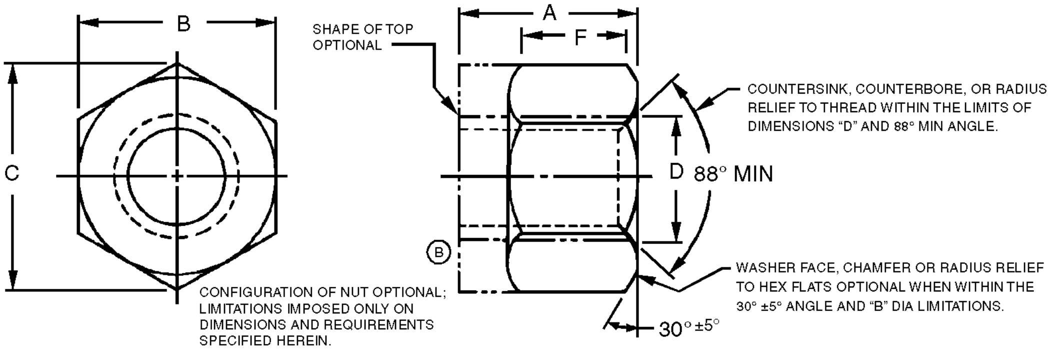
SELECT NUTS FROM THE FOLLOWING INTERCHANGEABILITY TABLE OF THIS STANDARD AND OF STANDARDS MS21044 AND MS21046 AS SUBSTITUTIVE PARTS FOR AN363, AN365, MS20365 AND NAS1021.

INACTIVATED PART NOS.				SUBSTITUTIVE PART NOS.
AN365	MS20365	AN363	NAS1021	MS21045
-448C				NO REPLACEMENT
-440C	-440C		A04	-04
-640C				NO REPLACEMENT
-632C	-632C	-632	A06	-06
-836C				NO REPLACEMENT
-832C	-832C	-832	A08	-08
-1032C	-1032C	-1032	A3	-3
-1024C		-1024		NO REPLACEMENT
-428C	-428C	-428	A4	-4
-420C		-420		NO REPLACEMENT
-524C	-524C	-524	A5	-5
-518C		-518		NO REPLACEMENT
-624C	-624C	-624	A6	-6
-616C		-616		NO REPLACEMENT
-720C	-720C	-720		
			A7	-7
-714C		-714		NO REPLACEMENT
-820C	-820C	-820	A8	-8
-813C		-813		NO REPLACEMENT
-918C	-918C	-918	A9	-9
-913C		-913		NO REPLACEMENT
-1018C	-1018C	-1018	A10	-10
-1011C		-1011		NO REPLACEMENT
-1216C	-1216C	-1216	A12	-12
-1210C		-1210		NO REPLACEMENT
-1414C	-1414C		A14	-14
-1409C				NO REPLACEMENT
-1614C	-1614C		A17	
			A16	-16
-1608C				NO REPLACEMENT
-1812C	-1812C		A18	-18
-1308C				NO REPLACEMENT
-2012C	-2012C		A20	-20
-2008C				NO REPLACEMENT

INTERCHANGEABILITY TABLE II	
INACTIVATED PART NOS	SUBSTITUTIVE PART NOS
AN363	MS21045
B632	NO REPLACEMENT
B832	
B1032	
B1024	
B423	
B420	
B524	
B518	
B624	
B616	
B720	
B714	
B820	
B813	
B918	
B913	
B1018	
B1011	
B1216	
B1210	

F05-031S03

Figure 5-32. Drawing MS21045 (Sheet 3)



DASH NUMBER	(a) THREAD MIL-S-8879/MOD	A		(c) B		B C MIN	D ±.020	F MIN	(b) X	AXIAL STRENGTH LBS MIN	WEIGHT LBS/100 MAX
		MAX	MIN	MAX	MIN						
C04	4-40UNC-3B	.157	.133	.251	.243	.268	.136	.044	.004	750	.15
C06	6-32UNC-3B	.188	.160	.313	.305	.339	.161	.072		1,130	.30
C08	8-32UNC-3B	.250	.219	.345	.336	.374	.188	.091		1,720	.50
C3	10-32UNF-3B	.250	.208	.376	.367	.410	.210	.085		2,460	.58
C4	1/4-28UNF-3B	.328	.240	.439	.430	.482	.273	.116	.005	4,580	.99
C5	5/16-24UNF-3B	.360	.271	.502	.492	.552	.336	.123	.006	7,390	1.40
C6	3/8-24UNF-3B	.469	.318	.564	.553	.622	.398	.153		11,450	2.15
C7	7/16-20UNF-3B	.469	.435	.690	.679	.766	.467	.178	.007	15,450	3.40
C8	1/2-20UNF-3B	.610	.575	.752	.741	.837	.531	.221		21,110	4.70
C9	9/16-18UNF-3B	.704	.623	.877	.865	.978	.594	.243	.008	26,810	7.80
C10	5/8-18UNF-3B	.766	.732	.940	.928	1.051	.656	.274		34,130	9.50
C12	3/4-16UNF-3B	.891	.855	1.064	1.052	1.191	.787	.316	.009	50,020	13.60
C14	7/8-14UNF-3B	1.016	.965	1.252	1.239	1.403	.918	.570	.010	68,440	21.00
C16	1-12UNF-3B	1.141	1.010	1.440	1.427	1.615	1.044	.635	.011	92,180	31.00
C18	1 1/8-12UNF-3B	1.266	1.130	1.627	1.614	1.826	1.171	.710	.012	116,700	46.00
C20	1 1/4-12UNF-3B	1.454	1.300	1.815	1.801	2.038	1.295	.795	.013	147,940	65.00

Ⓑ (a) THREADS IN ACCORDANCE WITH MIL-S-8879. THREADS IN ACCORDANCE WITH MIL-S-7742 ARE ACCEPTABLE UNTIL 31 DECEMBER 1969.
(b) BEARING SURFACE SHALL BE SQUARE WITH PITCH DIAMETER WITHIN "X" WHEN MEASURED IN ACCORDANCE WITH MIL-N-25027.
(c) DIMENSIONS ACROSS FLATS INCLUDES DEFORMATION OF SELF-LOCKING DEVICE.

MATERIAL: CORROSION RESISTANT STEEL, SEE PROCUREMENT SPECIFICATION.
PLATING: SILVER PLATE IN ACCORDANCE WITH AMS2410. PLATE THICKNESS, MEASURED ON THE EXTERNAL SURFACE OF THE NUT, SHALL NOT BE LESS THAN .0002 INCHES; THREADS SHALL SHOW COMPLETE COVERAGE BUT THICKNESS REQUIREMENTS ON THREADS ARE WAIVED.

MAGNETIC PERMEABILITY SHALL BE LESS THAN 2.0 (AIR = 1.0) FOR A FIELD STRENGTH H = 200 OERSTEDS USING A MAGNETIC PERMEABILITY INDICATOR IN ACCORDANCE WITH MIL-I-17214 OR EQUIVALENT.

BREAK ALL SHARP EDGES AND REMOVE ALL HANGING BURRS AND SLIVERS.
Ⓑ SURFACE ROUGHNESS IN ACCORDANCE WITH MIL-STD-10. UNLESS OTHERWISE SPECIFIED THE SURFACE ROUGHNESS SHALL NOT EXCEED 125 MICRO INCHES.

DIMENSIONS IN INCHES.

EXAMPLE OF PART NUMBER: MS21046C4 = 1/4-28 CORROSION RESISTANT STEEL NUT, SILVER PLATED.

DESIGN AND USAGE LIMITATIONS: THESE NUTS ARE DESIGNED TO DEVELOP THE TENSILE STRENGTH OF BOLTS AND SCREWS WITH AN ULTIMATE STRESS (Ftu) OF 125 KSI BASED ON THE CROSS SECTIONAL AREA AT THE BASIC ROOT DIAMETER OF THE THREAD. THESE NUTS ARE DESIGNED TO BE USED ON 3A EXTERNAL THREADS PER MIL-S-7742. THESE NUTS SHALL BE USED IN ACCORDANCE WITH THE LIMITATIONS OF MS33588. ONLY NUTS FOR WHICH THESE ARE QUALIFIED PRODUCTS LISTED ON QPL25027 SHALL BE USED.

Ⓑ SHEET 2 ADDED

INTERCHANGEABILITY RELATIONSHIP: EXCEPT FOR THE AN363, 7/16 THREAD SIZE NUTS, MS21046 NUTS CAN UNIVERSALLY REPLACE THE ALL METAL AN363 AND NAS1021 NUTS OF LIKE MATERIAL, PLATING AND THREAD SIZE. BUT THESE AN363 AND NAS1021 NUTS CAN NOT UNIVERSALLY REPLACE THE MS21046 NUTS. FOR DEFINITION AND APPLICATION OF DRAWING STATUS NOTES SEE MIL-STD-32.

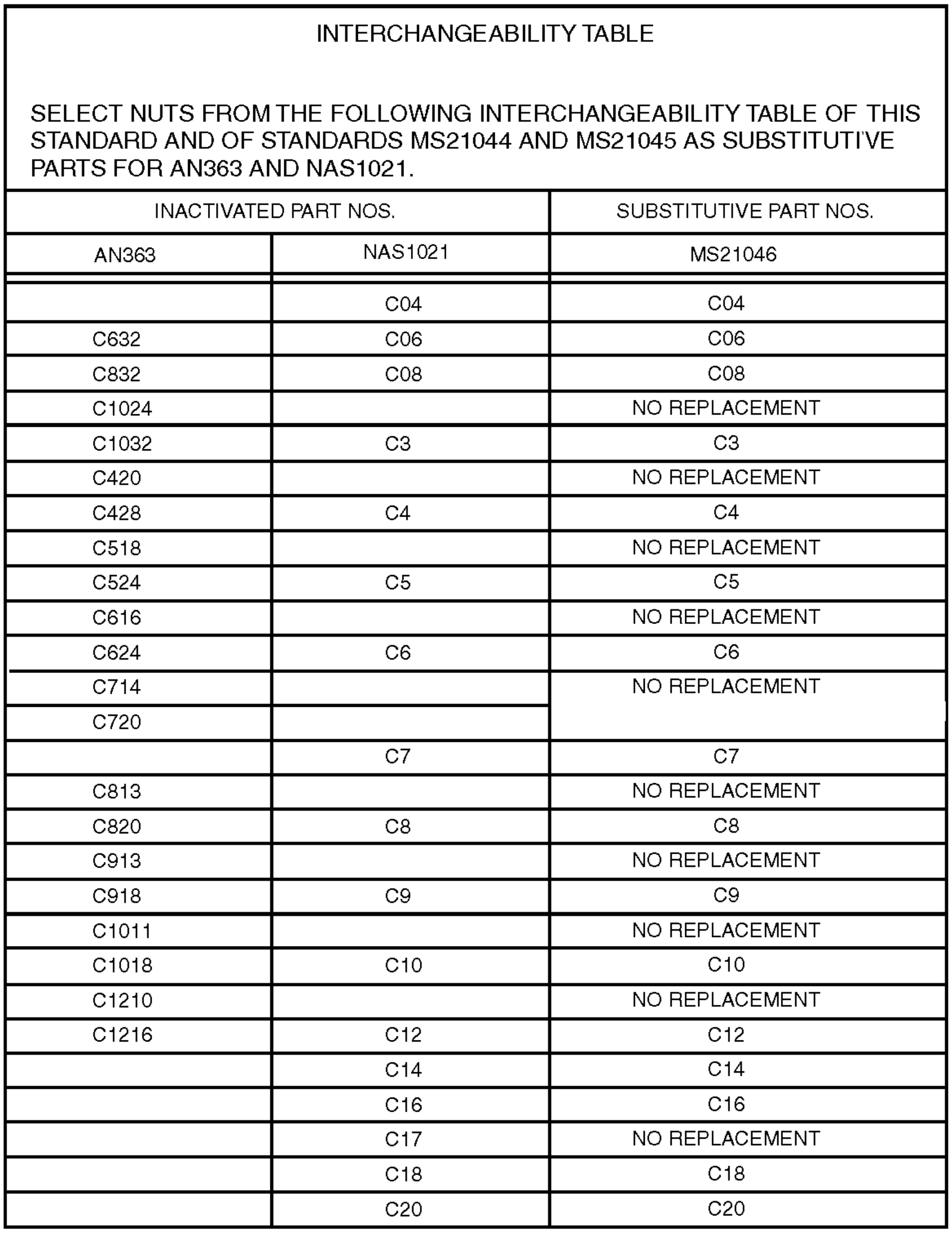
CERTAIN PROVISIONS TO APPLY TO THE ACROSS FLATS DIMENSION OF THIS STANDARD ARE THE SUBJECT OF INTERNATIONAL STANDARDIZATION AGREEMENT ABC AIR STD 17/2. WHEN REVISION OR CANCELLATION OF THIS STANDARD IS PROPOSED, THE DEPARTMENTAL CUSTODIAN WILL INFORM THEIR RESPECTIVE DEPARTMENTAL STANDARDIZATION OFFICE SO THAT APPROPRIATE ACTION MAY BE TAKEN RESPECTING THE INTERNATIONAL AGREEMENT CONCERNED.

THIS STANDARD TAKES PRECEDENCE OVER PROCUREMENT DOCUMENTS REFERENCED HEREIN. REFERENCED DOCUMENTS SHALL BE OF THE ISSUE IN EFFECT ON DATE OF INVITATIONS FOR BID.

Ⓑ FOR CHANGES SEE SHEET 1.

F05-032S01

Figure 5-33. Drawing MS21046 (Sheet 1 of 2)



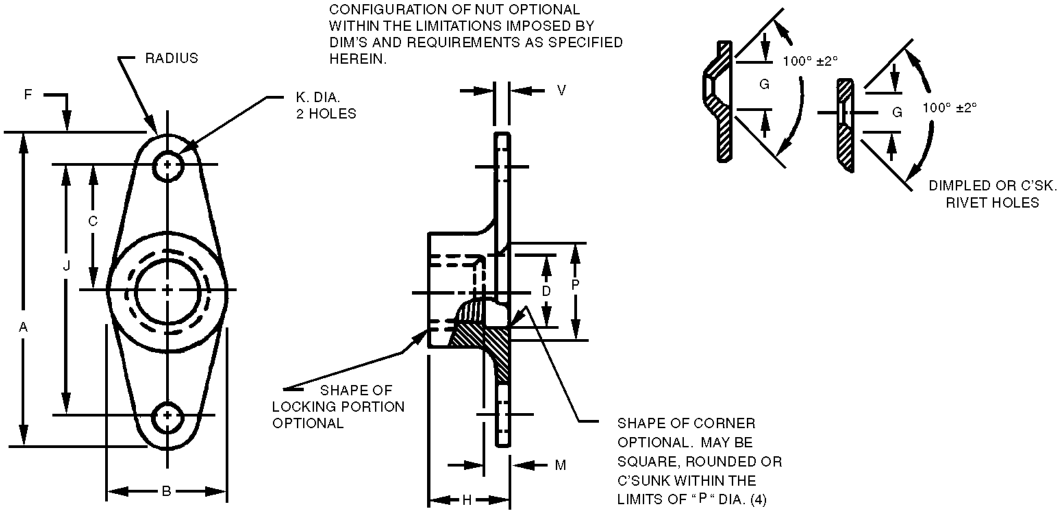
INTERCHANGEABILITY TABLE

SELECT NUTS FROM THE FOLLOWING INTERCHANGEABILITY TABLE OF THIS STANDARD AND OF STANDARDS MS21044 AND MS21045 AS SUBSTITUTIVE PARTS FOR AN363 AND NAS1021.

INACTIVATED PART NOS.		SUBSTITUTIVE PART NOS.
AN363	NAS1021	MS21046
	C04	C04
C632	C06	C06
C832	C08	C08
C1024		NO REPLACEMENT
C1032	C3	C3
C420		NO REPLACEMENT
C428	C4	C4
C518		NO REPLACEMENT
C524	C5	C5
C616		NO REPLACEMENT
C624	C6	C6
C714		NO REPLACEMENT
C720		
	C7	C7
C813		NO REPLACEMENT
C820	C8	C8
C913		NO REPLACEMENT
C918	C9	C9
C1011		NO REPLACEMENT
C1018	C10	C10
C1210		NO REPLACEMENT
C1216	C12	C12
	C14	C14
	C16	C16
	C17	NO REPLACEMENT
	C18	C18
	C20	C20

F05-032S02

Figure 5-33. Drawing MS21046 (Sheet 2)



(1) THREAD SIZE Ⓐ MIL-S-8879/MOD.	A MAX.	B DIA.		C ±.005	D DIA. MIN.	F MIN.	G DIA. ±.010	(2) H MAX.	(3) J ±.002	(5) K DIA. +.005 -.000	M MIN.	P DIA. MAX.	V MAX.	AXIAL STRENGTH LBS MIN	WEIGHT LBS/100
		MAX.	MIN.												
4-40UNC-3B	.948	.260	.195	.344	—	.100	.200	.143	.688	.098	—	.166	.047	750	.14
6-32UNC-3B	.948	.265	.239	.344	—	.100	.200	.171	.688	.098	—	.206	.047	1,130	.18
8-32UNC-3B	.948	.297	.277	.344	.168	.100	.200	.250	.688	.098	.062	.248	.047	1,720	.28
10-32UNF-3B	.948	.328	.308	.344	.196	.100	.200	.250	.688	.098	.062	.276	.047	2,460	.29
1/4-28UNF-3B	1.260	.414	.375	.500	.254	.100	.200	.281	1.000	.098	.062	.344	.055	4,580	.53
5/16-24UNF-3B	1.292	.505	.485	.500	.317	.125	.230	.328	1.000	.130	.062	.417	.065	7,390	.80
3/8-24UNF-3B	1.292	.614	.594	.500	.379	.125	—	.344	1.000	.130	.062	.505	.075	11,490	1.31
7/16-20 UNF-3B	1.477	.726	.695	.562	.442	.156	—	.390	1.125	.161	.062	.602	.085	15,450	1.84

Ⓐ (1) THREADS BEFORE LUBRICATION PER MIL-S-8879. THREADS IN ACCORDANCE WITH MIL-S-7742 ARE ACCEPTABLE UNTIL 31 DECEMBER 1969.
(2) MINIMUM "H" NOT SPECIFIED, LIMITED ONLY BY STRENGTH REQUIREMENTS.
(3) CENTER OF THE TAPPED HOLE SHALL NOT DEVIATE IN ANY DIRECTION FROM THE CENTER OF THE PLATE NUT AS DETERMINED BY THE RIVET HOLES BY MORE THAN .005.
(4) DIMPLED HOLE TOLERANCE FOR "K" IS +.015, -.000 AFTER FORMING.

MATERIAL: CORROSION RESISTANT STEEL, (A281) AMS 5525, AMS 5735, OR AMS 5737.

PLATING: 100°F, NUTS ONLY SILVER PLATE IN ACCORDANCE WITH AMS2410. PLATE THICKNESS, MEASURED ON ANY EXTERNAL SURFACE OF THE NUT, SHALL NOT BE LESS THAN 0.0002 IN. THREADS SHALL SHOW COMPLETE COVERAGE BUT THICKNESS REQUIREMENTS ON THREAD IS WAIVED. NO SILVER PLATE ON WELDINGS.
MAGNETIC PERMEABILITY: SHALL BE LESS THAN 2.0 (AIR-1.0) FOR A FIELD STRENGTH H=200 OERSTEDS USING A MAGNETIC PERMEABILITY INDICATOR IN ACCORDANCE WITH MIL-I-17214, OR EQUIVALENT.
HARDNESS: ROCKWELL C48 MAXIMUM.
LUBRICANT: 450°F, NUTS ONLY, DRY FILM LUBRICANT IN ACCORDANCE WITH MIL-N-25027 FOR USAF APPLICATIONS, NUTS TREATED WITH DRY FILM LUBRICANTS SHALL NOT BE USED IN INTERNAL FUEL SYSTEMS.

DIMENSIONS IN INCHES.

SURFACE ROUGHNESS IN ACCORDANCE WITH MIL-STD-10. UNLESS OTHERWISE SPECIFIED, THE SURFACE ROUGHNESS SHALL NOT EXCEED 125 MICRO INCHES.

PERFORMANCE: SEE PROCUREMENT SPECIFICATION, EXCEPT 458°F, DRY FILM LUBRICATED NUTS LIMITED TO FIVE REUSE CYCLES.

DESIGN AND USAGE LIMITATIONS: THESE NUTS ARE DESIGNED TO DEVELOP THE TENSILE STRENGTH OF BOLTS AND SCREWS WITH AN ULTIMATE TENSILE STRENGTH OF 125 KSI BASED ON THE CROSS SECTIONAL AREA AT THE BASIC ROOT DIAMETER OF THE THREAD. THESE NUTS ARE DESIGNED TO BE USED ON 3A EXTERNAL THREADS. THESE NUTS SHALL BE USED IN ACCORDANCE WITH THE LIMITATIONS OF MS 33588. ONLY NUTS FOR WHICH THERE ARE QUALIFIED PRODUCTS LISTED ON QPL 25827 SHALL BE USED.

INTERCHANGEABILITY RELATIONSHIP: MS 21054 NUTS CAN UNIVERSALLY REPLACE NAS 683 NUTS OF LIKE MATERIAL, THREAD SIZE, PLATING, LUBRICANTS (SILVER PLATE OR DRY FILM LUBRICANT), RIVET SPACING, AND FASTENING METHOD (PLAIN RIVET HOLES, DIMPLED, COUNTERSUNK RIVET HOLES OR PROJECTION WELDING), BUT NAS003 NUTS CANNOT UNIVERSALLY REPLACE MS21054 NUTS. FOR DEFINITION AND APPLICATION OF DRAWING STATUS NOTES SEE MIL-STD-32.

THIS STANDARD TAKES PRECEDENCE OVER DOCUMENTS REFERENCED HEREIN.

REFERENCED DOCUMENTS SHALL BE OF THE ISSUE IN EFFECT ON DATE OF INVITATION FOR BIDS.

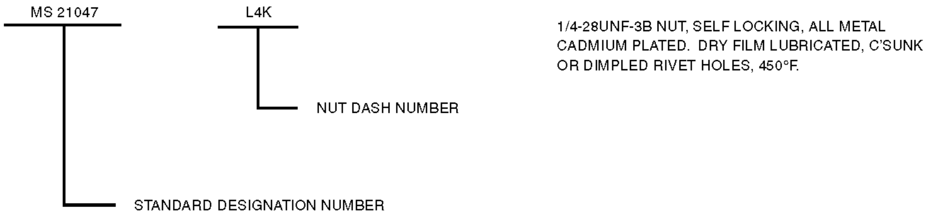
Ⓐ FOR CHANGES SEE SHEETS 1 AND 2.

F05-033S01

Figure 5-34. Drawing MS21047(ASG) (Sheet 1 of 2)

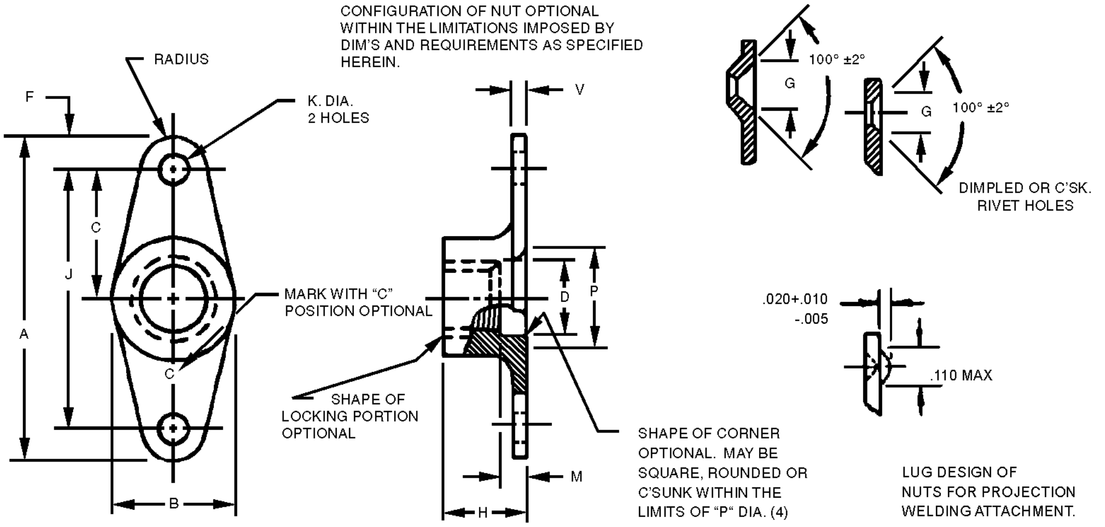
Ⓐ THREAD SIZE MIL-S-8879/MOD.	DASH NUMBERS			
	PLAIN RIVET HOLES		COUNTERSUNK OR DIMPLED RIVET HOLES	
	NON-DRY FILM LUBRICANT	DRY FILM LUBRICANT	NON-DRY FILM LUBRICANT	DRY FILM LUBRICANT
4-40UNC-3B	-04	L04	-04K	L04K
6-32UNC-3B	-06	L06	-06K	L06K
8-32UNC-3B	-08	L08	-08K	L08K
10-32UNF-3B	-3	L3	-3K	L3K
1/4-28UNF-3B	-4	L4	-4K	L4K
5/16-24UNF-3B	-5	L5	-5K	L5K
3/8-24UNF-3B	-6	L6		
7/16-20UNF-3B	-7	L7		

EXAMPLE OF PART NUMBERS:



F05-033S02

Figure 5-34. Drawing MS21047(ASG) (Sheet 2)



(1) THREAD SIZE Ⓐ MIL-S-8879/MOD.	A MAX.	B DIA.		C ±.005	D DIA. MIN.	F MIN.	G DIA. ±.010	(2) H MAX.	(3) J ±.002	(5) K DIA. +.005 -.000	M MIN.	P DIA. MAX.	V MAX.	AXIAL STRENGTH LBS. MIN.	WEIGHT LBS/100
		MAX.	MIN.												
4-40UNC-3B	.948	.260	.195	.344	—	.100	.200	.143	.688	.098	—	.166	.047	750	.14
6-32UNC-3B	.948	.265	.239	.344	—	.100	.200	.171	.688	.098	—	.206	.047	1,130	.18
8-32UNC-3B	.948	.297	.277	.344	.168	.100	.200	.250	.688	.098	.062	.248	.047	1,720	.28
10-32UNF-3B	.948	.328	.308	.344	.194	.100	.200	.250	.688	.098	.062	.276	.047	2,460	.29
1/4-28UNF-3B	1.260	.414	.375	.500	.254	.100	.200	.281	1.000	.098	.062	.344	.055	4,580	.53
5/16-24UNF-3B	1.292	.505	.485	.500	.317	.125	.230	.328	1.000	.130	.062	.417	.065	7,390	.80
3/8-24UNF-3B	1.292	.614	.594	.500	.379	.125	—	.344	1.000	.130	.062	.505	.075	11,450	1.31
7/16-20 UNF-3B	1.477	.726	.695	.562	.442	.156	—	.390	1.125	.161	.062	.602	.085	15,450	1.84

(1) THREADS BEFORE LUBRICATION PER MIL-S-8879. THREADS IN ACCORDANCE WITH MIL-S-7742 ARE ACCEPTABLE UNTIL Ⓐ 31 DECEMBER 1969.
(2) MINIMUM "H" NOT SPECIFIED, LIMITED ONLY BY STRENGTH REQUIREMENT OF SPECIFICATION.
(3) CENTER OF TAPPED HOLE SHALL NOT DEVIATE IN ANY DIRECTION FROM THE CENTER OF THE PLATE NUT AS DETERMINED BY THE RIVET HOLES BY MORE THAN .005.
(4) ON SIZE NO. 8 AND LARGER COUNTERBORE THREAD "D" DIA. X.062 DEEP MIN. THREAD RELIEF: ON SIZE NO. 6 AND SMALLER C'SINK TO "P" DIA. WITHIN THE LIMITS OF P, D AND M.
(5) DIMPLED RIVET HOLE TOLERANCE FOR "K" IS +.015, -.000.

MATERIAL: CORROSION RESISTANT STEEL, (A286) AMS5525, AMS5735, OR AMS5737.

HARDNESS: ROCKWELL C49 MAX.

PLATING: 800°F NUTS: SILVER PLATE IN ACCORDANCE WITH AMS2410. PLATE THICKNESS, MEASURED ON ANY EXTERNAL SURFACE OF THE NUT, SHALL NOT BE LESS THAN 0.0002 IN: THREADS SHALL SHOW COMPLETE COVERAGE BUT THICKNESS REQUIREMENT ON THREAD IS WAIVED. NO SILVER PLATE ON WELD NIBS.

LUBRICANT: 450° NUTS, DRY FILM LUBRICANT IN ACCORDANCE WITH MIL-N-25027. FOR USAF APPLICATIONS NUTS TREATED WITH DRY FILM LUBRICANTS SHALL NOT BE USED IN INTERNAL FUEL SYSTEMS. (NO SILVER PLATE.)

MAGNETIC PERMEABILITY: SHALL BE LESS THAN 2.0 (AIR-1.0) FOR A FIELD STRENGTH H=200 OERSTEDS USING A MAGNETIC PERMEABILITY INDICATOR PER MIL-I-17214 OR EQUIVALENT.

DIMENSIONS IN INCHES UNLESS OTHERWISE SPECIFIED.
DESIGN AND USAGE LIMITATIONS: THESE NUTS ARE DESIGNED TO DEVELOP THE TENSILE STRENGTH OF BOLTS AND SCREWS WITH AN ULTIMATE TENSILE STRENGTH OF 125 KSI BASED ON THE CROSS SECTION AREA AT THE BASIC ROOT DIAMETER OF THE THREAD. THESE NUTS ARE DESIGNED TO BE USED ON 3A EXTERNAL THREADS. THESE NUTS SHALL BE USED IN ACCORDANCE WITH THE LIMITATIONS OF MS33588. ONLY NUTS FOR WHICH THERE ARE QUALIFIED PRODUCTS LISTED ON QPL 25827 SHALL BE USED.
PERFORMANCE: SEE PROCUREMENT SPECIFICATION, EXCEPT 450°F DRY FILM LUBRICATED NUTS LIMITED TO FIVE REUSE CYCLES.
SURFACE ROUGHNESS IN ACCORDANCE WITH MIL-STD-10, UNLESS OTHERWISE SPECIFIED, THE SURFACE ROUGHNESS SHALL NOT EXCEED 125 MICRO INCHES.
INTERCHANGEABILITY RELATIONSHIP: MS21048 NUTS CAN UNIVERSALLY REPLACE AN362, AN366 AND NAS680 NUTS OF LIKE MATERIAL, THREAD SIZE, LUBRICANT (SILVER PLATE OR DRY FILM LUBRICANT), AND FASTENING METHOD (PLAIN RIVET HOLES: DIMPLED, C'SUNK RIVET HOLES: OR PROJECTION WELDING). BUT THESE AN362, AN366 AND NAS680 NUTS CANNOT UNIVERSALLY REPLACE MS 21048 NUTS. FOR DEFINITION AND APPLICATION OF DRAWING STATUS NOTES SEE MIL-STD-32.
THIS STANDARD TAKES PRECEDENCE OVER DOCUMENTS REFERENCED HEREIN.
REFERENCED DOCUMENTS SHALL BE OF THE ISSUE IN EFFECT ON DATE OF INVITATION FOR BID.

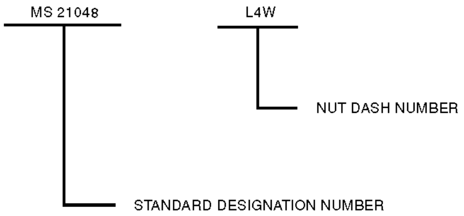
Ⓐ FOR CHANGES SEE SHEETS 1 AND 2.

F05-034S01

Figure 5-35. Drawing MS21048(ASG) (Sheet 1 of 2)

Ⓐ THREAD SIZE MIL-S-8879/MOD.	DASH NUMBERS					
	450° F			800° F		
	PLAIN HOLES	COUNTER SUNK OR DIMPLED HOLES	WELDING PROJECTION	PLAIN HOLES	COUNTER SUNK OR DIMPLED HOLES	WELDING PROJECTIONS
4-40UNC-3B	L04	L04K	L04W	-04	-04K	-04W
6-32UNC-3B	L06	L06K	L06W	-06	-06K	-06W
8-32UNC-3B	L08	L08K	L08W	-08	-08K	-08W
10-32UNF-3B	L3	L3K	L3W	-3	-3K	-3W
1/4-28UNF-3B	L4	L4K	L4W	-4	-4K	-4W
5/16-24UNF-3B	L5	L5K	L5W	-5	-5K	-5W
3/8-24UNF-3B	L6		L6W	-6		-6W
7/16-20UNF-3B	L7		L7W	-7		-7W

EXAMPLE OF PART NUMBERS:

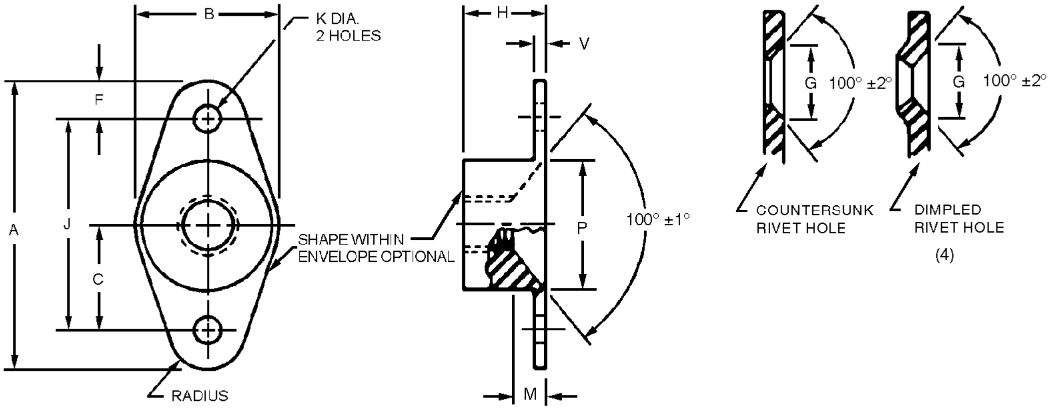


1/4-28UNF-3B NUT SELF LOCKING, ALL METAL
DRY FILM LUBRICANT, C'SUNK OR DIMPLED RIVET
HOLES,450° F.

F05-034S02

Figure 5-35. Drawing MS21048(ASG) (Sheet 2)

CONFIGURATION OF NUT OPTIONAL WITHIN THE LIMITATIONS IMPOSED BY DIM.'S AND REQUIREMENTS AS SPECIFIED HEREIN.



(1) THREAD SIZE MIL-S-8879/MOD. Ⓐ	A MAX.	B MAX.	B MIN.	C +.085	F MIN.	G DIA. +.040	(2) H MAX.	(3) J +.002	K DIA. +.005 -.000	M REF	P DIA. +.005	V MAT'L. MAX.	AXIAL STRENGTH LBS. MIN.	WEIGHT LBS/100 MAX.
8-32UNC-3B	.977	.442	.360	.344	.100	.200	.272	.688	.098	.084	.365	.047	1,720	.43
10-32UNF-3B	1.013	.453	.408	.344	.100	.200	.281	.688	.098	.083	.411	.047	2,480	.44
1/4-28UNF-3B	1.252	.619	.535	.500	.100	.200	.340	1.000	.098	.121	.540	.055	4,580	.88
5/16-24UNF-3B	1.340	.786	.881	.500	.125	.230	.422	1.000	.130	.158	.686	.065	7,300	1.17

Ⓐ

(1) THREADS BEFORE LUBRICATION PER MIL-S-8879. THREADS IN ACCORDANCE \WITH MIL-S-7742 ARE ACCEPTABLE UNTIL 31 DECEMBER 1969.
(2) MINIMUM "H" NOT SPECIFIED, LIMITED ONLY BY STRENGTH REQUIREMENTS.
(3) CENTER OF THE TAPPED HOLE SHALL NOT DEVIATE IN ANY DIRECTION FROM THE CENTER OF THE PLATE NUT AS DETERMINED BY THE RIVET HOLES BY MORE THAN .005.
(4) DIMPLED HOLE TOLERANCE FOR "K" IS +.015, -.000 AFTER FORMING.

MATERIAL: STEEL.

PLATING: CADMIUM PLATE IN ACCORDANCE WITH QQ-P-416, TYPE II, CLASS 3. FOR DRY FILM LUBRICATED NUTS, THE TYPE AND CLASS ARE OPTIONAL IF THE NUTS MEET THE SALT SPRAY REQUIREMENTS OF QQ-P-416, TYPE II.

HARDNESS: ROCKWELL C49 MAXIMUM.

LUBRICANT: DRY FILM LUBRICANT APPROVED IN ACCORDANCE WITH MIL-N-25027. OTHER LUBRICANTS SOLUBLE IN THE CLEANER SPECIFIED IN MIL-S-7502. FOR USAF APPLICATIONS, NUTS TREATED WITH DRY FILM LUBRICANTS SHALL NOT BE USED IN INTERNAL FUEL SYSTEMS APPLICATIONS.

DIMENSIONS IN INCHES.

SURFACE ROUGHNESS IN ACCORDANCE WITH MIL-STD-10, UNLESS OTHERWISE SPECIFIED, THE SURFACE ROUGHNESS SHALL NOT EXCEED 125 MICRO INCHES.

DESIGN AND USAGE LIMITATIONS: THESE NUTS ARE DESIGNED TO DEVELOP THE TENSILE STRENGTH OF BOLTS AND SCREWS WITH AN ULTIMATE TENSILE STRENGTH OF 125 KSI BASED ON THE CROSS SECTIONAL AREA AT THE BASIC ROOT DIAMETER OF THE THREAD. THESE NUTS ARE DESIGNED TO BE USED ON 3A EXTERNAL THREADS. THESE NUTS SHALL BE USED IN ACCORDANCE WITH THE LIMITATIONS OF MS 33588. ONLY NUTS FOR WHICH THERE ARE QUALIFIED PRODUCTS LISTED ON QPL 25827 SHALL BE USED.

(STATUS NOTE)

INTERCHANGEABILITY RELATIONSHIP: MS 21049 NUTS CAN UNIVERSALLY REPLACE NAS 681, AN 361, AND AN 373 NUTS OF LIKE MATERIAL, THREAD SIZE, PLATING, LUBRICANTS (DRY FILM, OR NON DRY FILM). RIVET SPACING, AND FASTENING METHOD (PLAIN RIVET HOLES, DIMPLED, COUNTERSUNK RIVET HOLES: OR PROJECTION WELDING). BUT NAS 681, AN361, AND AN 373 NUTS CANNOT UNIVERSALLY REPLACE MS 21049 NUTS. FOR DEFINITION AND APPLICATION OF DRAWING STATUS NOTES, SEE MIL-STD-32.

THIS STANDARD TAKES PRECEDENCE OVER DOCUMENTS REFERENCED HEREIN.

REFERENCED DOCUMENTS SHALL BE OF THE ISSUE IN EFFECT ON DATE OF INVITATION FOR BIDS.

F05-035S01

Figure 5-36. Drawing MS21049(ASG) (Sheet 1 of 2)

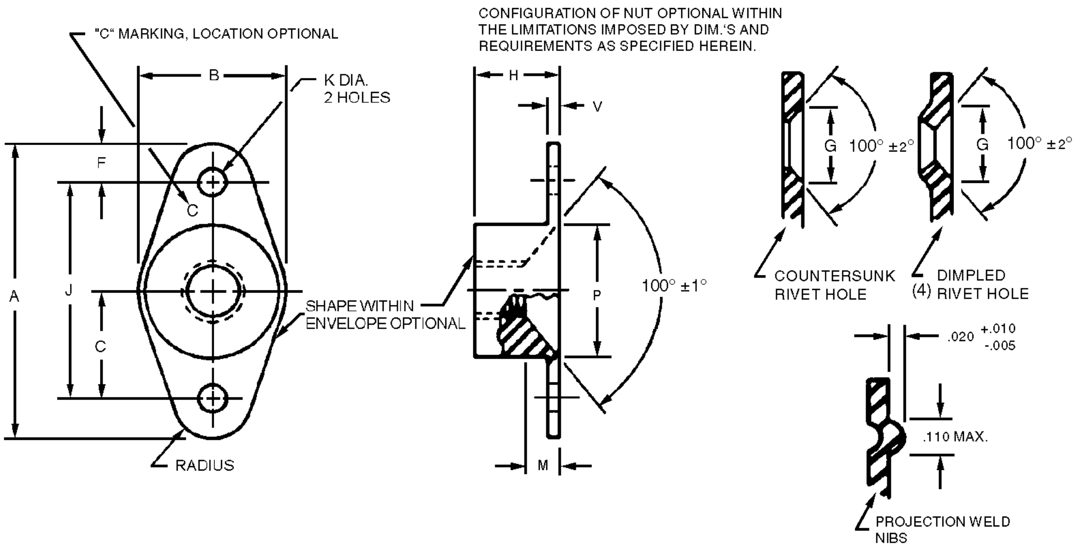
Ⓐ THREAD SIZE MIL-S-8879/MOD.	DASH NUMBERS			
	450°F.NON DRY FILM LUBRICATED		450°F. DRY FILM LUBRICATED	
	PLAIN HOLES	C'SUNK OR DIMPLED HOLES	PLAIN HOLES	C'SUNK OR DIMPLED HOLES
8-32 UNC-3B	-08	-08K	L08	L08K
10-32 UNF-3B	-3	-3K	L3	L3K
1/4-28 UNF-3B	-4	-4K	L4	L4K
5/16-24 UNF-3B	-5	-5K	L5	L5K

EXAMPLE OF PART NUMBER:

1/4-28 UNF-3B NUT, SELF LOCKING, TWO LUG, STEEL, 125 KSI, 450°F., DRY FILM LUBRICATED, WITH COUNTERSUNK OR DIMPLED RIVET HOLES.

F05-035S02

Figure 5-36. Drawing MS21049(ASG) (Sheet 2)



(1) Ⓐ THREAD SIZE MIL-S-8879/MOD.	A MAX.	B MAX.	B MIN.	C ±.005	F MIN.	G DIA. ±.010	(2) H MAX.	(3) J ±.002	K DIA. +.005 -.000	M REF	P DIA. ±.005	V MAT'L. MAX.	AXIAL STRENGTH LBS. MIN.	WEIGHT LBS/100 MAX.
8-32UNC-3B	.948	.422	.360	.344	.100	.200	.272	.688	.098	.084	.365	.047	1,720	.43
10-32UNF-3B	.948	.453	.408	.344	.100	.200	.281	.688	.098	.083	.411	.047	2,480	.44
1/4-28UNF-3B	1.269	.619	.535	.500	.100	.200	.340	1.000	.098	.121	.540	.055	4,580	.88
5/16-24UNF-3B	1.292	.786	.881	.500	.125	.230	.422	1.000	.130	.158	.686	.065	7,300	1.17

Ⓐ (1) THREADS BEFORE LUBRICATION PER MIL-S-8879. THREADS IN ACCORDANCE WITH MIL-S-7742 ARE ACCEPTABLE UNTIL 31 DECEMBER 1969.

(2) MINIMUM "H" NOT SPECIFIED, LIMITED ONLY BY STRENGTH REQUIREMENTS.

(3) CENTER OF THE TAPPED HOLE SHALL NOT DEVIATE IN ANY DIRECTION FROM THE CENTER OF THE PLATE NUT AS DETERMINED BY THE RIVET HOLES BY MORE THAN .005.

(4) DIMPLED HOLE TOLERANCE FOR "K" IS +.015, -.000 AFTER FORMING.

MATERIAL: CORROSION RESISTANT STEEL, (A286) AMS 5525, AMS 5735, OR AMS 5737.

PLATING: 800°F. NUTS ONLY, SILVER PLATE IN ACCORDANCE WITH AMS 2410. PLATE THICKNESS, MEASURED ON ANY EXTERNAL SURFACE OF THE NUT, SHALL NOT BE LESS THAN 0.0002 IN; THREADS SHALL SHOW COMPLETE COVERAGE BUT THICKNESS REQUIREMENTS ON THREAD IS WAIVED. NO SILVER PLATE ON WELD NIBS.

MAGNETIC PERMEABILITY: SHALL BE LESS THAN 2.0 (AIR=1.0) FOR A FIELD STRENGTH H=200 OERSTEDS USING A MAGNETIC PERMEABILITY INDICATOR PER MIL-I-17214 OR EQUIVALENT.

HARDNESS: ROCKWELL C49 MAXIMUM.

LUBRICANT: 450°F. NUTS ONLY, DRY FILM LUBRICANT IN ACCORDANCE WITH MIL-N-25027. FOR USAF APPLICATIONS NUTS TREATED WITH DRY FILM LUBRICANTS SHALL NOT BE USED IN INTERNAL FUEL SYSTEMS.

DIMENSIONS IN INCHES.

SURFACE ROUGHNESS IN ACCORDANCE WITH MIL-STD-10, UNLESS OTHERWISE SPECIFIED, THE SURFACE ROUGHNESS SHALL NOT EXCEED 125 MICRO INCHES.

PERFORMANCE: SEE PROCUREMENT SPECIFICATION, EXCEPT 450°F. DRY FILM LUBRICATED NUTS LIMITED TO FIVE REUSE CYCLES.

DESIGN AND USAGE LIMITATIONS: THESE NUTS ARE DESIGNED TO DEVELOP THE TENSILE STRENGTH OF BOLTS AND SCREWS WITH AN ULTIMATE TENSILE STRENGTH OF 125 KSI BASED ON THE CROSS SECTIONAL AREA AT THE BASIC ROOT DIAMETER OF THE THREAD. THESE NUTS ARE DESIGNED TO BE USED ON 3A EXTERNAL THREADS. THESE NUTS SHALL BE USED IN ACCORDANCE WITH THE LIMITATIONS OF MS 33588. ONLY NUTS FOR WHICH THERE ARE QUALIFIED PRODUCTS LISTED ON QPL 25827 SHALL BE USED.

INTERCHANGEABILITY RELATIONSHIP: MS 21050 NUTS CAN UNIVERSALLY REPLACE NAS 681 AND AN 361 NUTS OF LIKE MATERIAL, THREAD SIZE, PLATING, LUBRICANTS (SILVER PLATE OR DRY FILM LUBRICANT), RIVET SPACING, AND FASTENING METHOD (PLAIN RIVET HOLES, DIMPLED, COUNTERSUNK RIVET HOLES OR PROJECTION WELDING). BUT NAS 681 AND AN 361 NUTS CANNOT UNIVERSALLY REPLACE MS 21050 NUTS, FOR DEFINITION AND APPLICATION OF DRAWING STATUS NOTES SEE MIL-STD-32.
(STATUS NOTE)

THIS STANDARD TAKES PRECEDENCE OVER DOCUMENTS REFERENCED HEREIN.

REFERENCED DOCUMENTS SHALL BE OF THE ISSUE IN EFFECT ON DATE OF INVITATION FOR BIDS.

F05-036S01

Figure 5-37. Drawing MS21050(ASG) (Sheet 1 of 2)

Ⓐ	DASH NUMBERS					
	800°F.			450°F.		
THREAD SIZE MIL-S-8879/MOD.	PLAIN HOLES	C'SUNK OR DIMPLED HOLES	WELDING PROJECTION	PLAIN HOLES	C'SUNK OR DIMPLED HOLES	WELDING PROJECTION
8-32 UNC-3B	-08	-08K	-08W	L08	L08K	L08W
10-32 UNF-3B	-3	-3K	-3W	L3	L3K	L3W
1/4-20 UNF-3B	-4	-4K	-4W	L4	L4K	L4W
5/16-24 UNF-3B	-5	-5K	-5W	L5	L5K	L5W

EXAMPLE OF PART NUMBER:

MS 21050L4K

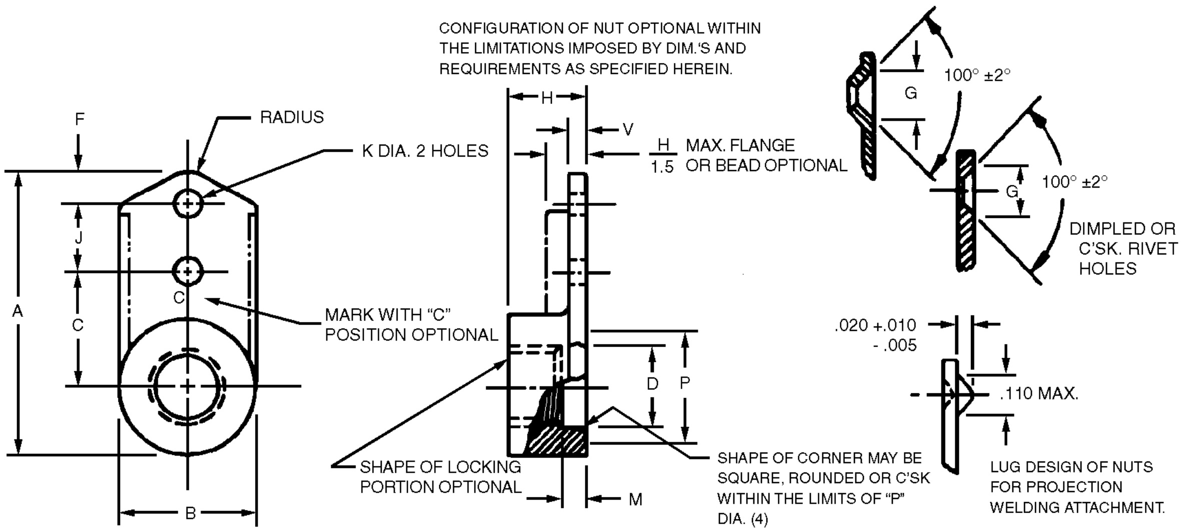
NUT DASH NUMBER

STANDARD IDENTIFICATION NUMBER

1/4-28 UNF-3B NUT, SELF LOCKING,
TWO LUG, CRES., 125 KSI 450°F.,
890°F., DRY FILM LUBRICATED WITH
COUNTERSUNK OR DIMPLED RIVET HOLES

F05-036S02

Figure 5-37. Drawing MS21050(ASG) (Sheet 2)



(1) Ⓐ THREAD SIZE MIL-S-8879/MOD.	A MAX.	B		C ±.005	D DIA. MIN.	(2) H MAX.	F MIN.	G DIA. ±.010	(3) J ±.002	(5) K DIA. +.005 -.000	M MIN.	P MAX.	V MAX.	AXIAL STRENGTH LBS./ MIN.	WEIGHT LBS/100
		MAX.	MIN.												
6-32UNC-3B	.935	.297	.239	.344	—	.171	.100	.200	.312	.098	—	.206	.047	1,130	.28
8-32UNC-3B	.935	.297	.277	.344	.168	.250	.100	.200	.312	.098	—	.248	.047	1,720	.29
10-32UNF-3B	.950	.328	.308	.344	.194	.250	.100	.200	.312	.098	.062	.274	.047	2,460	.33
1/4-28UNF-3B	.993	.414	.375	.344	.254	.281	.100	.200	.312	.098	.062	.344	.055	4,580	.57
5/16-24UNF-3B	1.210	.505	.485	.500	.317	.328	.125	.230	.312	.130	.062	.417	.065	7,390	.96
3/8-24UNF-3B	1.264	.614	.594	.500	.379	.344	.125	—	.312	.130	.062	.505	.075	11,450	1.44
7/16-20UNF-3B	1.446	.726	.697	.562	.442	.390	.156	—	.344	.161	.062	.602	.085	15,450	2.02

Ⓐ(1) THREADS BEFORE LUBRICATION PER MIL-S-8879. THREADS IN ACCORDANCE WITH MIL-S-7742 ARE ACCEPTABLE UNTIL 31 DECEMBER 1969.

(2) MINIMUM "H" NOT SPECIFIED, LIMITED ONLY BY STRENGTH REQUIREMENT OF SPECIFICATION.

(3) CENTER OF TAPPED HOLE SHALL NOT DEVIATE IN ANY DIRECTION FROM THE CENTER OF THE PLATE NUT AS DETERMINED BY THE RIVET HOLES BY MORE THAN .005.

(4) ON SIZE NO. 8 AND LARGER COUNTERBORE THREAD "D" DIA. X .062 DEEP MIN THREAD RELIEF: ON SIZE NO. 6 AND SMALLER C'SUNK TO "P" DIA. WITHIN THE LIMITS OF D, P AND M.

(5) DIMPLED RIVET HOLE TOLERANCE FOR "K" IS +.015, -.000.

MATERIAL: CORROSION RESISTANT STEEL, (A286), AMS5525, AMS5735, OR AMS5737.
HARDNESS: ROCKWELL C49 MAX.
PLATING: 800°F NUTS: SILVER PLATE IN ACCORDANCE WITH AMS2410. PLATE THICKNESS, MEASURED ON ANY EXTERNAL SURFACE OF THE NUT, SHALL NOT BE LESS THAN 0.0002 IN: THREADS SHALL SHOW COMPLETE COVERAGE BUT THICKNESS REQUIREMENT ON THREAD IS WAIVED. NO SILVER PLATE ON WELD NIBS.
LUBRICANT: 450° NUTS, DRY FILM LUBRICANT IN ACCORDANCE WITH MIL-N-25027. FOR USAF APPLICATIONS NUTS TREATED WITH DRY FILM LUBRICANTS SHALL NOT BE USED IN INTERNAL FUEL SYSTEMS. (NO SILVER PLATE.)

MAGNETIC PERMEABILITY: SHALL BE LESS THAN 2.0 (AIR 1.0) FOR A FIELD STRENGTH H=200 OERSTEDS USING A MAGNETIC PERMEABILITY INDICATOR PER MIL-I-17214 OR EQUIVALENT.

DIMENSIONS IN INCHES UNLESS OTHERWISE SPECIFIED.

DESIGN AND USAGE LIMITATIONS: THESE NUTS ARE DESIGNED TO DEVELOP THE TENSILE STRENGTH OF BOLTS AND SCREWS WITH AN ULTIMATE TENSILE STRENGTH OF 125 KSI BASED ON THE CROSS SECTION AREA AT THE BASIC ROOT DIAMETER OF THE THREAD. THESE NUTS ARE DESIGNED TO BE USED ON 3A EXTERNAL THREADS. THESE NUTS SHALL BE USED IN ACCORDANCE WITH THE LIMITATIONS OF MS33588. ONLY NUTS FOR WHICH THERE ARE QUALIFIED PRODUCTS LISTED ON QPL 25027 SHALL BE USED.

PERFORMANCE:
SEE PROCUREMENT SPECIFICATIONS, EXCEPT 450° DRY FILM LUBRICATED NUTS LIMITED TO FIVE REUSE CYCLES.

SURFACE ROUGHNESS IN ACCORDANCE WITH MIL-STD-10, UNLESS OTHERWISE SPECIFIED, THE SURFACE ROUGHNESS SHALL NOT EXCEED 125 MICRO INS.

INTERCHANGEABILITY RELATIONSHIP: MS21052 NUTS CAN UNIVERSALLY REPLACE NAS 682 NUTS OF LIKE MATERIAL, THREAD SIZE, (STATUS NOTES) LUBRICANT (DRY FILM OR NON-DRY FILM LUBRICANT), AND FASTENING METHOD (PLAIN RIVET HOLES: DIMPLED OR C'SUNK RIVET HOLES, OR PROJECTION WELDING). BUT THESE NAS 682 NUTS CANNOT UNIVERSALLY REPLACE MS21052 NUTS. FOR DEFINITION AND APPLICATION OF DRAWING STATUS NOTES SEE MIL-STD-32.

THIS STANDARD TAKES PRECEDENCE OVER DOCUMENTS REFERENCED HEREIN.

REFERENCED DOCUMENTS SHALL BE OF THE ISSUE IN EFFECT ON DATE OF INVITATION FOR BID.

Ⓐ FOR CHANGES SEE SHEETS 1 AND 2.

F05-037S01

Figure 5-38. Drawing MS21052(ASG) (Sheet 1 of 2)

Ⓐ THREAD SIZE MIL-S-8879/MOD.	DASH NUMBERS					
	450°F.			800°F.		
	PLAIN HOLES	COUNTER SUNK OR DIMPLED HOLES	WELDING PROJECTIONS	PLAIN HOLES	COUNTER SUNK OR DIMPLED HOLES	WELDING PROJECTIONS
6-32UNC-3B	L06	L06K	L06W	-06	-06K	-06W
8-32UNC-3B	L08	L08K	L08W	-08	-08K	-08W
10-32UNF-3B	L3	L3K	L3W	-3	-3K	-3W
1/4-28UNF-3B	L4	L4K	L4W	-4	-4K	-4W
5/16-24UNF-3B	L5	L5K	L5W	-5	-5K	-5W
3/8-24UNF-3B	L6		L6W	-6		-6W
7/16-UNF-3B	L7		L7W	-7		-7W

EXAMPLE OF PART NUMBER:

MS 21052 L4K

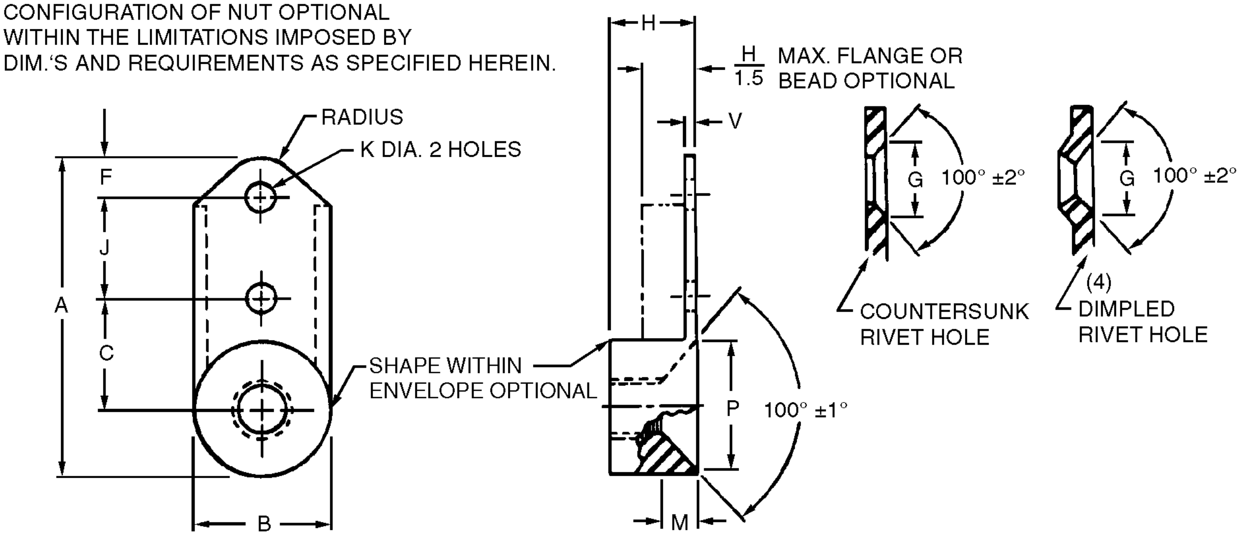
1/4-28UNF-3B NUT, SELF-LOCKING, CRES,
125 KSI Ftu, 450°, ONE LUG, LOW WEIGHT,
C'SUNK OR DIMPLED HOLES.

NUT DASH NUMBER

STANDARD IDENTIFICATION NUMBER

F05-037S02

Figure 5-38. Drawing MS21052(ASG) (Sheet 2)



(1) A THREAD SIZE MIL-S-8879/MOD.	A MAX.	B		C +.005	F MIN.	G DIA. +.010	2 H MAX	3 J +.002	K DIA. +.005 -.000	M REF	P DIA +.005	V MAT'L MAX.	AXIAL STRENGTH LBS. MIN.	WEIGHT LBS/100 MAX.
		MAX.	MIN.											
8-32 UNC-3B	.997	.422	.380	.344	.100	.200	.272	.312	.098	.084	.385	.047	1,720	.43
10-32 UNF-3B	1.013	.453	.408	.344	.100	.200	.281	.312	.098	.093	.411	.047	2,480	.44
1/4-28 UNF-3B	1.252	.619	.535	.500	.100	.200	.340	.312	.098	.121	.540	.055	4,580	.88
5/18-24 UNF-3B	1.340	.788	.681	.500	.125	.230	.422	.312	.130	.158	.686	.065	7,390	1.17

A

(1) THREADS BEFORE LUBRICATION PER MIL-S-6879. THREADS IN ACCORDANCE WITH MIL-S-7742 ARE ACCEPTABLE UNTIL 31 DECEMBER 1969.

(2) MINIMUM "H" NOT SPECIFIED, LIMITED ONLY BY STRENGTH REQUIREMENTS.
(3) CENTER OF THE TAPPED HOLE SHALL NOT DEVIATE IN ANY DIRECTION FROM THE CENTER OF THE PLATE NUT AS DETERMINED BY THE RIVET HOLES BY MORE THAN .005.
(4) DIMPLED HOLE TOLERANCE FOR "K" IS +.015, -.000 AFTER FORMING.

MATERIAL: STEEL.

PLATING: CADMIUM PLATE IN ACCORDANCE WITH QQ-P-418, TYPE II, CLASS 3. FOR DRY FILM LUBRICATED NUTS, THE TYPE AND CLASS ARE OPTIONAL IF THE NUTS MEET THE SALT SPRAY REQUIREMENTS OF QQ-P-418, TYPE II.

HARDNESS: ROCKWELL C49 MAXIMUM.

LUBRICANT: DRY FILM LUBRICANT APPROVED IN ACCORDANCE WITH MIL-N-25027. OTHER LUBRICANTS SOLUBLE IN THE CLEANER SPECIFIED IN MIL-S-7502. FOR USAF APPLICATIONS, NUTS TREATED WITH DRY FILM LUBRICANTS SHALL NOT BE USED IN INTERNAL FUEL SYSTEMS APPLICATIONS.

DIMENSIONS IN INCHES.

SURFACE ROUGHNESS IN ACCORDANCE WITH MIL-STD-10, UNLESS OTHERWISE SPECIFIED, THE SURFACE ROUGHNESS SHALL NOT EXCEED 125 MICRO INCHES.

DESIGN AND USAGE LIMITATIONS: THESE NUTS ARE DESIGNED TO DEVELOP THE TENSILE STRENGTH OF BOLTS AND SCREWS WITH AN ULTIMATE TENSILE STRENGTH OF 125 KSI BASED ON A CROSS SECTIONAL AREA AT THE BASIC ROOT DIAMETER OF THE THREAD. THESE NUTS ARE DESIGNED TO BE USED ON 3A EXTERNAL THREADS. THESE NUTS SHALL BE USED IN ACCORDANCE WITH THE LIMITATIONS OF MS 33588. ONLY NUTS FOR WHICH THERE ARE QUALIFIED PRODUCTS LISTED ON QPL 25027 SHALL BE USED.

(STATUS NOTE)

INTERCHANGEABILITY RELATIONSHIP: MS 21653 NUTS CAN UNIVERSALLY REPLACE NAS 683, NUTS OF LIKE MATERIAL, THREAD SIZE PLATING, LUBRICANTS (DRY FILM, OR NON DRY FILM). RIVET SPACING, AND FASTENING METHOD (PLAIN RIVET HOLES, DIMPLED, COUNTERSUNK RIVET HOLES OR PROJECTION WELDING). BUT NAS 683 NUTS CANNOT UNIVERSALLY REPLACE MS 21053 NUTS. FOR DEFINITION AND APPLICATION OF DRAWING STATUS NOTES, SEE MIL-STD-32.

THIS STANDARD TAKES PRECEDENCE OVER DOCUMENTS REFERENCED HEREIN.

REFERENCED DOCUMENTS SHALL BE OF THE ISSUE IN EFFECT ON DATE OF INVITATION FOR BIDS.

Ⓐ FOR CHANGES SEE SHEETS 1 AND 2.

F05-038S01

Figure 5-39. Drawing MS21053(ASG) (Sheet 1 of 2)

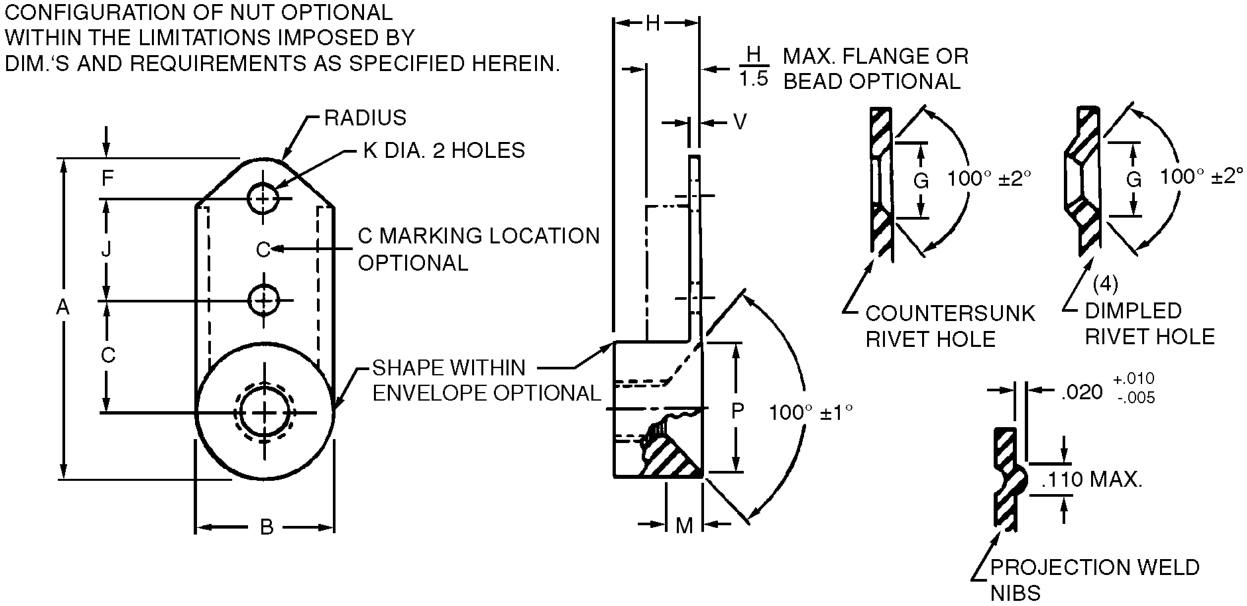
Ⓐ THREAD SIZE MIL-S-8879/MOD.	DASH NUMBERS			
	450°F. NON DRY FILM LUBRICATED		450°F. DRY FILM LUBRICATED	
	PLAIN HOLES	C'SUNK OR DIMPLED HOLES	PLAIN HOLES	C'SUNK OR DIMPLED HOLES
8-32 UNC-3B	-08	-08K	L08	L08K
10-32 UNF-3B	-3	-3K	L3	L3K
1/4-28 UNF-3B	-4	-4K	L4	L4K
5/16-24 UNF-3B	-5	-5K	L5	L5K

EXAMPLE OF PART NUMBER:

1/4-28 UNF-3B NUT, SELF LOCKING, ONE LUG, STEEL, 125 KSI, 450°F., DRY FILM LUBRICATED, WITH COUNTERSUNK OR DIMPLED RIVET HOLES.

F05-038S02

Figure 5-39. Drawing MS21053(ASG) (Sheet 2)



(1) Ⓐ THREAD SIZE MIL-S-8879/MOD.	A MAX.	B		C +.005	F MIN.	G DIA. +.010	2 H MAX	3 J +.002	K DIA. +.005 -.000	M REF	P DIA +.005	V MAT'L MAX.	AXIAL STRENGTH LBS. MIN.	WEIGHT LBS/100 MAX.
		MAX.	MIN.											
8-32 UNC-3B	.997	.422	.380	.344	.100	.200	.272	.312	.098	.084	.385	.047	1,720	.43
10-32 UNF-3B	1.013	.453	.408	.344	.100	.200	.281	.312	.098	.093	.411	.047	2,480	.44
1/4-28 UNF-3B	1.252	.619	.535	.500	.100	.200	.340	.312	.098	.121	.540	.055	4,580	.88
5/18-24 UNF-3B	1.340	.788	.681	.500	.125	.230	.422	.312	.130	.158	.686	.065	7,390	1.17

(1) THREADS BEFORE LUBRICATION PER MIL-S-80879. THREADS IN ACCORDANCE WITH MIL-S-7742 ARE ACCEPTABLE UNTIL 31 DECEMBER 1969.

(2) MINIMUM "H" NOT SPECIFIED, LIMITED ONLY BY STRENGTH REQUIREMENTS.

(3) CENTER OF THE TAPPED HOLE SHALL NOT DEVIATE IN ANY DIRECTION FROM THE CENTER OF THE PLATE NUT AS DETERMINED BY THE RIVET HOLES BY MORE THAN .005.

(4) DIMPLED HOLE TOLERANCE FOR "K" IS +.0015, -.000 AFTER FORMING.

MATERIAL: CORROSION RESISTANT STEEL, (A288) AMS 5525, AMS 5735, OR AMS 5737.

PLATING: 100°F. NUTS ONLY SILVER PLATE IN ACCORDANCE WITH AMS 2410. PLATE THICKNESS, MEASURED ON ANY EXTERNAL SURFACE OF THE NUT SHALL NOT BE LESS THAN 0.0002 IN; THREADS SHALL SHOW COMPLETE COVERAGE BUT THICKNESS REQUIREMENTS ON THREAD IS WAIVED. NO SILVER PLATE ON WELD RIBS.

MAGNETIC PERMEABILITY: SHALL BE LESS THAN 2.0 (AIR-1.0) FOR A FIELD STRENGTH H-200 OERSTEDS USING A MAGNETIC PERMEABILITY INDICATOR PER MIL-I-17214, OR EQUIVALENT.

HARDNESS: ROCKWELL C49 MAXIMUM.

LUBRICANT: 450°F NUTS ONLY. DRY FILM LUBRICANT IN ACCORDANCE WITH MIL-N-25027 FOR USAF APPLICATIONS, NUTS TREATED WITH DRY FILM LUBRICANTS SHALL NOT BE USED IN INTERNAL FUEL SYSTEMS.

DIMENSIONS IN INCHES.

SURFACE ROUGHNESS IN ACCORDANCE WITH MIL-STD-10. UNLESS OTHERWISE SPECIFIED, THE SURFACE ROUGHNESS SHALL NOT EXCEED 125 MICRO INCHES.

PERFORMANCE: SEE PROCUREMENT SPECIFICATION, EXCEPT 450°F. DRY FILM LUBRICATED NUTS LIMITED TO FIVE REUSE CYCLES.

DESIGN AND USAGE LIMITATIONS: THESE NUTS ARE DESIGNED TO DEVELOP THE TENSILE STRENGTH OF BOLTS AND SCREWS WITH AN ULTIMATE TENSILE STRENGTH OF 125 KSI BASED ON THE CROSS SECTIONAL AREA AT THE BASIC ROOT DIAMETER OF THE THREAD. THESE NUTS ARE DESIGNED TO BE USED ON 3A EXTERNAL THREADS. THESE NUTS SHALL BE USED IN ACCORDANCE WITH THE LIMITATIONS OF MS 33588. ONLY NUTS FOR WHICH THERE ARE QUALIFIED PRODUCTS LISTED ON QPL 25827 SHALL BE USED.

INTERCHANGEABILITY RELATIONSHIP: MS 21054 NUTS CAN UNIVERSALLY REPLACE MAS 683 NUTS OF LIKE MATERIAL, THREAD SIZE, PLATING, LUBRICANTS (SILVER PLATE OR DRY FILM LUBRICANT), RIVET SPACING, AND FASTENING METHOD (PLAIN RIVET HOLES, DISPLEU, COUNTERSUNK RIVET HOLES OR PROJECTION WELDING). BUT HAS 003 NUTS CANNOT UNIVERSALLY REPLACE MS 21054 NUTS, FOR DEFINITION AND APPLICATION OF DRAWING STATUS NOTES. SEE MIL-STD-32.

(STATUS NOTE)

THIS STANDARD TAKES PRECEDENCE OVER DOCUMENTS REFERENCED HEREIN.
REFERENCED DOCUMENTS SHALL BE OF THE ISSUE IN EFFECT ON DATE OF INVITATION FOR BIDS.

F05-039S01

Figure 5-40. Drawing MS21054(ASG) (Sheet 1 of 2)

Ⓐ	DASH NUMBERS					
	800°F.			450°F.		
THREAD SIZE MIL-S-8879/MOD.	PLAIN HOLES	C'SUNK OR DIMPLED HOLES	WELDING PROJECTION	PLAIN HOLES	C'SUNK OR DIMPLED HOLES	WELDING PROJECTION
8-32 UNC-3B	-08	-08K	-08W	L08	L08K	L08W
10-32 UNF-3B	-3	-3K	-3W	L3	L3K	L3W
1/4-28 UNF-3B	-4	-4K	-4W	L4	L4K	L4W
5/16-24 UNF-3B	-5	-5K	-5W	L5	L5K	L5W

EXAMPLE OF PART NUMBER:

MS 21054L4K

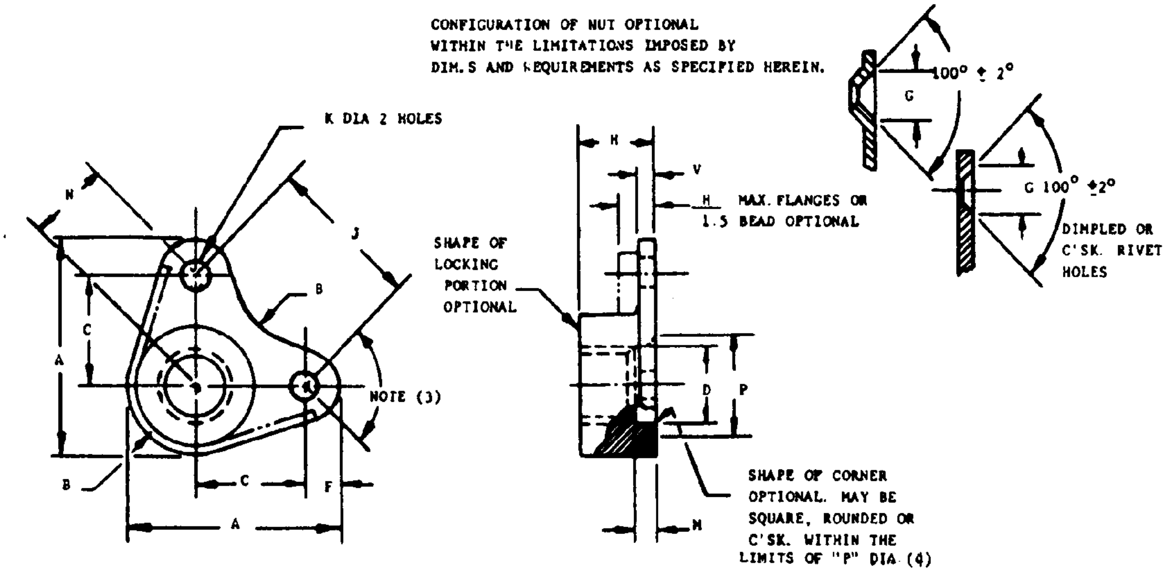
NUT DASH NUMBER

STANDARD IDENTIFICATION NUMBER

1/4-28 UNF-3B NUT, SELF LOCKING, ONE LUG, CRES., 125 KSI, 450°F, 800°F., DRY FILM LUBRICATED WITH COUNTERSUNK OR DIMPLED RIVET HOLES.

F05-039S02

Figure 5-40. Drawing MS21054(ASG) (Sheet 2)



(1) Ⓐ THREAD SIZE MIL-S-8879/MOD.	A MAX.	B		C ±.005	D DIA. MIN.	F MIN.	G DIA. ±.010	(2) H MAX.	(3) J ±.002	(5) K DIA. +.005 -.000	M MIN.	N MAX.	P DIA. MAX.	V MAX.	AXIAL STRENGTH LBS. MIN.	WEIGHT LBS/100
		MAX.	MIN.													
6-32UNC-3B	.637	.133	.108	.344	—	.100	.200	.171	.486	.098	—	.270	.206	.047	1,130	.25
8-32UNC-3B	.637	.149	.125	.344	.168	.100	.200	.250	.486	.098	—	.270	.248	.047	1,720	.28
10-32UNF-3B	.653	.164	.145	.344	.194	.100	.200	.250	.486	.098	.062	.270	.274	.047	2,460	.29
1/4-28UNF-3B	.852	.207	.185	.500	.254	.100	.200	.281	.707	.098	.062	.383	.344	.055	4,580	.58
5/16-24UNF-3B	.914	.248	.216	.500	.317	.125	.230	.328	.707	.130	.062	.383	.417	.065	7,390	.85
3/8-24UNF-3B	.968	.307	.290	.500	.379	.125	—	.344	.707	.130	.062	.383	.505	.075	11,450	1.31
7/16-20UNF-3B	1.101	.363	.340	.562	.442	.156	—	.390	.795	.161	.062	.427	.602	.085	15,450	1.84

(1) THREADS BEFORE LUBRICATION PER MIL-S-8879. THREADS IN ACCORDANCE WITH MIL-S-7742 ARE ACCEPTABLE UNTIL 31 DECEMBER 1969.
(2) MINIMUM "H" NOT SPECIFIED, LIMITED ONLY BY STRENGTH REQUIREMENTS OF SPECIFICATION.
(3) CENTER OF THE TAPPED HOLE SHALL NOT DEVIATE IN ANY DIRECTION FROM THE CENTER OF THE PLATE NUT AS DETERMINED BY THE RIVET HOLES BY MORE THAN .005.
(4) ON SIZE NO. 8 AND LARGER COUNTERBORE THREAD "D" DIA. X .062 DEEP MIN THREAD RELIEF: ON SIZE NO. 6 AND SMALLER C'SUNK TO "P" DIA. WITHIN THE LIMITS OF D, P AND M.
(5) DIMPLED RIVET HOLE TOLERANCE FOR "K" IS +.015, -.000.

MATERIAL: STEEL.
HARDNESS: ROCKWELL C49 MAX.
PLATING: CADMIUM PLATE IN ACCORDANCE WITH QQ-P-416 TYPE II, CLASS 3. FOR DRY FILM LUBRICANT NUTS, THE TYPE AND CLASS ARE OPTIONAL IF THE NUTS MEET THE SALT SPRAY REQUIREMENTS OF QQ-P-416 TYPE II.

LUBRICANT: DRY FILM LUBRICANT APPROVED IN ACCORDANCE WITH MIL-N-25027. OTHER LUBRICANTS SOLUBLE IN THE CLEANER SPECIFIED IN MIL-S-7502. FOR USAF APPLICATIONS, NUTS TREATED BY DRY FILM LUBRICANT, SHALL NOT BE USED IN INTERNAL FUEL SYSTEMS APPLICATIONS.

DIMENSIONS IN INCHES UNLESS OTHERWISE SPECIFIED.

DESIGN AND USAGE LIMITATIONS: THESE NUTS ARE DESIGNED TO DEVELOP THE TENSILE STRENGTH OF BOLTS AND SCREWS WITH AN ULTIMATE TENSILE STRENGTH OF 125 KSI BASED ON THE CROSS SECTION AREA AT THE BASIC ROOT DIAMETER OF THE THREAD. THESE NUTS ARE DESIGNED TO BE USED ON 3A EXTERNAL THREADS. THESE NUTS SHALL BE USED IN ACCORDANCE WITH THE LIMITATIONS OF MS33588. ONLY NUTS FOR WHICH THERE ARE QUALIFIED PRODUCTS LISTED ON QPL 25027 SHALL BE USED.

SURFACE ROUGHNESS IN ACCORDANCE WITH MIL-STD-10, UNLESS OTHERWISE SPECIFIED, THE SURFACE ROUGHNESS SHALL NOT EXCEED 125 MICRO INCHES.

INTERCHANGEABILITY RELATIONSHIP: MS21055 NUTS CAN UNIVERSALLY REPLACE NAS 684 NUTS OF LIKE MATERIAL, THREAD SIZE, LUBRICANT (DRY FILM OR NON-DRY FILM LUBRICANT), AND FASTENING METHOD (PLAIN RIVET HOLES: DIMPLED OR C'SUNK RIVET HOLES) BUT THESE NAS 684 NUTS CANNOT UNIVERSALLY REPLACE MS21055 NUTS. FOR DEFINITION AND APPLICATION OF DRAWING STATUS NOTES SEE MIL-STD-32.
(STATUS NOTES)

THIS STANDARD TAKES PRECEDENCE OVER DOCUMENTS REFERENCED HEREIN.

REFERENCED DOCUMENTS SHALL BE OF THE ISSUE IN EFFECT ON DATE OF INVITATION FOR BID.

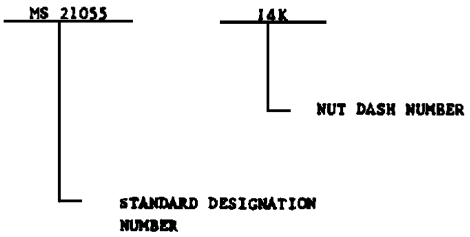
Ⓐ FOR CHANGES SEE SHEETS 1 AND 2.

F05-040S01

Figure 5-41. Drawing MS21055(ASG) (Sheet 1 of 2)

THREAD Ⓐ SIZE MIL-S-8879/MOD.	DASH NUMBERS			
	PLAIN RIVET HOLES		COUNTER SUNK OR DIMPLED RIVET HOLES	
	NON-DRY FILM LUBRICANT	DRY FILM LUBRICANT	NON-DRY FILM LUBRICANT	DRY FILM LUBRICANT
6-32UNC-3B	-06	L06	-06K	L06K
8-32UNC-3B	-08	L08	-08K	L08K
10-32UNF-3B	-3	L3	-3K	L3K
1 4-28UNF-3B	-4	L4	-4K	L4K
5/16-24UNF-3B	-5	L5	-5K	L5K
3/8-24UNF-3B	-6	L6		
7/16-20UNF-3B	-7	L7		

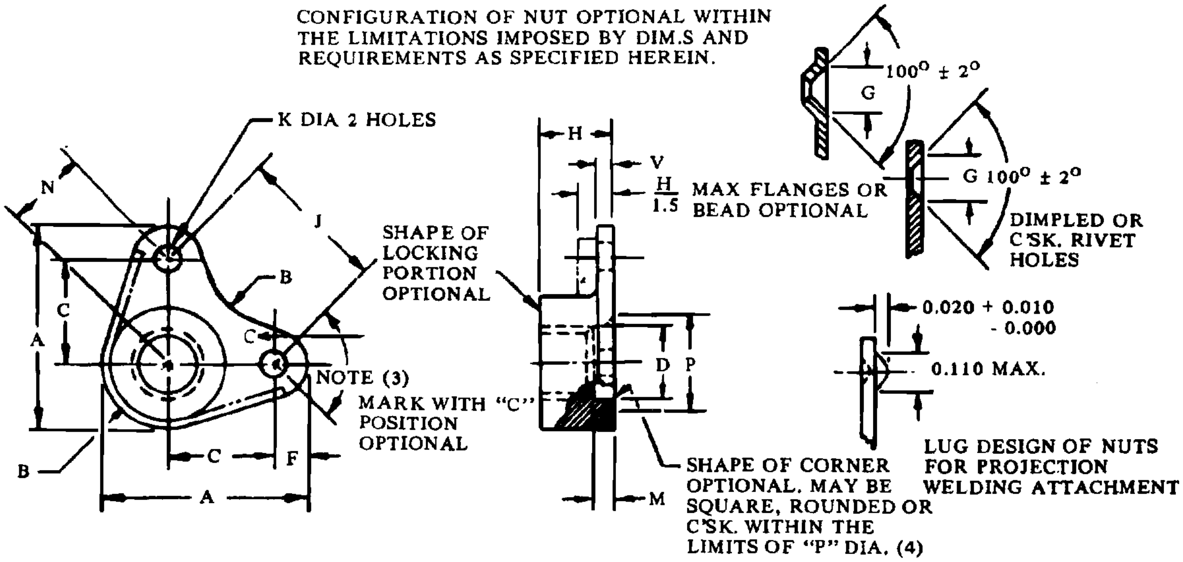
EXAMPLE OF PART NUMBERS:



1/4-28UNF-3B NUT, SELF LOCKING, ALL METAL CADMIUM PLATED, DRY FILM LUBRICATED, C'SUNK OR DIMPLED RIVET HOLES, 450°.

F05-040S02

Figure 5-41. Drawing MS21055(ASG) (Sheet 2)



(1) Ⓐ THREAD SIZE MIL-S-8879/MOD.	A MAX.	B		C ±.005	D DIA. MIN.	F MIN.	G DIA. ±.010	(2) H MAX.	(3) J ±.002	(5) K DIA. +.005 -.000	M MIN.	N MAX.	F DIA MAX.	V MAX.	AXIAL STRENGTH LBS. MIN.	WEIGHT LBS./100
		MAX.	MIN.													
6-32UNC-3B	.637	.133	.108	.344		.100	.200	.171	.486	.098	—	.270	.206	.047	1,130	.25
8-32UNC-3B	.637	.149	.125	.344	.168	.100	.200	.250	.486	.098	—	.270	.248	.047	1,720	.28
10-32UNF-3B	.853	.164	.145	.344	.194	.100	.200	.250	.486	.098	.062	.270	.274	.047	2,460	.29
1/4-28UNF-3B	.852	.207	.185	.500	.254	.100	.200	.281	.707	.098	.062	.383	.344	.055	4,580	.58
5/16-25UNF-3B	.914	.248	.216	.500	.317	.125	.230	.328	.707	.130	.062	.383	.417	.065	7,390	.85
3/8-24UNF-3B	.968	.307	.290	.500	.379	.125	—	.344	.707	.130	.062	.383	.505	.075	11,450	1.31
7/16-20UNF-3B	1.101	.363	.340	.562	.442	.156	—	.390	.795	.161	.062	.427	.602	.085	15,450	1.84

Ⓐ(1) THREADS BEFORE LUBRICATION PER MIL-S-8879. THREADS IN ACCORDANCE WITH MIL-S-7742 ARE ACCEPTABLE UNTIL 31 DECEMBER 1969.

(2) MINIMUM "H" NOT SPECIFIED, LIMITED ONLY BY STRENGTH REQUIREMENTS OF SPECIFICATION.

(3) CENTER OF TAPPED HOLE SHALL NOT DEVIATE IN ANY DIRECTION FROM THE CENTER OF THE PLATE NUT AS DETERMINED BY THE RIVET HOLES BY MORE THAN .005.

(4) ON SIZE NO. 8 AND LARGER COUNTERBORE THREAD "D" DIA. X.062 DEEP MIN. THREAD RELIEF: ON SIZE NO. 6 AND SMALLER C'SINK TO "P" DIA. WITHIN THE LIMITS OF D, P AND M.

(5) DIMPLED RIVET HOLE TOLERANCE FOR "K" IS +.015-.000.

MATERIAL: CORROSION RESISTANT STEEL, (A286) AMS5525, AMS5735 OR AMS5737.

HARDNESS: ROCKWELL C49 MAX.

PLATING: 800°F NUTS, SILVER PLATE IN ACCORDANCE WITH AMS2410. PLATE THICKNESS, MEASURED ON ANY EXTERNAL SURFACE OF THE NUT. SHALL NOT BE LESS THAN 0.0002 IN; THREADS SHALL SHOW COMPLETE COVERAGE BUT THICKNESS REQUIREMENT ON THREAD IS WAIVED, NO SILVER PLATE ON WELD NIBS.

LUBRICANT: 450° NUTS, DRY FILM LUBRICANT IN ACCORDANCE WITH MIL-N-25027. FOR USAF APPLICATIONS, NUTS TREATED WITH DRY FILM LUBRICANTS SHALL NOT BE USED IN INTERNAL FUEL SYSTEMS. (NO SILVER PLATE).

MAGNETIC PERMEABILITY: SHALL BE LESS THAN 2.0(AIR-1.0) FOR A FIELD STRENGTH H=200 OERSTEDS USING A MAGNETIC PERMEABILITY INDICATOR PER MIL-I-17214 OR EQUIVALENT.

DIMENSIONS IN INCHES UNLESS OTHERWISE SPECIFIED.

DESIGN AND USAGE LIMITATIONS: THESE NUTS ARE DESIGNED TO DEVELOP THE TENSILE STRENGTH OF BOLTS AND SCREWS WITH AN ULTIMATE TENSILE STRENGTH OF 125 KSI BASED ON THE CROSS SECTION AREA AT THE BASIC ROOT DIAMETER OF THE THREADS. THESE NUTS ARE DESIGNED TO BE USED ON 3A EXTERNAL THREADS. THESE NUTS SHALL BE USED IN ACCORDANCE WITH THE LIMITATIONS OF MS33588. ONLY NUTS FOR WHICH THERE ARE QUALIFIED PRODUCTS LISTED ON QPL 25027 SHALL BE USED.

PERFORMANCE: SEE PROCUREMENT SPECIFICATION, EXCEPT 450° DRY FILM LUBRICATED NUTS LIMITED TO FIVE REUSE CYCLES.

SURFACE ROUGHNESS IN ACCORDANCE WITH MIL-STD-10 UNLESS OTHERWISE SPECIFIED, THE SURFACE ROUGHNESS SHALL NOT EXCEED 125 MICRO INCHES.

INTERCHANGEABILITY RELATIONSHIP: MS 21056 NUTS CAN UNIVERSALLY REPLACE NAS 684. STEEL NUTS OF LIKE MATERIAL, THREAD SIZE LUBRICANT (SILVER PLATE ON DRY FILM LUBRICANT) AND FASTENING METHOD (PLAIN RIVET HOLES, DIMPLED OR C'SUNK RIVET HOLES: OR PROJECTION WELDING). BUT THESE NAS 684 NUTS CANNOT UNIVERSALLY REPLACE MS21056 NUTS. FOR DEFINITION AND APPLICATIONS OF DRAWING STATUS NOTES SEE MIL-STD-32.

(STATUS NOTE)

THIS STANDARD TAKES PRECEDENCE OVER DOCUMENTS REFERENCED HEREIN.

REFERENCED DOCUMENTS SHALL BE OF THE ISSUE IN EFFECT ON DATE OF INVITATIONS FOR BID.

Ⓐ FOR CHANGES SEE SHEETS 1 AND 2.

F05-041S01

Figure 5-42. Drawing MS21056(ASG) (Sheet 1 of 2)

THREAD SIZE Ⓐ MIL-S-8879/MOD.	DASH NUMBERS					
	450° F			800° F		
	PLAIN HOLES	COUNTER SUNK AND DIMPLED HOLES	WELDING PROJECTIONS	PLAIN HOLES	COUNTER SUNK AND DIMPLED HOLES	WELDING PROJECTION
6-32UNC-3B	L06	L06K	L06W	-06	-06K	-06W
8-32UNC-3B	L08	L08K	L08W	-08	-08K	-08W
10-32UNF-3B	L3	L3K	L3W	-3	-3K	-3W
1/4-28UNF-3B	L4	L4K	L4W	-4	-4K	-4W
5/16-24UNF-3B	L5	L5K	L5W	-5	-5K	-5W
3/8-24UNF-3B	L6		L6W	-6		-6W
7/16-20UNF-3B	L7		L7W	-7		-7W

(6) EXAMPLE OF PART NUMBER:

MS 21056 L4K

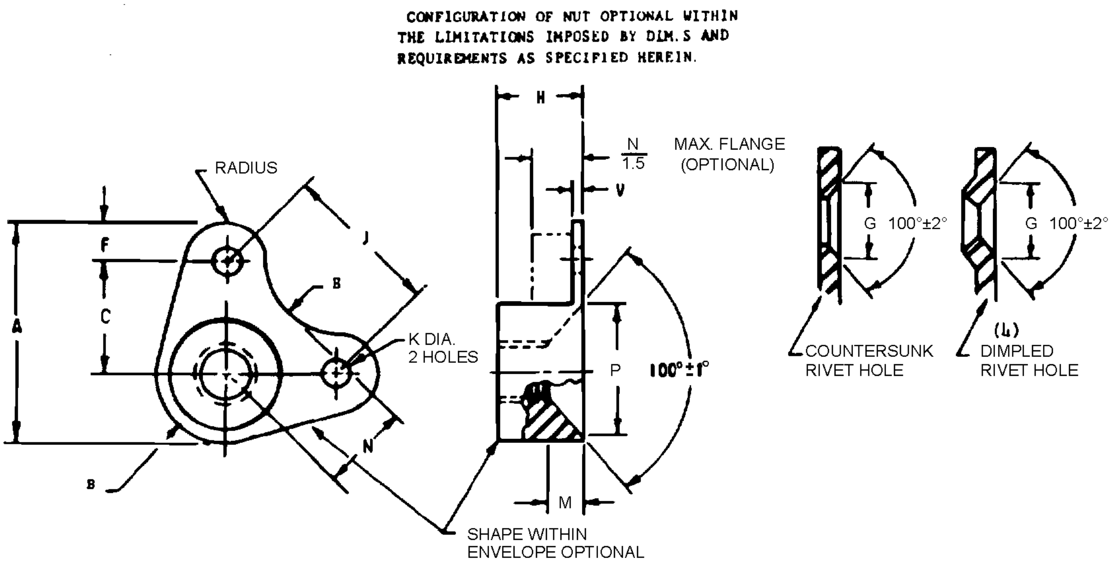
1'4-28UNF-3B NUT, SELF-LOCKING, CRES
125 KSI Ftu, 450° F, ONE LUG, LOW HEIGHT,
C'SUNK OR DIMPLED HOLES.

NUT DASH NUMBER

STANDARD DESIGNATION NUMBER

F05-041S02

Figure 5-42. Drawing MS21056(ASG) (Sheet 2)



(1) Ⓐ THREAD SIZE MIL-S-8879/MOD	A MAX.	B		C ±.005	F MIN.	G DIA. ± 010	(2) H MAX.	(3) J ±.002	K DIA. +.005 -.000	M REF.	N MAX.	P DIA. ±.005	V MAT'L MAX.	AXIAL STRENGTH LBS. MIN.	WEIGHT LBS/100 MAX.
		MAX.	MIN.												
8-32 UNC-3B	.788	.211	.180	.344	.100	.206	.272	.486	.096	.064	.278	.365	.947	1,720	.38
10-32 UNF-3B	.715	.227	.203	.344	.100	.206	.281	.486	.096	.063	.278	.411	.847	2,488	.41
1/4-28 UNF-3B	.955	.310	.267	.588	.100	.206	.348	.707	.096	.121	.383	.548	.955	4,588	.88
5/16-24 UNF-3B	1.844	.383	.340	.588	.125	.238	.422	.787	.138	.156	.383	.686	.985	2,396	1.17

Ⓐ
(1) THREADS BEFORE LUBRICATION PER MIL-S-8879. THREADS IN ACCORDANCE WITH MIL-S-7742 ARE ACCEPTABLE UNTIL 31 DECEMBER 1969.
(2) MINIMUM "H" NOT SPECIFIED, LIMITED ONLY BY STRENGTH REQUIREMENTS.
(3) CENTER OF THE TAPPED HOLE SHALL NOT DEVIATE IN ANY DIRECTION FROM THE CENTER OF THE PLATE NUT AS DETERMINED BY THE RIVET HOLES BY MORE THAN .005.
(4) DIMPLED HOLE TOLERANCE FOR "K" IS +.015, .000 AFTER FORMING.

MATERIAL: STEEL.

PLATING: CADMIUM PLATE IN ACCORDANCE WITH QQ-P-416, TYPE II, CLASS 3. FOR DRY FILM LUBRICATED NUTS, THE TYPE AND CLASS ARE OPTIONAL IF THE NUTS MEET THE SALT SPRAY REQUIREMENTS OF QQ-P-416, TYPE II.

HARDNESS: ROCKWELL 049 MAXIMUM.

LUBRICANT: DRY FILM LUBRICANT APPROVED IN ACCORDANCE WITH MIL-N-25027 . OTHER LUBRICANTS SOLUBLE IN THE CLEANER SPECIFIED IN MIL-S-7502. FOR USAF APPLICATIONS, NUTS TREATED WITH DRY FILM LUBRICANTS SHALL NOT BE USED IN INTERNAL FUEL SYSTEMS APPLICATIONS.

DIMENSIONS IN INCHES.

SURFACE ROUGHNESS IN ACCORDANCE WITH MIL-STD-10. UNLESS OTHERWISE SPECIFIED, THE SURFACE ROUGHNESS SHALL NOT EXCEED 125 MICRO INCHES.

DESIGN AND USAGE LIMITATIONS: THESE NUTS ARE DESIGNED TO DEVELOPE THE TENSILE STRENGTH OF BOLTS AND SCREWS WITH AN ULTIMATE TENSILE STRENGTH OF 125 KSI BASED ON A CROSS SECTIONAL AREA AT THE BASIC ROOT DIAMETER OF THE THREAD. THESE NUTS ARE DESIGNED TO BE USED ON 3A EXTERNAL THREADS. THESE NUTS SHALL BE USED IN ACCORDANCE WITH THE LIMITATIONS OF MS 33588. ONLY NUTS FOR WHICH THERE ARE QUALIFIED PRODUCTS LISTED ON QPL 25827 SHALL BE USED.

INTERCHANGEABILITY RELATIONSHIP: MS 21057 NUTS CAN UNIVERSALLY REPLACE NAS 885 NUTS OF LIKE MATERIAL, THREAD SIZE, PLATING, LUBRICANTS (DRY FILM, OR NON DRY FILM), RIVET SPACING, AND FASTENING METHOD (PLAIN RIVET HOLES, DIMPLED, COUNTERSUNK RIVET HOLES OR PROJECTION WELDING). BUT NAS 885 NUTS CANNOT UNIVERSALLY REPLACE MS 21097 NUTS, FOR DEFINITION AND APPLICATION OF DRAWING STATUS NOTES, SEE MIL-STD-32.

THIS STANDARD TAKES PRECEDENCE OVER DOCUMENTS REFERENCED HEREIN.

REFERENCED DOCUMENTS SHALL BE OF THE ISSUE IN EFFECT ON DATE OF INVITATIONS FOR BIDS.

Ⓐ FOR CHANGES SEE SHEETS 1 AND 2.

F05-042S01

Figure 5-43. Drawing MS21057(ASG) (Sheet 1 of 2)

Ⓐ	DASH NUMBERS			
	450°F. NON DRY FILM LUBRICATED		450°F DRY FILM LUBRICATED	
THREAD SIZE MIL-S-8879/MOD.	PLAIN HOLES	C SUNK OR DIMPLED HOLES	PLAIN HOLES	C SUNK OR DIMPLED HOLES
8-32 UNC-3B	-08	-08K	L08	-L08K
10-32 UNF-3B	-3	-3K	L3	-L3K
1/4-28 UNF-3B	-4	-4K	L4	-L4K
5/16-24 UNF-3B	-5	-45K	L5	-L5K

EXAMPLE OF PART NUMBER:

MS 21057L4K

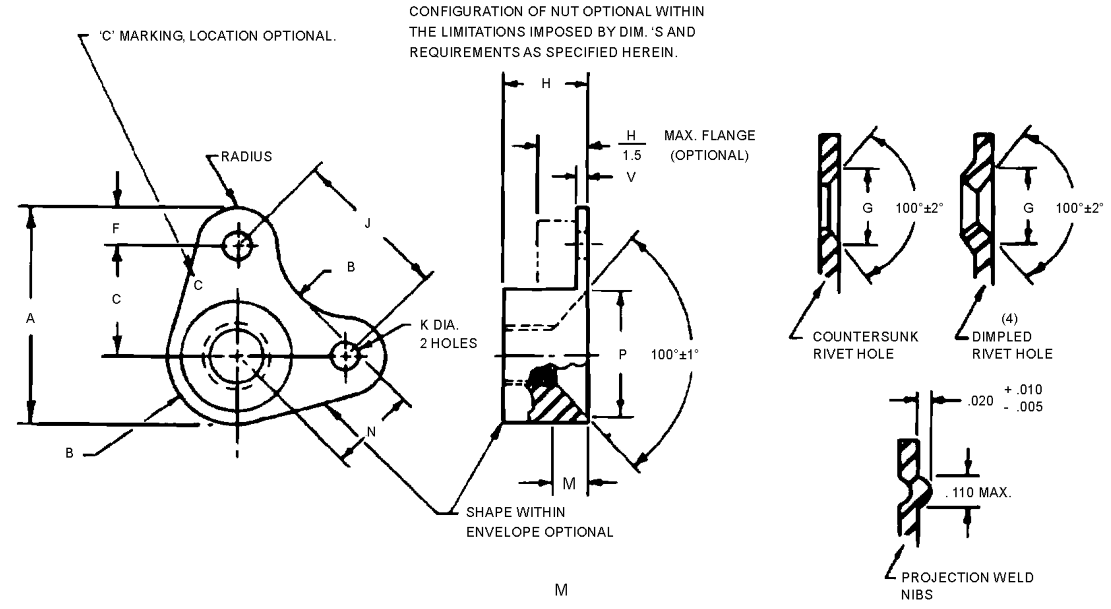
L4K — NUT DASH NUMBER

MS 21057 — STANDARD IDENTIFICATION NUMBER

1/4 - 28 UNF - 3B NUT, SELF LOCKING,
CORNER, STEEL, 123 KSI, 450° F.,
DRY FILM LUBRICATED, WITH COUNTERSUNK
OR DIMPLED RIVET HOLES.

F05-042S02

Figure 5-43. Drawing MS21057(ASG) (Sheet 2)



(1) THREAD Ⓐ SIZE MIL-S-8879/MOD.	A MAX.	B		C ±.005	F MIN.	G DIA. ±.010	(2) H MAX.	(3) J ±.002	K DIA. +.005 -.000	M REF.	N MAX.	P DIA. ±.005	V NAT'L MAX.	AXIAL STRENGTH LBS. MIN.	WEIGHT LBS/100 MAX.
		MAX.	MIN.												
8-32 UNC-3B	.700	.211	.180	.344	.100	.200	.272	.486	.098	.084	.270	.385	.847	1,720	.30
10-32 UNF-3B	.718	.227	.203	.344	.100	.200	.281	.486	.098	.093	.270	.411	.847	2,688	.41
1/4-28 UNF-3B	.855	.310	.267	.500	.100	.200	.340	.707	.098	.121	.383	.540	.055	4,500	.88
5/16-24 UNF-3B	1.044	.383	.340	.500	.125	.230	.422	.707	.130	.158	.383	.646	.085	7,390	1.17

Ⓐ(1) THREADS BEFORE LUBRICATION PER MIL-S-8879. THREADS IN ACCORDANCE WITH MIL-S-7742 ARE ACCEPTABLE UNTIL 31 DECEMBER 1969

(2) MINIMUM 'H' NOT SPECIFIED, LIMITED ONLY BY STRENGTH REQUIREMENTS.

(3) CENTER OF THE TAPPED HOLE SHALL NOT DEVIATE IN ANY DIRECTION FROM THE CENTER OF THE PLATE NUT AS DETERMINED BY THE RIVET HOLES BY MORE THAN .005.

(4) DIMPLED HOLE TOLERANCE FOR 'K' IS +.015, -.000 AFTER FORMING.

MATERIAL: CORROSION RESISTANT STEEL (A286) AMS 5525. AMS 5735, OR AMS 5737.

PLATING: 800°F, NUTS ONLY, SILVER PLATE IN ACCORDANCE WITH AMS 2410. PLATE THICKNESS, MEASURED ON ANY EXTERNAL SURFACE OF THE NUT, SHALL NOT BE LESS THAN 0.0002 IN; THREADS SHALL SHOW COMPLETE COVERAGE BUT THICKNESS REQUIREMENTS ON THREAD IS WAIVED. NO SILVER PLATE ON WELD NIBS.

MAGNETIC PERMEABILITY: SHALL BE LESS THAN 2.0 (AIR=1.0) FOR A FIELD STRENGTH H=200 OERSTEDS USING A MAGNETIC PERMEABILITY INDICATOR PER MIL-I-17214, OR EQUIVALENT.

HARDNESS: ROCKWELL C48 MAXIMUM.

LUBRICANT: 450°F, NUTS ONLY, DRY FILM LUBRICANT IN ACCORDANCE WITH MIL-N-25027. FOR USAF APPLICATIONS, NUTS TREATED WITH DRY FILM LUBRICANTS SHALL NOT BE USED IN INTERNAL FUEL SYSTEMS.

DIMENSIONS IN INCHES.

SURFACE ROUGHNESS IN ACCORDANCE WITH MIL-STD-10. UNLESS OTHERWISE SPECIFIED, THE SURFACE ROUGHNESS SHALL NOT EXCEED 125 MICRO INCHES.

PERFORMANCE: SEE PROCUREMENT SPECIFICATION. EXCEPT 450°F. DRY FILM LUBRICATED NUTS LIMITED TO FIVE REUSE CYCLES.

DESIGN AND USAGE LIMITATIONS: THESE NUTS ARE DESIGNED TO DEVELOPE THE TENSILE STRENGTH OF BOLTS AND SCREWS WITH AN ULTIMATE TENSILE STRENGTH OF 125 KSI BASED ON A CROSS SECTIONAL AREA AT THE BASIC ROOT DIAMETER OF THE THREAD. THESE NUTS ARE DESIGNED TO BE USED ON 3A EXTERNAL THREADS. THESE NUTS SHALL BE USED IN ACCORDANCE WITH THE LIMITATIONS OF MS 33588. ONLY NUTS FOR WHICH THERE ARE QUALIFIED PRODUCTS LISTED ON QPL 25027 SHALL BE USED.

INTERCHANGEABILITY RELATIONSHIP: MS 21958 NUTS CAN UNIVERSALLY REPLACE NAS 885 NUTS OF LIKE MATERIAL, THREAD SIZE, PLATING, LUBRICANTS (SILVER PLATE OR DRY FILM LUBRICANT). RIVET SPACING, AND, FASTENING METHOD (PLAIN RIVET HOLES, DIMPLED, COUNTERSUNK RIVET HOLES OR PROJECTION WELDING). BUT NAS 895 NUTS CANNOT UNIVERSALLY REPLACE MS 21058 NUTS, FOR DEFINITION AND APPLICATION OF DRAWING STATUS NOTES, SEE MIL-STD-32.

(STATUS NOTE)

THIS STANDARD TAKES PRECEDENCE OVER DOCUMENTS REFERENCED HEREIN.

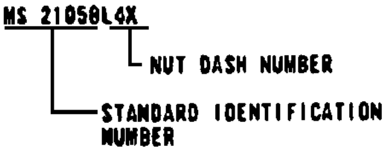
REFERENCED DOCUMENTS SHALL BE OF THE ISSUE IN EFFECT ON DATE OF INVITATIONS FOR BIDS.

Ⓐ FOR CHANGES SEE SHEETS 1 AND 2. F05-043S01

Figure 5-44. Drawing MS21058(ASG) (Sheet 1 of 2)

THREAD Ⓐ SIZE MIL-S-8879/MOD-	DASK NUMBERS					
	800°F.			450°F.		
	PLAIN HOLES	C'SUNK OR DIMPLED HOLES	WELDING PROJECTION	PLAIN HOLES	C'SUNK OR DIMPLED HOLES	WELDING PROJECTION
8-32 UNC-3B	-08	-08K	-08W	-L08	-L08K	-L08W
10-32 UNF-3B	-3	-3K	-3W	-L3	-L3K	-L3W
1/4-20 UNF-3B	-4	-4K	-4W	-L4	-L4K	-L4W
5/18-24 UNF-3B	-5	-5K	-5W	-L5	-L5K	-L5W

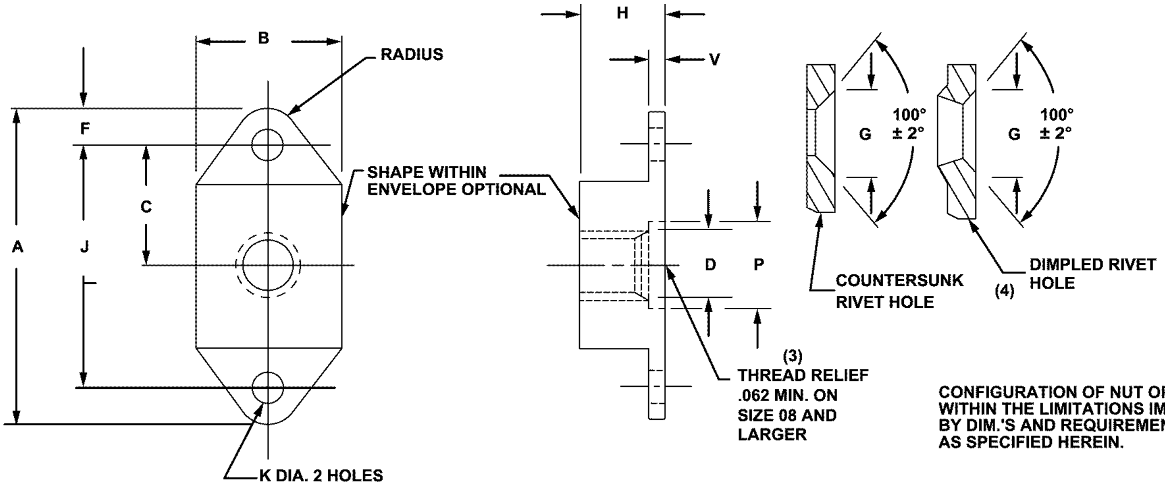
EXAMPLE OF PART NUMBER:



1/4-28 UNF-3B NUT, SELF LOCKING, CORNER, CRES., 125 KSI, 450°F., 800°F., DRY FILM LUBRICATED, WITH COUNTERSUNK OR DIMPLED RIVET HOLES.

F05-043S02

Figure 5-44. Drawing MS21058(ASG) (Sheet 2)



CONFIGURATION OF NUT OPTIONAL WITHIN THE LIMITATIONS IMPOSED BY DIM.'S AND REQUIREMENTS AS SPECIFIED HEREIN.

(1) THREAD SIZE Ⓐ MIL-S-8879/MOD.	A MAX.	B		C ± .005	D DIA. MIN.	F MIN.	G DIA. ± .010	(2) H MAX.	J ± .002	K DIA. + .005 - .005	P DIA.		V MAT'L MAX.	AXIAL STRENGTH LBS. MIN.	WEIGHT LBS/100 MAX.
		MAX.	MIN.								MAX.	MIN.			
4-40UNC-3B	.948	.416	.290	.344	—	.100	.200	.175	.688	.098	.270	.172	.032	750	.38
6-32UNC-3B	.948	.416	.290	.344	—	.100	.200	.203	.688	.098	.270	.198	.032	1,130	.39
8-32UNC-3B	.948	.416	.290	.344	.168	.100	.200	.250	.688	.098	.270	.224	.032	1,720	.40
10-32UNF-3B	.948	.416	.290	.344	.194	.100	.200	.250	.688	.098	.270	.250	.032	2,460	.41
1/4-28UNF-3B	1.292	.516	.350	.500	.254	.100	.200	.281	1.000	.098	.330	.310	.032	4,580	.90
5/16-24UNF-3B	1.292	.609	.412	.500	.317	.125	.230	.328	1.000	.130	.392	.372	.045	7,390	1.26
3/8-24UNF-3B	1.292	.680	.475	.500	.379	.125	-	.344	1.000	.130	.455	.435	.055	11,450	1.55

A (1) THREADS BEFORE LUBRICATION PER MIL-S-8879. THREADS IN ACCORDANCE WITH MIL-S-7742 ARE ACCEPTABLE UNTIL 31 DECEMBER 1969.

(2) MINIMUM "H" NOT SPECIFIED, LIMITED ONLY BY STRENGTH REQUIREMENT.
(3) SIZE NO. 06 AND SMALLER MAY BE COUNTERSUNK OR RADIUSED WITHIN "P" DIAMETER.
(4) DIMPLED HOLE TOLERANCE FOR "V" IS +.015, -.000 AFTER FORMING.

MATERIAL: STEEL

PLATING: CADMIUM PLATE IN ACCORDANCE WITH QQ-P-416, TYPE II, CLASS 3. FOR DRY FILM LUBRICATED NUTS, THE TYPE AND CLASS ARE OPTIONAL IF THE NUTS MEET THE SALT SPRAY REQUIREMENTS OF QQ-P-416, TYPE II

HARDNESS: RC 49 MAX.

LUBRICANT: DRY FILM LUBRICANT APPROVED IN ACCORDANCE WITH MIL-N-25027. OTHER LUBRICANTS SOLUBLE IN THE CLEANER SPECIFIED IN MIL-S-7502. FOR USAF APPLICATIONS, NUT TREATED WITH DRY FILMS LUBRICANTS SHALL NOT BE USED IN INTERNAL FUEL SYSTEMS APPLICATIONS.

FLOAT OF NUT PORTION OF ASSEMBLY SHALL NOT BE LESS THAN .030 RADIALLY FROM CENTERED POSITION. NUT ELEMENT SHALL BE CAPABLE OF ENGAGEMENT WITH BOLT IN THE MAXIMUM MISALIGNED POSITION.

DIMENSIONS IN INCHES.

SURFACE ROUGHNESS IN ACCORDANCE WITH MIL-STD-10. UNLESS OTHERWISE SPECIFIED, THE SURFACE ROUGHNESS SHALL NOT EXCEED 125 MICRO INCHES.

DESIGN AND USAGE LIMITATIONS: THESE NUTS ARE DESIGNED TO DEVELOP THE TENSILE STRENGTH OF BOLTS AND SCREWS WITH AN ULTIMATE TENSILE STRENGTH OF 125 KSI BASED ON THE CROSS SECTIONAL AREA AT THE BASIC ROOT DIAMETER OF THE THREAD. THESE NUTS ARE DESIGNED TO BE USED ON 3A EXTERNAL THREADS. THESE NUTS SHALL BE USED IN ACCORDANCE WITH THE LIMITATIONS OF MS 33588. ONLY NUTS FOR WHICH THESE ARE QUALIFIED PRODUCTS LISTED ON QPL 25027 SHALL BE USED.

INTERCHANGEABILITY RELATIONSHIP: MS 21059 NUTS CAN UNIVERSALLY REPLACE NAS 686 NUTS OF LIKE MATERIAL, THREAD SIZE, LUBRICANTS (DRY FILM OR NON DRY FILM), RIVET SPACING, AND FASTENING METHOD (PLAIN RIVET HOLES, DIMPLED OR COUNTERSUNK RIVET HOLES). BUT NAS 686 NUTS CANNOT UNIVERSALLY REPLACE MS 21059 NUTS. FOR DEFINITION AND APPLICATION OF DRAWING STATUS NOTES, SEE MIL-STD-32.

THIS STANDARD TAKES PRECEDENCE OVER DOCUMENTS REFERENCED HEREIN.

REFERENCED DOCUMENTS SHALL BE OF THE ISSUE IN EFFECT ON DATE OF INVITATIONS FOR BID.

Ⓐ FOR CHANGES SEE SHEETS 1 AND 2.

F05-044S01

Figure 5-45. Drawing MS21059(ASG) (Sheet 1 of 2)

Ⓐ THREAD SIZE MIL-S-8879/MOD.	DASH NUMBERS			
	PLAIN RIVET HOLES		C'SUNK OR DIMPLED RIVET HOLES	
	NON DRY FILM LUBE	DRY FILM LUBE	NON DRY FILM LUBE	DRY FILM LUBE
4-40 UNC-3B	-04	L04	-04K	L04K
6-32 UNC-3B	-06	L06	-06K	L06K
8-32 UNC-3B	-08	L08	-08K	L08K
10-32 UNF-3B	-3	L3	-3K	L3K
1/4-28 UNF-3B	-4	L4	-4K	L4K
5/16-24 UNF-3B	-5	L5	-5K	L5K
3/8-24 UNF-3B	-6	L6	—	—

EXAMPLE OF PART NUMBERS:

MS 21059 L4K

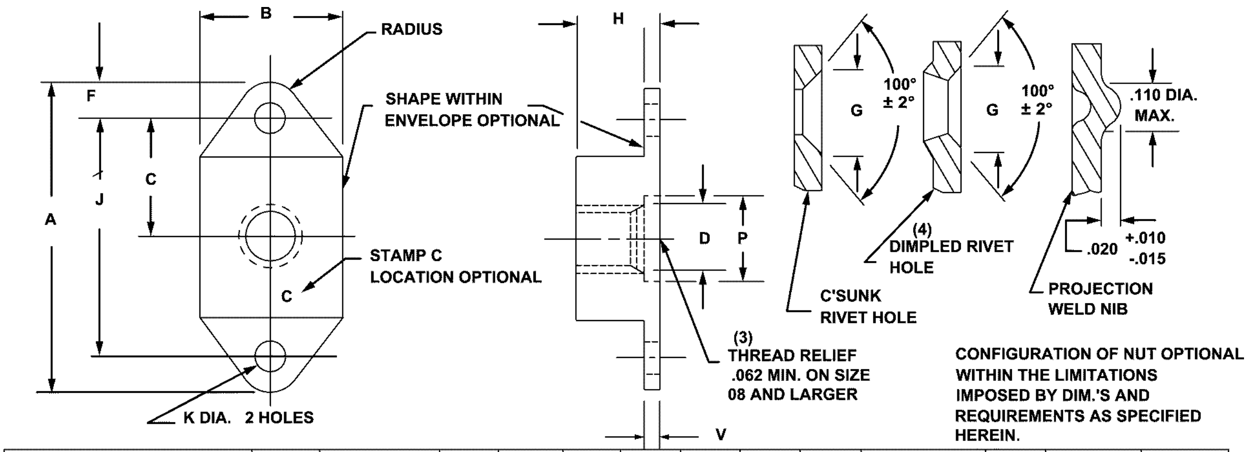
NUT DASH NUMBER

STANDARD
IDENTIFICATION NUMBER

1/4-28 UNF-38 NUT, SELF-LOCKING, TWO LUG,
FLOATING, STEEL, 125 KSI, 450°F,
CAD PLATED, DRY FILM LUBRICATED, C'SUNK OR
DIMPLED RIVET HOLES.

F05-044S02

Figure 5-45. Drawing MS21059(ASG) (Sheet 2)



CONFIGURATION OF NUT OPTIONAL WITHIN THE LIMITATIONS IMPOSED BY DIM.'S AND REQUIREMENTS AS SPECIFIED HEREIN.

(1) THREAD SIZE Ⓐ MIL-2-8879/MOD.	A MAX.	B		C ±.005	D DIA. MIN.	F MIN	G DIA. ± .010	(2) H MAX.	J ± .002	K DIA. + .005 - .000	P		V MAT'L MAX.	AXIAL STRENGTH LBS. MIN.	WEIGHT LBS./100 MAX.
		MAX.	MIN.								MAX.	MIN.			
4-40 UNC-3B	.948	.416	.290	.344	—	.100	.200	.175	.688	.098	.270	.172	.032	750	.38
6-32 UNC-3B	.948	.416	.290	.344	—	.100	.200	.203	.688	.098	.270	.198	.032	1,130	.39
8-32 UNC-3B	.948	.416	.290	.344	.168	.100	.200	.250	.688	.098	.270	.224	.032	1,720	.40
10-32 UNF-3B	.948	.416	.290	.344	.194	.100	.200	.250	.688	.098	.270	.250	.032	2,460	.41
1/4-28 UNF-3B	1.292	.516	.350	.500	.254	.100	.200	.281	.000	.098	.330	.310	.032	4,580	.90
5/16-24 UNF-3B	1.292	.609	.412	.500	.317	.125	.230	.328	.000	.130	.392	.372	.045	7,390	1.26
3/8-24 UNF-3B	1.292	.680	.475	.500	.379	.125	-	.344	.000	.130	.455	.435	.055	11,450	1.55

(1) THREADS BEFORE LUBRICATION PER MIL-S-8879. THREADS IN ACCORDANCE WITH MIL-S-7742 ARE ACCEPTABLE UNTIL Ⓐ 31 DECEMBER 1969

(2) MINIMUM "H" NOT SPECIFIED, LIMITED ONLY BY STRENGTH REQUIREMENTS
(3) SIZE NO. 06 AND SMALLER MAY BE COUNTERSUNK OR RADIUSED WITHIN "P" DIAMETER.
(4) DIMPLED HOLE TOLERANCE FOR "K" IS +.015, - .000 AFTER FORMING.

MATERIAL: CORROSION RESISTANT STEEL (A -286) PER AMS 5525, AMS 5735, OR AMS 5737.

PLATING: 800°F NUTS ONLY: SILVER PLATE PER AMS 2410. PLATE THICKNESS MEASURED ON ANY EXTERNAL SURFACE OF THE NUT, SHALL NOT BE LESS THAN 0.0002 IN; THREADS SHALL SHOW COMPLETE COVERAGE BUT THICKNESS REQUIREMENT ON THREAD IS WAIVED. NO SILVER PLATE ON WELD NIBS.

MAGNETIC PERMEABILITY: SHALL BE LESS THAN 2.0 (AIR = 1.0) FOR A FIELD A STRENGTH H = 200 OESTREDS USING A MAGNETIC PERMEABILITY INDICATOR PER MIL-I-17214, OR EQUIVALENT.

HARDNESS: Rc 49 MAX.

LUBRICANT: 450°F NUTS ONLY: DRY FILM LUBRICANT APPROVED IN ACCORDANCE WITH MIL-N-25027. FOR USAF APPLICATIONS, NUTS TREATED WITH DRY FILM LUBRICANTS SHALL NOT BE USED IN INTERNAL FUEL SYSTEMS APPLICATIONS.

FLOAT OF NUT PORTION OF ASSEMBLY SHALL NOT BE LESS THAN .030 RADIALLY FROM CENTERED POSITION.
NUT ELEMENT SHALL BE CAPABLE OF ENGAGEMENT WITH BOLT IN THE MAXIMUM MISALIGNED POSITION.

DIMENSIONS IN INCHES.

SURFACE ROUGHNESS IN ACCORDANCE WITH MIL-STD-10. UNLESS OTHERWISE SPECIFIED, THE SURFACE ROUGHNESS SHALL NOT EXCEED 125 MICRO INCHES.

PERFORMANCE: SEE PROCUREMENT SPECIFICATION, EXCEPT 450°F DRY FILM LUBRICATED NUTS LIMITED TO FIVE REUSE CYCLES.

DESIGN AND USAGE LIMITATIONS: THESE NUTS ARE DESIGNED TO DEVELOP THE TENSILE STRENGTH OF BOLTS AND SCREWS WITH AN ULTIMATE TENSILE STRENGTH OF 125 KSI BASED ON THE CROSS SECTIONAL AREA AT THE BASIC ROOT DIAMETER OF THE THREAD. THESE NUTS ARE DESIGNED TO BE USED ON 3A EXTERNAL THREADS. THESE NUTS SHALL BE USED IN ACCORDANCE WITH THE LIMITATIONS OF MS 33588. ONLY NUTS FOR WHICH THERE ARE QUALIFIED PRODUCTS LISTED ON QPL 25027 SHALL BE USED

INTERCHANGEABILITY RELATIONSHIP: (STATUS NOTE) MS 21060 NUTS CAN UNIVERSALLY REPLACE NAS 686 NUTS OF LIKE MATERIAL, THREAD SIZE; LUBRICANT (DRY FILM OR SILVER PLATE), RIVET SPACING, AND FASTENING METHOD (PLAIN RIVET HOLES, DIMPLED, COUNTERSUNK RIVET HOLES OR PROJECTION WELDING.) BUT NAS 686 NUTS CANNOT UNIVERSALLY REPLACE MS21060 NUTS. FOR DEFINITION AND APPILCATION OF DRAWING STATUS NOTES, SEE MIL-STD-32.

THIS STANDARD TAKES PRECEDENCE OVER DOCUMENTS REFERENCED HEREIN.

REFERENCED DOCUMENTS SHALL BE OF THE ISSUE INEFFECT ON DATE OF INVITATIONS FOR BID.

Ⓐ FOR CHANGES SEE SHEETS 1 AND 2.

F05-045S01

Figure 5-46. Drawing MS21060(ASG) (Sheet 1 of 2)

Ⓐ THREAD SIZE MIL-S-8879/MOD.	DASH NUMBER					
	450°F			800°F		
	PLAIN HOLES	C'SUNK OR DIMPLED	WELDING PROJECTION	PLAIN HOLES	C'SUNK OR DIMPLED	WELDING PROJECTION
4-40UNC-3B	L04	L04K	L04W	-04	-04K	-04W
6-32UNC-3B	L06	L06K	L06W	-06	-06K	-06W
8-32UNC-3B	L08	L08K	L08W	-08	-08K	-08W
10-32UNF-3B	L3	L3K	L3W	-3	-3K	-3W
1/4-28UNF-3B	L4	L4K	L4W	-4	-4K	-4W
5/16-24UNF-3B	L5	L5K	L5W	-5	-5K	-5W
3/8-24UNF-3B	L6	- - -	L6W	-6	- - -	-6W

EXAMPLE OF PART NUMBER:

MS 21060 L4K

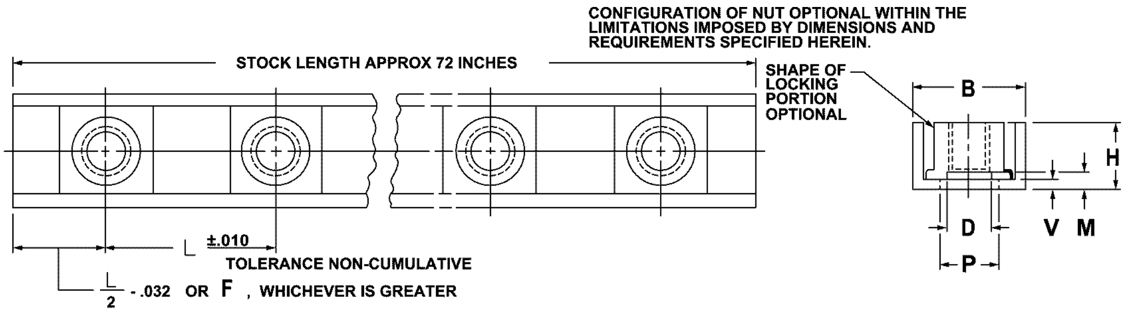
L4K — NUT DASH NUMBER

MS 21060 — STANDARD IDENTIFICATION NUMBER

1/4-28UNF-3B NUT, SELF-LOCKING, TWO LUG, FLOATING, CRES, 125 KSI, 450°F, DRY FILM LUBRICATED, WITH COUNTERSUNK OR DIMPLED RIVET HOLES.

F05-045S02

Figure 5-46. Drawing MS21060(ASG) (Sheet 2)



THREAD SIZE DASH NO.	(1) B THREAD MIL-S-8879/MOD.	B MAX	D MIN	F MIN	(2) H MAX	L MIN SPACING AVAILABLE	M MIN	P MAX	(5) MIN	V MAX	AXIAL STRENGTH LBS MIN	WEIGHT (MAX) NUT ELEMENTS LBS/100	WEIGHT (MAX) CHANNEL LBS/INCH
-08	8-32 UNC-3B	.416	.168	.343	.250	.625	.062	.270	.184	.035	1,720	.19	.0028
-3	10-32 UNF-3B	.416	.194	.343	.250	.625	.062	.270	.210	.035	2,460	.20	.0028
-4	1/4-28 UNF-3B	.516	.254	.406	.281	.750	.062	.330	.270	.045	4,580	.43	.0032
-5	5/16-24 UNF-3B	.609	.317	.469	.328	.875	.062	.393	.333	.045	7,390	.64	.0053
-6	3/8-24 UNF-3B	.726	.379	.562	.344	1.000	.062	.455	.395	.055	11,450	1.08	.0073

(1) THREADS BEFORE LUBRICATION PER MIL-S-8879. THREADS IN ACCORDANCE
B WITH MIL-S-7742 ARE ACCEPTABLE UNTIL 31 DECEMBER 1969.

(2) "H" MAX APPLIES TO NUT ELEMENT AND CHANNEL. MIN "H" NOT SPECIFIED, LIMITED ONLY BY STRENGTH REQUIREMENTS OF SPECIFICATION.

(3) FLOAT OF NUT ELEMENT PORTION OF ASSEMBLY SHALL NOT BE LESS THAN .030 NOR MORE THAN .040 LONGITUDINALLY AND NOT LESS THAN .010 NOR MORE THAN .030 LATERALLY FROM CENTERED POSITION. NUT ELEMENT SHALL BE CAPABLE OF ENGAGEMENT WITH A BOLT IN THE MAXIMUM MISALIGNMENT POSITION. MAXIMUM AXIAL FLOAT .020 INCH FOR MS21063-08 AND MS21063-3, .030 FOR LARGER SIZES.

(4) THE ASSEMBLY SHALL PROVIDE A BEARING SURFACE FOR THE NUT ELEMENT WITHIN THE HOUSING. THE CENTERLINE OF THE CHANNEL SHALL NOT DEVIATE FROM A STRAIGHT LINE BY MORE THAN .015 IN ANY 12 INCHES. THE NUT ELEMENT AND BASE PORTION OF THE ASSEMBLY SHALL FORM ONE INTEGRAL UNIT.

(5) HOLE IN CHANNEL MUST PROVIDE FOR FULL FLOAT OF NUT ELEMENT BUT NEED NOT BE CIRCULAR.

L NUT ELEMENT SPACING	NUT ELEMENT SPACING DASH No.	MAX No. OF NUT ELEMENTS
.625	-5	115
.750	-6	96
.875	-7	82
1.000	-8	72
1.125	-9	64
1.250	-10	57
1.375	-11	52
1.500	-12	48
1.625	-13	44
1.750	-14	41
1.875	-15	38
2.000	-16	36
2.250	-18	32
2.500	-20	28
3.000	-24	24

MATERIAL: NUT ELEMENT - STEEL
CHANNEL - ALUMINUM ALLOY.
HARDNESS: NUT ELEMENTS SHALL HAVE A MAXIMUM HARDNESS OF ROCKWELL C49
PLATING: NUT ELEMENTS - CADMIUM PLATED IN ACCORDANCE WITH QQ-P-416, TYPE II, CLASS 3, DRY FILM LUBRICATED NUT ELEMENTS IN ACCORDANCE WITH QQ-P-416, TYPE AND CLASS ARE OPTIONAL IF THE NUT ELEMENTS WILL MEET THE SALT SPRAY REQUIREMENTS OF QQ-P-416, TYPE II.

CHANNEL - SEE PROCUREMENT SPECIFICATION.

LUBRICANT: DRY FILM LUBRICANT, ON NUT ELEMENT ONLY, APPROVED IN ACCORDANCE WITH MIL-N-25027, OTHER LUBRICANTS SOLUBLE IN THE CLEANER SPECIFIED IN MIL-5-7502. FOR USAF APPLICATIONS, NUTS TREATED WITH DRY FILM LUBRICANTS SHALL NOT BE USED IN INTERNAL FUEL SYSTEMS APPLICATIONS.

DESIGN AND USAGE LIMITATIONS: THESE NUTS ARE DESIGNED TO DEVELOP THE TENSILE STRENGTH OF BOLTS AND SCREWS WITH AN ULTIMATE STRESS (Ftu) OF 125 KSI BASED ON THE CROSS SECTIONAL AREA AT THE BASIC ROOT DIAMETER OF THE THREAD. THESE NUTS ARE DESIGNED TO BE USED ON 3A EXTERNAL THREADS. THESE NUTS SHALL BE USED IN ACCORDANCE WITH THE LIMITATIONS OF MS33588. ONLY NUTS FOR WHICH THERE ARE QUALIFIED PRODUCTS LISTED ON QPL25027 SHALL BE USED.

CODE: FIRST DASH NUMBER, AS LISTED ABOVE, DESIGNATES THREAD SIZE. SECOND DASH NUMBER DESIGNATES NUT ELEMENT SPACING IN EIGHTHS OF AN INCH. THIRD DASH NUMBER INDICATES NUMBER OF NUT ELEMENTS WHEN LESS THAN STOCK LENGTH (APPROX 72 INCHES) IS DESIRED.
LETTER "L" BEFORE FIRST DASH NUMBER DESIGNATES DRY FILM LUBRICATED NUT ELEMENTS.

EXAMPLE OF PART NUMBERS:
MS21063-3-6 = GANG CHANNEL ASSEMBLY CONSISTING OF NINETY-SIX, 10-32, CADMIUM PLATED NUT ELEMENTS SPACED AT .750 INCH.
MS21063L4 7-10 = GANG CHANNEL ASSEMBLY CONSISTING OF THEN, 1/4-28, CADMIUM PLATED DRY FILM LUBRICATED NUT ELEMENTS, SPACED AT .875 INCH.

INTERCHANGEABILITY RELATIONSHIP: MS21063 NUTS CAN UNIVERSALLY REPLACE NAS688 THRU 692 NUTS
(STATUS NOTE) OF LIKE THREAD SIZE, LUBRICANT (DRY FILM OR NON-DRY FILM), PLATING, NUT ELEMENT SPACING, NUMBER OF NUT ELEMENTS, AND MATERIAL; BUT NAS688 THRU 692 NUTS CANNOT UNIVERSALLY REPLACE MS21063 NUTS.
FOR DEFINITION AND APPLICATION OF STATUS NOTES SEE MIL-STD-32.

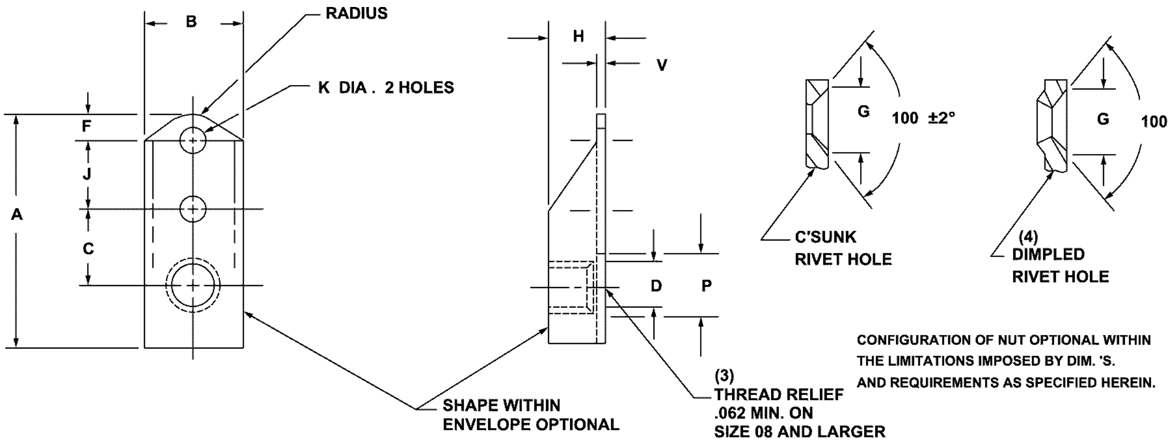
SURFACE ROUGHNESS: IN ACCORDANCE WITH MIL-STD-10. UNLESS OTHERWISE SPECIFIED THE SURFACE ROUGHNESS SHALL NOT EXCEED 125 MICRO INCHES.

BREAK SHARP CORNERS.
DIMENSIONS IN INCHES.
DIMENSIONS TO BE MET PRIOR TO LUBRICATION.
THIS STANDARD TAKES PRECEDENCE OVER DOCUMENTS REFERENCED HEREIN.
REFERENCED DOCUMENTS SHALL BE OF THE ISSUE IN EFFECT ON DATE OF INVITATIONS FOR BID.

Ⓑ FOR CHANGES SEE SHEETS 1 AND 2.

F05-046

Figure 5-47. Drawing MS21063(ASG)



(1) THREAD Ⓐ SIZE MIL-S-8879/MOD.	A MAX.	B		C ±.005	D DIA. MIN.	F MIN.	G DIA. ±.010	(2) H MAX.	J ±.002	K DIA. ±.005 -.000	P DIA.		V MAT'L MAX	AXIAL STRENGTH LBS. MIN.	WEIGHT LBS./100 MAX.
		MAX.	MIN.								MAX.	MIN.			
4-40 UNC-3B	1.051	.422	.290	.344	—	.100	.200	.175	.312	.098	.270	.172	.032	750	.52
6-32 UNC-3B	1.051	.422	.290	.344	—	.100	.200	.203	.312	.098	.270	.198	.032	1,130	.53
8-32 UNC-3B	1.051	.422	.290	.344	.168	.100	.200	.250	.312	.098	.270	.224	.032	1,720	.54
10-32 UNF-3B	1.051	.422	.290	.344	.194	.100	.200	.250	.312	.098	.270	.250	.032	2,460	.56
1/4-28 UNF-3B	1.306	.531	.350	.500	.254	.100	.200	.281	.312	.098	.330	.310	.032	4,580	.93
5/16-24 UNF-3B	1.396	.641	.412	.500	.317	.125	.230	.328	.312	.130	.392	.372	.045	7,390	1.44

Ⓐ (1) THREADS BEFORE LUBRICATION, PER MIL-S-8879. THREADS IN ACCORDANCE WITH MIL-S-7742 ARE ACCEPTABLE UNTIL 31 DECEMBER 1969.

(2) MINIMUM "H" NOT SPECIFIED, LIMITED ONLY BY STRENGTH REQUIREMENTS.

(3) SIZE NO. 06 AND SMALLER MAY BE COUNTERSUNK OR RADIUSED WITHIN "P" DIAMETER.

(4) DIMPLED HOLE TOLERANCE FOR "K" IS +.015, - 000 AFTER FORMING.

MATERIAL: STEEL

PLATING: CADMIUM PLATE IN ACCORDANCE WITH QQ-P-416, TYPE II, CLASS 3. FOR DRY FILM LUBRICATED NUTS, THE TYPE AND CLASS ARE OPTIONAL IF THE NUTS MEET THE SALT SPRAY REQUIREMENTS OF QQ-P-416, TYPE II.

HARDNESS: Rc 49 MAX.

LUBRICANT: DRY FILM LUBRICANT APPROVED IN ACCORDANCE WITH MIL-N-25027, OTHER LUBRICANTS SOLUBLE IN THE CLEANER SPECIFIED IN MIL-S-7502. FOR USAF APPLICATIONS, NUTS TREATED WITH DRY FILM LUBRICANTS SHALL NOT BE USED IN INTERNAL FUEL SYSTEMS APPLICATIONS.

FLOAT OF NUT PORTION OF ASSEMBLY SHALL NOT BE LESS THAN .030 RADIALLY FROM CENTERED POSITION.
NUT ELEMENTS SHALL BE CAPABLE OF ENGAGEMENT WITH BOLT IN THE MAXIMUM MISALIGNED POSITION.

DIMENSIONS IN INCHES.

SURFACE ROUGHNESS IN ACCORDANCE WITH MIL-STD-10. UNLESS OTHERWISE SPECIFIED, THE SURFACE ROUGHNESS SHALL NOT EXCEED 125 MICRO INCHES.

DESIGN AND USAGE LIMITATIONS: THESE NUTS ARE DESIGNED TO DEVELOP THE TENSILE STRENGTH OF BOLTS AND SCREWS WITH AN ULTIMATE TENSILE STRENGTH OF 125 KSI BASED ON THE CROSS SECTIONAL AREA AT THE BASIC ROOT DIAMETER OF THE THREAD. THESE NUTS ARE DESIGNED TO BE USED ON 3A EXTERNAL THREADS. THESE NUTS SHALL BE USED IN ACCORDANCE WITH THE LIMITATIONS OF MS 33588. ONLY NUTS FOR WHICH THERE ARE QUALIFIED PRODUCTS LISTED ON QPL 25027 SHALL BE USED.

INTERCHANGEABILITY RELATIONSHIP: MS 21061 NUTS CAN UNIVERSALLY REPLACE NAS 687 NUTS OF LIKE MATERIAL, THREAD SIZE, (STATUS NOTE) LUBRICANTS (DRY FILM OR NON DRY FILM), RIVET SPACING, AND FASTENING METHOD (PLAIN RIVET HOLES, DIMPLED OR COUNTERSUNK RIVET HOLES). BUT NAS 687 NUTS CANNOT UNIVERSALLY REPLACE MS 21061 NUTS. FOR DEFINITION AND APPLICATION OF DRAWING STATUS NOTES, SEE MIL-STD-32.

THIS STANDARD TAKES PRECEDENCE OVER DOCUMENTS REFERENCED HEREIN.

REFERENCED DOCUMENTS SHALL BE OF THE ISSUE IN EFFECT ON DATE OF INVITATIONS FOR BID.

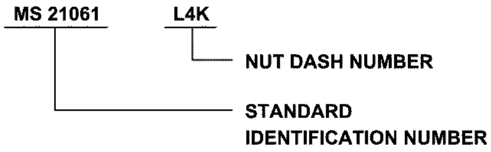
Ⓐ FOR CHANGES SEE SHEETS 1 AND 2.

F05-047S01

Figure 5-48. Drawing MS21061(ASG) (Sheet 1 of 2)

Ⓐ THREAD SIZE MIL-S-8879/MOD.	DASH NUMBERS			
	PLAIN RIVET HOLES		C'SUNK OR DIMPLE RIVET HOLES	
	NON DRY FILM LUBE	DRY FILM LUBE	NON DRY FILM LUBE	DRY FILM LUBE
4-40 UNC-3B	-04	L04	-04K	L04K
6-32 UNC-3B	-06	L06	-06K	L06K
8-32 UNC-3B	-08	L08	-08K	L08K
10-32 UNF-3B	-3	L3	-3K	L3K
1/4-28 UNF-3B	-4	L4	-4K	L4K
5/16-24 UNF-3B	-5	L5	-5K	L5K

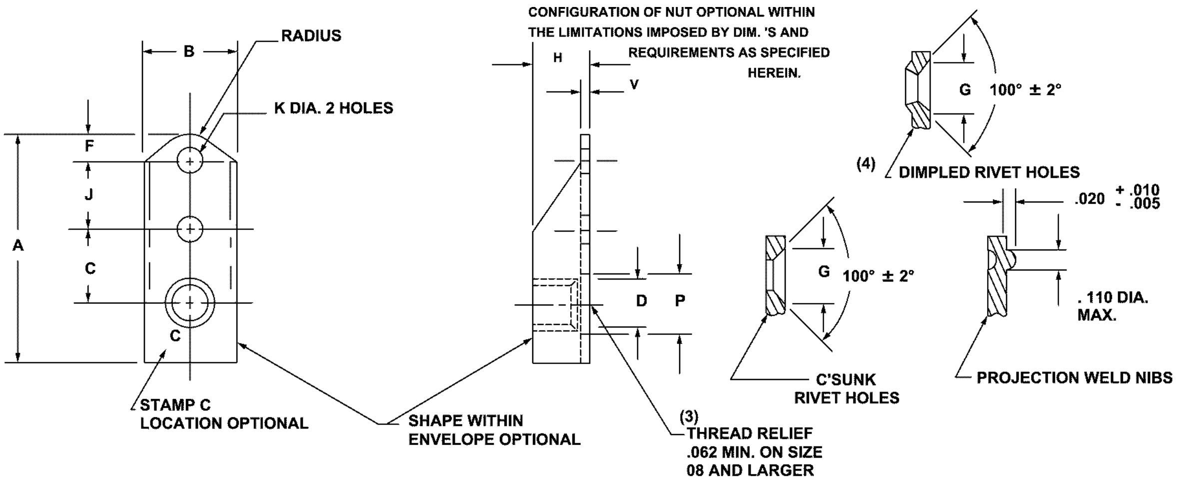
EXAMPLE OF PART NUMBERS:



1/4 - 28 UNF-3B NUT, SELF-LOCKING, ONE LUG, FLOATING, STEEL, 125 KSI, 450°F, CAD PLATED, DRY FILM LUBRICATED, C'SUNK OR DIMPLED RIVET HOLES.

F05-047S02

Figure 5-48. Drawing MS21061(ASG) (Sheet 2)



(1) THREAD SIZE Ⓐ MIL-S-8879/MOD.	A MAX.	B		C ±.005	D DIA. MIN.	F MIN.	G DIA. ±.010	(2) H MAX.	J ±.002	K DIA. + .005 - .000	P DIA.		V MAT'L MAX.	AXIAL STRENGTH LBS.MIN.	WEIGHT LBS./100 MAX.
		MAX.	MIN.								MAX.	MIN.			
4-40UNC-3B	1.051	.422	.290	.344		.100	.200	.175	.312	.098	.270	.172	.032	750	.52
6-32UNC-3B	1.051	.422	.290	.344		.100	.200	.203	.312	.098	.270	.198	.032	1,130	.53
8-32UNC-3B	1.051	.422	.290	.344	.168	.100	.200	.250	.312	.098	.270	.224	.032	1,720	.54
10-32UNF-3B	1.051	.422	.290	.344	.194	.100	.200	.250	.312	.098	.270	.250	.032	2,460	.56
1/4-28UNF-3B	1.306	.531	.350	.500	.254	.100	.200	.281	.312	.098	.330	.310	.032	4,580	1.00
5/16-24UNF-3B	1.396	.641	.412	.500	.317	.125	.230	.328	.312	.130	.392	.372	.045	7,390	1.44

Ⓐ (1) THREADS BEFORE LUBRICATION PER MIL-S-8879. THREADS IN ACCORDANCE WITH MIL-S-7742 ARE ACCEPTABLE UNTIL 31 DECEMBER 1969
(2) MINIMUM "H" NOT SPECIFIED, LIMITED ONLY BY STRENGTH REQUIREMENTS
(3) SIZE NO. 06 AND SMALLER MAY BE COUNTERSUNK OR RADIUSED WITHIN "P" DIAMETER.
(4) DIMPLED HOLE TOLERANCED FOR "K" IS +.015, - .000 AFTER FORMING.

MATERIAL: CORROSION RESISTANT STEEL (A-286) PER AMS 5525, AMS 5735, OR AMS 5737.

PLATING: 800°F NUTS ONLY: SILVER PLATE PER AMS 2410. PLATE THICKNESS MEASURED ON ANY EXTERNAL SURFACE OF THE NUT, SHALL NOT BE LESS THAN 0.0002 IN; THREADS SHALL SHOW COMPLETE COVERAGE BUT THICKNESS REQUIREMENT ON THREAD IS WAIVED. NO SILVER PLATE ON WELD NIBS.

MAGNETIC PERMEABILITY: SHALL BE LESS THAN 2.0 (AIR = 1.0) FOR A FIELD STRENGTH H - 200 OERSTEDS USING A MAGNETIC PERMEABILITY INDICATOR PER MIL-I-17314, OR EQUIVALENT

HARDNESS: Rc 49 MAX.

LUBRICANT: 450°F NUTS ONLY: DRY FILM LUBRICANT APPROVED IN ACCORDANCE WITH MIL-N-25027, FOR USAF APPLICATIONS, NUTS TREATED WITH DRY FILM LUBRICANTS SHALL NOT BE USED IN INTERNAL FUEL SYSTEMS APPLICATIONS.

FLOAT OF NUT PORTION OF ASSEMBLY SHALL NOT BE LESS THAN .030 RADIALLY FROM CENTERED POSITION.
NUT ELEMENT SHALL BE CAPABLE OF ENGAGEMENT WITH BOLT IN THE MAXIMUM MISALIGNED POSITION.
DIMENSIONS IN INCHES.

SURFACE ROUGHNESS IN ACCORDANCE WITH MIL-STD-10. UNLESS OTHERWISE SPECIFIED, THE SURFACE ROUGHNESS SHALL NOT EXCEED 125 MICRO INCHES.

PERFORMANCE: SEE PROCUREMENT SPECIFICATION, EXCEPT 450° DRY FILM LUBRICATED NUTS LIMITED TO FIVE REUSE CYCLES.

DESIGN AND USAGE LIMITATIONS: THESE NUTS ARE DESIGNED TO DEVELOP THE TENSILE STRENGTH OF BOLTS AND SCREWS WITH AN ULTIMATE TENSILE STRENGTH OF 125 KSI BASED ON THE CROSS SECTIONAL AREA AT THE BASIC ROOT DIAMETER OF THE THREAD. THESE NUTS ARE DESIGNED TO BE USED ON 3A EXTERNAL THREADS. THESE NUTS SHALL BE USED IN ACCORDANCE WITH THE LIMITATIONS OF MS 33588 ONLY NUTS FOR WHICH THERE ARE QUALIFIED PRODUCTS LISTED ON QPL 25027 SHALL BE USED.

INTERCHANGEABILITY RELATIONSHIP: (STATUS NOTE) MS 21062 NUTS CAN UNIVERSALLY REPLACE NAS 687 NUTS OF LIKE MATERIAL, THREAD SIZE, LUBRICANT (DRY FILM OR SILVER PLATE), RIVET SPACING, AND FASTENING METHOD (PLAIN RIVET HOLES, DIMPLED, COUNTERSUNK RIVET HOLES OR PROJECTION WELDING). BUT NAS 687 NUTS CANNOT UNIVERSALLY REPLACE MS21062 NUTS. FOR DEFINITION AND APPLICATION OF DRAWING STATUS NOTES, SEE MIL-STD-32.

THIS STANDARD TAKES PRECEDENCE OVER DOCUMENTS REFERENCED HEREIN.

REFERENCED DOCUMENTS SHALL BE OF THE ISSUE IN EFFECT ON DATE OF INVITATIONS FOR BID.

Ⓐ FOR CHANGES SEE SHEETS 1 AND 2.

F05-048S01

Figure 5-49. Drawing MS21062(ASG) (Sheet 1 of 2)

Ⓐ	DASH NUMBER					
	450°F			800°F		
THREAD SIZE MIL-S-8879/MOD.	PLAIN HOLES	C'SUNK OR DIMPLED	WELDING PROJECTION	PLAIN HOLES	C'SUNK OR DIMPLED	WELDING PROJECTION
4-40UNC-3B	L04	L04K	L04W	-04	-04K	-04W
6-32UNC-3B	L06	L06K	L06W	-06	-06K	-06W
8-32UNC-3B	L08	L08K	L08W	-08	-08K	-08W
10-32UNF-3B	L3	L3K	L3W	-3	-3K	-3W
1/4-282UNF-3B	L4	L4K	L4W	-4	-4K	-4W
5/16-24UNF-3B	L5	L5K	L5W	-5	-5K	-5W

EXAMPLE OF PART NUMBER:

MS 21062 L4K

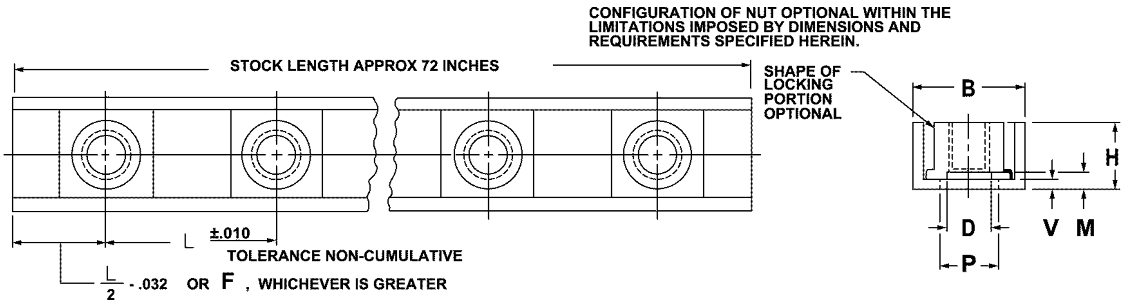
L4K — NUT DASH NUMBER

MS 21062 — STANDARD IDENTIFICATION NUMBER

1/4-28UNF-3B, NUT, SELF-LOCKING, ONE LUG, FLOATING. CRES, 125 KSI, 450°F, DRY FILM LUBRICATED, WITH COUNTER-SUNK OR DIMPLED RIVET HOLES.

F05-048S02

Figure 5-49. Drawing MS21062(ASG) (Sheet 2)



THREAD SIZE DASH No.	(1) THREAD MIL-S-8879/MOD.	B MAX	D MIN	F MIN	(2) H MAX	L MIN SPACING AVAILABLE	M MIN	P (5)		V MAX	AXIAL STRENGTH LBS MIN	WEIGHT (MAX)	
								MAX	MIN			NUT ELEMENTS LBS/100	CHANNEL LBS/INCH
-08	8-32UNC-3B	.416	.168	.343	.250	.625	.062	.270	.184	.035	1,720	.19	.0071
-3	10-32UNF-3B	.416	.194	.343	.250	.625	.062	.270	.210	.035	2,460	.20	.0071
-4	1/4-28UNF-3B	.516	.254	.406	.281	.750	.062	.330	.270	.045	4,580	.43	.0084
-5	5/16-24UNF-3B	.609	.317	.469	.328	.875	.062	.393	.333	.045	7,390	.64	.0146
-6	3/8-24UNF-3B	.726	.379	.562	.344	1.000	.062	.455	.395	.055	11,450	1.08	.0186

Ⓑ (1) THREADS BEFORE LUBRICATION PER MIL-5-8875 THREADS IN ACCORDANCE WITH MIL-S-7742 ARE ACCEPTABLE UNTIL 31 DECEMBER 1969.

(2) H"MAX APPLIES TO NUT ELEMENT AND CHANNEL. MIN "H" NOT SPECIFIED, LIMITED ONLY BY STRENGTH REQUIREMENTS OF SPECIFICATION.

(3) FLOAT OF NUT ELEMENT PORTION OF ASSEMBLY SHALL NOT BE LESS THAN .030 NOR MORE THAN .040 LONGITUDINALLY AND NOT LESS THAN .010 NOR MORE THAN .030 LATERALLY FROM CENTERED POSITION. NUT ELEMENT SHALL BE CAPABLE OF ENGAGEMENT WITH A BOLT IN THE MAXIMUM MISALIGNMENT POSITION. MAXIMUM AXIAL FLOAT .020 INCH FOR MS21064-08 AND MS21064-3, .030 FOR LARGER SIZES.

(4) THE ASSEMBLY SHALL PROVIDE A BEARING SURFACE FOR THE NUT ELEMENT WITHIN THE HOUSING. THE CENTERLINE OF THE CHANNEL SHALL NOT DEVIATE FROM A STRAIGHT LINE BY MORE THAN .015 IN ANY 12 INCHES. THE NUT ELEMENT AND BASE PORTION OF THE ASSEMBLY SHALL FORM ONE INTEGRAL UNIT.

(5) HOLE IN CHANNEL MUST PROVIDE FOR FULL FLOAT OF NUT ELEMENT BUT NEED NOT BE CIRCULAR.

L NUT ELEMENT SPACING	NUT ELEMENT SPACING DASH No.	MAX No. OF NUT ELEMENTS
.625	-5	115
.750	-6	96
.875	-7	82
1.000	-8	72
1.125	-9	64
1.250	-10	57
1.375	-11	52
1.500	-12	48
1.625	-13	44
1.750	-14	41
1.875	-15	38
2.000	-16	36
2.250	-18	32
2.500	-20	28
3.000	-24	24

MATERIAL: NUT ELEMENT - STEEL.
CHANNEL - CORROSION RESISTANT STEEL. SEE PROCUREMENT SPECIFICATION.

HARDNESS: NUT ELEMENTS SHALL HAVE A MAXIMUM HARDNESS OF ROCKWELL C 49.

PLATING: NUT ELEMENTS - CADMIUM PLATED IN ACCORDANCE WITH QQ-P-416, TYPE II, CLASS 3. DRY FILM LUBRICATED NUT ELEMENTS IN ACCORDANCE WITH QQ-P-416, TYPE AND CLASS ARE OPTIONAL IF THE NUT ELEMENTS WILL MEET THE SALT SPRAY REQUIREMENTS OF QQ-P-416, TYPE II.
CHANNEL - PLAIN (PASSIVATED).

LUBRICANT: DRY FILM LUBRICANT, ON NUT ELEMENT ONLY, APPROVED IN ACCORDANCE WITH MIL-N-25027 OTHER LUBRICANTS SOLUBLE IN THE CLEANER SPECIFIED IN MIL-S-7502. FOR USAF APPLICATIONS, NUTS TREATED WITH DRY FILM LUBRICANTS SHALL NOT BE USED IN INTERNAL FUEL SYSTEMS APPLICATIONS.

DESIGN AND USAGE LIMITATIONS: THESE NUTS ARE DESIGNED TO DEVELOP THE TENSILE STRENGTH OF BOLTS AND SCREWS WITH AN ULTIMATE STRESS (Ftu) OF 125 KSI BASED ON THE CROSS SECTIONAL AREA AT THE BASIC ROOT DIAMETER OF THE THREAD. THESE NUTS ARE DESIGNED TO BE USED ON 3A EXTERNAL THREADS. THESE NUTS SHALL BE USED IN ACCORDANCE WITH THE LIMITATIONS OF MS33588. ONLY NUTS FOR WHICH THERE ARE QUALIFIED PRODUCTS LISTED ON QPL25027 SHALL BE USED.

CODE: FIRST DASH NUMBER, AS LISTED ABOVE, DESIGNATES THREAD SIZE. SECOND DASH NUMBER DESIGNATES NUT ELEMENT SPACING IN EIGHTHS OF AN INCH. THIRD DASH NUMBER INDICATES NUMBERS OF NUT ELEMENTS WHEN LESS THAN STOCK LENGTH (APPROX 72 INCHES) IS DESIRED.
LETTER "L" BEFORE FIRST DASH NUMBER DESIGNATES DRY FILM LUBRICATED NUT ELEMENTS.

EXAMPLE OF PART NUMBERS:

MS21064-3-6 = GANG CHANNEL ASSEMBLY CONSISTING OF NINETY-SIX, 10-32, CADMIUM PLATED NUT ELEMENTS SPACED AT .750 INCH.

MS21064L4-7-10 = GANG CHANNEL ASSEMBLY CONSISTING OF TEN, 1/4-28, CADMIUM, PLATED DRY FILM LUBRICATED NUT ELEMENTS, SPACED AT .875 INCH.

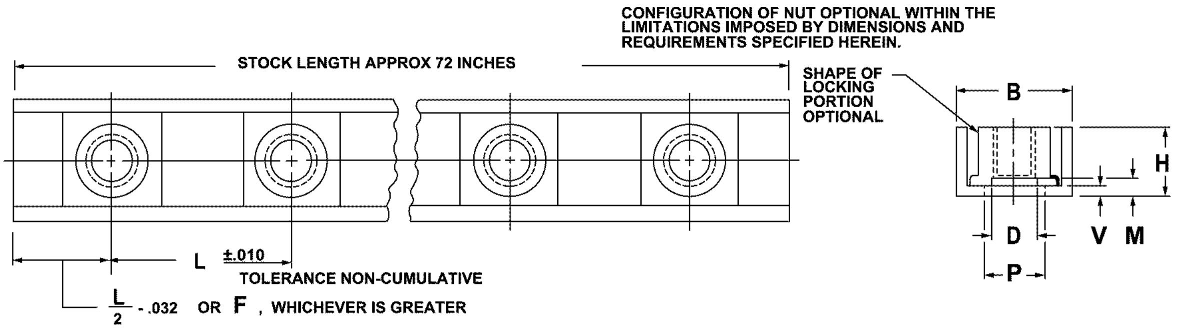
INTERCHANGEABILITY RELATIONSHIP: MS21064 NUTS CAN UNIVERSALLY REPLACE NAS688 THRU 692 NUTS OF LIKE THREAD SIZE,
(STATUS NOTE) LUBRICANT (DRY FILM OR NON-DRY FILM), PLATING, NUT ELEMENT SPACING, NUMBER OF NUT ELEMENTS, AND MATERIAL; BUT NAS688 THRU 692 NUTS CANNOT UNIVERSALLY REPLACE MS21064 NUTS.
FOR DEFINITION AND APPLICATION OF STATUS NOTES SEE MIL-STD-32.

SURFACE ROUGHNESS: IN ACCORDANCE WITH MIL-STD-10. UNLESS OTHERWISE SPECIFIED THE SURFACE ROUGHNESS SHALL NOT EXCEED 125 MICRO INCHES.

BREAK SHARP CORNERS.
DIMENSIONS IN INCHES.
DIMENSIONS TO BE MET PRIOR TO LUBRICATION.
THIS STANDARD TAKES PRECEDENCE OVER DOCUMENTS REFERENCED HEREIN.
REFERENCED DOCUMENTS SHALL BE OF THE ISSUE IN EFFECT ON DATE OF INVITATIONS FOR BID. Ⓑ FOR CHANGES SEE SHEETS 1 AND 2.

F05-049

Figure 5-50. Drawing MS21064(ASG)



THREAD SIZE DASH No.		Ⓑ (1) THREAD MIL-S-8879/MOD.	B MAX	D MIN	F MIN	(2) H MAX	L MIN SPACING AVAILABLE	M MIN	P (5)		V MAX	AXIAL STRENGTH LBS MIN	WEIGHT (MAX)	
450°F	800°F								MAX	MIN			NUT ELEMENTS LBS/100	CHANNEL LBS/INCH
L08	-08	8-32UNC-3B	.416	.168	.343	.250	.625	.062	.270	.184	.035	1,720	.19	.0071
L3	-3	10-32UNF-3B	.416	.194	.343	.250	.625	.062	.270	.210	.035	2,460	.20	.0071
L4	-4	1/4-28UNF-3B	.516	.254	.406	.281	.750	.062	.330	.270	.045	4,580	.43	.0084
L5	-5	5/16-24UNF-3B	.609	.317	.469	.328	.875	.062	.393	.333	.045	7,390	.64	.0146
L6	-6	3/8-24UNF-3B	.726	.379	.562	.344	1.000	.062	.455	.395	.055	11,450	1.08	.0186

L NUT ELEMENT SPACING	NUT ELEMENT SPACING DASH No.	MAX No. OF NUT ELEMENTS
.625	-5	115
.750	-6	96
.875	-7	82
1.000	-8	72
1.125	-9	64
1.250	-10	57
1.375	-11	52
1.500	-12	48
1.625	-13	44
1.750	-14	41
1.875	-15	38
2.000	-16	36
2.250	-18	32
2.500	-20	28
3.000	-24	24

Ⓑ (1) THREADS BEFORE LUBRICATION PER MIL-S-8879. THREADS IN ACCORDANCE WITH MIL-S-7742 ARE ACCEPTABLE UNTIL 31 DECEMBER 1969.

(2) "H" MAX APPLIES TO NUT ELEMENT AND CHANNEL. MIN "H" NOT SPECIFIED, LIMITED ONLY BY STRENGTH REQUIREMENTS OF SPECIFICATION.

(3) FLOAT OF NUT ELEMENT PORTION OF ASSEMBLY SHALL NOT BE LESS THAN .030 NOR MORE THAN .040 LONGITUDINALLY AND NOT LESS THAN .010 NOR MORE THAN .030 LATERALLY FROM CENTERED POSITION. NUT ELEMENT SHALL BE CAPABLE OF ENGAGEMENT WITH A BOLT IN THE MAXIMUM MISALIGNMENT POSITION. MAXIMUM AXIAL FLOAT .020 INCH FOR MS21065-06 AND MS21065-3, .030 FOR LARGER SIZES.

(4) THE ASSEMBLY SHALL PROVIDE A BEARING SURFACE FOR THE NUT ELEMENT WITHIN THE HOUSING. THE CENTERLINE OF THE CHANNEL SHALL NOT DEVIATE FROM A STRAIGHT LINE BY MORE THAN .015 IN ANY 12 INCHES. THE NUT ELEMENT AND BASE PORTION OF THE ASSEMBLY SHALL FORM ONE INTEGRAL UNIT.

(5) HOLE IN CHANNEL MUST PROVIDE FOR FULL FLOAT OF NUT ELEMENT BUT NEED NOT BE CIRCULAR.

MATERIAL: NUT ELEMENT - CORROSION AND HEAT RESISTANT STEEL, (A286) AMS5525, AMS5735 OR AMS5737.
CHANNEL - CORROSION RESISTANT STEEL.

HARDNESS: NUT ELEMENTS SHALL HAVE A MAXIMUM HARDNESS OF ROCKWELL C 49.

PLATING: 800°F NUT ELEMENTS - SILVER PLATED IN ACCORDANCE WITH AMS2410. PLATE THICKNESS MEASURED ON ANY EXTERNAL SURFACE OF THE NUT ELEMENT SHALL NOT BE LESS THAN 0.0002 INCHES THREADS SHALL SHOW COMPLETE COVERAGE BUT THICKNESS REQUIREMENT ON THREAD IS WAIVED.
CHANNEL - PLAIN (PASSIVATED).

LUBRICANT: 450°F NUT ELEMENTS - DRY FILM LUBRICANT, ON NUT ELEMENT ONLY, APPROVED IN ACCORDANCE WITH MIL-N-25027, FOR USAF APPLICATIONS, NUTS TREATED WITH DRY FILM LUBRICANTS SHALL NOT BE USED IN INTERNAL FUEL SYSTEMS APPLICATIONS. NO SILVER PLATE.

MAGNETIC PERMEABILITY: SHALL BE LESS THAN 2.0 (AIR = 1.0) FOR A FIELD STRENGTH H = 200 OERSTEDS USING A MAGNETIC PERMEABILITY INDICATOR PER MIL-I-17214 OR EQUIVALENT.

PERFORMANCE: SEE PROCUREMENT SPECIFICATION, EXCEPT 450°F DRY FILM LUBRICATED NUT ELEMENTS LIMITED TO FIVE REUSE CYCLES.

Ⓑ FOR CHANGES SEE SHEET 1.

F05-050S01

Figure 5-51. Drawing MS21065(ASG) (Sheet 1 of 2)

DESIGN AND USAGE LIMITATIONS: THESE NUTS ARE DESIGNED TO DEVELOP THE TENSILE STRENGTH OF BOLTS AND SCREWS WITH ULTIMATE STRESS (Ftu) OF 125 KSI BASED ON THE CROSS SECTIONAL AREA AT THE BASIC ROOT DIAMETER OF THE THREAD. THESE NUTS ARE DESIGNED TO BE USED ON 3A EXTERNAL THREADS. THESE NUTS SHALL BE USED IN ACCORDANCE WITH THE LIMITATIONS OF MS33588. ONLY NUTS FOR WHICH THERE ARE QUALIFIED PRODUCTS LISTED ON QPL25027 SHALL BE USED.

CODE: FIRST DASH NUMBER, DESIGNATES THREAD SIZE.
SECOND DASH NUMBER DESIGNATES NUT ELEMENT SPACING IN EIGHTHS OF AN INCH.
THIRD DASH NUMBER INDICATES NUMBER OF NUT ELEMENTS WHEN LESS THAN STOCK LENGTH (APPROX 72 INCHES) IS DESIRED.
LETTER "L" BEFORE FIRST DASH NUMBER DESIGNATES DRY FILM LUBRICATED NUT ELEMENTS.

EXAMPLE OF PART NUMBERS;

MS21065-3-6 = GANG CHANNEL ASSEMBLY CONSISTING OF NINETY-SIX, 10-32, SILVER PLATED NUT ELEMENTS, SPACED AT .750 INCH, 800°F
MS21065L4-7-10 = GANG CHANNEL ASSEMBLY CONSISTING OF TEN, 1/4-28, DRY FILM LUBRICATED NUT ELEMENTS, SPACED AT .875 INCH, 450°F

INTERCHANGEABILITY RELATIONSHIP: (STATUS NOTE) MS21065 NUTS CAN UNIVERSALLY REPLACE NAS688 THRU 692 NUTS OF LIKE THREAD SIZE, LUBRICANT (DRY FILM OR NON-DRY FILM), PLATING, NUT ELEMENT, SPACING, NUMBER OF NUT ELEMENTS, AND MATERIAL, BUT NAS688 THRU 692 NUTS CANNOT UNIVERSALLY REPLACE MS21065 NUTS. FOR DEFINITION AND APPLICATION OF STATUS NOTE SEE MIL-STD-32.

SURFACE ROUGHNESS: IN ACCORDANCE WITH MIL-STD-10. UNLESS OTHERWISE SPECIFIED THE SURFACE ROUGHNESS SHALL NOT EXCEED 125 MICRO INCHES.

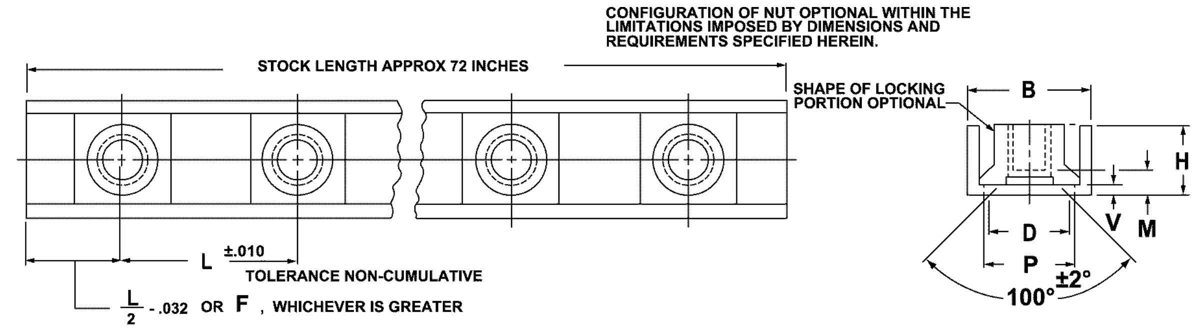
BREAK SHARP CORNERS.

DIMENSIONS IN INCHES.
DIMENSIONS TO BE MET PRIOR TO LUBRICATION.

THIS STANDARD TAKES PRECEDENCE OVER DOCUMENTS REFERENCED HEREIN.
REFERENCED DOCUMENTS SHALL BE OF THE ISSUE IN EFFECT ON DATE OF INVITATIONS FOR BID.

F05-050S02

Figure 5-51. Drawing MS21065(ASG) (Sheet 2)



THREAD SIZE DASH No.	Ⓑ THREAD MIL-S-8879/MOD.	B MAX	D MIN	F MIN	(2) H MAX	L MIN SPACING AVAILABLE	M REF	(5) P MAX	P MIN	V MAX	AXIAL STRENGTH LBS MIN	WEIGHT (MAX) NUT ELEMENTS LBS/100	WEIGHT (MAX) CHANNEL LBS/INCH
-08	8-32UNC-3B	.593	.360	.406	.272	.750	.084	.491	.385	.035	1,720	.24	.0038
-3	10-32UNF-3B	.593	.406	.406	.281	.750	.093	.491	.431	.035	2,460	.26	.0038
-4	1/4-28UNF-3B	.874	.509	.562	.340	1.000	.107	.620	.560	.045	4,580	.60	.0052

(1) THREADS BEFORE LUBRICATION PER MIL-5-8879. THREADS IN ACCORDANCE WITH MIL-S-7742 ARE
Ⓑ ACCEPTABLE UNTIL 31 DECEMBER 1969.

(2) H"MAX APPLIES TO NUT ELEMENT AND CHANNEL. MIN "H" NOT SPECIFIED, LIMITED ONLY BY STRENGTH REQUIREMENTS OF SPECIFICATION.

(3) FLOAT OF NUT ELEMENT PORTION OF ASSEMBLY SHALL NOT BE LESS THAN .030 NOR MORE THAN .040 LONGITUDINALLY AND NOT LESS THAN .010 NOR MORE THAN .030 LATERALLY FROM CENTERED POSITION. NUT ELEMENT SHALL BE CAPABLE OF ENGAGEMENT WITH A BOLT IN THE MAXIMUM MISALIGNMENT POSITION. MAXIMUM AXIAL FLOAT .020 INCH FOR MS21066-08 AND MS2106-3, .030 FOR MS21066-4.

(4) THE ASSEMBLY SHALL PROVIDE A BEARING SURFACE FOR THE NUT ELEMENT WITHIN THE HOUSING. THE CENTERLINE OF THE CHANNEL SHALL NOT DEVIATE FROM A STRAIGHT LINE BY MORE THAN .015 IN ANY 12 INCHES. THE NUT ELEMENT AND BASE PORTION OF THE ASSEMBLY SHALL FORM ONE INTEGRAL UNIT.

(5) HOLE IN CHANNEL MUST PROVIDE FOR FULL FLOAT OF NUT ELEMENT BUT NEED NOT BE CIRCULAR.

L NUT ELEMENT SPACING	NUT ELEMENT SPACING DASH No.	MAX No. OF NUT ELEMENTS
.750	-6	96
.875	-7	82
1.000	-8	72
1.125	-9	64
1.250	-10	57
1.375	-11	52
1.500	-12	48
1.625	-13	44
1.750	-14	41
1.875	-15	38
2.000	-16	36
2.250	-18	32
2.500	-20	28
3.000	-24	24

MATERIAL: NUT ELEMENT - STEEL.
CHANNEL - CORROSION RESISTANT STEEL.

HARDNESS: NUT ELEMENTS SHALL HAVE A MAXIMUM HARDNESS OF ROCKWELL C 49.

PLATING: NUT ELEMENTS - CADMIUM PLATED IN ACCORDANCE WITH QQ-P-416, TYPE II. CLASS 3. DRY FILM LUBRICATED NUT ELEMENTS IN ACCORDANCE WITH QQ-P-416, TYPE AND CLASS ARE OPTIONAL IF THE NUT ELEMENTS WILL MEET THE SALT SPRAY REQUIREMENTS OF QQ-P-416, TYPE II.
CHANNEL - PLAIN (PASSIVATED).

LUBRICANT: DRY FILM LUBRICANT, ON NUT ELEMENT ONLY, APPROVED IN ACCORDANCE WITH MIL-N-25027.
OTHER LUBRICANTS SOLUBLE IN THE CLEANER SPECIFIED IN MIL-S-7502. FOR USAF APPLICATIONS, NUTS TREATED WITH DRY FILM LUBRICANTS SHALL NOT BE USED IN INTERNAL FUEL SYSTEMS APPLICATIONS.

DESIGN AND USAGE LIMITATIONS: THESE NUTS ARE DESIGNED TO DEVELOP THE TENSILE STRENGTH OF BOLTS AND SCREWS WITH AN ULTIMATE STRESS (Ftu) OF 125 KSI BASED ON THE CROSS SECTIONAL AREA AT THE BASIC ROOT DIAMETER OF THE THREAD. THESE NUTS ARE DESIGNED TO BE USED ON 3A EXTERNAL THREADS. THESE NUTS SHALL BE USED IN ACCORDANCE WITH THE LIMITATIONS OF MS33588. ONLY NUTS FOR WHICH THERE ARE QUALIFIED PRODUCTS LISTED ON QPL25027 SHALL BE USED.

CODE: FIRST DASH NUMBER, AS LISTED ABOVE, DESIGNATES THREAD SIZE. SECOND DASH NUMBER DESIGNATES NUT ELEMENT SPACING IN EIGHTHS OF AN INCH. THIRD DASH NUMBER INDICATES NUMBERS OF NUT ELEMENTS WHEN LESS THAN STOCK LENGTH (APPROX 72 INCHES) IS DESIRED.
LETTER "L" BEFORE FIRST DASH NUMBER DESIGNATES DRY FILM LUBRICATED NUT ELEMENTS.

EXAMPLE OF PART NUMBERS:

MS21066-3-6	GANG CHANNEL ASSEMBLY CONSISTING OF NINETY-SIX, 10-32, CADMIUM PLATED NUT ELEMENTS SPACED AT .750 INCH.
MS21066L4-7-10	GANG CHANNEL ASSEMBLY CONSISTING OF TEN, 1/4-28, CADMIUM PLATED DRY FILM LUBRICATED NUT ELEMENTS, SPACED AT .875 INCH.

INTERCHANGEABILITY RELATIONSHIP: MS21066 NUTS CAN UNIVERSALLY REPLACE NAS693 THRU 695 NUTS OF LIKE THREAD SIZE,
(STATUS NOTE) LUBRICANT (DRY FILM OR NON-DRY FILM), PLATING, NUT ELEMENT SPACING, NUMBER OF NUT ELEMENTS, AND MATERIAL; BUT NAS693 THRU 695 NUTS CANNOT UNIVERSALLY REPLACE MS21066 NUTS. FOR DEFINITION AND APPLICATION OF STATUS NOTES SEE MIL-STD-32.

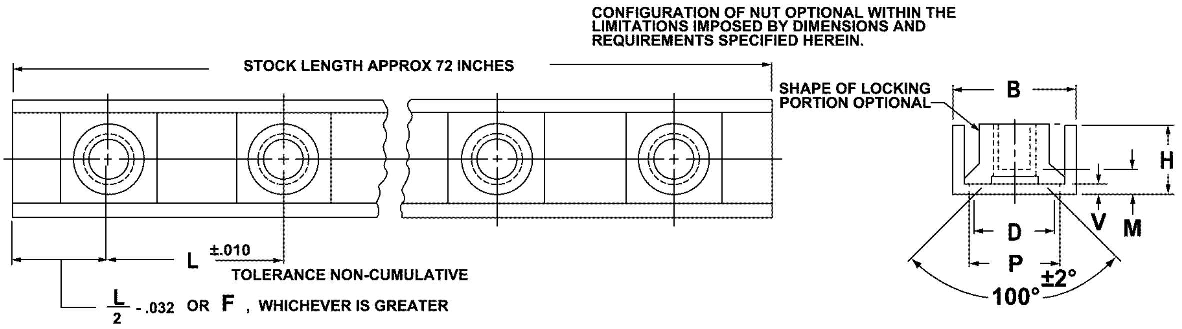
SURFACE ROUGHNESS: IN ACCORDANCE WITH MIL-STD-10. UNLESS OTHERWISE SPECIFIED THE SURFACE ROUGHNESS SHALL NOT EXCEED 125 MICRO INCHES.

BREAK SHARP CORNERS.
DIMENSIONS IN INCHES.
DIMENSIONS TO BE MET PRIOR TO LUBRICATION.

THIS STANDARD TAKES PRECEDENCE OVER DOCUMENTS REFERENCED HEREIN.
REFERENCED DOCUMENTS SHALL BE OF THE ISSUE IN EFFECT ON DATE OF INVITATIONS FOR BID.

F05-051

Figure 5-52. Drawing MS21066(ASG)



THREAD SIZE DASH No.	Ⓑ THREAD MIL-S-8879/MOD.	B MAX	D MIN	F MIN	(2) H MAX	L MIN SPACING AVAILABLE	M REF	(5) P		V MAX	AXIAL STRENGTH LBS MIN	WEIGHT (MAX)	
								MAX	MIN			NUT ELEMENTS LBS/100	CHANNEL LBS/INCH
-06	8-32UNC-3B	.593	.360	.406	.272	.750	.084	.491	.385	.035	1,720	.24	.0080
-3	10-32UNF-3B	.593	.406	.406	.281	.750	.093	.491	.431	.035	2,460	.26	.0080
-4	1/4-28UNF-3B	.874	.509	.562	.340	1.000	.107	.620	.560	.045	4,580	.60	.0100

(1) THREADS BEFORE LUBRICATION PER MIL-S-8879, THREADS IN ACCORDANCE WITH MIL-S-7742 ARE Ⓑ ACCEPTABLE UNTIL 31 DECEMBER 1969.

(2) "H"MAX APPLIES TO NUT ELEMENT AND CHANNEL. MIN "H" NOT SPECIFIED, LIMITED ONLY BY STRENGTH REQUIREMENTS OF SPECIFICATION.

(3) FLOAT OF NUT ELEMENT PORTION OF ASSEMBLY SHALL NOT BE LESS THAN .030 NOR MORE THAN .040 LONGITUDINALLY AND NOT LESS THAN .010 NOR MORE THAN .030 LATERALLY FROM CENTERED POSITION. NUT ELEMENT SHALL BE CAPABLE OF ENGAGEMENT WITH A BOLT IN THE MAXIMUM MISALIGNMENT POSITION. MAXIMUM AXIAL FLOAT .020 INCH FOR MS21067-08 AND MS21067-3, .030 FOR MS21067-4.

(4) THE ASSEMBLY SHALL PROVIDE A BEARING SURFACE FOR THE NUT ELEMENT WITHIN THE HOUSING. THE CENTERLINE OF THE CHANNEL SHALL NOT DEVIATE FROM A STRAIGHT LINE BY MORE THAN .015 IN ANY 12 INCHES. THE NUT ELEMENT AND BASE PORTION OF THE ASSEMBLY SHALL FORM ONE INTEGRAL UNIT.

(5) HOLE IN CHANNEL MUST PROVIDE FOR FULL FLOAT OF NUT ELEMENT BUT NEED NOT BE CIRCULAR.

L NUT ELEMENT SPACING	NUT ELEMENT SPACING DASH No.	MAX No. OF NUT ELEMENTS
.750	-6	96
.875	-7	82
1.000	-8	72
1.125	-9	64
1.250	-10	57
1.375	-11	52
1.500	-12	48
1.625	-13	44
1.750	-14	41
1.875	-15	38
2.000	-16	36
2.250	-18	32
2.500	-20	28
3.000	-24	24

MATERIAL: NUT ELEMENT - STEEL.
CHANNEL - CORROSION RESISTANT STEEL.

HARDNESS: NUT ELEMENTS SHALL HAVE A MAXIMUM HARDNESS OF ROCKWELL C 49.

PLATING: NUT ELEMENTS - CADMIUM PLATED IN ACCORDANCE WITH QQ-P-416, TYPE II, CLASS 3. DRY FILM LUBRICATED NUT ELEMENTS IN ACCORDANCE WITH QQ-P-416, TYPE AND CLASS ARE OPTIONAL IF THE NUT ELEMENTS WILL MEET THE SALT SPRAY REQUIREMENTS OF QQ-P-416, TYPE II.
CHANNEL - PLAIN (PASSIVATED).

LUBRICANT: DRY FILM LUBRICANT, ON NUT ELEMENT ONLY, APPROVED IN ACCORDANCE WITH MIL-N-25027, OTHER LUBRICANTS SOLUBLE IN THE CLEANER SPECIFIED IN MIL-S-7502. FOR USAF APPLICATIONS, NUTS TREATED WITH DRY FILM LUBRICANTS SHALL NOT BE USED IN INTERNAL FUEL SYSTEMS APPLICATIONS.

DESIGN AND USAGE LIMITATIONS: THESE NUTS ARE DESIGNED TO DEVELOP THE TENSILE STRENGTH OF BOLTS AND SCREWS WITH AN ULTIMATE STRESS (Ftu) OF 125 KSI BASED ON THE CROSS SECTIONAL AREA AT THE BASIC ROOT DIAMETER OF THE THREAD. THESE NUTS ARE DESIGNED TO BE USED ON 3A EXTERNAL THREADS. THESE NUTS SHALL BE USED IN ACCORDANCE WITH THE LIMITATIONS OF MS33588. ONLY NUTS FOR WHICH THERE ARE QUALIFIED PRODUCTS LISTED ON QPL25027 SHALL BE USED.

CODE: FIRST DASH NUMBER, AS LISTED ABOVE, DESIGNATES THREAD SIZE. SECOND DASH NUMBER DESIGNATES NUT ELEMENT SPACING IN EIGHTHS OF AN INCH. THIRD DASH NUMBER INDICATES NUMBERS OF NUT ELEMENTS WHEN LESS THAN STOCK LENGTH (APPROX 72 INCHES) IS DESIRED.
LETTER "L" BEFORE FIRST DASH NUMBER DESIGNATES DRY FILM LUBRICATED NUT ELEMENTS.

EXAMPLE OF PART NUMBERS:
MS21067-3-6 = GANG CHANNEL ASSEMBLY CONSISTING OF NINETY-SIX, 10-32, CADMIUM PLATED NUT ELEMENTS SPACED AT .750 INCH.
MS21067L4-7-10 = GANG CHANNEL ASSEMBLY CONSISTING OF TEN, 1/4-28, CADMIUM PLATED DRY FILM LUBRICATED NUT ELEMENTS, SPACED AT .875 INCH.

INTERCHANGEABILITY RELATIONSHIP: MS21067 NUTS CAN UNIVERSALLY REPLACE NAS693 THRU 695 NUTS OF LIKE THREAD SIZE, (STATUS NOTE) LUBRICANT (DRY FILM OR NON-DRY FILM), PLATING, NUT ELEMENT SPACING, NUMBER OF NUT ELEMENTS AND MATERIAL; BUT NAS693 THRU 695 NUTS CANNOT UNIVERSALLY REPLACE MS21067 NUTS. FOR DEFINITION AND APPLICATION OF STATUS NOTES SEE MIL-STD-32.

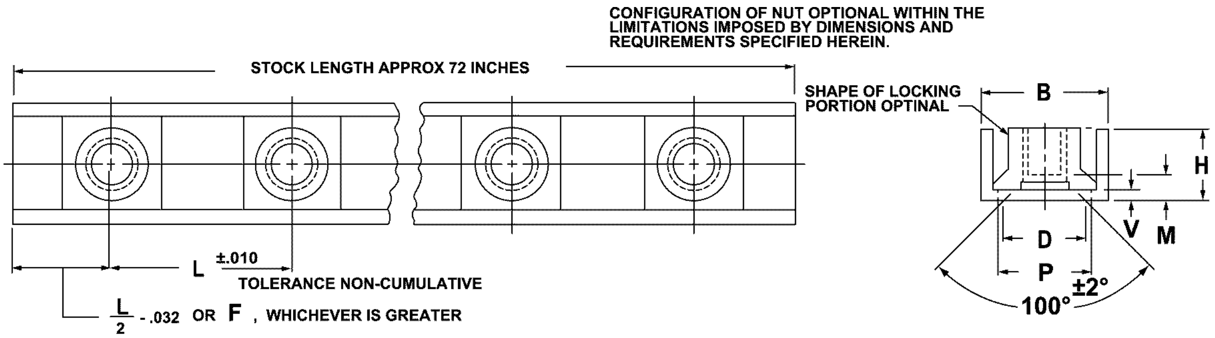
SURFACE ROUGHNESS: IN ACCORDANCE WITH MIL-STD-10. UNLESS OTHERWISE SPECIFIED THE SURFACE ROUGHNESS SHALL NOT EXCEED 125 MICRO INCHES.

BREAK SHARP CORNERS.
DIMENSIONS IN INCHES.
DIMENSIONS TO BE MET PRIOR TO LUBRICATION.

THIS STANDARD TAKES PRECEDENCE OVER DOCUMENTS REFERENCED HEREIN.
REFERENCED DOCUMENTS SHALL BE OF THE ISSUE IN EFFECT ON DATE OF INVITATIONS FOR BID.

F05-052

Figure 5-53. Drawing MS21067(ASG)



THREAD SIZE DASH No.		Ⓑ THREAD	B	D	F	H (2)	L MIN SPACING	M	P (5)		V	AXIAL STRENGTH	WEIGHT (MAX)	
450°F	800°F	MIL-S-8879/MOD.	MAX	MIN	MIN	MAX	AVAILABLE	MIN	MAX	MIN	MAX	LBS MIN	NUT ELEMENTS LBS/100	CHANNEL LBS/INCH
L08	-08	8-32UNC-3B	.593	.360	.406	.272	.750	.084	.491	.385	.035	1,720	.24	.0080
L3	-3	10-32UNF-3B	.593	.406	.406	.281	.750	.093	.491	.431	.035	2,460	.26	.0080
L4	-4	1/4-28UNF-3B	.874	.509	.562	.340	1.000	.107	.620	.560	.045	4,580	.50	.0100

L NUT ELEMENT SPACING	NUT ELEMENT SPACING DASH No.	MAX No. OF NUT ELEMENTS
.750	-6	96
.875	-7	82
1.000	-8	72
1.125	-9	64
1.250	-10	57
1.375	-11	52
1.500	-12	48
1.625	-13	44
1.750	-14	41
1.875	-15	38
2.000	-16	36
2.250	-18	32
2.500	-20	28
3.000	-24	24

Ⓑ (1) THREADS BEFORE LUBRICATION PER MIL-5-8879 THREADS IN ACCORDANCE WITH MIL-S-7742 ARE ACCEPTABLE UNTIL 31 DECEMBER 1969.

(2) "H"MAX APPLIES TO NUT ELEMENT AND CHANNEL. MIN "H" NOT SPECIFIED, LIMITED ONLY BY STRENGTH REQUIREMENTS OF SPECIFICATION.

(3) FLOAT OF NUT ELEMENT PORTION OF ASSEMBLY SHALL NOT BE LESS THAN .030 NOR MORE THAN .040 LONGITUDINALLY AND NOT LESS THAN .010 NOR MORE THAN .030 LATERALLY FROM CENTERED POSITION. NUT ELEMENT SHALL BE CAPABLE OF ENGAGEMENT WITH A BOLT IN THE MAXIMUM MISALIGNMENT POSITION. MAXIMUM AXIAL FLOAT .020 INCH FOR MS21068-08 AND MS21068-3, .030 FOR MS21068-4.

(4) THE ASSEMBLY SHALL PROVIDE A BEARING SURFACE FOR THE NUT ELEMENT WITHIN THE HOUSING. THE CENTERLINE OF THE CHANNEL SHALL NOT DEVIATE FROM A STRAIGHT LINE BY MORE THAN .015 IN ANY 12 INCHES. THE NUT ELEMENT AND BASE PORTION OF THE ASSEMBLY SHALL FORM ONE INTEGRAL UNIT.

(5) HOLE IN CHANNEL MUST PROVIDE FOR FULL FLOAT OF NUT ELEMENT BUT NEED NOT BE CIRCULAR.

MATERIAL: NUT ELEMENT - CORROSION AND HEAT RESISTANT STEEL, (A286) AMS5525, AMS5735 OR AMS5737
CHANNEL - CORROSION RESISTANT STEEL.

HARDNESS: NUT ELEMENTS SHALL HAVE A MAXIMUM HARDNESS OF ROCKWELL C 49.

PLATING: 800°F NUT ELEMENTS - SILVER PLATED IN ACCORDANCE WITH AMS2410. PLATE THICKNESS MEASURED ON ANY EXTERNAL SURFACE OF THE NUT ELEMENT SHALL NOT BE LESS THAN 0.0002 INCHES. THREADS SHALL SHOW COMPLETE COVERAGE BUT THICKNESS REQUIREMENT ON THREAD IS WAIVED.
CHANNEL - PLAIN (PASSIVATED).

LUBRICANT: 450°F NUT ELEMENTS - DRY FILM LUBRICANT, ON NUT ELEMENT ONLY, APPROVED IN ACCORDANCE WITH MIL-N-25027, FOR USAF APPLICATIONS, NUTS TREATED WITH DRY FILM LUBRICANTS SHALL NOT BE USED IN INTERNAL FUEL SYSTEMS APPLICATIONS. NO SILVER PLATE.

MAGNETIC PERMEABILITY: SHALL BE LESS THAN 2.0 (AIR = 1.0) FOR A FIELD STRENGTH H = 200 OERSTEDS USING A MAGNETIC PERMEABILITY INDICATOR PER MIL-I-17214 OR EQUIVALENT.

PERFORMANCE: SEE PROCUREMENT SPECIFICATION, EXCEPT 450°F DRY FILM LUBRICATED NUT ELEMENTS LIMITED TO FIVE REUSE CYCLES.

Ⓑ FOR CHANGES SEE SHEET 1.

F05-053S01

Figure 5-54. Drawing MS21068(ASG) (Sheet 1 of 2)

DESIGN AND USAGE LIMITATIONS: THESE NUTS ARE DESIGNED TO DEVELOP THE TENSILE STRENGTH OF BOLTS AND SCREWS WITH ULTIMATE STRESS (Ftu) OF 125 KSI BASED ON THE CROSS SECTIONAL AREA AT THE BASIC ROOT DIAMETER OF THE THREAD. THESE NUTS ARE DESIGNED TO BE USED ON 3A EXTERNAL THREADS. THESE NUTS SHALL BE USED IN ACCORDANCE WITH THE LIMITATIONS OF MS33588. ONLY NUTS FOR WHICH THERE ARE QUALIFIED PRODUCTS LISTED ON QPL25027 SHALL BE USED.

CODE: FIRST DASH NUMBER, DESIGNATES THREAD SIZE.
SECOND DASH NUMBER DESIGNATES NUT ELEMENT SPACING IN EIGHTHS OF AN INCH.
THIRD DASH NUMBER INDICATES NUMBER OF NUT ELEMENTS WHEN LESS THAN STOCK LENGTH (APPROX 72 INCHES) IS DESIRED.
LETTER "L" BEFORE FIRST DASH NUMBER DESIGNATES DRY FILM LUBRICATED NUT ELEMENTS.

EXAMPLE OF PART NUMBERS;

MS21068-3-6 = GANG CHANNEL ASSEMBLY CONSISTING OF NINETY-SIX, 10-32, SILVER PLATED NUT ELEMENTS, SPACED AT .750 INCH, 800°F
MS21068L4-7-10 = GANG CHANNEL ASSEMBLY CONSISTING OF TEN, 1/4-28, DRY FILM LUBRICATED NUT ELEMENTS, SPACED AT .875 INCH, 450°F

INTERCHANGEABILITY RELATIONSHIP: (STATUS NOTE) MS21065 NUTS CAN UNIVERSALLY REPLACE NAS693 THRU 695 NUTS OF LIKE THREAD SIZE, LUBRICANT (DRY FILM OR NON-DRY FILM), PLATING, NUT ELEMENT SPACING, NUMBER OF NUT ELEMENTS, AND MATERIAL, BUT NAS693 THRU 695 NUTS CANNOT UNIVERSALLY REPLACE MS21068 NUTS. FOR DEFINITION AND APPLICATION OF STATUS NOTE SEE MIL-STD-32.

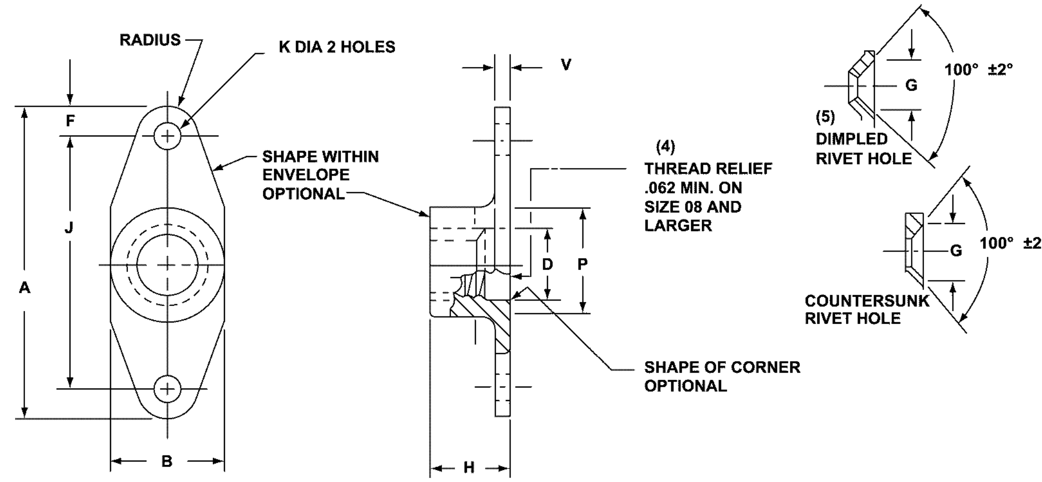
SURFACE ROUGHNESS: IN ACCORDANCE WITH MIL-STD-10. UNLESS OTHERWISE SPECIFIED THE SURFACE ROUGHNESS SHALL NOT EXCEED 125 MICRO INCHES.

BREAK SHARP CORNERS.

DIMENSIONS IN INCHES.
DIMENSIONS TO BE MET PRIOR TO LUBRICATION.

F05-053S02

Figure 5-54. Drawing MS21068(ASG) (Sheet 2)



(1) Ⓑ THREAD SIZE MIL-S-8879/MOD.	A	B		D DIA	F	G DIA	(2) H	J	K DIA	P DIA	V MAT'L	AXIAL STRENGTH	WEIGHT
	MAX	MAX	MIN	MIN	MIN	±.010	MAX	±.002	+.005 -.000	MAX	MAX	LBS MIN	LBS/100 MAX
2-56 UNC-3B	.410	.162	.140	—	.071	(3)	.110	.250	.066	.130	.035	440	.05
4-40 UNC-3B	.630	.260	.140	—	.089	.200	.143	.406	.098	.166	.040	750	.11
6-32 UNC-3B	.661	.265	.195	—	.089	.200	.171	.437	.098	.206	.047	1130	.14
8-32 UNC-3B	.692	.297	.230	.168	.100	.200	.250	.468	.098	.248	.047	1720	.18
10-32 UNF-3B	.724	.328	.298	.194	.100	.200	.250	.500	.098	.274	.047	2460	.26
1/4-28 UNF-3B	.786	.414	.380	.254	.100	.200	.281	.562	.098	.344	.055	4580	.40
5/16-24 UNF-3B	1.006	.505	.475	.317	.125	.230	.328	.718	.130	.417	.065	7390	.77
3/8-24 UNF-3B	1.116	.614	.580	.379	.125	---	.344	.828	.130	.505	.075	11450	1.86

Ⓑ (1) THREADS PER MIL-S-8879 BEFORE LUBRICATION. THREADS IN ACCORDANCE WITH MIL-S-7742 ARE ACCEPTABLE UNTIL 31 DECEMBER 1969.

(2) MINIMUM "H" NOT SPECIFIED, LIMITED ONLY BY STRENGTH REQUIREMENTS

(3) SPACE WILL NOT PERMIT COUNTERSINK

(4) CENTER OF THE TAPPED HOLE SHALL NOT DEVIATE IN ANY DIRECTION FROM THE CENTER OF THE PLATE NUT AS DETERMINED BY THE RIVET HOLES BY MORE THAN .005. SIZES NO. 06 AND SMALLER MAY BE COUNTERSUNK OR RADIUSED WITHIN 'P' DIAMETER.

(5) DIMPLED HOLE TOLERANCE FOR 'K' IS +.015, -.000 AFTER FORMING

MATERIAL: STEEL

PLATING: CADMIUM PLATE IN ACCORDANCE WITH QQ-P-416 TYE II CLASS 3. FOR DRY FILM LUBRICATED NUTS, THE TYPE AND CLASS ARE OPTIONAL IF THE NUTS MEET THE SALT SPRAY REQUIREMENTS OF QQ-P-416, TYPE II.

HARDNESS: ROCKWELL C49 MAXIMUM.

LUBRICANT: DRY FILM LUBRICANT APPROVED IN ACCORDANCE WITH MIL-N-25027. OTHER LUBRICANTS SOLUBLE IN THE CLEANER SPECIFIED IN MIL-S-7502. FOR USAF APPLICATIONS NUTS TREATED WITH DRY FILM LUBRICANTS SHALL NOT BE USED IN INTERNAL FUEL SYSTEMS APPLICATIONS.

DIMENSIONS IN INCHES.

SURFACE ROUGHNESS IN ACCORDANCE WITH MIL-STD-10. UNLESS OTHERWISE SPECIFIED, THE SURFACE ROUGHNESS SHALL NOT EXCEED 125 MICRO INCHES.

DESIGN AND USAGE LIMITATIONS: THESE NUTS ARE DESIGNED TO DEVELOP THE TENSILE STRENGTH OF BOLTS AND SCREWS AN ULTIMATE TENSILE STRENGTH OF 125 KSI BASED ON THE CROSS SECTIONAL AREA AT THE BASIC ROOT DIAMETER OF THE THREAD. THESE NUTS ARE DESIGNED TO BE USED ON 3A EXTERNAL THREADS. THESE NUTS SHALL BE USED IN ACCORDANCE WITH LIMITATIONS OF MS 33588. ONLY NUTS FOR WHICH THERE ARE QUALIFIED PRODUCTS LISTED ON QPL 25027 SHALL BE USED.

INTERCHANGEABILITY RELATIONSHIP: MS 21069 NUTS CAN UNIVERSALLY REPLACE MAS 697 NUTS OF LIKE MATERIAL, THREAD SIZE, (STATUS NOTE) LUBRICANTS (DRY FILM OR NON DRY FILM), RIVET SPACING, AND FASTENING METHOD (PLAIN RIVET HOLES, DIMPLED OR COUNTERSUNK RIVET HOLES). BUT THESE HAS 697 NUTS CANNOT UNIVERSALLY REPLACE MS 21069 NUTS. FOR DEFINITION AND APPLICATION OF DRAWING STATUS NOTES, SEE MIL-STD-32.

THIS STANDARD TAKES PRECEDENCE OVER DOCUMENTS REFERENCED HEREIN.

REFERENCED DOCUMENTS SHALL BE OF THE ISSUE EFFECT ON DATE OF INVITATIONS FOR BIDS.

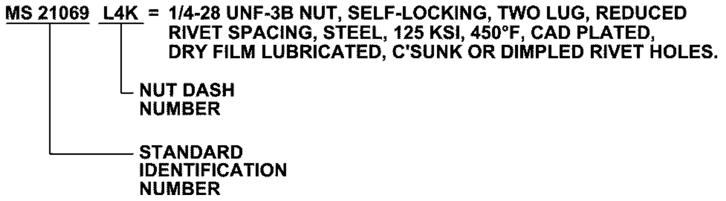
Ⓑ FOR CHANGES SEE SHEETS 1 AND 2.

F05-054S01

Figure 5-55. Drawing MS21069(ASG) (Sheet 1 of 2)

Ⓑ THREAD SIZE MIL-S-8879/MOD.	DASH NUMBERS			
	PLAIN RIVET HOLES		C'SUNK OR DIMPLED RIVET HOLES	
	NON DRY FILM LUBE	DRY FILM LUBE	NON DRY FILM LUBE	DRY FILM LUBE
2-56 UNC-3B	-02	L02	- - -	- - -
4-40 UNC-3B	-04	L04	-04K	L04K
6-32 UNC-3B	-06	L06	-06K	L06K
8-32 UNC-3B	-08	L08	-08K	L08K
10-32 UNF-3B	-3	L3	-3K	L3K
1/4-28 UNF-3B	-4	L4	-4K	L4K
5/16-24 UNF-3B	-5	L5	-5K	L5K
3/8-24 UNF-3B	-6	L6	- - -	- - -

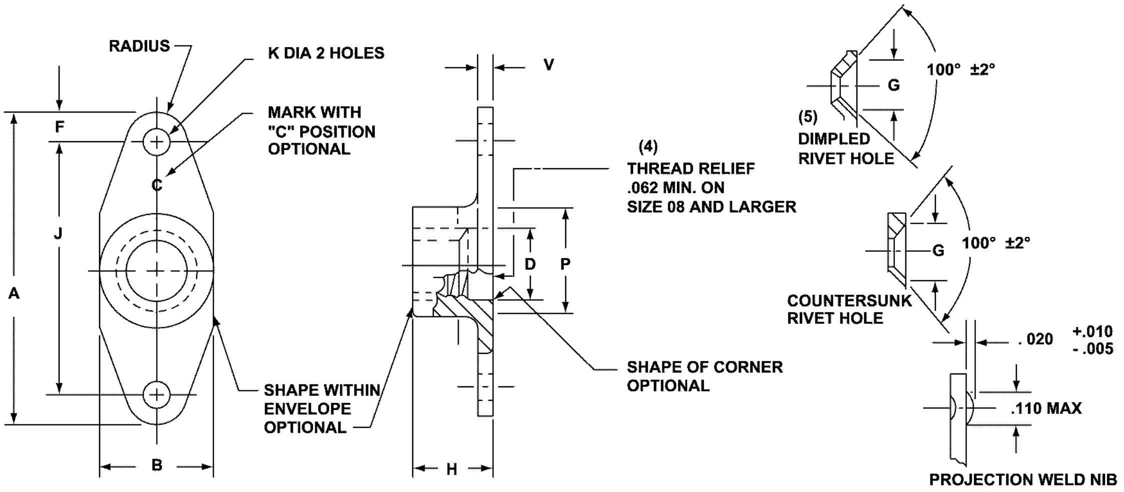
EXAMPLE OF PART NUMBERS:



MS 21069 L4K = 1/4-28 UNF-3B NUT, SELF-LOCKING, TWO LUG, REDUCED RIVET SPACING, STEEL, 125 KSI, 450°F, CAD PLATED, DRY FILM LUBRICATED, C'SUNK OR DIMPLED RIVET HOLES.

F05-054S02

Figure 5-55. Drawing MS21069(ASG) (Sheet 2)



(1) Ⓑ THREAD SIZE MIL-S-8879/MOD.	A	B		D DIA	F	G DIA	(2) H	(3) J	K DIA	P DIA	V MAT'L	AXIAL STRENGTH LBS MIN	WEIGHT LBS/100 MAX
	MAX	MAX	MIN	MIN	MIN	±.010	MAX	±.002	+.005 -.000	MAX	MAX		
2-56 UNC-3B	.410	.162	.140	—	.071	(3)	.110	.250	.066	.130	.035	440	.05
4-40 UNC-3B	.630	.260	.140	—	.089	.200	.143	.406	.098	.166	.040	750	.11
6-32 UNC-3B	.661	.265	.195	—	.089	.200	.171	.437	.098	.206	.047	1130	.14
8-32 UNC-3B	.692	.297	.230	.168	.100	.200	.250	.468	.098	.248	.047	1720	.18
10-32 UNF-3B	.724	.328	.298	.194	.100	.200	.250	.500	.098	.274	.047	2460	.26
1/4-28 UNF-3B	.786	.414	.380	.254	.100	.200	.281	.562	.098	.344	.055	4580	.40
5/16-24 UNF-3B	1.006	.505	.475	.317	.125	.230	.328	.718	.130	.417	.065	7390	.77
3/8-24 UNF-3B	1.116	.614	.580	.379	.125	---	.344	.828	.130	.505	.075	11450	1.86

Ⓑ (1) THREADS PER MIL-S-8879 BEFORE LUBRICATION. THREADS IN ACCORDANCE WITH MIL-S-7742 ARE ACCEPTABLE UNTIL 31 DECEMBER 1969.

(2) MINIMUM "H" NOT SPECIFIED, LIMITED ONLY BY STRENGTH REQUIREMENTS

(3) SPACE WILL NOT PERMIT COUNTERSINK

(4) CENTER OF THE TAPPED HOLE SHALL NOT DEVIATE IN ANY DIRECTION FROM THE CENTER OF THE PLATE NUT AS DETERMINED BY THE RIVET HOLES BY MORE THAN .005. SIZES NO. 06 AND SMALLER MAY BE COUNTERSUNK OR RADIUSED WITHIN 'P' DIAMETER

(5) DIMPLED HOLE TOLERANCE FOR 'K' IS +.015, -.000 AFTER FORMING

MATERIAL: CORROSION RESISTANT STEEL, (A286) AMS5525, AMS5735 OR AMS5737.

PLATING: 800° NUTS ONLY: SILVER PLATE PER AMS2410. THICKNESS ON EXTERNAL SURFACES SHALL NOT BE LESS THAN 0.0002 IN. THREADS SHALL SHOW COMPLETE COVERAGE BUT THICKNESS REQUIREMENT IS WAIVED. NO SILVER PLATE ON WELD NIBS.

LUBRICANT: 450° NUTS, DRY FILM LUBRICANT IN ACCORDANCE WITH MIL-N-25027. FOR USAF APPLICATIONS NUTS TREATED WITH DRY FILM LUBRICANTS SHALL NOT BE USED IN INTERNAL FUEL SYSTEMS. (NO SILVER PLATE)

MAGNETIC PERMEABILITY: SHALL BE LESS THAN 2.0 (AIR=1.0) FOR A FIELD STRENGTH H-200 OERSTEDS USING A MAGNETIC PERMEABILITY INDICATOR PER MIL-I-17214 OR EQUIVALENT.

DIMENSIONS IN INCHES.

SURFACE ROUGHNESS IN ACCORDANCE WITH MIL-STD-10. UNLESS OTHERWISE SPECIFIED, THE SURFACE ROUGHNESS SHALL NOT EXCEED 125 MICRO INCHES.

DESIGN AND USAGE LIMITATIONS: THESE NUTS ARE DESIGNED TO DEVELOP THE TENSILE STRENGTH OF BOLTS AND SCREWS WITH AN ULTIMATE TENSILE STRENGTH OF 125 KSI BASED ON THE CROSS SECTIONAL AREA AT THE BASIC ROOT DIAMETER OF THE THREAD, THESE NUTS ARE DESIGNED TO BE USED ON 3A EXTERNAL THREADS. THESE NUTS SHALL BE USED IN ACCORDANCE WITH THE LIMITATIONS OF MS 33588. ONLY NUTS FOR WHICH THERE ARE QUALIFIED PRODUCTS LISTED ON QPL 25027 SHALL BE USED.

INTERCHANGEABILITY RELATIONSHIP: (STATUS NOTE) MS 21070 NUTS CAN UNIVERSALLY REPLACE NAS 697 NUTS OF LIKE MATERIAL, THREAD SIZE, LUBRICANTS (DRY FILM OR SILVER PLATE), RIVET SPACING, AND FASTENING METHOD (PLAIN RIVET HOLES, DIMPLED OR COUNTERSUNK RIVET HOLES). BUT THESE NAS 697 NUTS CANNOT UNIVERSALLY REPLACE MS 21070 NUTS. FOR DEFINITION AND APPLICATION OF DRAWING STATUS NOTES, SEE MIL-STD-32.

THIS STANDARD TAKES PRECEDENCE OVER DOCUMENTS REFERENCED HEREIN.

REFERENCED DOCUMENTS SHALL BE OF THE ISSUE EFFECT ON DATE OF INVIATIONS FOR BIDS.

Ⓑ FOR CHANGES SEE SHEETS 1 AND 2.

F05-055S01

Figure 5-56. Drawing MS21070(ASG) (Sheet 1 of 2)

Ⓑ THREAD SIZE MIL-S-8879/MOD.	DASH NUMBERS					
	450°F DRY FILM LUBRICATED			800°F NON DRY FILM LUBRICATED		
	PLAIN HOLES	C'SUNK OR DIMPLED HOLES	WELDING PROJECTION	PLAIN HOLES	C'SUNK OR DIMPLED HOLES	WELDING PROJECTION
2-56 UNC-3B	L02	- - - -	L02W	-02	- - - -	-02W
4-40 UNC-3B	L04	L04K	L04W	-04	-04K	-04W
6-32 UNC-3B	L06	L06K	L06W	-06	-06K	-06W
8-32 UNC-3B	L08	L08K	L08W	-08	-08K	-08W
10-32 UNF-3B	L3	L3K	L3W	-3	-3K	-3W
1/4-28 UNF-3B	L4	L4K	L4W	-4	-4K	-4W
5/16-24 UNF-3B	L5	L5K	L5W	-5	-5K	-5W
3/8-24 UNF-3B	L6	- - - -	L6W	-6	- - - -	-6W

EXAMPLE OF PART NUMBER:

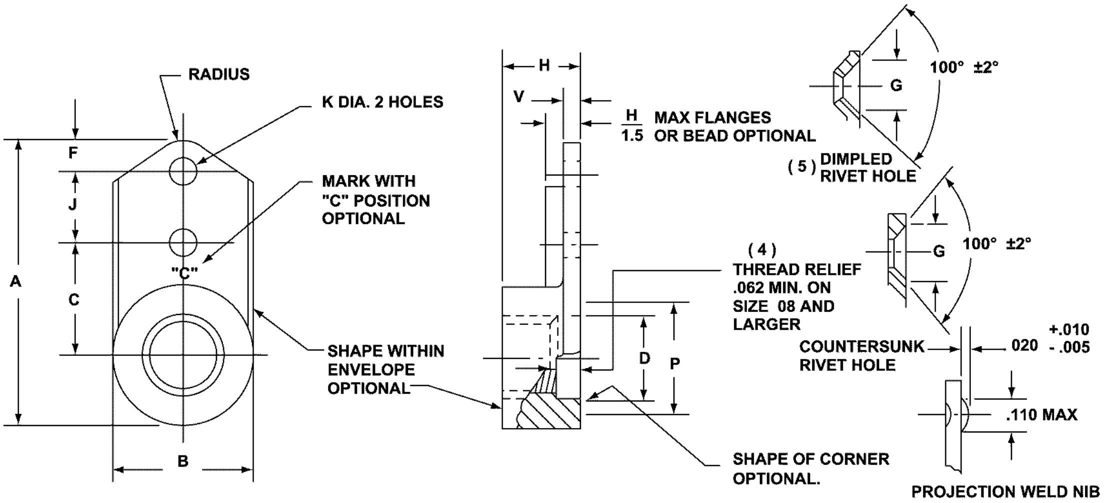
MS 21070 L4W = 1/4-28 UNF-3B NUT, SELF-LOCKING, TWO LUG, REDUCED RIVET SPACING CRES, 125 KSI, 450°F, DRY FILM LUBRICATED, WITH WELD PROJECTION NIBS.

NUT DASH NUMBER

STANDARD IDENTIFICATION NUMBER

F05-055S02

Figure 5-56. Drawing MS21070(ASG) (Sheet 2)



THREAD Ⓑ SIZE MIL-S-8879/MOD.	A	B		C	D DIA	F	G DIA	(2) H	J	K DIA	P DIA	V	AXIAL STRENGTH LBS	WEIGHT LBS/100
	MAX	MAX	MIN	±.005	MIN	MIN	±.010	MAX	±.002	+.005 -.000	MAX	MAX	MIN	MAX
2-56 UNC-3B	.507	.162	.140	.125	—	.071	(3)	.110	.219	.066	.130	.035	440	.06
4-40 UNC-3B	.667	.260	.140	.203	—	.089	.200	.143	.219	.098	.166	.040	750	.12
6-32 UNC-3B	.684	.265	.195	.218	—	.089	.200	.171	.219	.098	.206	.047	1130	.15
8-32 UNC-3B	.716	.297	.235	.234	.168	.100	.200	.250	.219	.098	.248	.047	1720	.23
10-32 UNF-3B	.745	.328	.298	.250	.194	.100	.200	.250	.219	.098	.274	.047	2460	.27
1/4-28 UNF-3B	.822	.414	.380	.281	.254	.100	.200	.281	.219	.098	.344	.055	4580	.46
5/16-24 UNF-3B	1.026	.505	.475	.359	.317	.125	.230	.328	.269	.130	.417	.065	7390	.85
3/8-24 UNF-3B	1.139	.614	.580	.414	.379	.125	---	.344	.269	.130	.505	.075	11450	2.04

Ⓑ (1) THREADS PER MIL-S48879 BEFORE LUBRICATION. THREADS IN ACCORDANCE WITH MIL-S-7742 ARE ACCEPTABLE UNTIL 31 DECEMBER 1969.

(2) MINIMUM "H" NOT SPECIFIED, LIMITED ONLY BY STRENGTH REQUIREMENTS

(3) SPACE WILL NOT PERMIT COUNTERSINK

(4) CENTER OF THE TAPPED HOLE SHALL NOT DEVIATE IN ANY DIRECTION FROM THE CENTER OF THE PLATE NUT AS DETERMINED BY THE RIVET HOLES BY MORE THAN .005. SIZES NO. 06 AND SMALLER MAY BE COUNTERSUNK OR RADIUSED WITHIN 'P' DIAMETER

(5) DIMPLED HOLE TOLERANCE FOR 'K' IS +.015, -.000 AFTER FORMING

MATERIAL: CORROSION RESISTANT STEEL, (A286) AMS5525, AMS5735 OR AMS5737.

PLATING: 800° NUTS ONLY: SILVER PLATE PER AMS2410. THICKNESS ON EXTERNAL SURFACES SHALL NOT BE LESS THAN 0.0002 IN. THREADS SHALL SHOW COMPLETE COVERAGE BUT THICKNESS REQUIREMENT IS WAIVED. NO SILVER PLATE ON WELD NIBS.

LUBRICANT: 450° NUTS, DRY FILM LUBRICANT IN ACCORDANCE WITH MIL-N-25027. FOR USAF APPLICATIONS NUTS TREATED WITH DRY FILM LUBRICANTS SHALL NOT BE USED IN INTERNAL FUEL SYSTEMS. (NO SILVER PLATE)

MAGNETIC PERMEABILITY: SHALL BE LESS THAN 2.0 (AIR=1.0) FOR A FIELD STRENGTH H-200 OERSTEDS USING A MAGNETIC PERMEABILITY INDICATOR PER MIL-I-17214 OR EQUIVALENT.

DIMENSIONS IN INCHES.

SURFACE ROUGHNESS IN ACCORDANCE WITH MIL-STD-10. UNLESS OTHERWISE SPECIFIED, THE SURFACE ROUGHNESS SHALL NOT EXCEED 125 MICRO INCHES.

DESIGN AND USAGE LIMITATIONS: THESE NUTS ARE DESIGNED TO DEVELOP THE TENSILE STRENGTH OF BOLTS AND SCREWS WITH AN ULTIMATE TENSILE STRENGTH OF 125 KSI BASED ON THE CROSS SECTIONAL AREA AT THE BASIC ROOT DIAMETER OF THE THREAD. THESE NUTS ARE DESIGNED TO BE USED ON 3A EXTERNAL THREADS. THESE NUTS SHALL BE USED IN ACCORDANCE WITH THE LIMITATIONS OF MS 33588. ONLY NUTS FOR WHICH THERE ARE QUALIFIED PRODUCTS LISTED ON QPL 25027 SHALL BE USED.

INTERCHANGEABILITY RELATIONSHIP: MS 21072 NUTS CAN UNIVERSALLY REPLACE NAS 696 NUTS OF LIKE MATERIAL, THREAD
(STATUS SIZE, LUBRICANTS (DRY FILM OR SILVER PLATE), RIVET SPACING, AND FASTENING METHOD (PLAIN RIVET HOLES,
NOTE) DIMPLED OR COUNTERSUNK RIVET HOLES). BUT THESE NAS 696 NUTS CANNOT UNIVERSALLY REPLACE MS 21072 NUTS. FOR DEFINITION AND APPLICATION OF DRAWING STATUS NOTES, SEE MIL-STD-32.

THIS STANDARD TAKES PRECEDENCE OVER DOCUMENTS REFERENCED HEREIN.

Ⓑ FOR CHANGES SEE SHEETS 1 AND 2.

REFERENCED DOCUMENTS SHALL BE OF THE ISSUE EFFECT ON DATE OF INVIATIONS FOR BIDS.

F05-056S01

Figure 5-57. Drawing MS21072(ASG) (Sheet 1 of 2)

Ⓑ THREAD SIZE MIL-S-8879/MOD.	DASH NUMBERS					
	450°F DRY FILM LUBRICATED			800°F NON DRY FILM LUBRICATED		
	PLAIN HOLES	C'SUNK OR DIMPLED HOLES	WELDING PROJECTION	PLAIN HOLES	C'SUNK OR DIMPLED HOLES	WELDING PROJECTION
2-56 UNC-3B	L02	- - - -	L02W	-02	- - - -	-02W
4-40 UNC-3B	L04	L04K	L04W	-04	-04K	-04W
6-32 UNC-3B	L06	L06K	L06W	-06	-06K	-06W
8-32 UNC-3B	L08	L08K	L08W	-08	-08K	-08W
10-32 UNF-3B	L3	L3K	L3W	-3	-3K	-3W
1/4-28 UNF-3B	L4	L4K	L4W	-4	-4K	-4W
5/16-24 UNF-3B	L5	L5K	L5W	-5	-5K	-5W
3/8-24 UNF-3B	L6	- - -	L6W	-6	- - -	-6W

EXAMPLE PART NUMBER:

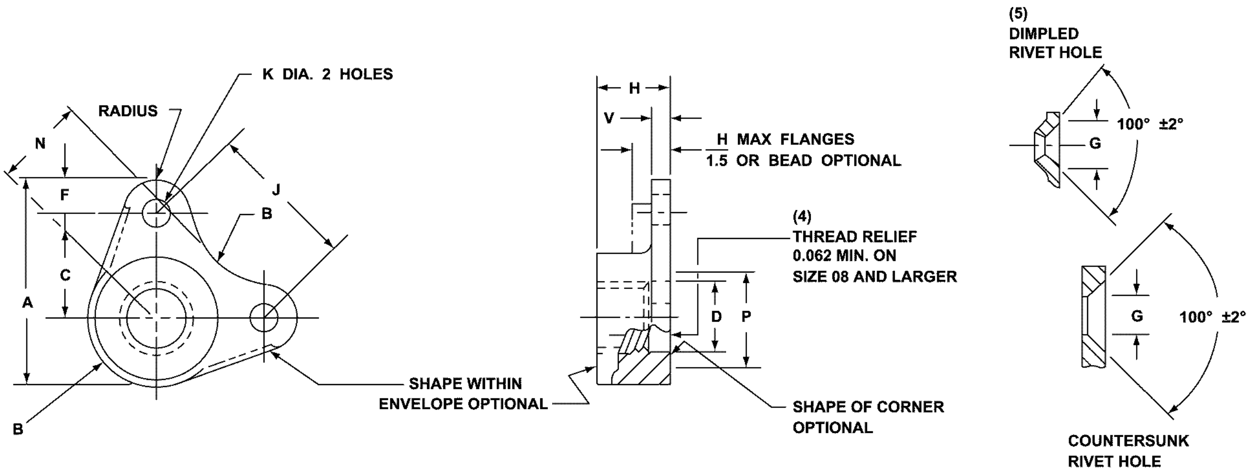
MS21072 L4K = 1/4-28 UNF-3B NUT, SELF LOCKING, ONE LUG, REDUCED RIVET SPACING, CRES, 125 KSI, 450° F, DRY FILM LUBRICATED, WITH COUNTERSUNK OR DIMPLED OR DIMPLED RIVET HOLES.

L4K — NUT DASH NUMBER

MS21072 — STANDARD INDENTIFICATION NUMBER

F05-056S02

Figure 5-57. Drawing MS21072(ASG) (Sheet 2)



Ⓑ THREAD SIZE MIL-S-8879/MOD.	A MAX	B		C ±.005	D DIA MIN	F MIN	G DIA ±.010	(2) H MAX	J ±.002	K +.005 -.000	N MAX	P DIA MAX	V MAX	AXIAL STRENGTH LBS MIN	WEIGHT LBS/100 MAX
		MAX	MIN												
2-56 UNC-3B	.288	.092	.081	.125	—	.071	(3)	.110	.177	.066	.120	.130	.035	440	.07
4-40 UNC-3B	.448	.156	.096	.203	—	.089	.200	.143	.287	.098	.215	.166	.040	750	.11
6-32 UNC-3B	.463	.156	.121	.218	—	.089	.200	.171	.308	.098	.232	.206	.047	1130	.14
8-32 UNC-3B	.497	.163	.125	.234	.168	.100	.200	.250	.331	.098	.210	.248	.047	1720	.21
10-32 UNF-3B	.526	.176	.156	.250	.194	.100	.200	.250	.354	.098	.215	.274	.047	2460	.26
1/4-28 UNF-3B	.603	.222	.200	.281	.254	.100	.200	.281	.398	.098	.233	.344	.055	4580	.45
5/16-24 UNF-3B	.757	.273	.250	.359	.317	.125	.230	.328	.508	.130	.280	.417	.065	7390	.80
3/8-24 UNF-3B	.870	.331	.305	.414	.379	.125	- - -	.344	.585	.130	.303	.505	.075	11450	1.92

Ⓑ (1) THREADS PER MIL-S-48879 BEFORE LUBRICATION. THREADS IN ACCORDANCE WITH MIL-S-7742 ARE ACCEPTABLE UNTIL 31 DECEMBER 1969.

(2) MINIMUM "H" NOT SPECIFIED, LIMITED ONLY BY STRENGTH REQUIREMENTS

(3) SPACE WILL NOT PERMIT COUNTERSINK

(4) SIZES NO. 06 AND SMALLER MAY BE COUNTERSUNK OR RADIUSED WITHIN 'P' DIAMETER.

(5) DIMPLED HOLE TOLERANCE FOR 'K' IS +.015, -.000 AFTER FORMING

MATERIAL: STEEL

PLATING: CADMIUM PLATE IN ACCORDANCE WITH QQ-P-416 TYPE II CLASS 3. FOR DRY FILM LUBRICATED NUTS, THE TYPE AND CLASS ARE OPTIONAL IF THE NUTS MEET THE SALT SPRAY REQUIREMENTS OF QQ-P-416, TYPE II.

HARDNESS: ROCKWELL C49 MAXIMUM.

LUBRICANT: DRY FILM LUBRICANT IN ACCORDANCE WITH MIL-W-25027. OTHER LUBRICANTS SOLUBLE IN THE CLEANER SPECIFIED IN MIL-S-7502. FOR USAF APPLICATIONS NUTS TREATED WITH DRY FILM LUBRICANTS SHALL NOT BE USED IN INTERNAL FUEL SYSTEMS APPLICATIONS.

DESIGN AND USAGE LIMITATIONS: THESE NUTS ARE DESIGNED TO DEVELOP THE TENSILE STRENGTH OF BOLTS AND SCREWS WITH AN ULTIMATE TENSILE STRENGTH OF 125 KSI BASED ON THE CROSS SECTIONAL AREA AT THE BASIC ROOT DIAMETER OF THE THREAD. THESE NUTS ARE DESIGNED TO BE USED ON 3A EXTERNAL THREADS. THESE NUTS SHALL BE USED IN ACCORDANCE WITH THE LIMITATIONS OF MS 33588. ONLY NUTS FOR WHICH THERE ARE QUALIFIED PRODUCTS LISTED ON QPL 25027 SHALL BE USED.

INTERCHANGEABILITY RELATIONSHIP: MS 21073 NUTS CAN UNIVERSALLY REPLACE NAS 698 NUTS OF LIKE MATERIAL, THREAD SIZE (STATUS NOTE) LUBRICANTS (DRY FILM OR NON DRY FILM), RIVET SPACING, AND FASTENING METHOD (PLAIN RIVET HOLES, DIMPLED OR COUNTERSUNK RIVET HOLES). BUT THESE NAS 698 NUTS CANNOT UNIVERSALLY REPLACE MS 21073 NUTS. FOR DEFINITION AND APPLICATION OF DRAWING STATUE NOTES, SEE MIL-STD-32.

THIS STANDARD TAKES PRECEDENCE OVER DOCUMENTS REFERENCED HEREIN.

REFERENCED DOCUMENTS SHALL BE OF THE ISSUE EFFECT ON DATE OF INVIATIONS FOR BIDS.

Ⓑ FOR CHANGES SEE SHEETS 1 AND 2.

F05-057S01

Figure 5-58. Drawing MS21073(ASG) (Sheet 1 of 2)

Ⓑ THREAD SIZE MIL-S-8879/MOD.	DASH NUMBERS			
	PLAIN RIVET HOLES		C'SUNK OR DIMPLED RIVET HOLES	
	NON DRY FILM LUB	DRY FILM LUB	NON DRY FILM LUB	DRY FILM LUB
2-56 UNC-3B	-02	L02	- - -	- - -
4-40 UNC-3B	-04	L04	-04K	L04K
6-32 UNC-3B	-06	L06	-06K	L06K
8-32 UNC-3B	-08	L08	-08K	L08K
10-32 UNF-3B	-3	L3	-3K	L3K
1/4-28 UNF-3B	-4	L4	-4K	L4K
5/16-28 UNF-3B	-5	L5	-5K	L5K
3/8-24 UNF-3B	-6	L6	- - -	- - -

EXAMPLE PART NUMBER:

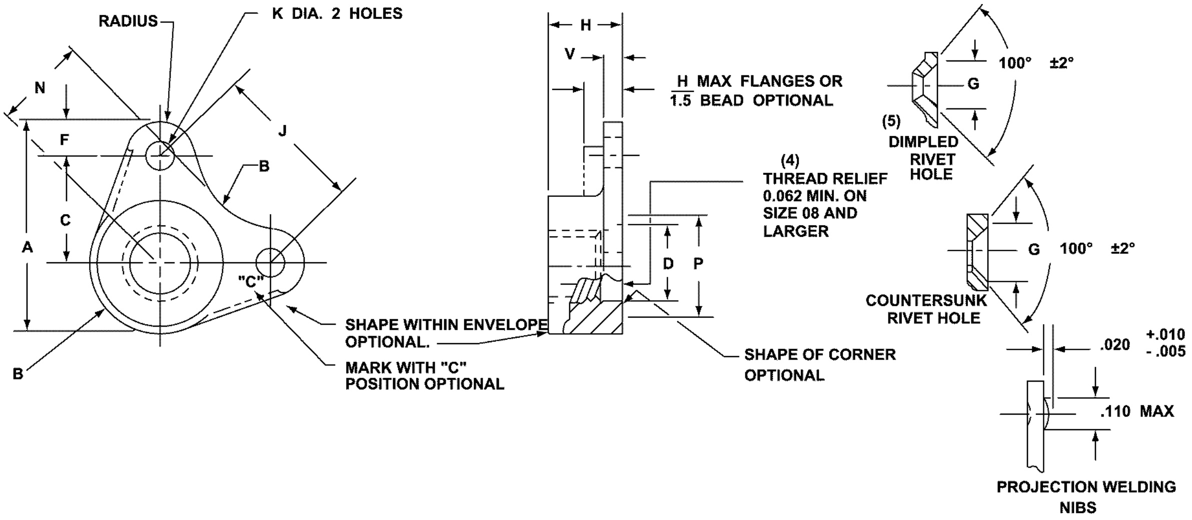
MS21073 L08K = 8-32 UNC-3B NUT, SELF-LOCKING, CORNER, REDUCED RIVET SPACING, STEEL, 125 KSI, 450°F, COUNTERSUNK RIVET HOLES, DRY FILM LUBRICATED.

L08K — NUT DASH NUMBER

MS21073 — STANDARD IDENTIFICATION NUMBER

F05-057S02

Figure 5-58. Drawing MS21073(ASG) (Sheet 2)



THREAD Ⓑ SIZE MIL-S-8879/MOD.	A MAX	B MAX	B MIN	C ±.005	D DIA MIN	F MIN	G DIA ±.010	(2) H MAX	J ±.002	K +.005 -.000	N MAX	P DIA MAX	V MAX	AXIAL STRENGTH LBS MIN	WEIGHT LBS/100 MAX
2-56 UNC-3B	.288	.092	.081	.125	—	.071	(3)	.110	.177	.066	.120	.130	.035	440	.07
4-40 UNC-3B	.448	.156	.096	.203	—	.089	.200	.143	.287	.098	.215	.166	.040	750	.11
6-32 UNC-3B	.463	.156	.121	.218	—	.089	.200	.171	.308	.098	.232	.206	.047	1130	.14
8-32 UNC-3B	.497	.163	.125	.234	.168	.100	.200	.250	.331	.098	.210	.248	.047	1720	.21
10-32 UNF-3B	.526	.176	.156	.250	.194	.100	.200	.250	.354	.098	.215	.274	.047	2460	.26
1/4-28 UNF-3B	.603	.222	.200	.281	.254	.100	.200	.281	.398	.098	.233	.344	.055	4580	.45
5/16-24 UNF-3B	.757	.273	.250	.359	.317	.125	.230	.328	.508	.130	.280	.417	.065	7390	.80
3/8-24 UNF-3B	.870	.331	.305	.414	.379	.125	- - -	.344	.585	.130	.303	.505	.075	11450	1.92

Ⓑ

(1) THREADS PER MIL-S-8879 BEFORE LUBRICATION. THREADS IN ACCORDANCE WITH MIL-S-7742 ARE ACCEPTABLE UNTIL 31 DECEMBER 1969.

(2) MINIMUM "H" NOT SPECIFIED, LIMITED ONLY BY STRENGTH REQUIREMENTS

(3) SPACE WILL NOT PERMIT COUNTERSINK

(4) SIZES NO. 06 AND SMALLER MAY BE COUNTERSUNK OR RADIUSED WITHIN 'P' DIAMETER.

(5) DIMPLED HOLE TOLERANCE FOR 'K' IS +.015, -.000 AFTER FORMING

MATERIAL: CORROSION RESISTANT STEEL

PLATING: 800° NUTS ONLY: SILVER PLATE PER AMS2410. THICKNESS ON EXTERNAL SURFACES SHALL NT BE LESS THAN 0.0002 IN., THREADS SHALL SHOW COMPLETE COVERAGE BUT THICKNESS REQUIREMENT IS WAIVED. NO SILVER PLATE ON WELD NIBS.

LUBRICANT: 450° NUTS, DRY FILM LUBRICANT IN ACCORDANCE WITH MIL-N-25027. FOR USAF APPLICATIONS, NUTS. TREATED WITH DRY FILM LUBRICANTS SHALL NOT BE USED IN INTERNAL FUEL SYSTEMS. (NO SILVER PLATE)

MAGNETIC PERMEABILITY: SHALL BE LESS THAN 2.0 (AIR-1.0) FOR A FIELD STRENGTH H-200 OERSTEDS USING A MAGNETIC PERMEABILITY INDICATOR PER MIL-I-17214 OR EQUIVALENT.

SURFACE ROUGHNESS IN ACCORDANCE WITH MIL-STD-10. UNLESS OTHERWISE SPECIFIED, THE SURFACE ROUGHNESS SHALL NOT EXCEED 125 MICRO INCHES.

PERFORMANCE: SEE PROCUREMENT SPECIFICATION EXCEPT DRY FILM LUBRICATED NUTS LIMITED TO FIVE REUSE CYCLES.

DESIGN AND USAGE LIMITATIONS: THESE NUTS ARE DESIGNED TO DEVELOP THE TENSILE STRENGTH OF BOLTS AND SCREWS WITH AN ULTIMATE TENSILE STRENGTH OF 125 KSI BASED ON THE CROSS SECTIONAL AREA AT THE BASIC ROOT DIAMETER OF THE THREAD. THESE NUTS ARE DESIGNED TO BE USED ON 3A EXTERNAL THREADS. THESE NUTS SHALL BE USED IN ACCORDANCE WITH THE LIMITS OF MS 33588. ONLY NUTS FOR WHICH THERE ARE QUALIFIED PRODUCTS LISTED ON QPL 25027 SHALL BE USED.

INTERCHANGEABILITY RELATIONSHIP: MS 21073 NUTS CAN UNIVERSALLY REPLACE NAS 698 NUTS OF LIKE MATERIAL, THREAD SIZE, (STATUS NOTE) LUBRICANTS (DRY FILM, NON LUBRICANT OR SILVER PLATING), RIVET SPACING, AND FASTENING METHOD (PLAIN RIVET HOLES, DIMPLED OR COUNTERSUNK RIVET HOLES). BUT THESE NAS 698 NUTS CANNOT UNIVERSALLY REPLACE MS 21074 NUTS. FOR DEFINITION AND APPLICATION OF DRAWING STATUS NOTES, SEE MIL-STD-32.

THIS STANDARD TAKES PRECEDENCE OVER DOCUMENTS REFERENCED HEREIN.

REFERENCED DOCUMENTS SHALL BE OF THE ISSUE EFFECT ON DATE OF INVIATIONS FOR BIDS.

Ⓑ FOR CHANGES SEE SHEETS 1 AND 2.

F05-058S01

Figure 5-59. Drawing MS21074(ASG) (Sheet 1 of 2)

Ⓑ THREAD SIZE MIL-S-8879/MOD.	DASH NUMBERS					
	450°F DRY FILM LUBRICATED			800°F NON DRY FILM LUBRICATED		
	PLAIN HOLES	C'SUNK OR DIMPLED HOLES	WELDING PROJECTION	PLAIN HOLES	C'SUNK OR DIMPLED HOLES	WELDING PROJECTION
2-56 UNC-3B	L02	- - -	L02W	-02	- - -	-02W
4-40 UNC-3B	L04	L04K	L04W	-04	-04K	-04W
6-32 UNC-3B	L06	L06K	L06W	-06	-06K	-06W
8-32 UNC-3B	L08	L08K	L08W	-08	-08K	-08W
10-32 UNF-3B	L3	L3K	L3W	-3	-3K	-3W
1/4-28 UNF-3B	L4	L4K	L4W	-4	-4K	-4W
5/16-24 UNF-3B	L5	L5K	L5W	-5	-5K	-5W
3/8-24 UNF-3B	L6	- - -	L6W	-6	- - -	-6W

EXAMPLE PART NUMBER:

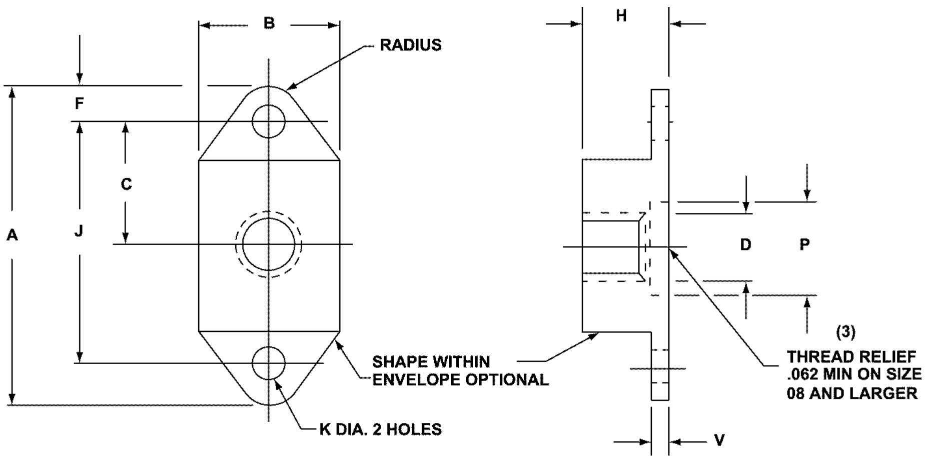
MS21074 - 3 = 10-32 UNF-3B NUT, SELF-LOCKING, CORNER, REDUCED RIVET SPACING, CRES, .125 KSI, 800°F, NON DRY FILM LUBRICATED, WITH PLAIN RIVET HOLES.

NUT DASH NUMBER

STANDARD IDENTIFICATION NUMBER

F05-058S02

Figure 5-59. Drawing MS21074(ASG) (Sheet 2)



(1) THREAD Ⓑ SIZE MIL-S-8879/MOD.	A MAX.	B		C ±.005	D DIA.	F MIN.	(2) H MAX.	J ±.002	K +.005 - .000	P DIA.		V MAT'L MAX	AXIAL STRENGTH LBS. MIN.	WEIGHT LBS/100 MAX.
		MAX.	MIN.							MAX.	MIN.			
4-40UNC-3B	.651	.315	.275	.203	—	.070	.153	.406	.098	.270	.152	.140	750	.25
6-32UNC-3B	.682	.357	.290	.218	—	.070	.171	.437	.098	.270	.178	.140	1,130	.32
8-32UNC-3B	.707	.367	.290	.234	.168	.100	.250	.468	.098	.270	.204	.140	1,720	.36
10-32UNF-3B	.739	.416	.290	.250	.194	.100	.250	.500	.098	.270	.230	.140	2,460	.39
1/4-28UNF-3B	.801	.500	.350	.281	.254	.100	.281	.562	.098	.330	.290	.140	4,580	.69
5/16-24UNF-3B	1.010	.581	.412	.359	.317	.117	.328	.718	.130	.392	.352	.160	7,390	1.10

Ⓑ (1) THREADS BEFORE LUBRICATION PER MIL-S-8879. THREADS IN ACCORDANCE WITH MIL-S-7742 ARE ACCEPTABLE UNTIL 31 DECEMBER 1969.

(2) MINIMUM "H" NOT SPECIFIED, LIMITED ONLY BY STRENGTH REQUIREMENTS

(3) SIZE NO. 06 AND SMALLER MAY BE COUNTERSUNK OR RADIUSED WITHIN "P" DIAMETER.

MATERIAL: STEEL

PLATING: CADMIUM PLATE IN ACCORDANCE WITH QQ-P-416 TYE II CLASS 3. FOR DRY FILM LUBRICATED NUTS, THE TYPE AND CLASS ARE OPTIONAL IF THE NUTS MEET THE SALT SPRAY REQUIREMENTS OF QQ-P-416, TYPE II.

HARDNESS: Rc 49 MAX.

LUBRICANT: DRY FILM LUBRICANT APPROVED IN ACCORDANCE WITH MIL-N-25027. OTHER LUBRICANTS SOLUBLE IN THE CLEANER SPECIFIED IN MIL-S-7502. FOR USAF APPLICATIONS NUTS TREATED WITH DRY FILM LUBRICANTS SHALL NOT BE USED IN INTERNALFUEL SYSTEMS APPLICATIONS.

FLOAT OF NUT PORTION OF ASSEMBLY SHALL NOT BE LESS THAN .020 RADIALLY FROM CENTERED POSITION.

NUT ELEMENT SHALL BE CAPABLE OF ENGAGEMENT WITH BOLT IN THE MAXIMUM MISALIGNED POSITION.

DIMENSIONS IN INCHES.

SURFACE ROUGHNESS IN ACCORDANCE WITH MIL-STD-10. UNLESS OTHERWISE SPECIFIED, THE SURFACE ROUGHNESS SHALL NOT EXCEED 125 MICRO INCHES.

DESIGN AND USAGE LIMITATIONS: THESE NUTS ARE DESIGNED TO DEVELOP THE TENSILE STRENGTH OF BOLTS AND SCREWS WITH AN ULTIMATE TENSILE STRENGTH OF 125 KSI BASED ON THE CROSS SECTIONAL AREA AT THE BASIC ROOT DIAMETER OF THE THREAD. THESE NUTS ARE DESIGNED TO BE USED ON 3A EXTERNAL THREADS. THESE NUTS SHALL BE USED IN ACCORDANCE WITH LIMITATIONS OF MS 33588. ONLY NUTS FOR WHICH THERE ARE QUALIFIED PRODUCTS LISTED ON QPL 25027 SHALL BE USED.

INTERCHANGEABILITY RELATIONSHIP: MS 21075 NUTS CAN UNIVERSALLY REPLACE NAS 1068 NUTS OF LIKE MATERIAL, THREAD
(STATUS NOTE) SIZE, LUBRICANTS (DRY FILM OR NON DRY FILM), AND RIVET SPACING. BUT NAS 1068 NUTS CANNOT UNIVERSALLY REPLACE MS 21075 NUTS. FOR DEFINITION AND APPLICATION OF DRAWING STATUS NOTES, SEE MIL-STD-32.

THIS STANDARD TAKES PRECEDENCE OVER DOCUMENTS REFERENCED HEREIN.

REFERENCED DOCUMENTS SHALL BE OF THE ISSUE EFFECT ON DATE OF INVITATIONS FOR BIDS.

Ⓑ FOR CHANGES SEE SHEETS 1 AND 2.

F05-059S01

Figure 5-60. Drawing MS21075(ASG) (Sheet 1 of 2)

Ⓑ THREAD SIZE MIL-S-8879/MOD.	DASH NUMBER	
	PLAIN RIVET HOLES	
	NON-DRY FILM LUBE	DRY FILM LUBE
4-40 UNC-3B	-04	L04
6-32 UNC-3B	-06	L06
8-32 UNC-3B	-08	L08
10-32 UNF-3B	-3	L3
1/4-28 UNF-3B	-4	L4
5/16-24 UNF-3B	-5	L5

EXAMPLE OF PART NUMBERS:

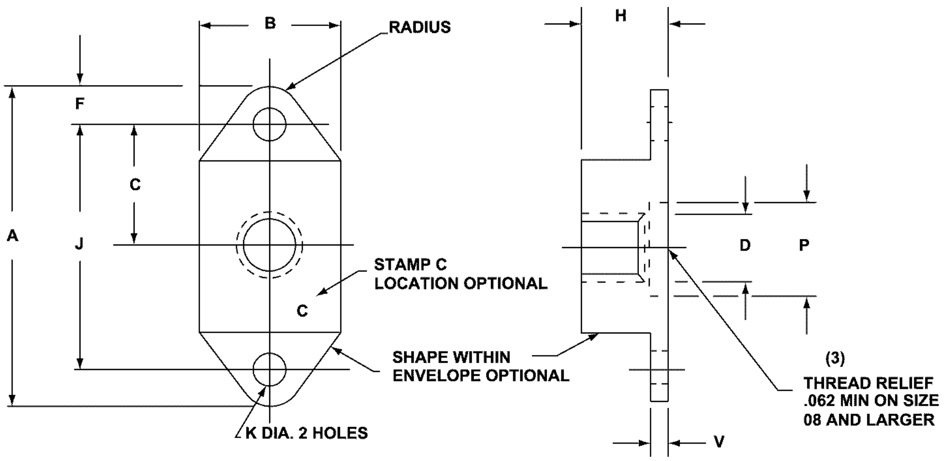
MS 21075 L4 1/4-28 UNF-3B, NUT, SELF-LOCKING, TWO LUG, FLOATING, REDUCED RIVET SPACING, STEEL, 125 KSI, 450°F, CAD PLATED, DRY FILM LUBRICATED, PLAIN RIVET HOLES.

L4 — NUT DASH NUMBER.

MS 21075 — STANDARD IDENTIFICATION NUMBER.

F05-059S02

Figure 5-60. Drawing MS21075(ASG) (Sheet 2)



(1) THREAD SIZE Ⓐ MIL-S-8879/MOD.	A MAX.	B		C ±.005	D DIA. MIN.	F MIN.	(2) H MAX.	J ±.002	K DIA. +.005 -.000	P DIA.		V MAT'L MAX	AXIAL STRENGTH LBS. MIN.	WEIGHT LBS/100 MAX.
		MAX.	MIN.							MAX.	MIN.			
4-40UNC-3B	.651	.315	.275	.203	—	.070	.153	.406	.098	.270	.152	.140	750	.25
6-32UNC-3B	.682	.357	.290	.218	—	.070	.171	.437	.098	.270	.178	.140	1,130	.32
8-32UNC-3B	.707	.367	.290	.234	.168	.100	.250	.468	.098	.270	.204	.140	1,720	.36
10-32UNF-3B	.739	.416	.290	.250	.194	.100	.250	.500	.098	.270	.230	.140	2,460	.39
1/4-28UNF-3B	.801	.500	.350	.281	.254	.100	.281	.562	.098	.330	.290	.140	4,580	.69
5/16-24UNF-3B	1.010	.581	.412	.359	.317	.117	.328	.718	.130	.392	.352	.160	7,390	1.10

Ⓐ (1) THREADS BEFORE LUBRICATION PER MIL-S-8879. THREADS IN ACCORDANCE WITH MIL-S-7742 ARE ACCEPTABLE UNTIL 31 DECEMBER 1969.
(2) MINIMUM "H" NOT SPECIFIED, LIMITED ONLY BY STRENGTH REQUIREMENTS
(3) SIZE NO. 06 AND SMALLER MAY BE COUNTERSUNK OR RADIUSED WITHIN "P" DIAMETER.

MATERIAL: CORROSION RESISTANT STEEL (A-286) PER AMS 5525, AMS 5735, OR AMS 5737.

PLATING: 800°F NUTS ONLY: SILVER PLATE PER AMS 2410. PLATE THICKNESS MEASURED ON ANY EXTERNAL SURFACE OF THE NUT, SHALL NOT BE LESS THAN 0.0002 IN; THREADS SHALL SHOW COMPLETE COVERAGE BUT THICKNESS REQUIREMENT ON THREAD IS WAIVED.

MAGNETIC PERMEABILITY: SHALL BE LESS THAN 2.0 (AIR = 1.0) FOR A FIELD STRENGTH H = 200 OERSTEDS USING A MAGNETIC PERMEABILITY INDICATOR PER MIL-I-17214, OR EQUIVALENT.

HARDNESS: Rc 49 MAX.

LUBRICANT: 450°F NUTS ONLY: DRY FILM LUBRICANT APPROVED IN ACCORDANCE WITH MIL-N-25027, FOR USAF APPLICATIONS, NUTS TREATED WITH DRY FILM LUBRICANTS SHALL NOT BE USED IN INTERNAL FUEL SYSTEMS APPLICATIONS.

FLOAT OF NUT PORTION OF ASSEMBLY SHALL NOT BE LESS THAN .020 RADIALLY FROM CENTERED POSITION.
NUT ELEMENT SHALL BE CAPABLE OF ENGAGEMENT WITH BOLT IN THE MAXIMUM MISALIGNED POSITION.

DIMENSIONS IN INCHES.

SURFACE ROUGHNESS IN ACCORDANCE WITH MIL-STD-10. UNLESS OTHERWISE SPECIFIED, THE SURFACE ROUGHNESS SHALL NOT EXCEED 125 MICRO INCHES.
PERFORMANCE: SEE PROCUREMENT SPECIFICATION, EXCEPT 450°F DRY FILM LUBRICATED NUTS LIMITED TO FIVE REUSE CYCLES.

DESIGN AND USAGE LIMITATIONS: THESE NUTS ARE DESIGNED TO DEVELOP THE TENSILE STRENGTH OF BOLTS AND SCREWS WITH AN ULTIMATE TENSILE STRENGTH OF 125 KSI BASED ON THE CROSS SECTIONAL AREA AT THE BASIC ROOT DIAMETER OF THE THREAD. THESE NUTS ARE DESIGNED TO BE USED ON 3A EXTERNAL THREADS. THESE NUTS SHALL BE USED IN ACCORDANCE WITH LIMITATIONS OF MS 33588. ONLY NUTS, FOR WHICH THERE ARE QUALIFIED PRODUCTS LISTED ON QPL 25027 SHALL BE USED.

INTERCHANGEABILITY RELATIONSHIP: (STATUS NOTE) MS 21076 NUTS CAN UNIVERSALLY REPLACE NAS 1068 NUTS OF LIKE MATERIAL, THREAD SIZE, PLATING, LUBRICANTS (DRY FILM OR NON DRY FILM), AND RIVET SPACING. BUT NAS 1068 NUTS CANNOT UNIVERSALLY REPLACE MS 21075 NUTS. FOR DEFINITION AND APPLICATION OF DRAWING STATUS NOTES, SEE MIL-STD-32.

THIS STANDARD TAKES PRECEDENCE OVER DOCUMENTS REFERENCED HEREIN.

REFERENCED DOCUMENTS SHALL BE OF THE ISSUE EFFECT ON DATE OF INVIATIONS FOR BIDS.

Ⓑ FOR CHANGES SEE SHEETS 1 AND 2.

F05-060S01

Figure 5-61. Drawing MS21076(ASG) (Sheet 1 of 2)

Ⓐ THREAD SIZE MIL-S-8879/MOD.	DASH NUMBER	
	PLAIN RIVET HOLES	
	800°F	450°F
4-40UNC-3B	-04	L04
6-32UNC-3B	-06	L06
8-32UNC-3B	-08	L08
10-32UNF-3B	-3	L3
1/4-28UNF-3B	-4	L4
5/16-24UNF-3B	-5	L5

EXAMPLE OF PART NUMBERS:

MS 21076 L4 = 1/4-28UNF-3B NUT, SELF LOCKING, TWO LUG, FLOATING, REDUCED RIVET SPACING, CRES, 125 KSI, 450°F, DRY FILM LUBRICATED, PLAIN RIVET HOLES.

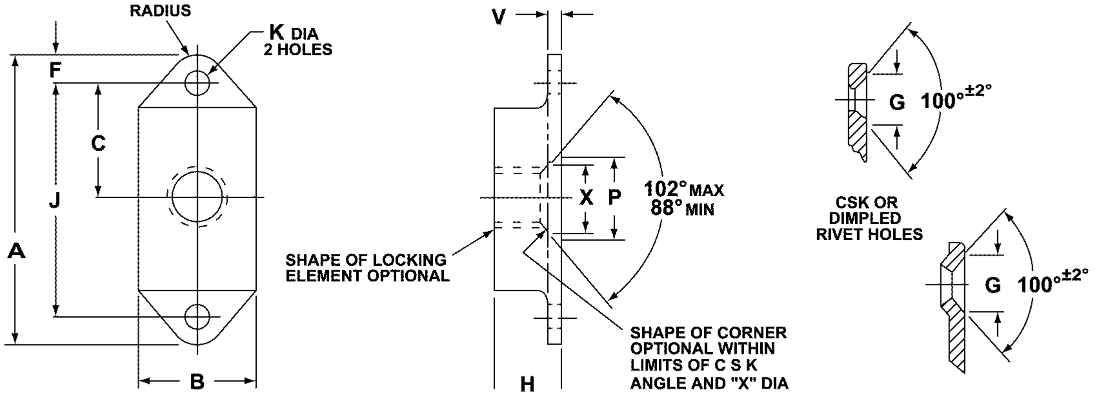
L4 — NUT DASH NUMBER

MS 21076 — STANDARD IDENTIFICATION NUMBER

F05-060S02

Figure 5-61. Drawing MS21076(ASG) (Sheet 2)

CONFIGURATION OF NUT OPTIONAL WITHIN THE LIMITATIONS IMPOSED
BY DIMENSIONS & REQUIREMENTS SPECIFIED HEREIN



DASH No.		(1) Ⓐ THREAD SIZE MIL-S-8879/MOD.	A MAX	B		C ±.005	F MIN	G DIA ±.010	H		J ±.002	(3) K DIA +.005 -.000	P DIA		V MAX	X MIN	AXIAL STRENGTH LB MIN	WEIGHT LB/100 MAX
PLAIN HOLES	CSK OR DIMPLED HOLES			MAX	MIN				MAX	MIN			MAX	MIN				
-06	-06K	6-32UNC-3B	.984	.416	.328	.344	.115	.200	.234	.160	.688	.098	.260	.198	.075	.138	1,130	.55
-08	-08K	8-32UNC-3B	.984	.416	.328	.344	.115	.200	.312	.234	.688	.098	.270	.224	.075	.164	1,720	.60
-3	-3K	10-32UNF-3B	.984	.416	.328	.344	.115	.200	.312	.234	.688	.098	.270	.250	.075	.190	2,460	.60
-4	-4K	1/4-28UNF-3B	1.296	.516	.406	.500	.115	.200	.387	.283	1.000	.098	.330	.310	.075	.250	4,580	1.20
-5	-5K	5/16-24UNF-3B	1.296	.609	.484	.500	.115	.230	.387	.283	1.000	.130	.393	.373	.075	.312	7,390	2.20
-6	-6K	3/8-24UNF-3B	1.296	.641	.563	.500	.115	.230	.479	.439	1.000	.130	.455	.435	.075	.375	11,450	2.80

Ⓐ (1) THREADS PER MIL-S-8879. THREADS IN ACCORDANACE WITH MIL-S-7742 ARE ACCEPTABLE UNTIL 31 DECEMBER 1969.

(2) THE NUT AND BASE PORTION OF THE ASSEMBLY SHALL FORM ONE INTEGRAL UNIT AND THE ASSEMBLY SHALL PROVIDE A BEARING SURFACE FOR THE NUT.

(3) DIMPLED RIVET HOLE TOLERANCE FOR "K" IS +.015 - .000.

MATERIAL: STEEL, EXCEPT INSERT; NYLON OR EQUIVALENT.

HARDNESS: ROCKWELL C 36 MAXIMUM.

PLATING: CADMIUM PLATE IN ACCORDANCE WITH QQ-P-416, TYPE II, CLASS 3.

VIBRATION LIFE: MINIMUM VIBRATION LIFE REQUIREMENT SHALL BE THREE TIMES AVERAGE VIBRATION LIFE LISTED IN SPECIFICATION MIL-N-25027.

FLOAT: FLOAT OF THE NUT PORTION OF ASSEMBLY SHALL NOT BE LESS THAN .030 LATERALLY AND LONGITUDIANALLY FROM CENTERED POSITION. NUT BODY SHALL BE CAPABLE OF ENGAGEMENT WITH A BOLT IN MAXIMUM MISALIGNED POSITION. MAXIMUM AXIAL FLOAT .020 INCHES FOR NO. 10 AND SMALLER, .030 FOR 1/4 AND LARGER.
NUT MISALIGNMENT SHALL NOT EXCEED DIMENSION "B".

SURFACE ROUGHNESS IN ACCORDANCE WITH MIL-STD-10 SHALL NOT EXCEED 125 MICROINCHES.
BREAK ALL SHARP EDGES AND REMOVE ALL HANGING BURRS AND SLIVERS.
DIMENSIONS IN INCHES UNLESS OTHERWISE SPECIFIED.

DESIGN AND USAGE LIMITATIONS: THESE NUTS ARE DESIGNED TO DEVELOP THE TENSILE STRENGTH OF BOLTS AND SCREWS WITH AN ULTIMATE STRESS (Ftu) OF 125 KSI BASED ON THE CROSS SECTIONAL AREA AT THE BASIC ROOT DIAMETER OF THE THREAD. THESE NUTS ARE DESIGNED TO BE USED ON 3A EXTERNAL THREADS. THESE NUTS SHALL BE USED IN ACCORDANCE WITH THE LIMITATIONS OF MS33588. ONLY NUTS FOR WHICH THERE ARE QUALIFIED PRODUCTS LISTED ON QPL25027 SHALL BE USED.

EXAMPLE OF PART NUMBER: MS21077 - 4 - 1/4 - 28UNF-3B NUT, SELF-LOCKING, PLATE, NON-METALLIC INSERT, STEEL, 125 KSI Ftu, 250°F, TWO LUG, PLAIN HOLES.
DASH NUMBER
MS IDENTIFICATION NUMBER

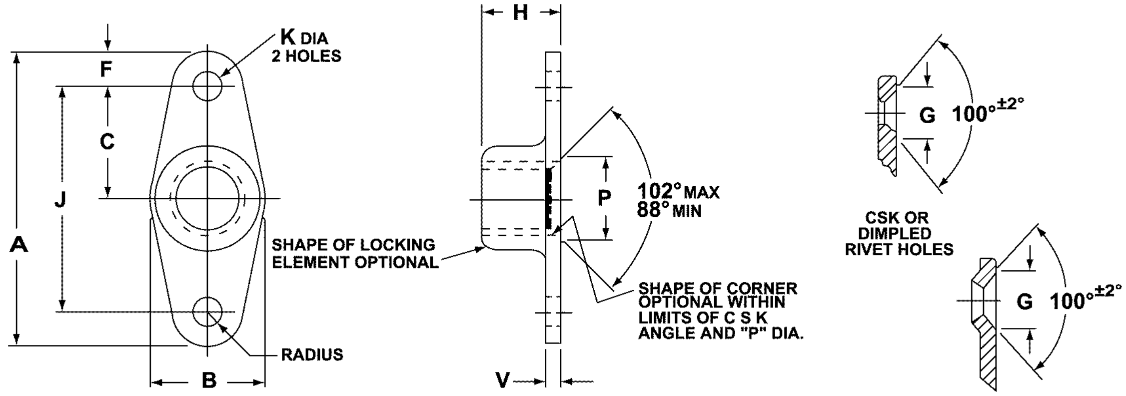
THIS STANDARD TAKES PRECEDENCE OVER DOCUMENTS REFERENCED HEREIN. REFERENCED DOCUMENTS SHALL BE ISSUE IN EFFECT ON DATE OF INVITATIONS FOR BID.

INTERCHANGEABILITY RELATIONSHIP: (STATUS NOTE) MS21077 NUTS CAN UNIVERSALLY REPLACE NAS1031 NUTS OF LIKE THREAD SIZE, FASTENING METHOD (PLAIN RIVET HOLES OR COUNTERSUNK AND DIMPLED RIVET HOLES) AND MATERIAL, BUT THESE NAS1031 NUTS CANNOT UNIVERSALLY REPLACE MS21077 NUTS. (FOR DEFINITION AND APPLICATION OF DRAWING STATUS NOTES SEE MIL-STD-32.)

F05-061

Figure 5-62. Drawing MS21077(ASG)

CONFIGURATION OF NUT OPTIONAL WITHIN THE LIMITATIONS IMPOSED
BY DIMENSIONS & REQUIREMENTS SPECIFIED HEREIN.



DASH No.		(1)	A	B		C	F	G	H		(2)	(2) K	P		V	AXIAL STRENGTH LB MIN	WEIGHT LB/100 MAX
PLAIN HOLES	CSK OR DIMPLED HOLES	A THREAD SIZE MIL-S-8879/MOD.	MAX	MAX	MIN	±.005	MIN	DIA ±.010	MAX	MIN	J ±.002	DIA +.005 -.000	DIA MAX	MIN	MAX		
-04	-04K	4-40UNC-3B	.984	.406	.375	.344	.115	.200	.218	.133	.688	.098	.151	.112	.075	750	.80
-06	-06K	6-32UNC-3B	.984	.406	.375	.344	.115	.200	.234	.160	.688	.098	.177	.138	.075	1,130	.85
-08	-08K	8-32UNC-3B	.984	.406	.375	.344	.115	.200	.297	.219	.688	.098	.230	.164	.075	1,720	1.00
-3	-3K	10-32UNF-3B	.984	.406	.375	.344	.115	.200	.312	.234	.688	.098	.230	.190	.075	2,460	1.00
-4	-4K	1/4-28UNF-3B	1.296	.516	.484	.500	.115	.200	.375	.240	1.000	.098	.293	.250	.075	4,580	1.60
-5	-5K	5/16-24UNF-3B	1.296	.531	.500	.500	.115	.230	.375	.271	1.000	.130	.356	.312	.075	7,390	1.90
-6	-6K	3/8-24UNF-3B	1.296	.641	.609	.500	.115	.230	.453	.318	1.000	.130	.418	.375	.115	11,450	2.50
-7	(4)	7/16-20UNF-3B	1.477	.719	.672	.562	.135	(4)	.469	.435	1.125	.161	.487	.437	.115	15,450	3.00
-8	(4)	1/2-20UNF-3B	1.602	.859	.796	.625	.135	(4)	.609	.575	1.250	.161	.550	.500	.115	21,110	4.80
-9	(4)	9/16-18UNF-3B	1.727	.953	.902	.688	.135	(4)	.656	.623	1.375	.161	.613	.562	.115	26,810	7.70
-10	(4)	5/8-18UNF-3B	1.852	1.016	.964	.750	.135	(4)	.765	.732	1.500	.161	.676	.625	.115	34,130	8.60

A (1) THREADS PER MIL-S-8879. THREADS IN ACCORDANCE WITH MIL-S-7742 ARE ACCEPTABLE UNTIL 31 DECEMBER 1969.

(2) THE CENTER OF THE TAPPED HOLE SHALL NOT DEVIATE IN ANY DIRECTION FROM THE CENTER OF THE PLATE NUT AS DETERMINED BY THE RIVET HOLES, BY MORE THAN .005.

(3) DIMPLED RIVET HOLE TOLERANCE FOR "K" IS +.015 - .000.

(4) NO COUNTERSUNK OR DIMPLED RIVET TYPE AVAILABLE FOR SIZES 7/16 THRU 5/8.

MATERIAL: STEEL, EXCEPT INSERT; NYLON OR EQUIVALENT.

HARDNESS: ROCKWELL C 32 MAXIMUM.

PLATING: CADMIUM PLATE IN ACCORDANCE WITH QQ-P-416, TYPE II, CLASS 3.

VIBRATION LIFE: MINIMUM VIBRATION LIFE REQUIREMENT SHALL BE THREE TIMES AVERAGE VIBRATION LIFE LISTED IN SPECIFICATION MIL-N-25027.

SURFACE ROUGHNESS IN ACCORDANCE WITH MIL-STD-10 SHALL NOT EXCEED 125 MICROINCHES.
BREAK ALL SHARP EDGES AND REMOVE ALL HANGING BURRS AND SLIVERS.
DIMENSIONS IN INCHES UNLESS OTHERWISE SPECIFIED.

DESIGN AND USAGE LIMITATIONS: THESE NUTS ARE DESIGNED TO DEVELOP THE TENSILE STRENGTH OF BOLTS AND SCREWS WITH AN ULTIMATE STRESS (Ftu) OF 125 KSI BASED ON THE CROSS SECTIONAL AREA AT THE BASIC ROOT DIAMETER OF THE THREAD. THESE NUTS ARE DESIGNED TO BE USED ON 3A EXTERNAL THREADS. THESE NUTS SHALL BE USED IN ACCORDANCE WITH THE LIMITATIONS OF MS33588. ONLY NUTS FOR WHICH THERE ARE QUALIFIED PRODUCTS LISTED ON QPL25027 SHALL BE USED.

EXAMPLE OF PART NUMBER: MS21078 - 4 = 1/4-28UNF-3B NUT, SELF-LOCKING, PLATE, NON-METALLIC INSERT, STEEL, 125 KSI Ftu, 250°F, TWO LUG, PLAIN HOLES.
- 4 — DASH NUMBER
MS21078 — MS IDENTIFICATION NUMBER

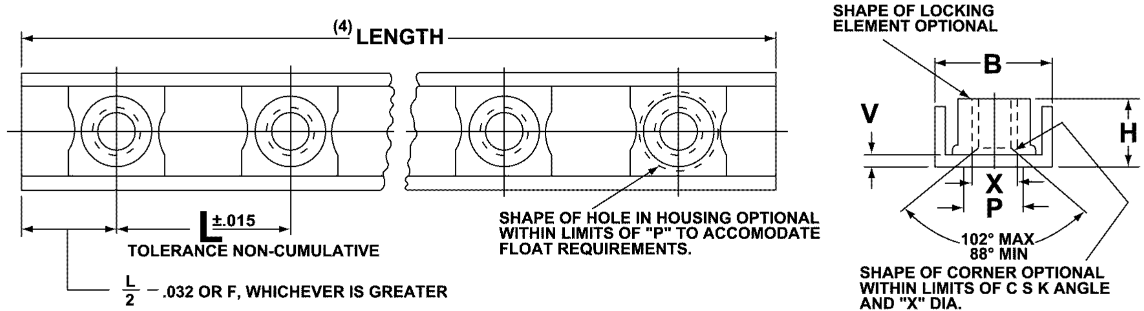
THIS STANDARD TAKES PRECEDENCE OVER DOCUMENTS REFERENCED HEREIN. REFERENCED DOCUMENTS SHALL BE ISSUE IN EFFECT ON DATE OF INVITATIONS FOR BID.

INTERCHANGEABILITY RELATIONSHIP: (STATUS NOTE) MS21078 NUTS CAN UNIVERSALLY REPLACE AN366 AND NAS1023 NUTS OF LIKE THREAD SIZE, FASTENING METHOD (PLAIN RIVET HOLES OR COUNTERSUNK AND DIMPLED RIVET HOLES) AND MATERIAL, BUT THESE AN366 AND NAS1023 NUTS CANNOT UNIVERSALLY REPLACE MS21078 NUTS. (FOR DEFINITION AND APPLICATION OF DRAWING STATUS NOTES SEE MIL-STD-32.)

F05-062

Figure 5-63. Drawing MS21078(ASG)

CONFIGURATION OF NUT OPTIONAL WITHIN THE LIMITATIONS IMPOSED
BY DIMENSIONS & REQUIREMENTS SPECIFIED HEREIN



SIZE DASH NO.	(1) A THREAD SIZE MIL-S-8879/MOD.	B	F	H		L MIN NUT SPACING	P DIA		V	X	AXIAL STRENGTH LB MIN
		MAX	MIN	MAX	MIN		MAX	MIN	MAX	MIN	
-08	8-32UNC-3B	.422	.343	.312	.234	.625	.270	.184	.030	.168	1,720
-3	10-32UNF-3B	.422	.343	.318	.234	.625	.270	.210	.030	.190	2,460
-4	1/4-28UNF-3B	.518	.406	.393	.283	.750	.330	.270	.037	.250	4,580
-5	5/16-24UNF-3B	.648	.469	.387	.283	.750	.393	.333	.045	.312	7,390
-6	3/8-24UNF-3B	.726	.562	.479	.434	1.000	.455	.395	.045	.375	11,450

L NUT SPACING	NUT SPACING DASH NO.	(4) MAX NO. NUTS
.625	5	115
.750	6	96
.875	7	82
1.000	8	72
1.125	9	64
1.250	10	57
1.375	11	52
1.500	12	48
1.625	13	44
1.750	14	41
1.875	15	38
2.000	16	36
2.250	18	32
2.500	20	28
3.000	24	24

Ⓐ(1) THREADS PER MIL-S-8879. THREADS IN ACCORDANCE WITH MIL-S-7742 ARE ACCEPTABLE UNTIL 31 DECEMBER 1969.

(2) THE CENTERLINE OF THE CHANNEL SHALL NOT DEVIATE FROM A STRAIGHT LINE BY MORE THAN .015 IN ANY 12 INCHES.

(3) THE NUT AND BASE PORTION OF THE ASSEMBLY SHALL FORM ONE INTEGRAL UNIT.

(4) LENGTH ESTABLISHED BY SPECIFYING NUMBER OF NUTS UP TO MAXIMUM NUMBER FOR APPROXIMATELY 72" LENGTH.

MATERIALS: NUTS = STEEL, EXCEPT INSERT, NYLON OR EQUIVALENT.
CHANNEL - ALUMINUM ALLOY.

HARDNESS: NUT ELEMENTS ROCKWELL C 36 MAXIMUM.

PLATING: NUT - CADMIUM PLATE IN ACCORDANCE WITH QQ-P-416, TYPE II, CLASS 3.
CHANNEL - SE PROCUREMENT SPECIFICATION.

VIBRATION LIFE: MINIMUM VIBRATION LIFE REQUIREMENT SHALL BE THREE TIMES AVERAGE VIBRATION LIFE LISTED IN SPECIFICATION MIL-N-25027.

FLOAT: FLOAT OF NUT PORTION OF ASSEMBLY SHALL NOT BE LESS THAN .030 NOR MORE THAN .040 LONGITUDINALLY AND NOT LESS THAN .010 NOR MORE THAN .030 LATERALLY FROM CENTERED POSITION. MAXIMUM AXIAL FLOAT .020 FOR -08 AND -3; .030 FOR LARGER SIZES. NUT BODY IN THE MISALIGNED POSITION SHALL BE CAPABLE OF ENGAGEMENT WITH A BOLT.

SURFACE ROUGHNESS IN ACCORDANCE WITH MIL-STD-10 SHALL NOT EXCEED 125 MICROINCHES.
BREAK ALL SHARP EDGES AND REMOVE ALL HANGING BURRS AND SLIVERS.
DIMENSIONS IN INCHES UNLESS OTHERWISE SPECIFIED.

DESIGN AND USAGE LIMITATIONS: THESE NUTS ARE DESIGNED TO DEVELOP THE TENSILE STRENGTH OF BOLTS AND SCREWS WITH AN ULTIMATE STRESS (Ftu) OF 125 KSI BASED ON THE CROSS SECTIONAL AREA AT THE BASIC ROOT DIAMETER OF THE THREAD. THESE NUTS ARE DESIGNED TO BE USED ON A 3A EXTERNAL THREADS. THESE NUTS SHALL BE USED IN ACCORDANCE WITH THE LIMITATIONS OF MS33588. ONLY NUTS FOR WHICH THERE ARE QUALIFIED PRODUCTS LISTED ON QPL25027 SHALL BE USED.

CODE: FIRST DASH NUMBER INDICATES SIZE, SECOND DASH NUMBER THE NUT SPACINGS(L) AND THE THIRD DASH NUMBER INDICATES THE NUMBER OF NUTS WHEN LESS THAN STOCK LENGTH (APPROXIMATELY 72 INCHES) IS DESIRED.

EXAMPLE OF PART NUMBERS:

MS21079-3-6-10 = 10-32 CADMIUM PLATED GANG CHANNEL NUT, ALUMINUM ALLOY CHANNEL, .739 NUT SPACING, 10 NUTS LONG.
MS21079-4-7 = 1/4-28 CADMIUM PLATED, GANG CHANNEL NUT, ALUMINUM ALLOY CHANNEL, .875 NUT SPACING, APPROXIMATELY 72 INCHES LONG.

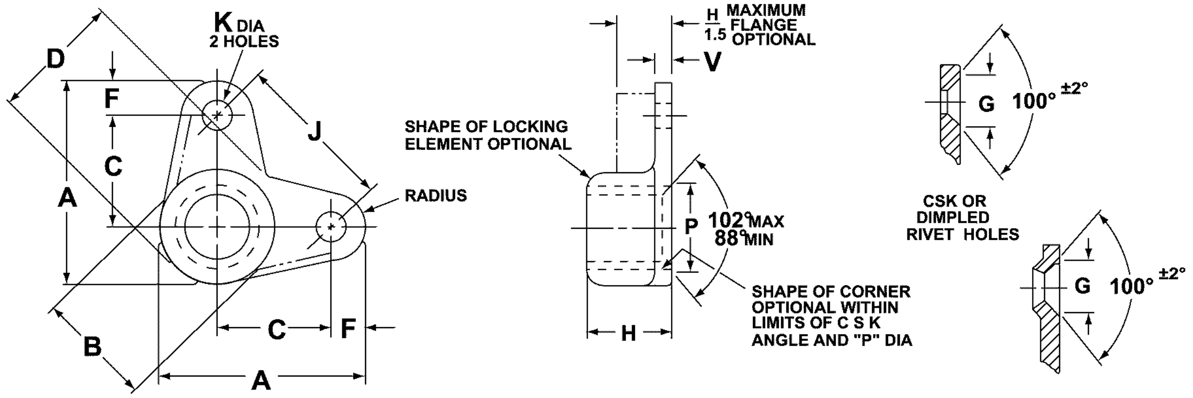
THIS STANDARD TAKES PRECEDENCE OVER DOCUMENTS REFERENCED HEREIN. REFERENCED DOCUMENTS SHALL BE ISSUE IN EFFECT ON DATE OF INVITATIONS FOR BID.

INTERCHANGEABILITY RELATIONSHIP: (STATUS NOTE) MS21079 NUTS CAN UNIVERSALLY REPLACE NAS1034 THRU NAS1038 NUTS OF LIKE THREAD SIZE, FASTENING METHOD AND MATERIAL, BUT THESE NAS1034 THRU NAS1038 NUTS CANNOT UNIVERSALLY REPLACE MS21079 NUTS. (FOR DEFINITION AND APPLICATION OF DRAWING STATUS NOTE SEE MIL-STD-32.

F05-063

Figure 5-64. Drawing MS21079(ASG)

CONFIGURATION OF NUT OPTIONAL WITHIN THE LIMITATIONS IMPOSED BY DIMENSIONS & REQUIREMENTS SPECIFIED HEREIN.



DASH No.		(1) Ⓐ THREAD SIZE MIL-S-8879/MOD.	A	B		C	D	F	G	H		(2) J	(3) K	P		V	AXIAL STRENGTH	WEIGHT
PLAIN HOLES	CSK OR DIMPLED HOLES		MAX	MAX	MIN	±.005	MAX	MIN	DIA ±.010	MAX	MIN	±.002	DIA +.005 -.000	DIA MAX	MIN	MAX	LB MIN	LB/100 MAX
-06	-06K	6-32UNC-3B	.703	.406	.375	.344	.531	.115	.200	.234	.160	.486	.098	.177	.138	.075	1,130	.85
-08	-08K	8-32UNC-3B	.703	.406	.375	.344	.531	.115	.200	.297	.219	.486	.098	.230	.164	.075	1,720	1.00
-3	-3K	10-32UNF-3B	.703	.406	.375	.344	.531	.115	.200	.312	.234	.486	.098	.230	.190	.075	2,460	1.00
-4	-4K	1/4-28UNF-3B	.906	.514	.484	.500	.600	.115	.200	.375	.240	.707	.098	.293	.250	.075	4,580	1.60
-5	-5K	5/16-24UNF-3B	.937	.582	.500	.500	.625	.115	.230	.375	.240	.707	.130	.356	.312	.075	7,390	1.90
-6	-6K	3/8-24UNF-3B	1.008	.718	.609	.500	.718	.115	.230	.453	.318	.707	.130	.418	.375	.075	11,450	2.50
-7	(4)	7/16-20UNF-3B	1.125	.782	.672	.562	.782	.135	(4)	.469	.435	.795	.161	.487	.437	.115	15,450	3.00
-8	(4)	1/2-20UNF-3B	1.234	.874	.796	.625	.874	.135	(4)	.609	.575	.884	.161	.550	.500	.115	21,100	4.80
-10	(4)	5/8-18UNF-3B	1.437	1.010	.964	.750	1.010	.135	(4)	.765	.732	1.061	.161	.676	.625	.115	34,130	8.60

Ⓐ (1) THREAD PER MIL-S-8879. THREADS IN ACCORDANCE WITH MIL-S-7742 ARE ACCEPTABLE UNTIL 31 DECEMBER 1969.
(2) THE CENTER OF THE TAPPED HOLE SHALL NOT DEVIATE IN ANY DIRECTION FROM THE CENTER OF THE PLATE NUT AS DETERMINED BY THE RIVET HOLES, BY MORE THAN .005.
(3) DIMPLED RIVET HOLE TOLERANCE FOR "K" IS +.015 - .000.
(4) NO COUNTERSUNK OR DIMPLED RIVET TYPE AVAILABLE FOR SIZES 7/16 THRU 5/8.

MATERIAL: STEEL, EXCEPT INSERT; NYLON OR EQUIVALENT.

HARDNESS: ROCKWELL C 32 MAXIMUM.

PLATING: CADMIUM PLATE IN ACCORDANCE WITH QQ-P-416, TYPE II, CLASS 3.

VIBRATION LIFE: MINIMUM VIBRATION LIFE REQUIREMENT SHALL BE THREE TIMES AVERAGE VIBRATION LIFE LISTED IN SPECIFICATION MIL-N-25027.

SURFACE ROUGHNESS IN ACCORDANCE WITH MIL-STD-10 SHALL NOT EXCEED 125 MICROINCHES.
BREAK ALL SHARP EDGES AND REMOVE ALL HANGING BURRS AND SLIVERS.
DIMENSIONS IN INCHES UNLESS OTHERWISE SPECIFIED.

DESIGN AND USAGE LIMITATIONS: THESE NUTS ARE DESIGNED TO DEVELOP THE TENSILE STRENGTH OF BOLTS AND SCREWS WITH AN ULTIMATE STRESS (Ftu) OF 125 KSI BASED ON THE CROSS SECTIONAL AREA AT THE BASIC ROOT DIAMETER OF THE THREAD, THESE NUTS ARE DESIGNED TO BE USED ON 3A EXTERNAL THREADS. THESE NUTS SHALL BE USED IN ACCORDANCE WITH THE LIMITATIONS OF MS33588. ONLY NUTS FOR WHICH THERE ARE QUALIFIED PRODUCTS LISTED ON QPL25027 SHALL BE USED.

EXAMPLE OF PART NUMBER: MS21081 - 4 - 1/4-28UNF-3B NUT, SELF-LOCKING, PLATE, NON-METALLIC INSERT, STEEL, 125 KSI Ftu, 250°F, CORNER, PLAIN HOLES.
DASH NUMBER
MS IDENTIFICATION NUMBER

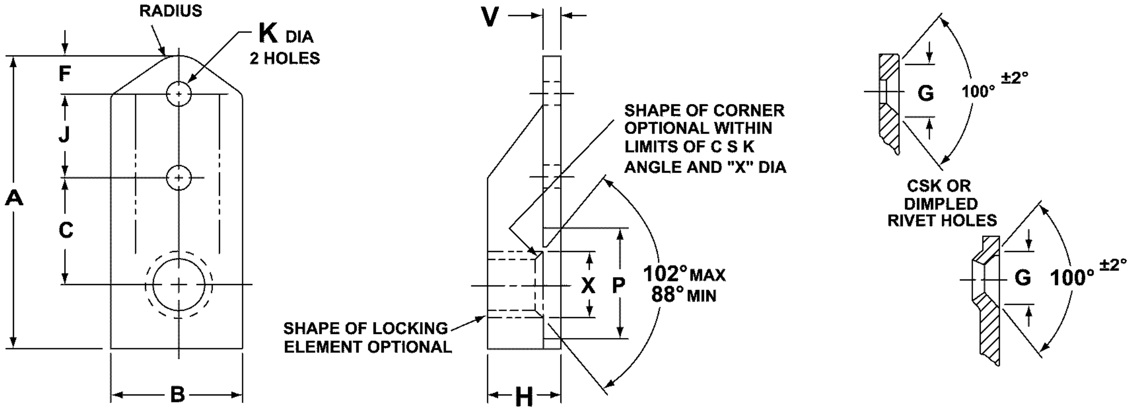
THIS STANDARD TAKES PRECEDENCE OVER DOCUMENTS REFERENCED HEREIN. REFERENCED DOCUMENTS SHALL BE ISSUE IN EFFECT ON DATE OF INVITATIONS FOR BID.

INTERCHANGEABILITY RELATIONSHIP: (STATUS NOTE) MS21081 NUTS CAN UNIVERSALLY REPLACE NAS1027 NUTS OF LIKE THREAD SIZE, FASTENING METHOD (PLAIN RIVET HOLES OR COUNTERSUNK AND DIMPLED RIVET HOLES) AND MATERIAL, BUT THESE NAS1027 NUTS CANNOT UNIVERSALLY REPLACE MS21081 NUTS. (FOR DEFINITION AND APPLICATION OF DRAWING STATUS NOTES SEE MIL-STD-32.)

F05-064

Figure 5-65. Drawing MS21081(ASG)

CONFIGURATION OF NUT OPTIONAL WITHIN THE LIMITATIONS IMPOSED
BY DIMENSIONS & REQUIREMENTS SPECIFIED HEREIN.



DASH No.		(1) Ⓐ THREAD SIZE MIL-S-8879/MOD.	A MAX	B		C ±.005	F MIN	G DIA ±.010	H		J ±.002	(3)K DIA +.005 -.000	P DIA		V MAX	X MIN	AXIAL STRENGTH LB MIN	WEIGHT LB/100 MAX
PLAIN HOLES	CSK OR DIMPLED HOLES			MAX	MIN				MAX	MIN			MAX	MIN				
-08	-08K	8-32UNC-3B	1.094	.422	.328	.344	.115	.200	.312	.234	.312	.098	.270	.224	.075	.164	1,720	.60
-3	-3K	10-32UNF-3B	1.094	.422	.328	.344	.115	.200	.312	.234	.312	.098	.270	.250	.075	.190	2,460	.60
-4	-4K	1/4-28UNF-3B	1.316	.531	.406	.500	.115	.200	.387	.283	.312	.098	.330	.310	.075	.250	4,580	1.20
-5	-5K	5/16-24UNF-3B	1.378	.641	.484	.500	.115	.230	.387	.283	.312	.130	.393	.373	.075	.312	7,390	2.20

Ⓐ
(1) THREADS PER MIL-S-8879. THREADS IN ACCORDANCE WITH MIL-S-7742 ARE ACCEPTABLE UNTIL 31 DECEMBER 1969.
(2) THE NUT AND BASE PORTION OF THE ASSEMBLY SHALL FORM ONE INTEGRAL UNIT, AND THE ASSEMBLY SHALL PROVIDE A BEARING SURFACE FOR THE NUT.
(3) DIMPLED RIVET HOLE TOLERANCE FOR "K" IS +.015 - .000.

MATERIAL: STEEL, EXCEPT INSERT; NYLON OR EQUIVALENT.

HARDNESS: ROCKWELL C 36 MAXIMUM.

PLATING: CADMIUM PLATE IN ACCORDANCE WITH QQ-P-416, TYPE II, CLASS 3.

VIBRATION LIFE: MINIMUM VIBRATION LIFE REQUIREMENT SHALL BE THREE TIMES AVERAGE VIBRATION LIFE LISTED IN SPECIFICATION MIL-N-25027.

FLOAT: FLOAT OF THE NUT PORTION OF ASSEMBLY SHALL NOT BE LESS THAN .030 LATERALLY AND LONGITUDINALLY FROM CENTERED POSITION. NUT BODY SHALL BE CAPABLE OF ENGAGEMENT WITH A BOLT IN MAXIMUM MISALIGNED POSITION.
MAXIMUM AXIAL FLOAT .020 INCHES FOR NO .10 AND SMALLER, .030 FOR 1/4 AND LARGER.
NUT MISALIGNMENT SHALL NOT EXCEED DIMENSION "B".

SURFACE ROUGHNESS IN ACCORDANCE WITH MIL-STD-10 SHALL NOT EXCEED 125 MIRCOINCHES.
BREAK ALL SHARP EDGES AND REMOVE ALL HANGING BURRS AND SLIVERS.
DIMENSIONS IN INCHES UNLESS OTHERWISE SPECIFIED.

DESIGN AND USAGE LIMITATIONS: THESE NUTS ARE DESIGNED TO DEVELOP THE TENSILE STRENGTH OF BOLTS AND SCREWS WITH AN ULTIMATE STRESS (Ftu) OF 125 KSI BASED ON THE CROSS SECTIONAL AREA AT THE BASIC ROOT DIAMETER OF THE THREAD, THESE NUTS ARE DESIGNED TO BE USED ON 3A EXTERNAL THREADS. THESE NUTS SHALL BE USED IN ACCORDANCE WITH THE LIMITATIONS OF MS33588. ONLY NUTS FOR WHICH THERE ARE QUALIFIED PRODUCTS LISTED ON QPL25027 SHALL BE USED.

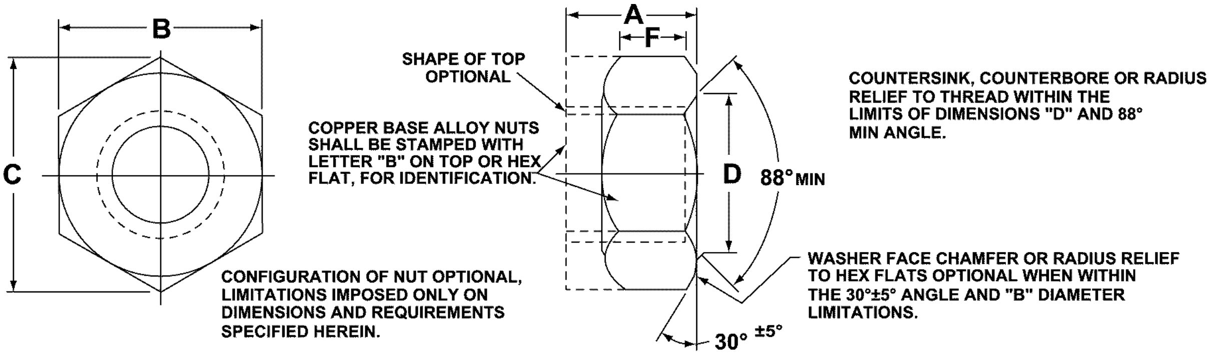
EXAMPLE OF PART NUMBER: MS21082 - 4 - 1/4-28UNF-3B NUT, SELF-LOCKING, PLATE, NON-METALLIC INSERT, STEEL, 125 KSI
Ftu, 250°F, ONE LUG, PLAIN HOLES, FLOATING
DASH NUMBER
MS IDENTIFICATION NUMBER

THIS STANDARD TAKES PRECEDENCE OVER DOCUMENTS REFERENCED HEREIN. REFERENCED DOCUMENTS SHALL BE ISSUE IN EFFECT ON DATE OF INVITATIONS FOR BID.

INTERCHANGEABILITY RELATIONSHIP: (STATUS NOTE) MS21082 NUTS CAN UNIVERSALLY REPLACE NAS1032 NUTS OF LIKE THREAD SIZE, FASTENING METHOD (PLAIN RIVET HOLES OR COUNTERSUNK AND DIMPLED RIVET HOLES) AND MATERIAL, BUT THESE NAS1032 NUTS CANNOT UNIVERSALLY REPLACE MS21082 NUTS. (FOR DEFINITION AND APPLICATION OF DRAWING STATUS NOTES SEE MIL-STD-32.)

F05-065

Figure 5-66. Drawing MS21082(ASG)



DASH NUMBER				(1) Ⓐ	(3)						(2)				WEIGHT
NON-METALLIC INSERT				THREAD MIL-S-8879/MOD.	A	B		C	D	F	X	AXIAL STRENGTH LB MIN			LB/100 MAX STEEL ONLY
ALUM ALLOY	STEEL	COPPER BASE ALLOY	CRES		MAX	MAX	MIN	MIN	+.020 -.010	MIN		STEEL	ALUM ALLOY	CRES	
D04	N04	B04	C04	4-40UNC-3B	.125	.251	.243	.275	.131	.031	.003	370	370	370	.13
D06	N06	B06	C06	6-32UNC-3B	.141	.313	.305	.344	.156	.047		560	560	560	.25
D08	N08	B08	C08	8-32UNC-3B	.188	.345	.336	.378	.183	.062	.006	860	860	860	.40
D3	N3	B3	C3	10-32UNF-3B		.376	.367	.413	.210			1,230	1,230	1,230	.46
D4	N4	B4	C4	1/4-28UNF-3B	.219	.439	.430	.488	.273		.007	2,290	2,290	2,290	.66
D5	N5	B5	C5	5/16-24UNF-3B	.266	.502	.492	.557	.336	.094		3,700	1,830	3,700	1.05
D6	N6	B6	C6	3/8-24UNF-3B	.282	.564	.553	.628	.398		.008	5,720	2,840	5,720	1.20
D7	N7	B7	C7	7/16-20UNF-3B	.328	.690	.679	.773	.458	.109		7,720	3,830	7,720	2.60
D8	N8	B8	C8	1/2-20UNF-3B		.752	.741	.840	.531		.009	10,550	5,240	10,550	2.60
D9	N9	B9	C9	9/16-18UNF-3B	.375	.877	.865	.982	.594	.125	.010	13,400	6,650	13,400	4.50
D10	N10	B10	C10	5/8-18UNF-3B	.407	.940	.928	1.051	.656	.156		17,060	8,460	17,060	5.10
D12	N12	B12	C12	3/4-16UNF-3B	.422	1.064	1.052	1.191	.787	.172		25,010	12,400	25,010	6.80
D14	N14	B14	C14	7/8-14UNF-3B	.485	1.252	1.239	1.403	.913	.203	.011	34,220	16,970	34,220	10.40
D16	N16	B16	C16	1-12UNF-3B	.578	1.440	1.427	1.615	1.039	.250	.012	45,000	22,320	45,000	18.00
D18	N18	B18	C18	1 1/8-12UNF-3B	.672	1.627	1.614	1.826	1.166	.313	.013	58,350	28,940	58,350	25.00
D20	N20	B20	C20	1 1/4-12UNF-3B	.766	1.815	1.801	2.038	1.290	.328	.014	73,970	36,690	73,970	36.00
D22	N22	B22	C22	1 3/8-12UNF-3B	.828	2.008	1.973	2.249	1.447	.281	.015	90,700	44,000	90,700	43.00
D24	N24	B24	C24	1 1/2-12UNF-3B		2.197	2.159	2.416	1.568	.328	.016	109,000	53,000	109,000	55.00

Ⓐ(1) THREADS IN ACCORDANCE WITH MIL-S-8879. THREADS IN ACCORDANCE WITH MIL-S-7742 ARE ACCEPTABLE UNTIL 31 DECEMBER 1969.
(2) BEARING SURFACE SHALL BE SQUARE WITH PITCH DIAMETER WITHIN X WHEN MEASURED IN ACCORDANCE WITH MIL-N-25027.
(3) MINIMUM "A" LIMITED ONLY BY STRENGTH REQUIREMENT OF SPECIFICATION.

MATERIAL: STEEL, ALUMINUM ALLOY, COPPER BASE ALLOY, CRES; SEE PROCUREMENT SPECIFICATION.
INSERT, NYLON OR EQUIVALENT.

HARDNESS: STEEL NUTS; ROCKWELL C 35 MAXIMUM.

PLATING: STEEL AND COPPER BASE ALLOY NUTS, CADMIUM PLATED IN ACCORDANCE WITH QQ-P-416, TYPE II, CLASS 3.

SURFACE TREATMENT: CORROSION RESISTANT STEEL NUTS. SEE PROCUREMENT SPECIFICATION.
ALUMINUM ALLOY NUTS, ANODIZE OR CHEMICALLY SURFACE TREAT IN ACCORDANCE WITH PROCUREMENT SPECIFICATION.
ALUMINUM ALLOY NUTS IN SIZES THRU 1/4-28 DYED BLUE PER PROCUREMENT SPECIFICATION.

LUBRICANT: LUBRICANT, WHEN USED, APPROVED IN ACCORDANCE WITH MIL-N-25027. LUBRICANTS SHALL BE SOLUBLE IN THE CLEANER SPECIFIED IN THE PROCUREMENT SPECIFICATION.

BREAK ALL SHARP EDGES AND REMOVE ALL HANGING BURRS AND SLIVERS.
SURFACE ROUGHNESS IN ACCORDANCE WITH MIL-STD-10. UNLESS OTHERWISE SPECIFIED, THE SURFACE ROUGHNESS SHALL NOT EXCEED 125 MICRO INCHES.
DIMENSIONS IN INCHES.

Ⓐ FOR CHANGES SEE SHEET 1

F05-066S01

Figure 5-67. Drawing MS21083(ASG) (Sheet 1 of 2)

EXAMPLE OF PART NUMBERS:

MS21083N4 = 1/4-28 STEEL NUT, NON-METALLIC INSERT, CADMIUM PLATED.
MS21083D4 = 1/4-28 ALUMINUM ALLOY NUT, NON-METALLIC INSERT, ANODIZED.
MS21083B4 = 1/4-28 COPPER BASE ALLOY NUT, NON-METALLIC INSERT, CADMIUM PLATED.

DESIGN AND USAGE LIMITATIONS: THESE NUTS ARE INTENDED FOR SHEAR APPLICATIONS AND ARE DESIGNED TO DEVELOP AN ULTIMATE STRESS (Ftu) OF 70 KSI (35 KSI FOR ALUMINUM PARTS -5 AND LARGER) BASED ON THE CROSS SECTIONAL AREA AT THE BASIC ROOT DIAMETER OF THE THREAD. THESE NUTS ARE DESIGNED TO BE USED ON 3A EXTERNAL THREADS. THESE NUTS SHALL BE USED IN ACCORDANCE WITH THE LIMITATIONS OF MS33588. ONLY NUTS FOR WHICH THERE ARE QUALIFIED PRODUCTS LISTED ON QPL25027 SHALL BE USED FOR DESIGN, UNLESS THE PROCEDURES OF ANA BULLETIN 437 ARE FOLLOWED.

VIBRATION LIFE: MINIMUM VIBRATION LIFE REQUIREMENT SHALL BE THREE TIMES AVERAGE VIBRATION LIFE LISTED IN MIL-N-25027.

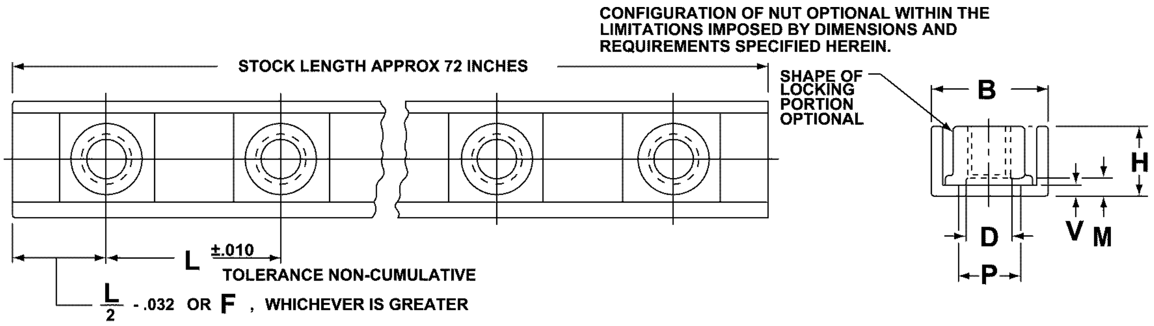
INTERCHANGEABILITY RELATIONSHIP: (STATUS NOTE) MS21083 NUTS CAN UNIVERSALLY REPLACE AN364, MS20364 AND NAS1022 NUTS OF LIKE MATERIAL, PLATING, THREAD SIZE AND LOCKING DESIGN (ALL-METAL OR WITH NON-METALLIC INSERT). BUT THESE AN364, MS20364 AND NAS1022 NUTS CANNOT UNIVERSALLY REPLACE THE MS21083 NUTS. FOR DEFINITION AND APPLICATION OF DRAWING STATUS NOTES SEE MIL-STD-32.

CERTAIN PROVISIONS (THE DIMENSIONS ACROSS THE WRENCHING FLATS) OF THE STANDARD ARE THE SUBJECT OF INTERNATIONAL STANDARDIZATION AGREEMENT ABC AIR STD 17/2. WHEN REVISION OR CANCELLATION OF THIS STANDARD IS PROPOSED, THE DEPARTMENTAL CUSTODIAN WILL INFORM THEIR RESPECTIVE DEPARTMENTAL STANDARDIZATION OFFICE SO THAT APPROPRIATE ACTION MAY BE TAKEN RESPECTING THE INTERNATIONAL AGREEMENT CONCERNED.

FOR DESIGN FEATURE PURPOSES, THIS STANDARD TAKES PRECEDENCE OVER PROCUREMENT DOCUMENTS REFERENCED HEREIN. REFERENCED DOCUMENTS SHALL BE OF THE ISSUE IN EFFECT ON DATE OF INVITATIONS FOR BID.

F05-066S02

Figure 5-67. Drawing MS21083(ASG) (Sheet 2)



THREAD SIZE DASH No.	(1) Ⓡ THREAD MIL-S-8879/MOD.	B MAX	D MIN	F MIN	(2) H MAX	L MIN SPACING AVAILABLE	M MIN	(5) P MAX	P MIN	V MAX	AXIAL STRENGTH LBS MIN	WEIGHT (MAX) NUT ELEMENTS LBS/100	WEIGHT (MAX) CHANNEL LBS/INCH
L08	8-32UNC-3B	.416	.168	.343	.250	.625	.062	.270	.184	.035	1,720	.19	.0028
L3	10-32UNF-3B	.416	.194	.343	.250	.625	.062	.210	.210	.035	2,460	.20	.0028
L4	1/4-28UNF-3B	.516	.254	.406	.281	.750	.062	.330	.270	.045	4,580	.40	.0032
L5	5/16-24UNF-3B	.609	.317	.469	.328	.875	.062	.393	.333	.045	7,390	.64	.0053
L6	3/8-24UNF-3B	.726	.379	.562	.344	1.000	.062	.455	.395	.055	11,450	1.08	.0073

THREADS IN ACCORDANCE WITH MIL-S-7742

L NUT ELEMENT SPACING	NUT ELEMENT SPACING DASH No.	MAX No. OF NUT ELEMENTS
.625	-5	115
.750	-6	96
.875	-7	82
1.000	-8	72
1.125	-9	64
1.250	-10	57
1.375	-11	52
1.500	-12	48
1.625	-13	44
1.750	-14	41
1.875	-15	38
2.000	-16	36
2.250	-18	32
2.500	-20	28
3.000	-24	24

Ⓑ(1) THREADS BEFORE LUBRICATION PER MIL-S-8879. ARE ACCEPTABLE UNTIL 31 DECEMBER 1969.

(2) "H" MAX APPLIES TO NUT ELEMENT AND CHANNEL. MIN "H" NOT SPECIFIED, LIMITED ONLY BY STRENGTH REQUIREMENTS OF SPECIFICATION.

(3) FLOAT OF NUT ELEMENT PORTION OF ASSEMBLY SHALL NOT BE LESS THAN .030 NOR MORE THAN .040 LONGITUDINALLY AND NOT LESS THAN .010 NOR MORE THAN .030 LATERALLY FROM CENTERED POSITION. NUT ELEMENT SHALL BE CAPABLE OF ENGAGEMENT WITH A BOLT IN THE MAXIMUM MISALIGNMENT POSITION. MAXIMUM AXIAL FLOAT .020 INCH FOR MS21086L08 AND MS21088L3, .030 FOR LARGER SIZES.

(4) THE ASSEMBLY SHALL PROVIDE A BEARING SURFACE FOR THE NUT ELEMENT WITHIN THE HOUSING. THE CENTERLINE OF THE CHANNEL SHALL NOT DEVIATE FROM A STRAIGHT LINE BY MORE THAN .015 IN ANY 12 INCHES. THE NUT ELEMENT AND BASE PORTION OF THE ASSEMBLY SHALL FORM ONE INTEGRAL UNIT.

(5) HOLE IN CHANNEL MUST PROVIDE FOR FULL FLOAT OF NUT ELEMENT BUT NEED NOT BE CIRCULAR.

MATERIAL: NUT ELEMENT - CORROSION AND HEAT RESISTANT STEEL, (A286) AMS5525, AMS5735 OR AMS5737.
CHANNEL - ALUMINUM ALLOY.

HARDNESS: NUT ELEMENTS SHALL HAVE A MAXIMUM HARDNESS OF ROCKWELL C 49.

PLATING: NUT ELEMENTS - DRY FILM LUBRICANT APPROVED IN ACCORDANCE WITH MIL-N-25027. FOR USAF APPLICATIONS, NUTS TREATED WITH DRY FILM LUBRICANTS SHALL NOT BE USED ININTERNAL FUEL SYSTEMS APPLICATIONS.
CHANNEL - SEE PROCUREMENT SPECIFICATION.

MAGNETIC PERMEABILITY: SHALL BE LESS THAN 2.0 (AIR = 1.0) FOR A FIELD STRENGTH H = 200 OERSTEDS USING A MAGNETIC PERMEABILITY INDICATOR PER MIL-I-17214 OR EQUIVALENT.

PERFORMANCE: SEE PROCUREMENT SPECIFICATION, EXCEPT NUT ELEMENTS LIMITED TO FIVE REUSE CYCLES.

DESIGN AND USAGE LIMITATIONS: THESE NUTS ARE DESIGNED TO DEVELOP THE TENSILE STRENGTH OF BOLTS OF SCREWS WITH AN ULTIMATE STRESS (Ftu) OF 125 KSI BASED ON THE CROSS SECTIONAL AREA AT THE BASIC ROOT DIAMETER OF THE THREAD. THESE NUTS ARE DESIGNED TO BE USED ON 3A EXTERNAL THREADS. THESE NUTS SHALL BE USED IN ACCORDANCE WITH THE LIMITATIONS OF MS33588. ONLY NUTS FOR WHICH THERE ARE QUALIFIED PRODUCTS LISTED ON QPL25027 SHALL BE USED.

CODE: FIRST DASH NUMBER, AS LISTED ABOVE, DESIGNATES THREAD SIZE. SECOND DASH NUMBER DESIGNATES NUT ELEMENT SPACING IN EIGHTHS OF AN INCH. THIRD DASH NUMBER INDICATES NUMBER OF NUT ELEMENTS WHEN LESS THAN STOCK LENGTH (APPROX 72 INCHES) IS DESIRED.

EXAMPLE OF PART NUMBERS:

MS21088L4-7-10 = GANG CHANNEL ASSEMBLY CONSISTING OF TEN, 1/4-28, DRY FILM LUBRICATED NUT ELEMENTS, SPACED AT .875 INCH.

Ⓑ

SURFACE ROUGHNESS: IN ACCORDANCE WITH MIL-STD-10. UNLESS OTHERWISE SPECIFIED THE SURFACE ROUGHNESS SHALL NOT EXCEED 125 MICRO INCHES.

BREAK SHARP CORNERS.

DIMENSIONS IN INCHES.

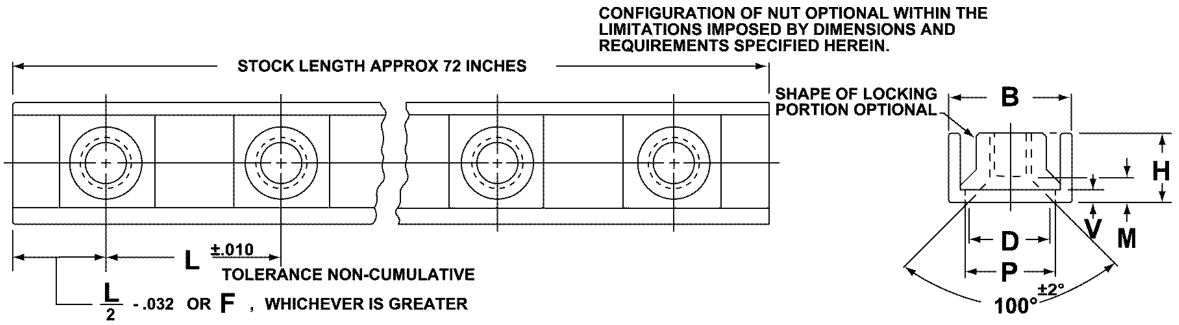
DIMENSIONS TO BE MET PRIOR TO LUBRICATION.

THIS STANDARD TAKES PRECEDENCE OVER DOCUMENTS REFERENCED HEREIN.

REFERENCED DOCUMENTS SHALL BE OF THE ISSUE IN EFFECT ON DATE OF INVITATIONS FOR BID.

F05-067

Figure 5-68. Drawing MS21088(ASG)



THREAD SIZE DASH No.	(1) THREAD MIL-S-8879/MOD. Ⓑ	B MAX	D MIN	F MIN	(2) H MAX	L MIN SPACING AVAILABLE	M MIN	(5) P MAX	P MIN	V MAX	AXIAL STRENGTH LBS MIN	WEIGHT (MAX) NUT ELEMENTS LBS/100	CHANNEL LBS/INCH
L08	8-32UNC-3B	.593	.360	.406	.272	.750	.084	.491	.385	.035	1,720	.24	.0038
L3	10-32UNF-3B	.593	.406	.406	.281	.750	.093	.491	.431	.035	2,460	.26	.0038
L4	1/4-28UNF-3B	.874	.535	.562	.340	1.000	.107	.620	.560	.045	4,580	.50	.0052

Ⓑ

(1) THREADS BEFORE LUBRICATION PER MIL-S-8879. THREADS IN ACCORDANCE WITH MIL-S-7742 ARE ACCEPTABLE UNTIL 31 DECEMBER 1969.

(2) "H" MAX APPLIES TO NUT ELEMENT AND CHANNEL. MIN "H" NOT SPECIFIED, LIMITED ONLY BY STRENGTH REQUIREMENTS OF SPECIFICATION.

(3) FLOAT OF NUT ELEMENT PORTION OF ASSEMBLY SHALL NOT BE LESS THAN .030 NOR MORE THAN .040 LONGITUDINALLY AND NOT LESS THAN .010 NOR MORE THAN .030 LATERALLY FROM CENTERED POSITION. NUT ELEMENT SHALL BE CAPABLE OF ENGAGEMENT WITH A BOLT IN THE MAXIMUM MISALIGNMENT POSITION. MAXIMUM AXIAL FLOAT .020 INCH FOR MS21089L08 AND MS21089L3, .030 FOR MS21089L4.

(4) THE ASSEMBLY SHALL PROVIDE A BEARING SURFACE FOR THE NUT ELEMENT WITHIN THE HOUSING. THE CENTERLINE OF THE CHANNEL SHALL NOT DEVIATE FROM A STRAIGHT LINE BY MORE THAN .015 IN ANY 12 INCHES. THE NUT ELEMENT AND BASE PORTION OF THE ASSEMBLY SHALL FORM ONE INTEGRAL UNIT.

(5) HOLE IN CHANNEL MUST PROVIDE FOR FULL FLOAT OF NUT ELEMENT BUT NEED NOT BE CIRCULAR.

L NUT ELEMENT SPACING	NUT ELEMENT SPACING DASH No.	MAX No. OF NUT ELEMENTS
.750	-6	96
.875	-7	82
1.000	-8	72
1.125	-9	64
1.250	-10	57
1.375	-11	52
1.500	-12	48
1.625	-13	44
1.750	-14	41
1.875	-15	38
2.000	-16	36
2.250	-18	32
2.500	-20	28
3.000	-24	24

MATERIAL: NUT ELEMENT - CORROSION AND HEAT RESISTANT STEEL, (A286) AMS5525, AMS5735 OR AMS5737.
CHANNEL - ALUMINUM ALLOY.

HARDNESS: NUT ELEMENTS SHALL HAVE A MAXIMUM HARDNESS OF ROCKWELL C 49.

PLATING: NUT ELEMENTS - DRY FILM LUBRICANT APPROVED IN ACCORDANCE WITH MIL-N-25027, FOR USAF APPLICATIONS, NUTS TREATED WITH DRY FILM LUBRICANTS SHALL NOT BE USED INTERNAL FUEL SYSTEMS APPLICATIONS.

CHANNEL - SEE PROCUREMENT SPECIFICATION.

MAGNETIC PERMEABILITY: SHALL BE LESS THAN 2.0 (AIR = 1.0) FOR A FIELD STRENGTH H = 200 OERSTEDS USING A MAGNETIC PERMEABILITY INDICATOR PER MIL-I-17214 OR EQUIVALENT.

PERFORMANCE: SEE PROCUREMENT SPECIFICATION, EXCEPT NUT ELEMENTS LIMITED TO FIVE REUSE CYCLES.

DESIGN AND USAGE LIMITATIONS: THESE NUTS ARE DESIGNED TO DEVELOP THE TENSILE STRENGTH OF BOLTS OF SCREWS WITH AN ULTIMATE STRESS (Ftu) OF 125 KSI BASED ON THE CROSS SECTIONAL AREA AT THE BASIC ROOT DIAMETER OF THE THREAD. THESE NUTS ARE DESIGNED TO BE USED ON 3A EXTERNAL THREADS. THESE NUTS SHALL BE USED IN ACCORDANCE WITH THE LIMITATIONS OF MS33588. ONLY NUTS FOR WHICH THERE ARE QUALIFIED PRODUCTS LISTED ON QPL25027 SHALL BE USED.

CODE: FIRST DASH NUMBER, AS LISTED ABOVE, DESIGNATES THREAD SIZE. SECOND DASH NUMBER DESIGNATES NUT ELEMENT SPACING IN EIGHTHS OF AN INCH. THIRD DASH NUMBER INDICATES NUMBER OF NUT ELEMENTS WHEN LESS THAN STOCK LENGTH (APPROX 72 INCHES) IS DESIRED.

EXAMPLE OF PART NUMBERS:

MS21089L4-7-10 = GANG CHANNEL ASSEMBLY CONSISTING OF TEN, 1/4-28, DRY FILM LUBRICATED NUT ELEMENTS, SPACED AT .875 INCH.

Ⓑ

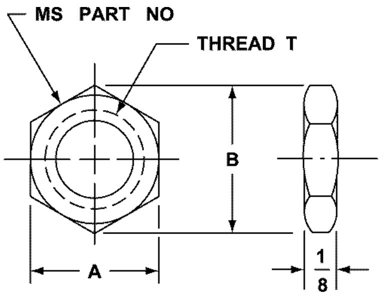
SURFACE ROUGHNESS: IN ACCORDANCE WITH MIL-STD-10. UNLESS OTHERWISE SPECIFIED THE SURFACE ROUGHNESS SHALL NOT EXCEED 125 MICRO INCHES.

BREAK SHARP CORNERS.
DIMENSIONS IN INCHES.
DIMENSIONS TO BE MET PRIOR TO LUBRICATION.

THIS STANDARD TAKES PRECEDENCE OVER DOCUMENTS REFERENCED HEREIN.
REFERENCED DOCUMENTS SHALL BE OF THE ISSUE IN EFFECT ON DATE OF INVITATIONS FOR BID.

F05-068

Figure 5-69. Drawing MS21089(ASG)



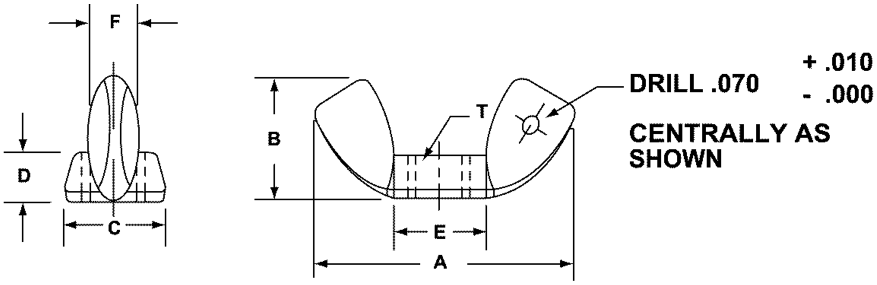
MS PART NUMBER	A	B	THREAD T	MATERIAL
MS24017-1	0.502 0.492	9/16	3/8-24 UNF-2B	Brass
MS24017-2	0.564 0.553	21/32	1/2-20 UNF-2B	Brass
MS24017-3	0.502 0.492	9/16	3/8-24 UNF-2B	Steel
MS24017-4	0.564 0.553	21/32	1/2-20 UNF-2B	Steel

NOTES:
1. MATERIAL - BRASS - SPEC. QQ-B-626, COMP. 22, HALF HARD
   STEEL - SPEC. QQ-S-624, COMP. FS 1330.
2. FINISH: SEE PROCUREMENT SPEC.
3. DIMENSIONS IN INCHES: UNLESS OTHERWISE SPECIFIED, TOLERANCES: FRACTIONS ± 1/64.
4. REFERENCED DOCUMENTS SHALL BE OF THE ISSUE IN EFFECT ON THE DATE OF INVITATION FOR BIDS.
5. THIS STANDARD TAKES PRECEDENCE OVER DOCUMENTS REFERENCED HEREIN. THE MS PART NUMBER MAKING REQUIRED ON THE ITEM MAY BE OMITTED BY MARKING THE PACKAGES OR TAGGING THE PARTS PER MIL-STD-130.

Ⓑ ENTIRE STANDARD REVISED

F05-069

Figure 5-70. Drawing MS24017



DASH NO.	SIZE	MATERIAL	T	DIMENSIONS											
				A		B		C		D		E		F	
				MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN
17 18	NO. 6 (.138)	STEEL BRASS	32UNC-2B	.670	.640	.360	.330	.328	.296	.140	.109	.210	.171	.109	.078
19 20	NO. 8 (.164)	STEEL BRASS	32UNC-2B	.670	.640	.360	.330	.328	.296	.140	.109	.210	.171	.109	.078
37 38	NO. 10 (.190)	STEEL BRASS	24UNC-2B	.858	.828	.452	.422	.425	.390	.173	.140	.265	.228	.140	.109
39 40	1/4	STEEL BRASS	20UNC-2B	1.082	1.042	.520	.480	.499	.453	.211	.171	.324	.265	.171	.140
41 24	5/16	STEEL BRASS	18UNC-2B	1.243	1.193	.635	.595	.575	.515	.242	.203	.387	.328	.203	.171
42 28	3/8	STEEL BRASS	16UNC-2B	1.436	1.376	.755	.695	.695	.640	.296	.261	.483	.421	.234	.203
43 32	7/16	STEEL BRASS	14UNC-2B	1.915	1.835	.941	.871	.921	.866	.390	.359	.642	.546	.312	.265
44 36	1/2	STEEL BRASS	13UNC-2B	1.915	1.835	.941	.871	.921	.866	.390	.359	.642	.546	.312	.265

TYPE: COLD FORCED (TYPE I OF PROCUREMENT SPECIFICATION)

MATERIAL: STEEL, CARBON, 50,000 PSI TENSILE STRENGTH
BRASS, COMMERCIAL

PROTECTIVE COATING: STEEL NUTS ARE CADMIUM PLATED, SPECIFICATION QQ-P-416, TYPE II, CLASS 3.

THREADS: THE THREADS SHALL BE IN ACCORDANCE WITH SCREW-THREAD STANDARDS FOR FEDERAL SERVICES, HANDBOOK H-28.

NOTES:

(1) REFERENCED DOCUMENTS OF ISSUE IN EFFECT ON DATE OF INVITATION FOR BIDS SHALL APPLY.

(2) IN CASE OF CONFLICT WITH ANY REFERENCED DOCUMENT, THIS STANDARD WILL GOVERN.

(3) THE MS PART NUMBER CONSISTS OF THE MS SHEET NUMBER, PLUS THE DASH NUMBER. EXAMPLE: MS35425-17.

(4) ALL DIMENSIONS IN INCHES.

® INTERCHANGEABILITY RELATIONSHIP WITH AN350. - After 3 February 1965, NC threaded wing nuts of AN350 are inactive for new design and replacement. Their existing stocks should be used until depleted. For new design and replacement use only applicable superseding wing nuts listed above.

F05-070

Figure 5-71. Drawing MS35425

REVIEWER: MI, AT, ME, AV, MU, GL, 85, IS, NSA
USER: SH, MC

This military standard has been approved by the Department of Defense and is mandatory for use by all Departments and Agencies of the Department of Defense. Selection for all new engineering and design applications and for repetitive use shall be made from this document.

APPROVED 12 MARCH 1956 REVISED Ⓐ 11 OCT 61 Ⓑ 21 MAR 66 Ⓒ 29 JAN 1969

FED. SUP CLASS
5310

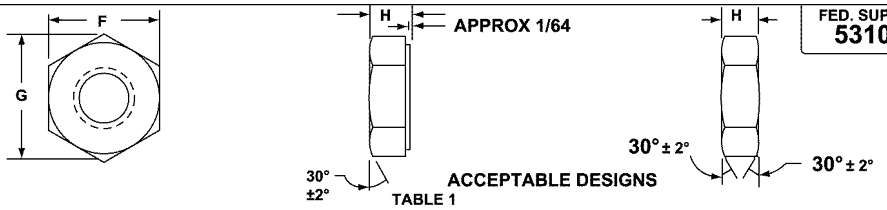


TABLE 1

NOMINAL SIZE OR BASIC MAJOR DIAMETER OF THREAD		WIDTH ACROSS FLATS F			WIDTH ACROSS CORNERS G		THICKNESS H		
		NOM	MAX	MIN	MAX	MIN	NOM	MAX	MIN
1/4	.2500	7/16	.4375	.428	.505	.488	5/32	.163	.150
5/16	.3125	1/2	.5000	.489	.577	.557	3/16	.195	.180
3/8	.3750	9/16	.5625	.551	.650	.628	7/32	.227	.210
7/16	.4375	11/16	.6875	.675	.794	.768	1/4	.260	.240
1/2	.5000	3/4	.7500	.736	.866	.840	5/16	.323	.302
9/16	.5625	7/8	.8750	.861	1.010	.982	5/16	.324	.301
5/8	.6250	15/16	.9375	.922	1.083	1.051	3/8	.387	.363
3/4	.7500	1 - 1/8	1.1250	1.088	1.299	1.240	27/64	.446	.398
7/8	.8750	1 - 5/16	1.3125	1.269	1.516	1.447	31/64	.510	.458
1	1.0000	1 - 1/2	1.5000	1.450	1.732	1.653	35/64	.575	.519
1 - 1/8	1.1250	1 - 11/16	1.6875	1.631	1.949	1.859	39/64	.639	.579
1 - 1/4	1.2500	1 - 7/8	1.8750	1.812	2.165	2.066	23/32	.751	.687
1 - 3/8	1.3750	2 - 1/16	2.0625	1.994	2.382	2.273	25/32	.815	.747
1 - 1/2	1.5000	2 - 1/4	2.2500	2.175	2.598	2.480	27/32	.880	.808
1 - 3/4	1.7500	2 - 5/8	2.6250	2.538	3.031	2.893	31/32	1.009	.929
2	2.0000	3	3.0000	2.900	3.464	3.306	1 - 3/32	1.138	1.050
2 - 1/4	2.2500	3 - 3/8	3.3750	3.262	3.897	3.719	1 - 13/64	1.251	1.155
2- 1/2	2.5000	3 - 3/4	3.7500	3.625	4.330	4.133	1 - 29/64	1.505	1.401
2 - 3/4	2.7500	4 - 1/8	4.1250	3.988	4.763	4.546	1 - 37/64	1.634	1.522
3	3.0000	4 - 1/2	4.5000	4.350	5.196	4.959	1 - 45/64	1.763	1.643

MATERIAL: Steel, Carbon, Grades B and C; Steel, Corrosion-Resisting, 300 Series; and Brass, Naval in accordance with procurement specification.

PROTECTIVE COATING OR TREATMENT: Cadmium Plate, Black Oxide, Phosphate Coating, and Passivation treatment in accordance with procurement specification.

Ⓒ **MAGNETIC PERMEABILITY:** Corrosion-Resisting Steel fasteners have a magnetic permeability of 2.0 maximum (air = 1.0) for a field strength of H = 200 Oersteds using a magnetic indicator per MIL-I-17214.

DIMENSIONS: All dimensions are in inches unless otherwise specified.

PART NUMBER: The MS part number consists of the MS number, plus the dash number.
Example: MS35691-1.

THREADS: The threads shall be in accordance with Screw-Thread Standards for Federal Services, Handbook H-28.

NOTES:
(1) Reference documents shall be of the issue in effect on date of invitation for bid.
(2) For design feature purposes, this standard takes precedence over procurement over procurement documents referenced herein.
(3) Dimensions and tolerances are in accordance with ASA B18.2.2.
(4) For new design use part numbers in Table II.
(5) For cancelled part numbers see Table III.
(6) For maintenance use inactivated part numbers of Table IV.
(7) For interchangeability between the cancelled (Grade A uncoated) nuts and superseding inactivated (Grade B, uncoated) nuts see Table V.
Ⓒ (8) For interchangeability of cancelled or inactivated and new part numbers see Table VI and Table VII.

Ⓒ For changes see sheets 1 thru 6

P.A. WC Other Cust 82 Ⓒ	TITLE NUT, PLAIN, HEXAGON (JAM) UNC-2B AND UNF-2B	MILITARY STANDARD MS35691
PROCUREMENT SPECIFICATION FF-N-836	SUPERSEDES: BBCX1 thru BBCX4, BBDX1, 2, and 3, BBXX1 BBXX2, BRDX2, BRDX2.1, BUNX5 thru BUNX7, MS16203 (SHIPS) in part	SHEET 1 OF 6

DD FORM 1 SEP 87 672-1 (Coordinated) PREVIOUS EDITIONS OF THIS FORM ARE OBSOLETE. F05-071S01

Figure 5-72. Drawing MS35691 (Sheet 1 of 6)

FED. SUP CLASS
5310

REVIEWER: MI, AT, ME, AV, MU, GL, 85, IS, NSA
USER: SH, MC

NOTE: The part numbers in Table I I only will be used for new design and engineering.

TABLE II

NOMINAL SIZE	1/4		5/16		3/8		7/16	
THREADS PER INCH	20UNC-2B	28UNF-2B	18UNC-2B	24UNF-2B	16UNC-2B	24UNF-2B	14UNC-2B	20UNF-2B
MATERIAL AND PROTECTIVE COATING	Dash No.	Dash No.	Dash No.	Dash No.	Dash No.	Dash No.	Dash No.	Dash No.
STEEL, CARBON, GRADE B, CAD PLATE	1	5	9	13	17	21	25	29
STEEL, CARBON, GRADE C, CAD PLATE	2	6	10	14	18	22	26	30
STEEL, CARBON, GRADE B, PHOS COATED	406	426	506	526	606	626	706	726
CRES, 300 SERIES, PASSIVATED *	3	7	11	15	19	23	27	31
BRASS, BLACK OXIDE	4	8	12	16	20	24	28	32
NOMINAL SIZE	1/2		9/16		5/8 Ⓒ		3/4	
TREADS PER INCH	13UNC-2B	20UNF-2B	12UNC-2B	18UNF-2B	11UNC-2B	18UNF-2B	10UNC-2B	16UNF-2B
MATERIAL AND PROTECTIVE COATING	Dash No.	Dash No.	Dash No.	Dash No.	Dash No.	Dash No.	Dash No.	Dash No.
STEEL, CARBON, GRADE B, CAD PLATE	33	37	41	45	49	53	57	61
STEEL, CARBON, GRADE C, CAD PLATE	34	38	42	46	50	54	58	62
STEEL, CARBON, GRADE B, PHOS COATED	806	826			1006	1026	1206	1226
CRES, 300 SERIES, PASSIVATED *	35	39	43	47	51	55	59	63
BRASS, BLACK OXIDE	36	40	44	48	52	56	60	64
NOMINAL SIZE	7/8		1		1 - 1/8		1 - 1/4	
THREADS PER INCH	9UNC-2B	14UNF-2B	8UNC-2B	12UNF-2B	7UNC-2B	12UNF-2B	7UNC-2B	12UNF-2B
MATERIAL AND PROTECTIVE COATING	Dash No.	Dash No.	Dash No.	Dash No.	Dash No.	Dash No.	Dash No.	Dash No.
STEEL, CARBON, GRADE B, CAD PLATE	65	69	73	77	81	85	89	93
STEEL, CARBON, GRADE C, CAD PLATE	66	70	74	78	82	86	90	94
CRES, 300 SERIES, PASSIVATED *	67	71	75	79	83	87	91	95
BRASS, BLACK OXIDE	68	72	76	80	84	88	92	96
NOMINAL SIZE	1 - 3/8		1 - 1/2		1 - 3/4		2	
THREADS PER INCH	6UNC-2B	12UNF-2B	6UNC-2B	12UNF-2B	5UNC-2B		4 - 1/2UNC-2B	
MATERIAL AND PROTECTIVE COATING	Dash No	Dash No	Dash No	Dash No	Dash No		Dash No	
STEEL, CARBON, GRADE B, CAD PLATE	97	101	105	109	113		117	
STEEL, CARBON, GRADE C, CAD PLATE	98	102	106	110	114		118	
CRES, 300 SERIES, PASSIVATED *	99	103	107	111	115		119	
BRASS, BLACK OXIDE	100	104	108	112	116		120	
NOMINAL SIZE	2 - 1/4		2 - 1/2		2 - 3/4		3	
THREADS PER INCH	4 - 1/2UNC-2B		4UNC-2B		4UNC-2B		4UNC-2B	
MATERIAL AND PROTECTIVE COATING	Dash No		Dash No		Dash No		Dash No	
STEEL, CARBON, GRADE B, CAD PLATE	121		125		129		133	
STEEL, CARBON, GRADE C, CAD PLATE	122		126		130		134	
CRES, 300 SERIES, PASSIVATED *	123		127		131		135	
BRASS, BLACK OXIDE	124		128		132		136	

* Add "B" before dash number for corrosion resistant steel nuts for black oxide coating class 4 in accordance with MIL-C-13924.
Example of MS part number:
MS35691-B3 = 1/4 20UNC-2B black oxide coated corrosion resistant steel nut.

APPROVED 12 MARCH 1956 REVISED Ⓐ 11 OCT 61 Ⓑ 21 MAR 66 Ⓒ FOR CHANGES SEE SHEETS 1 thru 6

This military standard has been approved by the Department of Defense and is mandatory for use by all Departments and Agencies of the Department of Defense. Selection for all new engineering and design applications and for repetitive use shall be made from this document.

P.A. WC Other Cust 82 Ⓒ	TITLE NUT, PLAIN, HEXAGON (JAM) UNC-2B AND UNF-2B	MILITARY STANDARD MS35691
PROCUREMENT SPECIFICATION FF-N-836	SUPERSEDES: BBCX1 thru BBCX4, BBDX1, 2 AND 3. BBXX1, BBXX2. BRDX2, BRDX2.1, BUNX5 thru BUNX7, MS16203(SHIPS) in part	SHEET 2 OF 6

DD FORM 1 SEP 87 672-1 (Coordinated) PREVIOUS EDITIONS OF THIS FORM OBSOLETE F05-071S02

Figure 5-72. Drawing MS35691 (Sheet 2)

CANCELLED The following part numbers are cancelled after 21 Mar 1966

FED SUP CLASS
5310

TABLE I I I

NOMINAL SIZE	1/4		5/16		3/8		3/16	
THREADS PER INCH	20UNC-2B	28UNF-2B	18UNC-2B	24UNF-2B	16UNC-2B	24UNF-2B	14UNC-2B	20UNF-2B
MATERIAL AND PROTECTIVE COATING	Dash No	Dash No	Dash No	Dash No	Dash No	Dash No	Dash No	Dash No
STEEL, CARBON, GRADE A, UNCOATED	401	421	501	521	601	621	701	721
CAD OR ZINC OPTIONAL	402	422	502	522	602	622	702	722
PHOSPHATE	403	423	503	523	603	623	703	723
STEEL, CARBON, GRADE B								
CAD OR ZINC OPTIONAL	405	425	505	525	605	625	705	725
STEEL, CARBON, GRADE C								
CAD OR ZINC OPTIONAL	408	428	508	528	608	628	708	728
PHOSPHATE	409	429	509	529	609	629	709	729
Cres, 300-400 series, Passivated	410	430	510	530	610	630	710	730
BRASS, UNCOATED	411	431	511	531	611	631	711	731
BRASS, TIN PLATED	412	432	512	532	612	632		
NOMINAL SIZE	1/2		9/16		5/8		3/4	
THREADS PER INCH	13UNC-2B	20UNF-2B	12UNC-2B	18UNF-2B	11UNC-2B	18UNF-2B	10UNC-2B	16UNF-2B
MATERIAL AND PROTECTIVE COATING	Dash No	Dash No	Dash No	Dash No	Dash No	Dash No	Dash No	Dash No
STEEL, CARBON, GRADE A, UNCOATED	801	821	901	921	1001	1021	1201	1221
CAD OR ZINC OPTIONAL	802	822	902	922	1002	1022	1202	1222
PHOSPHATE	803	823	903	923	1003	1023	1203	1223
STEEL, CARBON, GRADE B								
CAD OR ZINC OPTIONAL	805	825	905	925	1005	1025	1205	1225
PHOSPHATE			906	926				
STEEL, CARBON, GRADE C								
CAD OR ZINC OPTIONAL	808	828	908	928	1008	1028	1208	1228
PHOSPHATE	809	829	909	929	1009	1029	1209	1229
Cres, 300-400 series, Passivated	810	830	910	930	1010	1030	1210	1230
BRASS, UNCOATED	811	831	911	931	1011	1031	1211	1231
NOMINAL SIZE	7/8		1		1 - 1/8		1 - 1/4	
THREADS PER INCH	9UNC-2B	14UNF-2B	8UNC-2B	12UNF-2B	7UNC-2B	12UNC-2B	7UNC-2B	12UNF-2B
MATERIAL AND PROTECTIVE COATING	Dash No	Dash No	Dash No	Dash No	Dash No	Dash No	Dash No	Dash No
STEEL, CARBON, GRADE A, UNCOATED	1401	1421	1601	1621	1801	1821	2001	2021
CAD OR ZINC OPTIONAL	1402	1422	1602	1622	1802	1822	2002	2022
PHOSPHATE	1403	1423	1603	1623	1803	1823	2003	2023
STEEL, CARBON, GRADE B								
CAD OR ZINC OPTIONAL	1405	1425	1605	1625	1805	1825	2005	2025
PHOSPHATE	1406	1426	1606	1626	1806	1826	2006	2026
STEEL, CARBON, GRADE C								
CAD OR ZINC OPTIONAL	1408	1428	1608	1628	1808	1828	2008	2028
PHOSPHATE	1409	1429	1609	1629	1809	1829	2009	2029
Cres, 300-400 series, Passivated	1410	1430	1610	1630	1810	1830	2010	2030
BRASS, UNCOATED	1411	1431	1611	1631	1811	1831	2011	2031

NOMINAL SIZE	1 - 3/8		1 - 1/2		1 - 3/4	2	2 - 1/4
THREADS PER INCH	6UNC-2B	12UNF-2B	6UNC-2B	12UNF-2B	5UNC-2B	4 - 1/2UNC-2B	4 - 1/2UNC-2B
MATERIAL AND PROTECTIVE COATING	Dash No	Dash No	Dash No	Dash No	Dash No	Dash No	Dash No
STEEL, CARBON, GRADE A, UNCOATED	2201	2221	2401	2421	2801	3201	3601
CAD OR ZINC OPTIONAL	2202	2222	2402	2422	2802	3202	3602
PHOSPHATE	2203	2223	2403	2423	2803	3203	3603
STEEL, CARBON, GRADE B							
CAD OR ZINC OPTIONAL	2205	2225	2405	2425	2805	3205	3605
PHOSPHATE	2206	2226	2406	2426	2806	3206	3606
STEEL, CARBON, GRADE C							
CAD OR ZINC OPTIONAL	2208	2228	2408	2428	2808	3208	3608
PHOSPHATE	2209	2229	2409	2429	2809	3209	3609
Cres, 300-400 series, Passivated	2210	2230	2410	2430	2810	3210	3610
BRASS, UNCOATED	2211	2231	2411	2431	2811	3211	3611

REVIEWER: MI, AT, ME, AV, MU, GL, 85, IS, NSA
USER: SH, MC

APPROVED 12 MARCH 1956 REVISED Ⓐ 11 OCT 61 Ⓑ 21 MAR 66 Ⓒ FOR CHANGES SEE SHEETS 1 thru 6

This military standard has been approved by the Department of Defense and is mandatory for use by all Departments and Agencies of the Department of Defense. Selection for all new engineering and design applications and for repetitive use shall be made from this document.

P.A. WC
Other Cust
B2 Ⓒ

TITLE
NUT, PLAIN, HEXAGON (JAM)
UNC-2B AND UNF-2B

MILITARY STANDARD
MS35691

PROCUREMENT SPECIFICATION
FF-N-836

SUPERSEDES: BBCX1 thru BBCX4, BBDX1, 2 and 3, BBXX1, BBXX2, BRDX2, BRDX2.1, BUNX5 thru BUNX7, MS16203(SHIPS) in part

SHEET 3 OF 6

DD FORM 1 SEP 87 672-1 (Coordinated)

PREVIOUS EDITIONS OF THIS FORM ARE OBSOLETE

F05-071S03

Figure 5-72. Drawing MS35691 (Sheet 3)

FED. SUP CLASS
5310

TABLE I I I

NOMINAL SIZE	2 - 1/2	2 - 3/4	3	
THREADS PER INCH	4UNC-2B	4UNC-2B	4UNC-2B	
MATERIAL AND PROTECTIVE COATING	Dash No	Dash No	Dash No	
STEEL, CARBON, GRADE A UNCOATED	4001	4401	4801	
CAD OR ZINC OPTIONAL	4002	4402	4802	
PHOSPHATE	4003	4403	4803	
STEEL, CARBON, GRADE B				
CAD OR ZINC OPTIONAL	4005	4405	4805	
PHOSPHATE	4006	4406	4806	
STEEL, CARBON, GRADE C				
CAD OR ZINC OPTIONAL	4008	4408	4808	
PHOSPHATE	4009	4409	4809	
Cres, 300-400 series, Passivated	4010	4410	4810	
BRASS, UNCOATED	4011	4411	4811	

INACTIVE

The following part numbers in Table IV are inactive for new design after 21 MAR 66
Use for maintenance purposes only.

TABLE IV

NOMINAL SIZE	1/4		5/16		3/8		7/16	
THREADS PER INCH	20UNC-2B	28UNF-2B	18UNC-2B	24UNF-2B	16UNC-2B	24UNF-2B	14UNC-2B	20UNF-2B
MATERIAL AND PROTECTIVE COATING	Dash No	Dash No	Dash No	Dash No	Dash No	Dash No	Dash No	Dash No
STEEL, CARBON, GRADE B, UNCOATED	404	424	504	524	604	624	704	724
STEEL, CARBON, GRADE C, UNCOATED	407	427	507	527	607	627	707	727
NOMINAL SIZE	1/2		9/16		5/8		3/4	
THREADS PER INCH	13UNC-2B	20UNF-2B	12UNC-2B	18UNF-2B	11UNC-2B	18UNF-2B	10UNC-2B	16UNF-2B
MATERIAL AND PROTECTIVE COATING	Dash No	Dash No	Dash No	Dash No	Dash No	Dash No	Dash No	Dash No
STEEL, CARBON, GRADE B, UNCOATED	804	824	904	924	1004	1024	1204	1224
STEEL, CARBON, GRADE C, UNCOATED	807	827	907	927	1007	1027	1207	1227
NOMINAL SIZE	7/8		1		1 - 1/8		1 - 1/4	
THREADS PER INCH	9UNC-2B	14UNF-2B	8UNC-2B	12UNF-2B	7UNC-2B	12UNF-2B	7UNC-2B	12UNF-2B
MATERIAL AND PROTECTIVE COATING	Dash No	Dash No	Dash No	Dash No	Dash No	Dash No	Dash No	Dash No
STEEL, CARBON, GRADE B, UNCOATED	1404	1424	1604	1624	1804	1824	2004	2024
STEEL, CARBON, GRADE C, UNCOATED	1407	1427	1607	1627	1807	1827	2007	2027
NOMINAL SIZE	1-3/8		1-1/2		1 - 3/4		2	
THREADS PER INCH	6UNC-2B	12UNF-2B	6UNC-2B	12UNF-2B	5UNC-2B		4 - 1/2UNC-2B	
MATERIAL AND PROTECTIVE COATING	Dash No	Dash No	Dash No	Dash No	Dash No		Dash No	
STEEL, CARBON, GRADE B, UNCOATED	2204	2224	2404	2424	2804		3204	
STEEL, CARBON, GRADE C, UNCOATED	2207	2227	2407	2427	2807		3207	
NOMINAL SIZE	2 - 1/4		2 - 1/2		2 - 3/4		3	
THREADS PER INCH	4 - 1/2UNC-2B		4UNC-2B		4UNC-2B		4UNC-2B	
MATERIAL AND PROTECTIVE COATING	Dash No		Dash No		Dash No		Dash No	
STEEL, CARBON, GRADE B, UNCOATED	3604		4004		4404		4804	
STEEL, CARBON, GRADE C, UNCOATED	3607		4007		4407		4807	

INTERCHANGEABILITY TABLE

For interchangeability between the cancelled (Grade A Uncoated) nut and the superseding inactivated (Grade B Uncoated) nuts, see Table V

TABLE V

PART NUMBERS		PART NUMBERS		PART NUMBERS		PART NUMBERS	
CANCELLED	SUPERSEDING INACTIVATED	CANCELLED	SUPERSEDING INACTIVATED	CANCELLED	SUPERSEDING INACTIVATED	CANCELLED	SUPERSEDING INACTIVATED
MS35691-401	MS35691-404	MS35691-801	MS35691-804	MS35691-1401	MS35691-1404	MS35691-2201	MS39691-2204
421	424	821	824	1421	1424	2221	2224
501	504	901	904	1601	1604	2401	2404
521	524	921	924	1621	1624	2421	2424
601	604	1001	1004	1801	1804	2801	2804
621	624	1021	1024	1821	1824	3201	3204
701	704	1201	1204	2001	2004	3601	3604
721	724	1221	1224	2021	2024	4001	4004
						4401	4404
						4801	4804

APPROVED 12 MARCH 1956 REVISED Ⓐ 11 OCT 61 Ⓑ 21 MAR 66 Ⓒ FOR CHANGES SEE SHEETS 1 thru 6

REVIEWER: MI, AT, ME, AV, MU, GL, 85, IS, NSA
USER: SH, MC

This military standard has been approved by the Department of Defense and is mandatory for use by all Departments and Agencies of the Department of Defense. Selection for all new engineering and design applications and for repetitive use shall be made from this document.

P.A. WC Other Cust 82 Ⓒ	TITLE NUT, PLAIN, HEXAGON (JAM) UNC-2B AND UNF-2B	MILITARY STANDARD MS35691
PROCUREMENT SPECIFICATION FF-N-836	SUPERSEDES: BBCX1 thru BBCX4, BBDX1, 2 and 3, BBXX1, BBXX2 BRDX2, BRDX2.1, BUNX5 thru BUNX7, MS16203(SHIPS) in part	SHEET 4 OF 6

DD FORM 1 SEP 87 672-1 (Coordinated) PREVIOUS EDITIONS OF THIS FORM ARE OBSOLETE

F05-071S04

Figure 5-72. Drawing MS35691 (Sheet 4)

INTERCHANGEABILITY TABLE

FED. SUP CLASS
5310

The nuts covered by the dash numbers given in the original issue of this standard are cancelled or * inactivated after 21 MAR 1966 . The cancelled nuts should be used for maintenance purposes until existing stock is depleted. Use only the superseding nuts for new design.

TABLE VI

PART NUMBERS		PART NUMBERS		PART NUMBERS		PART NUMBERS	
CANCELLED OR INACTIVATED	SUPERSEDING	CANCELLED OR INACTIVATED	SUPERSEDING	CANCELLED OR INACTIVATED	SUPERSEDING	CANCELLED OR INACTIVATED	SUPERSEDING
MS35691-401	MS35691-1	MS35691-623	MS35691-21	MS35691-910	MS35691-43	MS35691*1407	MS35691-66
402	1	*624	21	911	44	1408	66
403	1	625	21	921	45	1409	66
*404	1			922	45	1410	67
405	1	*627	22	923	45	1411	68
		628	22	*924	45	1421	69
*407	2	629	22	925	45	1422	69
408	2	630	23	926	45	1423	69
409	2	631	24	*927	46	*1424	69
410	3	632	24	928	46	1425	69
411	4	701	25	929	46	1426	69
412	4	702	25	930	47	*1427	70
421	5	703	25	931	48	1428	70
422	5	*704	25	1001	49	1429	70
423	5	705	25	1002	49	1430	71
*424	5			1003	49	1431	72
425	5	*707	26	*1004	49	1601	73
		708	26	1005	49	1602	73
*427	6	709	26			1603	73
428	6	710	27	*1007	50	*1604	73
429	6	711	28	1008	50	1605	73
430	7	721	29	1009	50	1606	73
431	8	722	29	1010	51	*1607	74
432	8	723	29	1011	52	1608	74
501	9	*724	29	1021	53	1609	74
502	9	725	29	1022	53	1610	75
503	9			1023	53	1611	76
*504	9	*727	30	*1024	53	1621	77
505	9	728	30	1025	53	1622	77
		729	30			1623	77
*507	10	730	31	*1027	54	*1624	77
508	10	731	32	1028	54	1625	77
509	10	801	33	1029	54	1626	77
510	11	802	33	1030	55	*1627	78
511	12	803	33	1031	56	1628	78
512	12	*804	33	1201	57	1629	78
521	13	805	33	1202	57	1630	79
522	13			1203	57	1631	80
523	13	*807	34	*1204	57	*1801	81
*524	13	808	34	1205	57	1802	81
525	13	809	34			1803	81
		810	35	*1207	58	*1804	81
*527	14	811	36	1208	58	1805	81
528	14	821	37	1209	58	1806	81
529	14	822	37	1210	59	*1807	82
530	15	823	37	1211	60	1808	82
531	16	*824	37	1221	61	1809	82
532	16	825	37	1222	61	1810	83
601	17			1223	61	1811	84
602	17	*827	38	*1224	61	1821	85
603	17	828	38	1225	61	1822	85
*604	17	829	38			1823	85
605	17	830	39	*1227	62	*1824	85
		831	40	1228	62	1825	85
*607	18	901	41	1229	62	1826	85
608	18	902	41	1230	63	*1827	86
609	18	903	41	1231	64	1828	86
610	19	*904	41	1401	65	1829	86
611	20	905	41	1402	65	1830	87
612	20	906	41	1403	65	1831	88
621	21	*907	42	*1404	65	2001	89
622	21	908	42	1405	65	2002	89
		909	42	1406	65	2003	89

APPROVED 12 MARCH 1956 REVISED Ⓐ 11 OCT 61 Ⓑ 21 MAR 66 Ⓒ FOR CHANGES SEE SHEETS 1 thru 6

REVIEWER: MI, AT, ME, AV, MU, GL, 85, IS, NSA
USER: SH, MC

This military standard has been approved by the Department of Defense and is mandatory for use by all Departments and Agencies of the Department of Defense. Selection for all new engineering and design applications and for repetitive use shall be made from this document.

P.OA. WC
Other Cust
B2 Ⓓ

TITLE
NUT, PLAIN, HEXAGON (JAM)
UNC-2B AND UNF-2B

MILITARY STANDARD
MS35691

PROCUREMENT SPECIFICATION
FF-N-836

SUPERSEDES: BBCX1 thru BBCX4, BBDX1, 2 and 3, BBXX1, BBXX2, BRDX2, BRDX2.1, BUNXS thru BUNX7, MS16203 (SHIPS) in part

SHEET 5 OF 6

DD FORM 1 SEP 87 672-1 (Coordinated)   PREVIOUS EDITIONS OF THIS FORM ARE OBSOLETE   F05-071S05

Figure 5-72. Drawing MS35691 (Sheet 5)

FED. SUP CLASS
5310

TABLE VI

PART NUMBER		PART NUMBER		PART NUMBER		PART NUMBER	
CANCELLED OR INACTIVATED	SUPERSEDING	CANCELLED OR INACTIVATED	SUPERSEDING	CANCELLED OR INACTIVATED	SUPERSEDING	CANCELLED OR INACTIVATED	SUPERSEDING
MS35691-2004	MS35691-89	MS35691-2223	MS35691-101	MS35691-2802	MS35691-113	MS35691-4001	MS35691-125
2005	89	*2224	101	2803	113	4002	125
2006	89	2225	101	*2804	113	4003	125
*2007	90	2226	101	2805	113	*4004	125
2008	90	*2227	102	2806	113	4005	125
2009	90	2228	102	*2807	114	4006	125
2010	91	2229	102	2808	114	*4007	126
2011	92	2230	103	2809	114	4008	126
2021	93	2231	104	2810	115	4009	126
2022	93	2401	105	2811	116	4010	127
2023	93	2402	105	3201	117	4011	128
*2024	93	2403	105	3202	117	4401	129
2025	93	*2404	105	3203	117	4402	129
2026	93	2405	105	*3204	117	4403	129
*2027	94	2406	105	3205	117	*4404	129
2028	94	*2407	106	3206	117	4405	129
2029	94	2408	106	*3207	118	4406	129
2030	95	2409	106	3208	118	*4407	130
2031	96	2410	107	3209	118	4408	130
2201	97	2411	108	3210	119	4409	130
2202	97	2421	109	3211	120	4410	131
2203	97	2422	109	3601	121	4411	132
*2204	97	2423	109	3602	121	4801	133
2205	97	*2424	109	3603	121	4802	133
2206	97	2425	109	*3604	121	4803	133
*2207	98	2426	109	3605	121	*4804	133
2208	98	*2427	110	3606	121	4805	133
2209	98	2428	110	*3607	122	4806	133
2210	99	2429	110	3608	122	*4807	134
2211	100	2430	111	3609	122	4808	134
2221	101	2431	112	3610	123	4809	134
2222	101	2801	113	3611	124	4810	135
						4811	136

NOTE: For dimensions, material, protective coating and other pertinent data, see sheet 1.

* Inactive - see Table IV.

Ⓒ INTERCHANGEABILITY TABLE

The following nuts covered by dash numbers given in MS16203 (Ships) are cancelled after the date indicated on the cancelled document. Use the dash numbers given in Table II. The cancelled nuts cannot always replace the new nuts and should be used until existing stocks are depleted. Use only the new nuts for design and replacement. Replacement shall be in accordance with Table VI and VII. Interchangeability information regarding part numbers on the superseded drawing is also contained in this table.

CANCELLED MS16203(SHIPS)	SUPERSEDING MS35691	CANCELLED MS16203(SHIPS)	SUPERSEDING MS35691	CANCELLED MS16203(SHIPS)	SUPERSEDING MS35691
DASH NUMBER	DASH NUMBER	DASH NUMBER	DASH NUMBER	DASH NUMBER	DASH NUMBER
-13	-3	-17	-35	-21	-75
-14	-11	-18	-51	-22	-83
-15	-19	-19	-59	-23	-91
-16	-27	-20	-67	-24	-107

REVIEWER: MI, AT, ME, AV, MU, GL, 85, IS, NSA
USER: SH, MC

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APPROVED 12 MARCH 1956 REVISED Ⓐ 11 OCT 61 Ⓑ 21 MAR 66 Ⓒ FOR CHANGES SEE SHEETS 1 thru 6

P.A. WC
Other Cust
82 Ⓒ

TITLE
NUT, PLAIN, HEXAGON (JAM)
UNC-2B AND UNF-2B

MILITARY STANDARD
MS35691

PROCUREMENT SPECIFICATION
FF-N-836

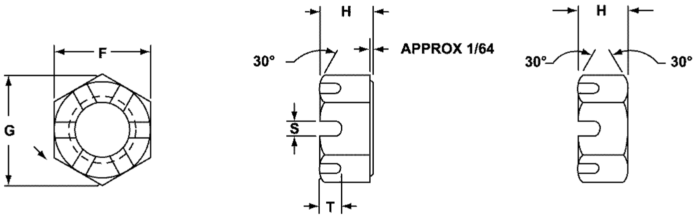
SUPERSEDES: BBCX1 thru BBCX4, BBDX1, 2, and 3. BBXX1, BBXX2 BRDX2, BRDX2.1, BUNX5 thru BUNX7, MS16203 (SHIPS) in part

SHEET 6 OF 6

DD FORM 1 SEP 87 672-1 (Coordinated) PREVIOUS EDITIONS OF THIS FORM ARE OBSOLETE.

F05-071S06

Figure 5-72. Drawing MS35691 (Sheet 6)



FED. SUP CLASS
5310

NOMINAL SIZE OR BASIC MAJOR DIAMETER OF THREAD		WIDTH ACROSS FLATS F			WIDTH ACROSS CORNERS G		THICKNESS H			SLOT S	T
		NOM	MAX	MIN	MAX	MIN	NOM	MAX	MIN	WIDTH	DEPTH
1/4	.2500	7/16	.4375	.428	.505	.488	7/32	.226	.212	.078	.094
5/16	.3125	1/2	.5000	.489	.577	.488	17/64	.273	.258	.094	.094
3/8	.3750	9/16	.5625	.551	.628	.488	21/64	.337	.320	.125	.125
7/16	.4375	11/16	.6875	.675	.768	.488	3/8	.385	.365	.125	.156
1/2	.5000	3/4	.7500	.736	.840	.488	7/16	.448	.427	.156	.156
9/16	.5625	7/8	.8750	.861	1.010	.488	31/64	.496	.473	.156	.188
5/8	.6250	15/16	.9375	.922	1.083	.488	35/64	.559	.535	.188	.219
3/4	.7500	1 - 1/8	1.1250	1.088	1.299	.488	41/64	.665	.617	.188	.250
7/8	.8750	1 - 5/16	1.3125	1.269	1.516	.488	3/4	.776	.724	.188	.250
1	1.0000	1 - 1/2	1.5000	1.450	1.712	.488	55/64	.887	.831	.250	.281
1 - 1/8	1.1250	1 - 11/16	1.6875	1.631	1.940	.488	31/32	.939	.939	.250	.344
1 - 1/4	1.2500	1 - 7/8	1.8750	1.812	2.165	.488	1 - 1/16	1.094	1.030	.312	.375
1 - 3/8	1.3750	2 - 1/16	2.0625	1.994	2.382	.488	1 - 11/64	1.206	1.138	.312	.375
1 - 1/2	1.5000	2 - 1/4	2.2500	2.175	2.598	.488	1 - 9/32	1.317	1.245	.375	.436

MATERIAL: Steel, Carbon, Grade B and C; Steel, Corrosion-Resisting, 300 series, and Brass, Naval in accordance with procurement specification.

PROTECTIVE COATING OR TREATMENT: Cadmium Plate, Black Oxide, and Passivation treatment in accordance with the procurement specification.

DIMENSIONS: All dimensions are in inches unless otherwise specified

PART NUMBER: The MS part number consists of the MS number, plus the dash number. Example: MS35692-1.

THREADS: The threads shall be in accordance with Screw-Thread Standards for Federal Services, Handbook H-28.

NOTES:
(1) Reference documents shall be of the issue in effect on date of invitations for bid.
(2) For design feature purposes, this standard takes precedence over procurement documents referenced herein.
(3) Dimensions and tolerances are in accordance with ASA B18.2.
(4) For new design use parts numbers in Table I I.
(5) For cancelled part numbers see Table I I I.
(6) For maintenance use inactivated part numbers of Table IV.
(7) For interchangeability between the cancelled (Grade A, uncoated) nuts and the superseding inactivated (Grade B, uncoated) nuts see Table V.
(8) For interchangeability of cancelled or inactivated and new part numbers see Table VI.

REVIEWER: MO, SH, WP, WC, IS, 69
USER: CL, MC, YD

This military standard has been approved by the Department of Defense and is mandatory for use by all Departments and Agencies of the Department of Defense. Selection for all new engineering and design applications and for repetitive use shall be made from this document.

APPROVED 12 MARCH 1956 REVISED Ⓐ 11 OCT 1961 Ⓑ 21 MAR 1966

Ⓑ **ENTIRE STANDARD REVISED**

P.A. WC Other Cust SH 69	TITLE NUT, SLOTTED-HEXAGON UNC-2B AND UNF-2B		MILITARY STANDARD MS35692
PROCUREMENT SPECIFICATION FF - N - 836	SUPERSEDES: BBCX1, 2, 3, BBHX1, 2, 2.1, 3, BBHX3.1, 3.2, 3.3, 5, BUNX8, 9		SHEET 1 OF 6

DD FORM 1 SEP 87 672-1 (Coordinated)

F05-072S01

Figure 5-73. Drawing MS35692 (Sheet 1 of 6)

FED. SUP CLASS
5310

The part numbers in Table II only will be used for new design and engineering.

TABLE II

NOMINAL SIZE	1/4		5/16		3/8		7/16	
THREADS PER INCH	20UNC-2B	28UNF-2B	18UNC-2B	24UNF-2B	16UNC-2B	24UNF-2B	14UNC-2B	20UNF-2B
MATERIAL AND PROTECTIVE COATING	DASH NO	DASH NO	DASH NO	DASH NO	DASH NO	DASH NO	DASH NO	DASH NO
STEEL, CARBON, GRADE B, CAD PLATED	1	5	9	13	17	21	25	29
STEEL, CARBON, GRADE C, CAD PLATED	2	6	10	14	18	22	26	30
CRES, 300 SERIES, PASSIVATED	3	7	11	15	19	23	27	31
BRASS, BLACK OXIDE	4	8	12	16	20	24	28	32
NOMINAL SIZE	1/2		9/16		5/8		3/4	
THREADS PER INCH	13UNC-2B	20UNF-2B	12UNC-2B	18UNF-2B	11UNC-2B	18UNF-2B	10UNC-2B	16UNF-2B
MATERIAL AND PROTECTIVE COATING	DASH NO	DASH NO	DASH NO	DASH NO	DASH NO	DASH NO	DASH NO	DASH NO
STEEL, CARBON, GRADE B, CAD PLATED	33	37	41	45	49	53	57	61
STEEL, CARBON, GRADE C, CAD PLATED	34	38	42	46	50	54	58	62
CRES, 300 SERIES, PASSIVATED	35	39	43	47	51	55	59	63
BRASS, BLACK OXIDE	36	40	44	48	52	56	60	64
NOMINAL SIZE	7/8		1		1 - 1/8		1 - 1/4	
THREADS PER INCH	9UNC-2B	14UNF-2B	8UNC-2B	12UNF-2B	7UNC-2B	12UNF-2B	7UNC-2B	12UNF-2B
MATERIAL AND PROTECTIVE COATING	DASH NO	DASH NO	DASH NO	DASH NO	DASH NO	DASH NO	DASH NO	DASH NO
STEEL, CARBON, GRADE B, CAD PLATED	65	69	73	77	81	85	89	93
STEEL, CARBON, GRADE C, CAD PLATED	66	70	74	78	82	86	90	94
CRES, 300 SERIES, PASSIVATED	67	71	75	79	83	87	91	95
BRASS, BLACK OXIDE	68	72	76	80	84	88	92	96
NOMINAL SIZE	1/4		1/4					
THREADS PER INCH	6UNC-2B	12UNF-2B	6UNC-2B	12UNF-2B				
MATERIAL AND PROTECTIVE COATING	DASH NO	DASH NO	DASH NO	DASH NO				
STEEL, CARBON, GRADE B, CAD PLATED	97	101	105	109				
STEEL, CARBON, GRADE C, CAD PLATED	98	102	106	110				
CRES, 300 SERIES, PASSIVATED	99	103	107	111				
BRASS, BLACK OXIDE	100	104	108	112				

CANCELLED The following part numbers are cancelled after **21 MAR 1966**

TABLE III

NOMINAL SIZE	1/4		5/16		3/8		7/16	
THREADS PER INCH	20UNC-2B	28UNF-2B	18UNC-2B	24UNF-2B	16UNC-2B	24UNF-2B	14UNC-2B	20UNF-2B
MATERIAL AND PROTECTIVE COATING	DASH NO	DASH NO	DASH NO	DASH NO	DASH NO	DASH NO	DASH NO	DASH NO
STEEL, CARBON, GRADE A, CAD PLATED	401	421	501	521	601	621	701	721
CAD OR ZINC OPTIONAL	402	422	502	522	602	622	702	722
PHOSPHATE	403	423	503	523	603	623	703	723
STEEL, CARBON, GRADE B								
CAD OR ZINC OPTIONAL	405	425	505	525	605	625	705	725
PHOSPHATE	406	426	506	526	606	626	706	726
STEEL, CARBON, GRADE C								
CAD OR ZINC OPTIONAL	408	428	508	528	608	628	708	728
PHOSPHATE	409	429	509	529	609	629	709	729
CRES, 300-400 SERIES, PASSIVATED	410	430	510	530	610	630	710	730
BRASS, UNCOATED	411	431	511	531	611	631	711	731

APPROVED 12 MARCH 1956 REVISED A FOR CHANGES SEE SHEETS 1, 2, AND 3. B FOR CHANGES SEE SHEETS 1

REVIEWER: MO, SH, WP, WC, IS, 69
USER: CL, MC, YD

This military standard has been approved by the Deartment of Defense and is mandatory for use by all Departments and Agencies of the Department of Defense. Selection for all new engineering and design applications and for repetitive use shall be made from this document.

P.A. WC
Other Cust SH
69

TITLE
NUT, SLOTTED-HEXAGON
UNC-2B AND UNF-2B

MILITARY STANDARD
MS35692

PROCUREMENT SPECIFICATION
FF - N - 836

SUPERSEDES: BBGX1, 2, 3, BBHX1, 2, 2.1, 3,
BBHX3.1, 3.2, 3.3, 5, BUNX8, 9

SHEET 2 OF 6

DD FORM 1 SEP 87 672-1 (Coordinated)

F05-072S02

Figure 5-73. Drawing MS35692 (Sheet 2)

REVIEWER: MO, SH, WP, WC, IS, 69
USER: CL, MC, YD

FED. SUP CLASS
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TABLE III CONT'D

NOMINAL SIZE	1/2		9/16		5/8		3/4	
THREADS PER INCH	13UNC-2B	20UNF-2B	13UNC-2B	20UNF-2B	11UNC-2B	18UNF-2B	10UNC-2B	16UNF-2B
MATERIAL AND PROTECTIVE COATING	DASH NO	DASH NO	DASH NO	DASH NO	DASH NO	DASH NO	DASH NO	DASH NO
STEEL, CARBON, GRADE A, UNCOATED	801	821	901	921	1001	1021	1201	1221
CAD OR ZINC OPTIONAL	802	822	902	922	1002	1022	1202	1222
PHOSPHATE	803	823	903	923	1003	1023	1203	1223
STEEL, CARBON, GRADE B								
CAD OR ZINC OPTIONAL	805	825	905	925	1005	1025	1205	1225
PHOSPHATE	806	826	906	926	1006	1026	1206	1226
STEEL, CARBON, GRADE C								
CAD OR ZINC OPTIONAL	808	828	908	928	1008	1028	1208	1228
PHOSPHATE	809	829	909	929	1009	1029	1209	1229
CRES, 300-400 SERIES, PASSIVATED	810	830	910	930	1010	1030	1210	1230
BRASS, UNCOATED	811	831	911	931	1011	1031	1211	1231
NOMINAL SIZE	7/8		1		1 - 1/8		1 - 1/4	
THREADS PER INCH	9UNC-2B	14UNF-2B	8UNC-2B	12UNF-2B	7UNC-2B	12UNF-2B	7UNC-2B	12UNF-2B
MATERIAL AND PROTECTIVE COATING	DASH NO	DASH NO	DASH NO	DASH NO	DASH NO	DASH NO	DASH NO	DASH NO
STEEL, CARBON, GRADE A, UNCOATED	1401	1421	1601	1621	1001	1021	2001	2021
CAD OR ZINC OPTIONAL	1402	1422	1602	1622	1002	1022	2002	2022
PHOSPHATE	1403	1423	1603	1623	1003	1023	2003	2023
STEEL, CARBON, GRADE B								
CAD OR ZINC OPTIONAL	1405	1425	1605	1625	1005	1025	2005	2025
PHOSPHATE	1406	1426	1606	1626	1006	1026	2006	2026
STEEL, CARBON, GRADE C								
CAD OR ZINC OPTIONAL	1408	1428	1608	1628	1008	1028	2008	2028
PHOSPHATE	1409	1429	1609	1629	1009	1029	2009	2029
CRES, 300-400 SERIES, PASSIVATED	1410	1430	1610	1630	1010	1030	2010	2030
BRASS, UNCOATED	1411	1431	1611	1631	1011	1031	2011	2031
NOMINAL SIZE	1 - 3/8		1 - 1/2					
THREADS PER INCH	6UNC-2B	12UNF-2B	6UNC-2B	12UNF-2B				
MATERIAL AND PROTECTIVE COATING	DASH NO	DASH NO	DASH NO	DASH NO				
STEEL, CARBON, GRADE A, UNCOATED	2201	2221	2401	2421				
CAD OR ZINC OPTIONAL	2202	2222	2402	2422				
PHOSPHATE	2203	2223	2403	2423				
STEEL, CARBON, GRADE B,								
CAD OR ZINC OPTIONAL	2205	2225	2405	2425				
PHOSPHATE	2206	2226	2406	2426				
STEEL, CARBON, GRADE C,								
CAD OR ZINC OPTIONAL	2208	2228	2408	2428				
PHOSPHATE	2209	2229	2409	2429				
CRES, 300-400 SERIES, PASSIVATED	2210	2230	2410	2430				
BRASS, UNCOATED	2211	2231	2411	2431				

INACTIVE The following part numbers in Table IV are inactive for design after **21 MAR 1966 .**
Use for maintenance purposes only.

TABLE IV

NOMINAL SIZE	1/4		5/16		3/8		7/16	
THREADS PER INCH	20UNC-2B	28UNF-2B	18UNC-2B	24UNF-2B	16UNC-2B	24UNF-2B	14UNC-2B	20UNF-2B
MATERIAL AND PROTECTIVE COATING	DASH NO	DASH NO	DASH NO	DASH NO	DASH NO	DASH NO	DASH NO	DASH NO
STEEL, CARBON, GRADE B, UNCOATED	404	424	504	524	604	624	704	724
STEEL, CARBON, GRADE C, UNCOATED	407	427	507	527	607	627	707	727
NOMINAL SIZE	1/2		9/16		5/8		3/4	
THREADS PER INCH	13UNC-2B	20UNF-2B	12UNC-2B	18UNF-2B	11UNC-2B	18UNF-2B	10UNC-2B	16UNF-2B
MATERIAL AND PROTECTIVE COATING	DASH NO	DASH NO	DASH NO	DASH NO	DASH NO	DASH NO	DASH NO	DASH NO
STEEL, CARBON, GRADE B, UNCOATED	804	824	904	924	1004	1024	1204	1224
STEEL, CARBON, GRADE C, UNCOATED	807	827	907	927	1007	1027	1207	1227

APPROVED 12 MARCH 1956 REVISED A FOR CHANGES SEE SHEETS 1, 2, AND 3. B FOR CHANGES SEE SHEETS 1

This military standard has been approved by the Department of Defense and is mandatory for use by all Departments and Agencies of the Department of Defense. Selection for all new engineering and design application and for repetitive use shall be made from this document.

P.A.	WC	TITLE NUT, SLOTTED-HEXAGON UNC-2B AND UNF-2B	MILITARY STANDARD **MS35692**
Other Cust	SH 69		
PROCUREMENT SPECIFICATION FF - N 836		SUPERSEDES: BBCX1, 2, 3, BBHX1, 2, 2.1, 3, BBHX3.1, 3.2, 3.3, 5, BUNX8, 9	SHEET 3 OF 6

DD FORM 1 SEP 87 672-1 (Coordinated)

F05-072S03

Figure 5-73. Drawing MS35692 (Sheet 3)

REVIEWER: MO, SH, WP, WC, IS, 69
USER: CL, MC, YD

TABLE IV CONT'D

FED. SUP CLASS
5310

NOMINAL SIZE	7/8		1		1 - 1/8		1 - 1/4	
THREADS PER INCH	9UNC-2B	14UNF-2B	8UNC-2B	12UNF-2B	7UNC-2B	12UNF-2B	7UNC-2B	12UNF-2B
MATERIAL AND PROTECTIVE COATING	DASH NO	DASH NO	DASH NO	DASH NO	DASH NO	DASH NO	DASH NO	DASH NO
STEEL, CARBON, GRADE B, UNCOATED	1404	1424	1604	1624	1804	1824	2004	2024
STEEL, CARBON, GRADE C, UNCOATED	1407	1427	1607	1627	1807	1827	2007	2027
NOMINAL SIZE	1 - 3/8		1 - 1/2					
THREADS PER INCH	6UNC-2B	12UNF-2B	6UNC-2B	12UNF-2B				
MATERIAL AND PROTECTIVE COATING	DASH NO	DASH NO	DASH NO	DASH NO				
STEEL, CARBON, GRADE B, UNCOATED	2204	2224	2404	2424				
STEEL, CARBON, GRADE C, UNCOATED	2207	2227	2407	2427				

INTERCHANGEABILITY TABLE

For interchangeability between the cancelled (Grade A, uncoated) nuts and the superseding inactivated (Grade B, uncoated) nuts, see Table V.

TABLE V

PART NUMBERS		PART NUMBERS		PART NUMBERS		PART NUMBERS	
CANCELLED	SUPERSEDING INACTIVATED	CANCELLED	SUPERSEDING INACTIVATED	CANCELLED	SUPERSEDING INACTIVATED	CANCELLED	SUPERSEDING INACTIVATED
MS35692-401	MS35692-404	MS35692-721	MS35692-724	MS35692-1201	MS35692-1204	MS35692-1821	MS35692-1824
421	424	801	804	1221	1224	2001	2004
501	504	821	824	1401	1404	2021	2024
521	524	901	904	1421	1424	2201	2204
601	604	921	924	1601	1604	2221	2224
621	624	1001	1004	1621	1624	2401	2404
701	704	1021	1024	1801	1804	2421	2424

INTERCHANGEABILITY TABLE

The nuts covered by the dash numbers given in the original issue of this standard are cancelled or * inactivated after 21 MAR 1966. The cancelled nuts should be used for maintenance purposes until existing stock is depleted. Use only the superseding nuts for new design.

TABLE VI

PART NUMBERS		PART NUMBERS		PART NUMBERS		PART NUMBERS	
CANCELLED OR INACTIVATED	SUPERSEDING	CANCELLED OR INACTIVATED	SUPERSEDING	CANCELLED OR INACTIVATED	SUPERSEDING	CANCELLED OR INACTIVATED	SUPERSEDING
MS35692 - 401	MS35692 - 1	MS35692 - 428	MS35692 - 6	MS35692 - *524	MS35692 - 13	MS35692 - 611	MS35692 - 20
402	1	429	6	525	13	621	21
403	1	430	7	526	13	622	21
*404	1	431	8	*527	14	623	21
405	1	501	9	528	14	*624	21
406	1	502	9	529	14	625	21
*407	2	503	9	530	15	626	21
408	2	*504	9	531	16	*627	22
409	2	505	9	601	17	628	22
410	3	506	9	602	17	629	22
411	4	*507	10	603	17	630	23
421	5	508	10	*604	17	631	24
422	5	509	10	605	17	701	25
423	5	510	11	606	17	702	25
*424	5	511	12	*607	18	703	25
425	5	521	13	608	18	*704	25
426	5	522	13	609	18	705	25
*427	6	523	13	610	19	706	25

APPROVED 12 MARCH 1956 REVISED Ⓐ FOR CHANGES SEE SHEETS 1, 2, AND 3 Ⓑ FOR CHANGES SEE SHEETS 1

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P.A. WC
Other Cust SH
69

TITLE
NUT, SLOTTED-HEXAGON
UNC-2B AND UNF-2B

MILITARY STANDARD
MS35692

PROCUREMENT SPECIFICATION
FF-N-836

SUPERSEDES: BBCX1, 2, 3, BBHX1, 2, 2.1, 3,
BBHX3.1, 3.2, 3.3, 5, BUNX8, 9

SHEET 1 OF 6

DD FORM 1 SEP 87 672-1 (Coordinated)

F05-072S04

Figure 5-73. Drawing MS35692 (Sheet 4)

FED. SUP CLASS
5310

PART NUMBERS		PART NUMBERS		PART NUMBERS		PART NUMBERS	
CANCELLED OR INACTIVATED	SUPERSEDING	CANCELLED OR INACTIVATED	SUPERSEDING	CANCELLED OR INACTIVATED	SUPERSEDING	CANCELLED OR INACTIVATED	SUPERSEDING
MS35692 - *707	MS35692 - 26	MS35692 - 909	MS35692 - 42	MS35692 - 1210	MS35692 - 59	MS35692 - 1611	MS35692 - 76
708	26	910	43	1211	60	1621	77
709	26	911	44	1221	61	1622	77
710	27	921	45	1222	61	1623	77
711	28	922	45	1223	61	*1624	77
721	29	923	45	*1224	61	1625	77
722	29	*924	45	1225	61	1626	77
723	29	925	45	1226	61	*1627	78
*724	29	926	45	*1227	62	1628	78
725	29	*927	46	1228	62	1629	78
726	29	928	46	1229	62	1630	79
*727	30	929	46	1230	63	1631	80
728	30	930	47	1231	64	1801	81
729	30	931	48	1401	65	1802	81
730	31	1001	49	1402	65	1803	81
731	32	1002	49	1403	65	*1804	81
801	33	1003	49	1404	65	1805	81
802	33	*1004	49	*1405	65	1806	81
803	33	1005	49	1406	65	*1807	82
*804	33	1006	49	1407	66	1808	82
805	33	*1007	50	*1408	66	1809	82
806	33	1008	50	1409	66	1810	83
*807	34	1009	50	1410	67	1811	84
808	34	1010	51	1411	68	1821	85
809	34	1011	52	1412	69	1822	85
810	35	1021	53	1422	69	1823	85
811	36	1022	53	1423	69	*1824	85
821	37	1023	53	1424	69	1825	85
822	37	*1024	53	*1425	69	1826	85
823	37	1025	53	1426	69	*1827	86
*824	37	1026	53	1427	70	1828	86
825	37	*1027	54	*1428	70	1829	86
826	37	1028	54	1429	70	1830	87
*827	38	1029	54	1430	71	1831	88
828	38	1030	55	1431	72	2001	89
829	38	1031	56	1601	73	2002	89
830	39	1201	57	1602	73	2003	89
831	40	1202	57	1603	73	*2004	89
901	41	1203	57	1604	73	2005	89
902	41	*1204	57	*1605	73	2006	89
903	41	1205	57	1606	73	*2007	90
*904	41	1206	57	1607	74	2008	90
905	41	*1207	58	*1608	74	2009	90
906	41	1208	58	1609	74	2010	91
*907	42	1209	58	1610	75	2011	92
908	42						

REVIEWER: MO, SH, WP, WC, IS, 69
USER: , CL, MC, YD

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APPROVED 12 MARCH 1956 REVISED Ⓑ FOR CHANGES SEE SHEET 1

P.A. WC Other Cust SH 69	TITLE NUT, SLOTTED-HEXAGON UNC-2B AND UNF-2B	MILITARY STANDARD **MS35692**
PROCUREMENT SPECIFICATION FF - N - 836	SUPERSEDES: BBCX1, 2, 3, BBHX1, 2, 2.1, 3 BBHX3.1, 3.2, 3.3, 5, BUNX8, 9	SHEET 5 OF 6

F05-072S05

Figure 5-73. Drawing MS35692 (Sheet 5)

FED. SUP CLASS
5310

PART NUMBER		PART NUMBER		PART NUMBER		PART NUMBER	
CANCELLED OR INACTIVATED	SUPERSEDING	CANCELLED OR INACTIVATED	SUPERSEDING	CANCELLED OR INACTIVATED	SUPERSEDING	CANCELLED OR INACTIVATED	SUPERSEDING
MS35692 - 2021	MS35692 - 93	MS35692 - 2205	MS35692 - 97	MS35692 - 2228	MS35692 - 102	MS35692 - 2411	MS35692 - 108
2022	93	2206	97	2229	102	2421	109
2023	93	*2207	98	2230	103	2422	109
*2024	93	2208	98	2231	104	2423	109
2025	93	2209	98	2401	105	*2424	109
2026	93	2210	99	2402	105	2425	109
*2027	94	2211	100	2403	105	2426	109
2028	94	2221	101	*2404	105	*2427	110
2029	94	2222	101	2405	105	2428	110
2030	95	2223	101	2406	105	2429	110
2031	96	*2224	101	*2407	106	2430	111
2201	97	2225	101	2408	106	2431	112
2202	97	2226	101	2409	106		
2203	97	*2227	102	2410	107		
2204	97						

NOTE: For dimensions, material, protective coating and other pertinent data, see sheet 1.

* Inactive - see Table IV.

REVIEWER: MO, SH, WP, WC, IS, 69
USER: CL, MC, YD

This military standard has been approved by the Department of Defense and is mandatory for use by all Departments and Agencies of the Department of Defense. Selection for all new engineering and design applications and for repetitive use shall be made from this document.

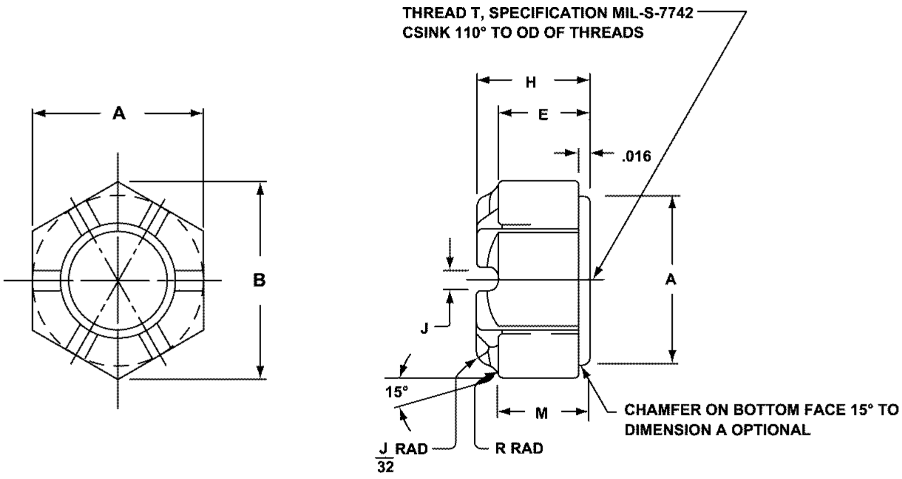
APPROVED 12 MARCH 1956 REVISED Ⓑ FOR CHANGES SEE SHEETS 1.

P.A. WC Other Cust SH 69	TITLE NUT, SLOTTED-HEXAGON UNC-2B AND UNF-2B		MILITARY STANDARD MS35692
PROCUREMENT SPECIFICATION FF - N - 836	SUPERSEDES:	BBCX1, 2, 3, BBHX1, 2, 2.1, 3 BBHX3.1, 3.2, 3.3, 5, BUNX8, 9	SHEET 6 OF 6

DD FORM 1 SEP 87 672-1 (Coordinated)

F05-072S06

Figure 5-73. Drawing MS35692 (Sheet 6)



THREAD T, SPECIFICATION MIL-S-7742
CSINK 110° TO OD OF THREADS

CHAMFER ON BOTTOM FACE 15° TO DIMENSION A OPTIONAL

ROUND OR SQUARE BOTTOM CASTELLATION OPTIONAL

AN PART NO.	(b) THREAD T	ULTIMATE TENSILE STRENGTH MINIMUM, POUNDS		(a) A	B APPROX	E	H	J +1/32 -0	M	R
		STEEL	AL ALLOY							
AN310-3	NO. 10-32NF-3	2 210	1 100	.375 +.002 - .010	7/16	7/64	1/4	5/64	.110	3/32
AN310-4	1/4 -28NF-3	4 080	2 030	.438 +.002 - .010	1/2	1/8	9/32	5/64	.125	3/32
AN310-5	5/16 -24NF-3	6 500	3 220	.500 +.002 - .010	37/64	11/64	21/64	5/64	.172	3/32
AN310-6	3/8 -24NF-3	10 100	5 020	.563 +.002 - .010	21/32	7/32	13/32	1/8	.218	3/32
AN310-7	7/16 -20NF-3	13 600	6 750	.625 +.002 - .011	23/32	17/64	29/64	1/8	.265	3/32
AN310-8	1/2 -20NF-3	18 500	9 180	.750 +.002 - .012	7/8	23/64	9/16	1/8	.359	1/8
AN310-9	9/16 -18NF-3	23 600	11 700	.875 +.002 - .012	1 - 1/64	25/64	39/64	5/32	.390	5/32
AN310-10	5/8 -18NF-3	30 100	14 900	1.000 +.002 - .014	1 - 5/32	15/32	23/32	5/32	.468	5/32
AN310-12	3/4 -16NF-3	44 000	21 800	1.125 +.002 - .016	1 - 19/64	9/16	13/16	5/32	.562	3/16
AN310-14	7/8 -14NF-3	60 000	29 800	1.313 +.002 - .017	1 - 33/64	21/32	29/32	5/32	.656	3/16
AN310-16	1 -14NF-3	80 700	40 000	1.500 +.002 - .019	1 - 47/64	3/4	1	5/32	.750	3/16
AN310-18	1 - 1/8 -12NF-3	101 800	50 900	1.688 +.002 - .021	1 - 61/64	13/16	1 - 5/32	5/32	.844	1/4
AN310-20	1 - 1/4 -12NF-	130 200	64 400	1.875 +.002 - .023	2 - 11/64	7/8	1 - 1/4	5/32	.938	1/4

(a) FOR AL-ALLOY NUTS LARGER THAN -5 SIZE, TOLERANCES ON A MAY CONFORM TO APPLICABLE MATERIAL SPECIFICATIONS FOR BAR AND ROD.

MATERIAL: STEEL, AL-ALLOY AND CORROSION-RESISTANT STEEL. SEE PROCUREMENT SPECIFICATION.

FINISH: SEE PROCUREMENT SPECIFICATION

ADD D BEFORE DASH NUMBER FOR AL-ALLOY NUTS.

ADD C BEFORE DASH NUMBER FOR CORROSION-RESISTANT STEEL NUTS.

EXAMPLES OF PART NO: AN310-5 = STEEL NUT, 5/16-24NF-3.
AN310D5 = AL-ALLOY NUT, 5/16-24NF-3.
AN310C5 = CORROSION-RESISTANT STEEL NUT, 5/16-24NF-3.

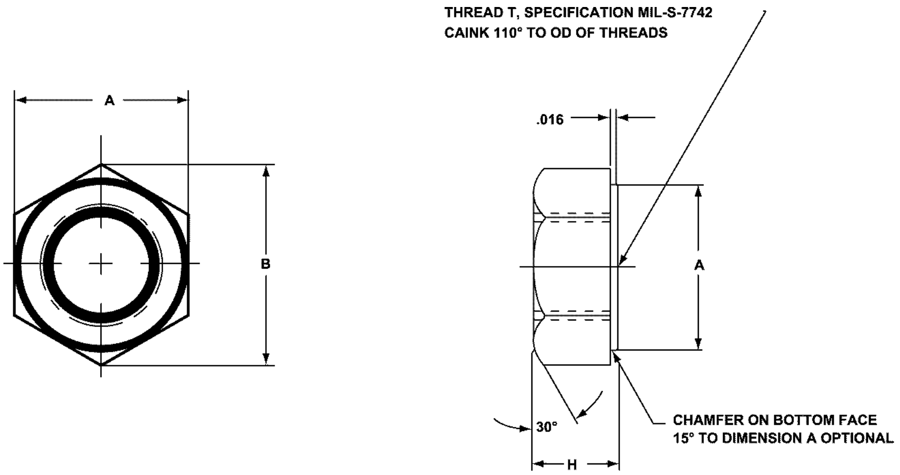
REMOVE ALL BURRS.

DIMENSIONS IN INCHES. UNLESS OTHERWISE SPECIFIED, TOLERANCES: FRACTIONS ±1/64, DECIMALS ±.010, ANGLES ±1°.

④ (b) UNF-3B THREADS ARE ACCEPTABLE.

F05-073

Figure 5-74. Drawing AN310



AN PART NO.	(b) THREAD T	ULTIMATE TENSILE STRENGTH MINIMUM POUNDS		(a) A	B APPROX	H
		STEEL	AL ALLOY			
AN315-640	NO. 6-40NF-3	-	-	.313 +.002 -.010	23/64	7/64
AN315-3	NO. 10-32NF-3	2 210	1 100	.375 +.002 -.010	7/16	9/64
AN315-4	1/4 -28NF-3	4 080	2 030	.438 +.002 -.010	1/2	3/16
AN315-5	5/16 -24NF-3	6 500	3 220	.500 +.002 -.010	37/64	15/64
AN315-6	3/8 -24NF-3	10 100	5 020	.563 +.002 -.010	21/32	9/32
AN315-7	7/16 -20NF-3	13 600	6 750	.625 +.002 -.011	23/32	21/64
AN315-8	1/2 -20NF-3	18 500	9 180	.750 +.002 -.012	7/8	3/8
AN315-9	9/16 -18NF-3	23 600	11 700	.875 +.002 -.012	1 - 1/64	27/64
AN315-10	5/8 -18NF-3	30 100	14 900	1.000 +.002 -.014	1 - 5/32	15/32
AN315-12	3/4 -16NF-3	44 000	21 800	1.125 +.002 -.016	1 - 19/64	5/8
AN315-14	7/8 -14NF-3	60 000	29 800	1.313 +.002 -.017	1 - 33/64	21/32
AN315-16	1 -14NF-3	80 700	44 000	1.500 +.002 -.019	1 - 47/64	3/4
AN315-18	1- 1/8 -12NF-3	101 800	50 500	1.688 +.002 -.021	1 - 61/64	13/16
AN315-20	1- 1/4 -12NF-3	130 200	64 400	1.875 +.002 -.023	2 - 11/64	7/8

(a) FOR ALUMINUM-ALLOY NUTS LARGER THAN -5 SIZE, TOLERANCES ON A MAY CONFORM TO APPLICABLE MATERIAL SPECIFICATIONS FOR BAR AND ROD.

MATERIAL: STEEL, ALUMINUM ALLOY, AND CORROSION-RESISTANT STEEL. SEE PROCUREMENT SPECIFICATION

FINISH: SEE PROCUREMENT SPECIFICATION.

ADD C BEFORE DASH NUMBER FOR CORROSION-RESISTANT STEEL NUTS.

ADD D BEFORE DASH NUMBER FOR ALUMINUM-ALLOY NUTS.

ADD R AFTER DASH NUMBER FOR RIGHT-HAND THREAD.

ADD L AFTER DASH NUMBER FOR LEFT-HAND THREAD.

EXAMPLES OF PART NO.: AN315-7L = STEEL NUT, 7/16-20NF-3, LEFT-HAND THREAD
AN315D7R = ALUMINUM-ALLOY NUT, 7/16-20NF-3, RIGHT-HAND THREAD.
AN315C7R = CORROSION-RESISTANT STEEL NUT, 7/16-20NF-3, RIGHT-HAND THREAD.

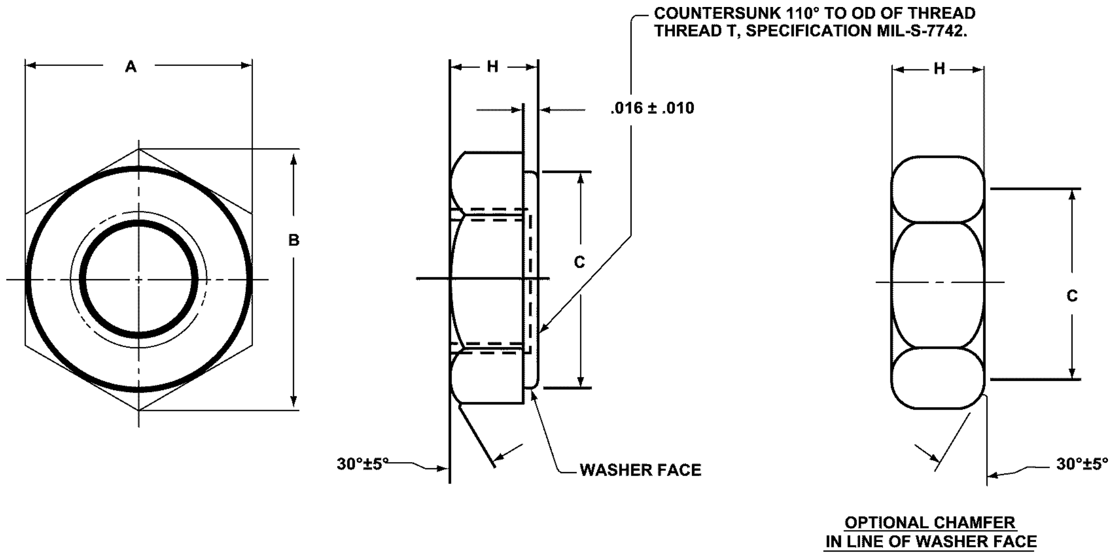
REMOVE ALL BURRS.

DIMENSIONS IN INCHES. UNLESS OTHERWISE SPECIFIED, TOLERANCES: FRACTION ±1/64, DECIMALS ±.010, ANGLES ±1°.

⑥ (b) UNF-3B THREADS ARE ACCEPTABLE.

F05-074

Figure 5-75. Drawing AN315



	AN PART NUMBERS											
	ALLOY STEEL	CORROSION-RESISTANT STEEL	BRASS	(f) ALUMINUM ALLOY	(a) THREAD T	(b) A		(c) B	C DIA		(d) H	
						MAX	MIN	REF	MAX	MIN	MAX	MIN
	AN340-2	AN340C2	AN340B2		NO. 2-56 NC-2B	.188	.180	.217	.188	.169	.066	.057
	AN340-3	AN340C3	AN340B3		NO. 3-48 NC-2B	.188	.180	.217	.188	.169	.066	.057
	AN340-4	AN340C4	AN340B4		NO. 4-40 NC-2B	.250	.241	.289	.250	.225	.098	.087
	AN340-5	AN340C5	AN340B5		NO. 5-40 NC-2B	.313	.302	.362	.313	.282	.114	.102
	AN340-6	AN340C6	AN340B6	AN340DD6	NO. 6-32 NC-2B	.313	.302	.362	.313	.282	.114	.102
	AN340-8	AN340C8	AN340B7	AN340DD8	NO. 8-32 NC-2B	.344	.332	.398	.344	.310	.130	.117
(e)	~~AN340-10~~	~~AN340C10~~	~~AN340B10~~	~~AN340DD10~~	~~NO.10-24 NC-2B~~	~~.375~~	~~.368~~	~~.423~~	~~.375~~	~~.336~~	~~.130~~	~~.117~~
	~~AN340-426~~	~~AN340C426~~	~~AN340B426~~	~~AN340DD426~~	~~1/4 - 20 UNC-2B~~	~~.438~~	~~.423~~	~~.506~~	~~.438~~	~~.394~~	~~.193~~	~~.178~~
	~~AN340-526~~	~~AN340C526~~	~~AN340B526~~	~~AN340DD526~~	~~5/16 - 18 UNC-2B~~	~~.563~~	~~.545~~	~~.650~~	~~.563~~	~~.507~~	~~.225~~	~~.208~~
	~~AN340-626~~	~~AN340C626~~	~~AN340B626~~	~~AN340DD626~~	~~3/8 - 16 UNC-2B~~	~~.625~~	~~.607~~	~~.722~~	~~.625~~	~~.563~~	~~.257~~	~~.239~~

(a) CLASS 2 THREADS MAY BE SUBSTITUTED FOR CLASS 2B THREADS UNTIL EXISTING STOCKS OF THE NUTS WITH CLASS 2 THREADS ARE EXHAUSTED.

(b) FOR ALUMINUM ALLOY NUTS, TOLERANCES ON A MAY CONFORM TO APPLICABLE MATERIAL SPECIFICATIONS FOR BAR AND ROD.

(c) REFERENCE DIMENSIONS ARE FOR DESIGN PURPOSES ONLY AND ARE NOT AN INSPECTION REQUIREMENT.

(d) THE H DIMENSION SHALL BE MEASURED AT A POINT APPROXIMATELY HALFWAY BETWEEN THE MINOR DIAMETER OF THE HOLE AND THE FLAT OF THE NUT.

(e) NO. 10. 1/4, 5/16, AND 3/8 SIZES ARE NOT RECOMMENDED FOR NEW DESIGN

(f) ALUMINUM ALLOY NUTS INACTIVE FOR DESIGN AFTER 19 JULY 1955.

FOR DEFINITION AND APPLICATION OF DRAWING STATUS NOTES, SEE ANA BULLETIN NO. 337.

MATERIAL: STEEL, 50,000-PSI TENSILE STRENGTH MINIMUM, COMMERCIAL GRADE.
CORROSION-RESISTANT STEEL, SPECIFICATION AN-QQ-8-770, CONDITION QT, CLASS II (431) OR SPECIFICATION MIL-S-7720, COMPOSITION FM (303).
BRASS, COMMERCIAL GRADE.
(f) ALUMINUM ALLOY, SPECIFICATION QQ-A-268 OR QQ-A-355.

HEAT TREAT: (f) ALUMINUM ALLOY, 62,000 PSI TENSILE STRENGTH, MINIMUM, SPECIFICATION ON MIL-H-6088.

FINISH: STEEL, CADMIUM PLATE, SPECIFICATION QQ-P-416. TYPE 1, CLASS C.
CORROSION-RESISTANT STEEL, PASSIVATE.
BRASS, NONE.
(f) ALUMINUM ALLOY, ANODIZE, SPECIFICATION MIL-A-8625.

NUTS SHALL BE FREE OF ALL LOOSE OR HANGING BURRS OR SLIVERS WHICH MIGHT BECOME DISLODGED UNDER USAGE.

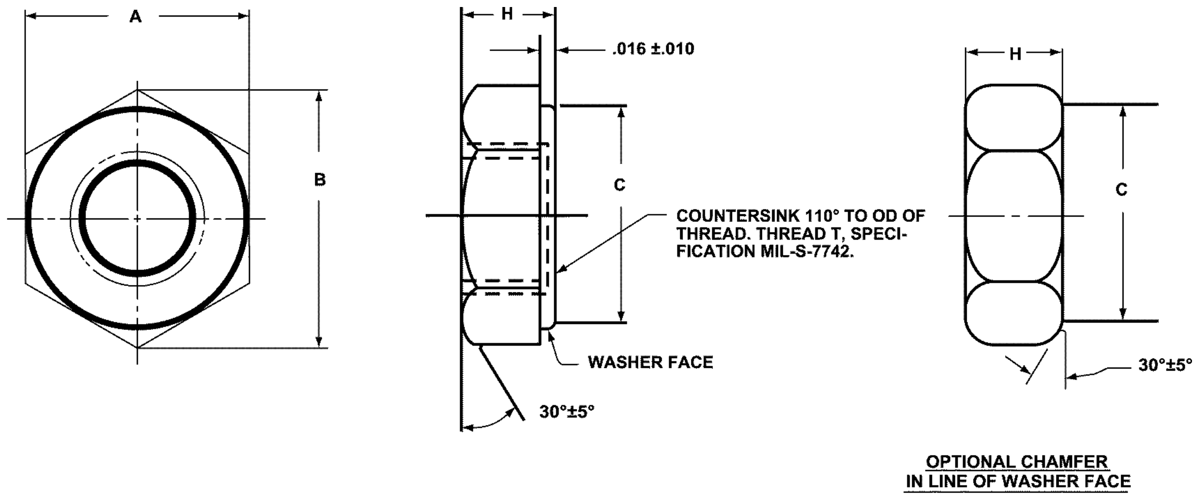
DIMENSIONS IN INCHES.

IN CASE OF CONFLICT, THE REQUIREMENTS SPECIFIED HEREON SHALL TAKE PRECEDENCE OVER THE REQUIREMENTS SPECIFIED IN SPECIFICATION MIL-S-933.

③ ENTIRE DRAWING REVISED.

F05-075

Figure 5-76. Drawing AN340



	AN PART NUMBERS				(a)	(b) A		(c)	C DIA		(d) H	
	ALLOY STEEL	CORROSION-RESISTANT STEEL	BRASS	(f) ALUMINUM ALLOY	THREAD T	MAX	MIN	B REF	MAX	MIN	MAX	MIN
	AN345 - 0	AN345C0	AN345B0		NO. 0-80 NF-2B	.156	.150	.180	.156	.140	.050	.043
	~~AN345 - 1~~	~~AN345C1~~	~~AN345B1~~		~~NO. 1-72 NF-2B~~	~~.156~~	~~.150~~	~~.180~~	~~.156~~	~~.140~~	~~.050~~	~~.043~~
	~~AN345 - 2~~	~~AN345C2~~	~~AN345B2~~		~~NO. 2-64 NF-2B~~	~~.188~~	~~.180~~	~~.227~~	~~.188~~	~~.169~~	~~.066~~	~~.057~~
	~~AN345 - 3~~	~~AN345C3~~	~~AN345B3~~		~~NO. 3-56 NF-2B~~	~~.188~~	~~.180~~	~~.227~~	~~.188~~	~~.169~~	~~.066~~	~~.057~~
(e)	~~AN345 - 4~~	~~AN345C4~~	~~AN345B4~~		~~NO. 4-48 NF-2B~~	~~.250~~	~~.242~~	~~.289~~	~~.250~~	~~.205~~	~~.098~~	~~.089~~
	~~AN345 - 5~~	~~AN345C5~~	~~AN345B5~~		~~NO. 5-44 NF-2B~~	~~.323~~	~~.302~~	~~.362~~	~~.333~~	~~.282~~	~~.114~~	~~.102~~
	~~AN345 - 6~~	~~AN345C6~~	~~AN345B6~~		~~NO. 6-40 NF-2B~~	~~.333~~	~~.302~~	~~.362~~	~~.333~~	~~.282~~	~~.114~~	~~.102~~
	~~AN345 - 8~~	~~AN345C8~~	~~AN345B8~~		~~NO. 8-36 NF-2B~~	~~.344~~	~~.332~~	~~.398~~	~~.344~~	~~.330~~	~~.130~~	~~.117~~
	AN345 - 10	AN345C10	AN345B10	AN3450B10	NO. 10-32 NF-2B	.375	.362	.433	.375	.338	.130	.117
	AN345 - 416	AN345C416	AN345B416	AN345DD416	1/4 - 28 UNF-2B	.438	.423	.506	.438	.394	.193	.178
	AN345 - 516	AN345C516	AN345B516		5/16 - 24 UNF-2B	.563	.545	.650	.563	.507	.225	.208
	AN345 - 626	AN345C616	AN345B616		3/8 - 24 UNF-2B	.625	.607	.722	.625	.563	.257	.239

(a) CLASS 2 THREADS MAY BE SUBSTITUTED FOR CLASS 2B THREADS UNTIL EXISTING STOCKS OF THE NUTS WITH CLASS 2 THREADS ARE EXHAUSTED.

(b) FOR ALUMINUM ALLOY NUTS, TOLERANCES ON A MAY CONFORM TO APPLICABLE MATERIAL SPECIFICATIONS FOR BAR AND ROD.

(c) REFERENCE DIMENSIONS ARE FOR DESIGN PURPOSES ONLY AND ARE NOT AN INSPECTION REQUIREMENT.

(d) THE H DIMENSION SHALL BE MEASURED AT A POINT APPROXIMATELY HALFWAY BETWEEN THE MINOR DIAMETER OF THE HOLE AND THE FLAT OF THE NUT.

(e) NUMBERS 1, 2, 3, 4, 5, 6, AND 8 SIZES ARE NOT RECOMMENDED FOR NEW DESIGN.

(f) ALUMINUM ALLOY NUTS INACTIVE FOR DESIGN AFTER 19 JULY 1955.

FOR DEFINITION AND APPLICATION OF DRAWING STATUS NOTES, SEE ANA BULLETIN NO. 337.

MATERIAL: STEEL, 50,000-PSI TENSILE STRENGTH, MINIMUM, COMMERCIAL GRADE.
CORROSION-RESISTANT STEEL, SPECIFICATION AN-QQ-8-770, CONDITION QT, CLASS II (431) OR SPECIFICATION MIL-S-7720, COMPOSITION FM (303).
BRASS, COMMERCIAL GRADE.
(f) ALUMINUM ALLOY, SPECIFICATION QQ-A-268 OR QQ-A-355.

HEAT TREAT: (f) ALUMINUM ALLOY, 62,000 PSI TENSILE STRENGTH, MINIMUM, SPECIFICATION MIL-H-6088.

FINISH: STEEL, CADMIUM PLATE, SPECIFICATION QQ-P-416, TYPE 1, CLASS C.
CORROSION-RESISTANT STEEL, PASSIVATE.
BRASS, NONE.
(f) ALUMINUM ALLOY, ANODIZE, SPECIFICATION MIL-A-8625.

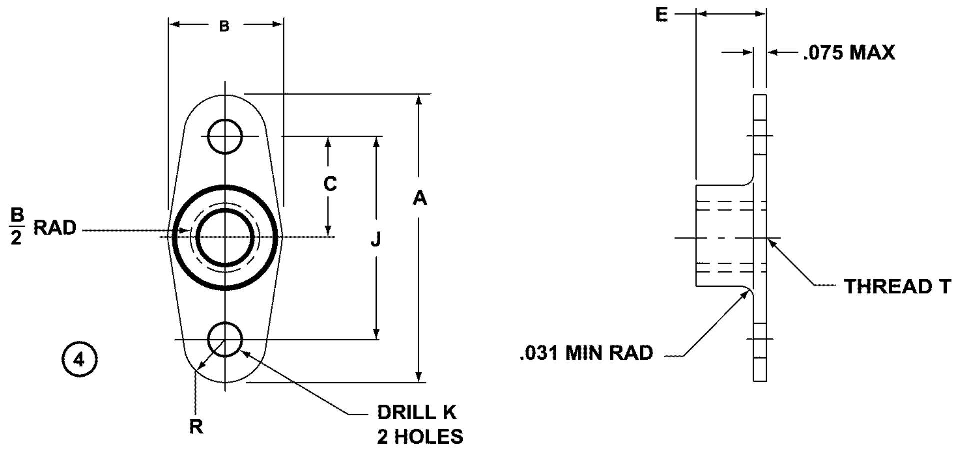
NUTS SHALL BE FREE OF ALL LOOSE OR HANGING BURRS OR SLIVERS WHICH MIGHT BECOME DISLODGED UNDER USAGE.

DIMENSIONS IN INCHES.

IN CASE OF CONFLICT, THE REQUIREMENTS SPECIFIED HEREON SHALL TAKE PRECEDENCE OVER THE REQUIREMENTS SPECIFIED IN SPECIFICATION MIL-S-933.

F05-076

Figure 5-77. Drawing AN345



SIZE	A	B		(b) C	(a) E	J	K +.005 -.000 DIA	R MIN RAD
	MAX	MAX	MIN	NOM	MAX	±.002		
NO. 6	.985	.407	.250	.344	.234	.688	.098	.100
NO. 8			.282		.297			
NO. 10			.314		.312			
1/4	1.297	.516	.374	.500	.375	1.000		.115
5/16		.532	.500				.130	.125
3/8		.641	.609		.453			

④

	DASH NUMBERS		④ THREAD T
	STEEL	COR RES STEEL	
(c)	~~F640~~	~~C640~~	~~NO. 6-40NF-2B~~
(c)	~~F836~~	~~C836~~	~~NO. 8-36NF-2B~~
	F1032	C1032	NO. 10-32NF-3B
	F428	C428	1/4 -28UNF-3B
	F524	C524	5/16 -24UNF-3B
	F624	C624	3/8 -24UNF-3B

	DASH NUMBERS		THREAD T
	STEEL	COR RES STEEL	
	F632	C632	NO. 6-32NF-2B
	F832	C832	NO. 8-36NF-2B
(c)	~~F1024~~	~~C1024~~	~~NO. 10-24NF-3B~~
(c)	~~F420~~	~~C420~~	~~1/4 -20UNF-3B~~
(c)	~~F518~~	~~C518~~	~~5/16 -18UNF-3B~~
(c)	~~F616~~	~~C616~~	~~3/8 -16UNF-3B~~

(a) MINIMUM E NOT SPECIFIED. LIMITED ONLY BY STRENGTH REQUIREMENT OF SPECIFICATION.

(b) THE CENTER OF THE TAPPED HOLE SHALL NOT DEVIATE IN ANY DIRECTION FROM THE CENTER THE PLATE NUT AS DETERMINED BY THE RIVET HOLES BY MORE THAN .005.

(c) DASH NUMBERS F640, F836, C640, C836, F1024, F420, F518, F616, C1024, C420, C518, AND C616 INACTIVE FOR DESIGN AFTER 14 APRIL 1949.

FOR DEFINITION AND APPLICATION OF DRAWING STATUS NOTE, SEE ANA BULLETIN NO. 337.

SHAPE OF TOP OPTIONAL TO SUIT LOCKING METHOD.

NUTS MAY BE MADE OF SHEET METAL.

NUTS FOR USE BY WELDING TO BE MADE OF COR RES STEEL AND WITHOUT RIVET HOLES. SPACING OF WELDING PROJECTIONS MUST BE EQUAL TO DIMENSION J.

ADD W BEFORE COR RES STEEL DASHNUMBERS FOR PLATE NUTS FOR USE BY WELDING.

EXAMPLES OF PART NUMBERS: AN362F428 = 1/4 - 28 STEEL NUT.
AN362C428 = 1/4 - 28 COR RES STEEL NUT.
AN362WC428 = 1/4-28 COR RES STEEL NUT FOR USE BY WELDING.

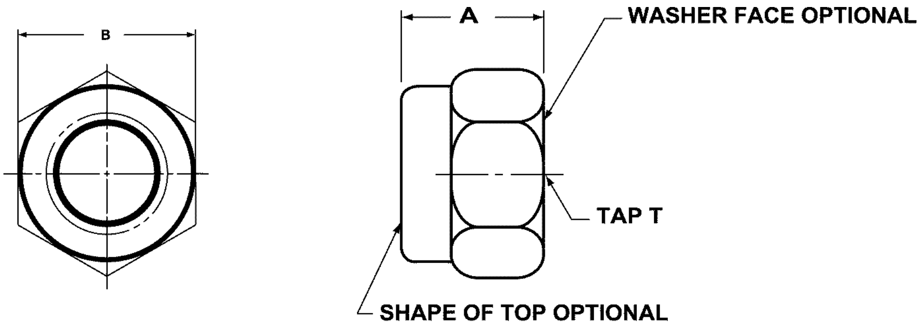
DIMENSIONS IN INCHES. UNLESS OTHERWISE SPECIFIED, TOLERANCES: DECIMALS ±.016.

④ FOR INSTALLATION INSTRUCTIONS SEE MS33588

* ALTHOUGH THIS SPECIFICATION HAS BEEN SUPERSEDED BY MIL-N-25027, PARTS CONFORMING TO AN-N-10 ARE REQUIRED FOR REPLACEMENT.

F05-077

Figure 5-78. Drawing AN362



FINE THREAD

DASH NUMBERS				(a)	
COR RES STEEL	STEEL	COPPER BASE ALLOY	TAP T	A + .016	B + .002 - .010
C1032	1032	B1032	NO. 10-32 NF-3B	.234	.375
C428	428	B428	1/4 -28UNF-3B	.312	.438
C524	524	B524	5/16-24UNF-3B	.344	.500
C624	624	B624	3/8 -24UNF-3B	.453	.563
C720	720	B720	7/16-20UNF-3B	.453	.625
C820	820	B820	1/2 -20UNF-3B	.594	.750
C918	918	B918	9/16-18UNF-3B	.688	.875
C1018	1018	B1018	5/8 -18UNF-3B	.750	.938
C1216	1216	B1216	3/4 -16UNF-3B	.875	1.063

COARSE THREAD

	C632	632	B632	NO. 6-32 NC-2B	.172	.312
	C832	832	B832	NO. 8-32 NC-2B	.234	.344
(b)	~~C1024~~	~~1024~~	~~B1024~~	~~NO. 10-24 NC-2B~~	~~.234~~	~~.375~~
	~~C420~~	~~420~~	~~B420~~	~~1/4 -20UNC-3B~~	~~.312~~	~~.438~~
	~~C518~~	~~518~~	~~B518~~	~~5/16-18UNC-3B~~	~~.344~~	~~.500~~
	~~C616~~	~~616~~	~~B616~~	~~3/8 -16UNC-3B~~	~~.453~~	~~.563~~
	~~C714~~	~~714~~	~~B714~~	~~7/16-14UNC-3B~~	~~.453~~	~~.625~~
	~~C813~~	~~813~~	~~B813~~	~~1/2 -13UNC-3B~~	~~.594~~	~~.750~~
	~~C913~~	~~913~~	~~B913~~	~~9/16-12UNC-3B~~	~~.688~~	~~.875~~
	~~C1011~~	~~1011~~	~~B1011~~	~~5/8 -11UNC-3B~~	~~.750~~	~~.938~~
	~~C1210~~	~~1210~~	~~B1210~~	~~3/4 -10UNC-3B~~	~~.875~~	~~1.063~~

(a) MINIMUM A NOT SPECIFIED. LIMITED ONLY BE STRENGTH REQUIREMENT OF SPECIFICATION.

(b) DASH NUMBERS C1024 THROUGH C1210, 1024 THROUGH 1210, AND B1024 THROUGH B1210 FOR COARSE THREAD NUTS INACTIVE FOR DESIGN AFTER 14 APRIL 1949.

EXAMPLES OF PART NUMBERS: AN363-428 = 1/4 - 28 STEEL NUT.
AN363B632 = NO. 6-32 COPPER-BASE ALLOY NUT.
AN363C428 = 1/4-28 CORROSION-RESISTANT STEEL NUT.

④ SHEET 2 ADDED.

④ INACTIVE FOR DESIGN AFTER 17 JUNE 1964, USE MS21044, MS21045 OR MS21046.

④ INTERCHANGEABILITY RELATIONSHIP: MS21044, MS21045 AND MS21046 CAN UNIVERSALLY REPLACE THE INACTIVATED AN363 NUTS IN ACCORDANCE WITH TABLE ON SHEET 2. AN363 NUTS CANNOT UNIVERSALLY REPLACE MS21044, MS21045 OR MS21046.

DIMENSIONS IN INCHES.

FOR INSTALLTION INSTRUCTIONS, SEE MS33588

④ FOR CHANGES SEE SHEET 1 AND 2.

F05-078S01

Figure 5-79. Drawing AN363 (Sheet 1 of 2)

④

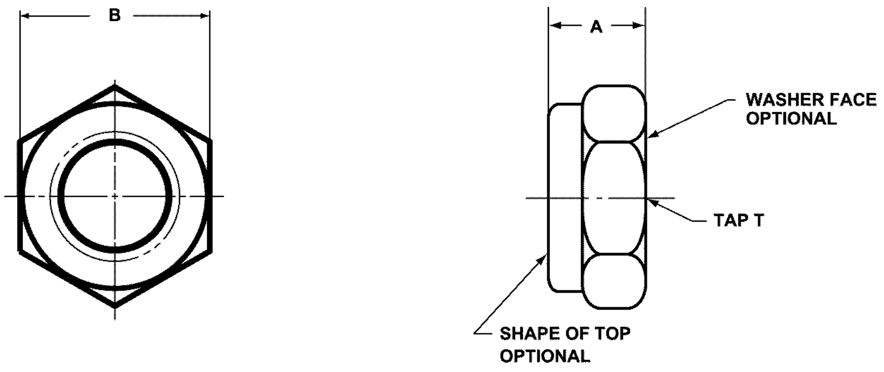
FINE THREAD					
INACTIVE PARTS			SUBSTITUTIVE PARTS		
CRES	STEEL	COPPER BASE ALLOY	CRES	STEEL	COPPER BASE ALLOY
AN363C1032	AN363-1032	AN363B1032	MS21046C3	MS21045-3	MS21044E3
C428	-428	B428	C4	-4	E4
C524	-524	B524	C5	-5	E5
C624	-624	B624	C6	-6	E6
C720	-720	B720	(a)	(a)	(a)
C820	-820	B820	C8	-8	E8
C918	-918	B918	C9	-9	E9
C1018	-1018	B1018	C10	-10	E10
C1216	-1216	B1216	C12	-12	E12
COARSE THREAD					
AN363C632	AN363-632	AN363B632	MS21046C06	MS21045-06	MS21044E06
C832	-832	B832	C08	-08	E08
C1024	-1024	B1024	(b)	(b)	(b)
C420	-420	B420	↑	↑	↑
C518	-518	B518			
C616	-616	B616			
C714	-714	B714			
C813	-813	B813			
C913	-913	B913			
C1011	-1011	B1011			
C1210	-1210	B1210	↓	↓	↓
			(b)	(b)	(b)

(a) AN363 NUTS WITH 7/16-20 THREAD HAVE NO SUBSTITUTIVE PARTS ON MS21044, MS21045 AND MS21046 BECAUSE THE CORRESPONDING MS NUTS HAVE A LARGER HEX SIZE TO CONFORM TO INTERNATIONAL STANDARD.

(b) AN363 NUTS WITH THREAD SIZES 10-24 THRU 3/4-10 HAVE NO SUBSTITUTIVE PARTS ON MS21044, MS21045 AND MS21046 BECAUSE THESE ARE NON-PREFERRED THREAD SIZES PER MIL-S-7742.

F05-078S02

Figure 5-79. Drawing AN363 (Sheet 2)



FINE THREAD

DASH NUMBERS			TAP T	(a) A +.016	B +.002 -.010
STEEL	COPPER BASE ALLOY	ALUMINUM ALLOY			
(b) ~~640~~			~~NO. 6-40 NF-2~~	~~.125~~	~~.312~~
~~836~~	~~B836~~		~~NO. 8-36 NF-2~~	~~.170~~	~~.344~~
1032	B1032	D1032	NO. 10-32 NF-3	.172	.375
428	B428	D428	1/4 -28 NF-3	.203	.438
524	B524	D524	5/16-24 NF-3	.250	.500
624	B624	D624	3/8 -24 NF-3	.266	.563
720	B720	D720	7/16-20 NF-3	.312	.625
820	B820	D820	1/2 -20 NF-3	.312	.750
918	B918	D918	9/16-18 NF-3	.359	.875
1018	B1018	D1018	5/8 -18 NF-3	.391	.938
1216	B1216	D1216	3/4 -16 NF-3	.406	1.063
1414	B1414	D1414	7/8 -14 NF-3	.469	1.250
1614	B1614	D1614	1 -14 NF-3	.562	1.438
1812	B1812	D1812	1 - 1/8 -14 NF-3	.656	1.625
2012	B2012	D2012	1 - 1/4 -14 NF-3	.750	1.813

COARSE THREAD

632		D632	NO. 6-32 NF-2	.125	.312
832		D832	NO. 6-32 NF-2	.172	.344
		(b)~~D1024~~	~~NO. 10-04 NF-3~~	~~.272~~	~~.375~~

(a) MINIMUM A NOT SPECIFIED. LIMITED ONLY BE STRENGTH REQUIREMENT OF SPECIFICATION.

(b) DASH NOS. 640 THRU 836 AND B836 FOR FINE THREAD NUTS AND D1024 FOR COARSE THREAD NUTS INACTIVE FOR DESIGN AFTER 14 APRIL, 1949.

FOR DEFINITION AND APPLICATION OF DRAWING STATUS NOTE SEE ANA BULLETIN NO. 337.

ADD A AFTER DASH-NUMBER FOR NUTS HAVING NON-METALLIC INSERTS.

ADD C AFTER DASH-NUMBER FOR NUTS FABRICATED ENTIRELY FROM METAL.

EXAMPLES OF PART NOS. AN364-428 = 1/4-28 STEEL NUT, EITHER ALL METAL OR WITH NON-METALLIC INSERT.
AN364D428 = 1/4-28 ALUMINUM ALLOY NUT, EITHER ALL METAL OR WITH NON-METALLIC INSERT.
AN364B428A = 1/4-28 COPPER BASE ALLOY NUT WITH NON-METALLIC INSERT.
AN364-428C = 1/4-28 STEEL NUT, ALL METAL

DIMENSIONS IN INCHES.

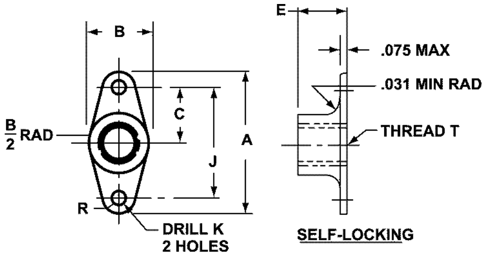
FOR INSTALLATION INSTRUCTIONS SEE DRAWING AND10068.

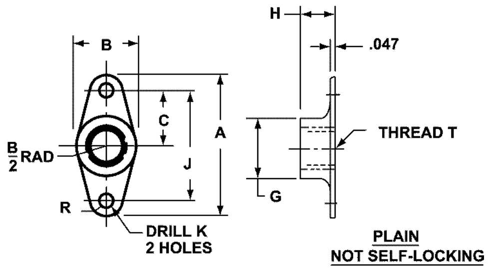
INACTIVE FOR DESIGN AFTER 13 MARCH 1957. USE STANDARD MS20364

MS20364 PARTS AND AN364 PARTS OF LIKE DASH NUMBERS ARE UNIVERSALLY, FUNCTIONALLY AND DIMENSIONALLY INTERCHANGEABLE.

F05-079

Figure 5-80. Drawing AN364





SIZE	A MAX	B MAX	B MIN	(b) C NOM	(a) E MAX	(c) G DIA	(c) H	J ±.002	K +.005 -.000 DIA	R MIN RAD
NO. 6	.985	.407	.250	.344	.234	——	——	.689	.098	.100
NO. 8			.282		.297	.250	.156			
NO. 10			.314		.312					
1/4	1.297	.516	.374	.500	.375	.375	.188	1.000		.115
5/16		.532	.500			.500	.250		.130	.125
3/8		.641	.609		.453	.562	.312			

DASH NUMBERS FINE THREAD ④

	AL ALLOY PLAIN	AL ALLOY SELF LOCKING	STEEL PLAIN	STEEL SELF LOCKING	THREAD T
(d)	~~-~~	~~DF640~~	~~-~~	~~F640~~	~~NO. 6-40 NF-2B~~
	~~D836~~	~~DF836~~	~~836~~	~~F836~~	~~NO. 8-36 NF-2B~~
	~~D1032~~	DF1032	~~1032~~	F1032	NO. 10-32 NF-3B
	~~D428~~	DF428	~~428~~	F428	1/4 -28UNF-3B
	~~D524~~	DF524	~~524~~	F524	5/16 -24UNF-3B
	~~D624~~	DF624	~~624~~	F624	3/8 -24UNF-3B
	(d)		(d)		

DASH NUMBERS COARSE THREAD ④

	~~-~~	DF632	~~-~~	F632	NO. 6-32 NF-2B
	~~D832~~	DF832	~~832~~	F832	NO. 8-32 NF-2B
(d)	~~D1024~~	~~DF1032~~	~~1032~~	~~F1024~~	~~NO. 10-24 NF-2B~~
	~~D420~~	~~DF420~~	~~420~~	~~F420~~	~~1/4 -20UNF-3B~~
	~~D518~~	~~DF518~~	~~518~~	~~F518~~	~~5/16 -18UNF-3B~~
	~~D616~~	~~DF616~~	~~616~~	~~F616~~	~~3/8 -16UNF-3B~~
	(d)		(d)		

(a) MINIMUM E NOT SPECIFIED. LIMITED ONLY BY STRENGTH REQUIREMENT OF SPECIFICATION.

(b) THE CENTER OF THE TAPPED HOLE SHALL NOT DEVIATE IN ANY DIRECTION FROM THE CENTER OF THE PLATE NUT AS DETERMINED BY THE RIVET HOLES BY MORE THAN .005.

(c) REQUIREMENTS OF MATERIAL AND DIMENSIONS G AND H MINIMUM WAIVED IF PLAIN PLATE NUT MEETS THE TENSILE REQUIREMENT FOR CORRESPONDING SIZE OF SELF-LOCKING PLATE NUT.

(d) DASH NO. D836 AND DF64C THRU DF836 AND 836 AND F640 THRU F836 FOR FINE THREAD NUTS AND D1024 THRU D616 AND DF1024 THRU DF616 AND 1024 THRU 616 AND F1024 THRU F616 FOR COARSE THREAD NUTS INACTIVE FOR DESIGN AFTER 14 APRIL, 1949.

PLAIN (NOT SELF-LOCKING) NUTS INACTIVE FOR DESIGN AFTER 14 APRIL, 1949.

CORROSION-RESISTING STEEL SELF-LOCKING PLATE NUTS FOR USE BY WELDING, DESIGNATED BY WC BEFORE STEEL DASH NO. INACTIVE FOR DESIGN AFTER 14 APRIL, 1949; SEE DRAWING AN362.

FOR DEFINITION AND APPLICATION OF DRAWING STATUS NOTE, SEE ANA BULLETIN NO. 337.

SHAPE OF TOP OF SELF-LOCKING NUTS OPTIONAL TO SUIT LOCKING METHOD.

SELF-LOCKING NUTS MAY BE MADE OF SHEET METAL.

ADD A AFTER DASH NO. FOR SELF-LOCKING PLATE NUTS HAVING NON-METALLIC INSERTS.

ADD B AFTER DASH NO. FOR SELF-LOCKING PLATE NUTS FABRICATED ENTIRELY FROM METAL.

EXAMPLES OF PART NOS.:
AN366-428 = 1/4-28 PLAIN STEEL PLATE NUT.
AN366D428 = 1/4-28 PLAIN ALUMINUM-ALLOY PLATE NUT.
AN366F428 = 1/4-28 SELF-LOCKING STEEL PLATE NUT, EITHER ALL METAL OR WITH NON-METALLIC INSERT.
AN366DF428 = 1/4-28 SELF-LOCKIGN ALUMINUM-ALLOY PLATE NUT, EITHER ALL METAL OR WITH NON-METALLIC
AN366DF428A = 1/4-28 SELF-LOCKING ALUMINUM-ALLOY PLATE NUT WITH NON-METALLIC INSERT
AN366F428B = 1/4-28 SELF-LOCKING STEEL ALL METAL PLATE NUT.

DIMENSIONS IN INCHES. UNLESS OTHERWISE SPECIFIED, TOLERANCES: DECIMALS +.016.

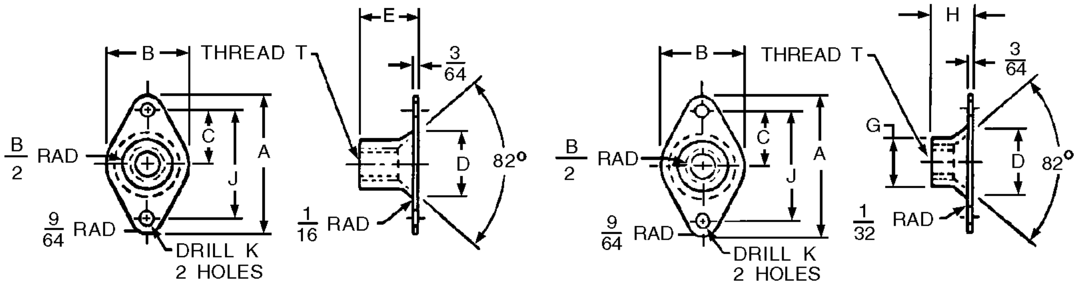
FOR ACCEPTABLE PRODUCTS, SEE ANA BULLETIN NO. 159

④ FOR INSTALLATION INSTRUCTIONS FOR SELF-LOCKING NUTS, SEE MS33588.

* ALTHOUGH THIS SPECIFICATION HAS BEEN SUPERSEDED BY MIL-N-25027, PARTS CONFORMING TO AN-N-5 ARE REQUIRED FOR REPLACEMENT.

F05-080

Figure 5-81. Drawing AN366



SELF LOCKING

PLAIN
NOT SELF LOCKING

SIZE	A	B	C	D	(a) E MAX	H	G	J ± .005	K +.005 −.000 DIA
NO. 8	31/32	7/16	11/12	.320	23/64	1/4	1/4	.688	.098
NO. 10	31/32	7/16	11/32	.372	13/32	1/4	1/4	.688	.098
1/4	1-9/32	9/16	1/2	.492	29/64	5/16	3/8	1.000	.098
5/16	1-9/32	3/4	1/2	.616	17/32	3/8	7/16	1.000	.130

DASH NUMBERS FINE THREAD

AL ALLOY PLAIN	AL ALLOY SELF-LOCKING	STEEL PLAIN	STEEL SELF-LOCKING	THREAD T
D836	DF836	836	F836	NO. 8-36 NF-2
D1032	DF1032	1032	F1032	NO. 10-32NF-3
D428	DF428	428	F428	1/4-20 NF-3
D524	DF524	524	F524	5/16-18 NF-3

DASH NUMBERS COARSE THREAD

D832	DF832	832	F832	NO. 8-32 NC-2
D1024	DF1024	1024	F1024	NO. 10-24NC-2
D420	DF420	420	F420	1/4-20 NC-3
D518	DF518	518	② F518	5/16-18 NC-3

(a) MINIMUM E NOT SPECIFIED. LIMITED ONLY BY STRENGTH REQUIREMENT OF SPECIFICATION.

② INACTIVE FOR DESIGN AFTER 14 APR 1949. NO SUPERSEDING AN STANDARD.

② FOR DEFINITION AND APPLICATION OF DRAWING STATUS NOTE SEE ANA BULLETIN NO. 337.

SELF LOCKING PLATE NUTS:
SHAPE OF TOP OPTIONAL TO SUIT LOCKING METHOD.
NUTS MAY BE MADE OF SHEET METAL.
NUTS FOR USE BY WELDING TO BE MADE OF CORROSION RESISTING STEEL AND WITHOUT RIVET HOLES. SPACING OF WELDING PROJECTIONS MUST BE EQUAL TO DIMENSION J.

PLAIN PLATE NUTS, MATERIAL AND FINISH:
STEEL, SPECIFICATION AN-S-11 OR SPECIFICATION AN-QQ-S-646, CADMIUM PLATE, SPECIFICATION AN-P-61 OR ZINC PLATE, SPECIFICATION AN-P-32.
② ALUMINUM ALLOY, SPECIFICATION QQ-A-351 RO QQ-A-355, TENSILE STRENGTH 55000 PSI. ANODIZE, SPECIFICATION AN-QQ-A-696, REQUIREMENTS ON MATERIAL AND DIMENSIONS G AND H WAIVERED IF PLAIN PLATE NUT MEETS THE TENSILE STRENGTH REQUIREMENT FOR CORRESPONDING SIZE OF SELF LOCKING PLATE NUT.

ADD WC BEFORE PLAIN STEEL DASH NUMBERS FOR CORROSION RESISTING STEEL SELF LOCKING NUTS FOR USE BY WELDING.

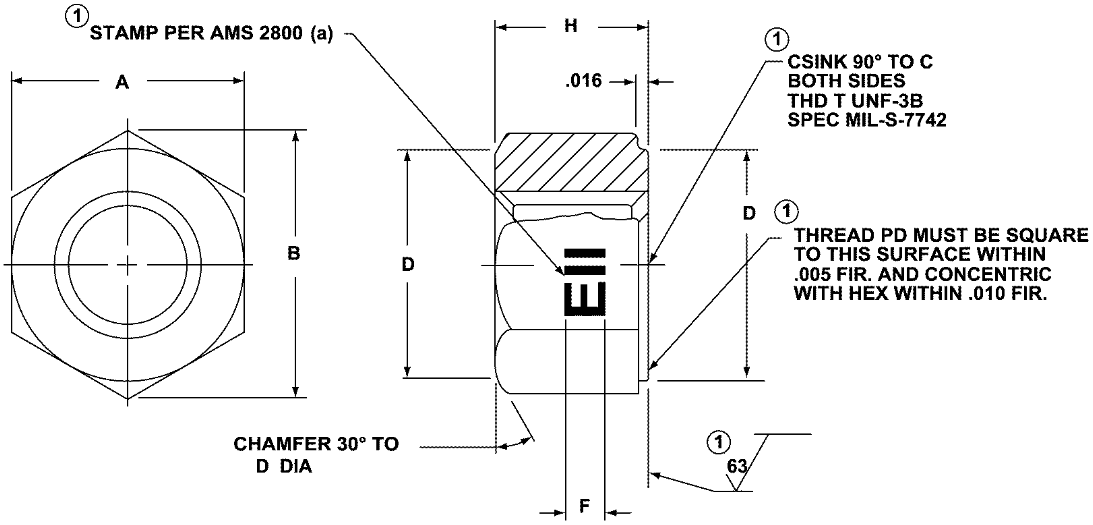
EXAMPLES OF PART NUMBERS: AN367DF836 = NO. 8-36 SELF LOCKING ALUMINUM ALLOY PLATE NUT.
AN367 -836 = NO. 8-36 PLAIN STEEL PLATE NUT.
AN367WC836 = NO. 8-36 SELF LOCKING CORROSION RESISTING STEEL PLATE NUT FOR BY WELDING.

② DIMENSIONS IN INCHES, UNLESS OTHERWISE SPECIFIED, TOLERANCES: FRACTIONS ±1/64, DECIMAL ±.010, ANGLES ±1/2 . THREADS IN ACCORDANCE WITH AN-S-126.

FOR INSTALLATION INSTRUCTIONS SEE DRAWING AND10068.

F05-081

Figure 5-82. Drawing AN367



THD T	A		B MIN	C	D	F	H	APPROX WT LBS/100	PART NO.
	MIN	MAX							
.190 (NO.10) -32	.367	.376	.419	.200	.375	.060 ±.020	.156	0.40	AN121501
.250-28	.430	.439	.491	.260	.438	.060 ±.020	.219	0.80	AN121502
.3125-24	.492	.502	.561	.322	.500	.120 ±.030	.266	1.10	AN121503
.375-24	.553	.564	.631	.385	.562	.120 ±.030	.328	1.60	AN121504
(b) .4375-20	.616	.627	.703	.448	.625	.120 ±.030	.375	2.20	AN121505
.500-20	.741	.752	.846	.510	.750	.120 ±.030	.438	3.90	AN121506
.5625-18	.865	.877	.987	.572	.875	.120 ±.030	.484	6.10	AN121507
.625-18	.928	.940	1.059	.635	.938	.120 ±.030	.547	7.60	AN121508
.750-16	1.052	1.064	1.200	.760	1.062	.120 ±.030	.656	10.80	AN121509
.875-14	1.239	1.252	1.414	.885	1.250	.120 ±.030	.766	13.90	AN121510
1.000-12	1.427	1.440	1.628	1.010	1.438	.120 ±.030	.875	17.00	AN121511
.4375-20	.679	.690	.775	.448	.688	.120 ±.030	.375	2.40	AN121512

(a) IN MULTIPLE MARKING OF BAR STOCK, DUPLICATION OF WHOLE OR PART OF SYMBOL OR OFFSET OR SYMBOL SUCH THAT UPPER PORTION APPEARS BELOW LOWER PORTION ON FINISHED PART IS PERMISSIBLE PROVIDED POSITIVE IDENTIFICATION IS SHOWN. PARTS MUST BE MARKED BEFORE THREADING.

① MATERIAL: STEEL AMS 6322

SURFACE ROUGHNESS: AS 107

HARDNESS: ROCKWELL C19-26. PARTS MUST BE HARDENED (OIL QUENCHED) AND TEMPERED BEFORE THREADING.

FINISH: CADMIUM PLATE AMS 2400

PARTS SUBJECT TO MAGNETIC INSPECTION PER AMS 2640

BREAK SHARP EDGES .003-.015 UNLESS OTHERWISE SPECIFIED.

① DIMENSIONS IN INCHES. UNLESS OTHERWISE SPECIFIED: TOLERANCES; LINEAR DIMENSIONS ±.010, ANGULAR DIMENSIONS ±5°.

DO NOT USE UNASSIGNED PART NUMBERS

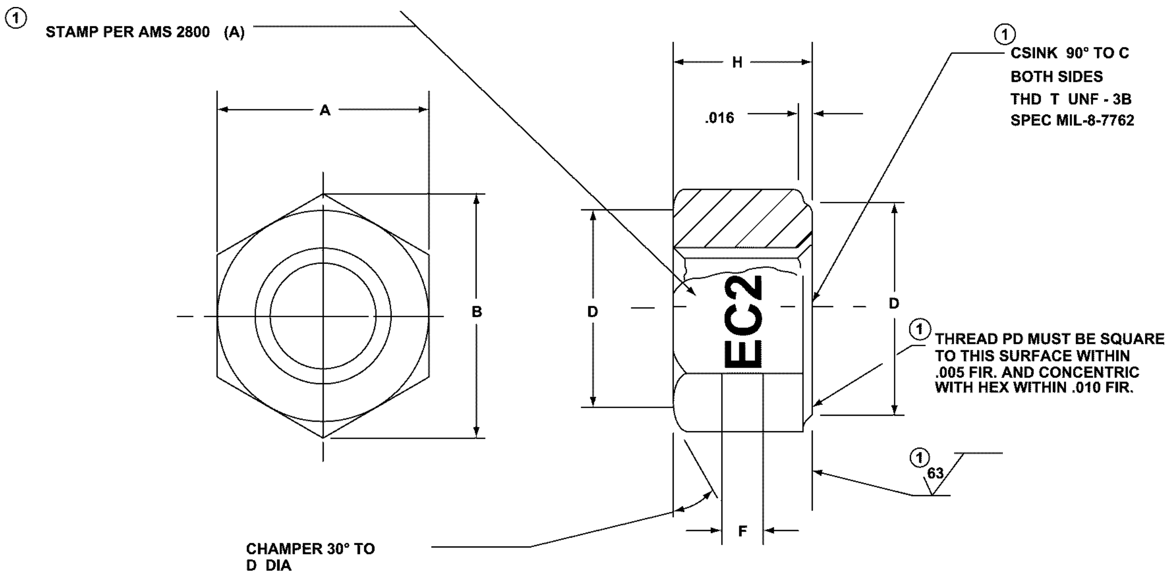
① (b) **PART NO. AN121505 INACTIVE FOR DESIGN AFTER** 25 MARCH 55. USE AN121512

For definition and application of drawing status notes, see ANA Bullet No. 337

①
THIS STANDARD WAS DEVELOPED COOPERATIVELY WITH THE ENGINE AND PROPELLER STANDARD PARTS COMMITEE OF THE SAE.

F05-082

Figure 5-83. Drawing AN121501 thru AN121525



①

THD T	MIN	MAX	B MIN	C	D	F		H	APPROX WT LBS/100	PART NO.
.190 (NO. 10) -32	.367	.376	.419	.200	.375	.060	±.020	.156	0.50	AN121526
.250-28	.430	.439	.491	.260	.438	.060	±.020	.219	0.71	AN121527
.3125-24	.492	.502	.561	.322	.500	.120	±.030	.266	1.00	AN121528
.375-24	.553	.564	.633	.385	.562	.120	±.030	.328	1.65	AN121529
(b) .4375-20	.616	.627	.703	.448	.625	.120	±.030	.375	2.20	AN121530
.500-20	.741	.752	.846	.510	.750	.120	±.030	.438	3.70	AN121531
.5625-18	.865	.877	.987	.572	.875	.120	±.030	.484	6.10	AN121532
.625-18	.928	.940	1.059	.635	.938	.120	±.030	.547	7.50	AN121533
.750-16	1.032	1.064	1.200	.760	1.062	.120	±.030	.656	10.80	AN121534
.875-14	1.239	1.252	1.414	.885	1.250	.120	±.030	.766	13.90	AN121535
1.000-12	1.427	1.440	1.628	1.010	1.438	.120	±.030	.875	17.00	AN121536
.4375-20	.679	.775	.775	.448	.688	.120	±.030	.375	2.40	AN121537

(a) IN MULTIPLE MARKING OF BAR, STOCK, DUPLICATION OF WHOLE OR PART OF SYMBOL OR, OFFSET OF SYMBOL SUCH THAT UPPER PORTION APPEARS BELOW LOWER PORTION ON FINISHED PART IS PERMISSIBLE PROVIDED POSITIVE IDENTIFICATION IS SHOWN. PART MUST BE MARKED BEFORE THREADING.

MATERIAL: CORROSION RESISTANT STEEL ANS 5628

SURFACE ROUGHNESS: AS 107

CLEANING: FINISHED PERTS SHALL BE DEGREASED FOR NOT LESS THAN 20 MINUTES IN A SOLUTION OF 1 VOLUME OF NITRIC ACID (SP OR 1.42) AND 9 VOLUMES OF WATER AT ROOM TEMPERATURE

PARTS SUBJECT TO MAGNETIC INSPECTION PER ANS 2640

BREAK SHARP EDGES .003-.015 UNLESS OTHERWISE SPECIFIED.

DIMENSIONS IN INCHES UNLESS OTHERWISE SPECIFIED: TOLERANCES: LINEAR DIMENSIONS .010 ANGULAR DIMENSIONS 50.

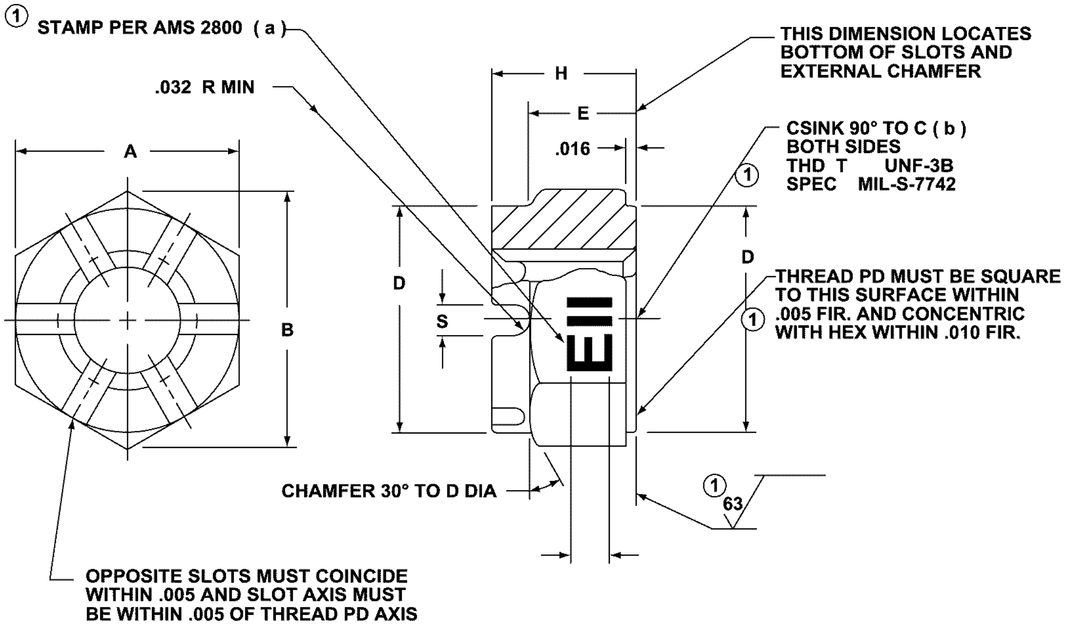
DO NOT USE UNASSIGNED PART NUMBERS.
(b) PART NUMBER AN121530 INACTIVE FOR DESIGN AFTER 25 MAR 55. USE AN 121537.
FOR DEFINITION AND APPLICATION OF DRAWING STATUS NOTES, SEE ANA BULLETIN NO. 337

THIS STANDARD WAS DEVELOPED COOPERATIVELY WITH THE ENGINE AND PROPELLER STANDARD PARTS

COMMITTEE OF THE SAE.

F05-083

Figure 5-84. Drawing 121526 thru 121550



①

THD T	A MIN	A MAX	B MIN	C	D	E	F	H	S	APPROX WT LBS/100	PART NO.
.190 (NO-10) -32	.367	.376	.419	.200	.375	.156	.060 ±.020	.250	.078 +.010 -.005	0.50	AN121551
.250-28	.430	.439	.491	.260	.438	.188	.060 ±.020	.262	.078 +.010 -.005	0.80	AN121552
.3125-24	.492	.502	.561	.322	.500	.234	.120 ±.030	.328	.078 +.010 -.005	1.20	AN121553
.375-24	.553	.564	.631	.385	.562	.281	.120 ±.030	.406	.125	1.70	AN121554
(c) .4375-20	.616	.627	.703	.448	.625	.328	.120 ±.030	.454	.125	2.30	AN121555
.500-20	.741	.752	.846	.510	.750	.375	.120 ±.030	.562	.125	4.20	AN121556
.5625-18	.865	.877	.987	.572	.875	.422	.120 ±.030	.610	.156	6.50	AN121557
.625-18	.928	.940	1.059	.635	.938	.468	.120 ±.030	.718	.156	8.30	AN121558
.750-16	1.052	1.064	1.200	.760	1.062	.562	.120 ±.030	.812	.156	11.50	AN121559
.875-14	1.239	1.252	1.414	.885	1.250	.656	.120 ±.030	.906	.156	14.30	AN121560
1.000-12	1.427	1.440	1.628	1.010	1.438	.750	.120 ±.030	1.000	.156	17.70	AN121561
.4375-20	.679	.690	.775	.448	.688	.328	.120 ±.030	.454	.125	2.20	AN121562

(a) IN MULTIPLE MARKING OF BAR STOCK, DUPLICATION OF WHOLE OR PART OF SYMBOL OR OFFSET OF SYMBOL SUCH THAT UPPER PORTION APPEARS BELOW LOWER PORTION ON FINISHED PART IS PERMISSIBLE PROVIDED POSITIVE IDENTIFICATION IS SHOWN. PARTS MUST BE MARKED BEFORE THREADING.

① (b) FOR SIZES .3125-24 AND SMALLER C DRILL "C" DIA FROM OPPOSITE END TO DEPTH OF SLOT.

① MATERIAL: STEEL AMS 6322

SURFACE ROUGHNESS: AS 107

HARDNESS: ROCKWELL C19-26. PARTS MUST BE HARDENED (OIL QUENCHED) AND TEMPERED BEFORE THREADING.

FINISH: CADMIUM PLATE AMS 2400

PARTS SUBJECT TO MAGNETIC INSPECTION PER AMS 2640.

BREAK SHARP EDGES .003-.015 UNLESS OTHERWISE SPECIFIED.

① DIMENSIONS IN INCHES, UNLESS OTHERWISE SPECIFIED: TOLERANCES; LINEAR DIMENSION ±.010.
ANGULAR DIMENSIONS ± 5°.

DO NOT USE UNASSIGNED PART NUMBERS.

① (c) **PART NO. AN121556 INACTIVE FOR DESIGN AFTER** 25 MARCH 1955. **USE AN121562**

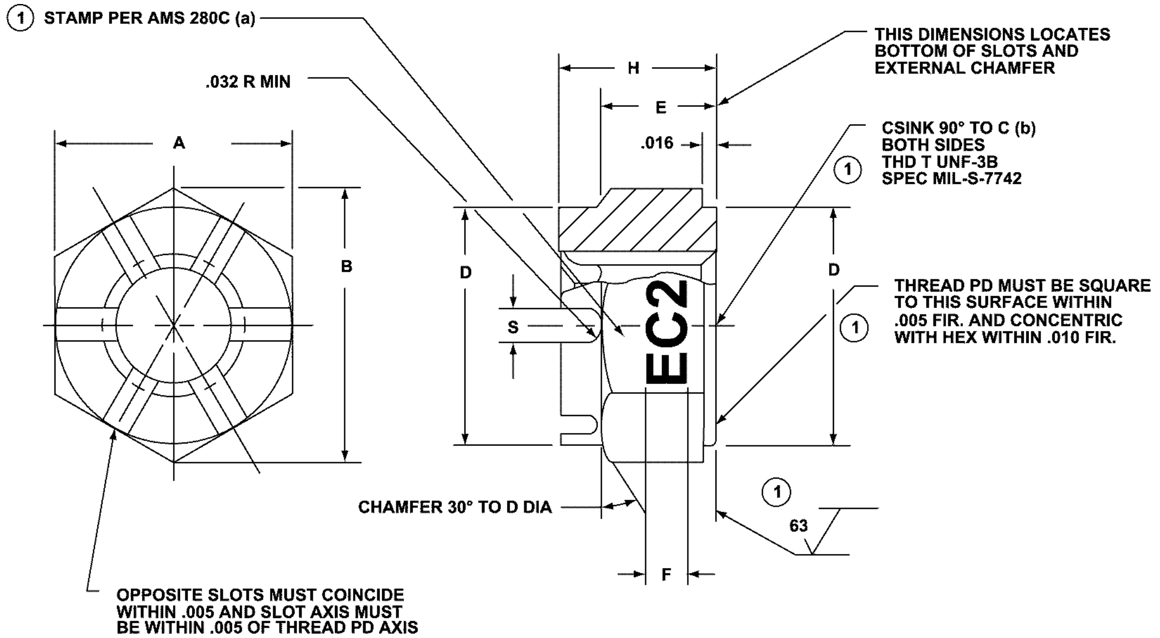
For definition and application of drawing status notes see ANA Bulletin No. 337.

①

THIS STANDARD WAS DEVELOPED COOPERATIVELY WITH THE ENGINE AND PROPELLER STANDARD PARTS COMMITTEE OF THE SAE.

F05-084

Figure 5-85. Drawing AN12155l thru AN121575



①

THD T	A		B MIN	C	D	E	F	H	S	APPROX WT LBS/100	PART NO.
	MIN	MAX									
.190 (NO .10) -32	.367	.376	.419	.200	.375	.156	.060 +.020	.250	.078 +.010 - .005	0.50	AN121576
.250-28	.430	.439	.491	.260	.438	.188	.060 +.020	.282	.078 +.010 - .005	0.80	AN121577
.3125-24	.492	.502	.561	.322	.500	.234	.120 +.030	.328	.078 +.010 - .005	1.20	AN121578
.375-24	.553	.564	.633	.385	.562	.281	.120 +.030	.406	.125	1.70	AN121579
(c) .4375-20	.616	.627	.703	.448	.625	.328	.120 +.030	.454	.125	2.30	AN121580
.500-20	.741	.752	.846	.510	.750	.375	.120 +.030	.562	.125	4.20	AN121581
.5625-18	.865	.877	.987	.572	.875	.422	.120 +.030	.610	.156	6.50	AN121582
.625-18	.928	.940	1.059	.635	.938	.468	.120 +.030	.718	.156	8.30	AN121583
.750-16	1.052	1.064	1.200	.760	1.062	.562	.120 +.030	.812	.156	11.50	AN121584
.875-14	1.239	1.252	1.414	.885	1.250	.656	.120 +.030	.906	.156	14.30	AN121585
1.000-12	1.427	1.440	1.628	1.010	1.438	.750	.120 +.030	1.000	.156	17.70	AN121586
.4375-20	.679	.690	.775	.448	.688	.328	.120 +.030	.454	.125	2.20	AN121587

(a) IN MULTIPLE MARKING OF BAR STOCK, DUPLICATION OF WHOLE OR PART OF SYMBOL OR OFFSET OF SYMBOL SUCH THAT UPPER PORTION APPEARS BELOW LOWER PORTION ON FINISHED PART IS PERMISSIBLE PROVIDED POSITIVE IDENTIFICATION IS SHOWN. PARTS MUST BE MARKED BEFORE THREADING.

① (b) FOR SIZES .3125-24 AND SMALLER C DRILL "C" DIA FROM OPPOSITE END TO DEPTH OF SLOT.

MATERIAL: CORROSION RESISTANT STEEL AMS 5628

SURFACE ROUGHNESS: AS 107

CLEANING: FINISHED PARTS SHALL BE DEGREASED AND IMMERSED FOR NOT LESS THAN 20 MINUTES IN A SOLUTION OF 1 VOLUME OF NITRIC ACID (SP GR 1.42) AND 9 VOLUMES OF WATER AT ROOM TEMPERATURE.

PARTS SUBJECT TO MAGNETIC INSPECTION PER AMS 2640.

BREAK SHARP EDGES .003-.015 UNLESS OTHERWISE SPECIFIED.

① DIMENSIONS IN INCHES, UNLESS OTHERWISE SPECIFIED: TOLERANCES; LINEAR DIMENSION ±.010. ANGULAR DIMENSIONS ± 5°.

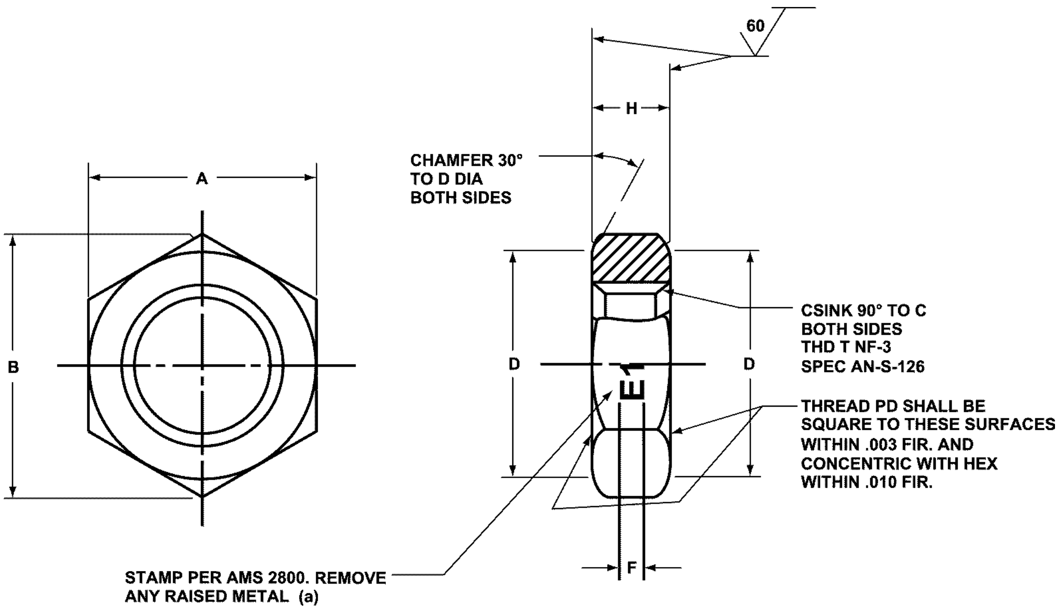
DO NOT USE UNASSIGNED PART NUMBERS.

① (c) PART NO. AN121580 INACTIVE FOR DESIGN AFTER 25 MARCH 1955. USE AN121587
For definition and application of drawing status notes see ANA Bulletin No. 337.

THIS STANDARD WAS DEVELOPED COOPERATIVELY WITH THE ENGINE AND PROPELLER STANDARD PARTS COMMITTEE OF THE SAE.

F05-085

Figure 5-86. Drawing AN121576 thru AN121600



THD T	A + .002 - .007	B MIN	C DIA	D DIA	F	H	PART NO.
.190 (NO .10) -32	.375	.420	.200	.375	.060± .020	.125	AN150407
.250-28	.437	.491	.260	.438	.060± .020	.125	AN150408
.3125-24	.500	.562	.322	.500	.060± .020	.156	AN150409
.375-24	.562	.633	.385	.562	.120± .030	.188	AN150410
(c) .4375-20	.625	.705	.448	.625	.120± .030	.219	AN150411
.500-20	.750	.847	.510	.750	.120± .030	.250	AN150412
.5625-18	.875	.990	.572	.875	.120± .030	.281	AN150413
.625-18	.938	1.061	.635	.938	.120± .030	.312	AN150414
.750-16	1.062	1.203	.760	1.062	.120± .030	.375	AN150415

(a) IN MULTIPLE MARKING OF BAR STOCK, DUPLICATION OF WHOLE OR PART OF SYMBOL OR OFFSET OF SYMBOL SUCH THAT UPPER PORTION APPEARS BELOW LOWER PORTION ON FINISHED PART IS PERMISSIBLE PROVIDED POSITIVE IDENTIFICATION IS SHOWN. PARTS SHALL BE MARKED BEFORE THREADING.

MATERIAL: STEEL AMS 6320 OR AMS 6325

HARDNESS: ROCKWELL C19-26, PARTS SHALL BE HARDENED (OIL QUENCHED) AND TEMPERED BEFORE THREADING.

FINISH: CADMIUM PLATE AMS 2400

SURFACE ROUGHNESS: AS 107

PARTS SUBJECT TO MAGNETIC INSPECTION PER AMS 2640.

BREAK SHARP EDGES .003 - .015 UNLESS OTHERWISE SPECIFIED.

DIMENSIONS IN INCHES. UNLESS OTHERWISE SPECIFIED: TOLERANCES; LINEAR DIMENSIONS ±.010,

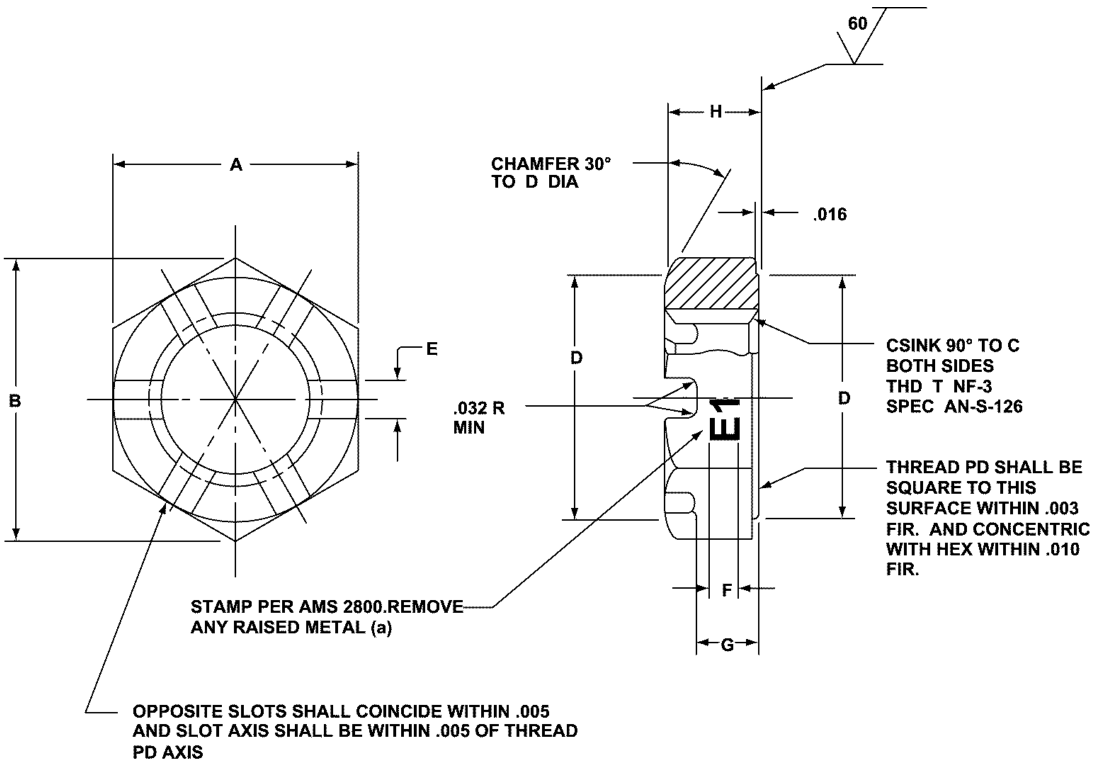
ANGULAR DIMENSIONS ±2°.

DO NOT USE UNASSIGNED PART NUMBERS.

THIS STANDARD WAS DEVELOPED COOPERATIVELY WITH THE ENGINE AND PROPELLER STANDARD PARTS COMMITTEE OF THE SAE.

F05-086

Figure 5-87. Drawing AN150401 thru AN150425



THREAD T	A + .002 - .007	B MIN	C DIA	D DIA	B	F	G	H	PART NO.
.190 (NO. 10) - 32	.375	.420	.200	.375	$.078^{+.010}_{-.005}$	.060± .020	.094	.188	AN150432
.250-28	.437	.491	.260	.438	$.078^{+.010}_{-.005}$	.060± .020	.094	.188	AN150433
.3125-24	.500	.562	.322	.500	$.078^{+.010}_{-.005}$	.060± .020	.094	.188	AN150434
.375-24	.562	.633	.385	.562	.125	.060± .020	.109	.219	AN150435
.4375-20	.625	.705	.448	.625	.125	.060± .020	.109	.219	AN150436
.500-20	.750	.847	.510	.750	.125	.060± .020	.141	.250	AN150437
.5625-18	.875	.990	.572	.875	.156	.120± .030	.188	.312	AN150438
.625-18	.938	1.061	.635	.938	.156	.120± .030	.188	.312	AN150439
.750-16	1.062	1.203	.760	1.062	.156	.120± .030	.250	.375	AN150440

(a) IN MULTIPLE MARKING OF BAR STOCK, DUPLICATION OF WHOLE OR PART OF SYMBOL OR OFFSET OF SYMBOL SUCH THAT UPPER PORTION APPEARS BELOW LOWER PORTION ON FINISHED PART IS PERMISSIBLE PROVIDED POSITIVE IDENTIFICATION IS SHOWN. PARTS SHALL BE MARKED BEFORE THREADING.

MATERIAL: STEEL AMS 6320 OR AMS 6325

HARDNESS: ROCKWELL C19-26. PARTS SHALL BE HARDENED (OIL QUENCHED) AND TEMPERED BEFORE THREADING.

FINISH: CADMIUM PLATE AMS 2400

SURFACE ROUGHNESS: AS 107

PARTS SUBJECT TO MAGNETIC INSPECTION PER AMS 2640.

BREAKSHARP EDGES .003-.015 UNLESS OTHERWISE SPECIFIED.

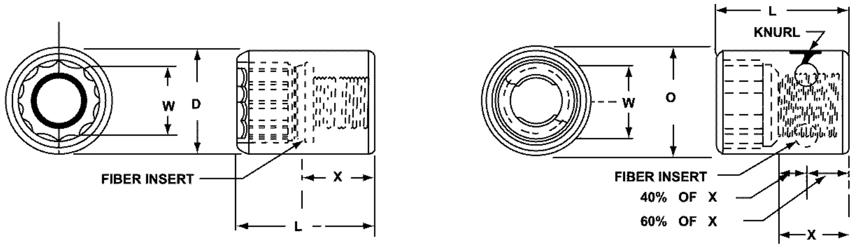
DIMENSIONS IN INCHES. UNLESS OTHERWISE SPECIFIED: TOLERANCES LINEAR DIMENSIONS ±.010,
ANGULAR DIMENSIONS ±2°.

DO NOT USE UNASSIGNED PART NUMBERS.

THIS STANDARD WAS DEVELOPED COOPERATIVELY WITH THE ENGINE AND PROPELLER STANDARD PARTS COMMITTEE OF THE SAE.

F05-087

Figure 5-88. Drawing AN150426 thru AN150450



ELASTIC STOP NUT CORP.   THREADS PER SPEC. AN-S-126.   STANDARD PRESSED STEEL CO.

MANUFACTURER		NAS NO.		THREAD SIZE	D	L	W		K	MIN. TENSILE STRENGTH (LBS.)
NAME	PART NO.						MIN.	MAX.		
ELASTIC	12B-048	NAS-443-4		1/4 - 28 NF-3	.531	.656	.378	.382	.297	5,950
STD. PRD. STL.	~~UIWN-04~~								.344	
STD. PRD. STL.	UWN-428						.375	.379		
ELASTIC	12B-054	NAS-443-5		5/16 - 24 NF-3	.593	.750	.440	.445	.375	9,610
STD. PRD. STL.	~~UIWN-05~~									
STD. PRD. STL.	UWN-524						.4375	.442		
ELASTIC	12B-064	NAS-443-6		3/8 - 24 NF-3	.687	.875	.503	.509	.406	14,750
STD. PRD. STL.	~~UIWN-06~~									
STD. PRD. STL.	UWN-624						.500	.5045		
ELASTIC	12B-070	NAS-443-7		7/16 - 20 NF-3	.781	1.000	.565	.571	.516	19,800
STD. PRD. STL.	~~UIWN-07~~									
STD. PRD. STL.	UWN-720						.5625	.568		
ELASTIC	12B-080	NAS-443-8		1/2 - 20 NF-3	.875	1.094	.628	.635	.547	27,100
STD. PRD. STL.	~~UIWN-08~~									
STD. PRD. STL.	UWN-820						.625	.631		
ELASTIC	12B-098	NAS-443-9		9/16 - 18 NF-3	.968	1.187	.690	.697	.594	34,500
STD. PRD. STL.	~~UIWN-09~~								.656	
STD. PRD. STL.	UWN-918						.6875	.694		
ELASTIC	12B-108	NAS-443-10		5/8 - 18 NF-3	1.062	1.281	.753	.761	.656	43,800
STD. PRD. STL.	~~UIWN-10~~									
STD. PRD. STL.	UWN-1018						.750	.757		
ELASTIC	12B-126	NAS-443-12		3/4 - 16 NF-3	1.250	1.468	.878	.886	.750	64,100
STD. PRD. STL.	~~UIWN-12~~								.812	
STD. PRD. STL.	UWN-1216						.875	.884		
ELASTIC	12B-144	NAS-443-14		7/8 - 14 NF-3	1.437	1.625	1.003	1.012	.875	87,600
STD. PRD. STL.	~~UIWN-14~~									
STD. PRD. STL.	UWN-1414						1.000	1.014		
ELASTIC	12B-164	NAS-443-16		1 - 14 NF-3	1.625	1.843	1.128	1.138	1.031	117,900
STD. PRD. STL.	~~UIWN-16~~									
STD. PRD. STL.	UWN-1614						1.125	1.139		
ELASTIC	12B-182	NAS-443-18		1 - 1/8 - 12 N-3	1.875	2.140	1.315	1.327	1.141	145,600
STD. PRD. STL.	~~UIWN-18~~					2.125			1.125	
STD. PRD. STL.	UWN-1812						1.3125	1.327		
STD. PRD. STL.	~~UIWN-20~~	NAS-443-20		1 - 1/4 - 12 N-3	2.125	2.437			1.250	187,000
STD. PRD. STL.	UWN-2012						1.4375	1.453		

PROCUREMENT: ELASTIC STOP NUT CORP., UNION, NEW JERSEY
STANDARD PRESSED STEEL CO., JENKINTOWN, PENN. (DRAWING NO. 16499)
SIMILAR ITEMS OF COMPARABLE FUNCTION MUST BE APPROVED PRIDE TO USE ON AIRCRAFT IN LIEU OF TEMS SHOWN HEREON.

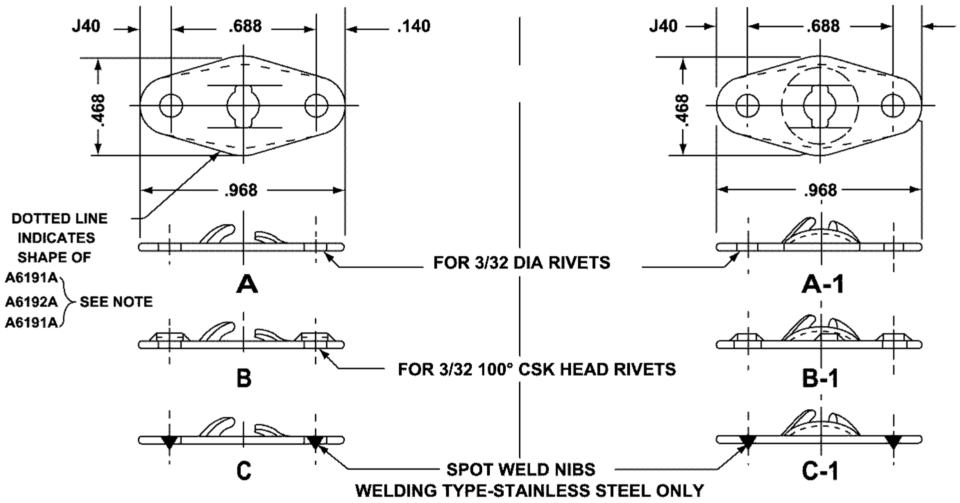
ENGINEERING INFORMATION:

ITEMS CROSSED OF INACTIVE FOR NEW DESIGN.
FOR RESTRICTIONS ON USE OF SELF-LOCKING NUTS SEE AND10068.
PROCUREMENT SPECIFICATION: AN-N-5 EXCEPT AS NOTED.
MATERIAL: 2330 STEEL, SPEC AN-QQ-S-689; NE-9430, STEEL, SPEC 57-107; NE-8630 STEEL, SPEC AN-S-14; NE-8740 STEEL, SPEC AN-8-16; OR 4340 STEEL, SPEC AN-QQ-S-756.
HEAT TREAT: 125,000 - 145,000 PSI SPEC AN-QQ-H-201.
COMMERCIAL PART CODE: 128-048 = NUT, INTERNAL WRENCHING, 1/4-28; L = 656.
NAS PART CODE: NAS-443-4 = NUT, INTERNAL WRENCHING, 1/4-28; L = 656.
FINISH: CADMIUM PLATE PER SPEC AN-P-61; OR ZINC PLATE PER SPEC AN-P-32.

① INACTIVE FOR NEW DESIGN

F05-088

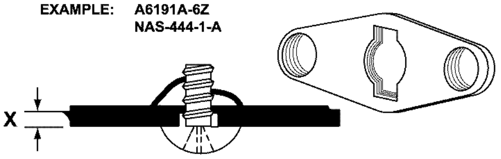
Figure 5-89. Drawing NAS-443

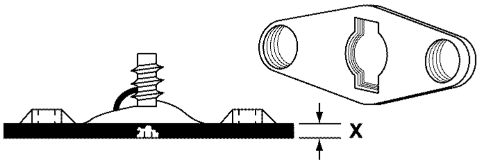


TINNERMAN NO.	NAS NO.	TYPE	SCREW NO.	MATERIAL THICKNESS ①
A6191-6Z	NAS-444-1	A	AN530-6	.022 (.025 SS)
A6195-6Z	NAS-444-2	B		
A6192-6Z	NAS-444-3	C		
A6191-6Z	NAS-444-4	A	AN530-8	.025 (.028 SS)
A6195-6Z	NAS-444-5	B		
A6192-6Z	NAS-444-6	C		
A6191-10Z	NAS-444-7	A	AN530-10	.028 (.031 SS)
A6195-10Z	NAS-444-8	B		
A6192-10Z	NAS-444-9	C		

TINNERMAN NO.	NAS NO.	TYPE	MATERIAL THICKNESS ①
A6203-6Z	NAS-444-10	A-1	.022 (.025 SS)
A6162-6Z	NAS-444-11	B-1	
A6164-6Z	NAS-444-12	C-1	
A6203-8Z	NAS-444-13	A-1	.025 (.028 SS)
A6162-8Z	NAS-444-14	B-1	
A6164-8Z	NAS-444-15	C-1	
A6203-10Z	NAS-444-16	A-1	.028 (.031 SS)
A6162-10Z	NAS-444-17	B-1	
A6164-10Z	NAS-444-18	C-1	

NOTE:
ADD SUFFIX "A" IMMEDIATELY AFTER FIRST THREE PART NUMBERS FOR NUT .385 WIDE.
EXAMPLE: A6191A-6Z
NAS-444-1-A





PROCUREMENT: TINNERMAN PRODUCTS, INC., CLEVELAND, OHIO.
SIMILAR ITEMS OF COMPARABLE FUNCTION MUST BE EQUIVALENT PRIDE TO USE ON AIRCRAFT IN LIEU OF ITEMS SHOWN HEREON.
①

ENGINEERING INFORMATION:

PROCUREMENT SPECIFICATION: AAF25533.
SCREW LENGTH: * * * * * * * * * * * * * (TYPE A, B, C, 6Z, X PLUS 1/4"; 8% & 10Z, X PLUS 5/16".
(TYPE A-1, B-1, C-1, 6Z, X PLUS 5/16"; 8Z & 10Z, X PLUS 3/8".

THE DOUBLE LUG ANCHOR TYPE NUT IS TO BE USED WHENEVER POSSIBLE IN APPLICATIONS THAT ARE NOT STRUCTURAL OR SUBJECT TO EXCESSIVE VIBRATION. FOR ADDITIONAL SIZES AND SHAPES CONSULT THE STANDARDS UNIT.

MATERIAL: SAE 1060 STEEL OR STAINLESS STEEL.

SUFFIXES: ADD SUFFIX "SS" FOR STAINLESS STEEL (EXAMPLE: A6191SS-6Z; NAS-444-1-SS).
ADD SUFFIX "C" FOR RIVET HOLES FOR 1/8" DIA RIVETS (EXAMPLE: A6191-6Z-C; NAS-444-1-C).

COMMERCIAL PART CODE: A6191-6Z = DOUBLE LUG ANCHOR TYPE SPEED NUT .968 LONG, .468 WIDE.

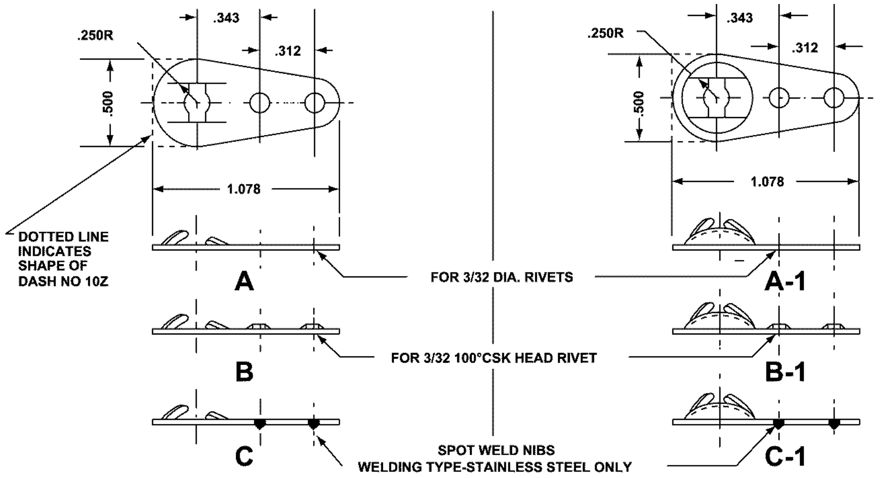
NAS PART CODE: NAS-444-1 = DOUBLE LUG ANCHOR TYPE SPEED NUT .968 LONG, .468 WIDE.

FINISH: SAE 1060 STEEL = METALLIC SPRAY (ZINC), AN-N-6
STAINLESS STEEL. NONE.

② ① **INACTIVE FOR NEW DESIGN**

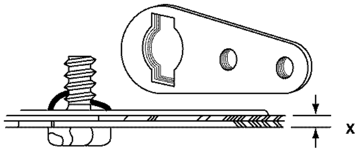
F05-089

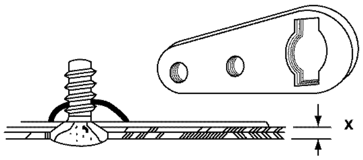
Figure 5-90. Drawing NAS-444



TINNERMAN NO.	NAS NO.	TYPE	MATERIAL THICKNESS ①
A6194-6Z	NAS-445-1	A	.022 (.025 SS)
A6196-6Z	-2	B	
A6193-6Z	-3	C	
A6194-8Z	-4	A	.025 (.028 SS)
A6196-8Z	-5	B	
A6193-8Z	-6	C	
A6194-10Z	-7	A	.028 (.031 SS)
A6196-10Z	-8	B	
A6193-10Z	NAS-445-9	C	

TINNERMAN NO.	NAS NO.	TYPE	MATERIAL THICKNESS ①
A6204-6Z	NAS-445-10	A-1	.022 (.025 SS)
A6163-6Z	-11	B-1	
A6165-6Z	-12	C-1	
A6204-8Z	-13	A-1	.025 (.028 SS)
A6163-8Z	-14	B-1	
A6165-8Z	-15	C-1	
A6204-10Z	-16	A-1	.028 (.031 SS)
A6163-10Z	-17	B-1	
A6165-10Z	NAS-445-18	C-1	





PROCUREMENT: TINNERMAN PRODUCTS, INC., CLEVELAND, OHIO.
SIMILAR ITEMS OF COMPARABLE FUNCTION MUST BE EQUIVALENT PRIOR TO USE ON AIRCRAFT IN LIEU OF ITEMS SHOWN HEREON. ①

ENGINEERING INFORMATION:

PROCUREMENT SPECIFICATION: AAF25533

SCREW LENGTH: - - - - - - - - - - - - - - - - - (TYPE A, B, C; 6Z X PLUS 1/4"; 8Z & 10Z, X PLUS 5/16".
(TYPE A-1, B-1, C-1; 6Z, X PLUS 5/16"; 8Z & 10Z X PLUS 3/8".

THIS OFFSET ANCHOR TYPE SPEED NUT IS TO BE USED WHENEVER POSSIBLE IN APPLICATIONS THAT ARE NOT STRUCTURAL OR SUBJECT TO EXCESSIVE VIBRATION.

FOR ADDITIONAL SIZES AND SHAPES CONSULT THE STANDARDS UNIT.

MATERIAL: SAE 1060 STEEL OR STAINLESS STEEL.

SUFFIXES: ADD SUFFIX "SS" FOR STAINLESS STEEL (EXAMPLE: A6194SS-6Z, NAS-445-1-SS).
ADD SUFFIX "C" FOR RIVET HOLES FOR 1/8" DIA RIVETS (EXAMPLE: A6194-6Z-C; NAS-445-1-C).

COMMERCIAL PART CODE: A6194-6Z = OFFSET ANCHOR TYPE SPEED NUT 1.078 LONG, .500 WIDE.

NAS PART CODE: NAS-445-1 = OFFSET ANCHOR TYPE SPEED NUT 1.078 LONG, .500 WIDE.

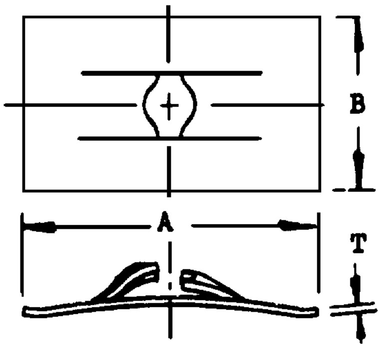
FINISH: SAE 1060 STEEL = METALLIC SPRAY (ZINC) AN-N-8
STAINLESS STEEL = NONE ①

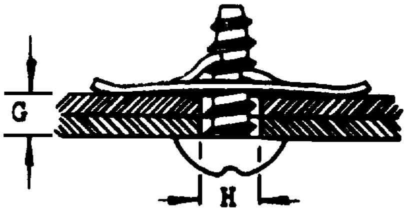
EXAMPLE OF CALL-OUT:

A6194-6Z	NUT - OFFSET ANCHOR TYPE NAS-445-1			TINNERMAN PRODUCTS, INC., CLEVELAND, OHIO (OR EQUIVALENT)	
PART NUMBER (OPTIONAL)	NAME OF PART NAS PART NUMBER	ZONE CODE	SIZE - GAGE SEC NO.	MATERIAL	H. T.

F05-090

Figure 5-91. Drawing NAS-445





TYPICAL INSTALLATION

BASIC PART NUMBER	A	B	T ±.002	INSTALLATION DATA			WT LBS PER 1000
				SCREW (a)		H HOLE	
				SIZE	LG (MIN)	DIA	
NAS446-1	.500	.312	.022	4Z	G + 1/4	.120	.95
NAS446-2	.515	.312	.025	6Z	G + 1/4	.147	1.10
NAS446-4	.625	.437	.028	8Z	G + 5/16	.173	1.95
NAS446-5	.875	.500	.031	10Z	G + 5/16	.199	3.60

PROCUREMENT SPECIFICATION: MIL-N-3337, TYPE II

MATERIAL: STEEL, TEMPERED

FINISH: -1 PHOSPHATE AND ZINC CHROMATE PRIMER
SPECIFICATION MIL-P-8585
-3 ZINC METAL SPRAY - SPECIFICATION MIL-M-6874

TOLERANCES: ±.010 UNLESS OTHERWISE NOTED
ALL DIMENSIONS IN INCHES

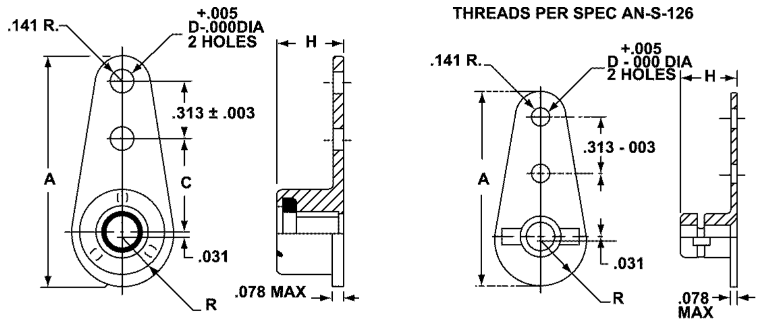
EXAMPLE OF PART NUMBER: NAS446 - 4 - 1
BASIC PART NUMBER
FINISH

NOTES: (a) USE AN530 SCREW OR SIMILAR FOR INSTALLATION
(b) FOR USAGE LIMITATIONS SEE DRAWINGS MS33538 AND AND10087.

③ EDITORIALLY UPDATED

F05-091

Figure 5-92. Drawing NAS-446



ELASTIC BOOTS

① RIVET HOLES CSK, 100° X .200 (1/4-28 & UNDER) RIVET HOLES CTPCH. 100° X .180
RIVET HOLES CSK, 100° X .200 (5/16-24)

MFG. NO.	MFG.	NAS NUMBER	MATERIAL	RIVET HOLES	THREAD SIZE.	A.	C.	D.	H MAX	B.	REPLACEABLE BY RIVETED NUT PLATES.
68A17-62	ELASTIC	NAS-447-6DP	ALUM.	PLAIN	6-32 NC2	1.078	.344	.098	.291	.250	
22A17-62		-6SP	STEEL								
① 68A17-62-BC100x.200	ELASTIC	-6DC	ALUM.	CSK.	6-32 NC2	1.078	.344	.098	.291	.250	
22A17-62-BS100x.200		-6SC	STEEL								
22A17P-62	ELASTIC	-6W	STEEL	WELD NIBS	6-32 NC2	1.078	.344	.098	.291	.250	NAS-447-6SPNAS-447-6SC
68A17-82	ELASTIC	-8DP	ALUM.	PLAIN	8-32 NC2	1.078	.344	.098	.291	.250	
22A17-82		-8DP	STEEL								
① 68A17-82-BC100x.200	ELASTIC	-8DC	ALUM.	CSK.	8-32 NC2	1.078	.344	.098	.291	.250	
22A17-82-BS100x.200		-8SC	STEEL								
22A17P-82	ELASTIC	-8W	STEEL	WELD NIBS	8-32 NC2	1.078	.344	.098	.291	.250	NAS-447-8SPNAS-447-8SC
W12S1032	BOOTS	-10SP	STEEL	PLAIN PLAIN	10-32 NF2	1.078	.344	.098	.322	.250	
68A17-02	ELASTIC	-10DP	ALUM.								
22A17-02		-10SP	STEEL								
W12S1032-BC100 x .180	BOOTS	-10SC	STEEL	CTPCH	10-32 NF2	1.078	.344	.098	.322	.250	
① 68A17-02-BC100x.200	ELASTIC	-10DC	ALUM.	CSK.	10-32 NF2	1.078	.344	.098	.291	.250	
22A17-02-BS100x.200		-10SC	STEEL								
W12S1032-PWB	BOOTS	-10W	STEEL	WELD NIBS	10-32 NF2	1.078	.344	.098	.291	.250	NAS-447-10SP OR NAS-447-10SC
22A17P-02	ELASTIC										
68A17-048	ELASTIC	-416DP	ALUM.	PLAIN	1/4 - 28 - NF3	1.078	.344	.098	.307	.250	
22A17-048		-416SP	STEEL								
① 68A17-048-BC100x.200	ELASTIC	-416DC	ALUM.	CSK.	1/4 - 28 NF3	1.078	.344	.098	.307	.250	
22A17-048-BC100x.200		-416SC	STEEL								
68A17-054	ELASTIC	-516DP	ALUM	PLAIN	5-16 - 24 NF3	1.266	.500	.130	.369	.281	
22A17-054		-516SP	STEEL								
① 68A17-054-BC100x.230	ELASTIC	-516DC	ALUM.	CSK.	5-16 - 24 NF3	1.266	.500	.130	.369	.281	
22A17-054-BC100x.230		-516SC	STEEL								

NOTE: DIMENSIONS NOT SPECIFIED ARE OPTIONAL

PROCUREMENT: ELASTIC STOP NUT CORP., UNION, NEW JERSEY
BOOTS AIRCRAFT NUT CORP., NEW CANAAN, CONN. ①
SIMILAR ITEMS OF COMPARABLE FUNCION MUST BE EQUIVALENT PRIOR TO USE ON AIRCRAFT IN LIEU OF ITEMS SHOWN HEREON.

ENGINEERING INFORMATION:
FOR RESTRICTION ON USE, SEE AND10068.
WHEN USING PROJECTION WELD NUT PLATES, A NOTE ON DRAWING SHOULD STATE PART NO. OF RIVETED NUT PLATE WHICH CAN REPLACE THE WELDED NUT PLATE: A FLAG NEXT TO PART NUMBER OF WELDED NUT PLATE SHOULD REFER TO THE NOTE. THE NOTE SHOULD REFER TO ONE OF THE RIVETED NUT PLATES LISTED ABOVE SELECT NUT PLATE WITH RIVET HOLES PLAIN OR COUNTERSUNK AS REQUIRED.

MANUFACTURING SPECIFICATION: AN-N-5 (THICK NUTS).

MATERIAL: RIVET TYPE - 1112 STEEL, FED SPEC QQ-S-671, FIBER INSERT, (ELASTIC); OR 1010 STEEL FED SPEC QQ-S-636 (BOOTS).
17ST ALUM. ALLOY, SPEC FED QQ-A-351, CONDITION T, FIBER INSERT, (ELASTIC); OR ALUM. ALLOY (BOOTS),
PROJECTION WELD TYPE -1010 STEEL, FED SPEC QQ-S-636 (BOOTS).
1112 STEEL, FED SPEC QQ-A-671. FIBER INSERT, (ELASTIC).

COMMERCIAL PART CODE: 22A17-62 = NUT PLATE, SELF-LOCKING, STEEL, ONE LUG, PLAIN RIVET HOLES, FOR NO. 6-32 SCREW.

NAS PART CODE: NAS-447-6SP = NUT PLATE, SELF-LOCKING, STEEL, ONE LUG, PLAIN RIVET HOLES, FOR NO. 6-32 SCREW.

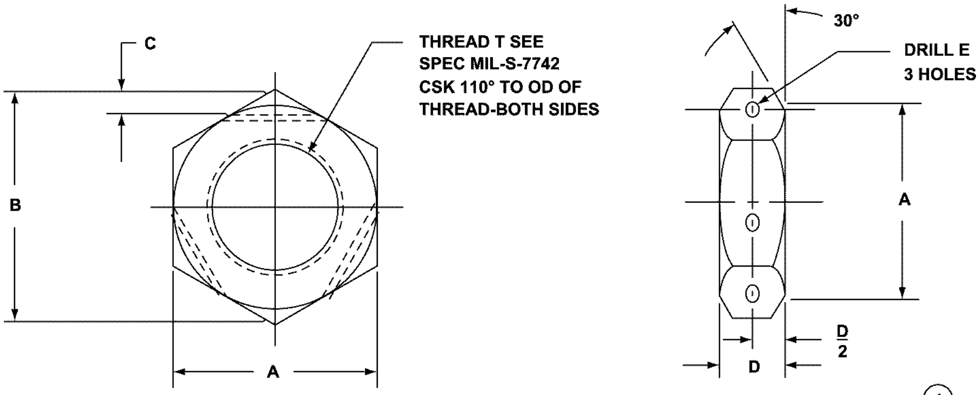
FINISH: RIVET TYPE - STEEL - CADMIUM PLATE PER SPEC AN-P-61 (BOOTS).
- CADMIUM PLATE PER SPEC AN-P-61; OR ZINC PLATE PER SPEC AN-P-32 (ELASTIC).
ALUM. ALLOY - ANODIZE PER SPEC AN-QQ-A-696.
PROJECTION WELD TYPE - CADMIUM PLATE PER SPEC AN-P-61.

EXAMPLE OF CALL-OUT:

22A17-62	NUT PLATE - SELF LOCKING - ONE LUG NAS-447-6SP			ELASTIC STOP NUT CORP., UNION, NEW JERSEY, (OR EQUIVALENT)	
PART NUMBER (OPTIONAL)	NAME OF PART NAS PART NUMBER	ZONE CODE	SIZE - GAGE SEC NO.	MATERIAL	H.T.

F05-092

Figure 5-93. Drawing NAS-447



④

④ (6)

Dash No.	Thread T	A	B Approx	C	D	Drill E	Approx Wt/lbs Ea.
4	1/4 - 28UNF-3B	.438 $^{+.002}_{-.010}$	.50	.093	.188	#56(.046)	.006
5	5/16-24UNF-3B	.500 $^{+.002}_{-.010}$	.58	.093	.219	#56(.046)	.009
6	3/8 - 24UNF-3B	.563 $^{+.002}_{-.010}$	.66	.093	.250	#56(.046)	.012
7	7/16-20UNF-3B	.625 $^{+.002}_{-.010}$	.72	.093	.281	#56(.046)	.015
8	1/2 - 20UNF-3B	.750 $^{+.002}_{-.010}$	.88	.093	.313	#56(.046)	.036
9	9/16-18UNF-3B	.875 $^{+.002}_{-.012}$	1.02	.093	.375	#56(.046)	.044
10	5/8 - 18UNF	1.000 $^{+.002}_{-.014}$	1.16	.093	.406	#56(.046)	.065
12	3/4 - 16UNF-3B	1.125 $^{+.002}_{-.016}$	1.30	.125	.469	#50(.070)	.087
14	7/8 - 14UNF-3B	1.313 $^{+.002}_{-.017}$	1.52	.125	.500	#50(.070)	.127
~~16~~	~~1 - 14UNS-3B~~	~~1.500 +.002~~ -.019	~~1.73~~	~~.125~~	~~.500~~	~~#50(.070)~~	~~.166~~
17	1 - 12UNF-3B	1.500 $^{+.002}_{-.019}$	1.73	.125	.500	#50(.070)	.166
18	1 1/8 - 12UNF-3B	1.625 $^{+.002}_{-.020}$	1.88	.125	.531	#50(.070)	.204
20	1 1/4 - 12UNF-3B	1.750 $^{+.002}_{-.022}$	2.02	.125	.563	#50(.070)	.252
22	1 3/8 - 12UNF-3B	1.875 $^{+.002}_{-.024}$	2.16	.125	.594	#50(.070)	.276
24	1 1/2 - 12UNF-3B	2.000 $^{+.002}_{-.025}$	2.31	.125	.625	#50(.070)	.300
26	1 5/8 - 17UN-3B	2.125 $^{+.002}_{-.027}$	2.45	.125	.656	#50(.070)	.358
28	1 3/4 - 12UN-3B	2.250 $^{+.002}_{-.028}$	2.60	.125	.688	#50(.070)	.421
30	1 7/8 - 12UN-3B	2.375 $^{+.002}_{-.030}$	2.74	.125	.719	#50(.070)	.490
32	2 -12UN-3B	2.625 $^{+.002}_{-.030}$	3.04	.125	.750	#50(.070)	.625
34	2 1/8 - 12UN-3B	2.750 $^{+.002}_{-.031}$	3.18	.125	.781	#50(.070)	.715
36	2 1/4 - 12UN-3B	2.875 $^{+.002}_{-.032}$	3.32	.125	.812	#50(.070)	.813

④ SHEET 2 ADDED
COMPLETELY REVISED

F05-093S01

Figure 5-94. Drawing NAS-509 (Sheet 1 of 2)

CODE: Dash number designates thread size as noted in the above table.
Suffix "L" to basic part number for left hand thread.

EXAMPLE: NAS509-4 = Jam Nut with 1/4-28UNF-3B Right Hand Thread.
NAS509L4 = Jam Nut with 1/4-28UNF-3B Left Hand Thread.

PROCUREMENT SPECIFICATION: MIL-N-6034, as applicable.

MATERIAL: Steel, 4130, Spec MIL-S-6758, Cond. F-4.

FINISH: Cadmium plate, Spec QQ-P-416, Type II, Class 3 (Type I parts already made, may be shipped until 1 July 1965).

HEAT-TREAT: (7) Rockwell C34-38 (150,000 PSI MIN TS) Spec MIL-H-6875.

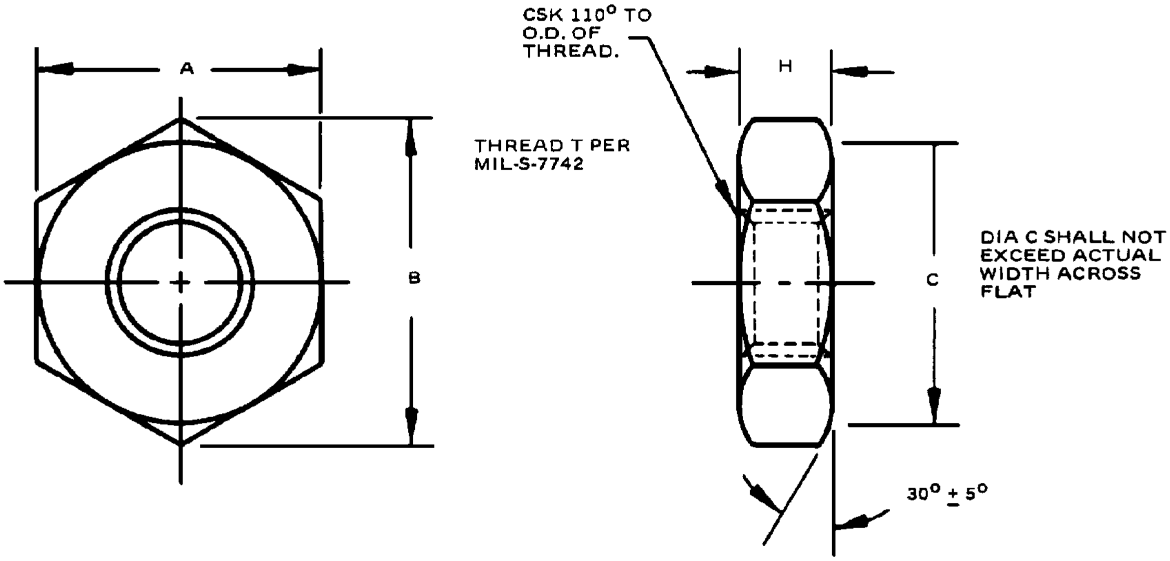
TOLERANCES: Unless otherwise specified, decimals, ±.010; Angles, ±1°.

NOTES:

1. This nut is intended for use with the NAS513 keyed washer for positive locking of rod end terminals to hydraulic piston rode.
2. All machined surfaces 250/per spec MIL-STD-10.
3. Parts shall be magnetic particle inspected per spec MIL-1-6868.
   Parts shall not be marked as an indication of magnetic particle inspection.
4. Remove all burrs and sharp edges.
5. Surface to be square with thread within .003 inch per inch diameter.
6. Inactive for design after 1 January 1965, see -17.
7. Parts already made to Rockwell C33-38 may be shipped until 1 December 1965.

F05-093S02

Figure 5-94. Drawing NAS-509 (Sheet 2)



NAS PART NO.		THREAD T	A		(a) B REF	C DIA. MIN	(b) H	
ALLOY STEEL	BRASS		MAX	MIN			MAX	MIN
NAS671-0 NAS671-1 NAS671-2 NAS671-3	NAS671B0 NAS671B1 NAS671B2 NAS671B3	NO. 0-80NF-2B NO. 1-64NC-2B NO. 2-56NC-2B NO. 3-48NC-2B	.125 .125 .156 .156	.121 .121 .150 .150	.140 .140 .180 .180	.112 .112 .140 .140	.050 .050 .066 .066	.043 .043 .057 .057
NAS671-4 NAS671-6 NAS671-8 NAS671-10	NAS671B4 NAS671B6 NAS671B8 NAS671B10	NO. 4-40NC-2B NO. 6-32NC-2B NO. 8-32NC-2B NO. 10-32NF-2B	.188 .250 .313 .344	.180 .241 .302 .332	.217 .289 .361 .398	.167 .220 .282 .310	.066 .098 .114 .130	.057 .087 .102 .117

THESE NUTS ARE NON STRUCTURAL.

(a) REFERENCE DIMENSIONS ARE FOR DESIGN PURPOSES ONLY AND ARE NOT AN INSPECTION REQUIREMENT.

(b) THE H DIMENSION SHALL BE MEASURED AT A POINT APPROX. HALFWAY BETWEEN THE MINOR DIAMETER OF THE THREAD AND THE FLAT OF THE NUT.

MATL: CORROSION, RESISTANT STEEL PER MIL-S-7720 COMP. FM (303)
STEEL, 50,000 PSI TENSILE STRENGTH, MINIMUM, COMMERCIAL GRADE
BRASS, 55,000 PSI MINIMUM UTS, COMMERCIAL GRADE
FINISH: CRES, PASSIVATE
STEEL, CADMIUM PLATE PER.QQ-P-416, TYPE II, CLASS C, POST PLATE CLEAR.
BRASS, CADMIUM PLATE PER QQ-P-416, TYPE II, CLASS C, POST PLATE TREATMENT COLOR YELLOW IRIDESCENT.
ADD C BEFORE DASH NUMBER FOR CORROSION RESISTANT STEEL

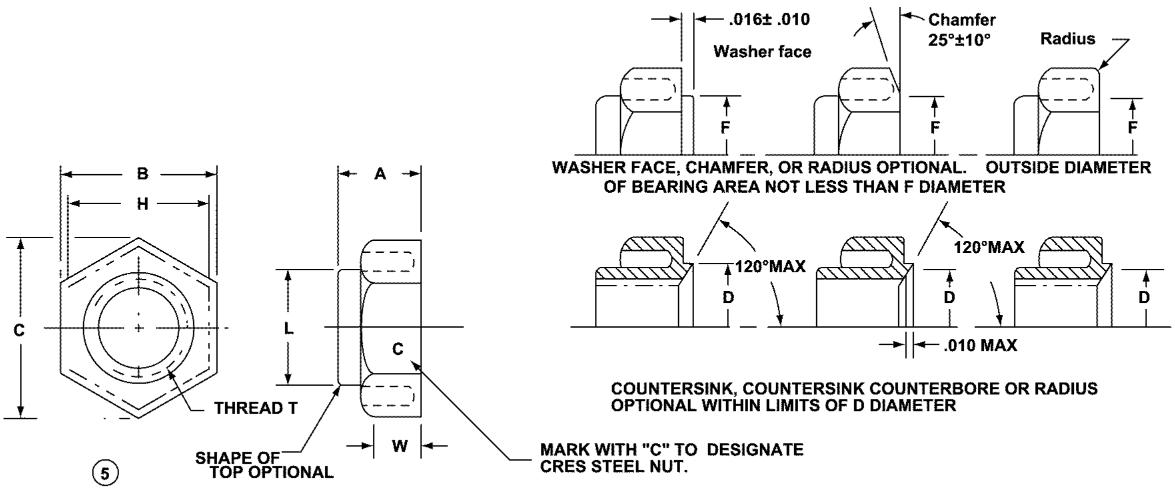
PART NO. EXAMPLE: NAS671-3 = 3-48 CAD. PLATED STEEL NUT

NUTS SHALL BE FREE OF ALL BURRS OR SLIVERS.
DIMENSIONS IN INCHES.

PROC. SPEC: MIL-S-933

F05-094

Figure 5-95. Drawing NAS-671



DASH NO.			(c) THREAD T	(a) A MAX	B		C REF	D DIA		F DIA MIN	(c) (b) H +.002 -.006	(b) L DIA MAX	W MIN	WEIGHT LBS/100	
450°F		800°F													
STEEL	CRES(d)	CRES(d)			MAX	MIN		MAX	MIN					AVG (REF)	MAX
A04	C04M	C06	4-40 UNC-3B	.125	.252	.240	.289	.154	.112	.190	.195	.150	.081	.10	.13
A06	C06M	C06	6-32 UNC-3B	.141	.314	.302	.361	.178	.138	.252	.240	.179	.092	.13	.23
A08	C08M	C08	8-32 UNC-3B	.188	.346	.334	.390	.303	.173	.284	.272	.209	.122	.23	.28
A3	C3M	C3	10-32 UNF-3B	.188	.377	.365	.430	.230	.199	.315	.203	.235	.122	.28	.35
A4	C4M	C4	1/4-28 UNF-3B	.219	.439	.430	.506	.293	.259	.380	.355	.302	.142	.44	.53
A5	C5M	C5	5/16-24 UNF-3B	.266	.502	.492	.580	.356	.322	.452			.173	.71	.85
A6	C6M	C6	3/8-24 UNF-3B	.282	.564	.553	.650	.418	.385	.523			.183	.94	1.10
A7	C7M	C7	7/16-20 UNF-3B	.328	.690	.679	.790	.482	.448	.629			.213	1.64	1.95

(a) MINIMUM "A" LIMITED ONLY BY STRENGTH REQUIREMENT OF SPECIFICATION.
(b) DIMENSIONS "H" AND "L" APPLICABLE TO INTERNAL WRENCHING TYPE, CODE W, ONLY.
(c) THREADS PER MIL-S-7742 BEFORE LUBRICATION.
(d) MAGNETIC PERMEABILITY OF CRES NUTS SHALL BE LESS THAN 2.0 (AIR 1.0) FOR A FIELD STRENGTH H 200 OERSTEDS USING A MAGNETIC PERMEABILITY INDICATOR PER MIL-I 17214 OR EQUIVALENT
(e) PLUS TOLERANCE ON DIMENSION "H" SHALL BE +.005 AND +.006 ON SIZES 04 AND 06 RESPECTIVELY

⑤ CODE: DASH NO. SUFFIXED BY "W" - INTERNAL WRENCHING (SIZES 04, 06, 08, 3 AND 4 ONLY). INSERT "X" IN LIEU OF "A" IN THE 450°F STEEL CODE FOR CADMIUM PLATED STEEL NUTS WITHOUT LUBRICANT.

EXAMPLES OF PART NOS:
NAS679A4 = 1/4-28 NUT, ALL METAL CONSTRUCTION, INTERNAL WRENCHING NOT REQUIRED.
NAS679A4W = 1/4-28 NUT, ALL METAL CONSTRUCTION, WITH INTERNAL WRENCHING FEATURE.
NAS679C4 = 1/4-28 NUT, ALL METAL CONSTRUCTION OF A286 CRES, SILVER PLATED FOR 800°F USE, INTERNAL WRENCHING FEATURE NOT REQUIRED.
⑤ NAS679C4MW = 1/4-28 NUT, ALL METAL CONSTRUCTION OF A296 CRES, WITH AN APPROVED DRY FILM LUBRICANT. INTERNAL WRENCHING FEATURE, FOR 450° F USE.
NAS679X4 = 1/4-28 NUT, ALL METAL CONSTRUCTION, INTERNAL WRENCHING NOT REQUIRED, WITHOUT LUBRICANT.

MATERIAL:
STEEL: SEE PROCUREMENT SPECIFICATION.
⑤ CRES: A286 PER AMS5525, NON-MAGNETIC.

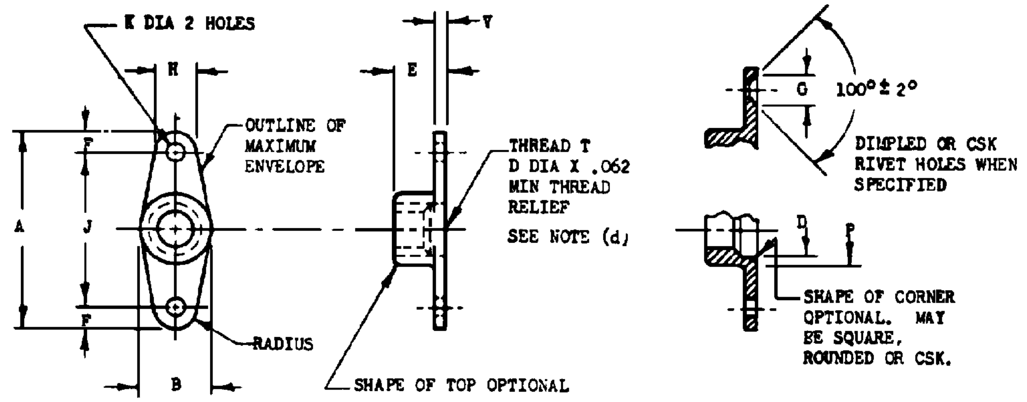
FINISH:
STEEL: CADMIUM PLATE PER QQ-P-416, TYPE II, CLASS 3 PLUS AN APPROVED DRY FILM LUBRICANT.
⑤ CRES: SILVER PLATE FOR 800°F USED PER AMS2410 TO A .0002 MIN. THICKNESS ON SURFACES WHICH CAN BE TOUCHED BY A 3/4-INCH BALL. THREADS SHALL SHOW COMPLETE COVERAGE BUT THICKNESS REQUIREMENT ON THREADS IS WAIVED.
CRES: APPROVED DRY FILM LUBRICANT FOR 450°F USE.

PROCUREMENT SPECIFICATION:
⑤ MIL-N-25027 EXCEPT AS NOTED. ALL NUTS SHALL MEET QUALIFICATION AND INSPECTION REQUIREMENTS. MANUFACTURERS SHALL PROVIDE EVIDENCE OF QUALIFICATION WHEN REQUIRED. TESTING SHALL BE PERFORMED BY MANUFACTURER OR INDEPENDENT LABORATORY. PROCURING AGENCY MAY CONDUCT CONFIRMING QUALIFICATION TESTS. NO QPL SHALL BE ESTABLISHED.

NOTE:
AXIAL STRENGTH REQUIREMENTS PER MIL-N-25027. TABLE I VALUES FOR REGULAR STEEL NUTS. DIMENSIONS IN INCHES.

F05-095

Figure 5-96. Drawing NAS-679



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DASH NUMBER			(c) THREAD T	A MAX	B DIA MAX	D DIA MIN	E(a) MAX	F MIN	G DIA ±.010	H		J(b) ±.002	K DIA +.005 -.000	P DIA MAX	V MAX	WEIGHT LBS/100	
450°F STEEL	450°F CRES(e)	800°F CRES(e)								MAX	MIN					AVG (REF)	MAX
A04	C04M	C04	4-40 UNC-3B	.948	.260	—	.143	.100	.200	.260	.200	.688	.098	.166	.047	.09	.14
A06	C06M	C06	6-32 UNC-3B	.948	.265	—	.171	.100	.200	.260	.200	.688	.098	.206	.047	.13	.18
A08	C08M	008	8-32 UNC-3B	.948	.297	.168	.250	.100	.200	.260	.200	.688	.098	.248	.047	.22	.28
A3	C3M	C3	10-32 UNF-3B	.948	.328	.194	.250	.100	.200	.260	.200	.688	.098	.274	.047	.23	.29
A4	C4M	C4	1/4-28 UNF-3B	1.260	.414	.254	.281	.100	.200	.260	.200	1.000	.098	.344	.055	.45	.53
A5	C5M	C5	5/16-24 UNF-3B	1.292	.505	.317	.328	.125	.230	.290	.250	1.000	.130	.417	.065	.67	.80
A6	C6M	C6	3/8-24 UNF-3B	1.292	.614	.379	.344	.125		.290	.250	1.000	.130	.505	.075	1.00	1.31
A7	C7M	C7	7/16-20 UNF-3B	1.477	.726	.442	.390	.156		.352	.312	1.125	.161	.602	.085	1.64	1.84

(a) MINIMUM "E" NOT SPECIFIED, LIMITED ONLY BY STRENGTH REQUIREMENT OF SPECIFICATION.
(b) THE CENTER OF THE TAPPED HOLE SHALL NOT DEVIATE IN ANY DIRECTION FROM THE CENTER OF THE PLATE NUT AS DETERMINED BY THE RIVET HOLES, BY MORE THAN .005.
(c) THREADS PER MIL-S-7742 BEFORE LUBRICATION.
(d) ON SIZES NO. 6 & SMALLER CSK TO D DIA.
(e) MAGNETIC PERMEABILITY SHALL BE LESS THAN 2.0 (AIR=1.0) FOR A FIELD STRENGTH H = 200 OERSTEDS USING A MAGNETIC PERMEABILITY INDICATOR PER MIL-I-17214 OR EQUIVALENT.

⑤ CODE: DASH NO. SUFFIXED BY A BACK CSK OR DIMPLED RIVET HOLES.
INSERT "X" IN LIEU OF "A" IN THE 450°F STEEL CODE FOR CADMIUM PLATED STEEL NUTS WITHOUT LUBRICANT.

EXAMPLES OF PART NUMBERS:
NAS680A4 = 1/4-28 PLATE NUT, ALL METAL, PLAIN RIVET HOLES, 450°F MAX.
⑤ NAS680A4K = 1/4-28 PLATE NUT, ALL METAL CONSTRUCTION WITH BACK CSK OR DIMPLED RIVET HOLES.
NAS680C4 = 1/4-28 PLATE NUT, ALL METAL, A286 CRES, 800°F MAX.
NAS680C4M = 1/4-28 PLATE NUT, ALL METAL, A286 CRES, 450°F MAX, WITH APPROVED DRY FILM LUBRICANT.
NAS680X4 = 1/4-28 PLATE NUT, ALL METAL, PLAIN RIVET HOLES, 450°F MAX, WITHOUT LUBRICANT.

MATERIAL:
NUT AND BASE: STEEL. SEE PROCUREMENT SPECIFICATION.
CRES. A286 PER AMS 5525, NON-MAGNETIC.

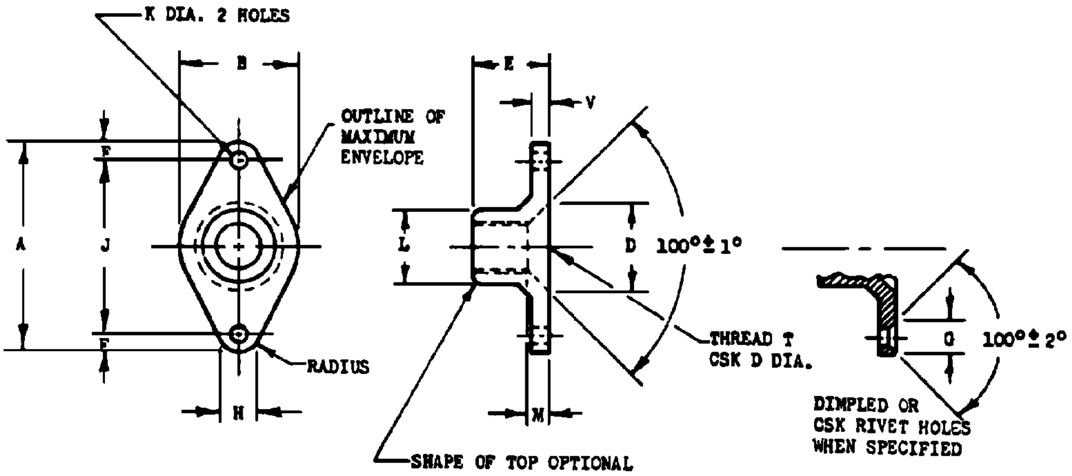
FINISH:
STEEL: CADMIUM PLATE PER QQ-P-416 TYPE II CLASS 3 PLUS AN APPROVED DRY FILM LUBRICANT.
⑤ CRES: SILVER PLATE FOR 800°F USE PER AMS2410 TO A .0002 MIN. THICKNESS ON SURFACES WHICH CAN BE TOUCHED BY A 3/4 INCH BALL. THREADS SHALL SHOW COMPLETE COVERAGE, BUT THICKNESS REQUIREMENT ON THREADS IS WAIVED.
CRES: APPROVED DRY FILM LUBRICANT FOR 450°F USE.

PROCUREMENT SPECIFICATION:
⑤ MIL-N-25027 EXCEPT AS NOTED. ALL NOTS SHALL MEET QUALIFICATION AND INSPECTION REQUIREMENTS. MANUFACTURERS SHALL PROVIDE EVIDENCE OF QUALIFICATION WHEN REQUIRED. TESTING SHALL BE PERFORMED BY MANUFACTURER OR INDEPENDENT LABORATORY. PROCURING AGENCY MAY CONDUCT CONFIRMING QUALIFICATION TESTS. NO QPL SHALL BE ESTABLISHED.

NOTE: AXIAL STRENGTH REQUIREMENTS PER MIL-N-25027 TABLE I VALUES FOR STEEL NUTS. DIMENSIONS IN INCHES.

F05-096

Figure 5-97. Drawing NAS-680



⑤

DASH NUMBER			(c) THREAD T	A MAX	B DIA MAX	D DIA ±.005	E(a) MAX	F MIN	G DIA ±.010	H		J(b) ±.002	K DIA +.005 -.000	L DIA MAX	M REF	V MAX	WEIGHT LBS/100	
450°F STEEL	450°F CRES (d)	800°F CRES (d)								MAX	MIN						AVG (REF)	MAX
A08	C08M	C08	8-32 UNC-3B	.948	.422	.365	.272	.100	.200	.260	.200	.688	.098	.297	.084	.047	.30	.35
A3	C3M	C3	10-32 UNF-3B	.948	.453	.411	.281	.100	.200	.260	.200	.688	.098	.328	.093	.047	.31.	.37
A4	C4M	C4	1/4-28 UNF-3B	1.260	.619	.540	.340	.100	.200	.260	.200	1.000	.098	.414	.121	.055	.62	.80
A5	C5M	C5	5/16-24 UNF-3B	1.292	.766	.686	.422	.125	.230	.290	.250	1.000	.130	.505	.156	.065	.93	1.06

(a) MINIMUM “E” NOT SPECIFIED, LIMITED ONLY BY STRENGTH REQUIREMENT OF SPECIFICATION.

(b) THE CENTER OF THE TAPPED HOLE SHALL NOT DEVIATE IN ANY DIRECTION FROM THE CENTER OF THE PLATE NUT AS DETERMINED BY THE RIVET HOLES, BY MORE THAN .005.

(c) THREADS PER MIL-S-7742 BEFORE LUBRICATION.

(d) MAGNETIC PERMEABILITY SHALL BE LESS THAN 2.0 (AIR=1.0) FOR A FIELD STRENGTH H = 200 OERSTEDS USING A MAGNETIC PERMEABILITY INDICATOR PER MIL-I-17214 OR EQUIVALENT.

⑤ CODE: DASH NO. SUFFIXED BY K BACK CSK OR DIMPLED RIVET HOLES.
INSERT “X” IN LIEU OF “A” IN THE 450°F STEEL CODE FOR CADMIUM PLATED STEEL NUTS WITHOUT LUBRICANT.

EXAMPLES OF PART NUMBERS:

⑤
NAS681A4 =1/4-28 PLATE NUT, ALL METAL, PLAIN RIVET HOLES, 450°F MAX.
NAS681A4K = 1/4-28 PLATE NUT, ALL METAL CONSTRUCTION WITH BACK CSX OR DIMPLED RIVET HOLES.
NAS681C4 = 1/4-28 PLATE NUT, ALL METAL, A286 CRES, 800°F MAX.
NAS681C4M = 1/4-28 PLATE NUT, ALL METAL, A286 CRES, 450°F MAX, WITH APPROVED DRY FILM LUBRICANT.
NAS681X4 = 1/4-28 PLATE NUT, ALL METAL, PLAIN RIVET HOLES, 450°F MAX, WITHOUT LUBRICANT.

MATERIAL:

NUT AND BASE: STEEL. SEE PROCUREMENT SPECIFICATION
CRES. A286 PER AMS 5525, NON-MAGNETIC.

FINISH:

⑤
STEEL: CADMIUM PLATE PER QQ-P-416 TYPE II CLASS 3 PLUS AN APPROVED DRY FILM LUBRICANT.
CRES: SILVER PLATE FOR 800°F USE PER AMS2410 TO A .0002 MIN. THICKNESS ON SURFACES WHICH CAN BE TOUCHED BY A 3/4 INCH BALL. THREADS SHALL SHOW COMPLETE COVERAGE, BUT THICKNESS REQUIREMENT ON THREADS IS WAIVED.
CRES: APPROVED DRY FILM LUBRICANT FOR 450°F USE.

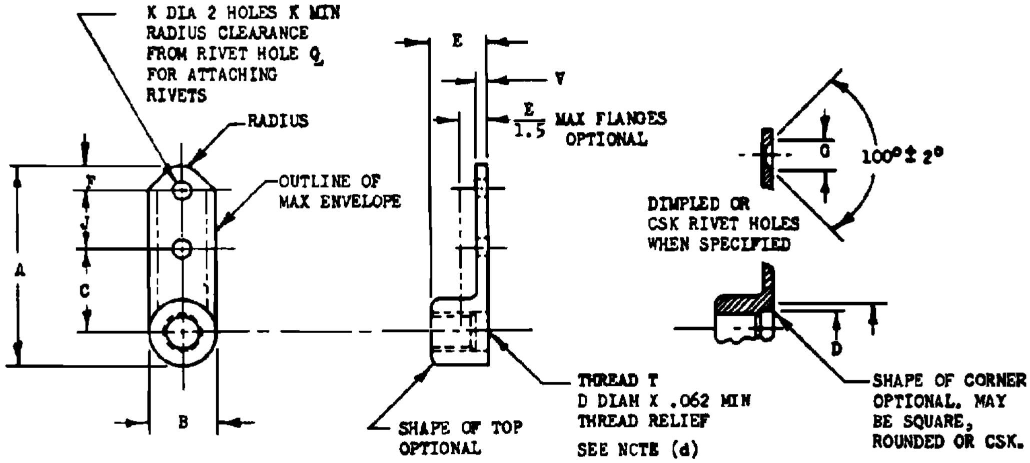
PROCUREMENT SPECIFICATION:

⑤ MIL-N-25027 EXCEPT AS NOTED. ALL NUTS SHALL MEET QUALIFICATION AND INSPECTION REQUIREMENT. MANUFACTURERS SHALL PROVIDE EVIDENCE OF QUALIFICATION WHEN REQUIRED. TESTING SHALL BE PERFORMED BY MANUFACTURER OR INDEPENDENT LABORATORY. PROCURING AGENCY MAY CONDUCT CONFIRMING QUALIFICATION TESTS. NO QPL SHALL BE ESTABLISHED.

NOTE: AXIAL STRENGTH REQUIREMENTS PER MIL-N-25027 TABLE I VALUES FOR STEEL NUTS. DIMENSIONS IN INCHES.

F05-097

Figure 5-98. Drawing NAS-681



⑤

DASH NUMBER			(c) THREAD T	A MAX	B DIA MAX	C(b) ±.005	D DIA MIN	E(a) MAX	F MIN	G DIA ±.010	J ±.002	K DIA +.005 -.000	P MAX	V MAX	WEIGHT LBS/100	
450°F STEEL	450°F CRES(e)	800°F CRES(e)													AVG (REF)	MAX
A06	C06M	C06	6-32 UNC-3B	.935	.297	.344	—	.171	.100	.200	.312	.098	.206	.047	.24	.28
A08	C08M	C08	8-32 UNC-3B	.935	.297	.344	.168	.250	.100	.200	.312	.098	.248	.047	.25	.29
A3	C3M	C3	10-32 UNF-3B	.950	.328	.344	.194	.250	.100	.200	.312	.098	.274	.047	.27	.33
A4	C4M	C4	1/4-28 UNF-3B	.993	.414	.344	.254	.281	.100	.200	.312	.098	.344	.055	.49	.57
A5	C5M	C5	5/16-24 UNF-3B	1.210	.505	.500	.317	.328	.125	.230	.312	.130	.417	.065	.81	.96
A6	C6M	C6	3/8-24 UNF-3B	1.264	.614	.500	.379	.344	.125		.312	.130	.505	.075	1.09	1.44
A7	C7M	C7	7/16-20 UNF-3B	1.446	.726	.562	.442	.390	.156		.344	.161	.602	.085	1.77	2.02

(a) MINIMUM “E” NOT SPECIFIED, LIMITED ONLY BY STRENGTH REQUIREMENT OF SPECIFICATION.
(b) THE CENTER OF THE TAPPED HOLE SHALL NOT DEVIATE IN ANY DIRECTION FROM THE CENTER OF THE PLATE NUT AS DETERMINED BY THE RIVET HOLES, BY MORE THAN .005.
(c) THREADS PER MIL-S-7742 BEFORE LUBRICATION.
(d) ON SIZES NO. 6 & SMALLER CSK TO D DIA.
(e) MAGNETIC PERMEABILITY SHALL BE LESS THAN 2.0 (AIR=1.0) FOR A FIELD STRENGTH H = 200 OERSTEDS USING A MAGNETIC. PERMEABILITY INDICATOR PER MIL-I-17214 OR EQUIVALENT.

⑤ CODE: DASH NO. SUFFIXED BY K BACK CSK OR DIMPLED RIVET HOLES.
INSERT “X” IN LIEU OF “A” IN THE 450°F STEEL CODE FOR CADMIUM PLATED STEEL NUTS WITHOUT LUBRICANT.

EXAMPLES OF PART NUMBERS:

⑤
NAS682A4 = 1/4-28 PLATE NUT, ALL METAL, PLAIN RIVET HOLES, 450°F MAX.
NAS682A4K = 1/4-28 PLATE NUT, ALL METAL CONSTRUCTION WITH BACK CSK OR DIMPLED RIVET HOLES.
NAS682C4 = 1/4-28 PLATE NUT, ALL METAL, A286 CRES, 800°F MAX.
NAS682C4M = 1/4-28 PLATE NUT, ALL METAL, A286 CRES, 450°F MAX, WITH APPROVED DRY FILM LUBRICANT.
NAS682X4 = 1/4-28 PLATE NUT, ALL METAL, PLAIN RIVET HOLES, 450°F MAX, WITHOUT LUBRICANT.

MATERIAL:
NUT AND BASE: STEEL. SEE PROCUREMENT SPECIFICATION.
CRES. A286 PER AMS 5525, NON-MAGNETIC.

FINISH:

⑤
STEEL: CADMIUM PLATE PER QQ-P-416 TYPE II CLASS 3 PLUS AN APPROVED DRY FILM LUBRICANT.
CRES: SILVER PLATE FOR 800°F USE PER AMS2410 TO A .0002 MIN. THICKNESS ON SURFACES WHICH CAN BE TOUCHED BY A 3/4 INCH BALL. THREADS SHALL SHOW COMPLETE COVERAGE, BUT THICKNESS REQUIREMENT ON THREAD)S IS WAIVED.
CRES: APPROVED DRY FILM LUBRICANT FOR 450°F USE.

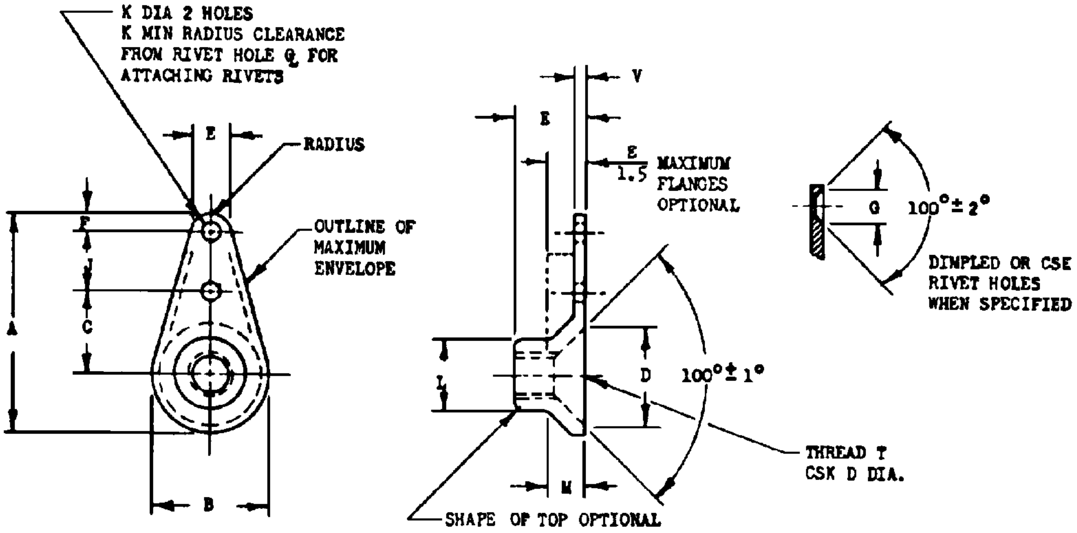
PROCUREMENT SPECIFICATION:

⑤ MIL-N-25027 EXCEPT AS NOTED. ALL NUTS SHALL MEET QUALIFICATION AND INSPECTION REQUIREMENTS. MANUFACTURERS SHALL PROVIDE EVIDENCE OF QUALIFICATION WHEN REQUIRED. TESTING SHALL BE PERFORMED BY MANUFACTURER OR INDEPENDENT LABORATORY. PROCURING AGENCY MAY CONDUCT CONFIRMING QUALIFICATION TESTS. NO QPL SHALL BE ESTABLISHED.

NOTE: AXIAL STRENGTH REQUIREMENTS PER MIL-N-25027 TABLE I VALUES FOR STEEL NUTS. DIMENSIONS IN INCHES.

F05-098

Figure 5-99. Drawing NAS-682



⑤

DASH NUMBER			(c) THREAD T	A MAX	B DIA MAX	C(b) ±.005	D ±.005	E(a) MAX	F MIN	G DIA ±.010	H		J ±.002	K DIA +.005 -.000	L DIA MAX	M REF	V MAX	WEIGHT LBS/100	
450°F STEEL	450°F CRES (d)	800°F CRES (d)									MAX	MIN						AVG (REF)	MAX
A08	C08M	C08	8-32 UNC-3B	.997	.422	.344	.365	.272	.100	.200	.260	.200	.312	.098	.297	.084	.047	.33	.39
A3	C3M	C3	10-32 UNF-3B	1.013	.453	.344	.411	.281	.100	.200	.260	.200	.312	.098	.328	.093	.047	.34	.40
A4	C4M	C4	1/4-28 UNF-3B	1.252	.619	.500	.540	.340	.100	.200	.260	.200	.312	.098	.414	.121	.055	.63	.78
A5	C5M	C5	5/16-24 UNF-3B	1.340	.766	.500	.686	.422	.125	.230	.290	.250	.312	.130	.505	.156	.065	.93	1.06

(a) MINIMUM “E” NOT SPECIFIED, LIMITED ONLY BE STRENGTH REQUIREMENT OF SPECIFICATION.

(b) THE CENTER OF THE TAPPED HOLE SHALL NOT DEVIATE IN ANY DIRECTION FROM THE CENTER OF THE PLATE NUT AS DETERMINED BY THE RIVET HOLES, BY MORE THAN •005.

(c) THREADS PER MIL-S-7742 BEFORE LUBRICATION.

(d) MAGNETIC PERMEABILITY SHALL BE LESS THAN 2.0 (AIR=1.0) FOR A FIELD STRENGTH H = 200 OERSTEDS USING A MAGNETIC PERMEABILITY INDICATOR PER MIL- I -17214 OR EQUIVALENT.

⑤ CODE: DASH NO. SUFFIXED BY K BACK CSK OR DIMPLED RIVET HOLES.
INSERT “X” IN LIEU OF “A” IN THE 450°F STEEL CODE FOR CADMIUM PLATED STEEL NUTS WITHOUT LUBRICANT.

⑤ EXAMPLES OF PART NUMBERS:

NAS683A4 = 1/4-28 PLATE NUT, ALL METAL, PLAIN RIVET HOLES, 450°F MAX.
NAS683A4K = 1/4-28 PLATE NUT, ALL METAL CONSTRUCTION WITH BACK CSK OR DIMPLED RIVET HOLES.
NAS683C4 = 1/4-28 PLATE NUT, ALL METAL, A286 CRES, 800°F MAX.
NAS683C4K = 1/4-28 PLATE NUT, ALL METAL, A286 CRES, 450°F MAX, WITH APPROVED DRY FILM LUBRICANT.
NAS683X4 = 1/4-28 PLATE NUT, ALL METAL, PLAIN RIVET HOLES, 450°F MAX, WITHOUT LUBRICANT.

MATERIAL:

NUT AND BASE: STEEL. SEE PROCUREMENT SPECIFICATION.
CRES. A286 PER AMS 5525, NON-MAGNETIC.

⑤ FINISH:

STEEL: CADMIUM PLATE PER QQ-P-416 TYPE II CLASS 3 PLUS AN APPROVED DRY FILM LUBRICANT.
CRES: SILVER PLATE FOR 800°F USE PER AMS2410 TO A .0002 MIN. THICKNESS ON SURFACES WHICH CAN CAN BE TOUCHED BY A 3/4 INCH BALL. THREADS SHALL SHOW COMPLETE COVERAGE, BUT THICKNESS REQUIREMENTS ON THREADS IS WAIVED.
CRES: APPROVED DRY FILM LUBRICANT FOR 450°F USE.

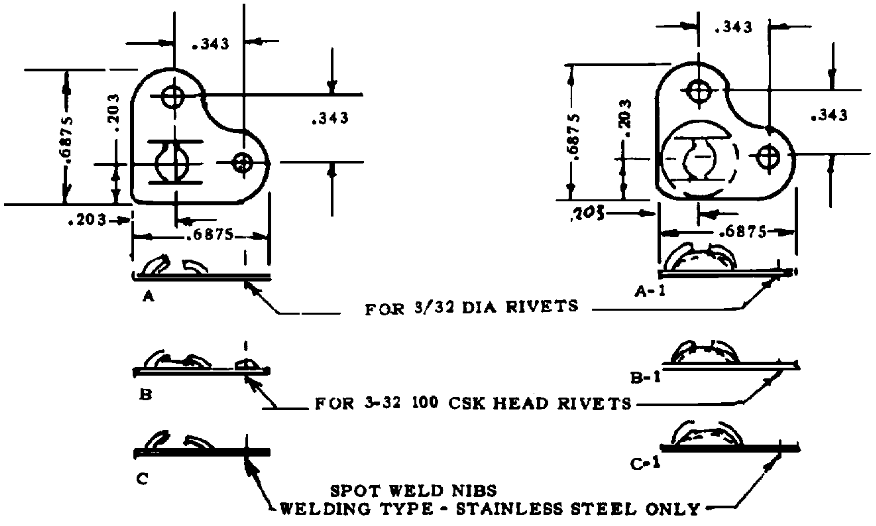
⑤ PROCUREMENT SPECIFICATION:

MIL-N-25027 EXCEPT AS NOTED. ALL NUTS SHALL MEET QUALIFICATION AND INSPECTION REQUIREMENTS, MANUFACTURERS SHALL PROVIDE EVIDENCE OF QUALIFICATION WHEN REQUIRED. TESTING SHALL BE PERFORMED BY MANUFACTURER OR INDEPENDENT LABORATORY. PROCURING AGENCY MAY CONDUCT CONFIRMING QUALIFICATION TESTS. NO QPL SHALL BE ESTABLISHED.

NOTE: AXIAL STRENGTH REQUIREMENTS PER MIL-N-25027 TABLE I VALUES FOR STEEL NUTS. DIMENSIONS IN INCHES.

F05-099

Figure 5-100. Drawing NAS-683



PREFIX "A" DESIGNATES AIRCRAFT PARTS

MFRS NEW NO.	①	NAS NO.	TYPE		MATERIAL THICKNESS ①
A6200-6Z		NAS-449-1	A		.022 (.025 SS)
A6021-6Z		NAS-449-2	B		
A6202-6Z		NAS-449-3	C		
A6200-8Z		NAS-449-4	A		.025 (.028 SS)
A6201-8Z		NAS-449-5	B		
A6202-8Z		NAS-449-6	C		
A6200-10Z		NAS-449-13	A		.032 (.031 SS)
A6201-10Z		NAS-449-14	B		
A6202-10Z		NAS-449-15	C		

①

MFRS NEW NO.		NAS NO.	TYPE	AIRCRAFT SCREW NO	MATERIAL THICKNESS
A6197-6Z		449-7	A-1	100° CSK HEAD 6Z S.N.S	.022 (.025 SS)
A6198-6Z		449-8	B-1		
A6199-6Z		449-9	C-1		
A6197-8Z		449-10	A-1	100° CSK HEAD 8Z S.M.S	.025 (.028 SS)
A6198-8Z		449-11	B-1		
A6199-8Z		449-12	C-1		

PROCUREMENT: TINNERMAN PRODUCTS, INC., CLEVELAND, OHIO.
SIMILAR ITEMS OF COMPARABLE FUNCTION MUST BE EQUIVALENT PRIOR TO USE ON AIRCRAFT IN LIEU OF ITEMS SHOWN HEREON.

ENGINEERING INFORMATION: ①

PROCUREMENT SPECIFICATION: AAF25533.

THE CORNER ANCHOR TYPE SPEED NUT IS TO BE USED IN CORNERS WHEREVER POSSIBLE IN APPLICATIONS THAT ARE NOT STRUCTURAL SUBJECT TO EXCESSIVE VIBRATION.

MATERIAL: SAE 1060 STEEL OR STAINLESS STEEL.
SUFFIXES: ADD SUFFIX "SS" FOR STAINLESS STEEL (EXAMPLE: A6200SS-6Z; NAS-449-1-SS).
ADD SUFFIX "C" FOR RIVET HOLES FOR 1/8 INCH DIA RIVETS (EXAMPLE: A6200-6Z-C; NAS-449-1-C).

COMMERCIAL PART CODE: A6200-6Z CORNER ANCHOR TYPE A SPEED NUT FOR NO. 6 SIZE SCREW.

NAS PART CODE: NAS 449-1 CORNER ANCHOR TYPE A SPEED NUT FOR A NO. 6 SIZE SCREW.

FINISH: SAE 1060 STL - METALLIC SPRAY (ZINC). AN-M-8. ①
STAINLESS STL - NONE.

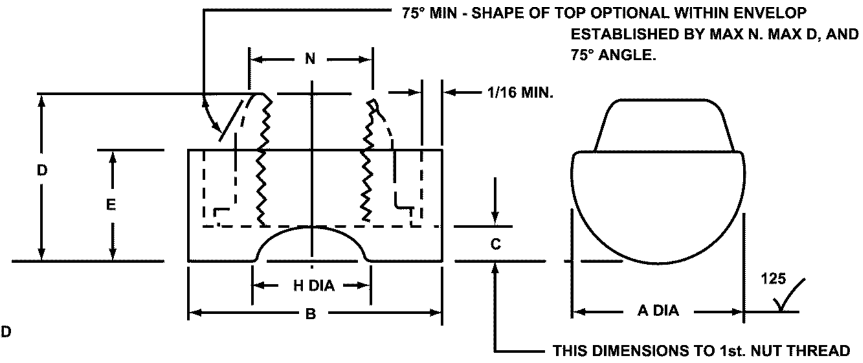
EXAMPLE OF CALL-OUT.

② INACTIVE FOR NEW DESIGN.

A6200-6Z	NUT-CORNER ANCHOR TYPE (NAS-449-1)			TIMMERMAN PRODUCTS, INC., CLEVELAND OHIO (OR EQUIVALENT)	
(OPTIONAL) PART NUMBER	NAS PART NUMBER NAME OF PART	ZONE CODE	SIZE - GAGE SEC - NO.	MATERIAL	M.T.

F05-100

Figure 5-101. Drawing NAS-449



② COMPLETELY REVISED

DASH NO.	THREAD UNF-3B UNLESS NOTED	A DIA + .000 - .003	INSTALLATION HOLE SIZE (REF)		B ±.010	C ±.005	D MAX	E +.000 - .010	H +.010 - .000	N MAX	SEE NOTES 1 & 2		MAX WEIGHT LB/100	MATERIAL HARDNESS RANGES (RC)	
			MIN	MAX							AXIAL TEN-SILE STRE-NGTH LBS MIN	TEN-SILE LOAD-ING RATES LB/MIN (±10%)(b)		NUT	CRA-DLE
4	1/4-28	.528	.531	.535	.625	.125	.406	.320	.281	.375	7200	5000	1.50	34-41	36-43
5	5/16-24	.590	.594	.599	.688	.125	.468	.360	.344	.406	11400	7700	2.00	36-43	41-48
6	3/8-24	.684	.688	.693	.750	.156	.531	.420	.406	.500	17000	11000	3.00	41-48	41-48
7	7/16-20	.778	.781	.788	.875	.188	.625	.470	.469	.563	23000	15000	5.10	36-43	41-48
8	1/2-20	.872	.875	.882	1.000	.219	.703	.540	.531	.625	30700	19600	8.20	36-43	41-48
9	9/16-18	.965	.969	.976	1.094	.250	.765	.590	.594	.688	38900	24800	14.00	36-43	36-43
10	5/8-18	1.060	1.062	1.072	1.125	.281	.844	.650	.656	.750	48700	30600	18.00	36-43	36-43
12	3/4-16	1.278	1.281	1.291	1.500	.344	1.062	.750	.781	.875	70800	44000	23.00	34-41	36-43
14	7/8-14	1.433	1.438	1.448	1.531	.375	1.156	.850	.906	1.000	96600	60000	31.00	34-41	36-43
16	1-12	1.559	1.562	1.572	1.728	.375	1.281	.880	1.032	1.125	125900	78000	44.00	39-46	36-43
17	1-14 NS-3B	1.559	1.562	1.572	1.728	.375	1.281	.880	1.032	1.125	128250	78000	44.00	39-46	36-43
18	1 1/8-12	1.872	1.875	1.885	2.063	.438	1.562	1.230	1.156	1.250	161000	100000	78.00	39-46	36-43
20	1 1/4-12	2.122	2.125	2.135	2.352	.500	1.813	1.320	1.281	1.375	201000	122000	120.00	39-46	36-43
22	1 3/8-12	2.372	2.375	2.385	2.646	.562	2.000	1.460	1.406	1.500	246000	148000	165.00	39-46	36-43
24	1 1/2-12	2.622	2.625	2.635	3.000	.625	2.187	1.520	1.531	1.625	295000	176000	215.00	39-46	36-43

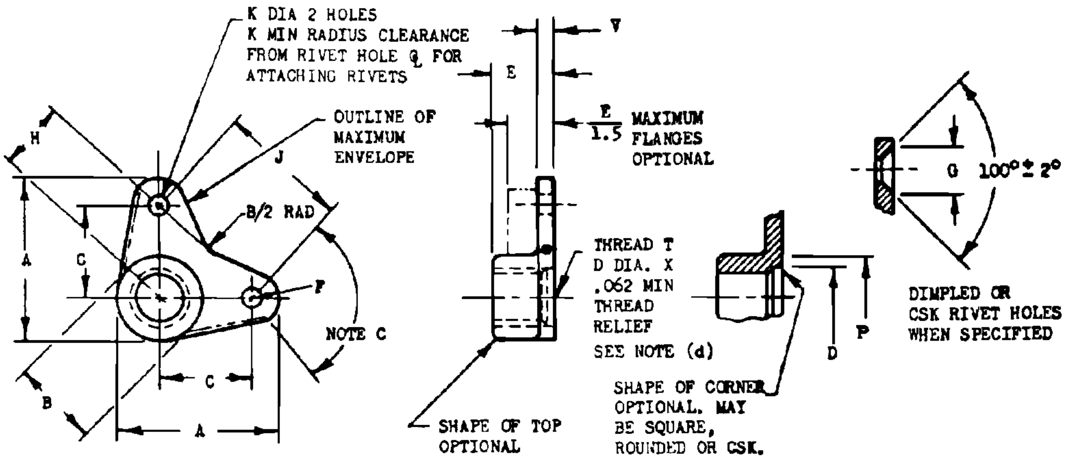
MATERIAL -	THE NUT AND BARREL SHALL BE FABRICATED FROM NON-CORROSION RESISTANT STEEL, EXCEPT THAT IN THOSE INSTANCES WHERE THE ROCKWELL "C" RANGE IN THE ABOVE TABLE IN 39-46 OR 41-48, THE MATERIAL SHALL BE EITHER 4140 (MIL-S-5626), 8740 (MIL-S-6049), OR 4340 (MIL-S-5000) STEEL BAR ONLY.
FINISH -	NUT AND BARREL: CADIUM PLATE PER SPECIFICATION NAS672 (ALTERNATIVE VACUUM DEPOSITED CADMIUM PLATE PER SPECIFICATION MIL-C-8837). FINISH ON "A", "K" OR NO CODE PARTS CADMIUM PLATE PER QQ-P-416, TYPE II, CLASS 3.
THREADS -	PER MIL-S-7742 BEFORE PLATING, PER MIL-S-8879 FOR "F" CODE NUTS. MINIMUM "GO" THREAD PENETRATION SHALL BE 3/4 OF ONE REVOLUTION.
HARDNESS-	NOTED IN TABLE. IN NO CASE SHALL THE TEMPERING TEMPERATURE BE LESS THAN 725° F.
TOTAL FLOAT -	ACROSS BARREL .028 MIN LENGTHWISE - PERMISSIBLE BUT NOT REQUIRED. VERTICLE - .016 MAX.
CODE -	NO CODE - NON METALLIC OR ALL METAL LOCKING DEVICE FOR USE TO 250° F. (SEE NOTE 5). "A" CODE - ALL METAL LOCKING DEVICE ONLY, FOR USE TO 500°F. (CAD PLATE PER QQ-P-416) "K" CODE - NON METALLIC LOCKING DEVICE ONLY, FOR USE TO 250°F. (SEE NOTE 5). "F" CODE - ALL METAL LOCKING DEVICE ONLY FOR USE TO 500°F. (CAD PLATE PER NAS 672).
EXAMPLE-	NAS577-8F ALL METAL FLOATING BARREL NUT FOR 1-2" DIA BOLT.

NOTES:

1. MINIMUM AXIAL TENSILE STRETCH BASED ON SPECIFICATION MIL-B-8831.
2. ALL REQUIREMENTS OF SPECIFICATION MIL-N-25027 MUST BE MET EXCEPT AS NOTED. AXIAL TENSILE STRENGTH VALUES SHALL BE MET WITH NUT INSTALLED IN A CLOSE PITTING STEEL JIG. (HARDNESS RC-41-43) WITH A HOLE NO LARGER THEN .003 OVER THE MAXIMUM "A" DIA AND TESTED WITH A BOLT OF SUFFICIENT STRENGTH TO CAUSE STRIPPING OF NUT THREADS. STRENGTH VALUES LISTED ABOVE ARE FOR INSPECTION TEST PURPOSES ONLY: NOT FOR DESIGN.
3. CONFIGURATION OF NUT ELEMENT AND BARREL WITHIN ENVELOPE IS OPTIONAL.
4. NUTS FURNISHED UNDER THIS PART NUMBER MUST BE CAPABLE OF BEING RETAINED BY CORRESPONDING DASH NUMBER OF NAS578 RETAINER. (1-17 NUT MUST BE RETAINED BY -16 RETAINER.)
   - (a) DASH NUMBERS 17 AND 18 THROUGH 24 ARE SUBJECT TO SATISFACTORY TEST BY A FIRST USER. THEIR DIMENSIONS ARE DESIRED BUT MUST BE PROVEN AS ADEQUATE.
   - (b) TENSILE LOAD RATE IS BASED ON APPLICATION OF TENSILE LOAD AT A RATE OF 1000,000 PSI PER MINUTE IN THE NOMINAL SHANK AREA OF MATING BOLT.
5. CODES CROSSED OUT - INACTIVE FOR DESIGN AFTER 7-1-62. SUPERSEDED BY "A" OR "F" CODE.
6. NUTS SHALL BE MAGNETICALLY INSPECTED 100% WITH THE MAGNETIZED FIELD NORMAL TO AXIS OF NUT THREAD. BARREL SHALL BE 100% MAGNETICALLY INSPECTED WITH THE MAGNETIZED FIELD NORMAL TO THE LONGITUDINAL AXIS OF THE BARREL.

F05-101

Figure 5-102. Drawing NAS-577



⑥

DASH NUMBER			(b) THREAD T	A MAX	B DIA MAX	C ±.005	D DIA MIN	E(a) MAX	F RIVET EDGE DISTANCE		G DIA ±.010	H MAX	J ±.002	K DIA +.005 -.000	P MAX	V MAX	WEIGHT LBS/100	
450°F STEEL	450°F CRES(e)	800°F CRES(e)							MAX(c)	MIN							AVG (REF)	MAX
A06	C06M	C06	6-32 UNC-3B	.637	.265	.344	—	.171	.145	.100	.200	.270	.486	.098	.206	.047	.20	.25
A08	C08M	C08	8-32 UNC-3B	.637	.297	.344	.168	.250	.145	.100	.200	.270	.486	.098	.248	.047	.23	.28
A3	C3M	C3	10-32 UNF-3B	.653	.328	.344	.194	.250	.145	.100	.200	.270	.486	.098	.274	.047	.24	.29
A4	C4M	C4	1/4-28 UNF-3B	.852	.414	.500	.254	.281	.145	.100	.200	.383	.707	.098	.344	.055	.47	.58
A5	C5M	C5	5/16-24 UNF-3B	.914	.505	.500	.317	.328	.161	.125	.230	.383	.707	.130	.417	.065	.73	.85
A6	C6M	C6	3/8-24 UNF-3B	.968	.614	.500	.379	.344	.161	.125		.383	.707	.130	.505	.075	1.08	1.31
A7	C7M	C7	7/16-20 UNF-3B	1.101	.726	.562	.442	.390	.176	.156		.427	.795	.161	.602	.085	1.61	1.84

(a) MINIMUM "E" NOT SPECIFIED, LIMITED ONLY BY STRENGTH REQUIREMENT OF SPECIFICATION.

⑥ (b) THE CENTER OF THE TAPPED HOLE SHALL NOT DEVIATE IN ANY DIRECTION FROM THE CENTER OF THE PLATE NUT AS DETERMINED BY THE RIVET HOLES, BY MORE THAN .005

(c) THREADS PER MIL-S-7742 BEFORE LUBRICATION.

(d) ON SIZES NO. 6 & SMALLER CSK TO D DIA.

(e) MAGNETIC PERMEABILITY SHALL BE LESS THAN 2.0 (AIR=1.0) FOR A FIELD STRENGTH H = 200 OERSTEDS USING A MAGNETIC PERMEABILITY INDICATOR PER MIL-I-17214

⑥ CODE: DASH NO. SUFFIXED BY K BACK CSK OR DIMPLED RIVET HOLES.
INSERT "X" IN LIEU OF "A" IN THE 450°F STEEL CODE FOR CADMIUM PLATED STEEL NUTS WITHOUT LUBRICANT.

EXAMPLES OF PART NUMBERS:

⑥
NAS684A4 = 1/4-28 PLATE NUT, ALL METAL, PLAIN RIVET HOLES, 450°F MAX.
NAS684A4K = 1/4-28 PLATE NUT, ALL METAL CONSTRUCTION WITH BACK CSK OR DIMPLED RIVET HOLES.
NAS684C4 = 1/4-28 PLATE NUT, ALL METAL, A286 CRES, 800°F MAX.
NAS684C4M = 1/4-28 PLATE NUT, ALL METAL, A286 CRES, 450°F MAX, WITH APPROVED DRY FILM LUBRICANT.
NAS684X4 = 1/4-28 PLATE NUT, ALL METAL, PLAIN RIVET HOLES, 450°F MAX, WITHOUT LUBRICANT.

MATERIAL:
NUT AND BASE: STEEL. SEE PROCUREMENT SPECIFICATION.
CRES. A286 FOR AMS 5525, NON-MAGNETIC.

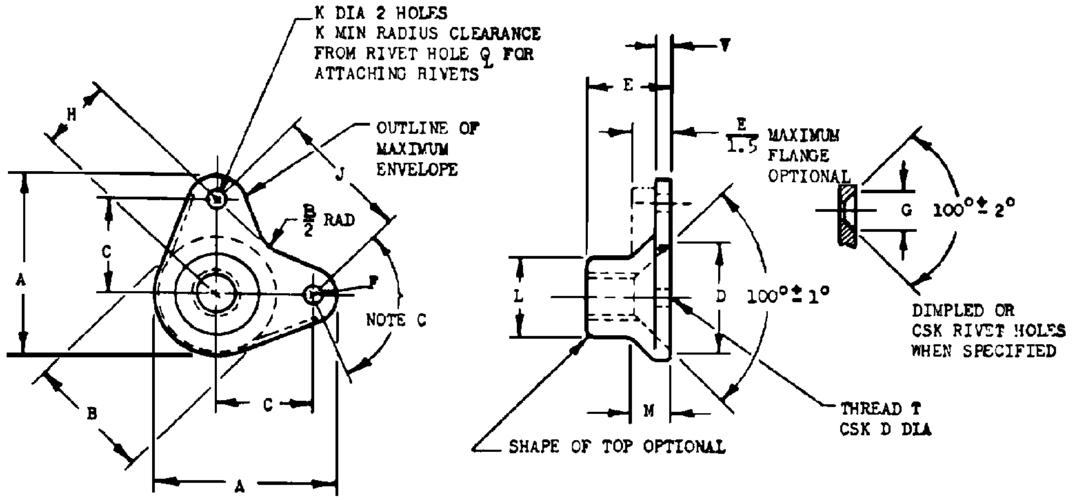
⑥ FINISH:
STEEL: CADMIUM PLATE PER QQ-P-416 TYPE II CLASS 3 PLUS ON APPROVED DRY FILM LUBRICANT.
CRES: SILVER PLATE FOR 800°F USE PER AMS2410 TO A .0002 MIN. THICKNESS ON SURFACES WHICH CAN BE TOUCHED BY A 3/4 INCH BALL. THREADS SHALL SHOW COMPLETE COVERAGE, BUT THICKNESS REQUIREMENT ON THREADS IS WAIVED.
CRES: APPROVED DRY FILM LUBRICANT FOR 450°F USE.

⑥ PROCUREMENT SPECIFICATION:
MIL-N-25027 EXCEPT AS NOTED. ALL NUTS SHALL MEET QUALIFICATION AND INSPECTION REQUIREMENTS. MANUFACTURERS SHALL PROVIDE EVIDENCE OF QUALIFICATION WHEN REQUIRED. TESTING SHALL BE PERFORMED BY MANUFACTURER OR INDEPENDENT LABORATORY. PROCURING AGENCY MAY CONDUCT CONFIRMING QUALIFICATION TESTS. NO QPL SHALL BE ESTABLISHED.

NOTE: AXIAL STRENGTH REQUIREMENTS PER MIL-N-25027 TABLE I VALUES FOR STEEL NUTS. DIMENSIONS IN INCHES.

F05-102

Figure 5-103. Drawing NAS-684



⑥

DASH NUMBER			(b) THREAD T	A MAX	B DIA MAX	C ± 005	D DIA ± 005	E(a) MAX	F RIVET EDGE DISTANCE		G DIA ± 010	H MAX	J ± 002	K DIA +.005 -.000	L DIA MAX	M REF	V MAX	WEIGHT LBS/100	
450°F STEEL	450°F CRES(d)	800°F CRES(d)							MAX(c)	MIN								AVG (REF)	MAX
A08	C08M	C08	8-32 UNC-3B	.700	.422	.344	.365	.272	.145	.100	.200	.270	.486	.098	.297	.084	.047	.28	.34
A3	C3M	C3	10-32 UNF-3B	.716	.453	.344	.411	.281	.145	.100	.200	.270	.486	.098	.328	.093	.047	.31	.38
A4	C4M	C4	1/4-28 UNF-3B	.955	.619	.500	.540	.340	.145	.100	.200	.383	.707	.098	.414	.121	.055	.60	.78
A5	C5M	C5	5/16-24 UNF-3B	1.044	.766	.500	.686	.422	.161	.125	.230	.383	.707	.130	.505	.156	.065	.93	1.06

(a) MINIMUM "E" NOT SPECIFIED, LIMITED ONLY BY STRENGTH REQUIREMENT OF SPECIFICATION.

⑥ (b) THE CENTER OF THE TAPPED HOLE SHALL NOT DEVIATE IN ANY DIRECTION FROM THE CENTER OF THE PLATE NUT AS DETERMINED BY THE RIVET HOLES, BY MORE THAN .005.

(c) THREADS PER MIL-S-7742 BEFORE LUBRICATION.

(d) MAGNETIC PERMEABILITY SHALL BE LESS THAN 2.0 (AIR = 1.0) FOR A FIELD STRENGTH H = 200 OERSTEDS USING A MAGNETIC PERMEABILITY INDICATOR PER MIL-I-17214 OR EQUIVALENT.

⑥ CODE: DASH NO. SUFFIXED BY K BACK CSK OR DIMPLED RIVET HOLES.
INSERT "X" IN LIEU OF "A" IN THE 450°F STEEL CODE FOR CADMIUM PLATED STEEL NUTS WITHOUT LUBRICANT.

EXAMPLES OF PART NUMBERS:

⑥
NAS685A4 = 1/4-28 PLATE NUT, ALL METAL, PLAIN RIVET HOLES, 450°F MAX.
NAS685A4K = 1/4-28 PLATE NUT, ALL METAL CONSTRUCTION WITH BACK CSK OR DIMPLED RIVET HOLES.
NAS685C4 = 1/4-28 PLATE NUT, ALL METAL, A286 CRES, 800°F MAX.
NAS685C4M = 1/4-28 PLATE NUT, ALL METAL, A286 CRES, 450°F MAX, WITH APPROVED DRY FILM LUBRICANT.
NAS685X4 = 1/4-28 PLATE NUT, ALL METAL, PLAIN RIVET HOLES, 450°F MAX, WITHOUT LUBRICANT.

MATERIAL:
NUT AND BASE: STEEL. SEE PROCUREMENT SPECIFICATION.
CRES. A286 PER AMS 5525, NON-MAGNETIC.

FINISH:

⑥
STEEL: CADMIUM PLATE PER QQ-P-416 TYPE II CLASS 3 PLUS AN APPROVED DRY FILM LUBRICANT.
CRES: SILVER PLATE FOR 800°F USE PER AMS2410 TO A .0002 MIN. THICKNESS ON SURFACES WHICH CAN BE TOUCHED BY A 3/4 INCH BALL. THREADS SHALL SHOW COMPLETE COVERAGE, BUT THICKNESS REQUIREMENT ON THREADS IS WAIVED.
CRES: APPROVED DRY FILM LUBRICANT FOR 450°F USE.

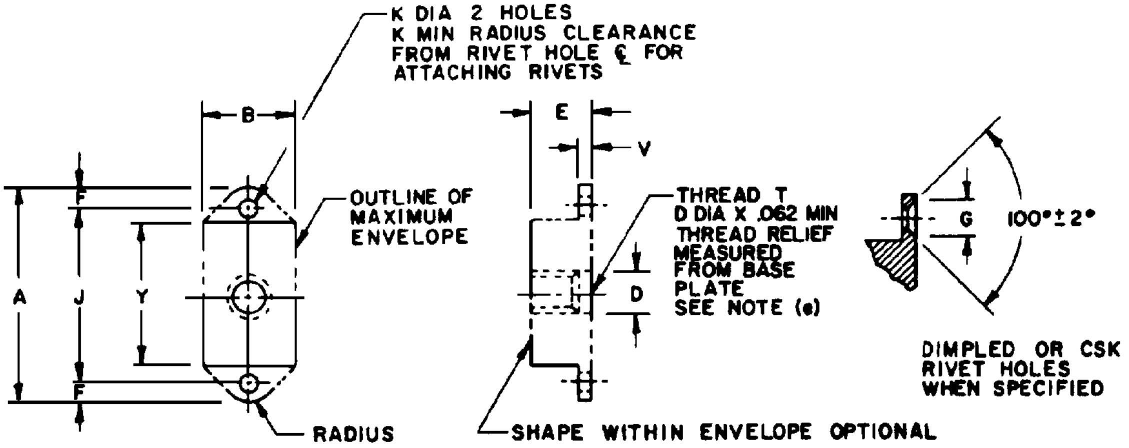
PROCUREMENT SPECIFICATION:

⑥ MIL-N-25027 EXCEPT AS NOTED. ALL NUTS SHALL MEET QUALIFICATION AND INSPECTION REQUIREMENTS. MANUFACTURERS SHALL PROVIDE EVIDENCE OF QUALIFICATION WHEN REQUIRED. TESTING SHALL BE PERFORMED BY MANUFACTURER OR INDEPENDENT LABORATORY. PROCURING AGENCY MAY CONDUCT CONFIRMING QUALIFICATION TESTS. NO QPL SHALL BE ESTABLISHED.

NOTE: AXIAL STRENGTH REQUIREMENTS PER MIL-N-25027 TABLE I VALUES FOR STEEL NUTS. DIMENSIONS IN INCHES.

F05-103

Figure 5-104. Drawing NAS-685



⑤ DASH NUMBER			(c) THREAD T	A MAX	B MAX	D DIA	E(a) MAX	F MIN	G DIA ±.010	J(b) ±.002	K DIA +.005 -.000	V MAX	Y MAX	WEIGHT	
450°F STEEL	450°F CRES(f)	800°F CRES(f)												AVG (REF)	MAX
A04	C04M	C04	4-40 UNC-3B	.948	.416	--	.175	.100	.200	.688	.098	.032	.590	.31	.38
A06	C06M	C06	6-32 UNC-3B	.948	.416	--	.203	.100	.200	.688	.098	.032	.590	.32	.39
A08	C08M	C08	8-32 UNC-3B	.948	.416	.168	.250	.100	.200	.688	.098	.032	.590	.33	.40
A3	C3M	C3	10-32 UNF-3B	.948	.416	.194	.250	.100	.200	.688	.098	.032	.590	.34	.41
A4	C4M	C4	1/4-28 UNF-3B	1.292	.516	.254	.281	.100	.200	1.000	.098	.032	.870	.69	.90
A5	C5M	C5	5/16-24 UNF-3B	1.292	.609	.317	.328	.125	.230	1.000	.130	.045	.870	1.02	1.26
A6	C6M	C6	3/8-24 UNF-3B	1.292	.680	.379	.344	.125		1.000	.130	.055	.870	1.37	1.55

(a) MINIMUM "E" NOT SPECIFIED, LIMITED ONLY BY STRENGTH REQUIREMENTS OF SPECIFICATION.
(b) FLOAT OF NUT PORTION OF ASSEMBLY SHALL NOT BE LESS THAN .030 NOR MORE THAN .040 INCHES LATERALLY AND LONGITUDINALLY FROM CENTERED POSITION. NUT BODY SHALL BE CAPABLE OR ENGAGEMENT WITH A BOLT IN THE MAXIMUM MISALIGNED POSITION. MAXIMUM AXIAL FLOAT .020 INCHES.
(c) THREADS PER MIL-S-7742 BEFORE LUBRICATION.
(d) THE ASSEMBLY SHALL PROVIDE A BEARING SURFACE FOR THE NUT WITHIN THE HOUSING.
NOTE: THE NUT AND BASE PORTION OF THE ASSEMBLY SHALL FORM ONE INTEGRAL UNIT.
(e) ON SIZE NUMBER 6 AND SMALLER CSK TO D DIAMETER.
(f) MAGNETIC PERMEABILITY SHALL BE LESS THAN 2.0 (AIR = 1.0) FOR A FIELD STRENGTH H = 200 OERSTEDS USING A MAGNETIC PERMEABILITY INDICATOR PER MIL-I-17214 OR EQUIVALENT.

CODE: DASH NUMBER SUFFIXED BY K = BACK CSK OR DIMPLED RIVET HOLES.
INSERT "X" IN LIEU OF "A" IN THE 450°F STEEL CODE FOR CADMIUM PLATED STEEL NUTS WITHOUT LUBRICANT.

EXAMPLES OF PART NUMBERS: ⑤
NAS686A4 = 1/4-28 PLATE NUT, ALL METAL, PLAIN RIVET HOLES, 450°F MAX.
NAS686A4K = 1/4-28 PLATE NUT, ALL METAL CONSTRUCTION WITH BACK CSK OR DIMPLED RIVET HOLES.
NAS686C4 = 1/4-28 PLATE NUT, ALL METAL, A286 CRES, 800°F MAX.
NAS686C4M = 1/4-28 PLATE NUT, ALL METAL, A286 CRES, 450°F MAX, WITH APPROVED DRY FILM LUBRICANT.
NAS686X4 = 1/4-28 PLATE NUT, ALL METAL, PLAIN RIVET HOLES, 450°F MAXIMUM WITHOUT LUBRICANT.

MATERIAL: NUT AND BASE: STEEL. SEE PROCUREMENT SPECIFICATION.
CRES. A286 PER AMS 5525, NON-MAGNETIC.

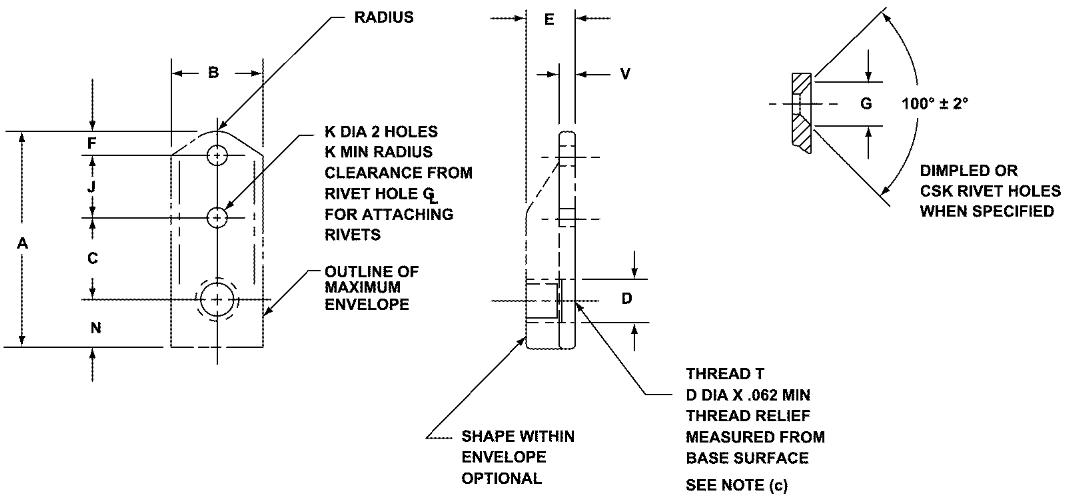
FINISH: STEEL - CADMIUM PLATE PER QQ-P-416 TYPE I OR II CLASS 3 PLUS AN APPROVED DRY FILM LUBRICANT.
CRES - SILVER PLATE, 800°F USE.
CRES - APPROVED DRY FILM LUBRICANT FOR 450°F USE.

⑤ PROCUREMENT SPECIFICATION:
MIL-N-25027, EXCEPT AS NOTED. ALL NUTS SHALL MEET QUALIFICATION AND INSPECTION REQUIREMENTS. MANUFACTURER SHALL PROVIDE EVIDENCE OF QUALIFICATION WHEN REQUIRED. TESTING SHALL BE PERFORMED BY MANUFACTURER OR INDEPENDENT LABORATORY. PROCURING AGENCY MAY CONDUCT CONFIRMING QUALIFICATION TESTS. NO QPL SHALL BE ESTABLISHED.

NOTE: AXIAL STRENGTH REQUIREMENTS PER MIL-N-25027 TABLE I VALUES FOR REGULAR STEEL NUTS.
DIMENSIONS IN INCHES.

F05-104

Figure 5-105. Drawing NAS-686



⑥

DASH NUMBER			(c) THREAD T	A MAX	B MAX	C(b) ±.005	D DIA MIN	E(a) MAX	F		G DIA ±.010	J ±.002	K DIA + .005 - .000	N MAX	V MAX	WEIGHT LBS/100	
450°F STEEL	450°F CRES(f)	800°F CRES(f)							MAX	MIN						AVG (REF)	MAX
A04	C04M	C04	4-40 UNF-3B	1.051	.422	.344	—	.175	.130	.100	.200	.312	.098	.275	.032	.42	.52
A06	C06M	C06	6-32 UNF-3B	1.051	.422	.344	—	.203	.130	.100	.200	.312	.098	.275	.032	.43	.53
A08	C08M	C08	8-32 UNF-3B	1.051	.422	.344	.168	.250	.130	.100	.200	.312	.098	.275	.032	.44	.54
A3	C3M	C3	10-32 UNF-3B	1.051	.422	.344	.194	.250	.130	.100	.200	.312	.098	.275	.032	.45	.56
A4	C4M	C4	1/4-28 UNF-3B	1.306	.531	.500	.254	.281	.130	.100	.200	.312	.098	.364	.032	.80	.93
A5	C5M	C5	5/16-24 UNF-3B	1.396	.641	.500	.317	.328	.141	.125	.230	.312	.130	.440	.045	1.17	1.44

(a) MINIUM "E" NOT SPECIFIED, LIMITED ONLY BY STRENGTH REQUIREMENT OF SPECIFICATION.

(b) FLOAT OF NUT PORTION OF ASSEMBLY SHALL NOT BE LESS THAN .030 NOR MORE THAN .040 INCHES LATERALLY AND LONGITUDINALLY FROM CENTERED POSITION. NUT BODY SHALL BE CAPABLE OF ENGAGEMENT WITH A BOLT IN THE MAXIMUM MISALIGNED POSITION. MAXIMUM AXIAL FLOAT .020 INCHES.

(c) THREADS PER MIL-S-7742 BEFORE LUBRICATION.

(d) ON SIZES NO. 6 & SMALLER CSK TO D DIA.

(e) MAGNETIC PERMEABILITY SHALL BE LESS THAN 2.0 (AIR = 1.0) FOR A FIELD STRENGTH H = 200 OERSTEDS USING A MAGNETIC. PERMEABILITY INDICATOR PER MIL-I-17214 OR EQUIVALENT.

⑥ CODE: DASH NO. SUFFIXED BY K BACK CSK OR DIMPLED RIVET HOLES.
INSERT "X" IN LIEU OF "A" IN THE 450°F STEEL CODE FOR CADMIUM PLATED STEEL NUTS WITHOUT LUBRICANT.

⑥ EXAMPLES OF PART NUMBERS:
NAS687A4 = 1/4-28 PLATE NUT, ALL METAL, PLAIN RIVET HOLES, 450°F MAX.
NAS687A4K = 1/4-28 PLATE NUT, ALL METAL CONSTRUCTION WITH BACK CSK OR DIMPLED RIVET HOLES.
NAS687C4 = 1/4-28 PLATE NUT, ALL METAL, A286 CRES, 800°F MAX.
NAS687C4M = 1/4-28 PLATE NUT, ALL METAL, A286 CRES, 450°F MAX, WITH APPROVED DRY FILM LUBRICANT.
NAS687X4 = 1/4-28 PLATE NUT, ALL METAL, PLAIN RIVET HOLES, 450°F MAX, WITHOUT LUBRICANT.

MATERIAL:
NUT AND BASE: STEEL. SEE PROCUREMENT SPECIFICATION.
CRES. A286 PER AMS5525, NON-MAGNETIC.

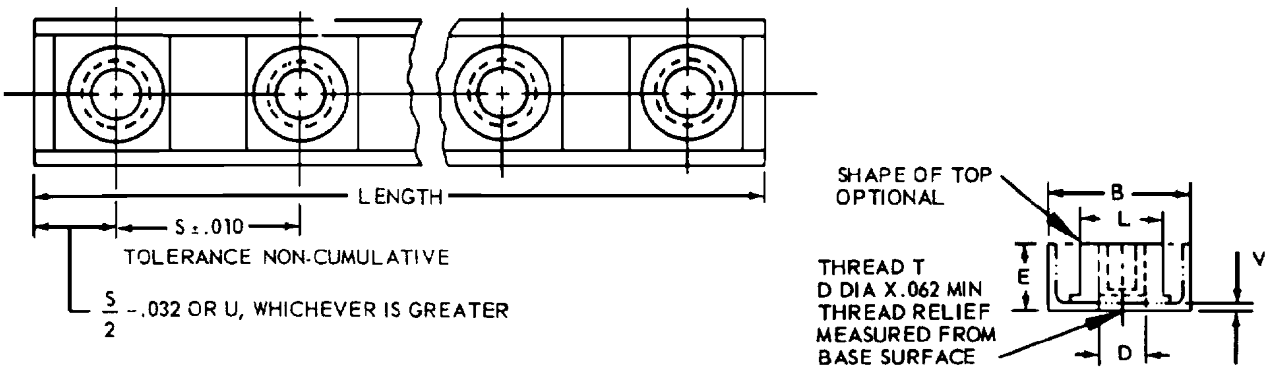
⑥ FINISH:
STEEL: CADMIUM PLATE PER QQ-P-416 TYPE II CLASS 3 PLUS AN APPROVED DRY FILM LUBRICANT.
CRES: SILVER PLATE FOR 800°F USE PER AMS2410 TO A .0002 MIN. THICKNESS ON SURFACES WHICH CAN BE TOUCHED BY A 3/4 INCH BALL. THREADS SHALL SHOW COMPLETE COVERAGE, BUT THICKNESS REQUIREMENT ON THREADS IS WAIVED. NUT RETAINING CAGE OPTIONAL.
CRES: APPROVED DRY FILM LUBRICANT FOR 450°F USE.

⑥ PROCUREMENT SPECIFICATION:
MIL-N-25027 EXCEPT AS NOTED. ALL NUTS SHALL MEET QUALIFICATION AND INSPECTION REQUIREMENTS. MANUFACTURERS SHALL PROVIDE EVIDENCE OF QUALIFICATION WHEN REQUIRED. TESTING SHALL BE PERFORMED BY MANUFACTURER OR INDEPENDENT LABORATORY, .PROCURING AGENCY MAY CONDUCT CONFIRMING QUALIFICATION TESTS. NO QPL SHALL BE ESTABLISHED.

NOTE: AXIAL STRENGTH REQUIREMENTS PER MIL-N-25027 TABLE I VALUES FOR STEEL NUTS. DIMENSIONS IN INCHES.

F05-105

Figure 5-106. Drawing NAS-687



BASIC PART NUMBER	TYPE CODE LETTER		THREAD(d) T	B MAX	D(b) DIA MIN	E(a) MAX	L DIA MAX	MIN S NUT SPACING	U MIN	V MAX
	250° AL ALLOY CHANNEL ALL METAL NUT	500° CRES CHANNEL ALL METAL NUT								
NAS688	P	A	8-32 UNC-3B	.416	.168	.250	.297	.625	.343	.035
NAS689			10-32 UNF-3B	.416	.194	.250	.328	.625	.343	.035
NAS690			1/4-28 UNF-3B	.516	.254	.281	.414	.750	.406	.045
NAS691			5/16-24 UNF-3B	.609	.317	.328	.505	.750	.469	.045
NAS692			3/8-24 UNF-3B	.726	.379	.344	.614	1.000	.562	.055

(a) "E MAX" APPLIES TO NUT AND CHANNEL, MIN "E" NOT SPECIFIED, LIMITED ONLY BY STRENGTH REQUIREMENTS OF SPECIFICATION.

(b) FLOAT OF NUT PORTION OF ASSEMBLY SHALL NOT BE LESS THAN .030 NOR MORE THAN .040 LONGITUDINALLY AND NOT LESS THAN .010 NOR MORE THAN .030 LATERALLY FROM CENTERED POSITION. NUT BODY SHALL BE CAPABLE OF ENGAGEMENT WITH A BOLT IN THE MAXIMUM MISALIGNMENT POSITION. MAXIMUM AXIAL FLOAT .020 INCHES FOR NAS688 AND NAS689; .030 FOR LARGER SIZES.

(c) THE ASSEMBLY SHALL PROVIDE A BEARING SURFACE FOR THE NUT WITHIN THE HOUSING.

(d) THREADS PER MIL-S-7742 BEFORE LUBRICATION.

(e) THE CENTERLINE OF THE CHANNEL SHALL NOT DEVIATE FROM A STRAIGHT LINE BY MORE THAN .015 IN ANY 12 INCHES.

NOTE: THE NUT AND BASE PORTION OF THE ASSEMBLY SHALL FORM ONE INTEGRAL UNIT.

CODE: PART NUMBER = NUT THREAD SIZE
1st DASH NO. PREFIXED BY: P = ALL METAL NUT, ALUMINUM ALLOY CHANNEL, MAXIMUM TEMPERATURE 250°F.
A = ALL METAL NUT, CRES CHANNEL, MAXIMUM TEMPERATURE 500°F.
ADD "X" TO CODE LETTER TO SPECIFY PARTS WITHOUT LUBRICANT.
1st DASH NO. = NUT SPACING (SEE TABLE).
2nd DASH NO. = NO. OF NUTS IN STRIP (NOT TO EXCEED MAX SHOWN IN TABLE). OMISSION OF 2nd DASH NO. INDICATES STOCK LENGTH STRIP APPROX 72 INCHES LONG.

EXAMPLES OF PART NUMBERS:
NAS689P6-10 = 10-32 GANG CHANNEL NUT, ALL METAL, ALUMINUM ALLOY CHANNEL, 3/4 NUT SPACING, 10 NUTS.
NAS690A7-12 = 1/4-28 GANG CHANNEL NUT, ALL METAL NUT, CRES CHANNEL, 7/8 NUT SPACING, 12 NUTS.
NAS690A7 = 1/4-28 GANG CHANNEL NUT, ALL METAL NUT, CRES CHANNEL, 7/8 NUT SPACING, APPROX 72 INCHES LONG.

MATERIALS: SEE PROCUREMENT SPECIFICATION.
NUT – STEEL
CHANNEL – ALUMINUM ALLOY
– CORROSION RESISTANT STEEL

FINISH: SEE PROCUREMENT SPECIFICATION.

LUBRICANT: MOLYBDENUM DISULFIDE ON NUT ELEMENTS.

PROCUREMENT SPECIFICATION:
MIL-N-25027
AXIAL STRENGTH REQUIREMENTS PER TABLE 1 VALUES FOR REGULAR STEEL NUTS.

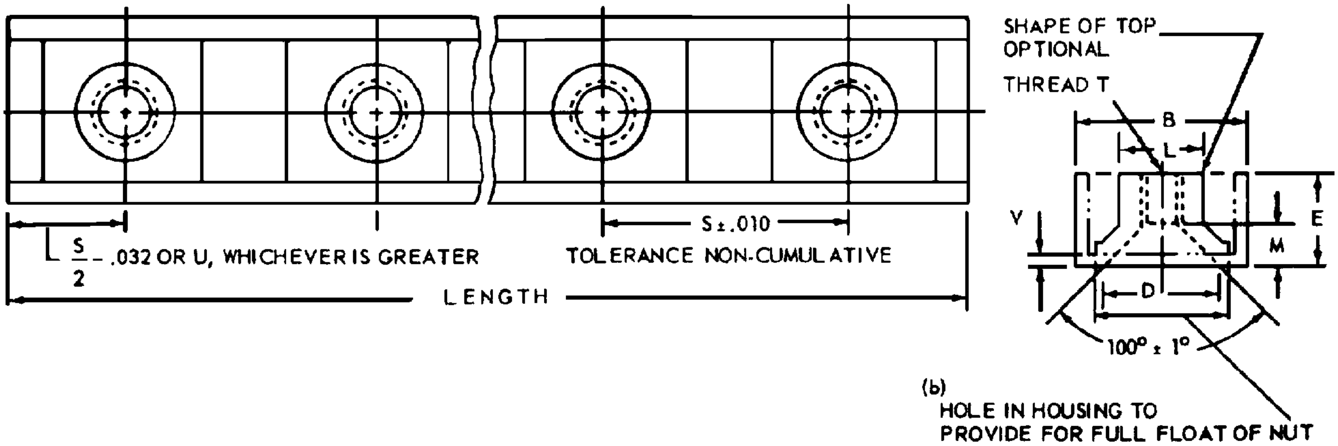
DIMENSIONS IN INCHES

④ EDITORIALLY UPDATED

S NUT SPACING	FIRST DASH NO.	MAX NO. NUTS
.625	5	115
.750	6	96
.875	7	82
1.000	8	72
1.125	9	64
1.250	10	57
1.375	11	52
1.500	12	48
1.625	13	44
1.750	14	41
1.875	15	38
2.000	16	36
2.250	18	32
2.500	20	28
3.000	24	24

F05-106

Figure 5-107. Drawing NAS-688 thru 692



BASIC PART NUMBER	TYPE CODE LETTER		THREAD[d] T	B MAX	D DIA ±.005	E[a] MAX	L DIA MAX	M REF	MIN S NUT SPACING	U MIN	V MAX
	250° AL ALLOY CHANNEL ALL METAL NUT	500° CRES CHANNEL ALL METAL NUT									
NAS693	P	A	8-32 UNC-3B	.593	.365	.272	.297	.084	.625	.406	.035
NAS694			10-32 UNF-3B	.593	.411	.281	.328	.093	.625	.406	.035
NAS695			1/4-28 UNF-3B	.874	.540	.340	.414	.121	1.000	.562	.045

(a) MINIMUM "E" NOT SPECIFIED, LIMITED ONLY BY STRENGTH REQUIREMENTS OF SPECIFICATION

(b) FLOAT OF NUT PORTION OF ASSEMBLY SHALL NOT BE LESS THAN .030 NOR MORE THAN .040 LONGITUDINALLY AND NOT LESS THAN .010 NOR MORE THAN .030 LATERALLY FROM CENTERED POSITION. NUT BODY SHALL BE CAPABLE OF ENGAGEMENT WITH A BOLT IN THE MAX MISALIGNMENT POSITION. MIN HOLE IN HOUSING = D + FULL FLOAT OF NUT MAX AXIAL FLOAT .020 INCHES FOR NAS603 AND NAS694 .030 FOR LARGER SIZES.

(c) THE ASSEMBLY SHALL PROVIDE A BEARING SURFACE FOR THE NUT WITHIN THE HOUSING.

(d) THREADS PER MIL-S-7742 BEFORE LUBRICATION

(e) THE CENTERLINE OF THE CHANNEL SHALL NOT DEVIATE FROM A STRAIGHT LINE BY MORE THAN .015 IN ANY 12 INCHES.

NOTE: THE NUT AND BASE PORTION OF THE ASSEMBLY SHALL FORM ONE INTEGRAL UNIT.

CODE: PART NUMBER = NUT THREAD SIZE
1ST DASH NO. PREFIXED BY: P = ALL METAL NUT, ALUMINUM ALLOY CHANNEL
MAXIMUM TEMPERATURE 250°F.
A = ALL METAL NUT, CRES CHANNEL,
MAXIMUM TEMPERATURE 500°F.
ADD "X" TO CODE LETTER TO SPECIFY PARTS
WITHOUT LUBRICANT.
1ST DASH NO. = NUT SPACING (SEE TABLE)
2ND DASH NO. = NO. OF NUTS IN STRIP (NOT TO EXCEED MAX SHOWN IN TABLE) OMISSION OF
2ND DASH NO. INDICATES STOCK LENGTH STRIP APPROX 72 INCHES LONG.

EXAMPLES OF PART NUMBERS:
NAS694P6-10 = 10-32 GANG CHANNEL NUT, ALL METAL, ALUMINUM ALLOY CHANNEL,
3/4 NUT SPACING, 10 NUTS.
NAS695A7-12 = 1/4-28 GANG CHANNEL NUT, ALL METAL NUT, CRES CHANNEL,
7/8 NUT SPACING, 12 NUTS.
NAS695A7 = 1/4-28 GANG CHANNEL NUT, ALL METAL NUT, CRES CHANNEL,
7/8 NUT SPACING, APPROX. 72 INCHES LONG.

MATERIALS: SEE PROCUREMENT SPECIFICATION.
NUT - STEEL
CHANNEL - ALUMINUM ALLOY
- CORROSION RESISTANT STEEL.

FRESH: SEE PROCUREMENT SPECIFICATION.

LUBRICANT: MOLYBDENUM DISULFIDE ON NUT ELEMENTS.

PROCUREMENT SPECIFICATION:
MIL-N-25027
AXIAL STRENGTH REQUIREMENTS PER TABLE I VALUES FOR REGULAR STEEL NUTS.

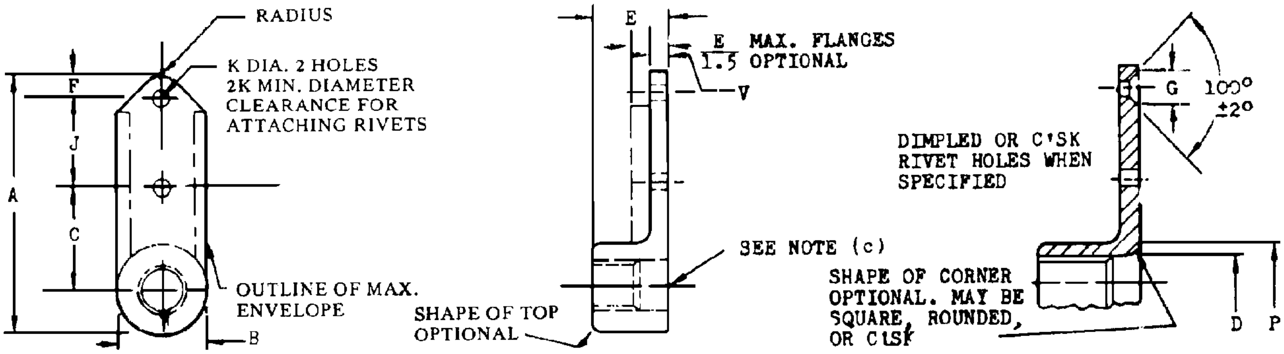
DIMENSIONS IN INCHES

④ EDITORIALLY UPDATED

S NUT SPACING	FIRST DASH NO.	MAX NO. NUTS
.625	5	115
.750	6	96
.875	7	82
1.000	8	72
1.125	9	64
1.250	10	57
1.375	11	52
1.500	12	48
1.625	13	44
1.750	14	41
1.875	15	38
2.000	16	36
2.250	18	32
2.500	20	28
3.000	24	24

F05-107

Figure 5-108. Drawing NAS-693 thru 695



Dash No.			Thread T	A	B	C (b)	D Dia.	E (a)	F	G Dia.	J (b)	K +.005	P	V
500°F		800°F												
Steel	(e) CRES	(e) CRES		Max.	Max.	±.005	Min.	Max.	Min.	±.010	±.002	-.000	Max.	Max.
A02	C02M	C02	2-56 UNC-3B	.507	.162	.125	.090	.110	.071	(d)	.219	.066	.130	.035
A03	C03M	C03	3-48 UNC-3B	.535	.184	.133	.103	.125	.071	(d)	.219	.066	.143	.035
A04	C04M	C04	4-40 UNC-3B	.550	.194	.148	.116	.143	.071	(d)	.219	.066	.166	.040
A04L	C04LM	C04L	4-40 UNC-3B	.667	.260	.203	.116	.143	.089	.200	.219	.098	.166	.040
A06	C06M	C06	6-32 UNC-3B	.598	.242	.171	.142	.171	.071	(d)	.219	.066	.206	.047
A06L	C06LM	C06L	6-32 UNC-3B	.684	.265	.218	.142	.171	.089	.200	.219	.098	.206	.047
A08	C08M	C08	8-32 UNC-3B	.716	.297	.234	.168	.250	.100	.200	.219	.098	.248	.047
A3	C3M	C3	10-32 UNF-3B	.745	.328	.250	.194	.250	.100	.200	.219	.098	.274	.047
A4	C4M	C4	1/4-28 UNF-3B	.822	.414	.281	.254	.281	.100	.200	.219	.098	.344	.055
A5	C5M	C5	5/16-24 UNF-3B	1.026	.505	.359	.317	.328	.125	.230	.269	.130	.417	.065
A6	C6M	C6	3/8-24 UNF-3B	1.139	.614	.414	.379	.344	.125	.230	.269	.130	.505	.075

(a) Minimum "E" not specified, limited only by strength requirement of specification.
(b) The center of the tapped hole shall not deviate in any direction from the center line of the plate nut as determined by the rivet holes by more than .005.
(c) On size No. 8 and larger, counter bore thread D dia. x .062 deep min. thread relief; on size No. 6 and smaller c'sink to D dia. Threads per MIL-S-7742 before lubrication.
(d) Space will not permit countersink.
(e) Magnetic permeability shall be less than 2.0 (Air=1.0) for a field strength of H=200 oersteds using a magnetic permeability indicator per MIL-I-17214 or equivalent.

CODE: Dash no. suffixed by K = All metal construction, back countersunk or dimpled rivet holes.
The CRES dash number suffixed by M designates an approved dry film lubricant finish.
Insert X in lieu of A in the 500°F steel code for cadmium plated steel nuts without molybdenum disulfide or any other lubricant.

EXAMPLES OF PART NUMBERS:
NAS696A4 = 1/4-28 plate nut, all metal construction, plain rivet holes.
NAS696A4K = 1/4-28 plate nut, all metal construction, countersunk or dimpled rivet holes.
NAS696C4 = 1/4-28 plate nut, all metal construction of A286 CRES, silver plated for 800°F use.
NAS696C4M = 1/4-28 plate nut, all metal construction of A286 CRES with an approved dry film lubricant for 500°F use.
NAS696X4 = 1/4-28 plate nut, all metal construction, plain rivet holes without lubricant.

MATERIAL: Steel. See Performance Specification.
CRES. A286 per AMS 5525.

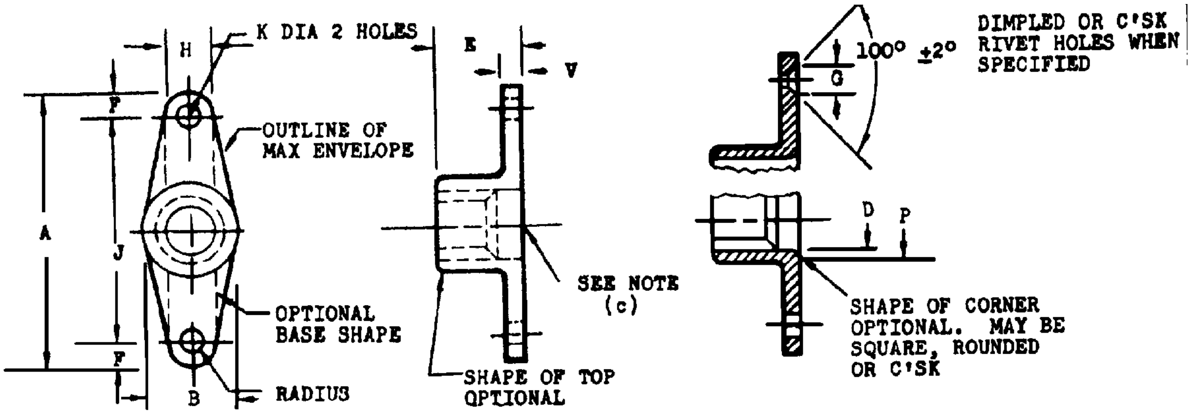
FINISH: Steel - See Performance Specification, plus an approved dry film lubricant.
⑤ CRES - Silver Plate per AMS2410 for 800° use.
CRES - Approved dry film lubricant for 500° use.

NOTE: Axial strength requirements per MIL-N-25027 Table I values for regular steel nuts.

Dimensions in inches.

F05-108

Figure 5-109. Drawing NAS-696



Dash No.			Thread T	A	B	D	E	F	G	H		J	K	P	V
500°F		800°F													
Steel	(e) CRES	(e) CRES		Max.	Max.	Dia. Min.	(a) Max.	Min.	Dia. ±.010	Min.	Max.	(b) ±.002	+.005 -.000	Max.	Max.
A02	C02M	C02	2-56UNC-3B	.410	.162	.090	.110	.071	(d)	.142	.162	.250	.066	.130	.035
A03	C03M	C03	3-48UNC-3B	.425	.184	.103	.125	.071	(d)	.142	.162	.265	.066	.143	.035
A04	C04M	C04	4-40UNC-3B	.456	.194	.116	.143	.071	(d)	.142	.162	.296	.066	.166	.040
A04L	C04LM	C04L	4-40UNC-3B	.630	.260	.116	.143	.089	.200	.178	.260	.406	.098	.166	.040
A06	C06M	C06	6-32UNC-3B	.503	.242	.142	.171	.071	(d)	.142	.162	.343	.066	.206	.047
A06L	C06LM	C06L	6-32UNC-3B	.661	.265	.142	.171	.089	.200	.178	.260	.437	.098	.206	.047
A08	C08M	C08	8-32UNC-3B	.692	.297	.168	.250	.100	.200	.200	.260	.468	.098	.248	.047
A3	C3M	C3	10-32UNF-3B	.724	.328	.194	.250	.100	.200	.200	.260	.500	.098	.274	.047
A4	C4M	C4	1/4-28UNF-3B	.786	.414	.254	.281	.100	.200	.200	.260	.562	.098	.344	.055
A5	C5M	C5	5/16-24UNF-3B	1.006	.505	.317	.328	.125	.230	.250	.290	.718	.130	.417	.065
A6	C6M	C6	3/8-24UNF-3B	1.116	.614	.379	.344	.125	.230	.250	.290	.828	.130	.505	.075

(a) Minimum "E" not specified, limited only by strength requirement of specification.
(b) The center of the tapped hole shall not deviate in any direction from the center of the plate nut as determined by the rivet holes by more than .005.
(c) On size No. 8 and larger, counter bore thread D dia. x .062 deep min. thread relief; on size No. 6 and smaller c'sink to D dia. Threads per MIL-S-7742 before lubrication.
(d) Space will not permit countersink.
(e) Magnetic permeability shall be less than 2.0 (Air=1.0) for a field strength of H=200 oersteds using a magnetic permeability indicator per MIL-I-17214 or equivalent.

CODE: Dash no. suffixed by K = All metal construction, back countersunk or dimpled rivet holes.
The CRES dash number suffixed by M designates an approved dry film lubricant finish.
Insert X in lieu of A in the 500°F steel code for cadmium plated steel nuts without molybdenum disulfide or any other lubricant.

EXAMPLES OF PART NUMBERS:
NAS697A4 = 1/4-28 plate nut, all metal construction, plain rivet holes.
NAS697A4K = 1/4-28 plate nut, all metal construction, back countersunk or dimpled rivet holes.
NAS697C4 = 1/4-28 plate nut, all metal construction of A286 CRES, silver plated for 800°F use.
NAS697C4M = 1/4-28 plate nut, all metal construction of A286 CRES, with an approved dry film lubricant for 500°F use.
NAS697X4 = 1/4-28 plate nut, all metal construction, plain rivet holes without lubricant.

MATERIAL: Steel. See Performance Specification.
CRES. A286 per AMS 5525.

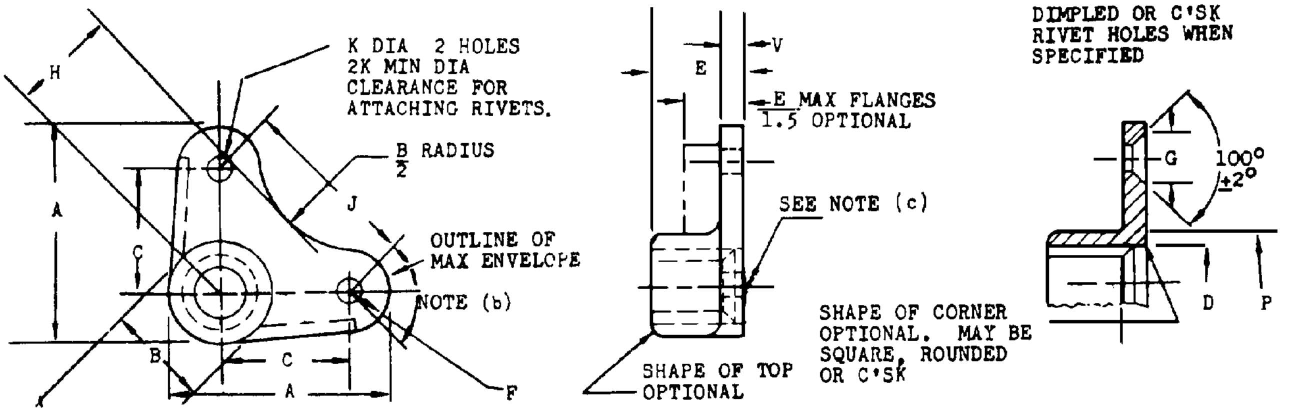
FINISH: ⑤ Steel - See Performance Specification, plus an approved dry film lubricant.
CRES - Silver Plate per AMS2410 for 800°F use.
CRES - Approved dry film lubricant for 500°F use.

NOTE: Axial strength requirements per MIL-N-25027 per Table I values for regular steel nuts.

Dimensions in inches.

F05-109

Figure 5-110. Drawing NAS-697



Dash No.			Thread T	A Max.	B Dia. Max.	C ±.005	D Dia. Min.	E (a) Max.	F (b) Min.	G Dia. ±.010	J ±.002	K(b) +.005 -.000	P Max.	H Max.	V Max.
500°F		800°F													
Steel	(e) CRES	(e) CRES													
A02	C02M	C02	2-56UNC-3B	.288	.162	.125	.090	.110	.071	(d)	.177	.066	.130	.120	.035
A03	C03M	C03	3-48UNC-3B	.316	.184	.138	.103	.125	.071	(d)	.196	.066	.143	.130	.035
A04	C04M	C04	4-40UNC-3B	.331	.194	.148	.116	.143	.071	(d)	.210	.066	.166	.138	.040
A04L	C04LM	C04L	4-40UNC-3B	.448	.260	.203	.116	.143	.089	.200	.287	.098	.166	.215	.040
A06	C06M	C06	6-32UNC-3B	.379	.242	.172	.142	.171	.071	(d)	.243	.066	.206	.148	.047
A06L	C06LM	C06L	6-32UNC-3B	.463	.265	.218	.142	.171	.089	.200	.308	.098	.206	.232	.047
A08	C08M	C08	8-32UNC-3B	.497	.297	.234	.168	.250	.100	.200	.331	.098	.248	.210	.047
A3	C3M	C3	10-32UNF-3B	.526	.328	.250	.194	.250	.100	.200	.354	.098	.274	.215	.047
A4	C4M	C4	1/4-28UNF-3B	.603	.414	.281	.254	.281	.100	.200	.398	.098	.344	.233	.055
A5	C5M	C5	5/16-24UNF-3B	.757	.505	.359	.317	.328	.125	.230	.508	.130	.417	.280	.065
A6	C6M	C6	3/8-24UNF-3B	.870	.614	.414	.379	.344	.125	.230	.585	.130	.505	.303	.075

(a) Minimum "E" not specified, limited only by strength requirement of specification.
(b) Shape of lug optional within limits of "F".
(c) On size No. 8 and larger counter bore thread D dia. x .062 deep min. thread relief; on size No. 6 and smaller c'sink to D dia. Threads per MIL-S-7742 before lubrication
(d) Space will not permit countersink.
(e) Magnetic permeability shall be less than 2.0 (Air=1.0) for a field strength of H=200 oersteds using a magnetic permeability indicator per MIL-I-17214 or equivalent.

CODE: Dash no. suffixed by K = All metal construction, back countersunk or dimpled rivet holes.
The CRES dash number suffixed by M designates an approved dry film lubricant finish.
Insert X in lieu of A in the 500°F steel code for cadmium plated steel nuts without molybdenum disulfide or any other lubricant.

EXAMPLES OF PART NUMBERS:
NAS698A4 = 1/4-28 plate nut, all metal construction, plain rivet holes.
NAS698A4K = 1/4-28 plate nut, all metal construction with back c'sunk or dimpled rivet holes.
NAS698C4 = 1/4-28 plate nut, all metal construction of A286 CRES, silver plated for 800°F use.
NAS698C4M = 1/4-28 plate nut, all metal construction of A286 CRES with an approved dry film lubricant for 500°F use.
NAS698X4 = 1/4-28 plate nut, all metal construction plain rivet holes without lubricant.

MATERIAL: Steel. See Performance Specification.
CRES. A286 per AMS 5525,

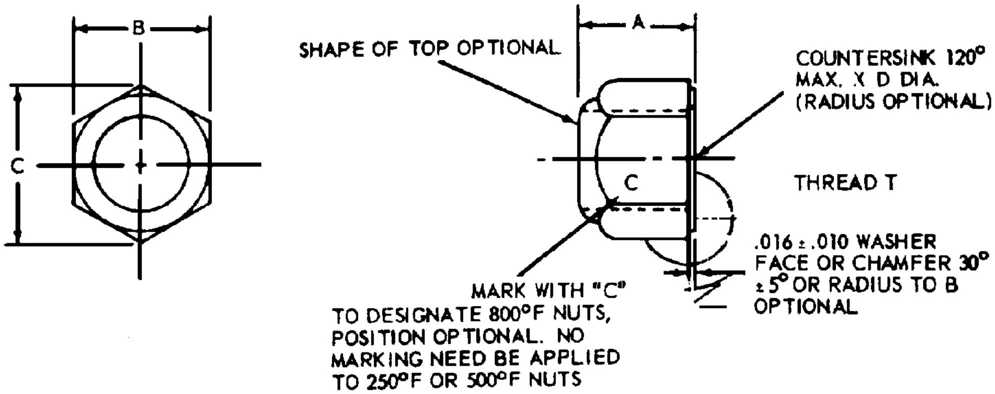
FINISH: Steel - See Performance Specification, plus an approved dry film lubricant.
⑤ CRES - Silver Plate per AMS2410 for 800° use.
CRES - Approved dry film lubricant for 500°F use.

NOTE: Axial strength requirements per MIL-N-25027 Table I values for regular steel nuts.

Dimensions in inches.

F05-110

Figure 5-111. Drawing NAS-698



DASH NUMBERS												
NYLON INSERT			ALL METAL									
AL ALLOY 250°F	STEEL 250°F	COPPER BASE ALLOY 250°F	AL ALLOY 250°F	COPPER BASE ALLOY 250°F	STEEL 500°F	CRES 800°F	THREAD T	B MAX.	B MIN.	(a) A MAX.	C (REF)	D + .020 - .010
D04	N04	B04	H04	E04	A04	C04	No. 4-40 UNC-3B	.252	.240	.157	.290	.131
D06	N06	B06	H06	E06	A06	C06	No. 6-32 UNC-3B	.314	.302	.188	.350	.156
D08	N08	B08	H08	E08	A08	C08	No. 8-32 UNC-3B	.346	.334	(b) .250	.390	.183
D3	N3	B3	H3	E3	A3	C3	No. 10-32 UNF-3B	.377	.365	(b) .250	.430	.210
D4	N4	B4	H4	E4	A4	C4	1/4-28 UNF-3B	.439	.430	(b) .328	.505	.273
D5	N5	B5	H5	E5	A5	C5	5/16-24 UNF-3B	.502	.492	.360	.580	.336
D6	N6	B6	H6	E6	A6	C6	3/8-24 UNF-3B	.564	.553	.469	.650	.398
D7	N7	B7	H7	E7	A7	C7	7/16-20 UNF-3B	.690	.679	.489	.790	.458
D8	N8	B8	H8	E8	A8	C8	1/2-20 UNF-3B	.752	.741	.610	.870	.534
D9	N9	B9	H9	E9	A9	C9	9/16-18 UNF-3B	.877	.865	.704	1.010	.594
D10	N10	B10	H10	E10	A10	C10	5/8-18 UNF-3B	.940	.928	.786	1.080	.656
D12	N12	B12	H12	E12	A12	C12	3/4-16 UNF-3B	1.064	1.052	.891	1.230	.787
D14	N14	B14	H14	E14	A14	C14	7/8-14 UNF-3B	1.252	1.239	1.016	1.440	.913
D16	N16	B16	H16	E16	A16	C16	1-12 UNF-3B	1.440	1.427	1.141	1.660	1.039
D18	N18	B18	H18	E18	A18	C18	1 1/8-12 UNF-3B	1.627	1.614	1.266	1.880	1.166
D20	N20	B20	H20	E20	A20	C20	1 1/4-12 UNF-3B	1.815	1.801	1.454	2.090	1.290
D17	N17	B17	H17	E17	A17	C17	1-14 UNS-3B	1.440	1.427	1.141	1.660	1.039

②

(a) MINIMUM A LIMITED ONLY BY STRENGTH REQUIREMENT OF SPECIFICATION

(b) MAXIMUM A MAY BE .280 FOR HIGH STRENGTH ALUMINUM ALLOY NUTS SIZES 8-32 AND 10-32
MAXIMUM A MAY BE .360 FOR HIGH STRENGTH ALUMINUM ALLOY NUTS SIZE 1/4-28

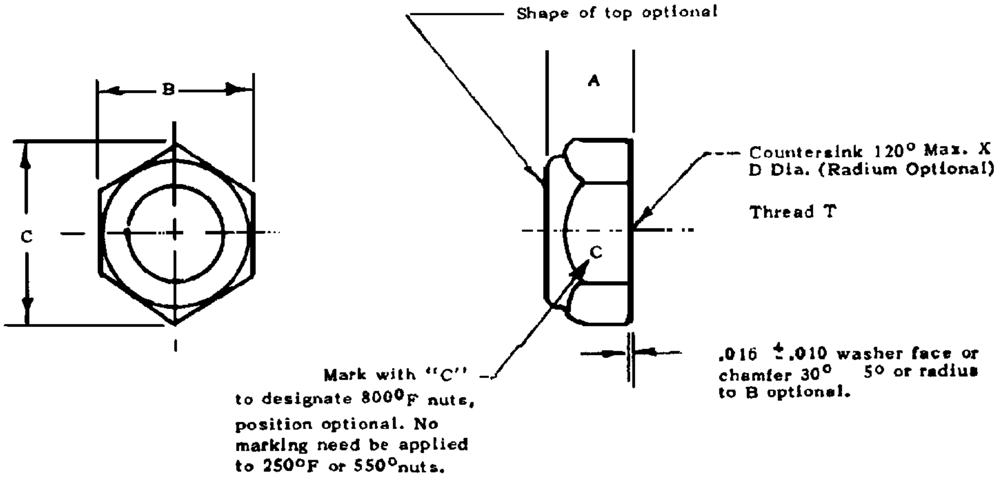
MATERIAL AND FINISH: SEE PROCUREMENT SPECIFICATION

EXAMPLE OF PART NUMBER:
NAS1021A3 = NUT - STEEL WITH 10-32 UNF-3B THREAD FOR USE UP TO 500°F - ALL METAL
NAS1021N3 = NUT - STEEL WITH 10-32 UNF-3B THREAD FOR USE UP TO 250°F - NYLON INSERT

DIMENSIONS IN INCHES

② F05-111

Figure 5-112. Drawing NAS-1021



DASH NUMBERS												
Nylon Insert			All Metal									
Alum. Alloy. 250°F	Steel 250°F	Copper Base Alloy 250°F.	Alum. Alloy 250°F.	Copper Base Alloy 250°F	Steel 550°F	Corr. Reses. Steel 800°F.	Thread T	B		(a) A	C	D .020
								Max	Min	Max	(Ref)	.010
DO6	NO6	BO6	HO6	EO6	AO6	CO6	No. 6-22 NC-3B	.314	.302	.141	.360	.156
DO8	NO8	BO8	HO8	EO8	AO8	CO8	NO. 6-32 NC-3B	.346	.334	.186	.380	.183
D3	N3	B3	H3	E3	A3	C3	No. 10-32 NF-3B	.377	.365	.186	.430	.210
D4	N4	B4	H4	E4	A4	C4	1/4-28 UNF-3B	.430	.430	.216	.506	.273
D5	N5	B5	H5	E5	A5	C5	5/16-24 UNF-3B	.502	.492	.266	.580	.334
D6	N6	B6	H6	E6	A6	C6	3/8-24 UNF-3B	.564	.553	.282	.650	.398
D7	N7	B7	H7	E7	A7	C7	7/16-20 UNF-3B	.690	.679	.328	.780	.465
D8	N8	B8	H8	E8	A8	C8	1/2-20 UNF-3B	.752	.741	.326	.870	.831
D9	N9	B9	H9	E9	A9	C9	9/16-18 UNF-3B	.877	.865	.875	1.010	.894
D10	N10	B10	H10	E10	A10	C10	5/8-18 UNF-3B	.940	.928	.407	1.090	.656
D12	N12	B12	H12	E12	A12	C12	3/4-16 UNF-3B	1.064	1.052	.422	1.230	.787
D14	N14	B14	H14	E14	A14	C14	7/8-14 UNF-3B	1.252	1.239	.485	1.440	.913
D16	N16	B16	H16	E16	A16	C16	1-12 UNF-3B	1.440	1.427	.578	1.660	1.030
D18	N18	B18	H18	E18	A18	C18	1 1/8-12 UNF-3B	1.627	1.614	.672	1.880	1.166
D20	N20	B20	H20	E20	A20	C20	1 1/4-12 UNF-3B	1.815				
D17	N17	B17	H17	E17	A17	C17	1-14 NF-3B	1.440	1.437	.876	1.680	1.636

(a) Minimum A limited only by strength requirements of specification.

Material and Finish: See Specification MIL-N-25027 (ASG).

Performance Specification MIL-N-25027 (ASG).

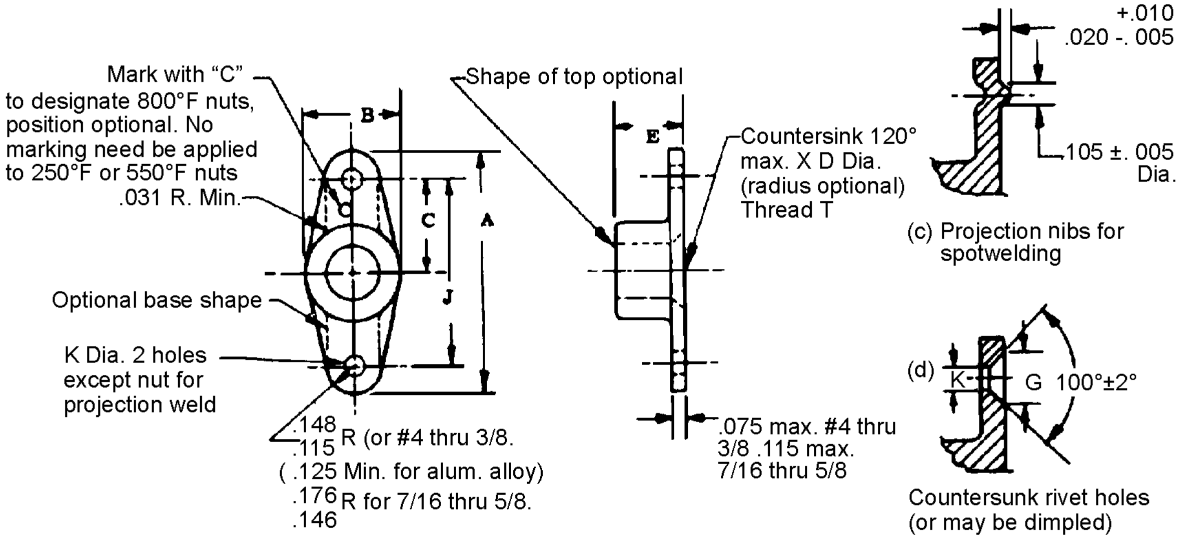
Example of Part Number:

NAS1022 A3 - Nut - Steel with 10-32 thread for use up to 550°F - all metal.
NAS1022 N3 - Nut - Steel with 10-32 thread for use up to 250°F - nylon insert.

Dimensions in inches.

F05-112

Figure 5-113. Drawing NAS-1022



DASH NUMBERS					Thread T	A	(b) B	(a) C	(b) E	D Dia.	J	K Dia.	G Dia.
Nylon Insert		All Metal											
Alum. Alloy 250°F	Steel 250°F	Alum Alloy 250°F	Steel 550°F	Corr. Resis. Steel 800°F		Max.	Max.	Nom.	Max.	+.020 -.010	±.002	+.005 -.000	±.010
DO4	NO4	HO4	AO4	CO4	No. 4-40 NC-3B	.984	.406	.344	.218	.131	.688	.098	.200
DO6	NO6	HO6	AO6	CO6	No. 6-32 NC-3B	.984	.406	.344	.234	.156	.688	.098	.200
DO8	NO8	HO8	AO8	CO8	No. 8-32 NC-3B	.984	.406	.344	.297	.183	.688	.098	.200
D3	NS	H3	A3	C3	No. 10-32 NF-3B	.984	.406	.344	.312	.210	.688	.098	.200
D4	N4	H4	A4	C4	1/4-28 UNF-3B	1.296	.516	.500	.375	.273	1.000	.098	.200
D5	N5	H5	A5	C5	5/16-24 UNF-3B	1.296	.531	.500	.375	.336	1.000	.130	.230
D6	N6	H6	A6	C6	3/8-24 UNF-3B	1.296	.641	.500	.453	.398	1.000	.130	.230
D7	N7	H7	A7	C7	7/16-20 UNF-3B	1.477	.719	.562	.469	.456	1.125	.161	-
D8	N8	H8	A8	C8	1/2-20 UNF-3B	1.602	.859	.625	.609	.531	1.250	.161	-
D9	N9	H9	A9	C9	9/16-18 UNF-3B	1.727	.953	.688	.656	.594	1.375	.161	-
D10	N10	H10	A10	C10	5/6-18 UNF-3B	1.852	1.016	.750	.765	.656	1.500	.161	-

(a) The center of the tapped hole shall not deviate in any direction from the center of the plate mnt as determined by the rivet holes by more than .005.

(b) Minimum B and E limited only by strength requirement of specification.

(c) Nuts for use by welding to have welding projections with nominal spacing equal to dimension J ±.005.

(d) For dimpled rivet type only, tolerance may be K +.015 max. after formin

Material and Finish: See Specification MIL-N-25027(ASG).

Performance Specification MIL-N-25027(ASG).

Add W to end of part number to obtain nuts with welding projection (C code only).
Add K to end of part number to obtain nuts with countersunk rivet holes.

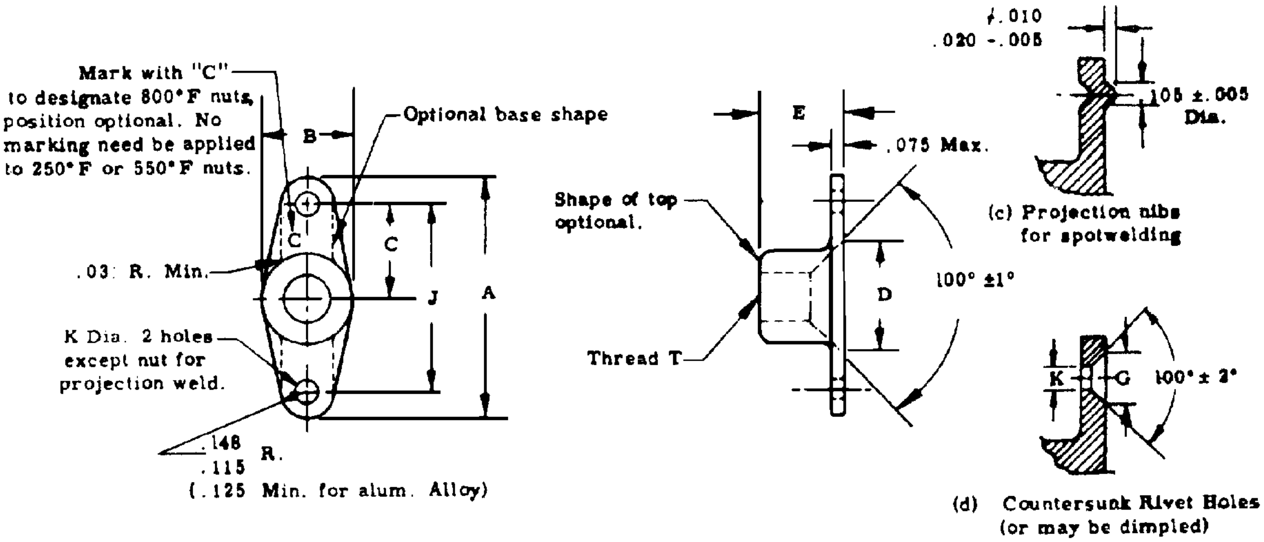
Example of Part Number:

NAS1023 A3 = Nut - Steel with 10-32 thread for use up to 550°F - all metal.
NAS1023 N3 = Nut - Steel with 10-32 thread for use up to 250°F - nylon insert.
NAS1023 C3W = Nut - Steel with 10-32 thread for use up to 800°F - all metal with welding projections.
NAS1023 N3K = Nut - Steel with 10-32 thread for use up to 250°F - nylon insert and countersunk rivet holes.

Dimensions in inches.

F05-113

Figure 5-114. Drawing NAS-1023



(c) Projection nibs for spotwelding

(d) Countersunk Rivet Holes (or may be dimpled)

DASH NUMBERS												
Nylon Insert		All Metal										
Alum. Alloy 250°F	Steel 250°F	Steel 550°F	Corr. Resis. Steel 800°F	Thread T	A Max.	(b) B Max.	(a) C Nom.	(b) E Max.	D Dia. ±.005	J ±.002	K Dia. +.005 -.000	G Dia. ±.010
D06	NO6	AO6	CO6	No. 6-32 NC-3B	.984	.453	.344	.359	.304	.688	.098	.200
D08	NO8	AO8	CO8	No. 8-32 NC-3B	.984	.453	.344	.359	.365	.688	.098	.200
D3	N3	A3	C3	No. 10-32 NF-3B	.984	.453	.344	.378	.411	.688	.098	.200
D4	N4	A4	C4	1/4-28 UNF-3B	1.296	.671	.500	.453	.540	1.000	.098	.200
D5	N5	A5	C5	5/16-24 UNF-3B	1.296	.765	.500	.531	.686	1.000	.130	.230
D6	N6	A6	C6	3/8-24 UNF-3B	1.546	.953	.625	.671	.809	1.250	.130	.230

(a) The center of the tapped hole shall not deviate in any direction from the center of the plate nut as determined by the rivet holes by more than .005.

(b) Minimum B and E limited only by strength requirement of the specification.

(c) Nuts for use by welding to have welding projections with nominal spacing equal to dimension J ±.005.

(d) For dimpled rivet type only, tolerance may be K +.015 max. after forming.

Material and Finish: See Specification MIL-N-25027(ASG).

Performance Specification MIL-N-25027(ASG).

Add W to end of part number to obtain nuts with welding projection (C code only).
Add K to end of part number to obtain nuts with countersunk rivet holes.

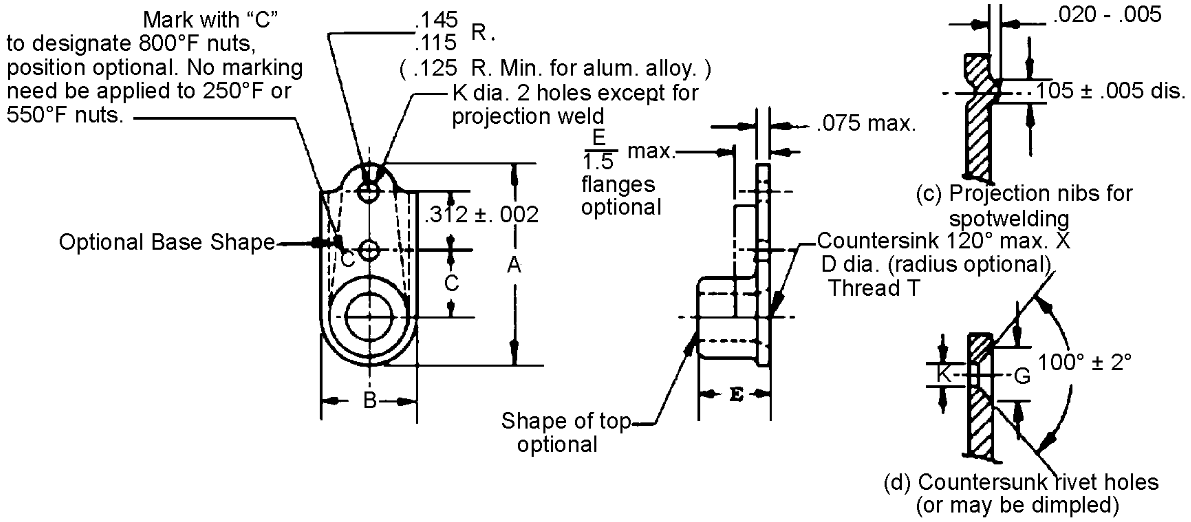
Example of Part Number:

NAS1024 A3 = Nut - Steel with 10-32 thread for use up to 550°F - all metal.
NAS1024 N3 = Nut - Steel with 10-32 thread for use up to 250°F - nylon insert.
NAS1024 C3W = Nut - Steel with 10-32 thread for use up to 800°F - all metal with welding projections.
NAS1024 N3K = Nut - Steel with 10-32 thread for use up to 250°F - nylon insert and countersunk rivet holes.

Dimensions in inches.

F05-114

Figure 5-115. Drawing NAS-1024



DASH NUMBERS												
Nylon Insert		All Metal										
Alum. Alloy 250°F	Steel 250°F	Alum. Alloy 250°F	Steel 550°F	Corr. Resis. Steel 800°F	Thread T	A Max.	(b) B Max.	(a) C ±.005	(b) E Max.	D Dia. +.020 - .010	K Dia. +.005 - .000	G Dia. ±.010
D06	N06	H06	A06	C06	No. 6-32 NC-3B-	1.031	.406	.344	.234	.156	.098	.200
D08	N08	H08	A08	C08	No. 8-32 NC-3B	1.031	.406	.344	.297	.183	.098	.200
D3	N3	H3	A3	C3	No. 10-32 NF-3B	1.031	.406	.344	.312	.210	.098	.200
D4	N4	H4	A4	C4	1/4-28 UNF-3B	1.062	.516	.344	.375	.273	.098	.200
D5	N5	H5	A5	C5	5/16-24 UNF-3B	1.250	.531	.500	.375	.336	.130	.230
D6	N6	H6	A6	C6	3/8-24 UNF-3B	1.344	.641	.500	.453	.398	.130	.230

(a) The center of the tapped hole shall not deviate from the center of the plate nut as determined by the rivet holes by more than .005.

(b) Minimum B and E limited only by strength requirement of specification.

(c) Nuts for use by welding to have welding projections with spacing equal to rivet spacing ± .005.

(d) For dimpled rivet type only, tolerance may be K + .015 max. after forming.

Material and Finish: See Specification MIL-N-25027 (ASG).

Performance Specification MIL-N-25027 (ASG),

Add W to end of part number to obtain nuts with welding projection (C code only).
Add K to end of part number to obtain nuts with countersunk rivet holes.

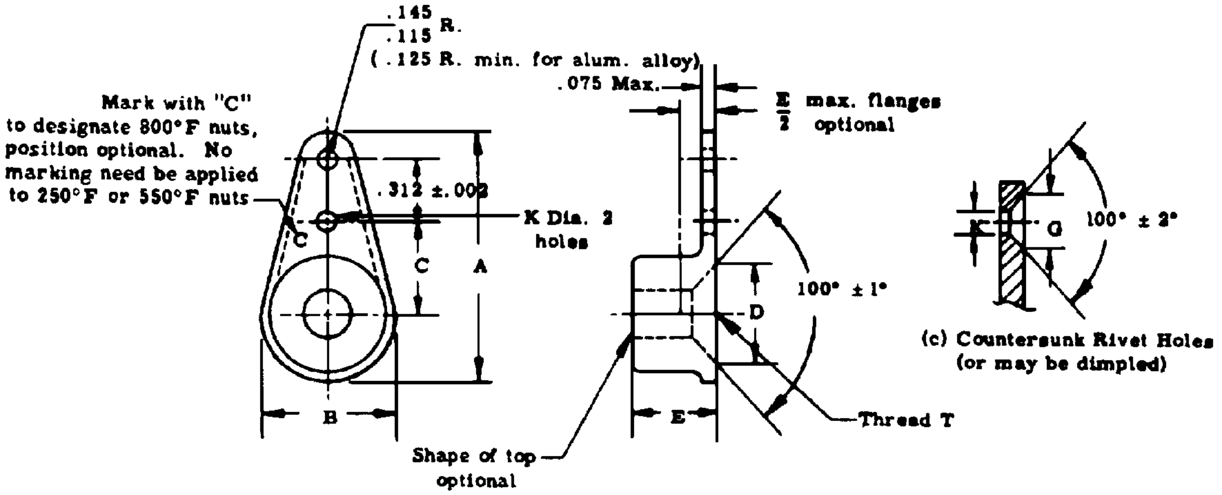
Example of Part Number:

NAS1025 A3 = Nut - Steel with 10-32 thread for use up to 550°F - all metal.
NAS1025 N3 = Nut - Steel with 10-32 thread for use up to 250°F - nylon insert.
NAS1025 C3W= Nut - Steel with 10-32 thread for use up to 800°F - all metal with welding projections.
NAS1025 N3K = Nut - Steel with 10-32 thread for use up to 250°F - nylon insert and countersunk rivet holes.

F05-115

Dimensions in inches.

Figure 5-116. Drawing NAS-1025



DASH NUMBERS											
Nylon Insert		All Metal									
Alum. Alloy 250°F	Steel 250°F	Steel 550°F	Corr. Resis. Steel 800°F	Thread T	A Max.	(b) B Max.	(a) C ±.005	(b) E Max.	D Dia. ±.005	K Dia. +.005 -.000	G Dia. ±.010
DO6	NO6	AO6	CO6	No. 6-32 NC-3B	1.093	.530	.344	.359	.304	.098	.200
DO8	NO8	AO8	CO8	No. 8-32 NC-3B	1.093	.530	.344	.359	.365	.098	.200
D3	N3	A3	C3	No. 10-32 NF-3B	1.093	.530	.344	.378	.411	.098	.200
D4	N4	A4	C4	1/4-28 UNF-3B	1.343	.718	.500	.453	.540	.098	.200
D5	N5	A5	C5	5/16-24 UNF-3B	1.406	.830	.500	.531	.686	.130	.230
D6	N6	A6	C6	3/8-24 UNF-3B	1.593	1.062	.500	.671	.809	.130	-

(a) The center of the tapped hole shall not deviate from the center of the plate nut as determined by the rivet holes by more than .005.

(b) Minimum B and E limited only by strength requirement of the specification.

(c) For dimpled rivet type only, tolerance may be K + .015 max. after forming.

Material and Finish: See Specification MIL-N-25027(ASG).

Performance Specification MIL-N-25027(ASG).

Add K to end of part number to obtain nuts with countersunk rivet holes.

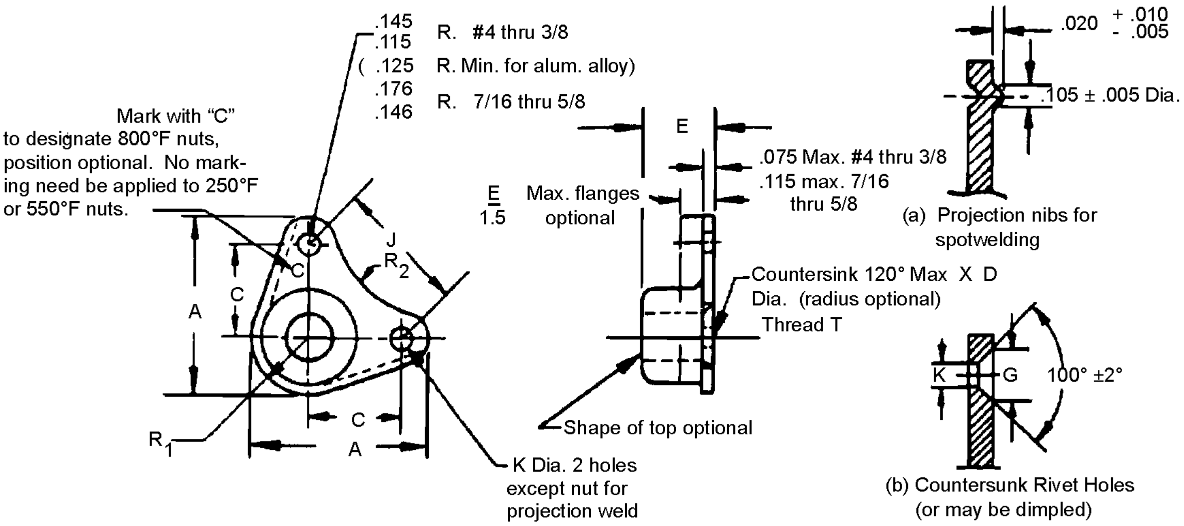
Example of Part Number:

NAS1026 A3 = Nut - Steel with 10-32 thread for use up to 550°F - all metal.
NAS1026 N3 = Nut - Steel with 10-32 thread for use up to 250°F - nylon insert.
NAS1026 N3K = Nut - Steel with 10-32 thread for use up to 250°F - nylon insert and countersunk rivet holes.

Dimensions in inches.

F05-116

Figure 5-117. Drawing NAS-1026



DASH NUMBERS														
Nylon Insert		All Metal												
Alum. Alloy 250°F	Steel 250°F	Alum. Alloy 250°F	Steel 550°F	Corr. Resis. Steel 800°F	Thread T	A Max.	R_1 Max.	R_2 Max.	C ±.005	E Max.	D Dia. + .020 - .010	J ±.002	K Dia. + .005 - .000	G Dia. ± .010
D04	N04	H04	A04	C04	No. 4-40 NC-3B	.650	.172	.240	.344	.216	.131	.486	.098	.200
D06	N06	H06	A06	C06	No. 6-32 NC-3B	.703	.203	.215	.344	.234	.156	.486	.098	.200
D08	N08	H08	A08	C08	No. 8-32 NC-3B	.703	.203	.215	.344	.297	.183	.486	.098	.200
D3	N3	H3	A3	C3	No. 10-32 NF-3B	.703	.203	.215	.344	.312	.240	.486	.098	.200
D4	N4	H4	A4	C4	1/4-28 UNF-3B	.906	.257	.257	.500	.375	.273	.707	.098	.200
D5	N5	H5	A5	C5	5/16-24 UNF-3B	.937	.281	.296	.500	.375	.336	.707	.130	.230
D6	N6	H6	A6	C6	3/8-24 UNF-3B	1.008	.359	.375	.500	.453	.395	.707	.130	.230
D7	N7	H7	A7	C7	7/16-20 UNF-3B	1.125	.391	.406	.562	.469	.458	.795	.161	-
D8	N8	H8	A8	C8	1/2-20 UNF-3B	1.234	.437	.500	.625	.609	.531	.885	.161	-
D10	N10	H10	A10	C10	5/8-18 UNF-3B	1.437	.505	.500	.750	.765	.656	1.060	.161	-

(a) Nuts for use by welding to have welding projections with nominal spacing equal to dimension J ± .005.

(a) For dimpled rivet type only, tolerance may be K + .015 max. after forming.

Minimum base area and height limited only by strength requirement of specification.

Material and Finish: See Specification MIL-N-25027(ASG).

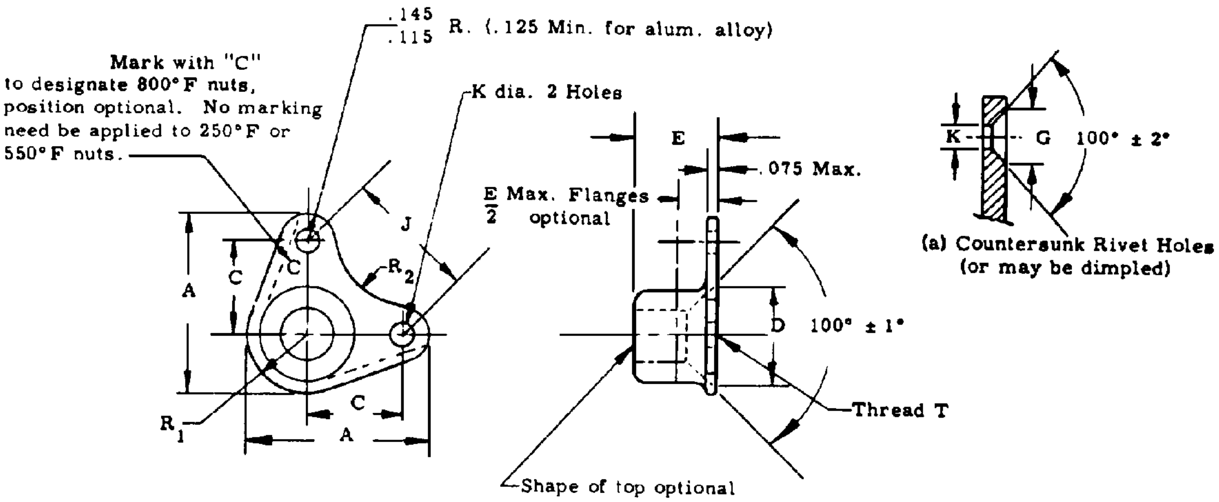
Performance Specification MIL-N-25027(ASG)

Add W to end of part number to obtain nuts with welding projection (C code only).
Add K to end of part number to obtain nuts with countersunk rivet holes.

Example of Part Number:
NAS1027 A3 = Nut - Steel with 10-32 thread for use up to 550°F - all metal.
NAS1027 N3 = Nut - Steel with 10-32 thread for use up to 250°F - nylon insert.
NAS1027 C3W = Nut - Steel with 10-32 thread for use up to 500°F - all metal with welding projections.
NAS1027 N3K = Nut - Steel with 10-32 thread for use up to 250°F - nylon insert and countersunk rivet holes.

Dimensions in inches. F05-117

Figure 5-118. Drawing NAS-1027



DASH NUMBERS													
Nylon Insert		All Metal											
Alum. Alloy 250°F	Steel 250°F	Steel 550°F	Corr. Resis. Steel 800°F	Thread T	A Max.	R_1 Max.	R_2 Max.	C ±.005	E Max.	D Dia. ±.005	J ±.002	K Dia. +.005 -.000	G Dia. ±.010
DO6	NO6	AO6	CO6	No. 6-32 NC-3B	.765	.270	.215	.344	.359	.304	.486	.098	.200
DO8	NO8	AO8	CO8	No. 8-32 NC-3B	.765	.280	.215	.344	.359	.365	.486	.098	.200
D3	N3	A3	C3	No. 10-32 NF-3B	.765	.280	.215	.344	.378	.411	.486	.098	.200
D4	N4	A4	C4	1/4-28 UNF-3B	.984	.343	.343	.500	.453	.540	.707	.098	.200
D5	N5	A5	C5	5/16-24 UNF-3B	1.062	.421	.641	.500	.531	.686	.707	.130	.230
D6	N6	A6	C6	3/8-24 UNF-3B	1.250	.484	.843	.500	.671	.809	.707	.130	-

(a) For dimpled rivet type only, tolerance may be K +.015 max. after forming.

Minimum base area and height limited only by strength requirement of specification.

Material and Finish: See Specification MIL-N-25027(ASG).

Performance Specification MIL-N-25027(ASG).

Add K to end of part number to obtain nuts with countersunk rivet holes.

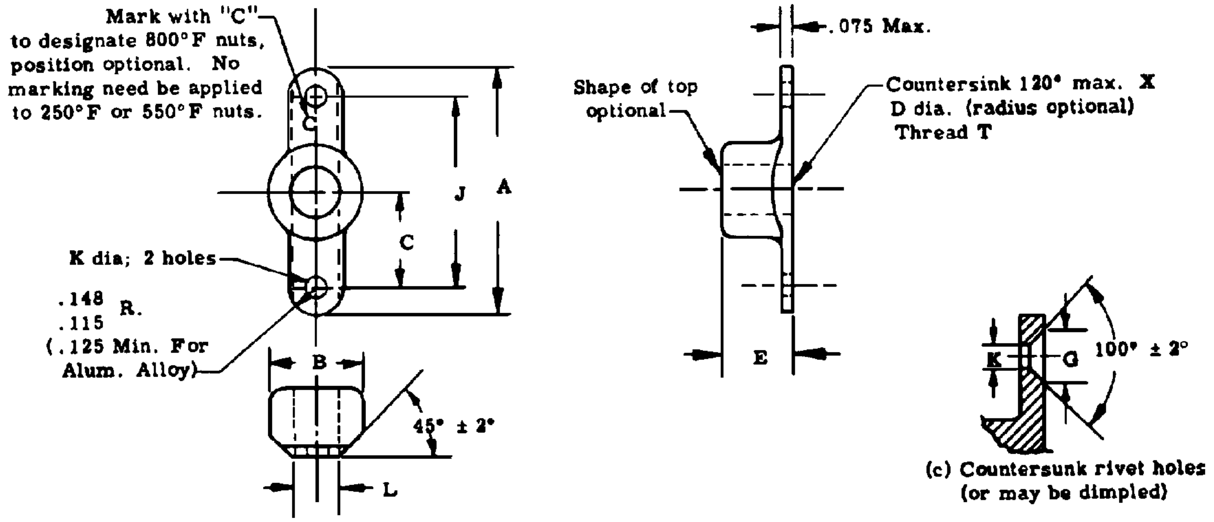
Example of Part Number:

NAS1028 A3 = Nut - Steel with 10-32 thread for use up to 550°F - all metal.
NAS1028 N3 = Nut - Steel with 10-32 thread for use up to 250°F - nylon insert.
NAS1028 N3K = Nut - Steel with 10-32 thread for use up to 250°F - nylon insert and countersunk rivet holes.

Dimensions in inches.

F05-118

Figure 5-119. Drawing NAS-1028



(c) Countersunk rivet holes (or may be dimpled)

DASH NUMBERS														
Nylon Insert		All Metal		Thread T	A	B	(a) C	(b) E	D Dia. +.020 -.010	J	L	K Dia. +.005 -.000	G Dia
Alum. Alloy 250°F	Steel 250°F	Steel 550°F	Corr. Resis. Steel 800°F		Max.	Max.	Nom.	Max.		±.002	±.015		±.010
DO6	NO6	AO6	CO6	No. 6-32 NC-3B	.984	.379	.344	.234	.156	.688	.188	.098	.200
DO6	NO8	AO8	CO8	No. 8-32 NC-3B	.984	.388	.344	.297	.183	.688	.188	.098	.200
D3	N3	A3	C3	No. 10-32 NF-3B	.984	.388	.344	.312	.210	.688	.188	.098	.200
D4	N4	A4	C4	1/4-28 UNF-3B	1.296	.468	.500	.375	.275	1.000	.266	.098	.200
D5	N5	A5	C5	5/16-24 UNF-3B	1.296	.516	.500	.375	.336	1.000	.328	.130	.230

(a) The center of the tapped hole shall not deviate from the center of the plate nut as determined by the rivet holes by more than .005.

(b) Minimum height limited only by strength requirement of the specification.

(c) For dimpled rivet type only, tolerance may be K +.015 max. after forming.

Material and Finish: See Specification MIL-N-25027(ASG).

Performance Specification MIL-N-25027(ASG).

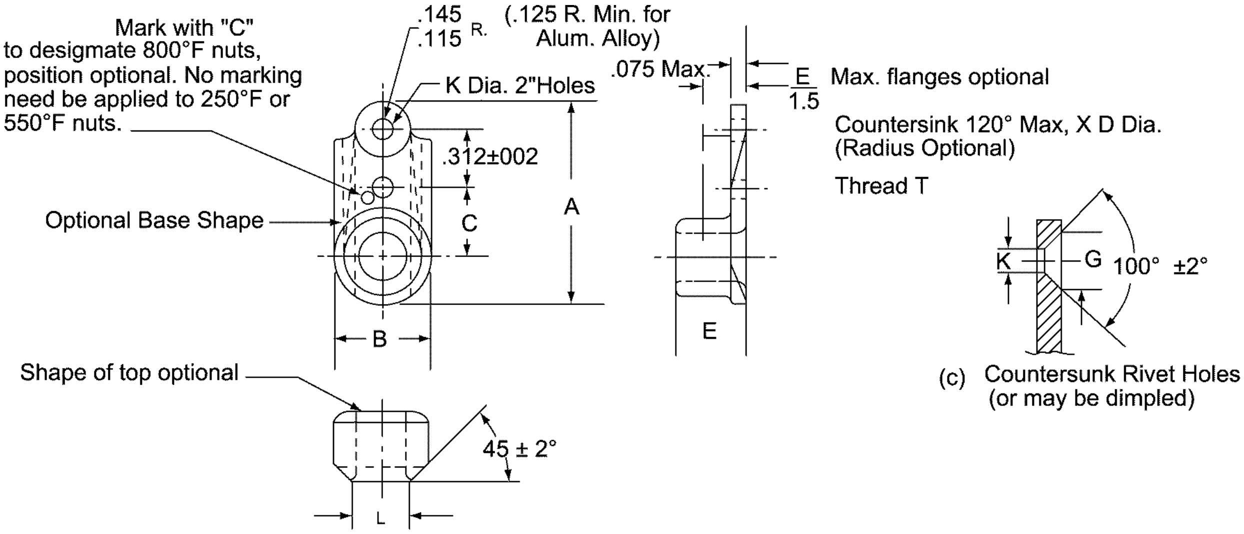
Add K to end of part number to obtain nuts with countersunk rivet holes.

Example of Part Number:
NAS1029 A3 = Nut - Steel with 10-32 thread for use up to 550°F - all metal.
NAS1029 N3 = Nut - Steel with 10-32 thread for use up to 250°F - nylon insert.
NAS1029 N3K = Nut - Steel with 10-32 thread for use up to 250°F - nylon insert and countersunk rivet holes.

Dimensions in inches.

F05-119

Figure 5-120. Drawing NAS-1029



DASH NUMBERS												
Nylon Insert		All Metal					(a)	(b)				
Alum Alloy 250°F	Steel 250°F	Steel 550°F	Corr. Steel Steel 550°F	Thread T	A Max.	B Max.	C ±.005	E Max.	D Dia. +.020 - .010	L +.015	K Dia. +.005 - .000	G Dia. ±.010
D06	N06	A06	C06	No. 6-32 NC-3B	1.006	.406	.344	.234	.156	.188	.098	.200
D08	N08	A08	C08	No. 8-32 NC-3B	1.006	.406	.344	.297	.183	.188	.098	.200
D3	N3	A3	C3	No. 10-32 NF-3B	1.006	.406	.344	.312	.210	.188	.098	.200
D4	N4	A4	C4	1/4-28 UNF-3B	1.038	.516	.344	.375	.273	.313	.098	.200
D5	N5	A5	C5	5/16-24 UNF-3B	1.225	.531	.500	.375	.336	.375	.130	.230

(a) The center of the tapped hole shall not deviate from the center of the plate nut as determined by the rivet holes by more than .005.

(b) Minimum E limited only by strength requirement of the specification.

(c) For dimpled rivet type only, tolerance may be K +.015 max. after forming.

Material and Finish: See specification MIL-N-25027 (ASG).

Performance Specification MIL-N-25027(ASG).

Add K to end of part number to obtain nuts with countersunk rivet holes.

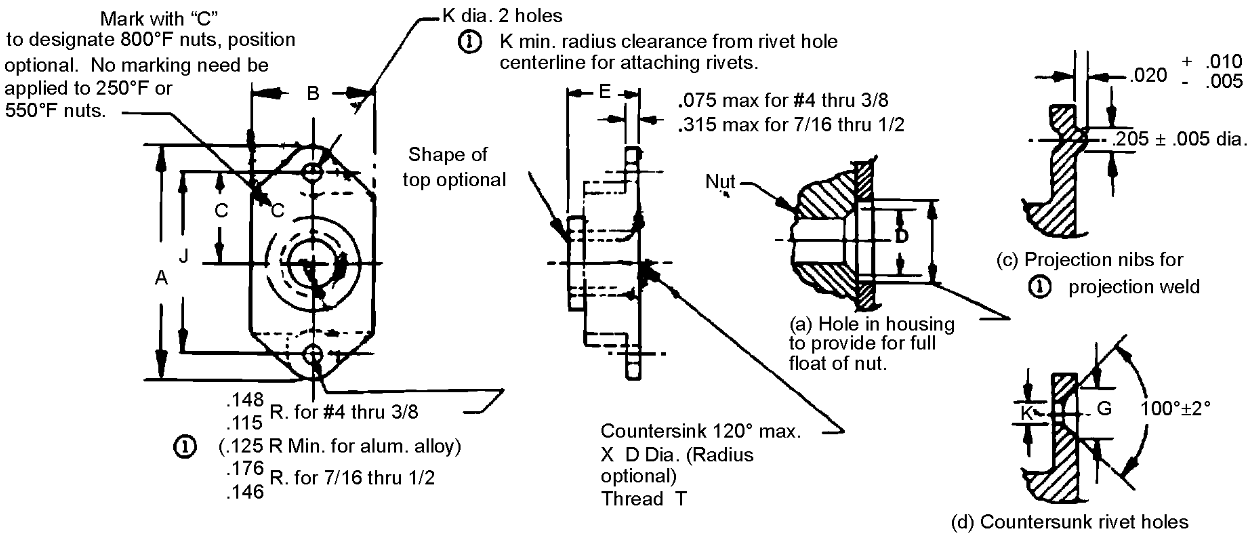
Example of Part Number:

NAS1030 A3 = Nut - Steel with 10-32 thread for use up to 550°F - all metal.
NAS1030 N3 = Nut - Steel with 10-32 thread for use up to 250°F - nylon insert.
NAS1030 N3K = Nut - Steel with 10-32 thread for use up to 550°F - nylon insert and countersunk rivet holes.

Dimensions in inches.

F05-120

Figure 5-121. Drawing NAS-1030



DASH NUMBERS													
Nylon Insert		All Metal											
Alum Alloy Nut	Steel Nut	Steel Nut	Steel Assy	Corr. Resis. Steel Assy	Thread T	A Max.	(b) B Max.	(a) C Nom.	(b) E Max.	D Dia. + .020 - .010	J ± .002	K Dia. + .005 - .000	G Dia. ± .010
Alum. Alloy or Steel Housing													
250°F	250°F	250°F	550°F	800°F									
D04	N04	P04	A04	C04	No. 4-40 NC-3B	.984	.416	.344	.218	.131	.688	.098	.200
D06	N06	P06	A06	C06	No. 6-32 NC-3B	.984	.416	.344	.234	.156	.688	.098	.200
D08	N08	P08	A08	C08	No. 8-32 NF-3B	.984	.416	.344	.312	.183	.688	.098	.200
D3	N3	P3	A3	C3	No. 10-32 NF-3B	.984	.416	.344	.312	.210	.688	.098	.200
D4	N4	P4	A4	C4	1/4-28 UNF-3B	1.296	.516	.500	.387	.273	1.000	.098	.200
D5	N5	P5	A5	C5	5/16-24 UNF-3B	1.296	.609	.500	.387	.336	1.000	.130	.230
D6	N6	P6	A6	C6	3/8-24 UNF-3B	1.296	.641	.500	.479	.398	1.000	.130	.230
D7	N7	P7	A7	C7	7/16-20 UNF-3B	1.477	.719	.562	.504	.458	1.125	.161	—
D8	N8	P8	A8	C8	1/2-20 UNF-3B	1.802	.859	.645	.630	.531	1.250	.161	—

(a) Float of nut portion of assembly shall not be less than .030 inches, or more than .040 inches laterally and longitudinally from the centered position. Nut body shall be capable of engagement with a bolt in the maximum misaligned position. Maximum vertical float within the housing .020 for #10 and smaller, .030 for 1/4 and larger.

(b) Minimum B and E limited only by strength requirement of specification.

(c) Nuts for use by welding to have welding projections with nominal spacing equal to dimension J ± .005.

(d) For dimpled rivet type only, tolerance may be K + .015 max. after forming.

Nut misalignment shall not exceed dimension B nor clearance for rivet attachment.

Shape of nut and housing optional within limits specified, and shall form one integral unit to prevent seperation during handling. The assembly shall provide a bearing surface for the nut within the housing.

Material and Finish: See Specification MIL-N-25027(ASG).

Performance Specification MIL-N-25027(ASG).

Add W to end of part number to obtain nuts with welding projection (C code only).
Add K to end of part number to obtain nuts with countersunk rivet holes.

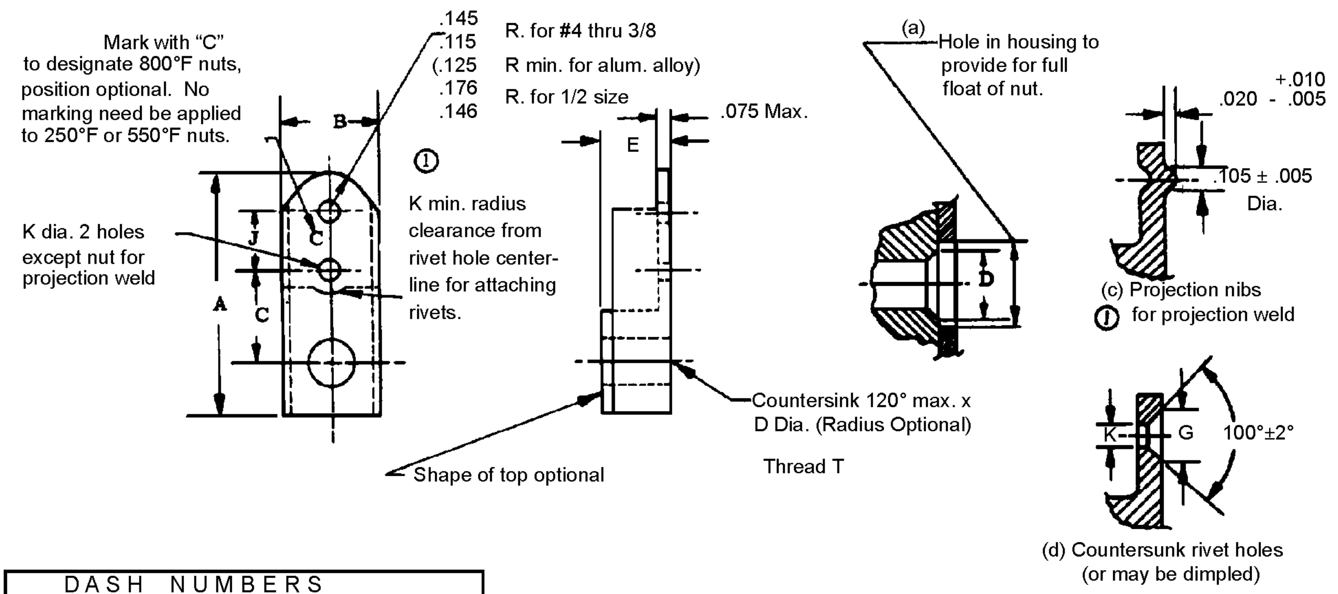
Example of Part Number:

NAS1031 A3 = Nut - Steel with 10-32 thread for use up to 550°F - all metal.
NAS1031 N3 = Nut - Steel with 10-32 thread for use up to 250°F - aluminum or steel housing - nylon insert.
NAS1031 C3W= Nut - Steel with 10-32 thread for use up to 800°F - all metal with welding projections.
NAS1031 N3K = Nut - Steel with 10-32 thread for use up to 250°F - aluminum alloy or steel housing - nylon insert and countersunk rivet holes.

Dimensions in inches.

F05-121

Figure 5-122. Drawing NAS-1031



DASH NUMBERS													
Nylon Insert		All Metal											
Alum Alloy Nut	Steel Nut	Steel Nut	Steel Assy	Corr. Resis. Steel Assy	Thread T	A Max.	(b) B Max.	(a) C ±.005	(b) E Max.	D Dia. + .020 - .010	J ± .002	K Dia. + .005 - .000	G Dia. ± .010
Alum. Alloy or Steel Housing													
250°F	250°F	250°F	550°F	800°F									
D04	N04	P04	A04	C04	No. 4-40 NC-3B	1.094	.422	.344	.218	.131	.312	.098	.200
D06	N06	P06	A06	C06	No. 6-32 NC-3B	1.094	.422	.344	.234	.156	.312	.098	.200
D08	N08	P08	A08	C08	No. 8-32 NC-3B	1.094	.422	.344	.312	.183	.312	.098	.200
D3	N3	P3	A3	C3	No. 10-32 NF-3B	1.094	.422	.344	.312	.210	.312	.098	.200
D4	N4	P4	A4	C4	1/4-28 UNF-3B	1.316	.531	.500	.387	.273	.312	.098	.200
D5	N5	P5	A5	C5	5/16-24 UNF-3B	1.378	.641	.500	.387	.336	.312	.130	.230
D6	N6	P6	A6	C6	3/8-24 UNF-3B	1.422	.703	.500	.479	.398	.312	.130	.230
D8	N8	P8	A8	C8	1/2-20 UNF-3B	1.800	.859	.625	.630	.531	.500	.161	—

(a) Float of nut portion of assembly shall not be less than .030 inches, or more than .040 inches laterally and longitudinally from the centered position. Nut body shall be capable of engagement with a bolt in the maximum misaligned position. Maximum vertical float within the housing .020 for #10 and smaller, .030 for 1/4 and larger.

(b) Minimum B and E limited only by strength requirement of specification.

(c) Nuts for use by welding to have welding projections with nominal spacing equal to dimension J ± .005.

(d) For dimpled rivet type only, tolerance may be K + .015 max. after forming.

Nut misalignment shall not exceed dimension B nor clearance for rivet attachment.
Shape of nut and housing optional within limits specified, and shall form one integral unit to prevent separation during handling. The assembly shall provide a bearing surface for the nut within the housing.

Material and Finish: See Specification MIL-N-25027(ASG).

Performance Specification MIL-N-25027(ASG).

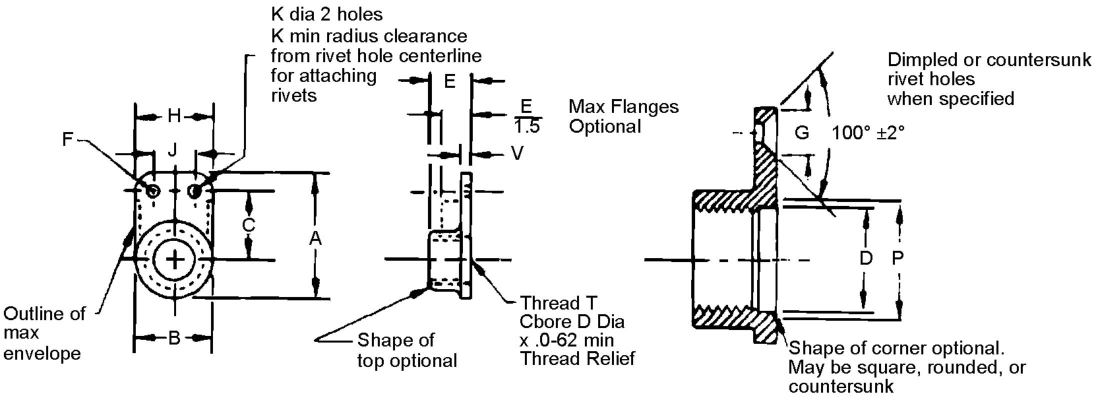
Add W to end of part number to obtain nuts with welding projection (C code only).
Add K to end of part number to obtain nuts with countersunk rivet holes.

Example of Part Number:
NAS1032 A3 = Nut - Steel with 10-32 thread for use up to 550°F - all metal.
NAS1032 N3 = Nut - Steel with 10-32 thread for use up to 250°F - aluminum or steel housing - nylon insert.
NAS1032 C3W= Nut - Steel with 10-32 thread for use up to 800°F - all metal with welding projections.
NAS1032 N3K = Nut - Steel with 10-32 thread for use up to 250°F - aluminum alloy or steel housing - nylon insert and countersunk rivet holes.

Dimensions in inches.

F05-122

Figure 5-123. Drawing NAS-1032



④

Dash No.			Thread T	A Max	B Dia Max	C ± .005	D Dia Min	(a) E Max	(c) F Min	G Dia ±.010	H Max	J ±.002	K(b) Dia +.005 -.000	P Dia Max	V Max	Max Wt
450°F	500°F	800°F														
Steel	CRes(e)	CRes(e)														
A08	C08M	C08	8 - 32UNC-3B	.486	.287	.234	.168	.250	.100	.200	.437	.219	.098	.248	.047	
A3	C3M	C3	10 - 32UNF-3B	.521	.328	.250	.194	.250	.100	.200	.437	.219	.098	.274	.047	
A4	C4M	C4	1/4 - 28UNF-3B	.591	.414	.281	.254	.281	.100	.200	.437	.219	.098	.344	.055	
A5	C5M	C5	5/16 - 24UNF-3B	.747	.505	.359	.317	.328	.125	.230	.537	.269	.130	.417	.065	
A6	C6M	C6	3/8 - 24UNF-3B	.856	.614	.414	.379	.344	.125	.230	.537	.269	.130	.505	.075	

(a) Minimum “E” not specified. Limited only by strength requirements of specification.
(b) For dimpled rivet type, “K” tolerance may be + .015, - .000 after forming.
(c) The center of the tapped hole shall not deviate from the longitudinal center line of the plate nut as determined by the rivet holes by more than .005.
(e) Magnetic Permeability shall be less than 2.0 (Air=1.0) for a field strength H=200 oersteds using a magnetic permeability indicator per MIL-I-17214 or equivalent.

CODE: Dash numbers suffixed by K = back countersunk or dimpled rivet holes.
The CRes Dash Number suffixed by M designates an approved dry film lubricant finish.
④ Insert “X” in lieu of “A” in the 450°F steel code for cadmium plated steel nuts without molybdenum disulfide coating or any other lubricant.

EXAMPLE OF PART NUMBERS:
NAS1067A4 = 1/4-28 plate nut, all metal construction plain rivet holes.
NAS1067A4K = 1/4-28 plate nut, all metal construction countersunk or dimpled rivet holes.
NAS1067C4 = 1/4-28 plate nut, all all metal construction of A286 CRes, silver plated for 800°F use.
NAS1067C4M = 1/4-28 plate nut, all metal construction of A286 CRes with an approved dry film lubricant for 500°F use.
NAS1067X4 = 1/4-28 plate nut, all metal construction plain rivet holes without lubricant.

MATERIAL: Steel. See Procurement Specification
CRes. A286 per AMS 5525.

FINISH: ④ Steel - Cadmium plate per QQ-P-416 plus an approved dry film lubricant. Type and class of plating optional if lubricated nuts will meet salt spray requirements of QQ-P-416, Type II.
④ CRes - Silver plate, for 800°F use, per AMS2410 to a .0002 minimum of silver plate on nut surfaces which can be touched by a .75 inch ball. Threads shall show complete coverage but thickness requirements on threads is waved. Plating on retaining cage is optional.
CRes - Approved dry film lubricant for 500°F use.

④ PROCUREMENT SPECIFICATION: MIL-N-25027, except as noted. All nuts shall meet qualification and inspection requirement. Manufacturer shall provide evidence of qualification when required Testing shall be performed by manufacturer or independent laboratory. Procuring agency may conduct confirming qualification tests. No QPL shall be established.

NOTES:
1. Axial strength requirements per MIL-N-25027 Table I values for regular steel nuts.
2. Dimensions in inches.

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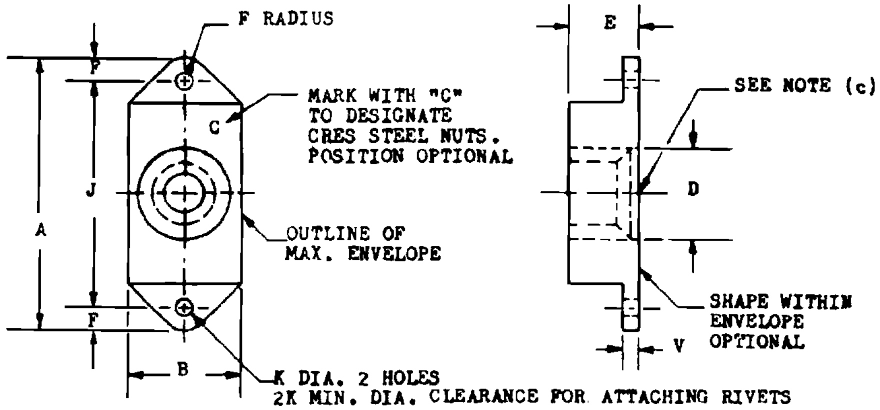
F05-123

Figure 5-124. Drawing NAS-1067



⑤ Dash Number			Thread T	A Max	B Max	D Dia Min	E (a) Max	F Min	J (b) ±.002	K +.005 -.000	V Max
450°F Steel	500°F CRes(d)	800°F CRes(d)									
A04	C04M	C04	4-40UNC-3B	.498	.315	.116	.153	.075	.296	.066	.140
A04L	C04LM	C04L	4-40UNC-3B	.651	.315	.116	.153	.089	.406	.098	.140
A06	C06M	C06	6-32UNC-3B	.545	.357	.142	.171	.075	.343	.066	.140
A06L	C06LM	C06L	6-32UNC-3B	.682	.357	.142	.171	.089	.437	.098	.140
A08	C08M	C08	8-32UNC-3B	.707	.367	.168	.250	.100	.468	.098	.140
A3	C3M	C3	10-32UNF-3B	.739	.416	.194	.250	.100	.500	.098	.140
A4	C4M	C4	1/4-28UNF-3B	.801	.500	.254	.281	.100	.562	.098	.140
A5	C5M	C5	5/16-24UNF-3B	1.010	.581	.317	.328	.117	.718	.130	.140

(a) Minimum "E" not specified, limited only by strength requirement of specifications.
(b) Float of nut portion of assembly shall not be less than .020 inches laterally and longitudinally from centered position. Nut body shall be capable of engagement with a bolt in the maximum misaligned position.
(c) On size no. 8 and larger, counter bore thread D dia. x .062 deep min. thread relief; on size no. 6 and smaller c'sink to D dia. Threads per MIL-S-7742 before lubrication.
(d) Magnetic permeability of CRes nuts shall be less than 2.0 (Air=1.0) for a field strength of H=200 oersteds using a magnetic permeability indicator per MIL-I-17214 or equivalent.
(e) The assembly shall provide a bearing surface for the nut within the housing and the nut and base portion of the assembly shall form one integral unit.

CODE: ⑤ The CRes dash number suffixed by M designates an approved dry film lubricant finish. Insert X in lieu of A in the 450°F steel code for cadmium plated steel nuts without molybdenum disulfide or any other lubricant.

EXAMPLES OF PART NUMBERS:
NAS1068A3 = 10-32 floating all metal construction plate nut.
NAS1068C3 = 10-32 floating all metal construction plate nut of A286 CRes. Silver plate for 800°F use.
NAS1068C3M = 10-32 floating all metal construction plate nut of A286 CRes plus an approved dry film lubricant for 500°F use.
⑤ NAS1068X3 = 10-32 floating all metal construction plate nut for 450°F use, without lubricant.

MATERIAL: ⑤ Steel - See Procurement Specification.
CRes - A286 per AMS5525

FINISH: ⑤ Steel - Cadmium plate per QQ-P-416 plus an approved dry film lubricant. Type and class of plating optional if lubricated nuts will meet salt spray requirements of QQ-P-416, Type II.

⑤ CRes - Silver plate, for 800°F use, per AMS2410 to a .0002 minimum of silver plate on nut surfaces which can be touched by a .75 inch ball. Threads shall show complete coverage but thickness requirements on threads is waived. Plating on retaining cage is optional.

CRes - Approved dry film lubricant for 500°F use.

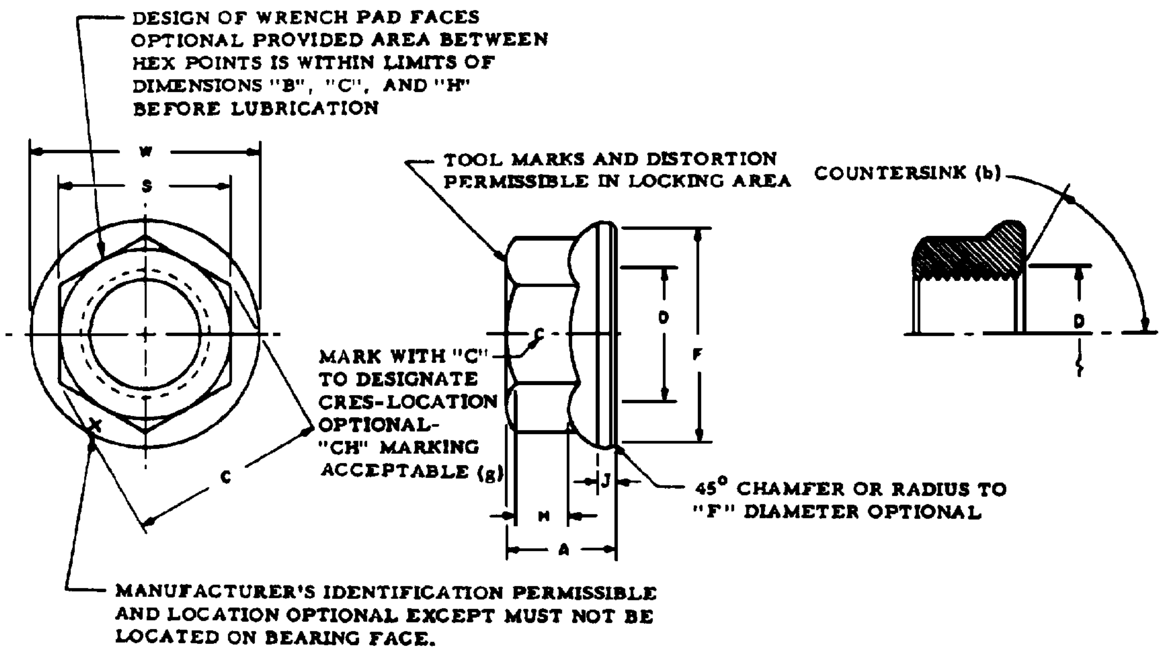
⑤ **PROCUREMENT SPECIFICATION:** MIL-N-25027, except as noted. All nuts shall meet qualification and inspection requirements. Manufacturer shall provide evidence of qualification when required. Testing shall be performed by manufacturer or independent laboratory. Procuring agency may conduct confirming qualification tests. No QPL shall be established.

NOTES:
1. Axial strength requirements per MIL-N-25027 Table I values for regular steel nuts.
2. Dimensions in inches.

CHECK PRINT

F05-124

Figure 5-125. Drawing NAS-1068



Dash Number						(c)				(b)				(f)			(a)	(a)
	450°F		800°F	~~450°F~~	~~500°F~~													
Steel	Steel	(d) A286 CRes	(d) A286 CRes	~~(d) A286 CRes~~	~~(d) A286 CRes~~	Thread	A	B	C (Min)	D	F (Min)	H (Min)	J (Min)	S	W (Min)	Max Wt. Lbs. Per 100	Axial Tensile Strength Lbs. (Min) Steel	Axial Tensile Strength Lbs. (Min) A286 CRes
02	X02	C02M	C02	~~A02M~~	~~A02~~	2-56 UNC-3B	.100 .080	.127 .122	.138	.106 .086	.137	.045	.008	.0025	.167	.02	660	463
04	X04	C04M	C04	~~A04M~~	~~A04~~	4-40 UNC-3B	.125 .105	.158 .150	.171	.142 .112	.176	.050	.010	.003	.206	.05	1,110	760
06	X06	C06M	C06	~~A06M~~	~~A06~~	6-32 UNC-3B	.141 .115	.190 .181	.207	.168 .138	.214	.055	.010	.003	.244	.08	1,670	1,150
08	X08	C08M	C08	~~A0M8~~	~~A08~~	8-32 UNC-3B	.188 .125	.221 .213	.244	.194 .164	.260	.060	.015	.003	.290	.15	2,490	1,720
3	X3	C3M	C3	~~A3M~~	~~A3~~	10-32 UNF-3B	. 28 .154	.252 .243	.277	.220 .150	.290	.065	.015	.003	.330	.18	3,470	2,460
4	X4	C4M	C4	~~A4M~~	~~A4~~	1/4-28 UNF-3B	.219 .204	.316 .304	.347	.280 .250	.386	.090	.019	.003	.420	.35	6,200	4,580
5	X5	C5M	C5	~~A5M~~	~~A5~~	5-16-24 UNF-3B	.264 .251	.378 .367	.419	.342 .312	.482	.120	.023	.004	.520	.60	9,820	7,390
6	X6	C6M	C6	~~A6M~~	~~A6~~	3/8-14 UNF-3B	.282 .267	.440 .430	.491	.405 .375	.575	.125	.030	.004	.620	.80	15,200	11,450
7	X7	C7M	C7	~~A7M~~	~~A7~~	7/16-20 UINF-3B	.328 .313	.304 .494	.562	.467 .437	.680	.160	.035	.005	.708	1.3	20,600	15,450
8	X8	C8M	C8	~~A8M~~	~~A8~~	1/2-20 UNF-3B	.410 .350	.566 .556	.633	.530 .500	.786	.225	.040	.005	.814	2.1	27,500	21,110
9	X9	C9M	C9	~~A9M~~	~~A9~~	9/16-18 UNF-3B	.480 .420	.692 .680	.773	.592 .562	.874	.320	.045	.006	.912	3.6	34,800	26,810
10	X10	C10M	C10	~~A10M~~	~~A10~~	5/8-18 UNF-3D	.550 .490	.755 .743	.846	.655 .625	.976	.365	.050	.007	1.014	4.5	43,600	34,130

③ **Completely Revised - Sheet 2 Added**

LIST OF ACTIVE SHEETS

Sheet	Revision
1	3
2	1

F05-125S01

Figure 5-126. Drawing NAS-1291 (Sheet 1 of 2)

(a) Minimum tensile strength for steel (450°F) nut per table is based on 160,000 psi and on areas calculated by using 98% of the basic pitch diameter as shown in Tables III-3 and III-4, Screw Thread Standards for Federal Services 1957 (National Bureau of Standards Handbook H-28) Part I, except 3/8 and larger sizes which are based on 100%. Test bolts shall be 180,000 psi min. Tensile values for A286 are based on 125,000 psi per MIL-N-25027.

(b) Countersink, countersink-counterbore or radius relief to thread within limits of "D" diameter and 120° max. angle.

(c) Threads per MIL-S-7742 or MIL-S-8879 before lubrication.

(d) Magnetic permeability of A286 nuts shall be less than 2.0 (Air = 1.0) for a field strength H = 200 Oersteds using a magnetic permeability indicator per MIL-I-17214 or equivalent.

(e) Minimum "Go" thread gage penetration shall be 3/4 revolution before dry film lubricant.

(f) Bearing surface must be square with pitch diameter "S" when measured in accordance with MIL-N-25027.

(g) Individual marking on size number 3 (10-32) and smaller at manufacturer's option.

(h) -8(1/2-20), -9(9/16-18) and -10(5/8-18) nuts not intended for use with short thread screws or bolts.

EXAMPLES OF PART NUMBERS:

NAS121-4 = 1/4-28 nut, all metal construction of steel, cadmium with an approved dry film lubricant for 450°F use.
NAS1291X4 = 1/4-28 nut, all metal construction, cadmium plated, without dry film coating or any other lubricant for 450°F use.
NAS1291C4M = 1/4-28 nut, all metal construction of A286, with an approved dry film lubricant for 450°F use.
NAS1291C4 = 1/4-28 nut, all metal construction of A286, silver plated for 800°F use.

NOTE: "A" material code call-out to designate A286 CRes, as in NAS 1291A4, is inactive for new design. Use "C" material code call-out to designate A286 CRes, as in NAS 1291C4, for new design.

MATERIAL: Steel. See procurement specification.
A286 CRes per AMS5735, AMS5737, or AMS5525.

FINISH: Steel: Plain Cadmium Plated Nuts in accordance with QQ-P-416, Type II, Class 3

Dry film lubricated Nuts, the Cadmium Plate in accordance with QQ-P-416, Type and Class optional provided Nuts meet Salt Spray Requirements of QQ-P-416, Type II. Dry Film Lubricant in accordance with MIL-N-25027. Other lubricants shall be soluble in the cleaners specified in the procurement specification.

A286: Silver plate, for 800°F use, in accordance with AMS 2410. Silver plate thickness shall be .0002 minimum on all visible surfaces that can be touched by a 0.75 inch diameter ball. All other surfaces, including threads, shall show complete coverage.

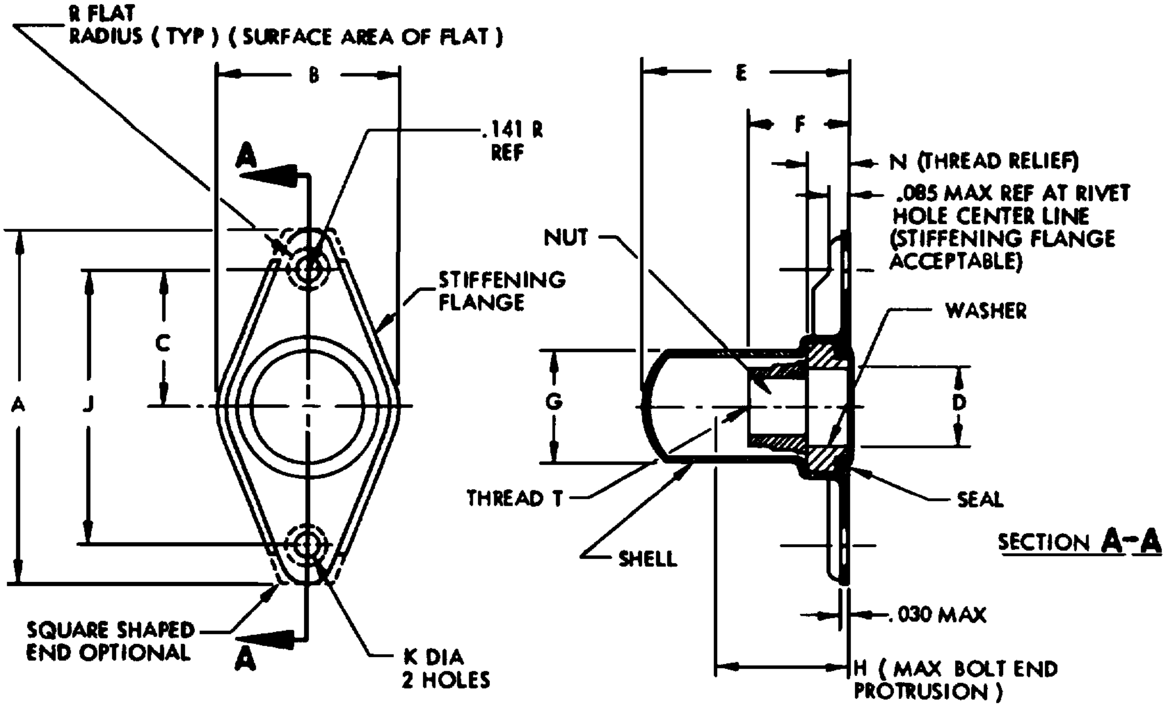
Dry Film Lubricant, for 450°F use, in accordance with MIL-N-25027. Other lubricants shall be soluble in the cleaners specified in the procurement specification.

NOTE: Wrench torque per MIL-N-25027 Table II for regular nuts; box or socket wrench required only for test purposes. Minimum break-away torque shall be 0.2 inch pound for size 2-56 and 0.5 inch pound for size 4-40. For larger sizes see MIL-N-25027.

PROCUREMENT SPECIFICATION: MIL-N-25027, except as noted. All nuts shall meet qualification and inspection requirements. Manufacturer shall provided evidence of qualification when required. Testing shall be performed by manufacturer or independent laboratory. Procuring agency may conduct confirming qualification tests. No QPL shall be established.

F05-125S02

Figure 5-126. Drawing NAS-1291 (Sheet 2)



THREAD T	DASH NO NUT STEEL 225°F	NUT CRES 450°F	A MAX	B MAX	C ±.005	D MIN	E MAX	F MAX
.1640-32UNJC-3B	A08	C08	.989	.568	.344	.229	.640	.313
.1900-32UNJF-3B	A3	C3						
.2500-28UNJF-3B	A4	C4	1.296	.668	.500	.289	.755	.372
.3125-24UNJF-3B	A5	C5		.762		.351	.823	.410

THREAD T	G MAX	BOLT END H MAX	J ±.002	K +.005 -.000	N MIN	R MIN	WEIGHT/100 LBS MAX 225°F	450°F
.1640-32UNJC-3B	.352	.568	.688	.098	.125	.098	.92	1.00
.1900-32UNJF-3B								
.2500-28UNJF-3B	.419	.687	1.000		.135		1.40	1.65
.3125-24UNJF-3B	.520	.728		.130		.130	1.95	2.25

CODE: "A" DESIGNATES NON-CORROSION RESISTANT STEEL CADMIUM PLATE NUT AND SHELL WITH ALUMINUM OR STEEL WASHER, (AVAILABLE ONLY WITH MIL-R-6855 SEAL).
"C" DESIGNATES CORROSION RESISTANT STEEL NUT, SHELL AND WASHER WITH AMS3304 SILICONE RUBBER SEAL, NON-FUEL RESISTANT.
INSERT "X" IN LIEU OF "A" IN THE STEEL CODE FOR CADMIUM PLATED STEEL NUTS WITHOUT LUBRICANT.

TITLE

NUT, SELF-LOCKING, PLATE-TWO LUG, CAP, FLOATING

F05-126S01

Figure 5-127. Drawing NAS-1473 (Sheet 1 of 3)

EXAMPLES: NAS1473A08 = STEEL NUT AND SHELL WITH ALUMINUM ALLOY OR STEEL WASHER, .1640-32UNJC-3B THREAD AND MIL-R-6855 FUEL RESISTANT RUBBER SEAL FOR USE UP TO +225°F.
NAS1473C08 = CRES NUT, SHELL AND WASHER WITH .1640=32UNJC-3B THREAD AND AMS3304 NON-FUEL RESISTANT SILICONE RUBBER SEAL FOR USE UP TO +450°F.

MATERIALS: NUT - STEEL, SEE PROCUREMENT SPECIFICATION.
CRES, AMS5525 OR AMS5735, A-286, NON-MAGNETIC
SHELL - STEEL, SEE PROCUREMENT SPECIFICATION.
CRES, AMS5525, A-286, NON-MAGNETIC
WASHER - (225°F) ALUMINUM ALLOY OR STEEL, SEE PROCUREMENT SPECIFICATION.
(450°F) CRES, AMS5525 OR AMS5735, A-286, NON-MAGNETIC
SEAL - (225°F) RUBBER, MIL-R-6855. CLASS I, GRADE 60, DUROMETER A60, COLOR BLACK.
(450°F) SILICONE RUBBER, AMS3304, DUROMETER A70, COLOR RED.

FINISH: STEEL SHELL AND WASHER - CADMIUM PLATE PER QQ-P-416, TYPE II, CLASS 2.
STEEL NUT - CADMIUM PLATE PER QQ-P-416, TYPE II, CLASS 2, PLUS AN APPROVED DRY FILM LUBRICANT. EXISTING NUTS WITH AN OPTIONAL TYPE AND CLASS OF CADMIUM PLATE PER QQ-P-416, AS PREVIOUSLY PERMITTED, MAY BE FURNISHED UNTIL 16 DEC. 1976.

CRES: SHELL AND WASHER - CLEAN AND PASSIVATE PER MIL-S-5002. NUT-SILVER PLATE FOR 450°F USE PER MIL-N-25027 TO A .0002 MINIMUM THICKNESS ON SURFACES WHICH CAN BE TOUCHED BY A .7500 (3/4-INCH) BALL. THREADS SHALL SHOW COMPLETE COVERAGE, BUT THICKNESS REQUIREMENT ON THREADS IS WAIVED. ⑥

ALUMINUM ALLOY: ANODIZE OR CHEMICAL FILM PER MIL-N-25027, EXCEPT ANODIZE SHALL BE LIMITED TO TYPE I OR TYPE II.

FLOAT: MINIMUM RADIAL FLOAT .020.
MAXIMUM AXIAL FLOAT .030.

PRESSURE RANGE: 0 TO 50 PSIG

TEMPERATURE RANGE: MIL-R-6855 RUBBER (-65°F TO 225°F).
AMS3304 RUBBER (-65°F TO 450°F)

THREADS: THREADS IN ACCORDANCE WITH MIL-S-8879 BEFORE LUBRICATION.

MARKING: THE SMALLEST CONTAINER USED TO PACKAGE "A" CODED PARTS SHALL BE MARKED WITH THE CURE DATE (QUARTER AND YEAR) OF THE OLDEST RUBBER SEAL CONTAINED THEREIN. THE AGE OF RUBBER SEALS SHALL NOT EXCEED 6 QUARTERS AT THE TIME OF DELIVERY TO THE CONTRACTOR.

NOTES:
1. THREAD ELEMENT SHALL BE CAPABLE OF ENGAGEMENT WITH A BOLT IN THE MAXIMUM MISALIGNED POSITION.
2. NUT AND SHELL SHAPE OPTIONAL, WITHIN SPECIFIED MAXIMUM DIMENSIONS.
3. MAGNETIC PERMEABILITY OF CRES NUTS SHALL BE LESS THAN 2.0 (AIR = 1.0) FOR A FIELD STRENGTH H = 200 OERSTEDS. MAGNETIC PERMEABILITY INDICATOR PER MIL-I-17214 OR EQUIVALENT.

PERFORMANCE: QUALIFICATION TEST

1 . 0 ALL REQUIREMENTS OF MIL-N-25027 PERTAINING TO STEEL FLOATING PLATE NUTS INCLUDING AXIAL STRENGTH REQUIREMENTS OF TABLE I FOR REGULAR STEEL NUTS, SHALL APPLY TO THIS PART EXCEPT THE MAXIMUM TEMPERATURE SHALL BE 450°F. A POSITIVE SEAL SHALL BE REQUIRED AFTER TESTING PER PARAGRAPH 3.10 (PUSHOUT) AND 3.9.3 (TORQUE OUT) OF MIL-N-25027. THE PUSH OUT AND TORQUE OUT TESTS SHALL BE CARRIED TO A PROOF LOAD. EQUAL TO THE REQUIREMENTS FOR THE APPLICABLE SIZE. ALL TESTS SHALL BE PERFORMED ON A SINGLE SHEET OF 2024-T3 OR 7075-T6 ALUMINUM ALLOY, NOMINAL THICKNESS OF .312 INCHES, AND HAVING A MINIMUM OF TEN (10) INCHES SQUARE (100 SQUARE INCHES) UNSUPPORTED AREA.

F05-126S02

Figure 5-127. Drawing NAS-1473 (Sheet 2)

(continued)

SIX (6) NUTS SHALL BE EQUALLY SPACED ON A CIRCLE HAVING A DIAMETER OF SEVEN AND ONE HALF (7-1/2) INCHES, THE NUTS SHALL BE ATTACHED TO THE PLATE BY SOCKET HEAD CAP SCREWS THREADED INTO BLIND HOLES TAPPED TO A DEPTH OF APPROXIMATELY .218 INCHES. #3-48 SCREWS SHALL BE USED FOR PARTS WITH .098 INCH DIAMETER RIVET HOLES AND #5-40 SOCKET HEAD CAP SCREWS SHALL BE USED FOR PARTS WITH .130 INCH DIAMETER RIVET HOLES. THE #3-48 SCREWS SHALL BE SEATED TO FOURTEEN (14) INCH-POUNDS AND THE #5-40 SCREWS TO EIGHTEEN (18) INCH-POUNDS. INSTALL BOLTS IN NUTS USING A SEATING TORQUE THREE (3) TIMES THE MAXIMUM LOCKING TORQUE OF MIL-N-25027. THREE (3) NUTS SHALL BE TESTED WITH BOLTS INSTALLED AND THREE (3) NUTS WITH BOLTS REMOVED.

2.0 A POSITIVE SEAL SHALL BE CONSIDERED TO MEAN NO LEAKAGE BY VISUAL EXAMINATION, USING DYED LIQUID, WHEN SUBJECTED TO A STATIC DIFFERENTIAL PRESSURE OF 50 PSI+2 -0 PSI FOR A PERIOD OF FIVE (5) MINUTES MINIMUM. THE LIQUIDS USED SHALL BE FUELS CONFORMING TO MIL-J-5624 OR TT-S-735, TYPE III, FOR 225°F SEALS AND METHYL ALCOHOL FOR 450°F SEALS. IN ADDITION, A CYCLING TEST SHALL BE-PERFORMED CONSISTING OF A CYCLING PRESSURE OF BETWEEN 0 AND 50 PSI FOR 1000 CYCLES, A CYCLE BEING COMPLETED APPROXIMATELY EVERY TWELVE (12) SECONDS.

2.1 A POSITIVE SEAL SHALL BE PROVIDED AFTER AGING AN EMPTY TEST FIXTURE WITH NUTS MOUNTED IN A HOT AIR FURNACE AT 450°F ±10°F 225°F ±10°F, AS APPLICABLE FOR A PERIOD OF 4 HOURS ±10 MINUTES, A CYCLING TEST SHALL BE PERFORMED AT TEMPERATURE WITHOUT LIQUID USING AIR PRESSURE ALONE. THE TEST PRESSURES AND PROCEDURES OF PARAGRAPH 2.0 SHALL APPLY EXCEPT THE NUMBER OF PRESSURE CYCLES SHALL BE LIMITED TO 100. DURING THIS PERIOD, SINCE THERE IS NO LIQUID IN THE TANK, THERE IS NO CHECK FOR LEAKAGE.

2.2 IMMEDIATELY AFTER ELEVATED TEMPERATURE TEST CYCLES, THE FIXTURE SHALL BE REMOVED FROM THE FURNACE AND ALLOWED TO COOL TO ROOM TEMPERATURE. AT ROOM TEMPERATURE, LIQUID SHALL BE ADDED AND POSITIVE SEAL SHALL BE PROVIDED IN LIQUIDS WHEN TESTED IN ACCORDANCE WITH TEST PRESSURES AND PROCEDURES OUTLINED IN PARAGRAPH 2.0.

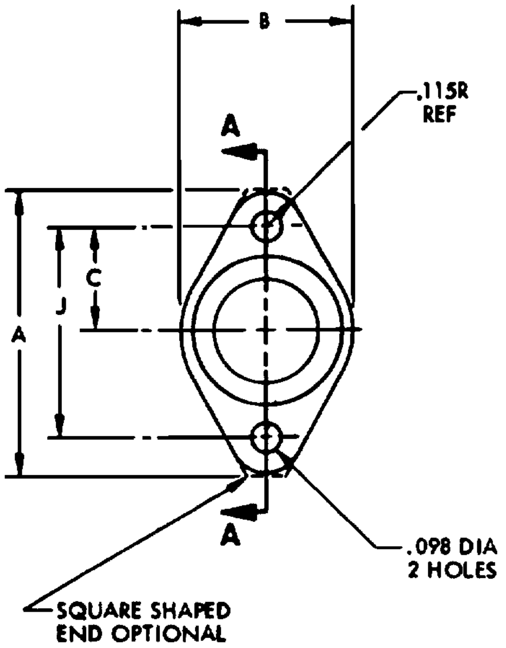
2.3 IN ADDITION, THE SAMPLES TESTED IN 2.1 SHALL PROVIDE A POSITIVE SEAL AFTER A CYCLING TEST HAS BEEN PERFORMED AS FOLLOWS: PLACE TEST FIXTURE IN A COLD BOX AT -65°F ±10°F AND ALLOW TO SOAK FOR A PERIOD OF 4 HOURS ±10 MINUTES. AFTER SOAKING AT THIS TEMPERATURE, APPLY A STATIC PRESSURE OF 50 PSI ±5 PSI FOR A PERIOD OF ONE (1) HOUR, A CYCLING TEST SHALL THEN BE PERFORMED BY HOLDING A PRESSURE OF 50 PSI ±5 PSI ON THE TEST FLUID FOR A PERIOD OF TWENTY (20) SECONDS AND RELEASING PRESSURE FOR TEN (10) SECONDS. REPEAT THIS THIRTY (30) SECOND CYCLE FOR 120 CYCLES. ALL TESTING UNDER THIS PARAGRAPH SHALL BE PERFORMED AT -65°F ±F°.

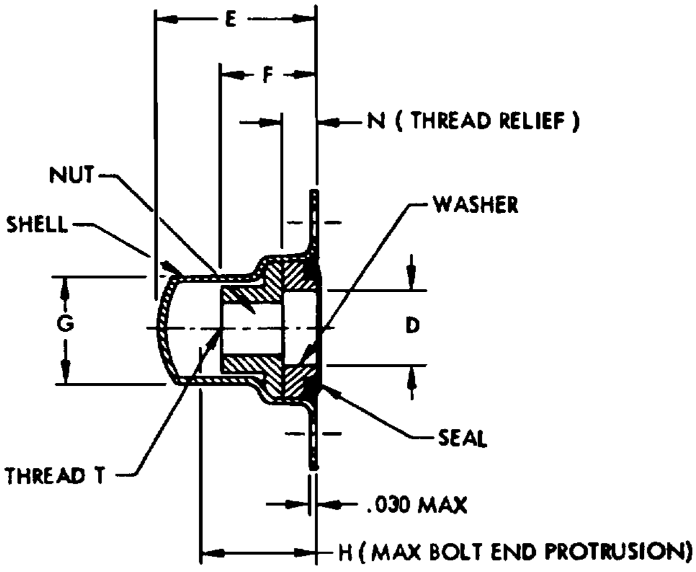
PROCUREMENT SPECIFICATION:

MIL-N-25027 EXCEPT AS NOTED, ALL NUTS SHALL MEET QUALIFICATION AND INSPECTION REQUIREMENTS. MANUFACTURERS SHALL PROVIDE EVIDENCE OF QUALIFICATION WHEN REQUIRED. TESTING SHALL BE PERFORMED BY MANUFACTURER OR INDEPENDENT LABORATORY. PROCURING AGENCY MAY CONDUCT CONFIRMING QUALIFICATION TESTS. NO QPL SHALL BE ESTABLISHED.

F05-126S03

Figure 5-127. Drawing NAS-1473 (Sheet 3)





SECTION A-A

THREAD T	DASH NUMBERS		A MAX	B MAX	C ±.005	D MIN	E MAX	F MAX	G MAX	BOLT END H MAX	J ±.002
	NUT STEEL 225°F	NUT CRES 450°F									
.1120-40UNJC-3B	A04	C04	.840	.443	.295	.142	.405	.204	.352	.340	.590
.1380-32UNJC-3B	A06	C06				.173		.221			
.1640-32UNJC-3B	A08	C08				.194		.268			
.1900-32UNJF-3B	A3	C3				.220					
.2500-28UNJF-3B	A4	C4	1.000	.635	.376	.280	.560	.350	.419	.490	.752

THREAD T	N MIN	WEIGHT/100 LB APPROX	
		225°F	450°F
.1120-40UNJC-3B	.070	.41	.50
.1380-32UNJC-3B		.42	.51
.1640-32UNJC-3B		.43	.52
.1900-32UNJF-3B		.45	.54
.2500-28UNJF-3B	.105	1.00	1.10

CODE: "A" DESIGNATES NON-CORROSION RESISTANT STEEL CADMIUM PLATE NUT AND SHELL WITH ALUMINUM OR STEEL WASHER, (AVAILABLE ONLY WITH MIL-R-6855 SEAL).
"C" DESIGNATES CORROSION RESISTANT STEEL NUT, SHELL AND WASHER WITH AMS3304 SILICONE RUBBER SEAL, NON-FUEL RESISTANT.

INSERT "X" IN LIEU OF "A" IN THE STEEL CODE FOR CADMIUM PLATED STEEL NUTS WITHOUT LUBRICANT.

NUT, SELF-LOCKING, PLATE-TWO LUG, CAP, FLOATING, REDUCED RIVET SPACING

F05-127S01

Figure 5-128. Drawing NAS-1474 (Sheet 1 of 3)

EXAMPLES: NAS1474A08 = STEEL NUT AND SHELL WITH ALUMINUM ALLOY OR STEEL WASHER.
.1640-32UNJC-3B THREAD WITH MIL-R-6855 FUEL RESISTANT RUBBER
SEAL FOR USE UP TO +225°F.
NAS1474C08 = CRES NUT, SHELL AND WASHER WITH .1640-32UNJC-3B THREAD AND
AMS3304 NON-FUEL RESISTANT SILICONE RUBBER SEAL FOR USE UP
TO +450°F.

MATERIALS: NUT - STEEL, SEE PROCUREMENT SPECIFICATION.
CRES, AMS5525, OR AMS5735, A-286, NON-MAGNETIC.
SHELL - STEEL, SEE PROCUREMENT SPECIFICATION.
CRES, AMS5525, A-286 NON-MAGNETIC.
WASHER - (225°F) ALUMINUM ALLOY OR STEEL. SEE PROCUREMENT SPECIFICATION.
(450°F) CRES, AMS5525 OR AMS5735, A-286, NON-MAGNETIC.
SEAL - (225°F) RUBBER, MIL-R-6855, CLASS I, GRADE 60, DUROMETER A60,
COLOR BLACK.

(450°F) SILICONE RUBBER, AMS 3304, DUROMETER A70, COLOR RED.

FINISH: STEEL SHELL AND WASHER - CADMIUM PLATE PER QQ-P-416, TYPE II, CLASS 2.
STEEL NUT: CADMIUM PLATE PER QQ-P-416, TYPE II, CLASS 2, PLUS AND APPROVED
DRY FILM LUBRICANT. EXISTING NUTS WITH AN OPTIONAL TYPE AND CLASS
OF CADMIUM PLATE PER QQ-P-416, AS PREVIOUSLY PERMITTED,
FURNISHED UNTIL 16 DEC. 1976.
CRES - SHELL AND WASHER - CLEAN AND PASSIVATE PER MIL-S-5002.
NUT - SILVER PLATE FOR 450°F USE PER MIL-N-25027 TO A .0002 MINIMUM
THICKNESS ON SURFACES WHICH CAN BE TOUCHED BY A .7500 (3/4-INCH) BALL.
THREADS SHALL SHOW COMPLETE COVERAGE. BUT THICKNESS REQUIREMENT ON
THREADS IS WAIVED.
ALUMINUM ALLOY - ANODIZE OR CHEMICAL FILM PER MIL-N-25027, EXCEPT ANODIZE SHALL
BE LIMITED TO TYPE I OR TYPE II.

FLOAT: MINIMUM RADIAL FLOAT .015.
MAXIMUM AXIAL FLOAT .030

PRESSURE RANGE: 0 TO 50 PSIG.

TEMPERATURE RANGE: MIL-R-6855 RUBBER (-65°F TO 225°F).

THREADS: THREADS IN ACCORDANCE WITH MIL-S-8879 BEFORE LUBRICATION.

MARKING: THE SMALLEST CONTAINER USED TO PACKAGE "A" CODED PARTS SHALL BE MARKED WITH THE CURE DATE (QUARTER AND YEAR) OF THE OLDEST RUBBER SEAL CONTAINED THEREIN. THE AGE OF RUBBER SEALS SHALL NOT EXCEED 6 QUARTERS AT THE TIME OF DELIVERY TO THE CONTRACTOR.

NOTES:

1. THREAD ELEMENT SHALL BE CAPABLE OF ENGAGEMENT WITH A BOLT IN THE MAXIMUM MISALIGNED POSITION.
2. NUT AND SHELL SHAPE OPTIONAL, WITHIN SPECIFIED MAXIMUM DIMENSIONS.
3. MAGNETIC PERMEABILITY OF CRES NUTS SHALL BE LESS THAN 2.0 (AIR = 1.0) FOR A FIELD STRENGTH H = 200 OERSTEDS. MAGNETIC PERMEABILITY INDICATOR PERMEABILITY PER MIL-I-17214 OR EQUIVALENT.
4. NACA RIVETING METHOD FOR ATTACHMENT NOT TO BE USED.

F05-127S02

Figure 5-128. Drawing NAS-1474 (Sheet 2)

PERFORMANCE: QUALIFICATION TEST

1.0 ALL REQUIREMENTS OF MIL-N-25027 PERTAINING TO STEEL FLOATING PLATE NUTS INCLUDING AXIAL STRENGTH REQUIREMENTS OF TABLE I FOR REGULAR STEEL NUTS, SHALL APPLY TO THIS PART EXCEPT THE MAXIMUM TEMPERATURE SHALL BE 450°F. A POSITIVE SEAL SHALL BE REQUIRED AFTER TESTING PER PARAGRAPH 3.10 (PUSHOUT) AND 3.9.3 (TORQUE OUT) OF MIL-N-25027 THE PUSH OUT AND TORQUE OUT TESTS SHALL BE CARRIED TO A PROOF LOAD EQUAL TO THE REQUIREMENT FOR THE APPLICABLE SIZE. ALL TESTS SHALL BE PERFORMED ON A SINGLE SHEET OF 2024-T3 OR 7075-T6 ALUMINUM ALLOY, NOMINAL THICKNESS OF .312 INCHES, AND HAVING A MINIMUM OF TEN (10) INCHES SQUARE (100 SQUARE INCHES) UNSUPPORTED AREA. SIX (6) NUTS SHALL BE EQUALLY SPACED ON A CIRCLE HAVING A DIAMETER OF SEVEN AND ONE HALF (7-1/2) INCHES. THE NUTS SHALL BE ATTACHED TO THE PLATE BY SOCKET HEAD CAP SCREWS THREADED INTO BLIND HOLES TAPPED TO A DEPTH OF APPROXIMATELY .218 INCHES WITH #3-48 SCREWS. THE #3-48 SCREWS SHALL BE SEATED TO FOURTEEN (14) INCH-POUNDS. INSTALL BOLTS IN NUTS USING A SEATING TORQUE THREE (3) TIMES THE MAXIMUM LOCKING TORQUE OF MIL-N-25027. THREE (3) NUTS SHALL BE TESTED WITH BOLTS INSTALLED AND THREE (3) NUTS WITH BOLTS REMOVED.

2.0 A POSITIVE SEAL SHALL BE CONSIDERED TO MEAN NO LEAKAGE BY VISUAL EXAMINATION, USING DYED LIQUID, WHEN SUBJECTED TO A STATIC DIFFERENTIAL PRESSURE OF 50 PSI +2 -0 PSI FOR A PERIOD OF FIVE (5) MINUTES MINIMUM. THE LIQUIDS USED SHALL BE FUELS CONFORMING TO MIL-J-5624 OR TT-S-735, TYPE III, FOR 225°F SEALS AND METHYL ALCOHOL FOR 450°F SEALS. IN ADDITION, A CYCLING TEST SHALL BE PERFORMED CONSISTING OF A CYCLING PRESSURE OF BETWEEN 0 AND 50 PSI FOR 1000 CYCLES, A CYCLE BEING COMPLETED APPROXIMATELY EVERY TWELVE (12) SECONDS.

2.1 A POSITIVE SEAL SHALL BE PROVIDED AFTER AGING AN EMPTY TEST FIXTURE WITH NUTS MOUNTED IN A HOT AIR FURNACE AT 450°F ±10°F OR 225°F ±10°F, AS APPLICABLE FOR A PERIOD OF 4 HOURS ±10 MINUTES. A CYCLING TEST SHALL BE PERFORMED AT TEMPERATURE WITHOUT LIQUID USING AIR PRESSURE ALONE. THE TEST PRESSURES AND PROCEDURES OF PARAGRAPH 2.0 SHALL APPLY EXCEPT THE NUMBER OF PRESSURE CYCLES SHALL BE LIMITED TO 100. DURING THIS PERIOD, SINCE THERE IS NO LIQUID IN THE TANK, THERE IS NO CHECK FOR LEAKAGE.

2.2 IMMEDIATELY AFTER ELEVATED TEMPERATURE TEST CYCLES, THE FIXTURE SHALL BE REMOVED FROM THE FURNACE AND ALLOWED TO COOL TO ROOM TEMPERATURE. AT ROOM TEMPERATURE, LIQUID SHALL BE ADDED AND POSITIVE SEAL SHALL BE PROVIDED IN LIQUIDS WHEN TESTED IN ACCORDANCE WITH TEST PRESSURES AND PROCEDURES OUTLINED IN PARAGRAPH 2.0.

2.3 IN ADDITION, THE SAMPLES TESTED IN 2.1 SHALL PROVIDE A POSITIVE SEAL AFTER A CYCLING TEST HAS BEEN PERFORMED AS FOLLOWS: PLACE TEST FIXTURE IN A COLD BOX AT -65°F ±10°F AND ALLOW TO SOAK FOR A PERIOD OF 4 HOURS ±10 MINUTES. AFTER SOAKING AT THIS TEMPERATURE, APPLY A STATIC PRESSURE OF 50 PSI ±5 PSI FOR A PERIOD OF ONE (1) HOUR. A CYCLING TEST SHALL THEN BE PERFOMED BY HOLDING A PRESSURE OF 50 PSI ±5 PSI ON THE TEST FLUID FOR A PERIOD OF TWENTY (20) SECONDS AND RELEASING PRESSURE FOR TEN (10) SECONDS. REPEAT THIS THIRTY (30) SECOND CYCLE FOR 120 CYCLES. ALL TESTING UNDER THIS PARAGRAPH SHALL BE PERFORMED AT -65°F ±10°F.

PROCUREMENT SPECIFICATION:

MIL-N-25027 EXCEPT AS NOTED. ALL NUTS SHALL MEET QUALIFICATION AND INSPECTION REQUIREMENTS. MANUFACTURERS SHALL PROVIDE EVIDENCE OF QUALIFICATION WHEN REQUIRED. TESTING SHALL BE PERFORMED BY MANUFACTURER OR INDEPENDENT LABORATORY. PROCURING AGENCY MAY CONDUCT CONFIRMING QUALIFICATION TESTS. NO QPL SHALL BE ESTABLISHED.

F05-127S03

Figure 5-128. Drawing NAS-1474 (Sheet 3)

CHAPTER 6
WASHERS

6.1 WASHERS.

The types of washers used in aircraft structure are plain washers, lockwashers, and special washers.

6.1.1 Plain Washers. (Refer to Table 6-1 through Table 6-9.) Plain washers are used under nuts to provide a smooth bearing surface, to act as shims in obtaining the correct relationship between the threads of the bolt and the nut, and in adjusting the position of castellated nuts with respect to drilled cotter pin holes in bolts. Plain washers are used under lockwashers to prevent damage to surfaces of soft material.

6.1.2 Aluminum or aluminum alloy washers are used under bolt heads or nuts on aluminum alloy or magnesium structures where corrosion is a factor. In this application, the resulting galvanic coupling will not involve the surface material. General practice, however, is to use a cadmium-plated steel washer under the nut, with the washer bearing directly against the structure. The washer is kept from rotating by friction against the surface of the structure, and will resist the cutting action of the nut better than the aluminum washer.

6.1.3 The AN970 steel washer (Table 6-7) provides a greater bearing area than the plain type, and is used in wooden structures under both bolt head and nut to prevent local crushing of the surface.

6.1.4 Lockwashers. (Refer to Table 6-10 through Table 6-19.) Lockwashers are used with plain nuts when self-locking or castellated type nuts are not applicable. The spring action of the washer prevents the nut from becoming loose. Lockwashers may be used to prevent loosening of threaded fasteners in airframe construction under the following conditions:

a. When a self-locking feature cannot be provided in externally or internally threaded part, or

b. When a cotter pin cannot be used to prevent rotation of an internally threaded part with respect to an externally threaded part, or

c. When lock wire cannot be used to prevent loosening of threaded parts,

d. When fastening is not used for fabrication of primary structure,

e. When loosening of threaded parts would not endanger the safety of the airplane or personnel,

f. When corrosion, encouraged by gouging of aluminum or magnesium alloys by edges of teeth on AN936, would not cause malfunctioning of parts being fastened together. Corrosion of dissimilar metals may be reduced by installing AN936 washers with wet primer.

6.2 SPECIAL WASHERS.

WARNING

Lockwashers are not to be used on primary structures, secondary structures, superstructures, or accessories where failure might result in damage or danger to aircraft or personnel.

CAUTION

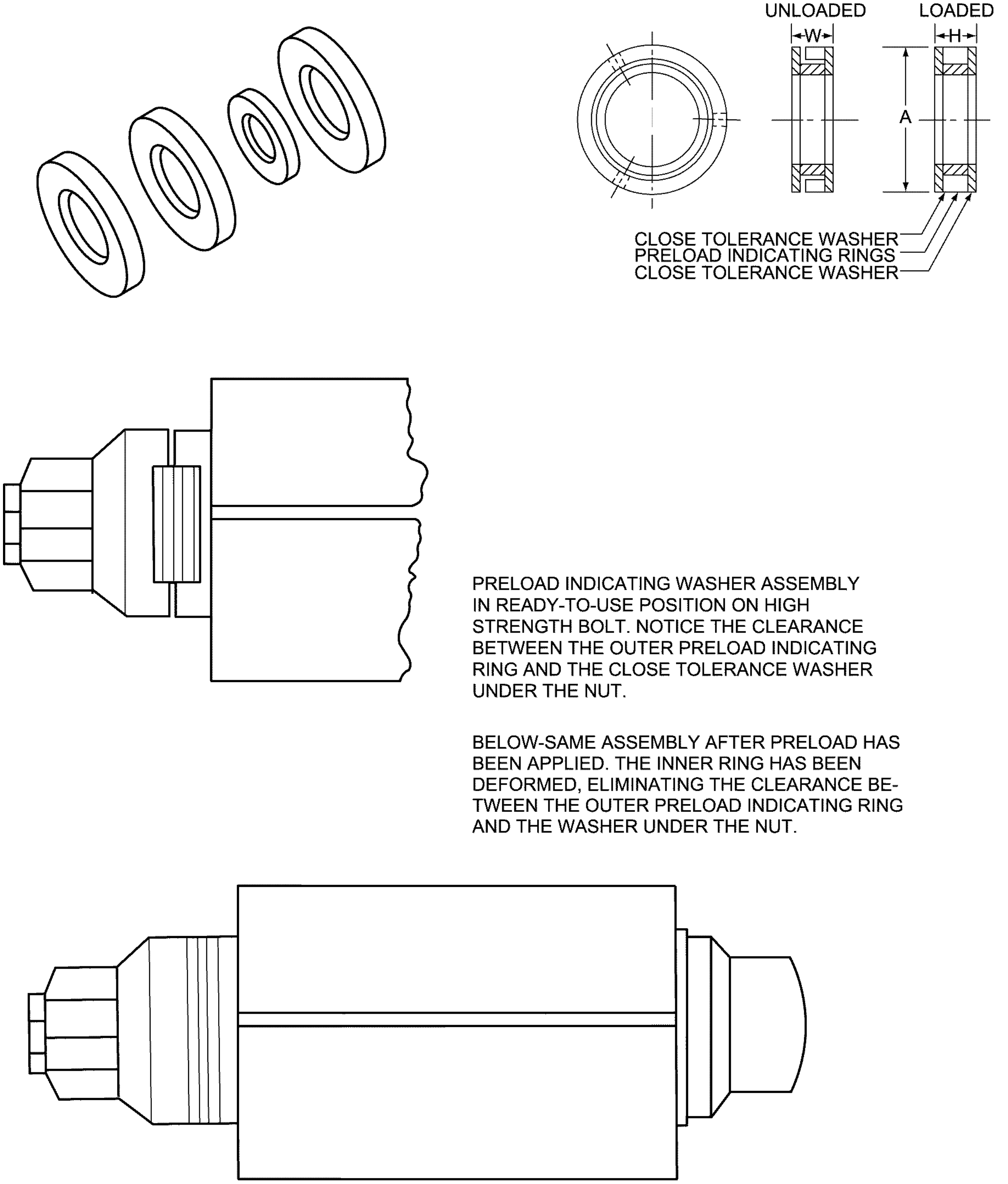
Do not use lockwashers on soft metal, such as aluminum or magnesium, without a plain washer underneath to prevent damage to the soft metal surface. Lockwashers are not to be used where their failure would permit leakage, or on exposed surfaces subject to airflow. Neither should they be installed in places where they will be subjected to corrosive conditions, nor in places where they must be removed frequently.

(Refer to Table 6-20 through Table 6-42.) There are many types and varieties of special washers, used in a multiplicity of applications. Table 6-20 through Table 6-42 give data on many of these washers.

6.2.1 Ball Socket and Ball Seat Washers. Ball socket and ball seat washers are used in applications where the bolt is installed at an angle to the surface, or where perfect alignment with the surface is required at all times. Ball socket and ball seat washers are used together.

6.2.2 Taper Pin Washers. Taper pin washers are used in conjunction with threaded taper pins, and are installed under the nut to effect adjustment where a plain washer would distort.

6.2.3 Preload-Indicating Washers. (See Figure 6-1.) Preload-indicating washers are used under nuts and provide a means of measuring the torque applied to a tightened nut. The preload-indicating washer consists of two concentric steel rings between two close-tolerance washers. The inner ring is attached to the two washers, and is smaller in diameter and thicker than the outer ring. As a nut is tightened against the preload-indicating washer, the inner ring is compressed until the loose outer ring is bound between the two washers. The inner ring has a constant resistance to deformation; therefore, the force necessary to compress the inner ring is predetermined, and is equal to the torque applied to the nut. The exact predetermined torque has been reached when binding of the outer ring occurs. The preload-indicating washer can be used only one time for measuring torque.



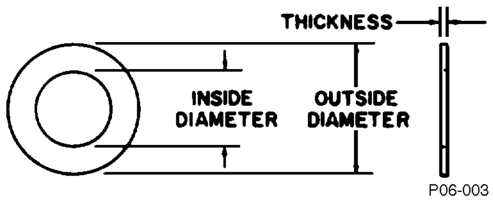
PRELOAD INDICATING WASHER ASSEMBLY IN READY-TO-USE POSITION ON HIGH STRENGTH BOLT. NOTICE THE CLEARANCE BETWEEN THE OUTER PRELOAD INDICATING RING AND THE CLOSE TOLERANCE WASHER UNDER THE NUT.

BELOW-SAME ASSEMBLY AFTER PRELOAD HAS BEEN APPLIED. THE INNER RING HAS BEEN DEFORMED, ELIMINATING THE CLEARANCE BETWEEN THE OUTER PRELOAD INDICATING RING AND THE WASHER UNDER THE NUT.

F06-001

Figure 6-1. Preload-Indicating Washer

Table 6-1. NAS70 Plain Washer



	Washer Dimensions			Washer Material					
Bolt Size	Inside Diameter +.010 -.005	Outside Diameter ±.010	Thickness	Clad Aluminum Alloy	Corrosion-Resistant	Brass	Vulcanized Fiber	Phenolic Fiber	SAE 1010 Steel
No. 2	.099	.250	.016	AL	CL				SAE 1010 Steel Is Specified By Using No Material Symbol After Part Number
			.031	A	C	B	V	P	
No. 3	.113	.250	.016	AL	CL				
			.031	A	C	B			
No. 4	.128	.313	.016	AL	CL				
			.031	A	C	B			
No. 6	.144	.375	.016	AL	CL				
			.031	A	C	B	V	P	
No. 6	.161	.438	.016	AL	CI				
			.031	A	C				
No. 8	.177	.375	.016	AL	CL				
			.031	A	C	B	V	P	
No. 8	.177	.500	.016	AL	CL				
			.031	A	C				
No. 10	.209	.438	.016	AL	CL				
			.031	A	C	B	V	P	
1/4	.261	.500	.016	AL	CL				
			.031	A	C				
1/4	.261	.750	.016	AL	CL				
			.063	A	C				
1/4	.261	1.000	.016	AL	CL				

Table 6-1. NAS70 Plain Washer - Continued

	Washer Dimensions			Washer Material					
Bolt Size	**Inside Diameter +.010 -.005**	**Outside Diameter ±.010**	**Thickness**	**Clad Aluminum Alloy**	**Corrosion-Resistant**	**Brass**	**Vulcanized Fiber**	**Phenolic Fiber**	**SAE 1010 Steel**
			.063	A	C				
1/4	.261	1.500	.016	AL	CL				
			.031	A	C	BL	V	P	
			.063			B			
5/16	.328	.563	.016	AL	CL				
			.031	A	C	B	V	P	
3/8	.390	.625	.016	AL	CL				
			.063	A	C	B	V	P	
7/16	.453	.750	.016	AL	CL				
			.063	A	C		V	P	
1/2	.515	.875	.016	AL	CL				
			.063	A	C	B	V	P	
9/16	.578	1.062	.016	AL	CL				
			.063	A	C				
5/8	.640	1.188	.016	AL	CL				
			.063	A	C	B			
3/4	.765	1.313	.031	AL	CL				
			.093	A	C	B			
7/8	.890	1.500	.031	AL	CL				
			.093	A	C	B			
1	1.015	1.750	.031	AL	CL				
			.093	A	C	B			

Code:

Material-designating letter or letters after basic part number are specified above under washer material.

First dash number is the inside diameter.

Second dash number is the outside diameter.

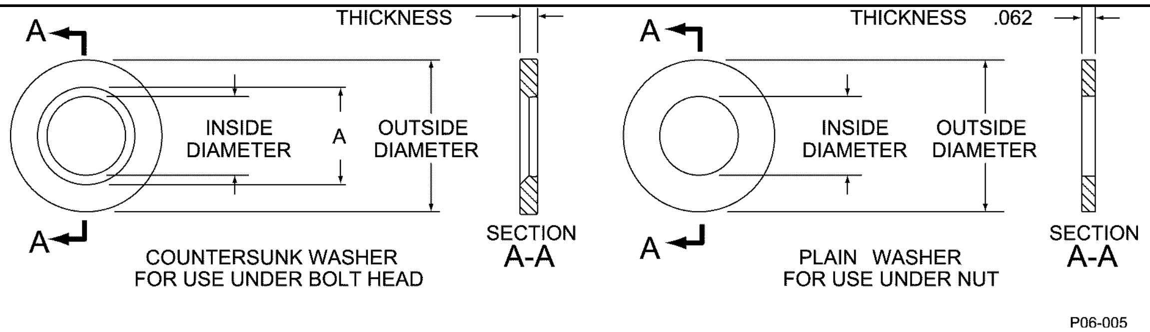
Example of part number:

NAS-70AL-.113-.250 = washer, .016-inch thick clad aluminum alloy, .113-inch inside diameter, .250-inch outside diameter.

Table 6-1. NAS70 Plain Washer - Continued

Material:
Clad aluminum alloy, Federal Specification QQ-A-362.
Steel.
Corrosion-resistant steel, Military Specification MIL-S-5059.
Brass Federal Specification QQ-B-613.
Vulcanized fiber, Military Specification MIL-F-10336.
Phenolic fiber.
Finish:
Cadmium plating, Federal Specification QQ-P-416. Brass, black oxide.

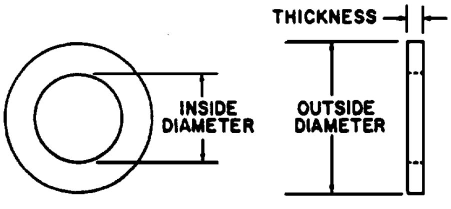
Table 6-2. NAS143 Countersunk and Plain Washers



Dash Number		Bolt Size	Inside Diameter		Outside Diameter ±.010	A Diameter		Thickness Countersunk Washers Only ±.010
Countersunk	Plain		Max	Min		Max	Min	
-4C	-4	1/4	.260	.252	.531	.344	.334	.078
-5C	-5	5/16	.324	.315	.593	.406	.396	
-6C	-6	3/8	.388	.378	.687	.495	.483	
-7C	-7	7/16	.451	.441	.781	.557	.543	
-8C	-8	1/2	.515	.504	.875	.620	.604	
-9C	-9	9/16	.579	.568	.968	.687	.667	
-10C	-10	5/8	.643	.631	1.062	.785	.765	
-12C	-12	3/4	.770	.757	1.250	.910	.890	
-14C	-14	7/8	.897	.884	1.437	1.035	1.015	
-16C	-16	1	1.025	1.010	1.750	1.160	1.140	
-18C	-18	1-1/8	1.150	1.135	1.875	1.285	1.265	
-20C	-20	1-1/4	1.275	1.260	2.125	1.447	1.427	.094
-22C	-22	1-3/8	1.400	1.385	2.313	1.572	1.552	
-24C	-24	1-1/2	1.525	1.510	2.500	1.697	1.677	

Code:
Dash number indicates bolt diameter in 1/16 inch.
C after dash number indicates countersunk washer.
Example of part number:
NAS143-8C = washer, countersunk, cadmium-plated chrome-molybdenum steel, for 1/2-inch diameter bolt.
NAS143-8 = washer, cadmium-plated chrome-molybdenum steel, for 1/2-inch diameter bolt.
Material:
Steel, Military Specification MIL-S-18729.
Finish:
Cadmium plating, Federal Specification QQ-P-416.

Table 6-3. NAS620 Washer



P06-006

Dash Number	Bolt Size	Inside Diameter +.010 -.000	Outside Diameter +.015 -.005	Thickness
-0	No. 0	.063	.099	.016
-2	No. 2	.089	.149	.016
-3L	No. 3	.102	.180	.016
-3				.032
-4L	No. 4	.115	.209	.016
-4				.032
-5L	No. 5	.128	.238	.016
-5				.032
-6L	No. 6	.143	.267	.016
-6				.032
-8L	No. 8	.169	.304	.016
-8				.032
-10L	No. 10	.195	.354	.032
-10				.063
-416L	1/4	.255	.468	.032
-416				.063

Code:

A before dash number indicates aluminum alloy washer.

B before dash number indicates brass washer.

Dash number from 0 to 10 is bolt size. Dash number 416 indicates bolt diameter in 1/16 inch.

Example of part number:

NAS620-10 = washer, cadmium-plated low carbon steel, for number 10 bolt.

NAS620A10L = washer, light series, 52S aluminum alloy, for number 10 bolt.

NAS620B10 = washer, cadmium-plated brass, for number 10 bolt.

Material:

Low carbon steel, Federal Specification QQ-S-636.

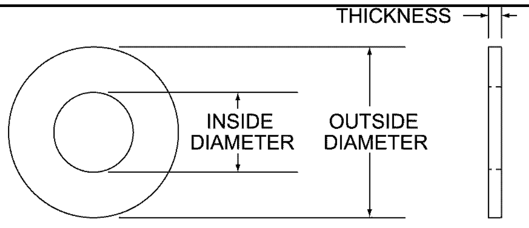
52S aluminum alloy, Federal Specification QQ-A-318.

Brass, Federal Specification QQ-B-613

Finish:

Cadmium plating, Federal Specification QQ-P-416.

Table 6-4. 945 Washer



P06-007

Dash Number					
Unplated	**Plated**	**Bolt Size**	**Inside Diameter**	**Outside Diameter**	**Thickness**
-3	-3P	No. 10	.203	.375	.0468
-4	-4P	1/4	.313	.750	.0625
-5	-5P	5/16	.375	.875	.0625
-6	-6P	3/8	.438	1.000	.0781
-7	-7P	7/16	.500	1.250	.0781
-8	-8P	1/2	.563	1.375	.0937
-9	-9P	9/16	.625	1.500	.0937
-10	-10P	5/8	.688	1.750	.1250
-12	-12P	3/4	.813	2.000	.1562
-14	-14P	7/8	.938	2.250	.1718
-16	-16P	1	1.063	2.500	.1718
-18	-18P	1-1/8	1.250	2.750	.1718
-20	-20P	1-1/4	1.375	3.000	.1718
-22	-22P	1-3/8	1.500	3.250	.1875
-24	-24P	1-1/2	1.625	3.500	.1875

Code:

Dash number indicates bolt diameter in 1/16 inch.

P after dash number indicates plated washer.

Example of part number:

945-4 = washer, unplaced wrought iron or steel, for 1/4-inch bolt.

945-4P = washer, plated wrought iron or steel, for 1/4-inch bolt.

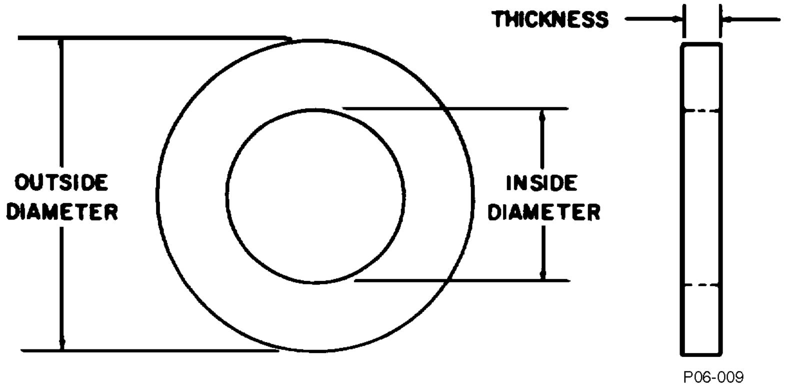
Material:

Wrought iron or steel.

Finish:

Cadmium plating, Federal Specification QQ-P-416.

Table 6-5. AN960 Washer



Dash Number											
		Clad Aluminum Alloy		Aluminum							
Carbon Steel	Corrosion-Resistant Steel	Treated Surface	Untreated Surface	Treated Surface	Untreated Surface	Brass	Copper	Bolt Size	Inside Diameter ±.010	Outside Diameter +.020 -.005	Thickness ±.010*
-3L	-C3L	-PD3L	-D3L	-PA3L	-A3L			No. 3	.105	.250	.016
-3	-C3	-PD3	-D3	-PA3	-A3	-B3					.032
-4L	-C4L	-PD4L	-D4L	-PA4L	-A4L						.016
-4	-C4	-PD4	-D4	PA4	-A4	-B4		No. 4	.125	.312	.032
							-CU12				.035
							-CU11	No. 5	.140	.438	.042
-6L	-C6L	-PD6L	-D6L	-PA6L	-A6L			No. 6	.149	.375	.016
-6	-C6	-PD6	-D6	-PA6	-A6	-B6					.032
-8L	-C8L	-PD8L	-D8L	-PA8L	-A8L			No. 8	.174	.375	.016
-8	-C8	-PD8	-D8	-PA8	-A8	-B8					.032
							-CU7		.188	.500	.049
		-PD10L	-D10L	-PA10L	-A10L						.016
-10L	-C10L							No. 10	.203		.032
							-CU316				.049

Table 6-5. AN960 Washer - Continued

Dash Number											
		Clad Aluminum Alloy		Aluminum							
Carbon Steel	Corrosion-Resistant Steel	Treated Surface	Untreated Surface	Treated Surface	Untreated Surface	Brass	Copper	Bolt Size	Inside Diameter ±.010	Outside Diameter +.020 -.005	Thickness ±.010*
-10	-C10	-PD10	-D10	-PA10	-A10	-B10				.438	.063
							-CU5		.234	.625	.065
		-PD416L	-D416L	-PA416L	-A416L						.016
-416L	-C416L							1/4	.265	.500	.032
-416	-C416	-PD416	-D416	-PA416	-A416	-B416					.063
		-PD516L	-D516L	-PA516L	-A516L						.016
-516L	-C516L							5/16	.328	.562	.032
-516	-C516	-PD516	-D516	-PA516	-A516	-B516					.063
		-PD616L	-D616L	-PA616L	-A616L						.016
-616L	-C616L							3/8	.390	.625	.032
-616	-C616	-PD616	-D616	-PA616	-A616	-B616					.063
		-PD716L	-D716L	-PA716L	-A716L						.016
-716L	-C716L							7/16	.453	.750	.032
-716	-C716	-PD716	-D716	-PA716	-A716	-B716					.063
		-PD816L	-D816L	-PA816L	-A816L						.016
-816L	-C816L							1/2	.515	.875	.032
-816	-C816	-PD816	-D816	-PA816	-A816	-B816					.063
		-PD916L	-D916L	-PA916L	-A916L						.016
-916L	-C916L							9/16	.578	1.062	.032
-916	-C916	-PD916	-D916	-PA916	-A916	-B916					.063
		-PD1016L	-D1016L	-PA1016L	-A1016L						.016
-1016L	-C1016L							5/8	.640	1.188	.032
-1016	-C1016	-PD1016	-D1016	-PA1016	-A1016	-B1016					.063
		-PD1216L	-D1216L	-PA1216L	-A1216L	-B1216					.016
-1216L	-C1216L							3/4	.765	1.312	.032
-1216	-C1216	-PD1216	-D1216	-PA1216	-A1216						.090

Table 6-5. AN960 Washer - Continued

Dash Number											
		Clad Aluminum Alloy		Aluminum							
Carbon Steel	Corrosion-Resistant Steel	Treated Surface	Untreated Surface	Treated Surface	Untreated Surface	Brass	Copper	Bolt Size	Inside Diameter ±.010	Outside Diameter +.020 -.005	Thickness ±.010*
		-PD1416L	-D1416L	-PA1416L	-A1416L						.016
-1416L	-C1416L							7/8	.890	1.500	.032
-1416	-C1416	-PD1416	-D1416	-PA1416	-A1416	-B1416					.090
		-PD1616L	-D1616L	-PA1616L	-A1616L						.016
-1616L	-C1616L							1	1.015	1.750	.032
-1616	-C1616	-PD1616	-D1616	-PA1616	-A1616	-B1616					.090
		-PD1716L	-D1716L	-PA1716L	-A1716L						.016
-1716L								1-1/16	1.078	1.812	.032
-1716	-C1716	-PD1716	-D1716	-PA1716	-A1716	-B1716					.090
		-PD1816L	-D1816L								.016
-1816L								1-1/8	1.140	1.875	.032
-1816	-C1816	-PD1816	-D1816			-B1816					.090
		-PD2016L	-D2016L								.016
-2016L								1-1/4	1.265	2.000	.032
-2016	-C2016	-PD2016	-D2016			-B2016					.090
		-PD2116L	-D2116L	-PA2116L	-A2116L						.016
-2116L								1 5/16	1.328	2.062	.032
-2116	-C2116	-PD2116	-D2116	-PA2116	-A2116	-B2416					.090
		-PD2616L	-D2616L	-PA2616L	-A2616L						.016
-2616L								1-5/8	1.640	2.375	.032
-2616	-C2616	-PD2616	-D2616	-PA2616	-A2616	-B2616					.090
		-PD3016L	-D3016L	-PA3016L	-A3016L						.016
-3016L								1-7/8	1.890	2.625	.032
-3016	-C3016	-PD3016	-D3016	-PA3016	-A3016	-B3016					.090
		-PD3616L	-D3616L	-PA3616L	-A3616L						.016
-3616L								2-1/4	2.265	3.000	.032

Table 6-5. AN960 Washer - Continued

Dash Number											
		Clad Aluminum Alloy		Aluminum							
Carbon Steel	Corro-sion-Resis-tant Steel	Treated Surface	Untreat-ed Sur-face	Treated Surface	Untreat-ed Sur-face	Brass	Copper	Bolt Size	Inside Diameter ±.010	Outside Diameter +.020 -.005	Thick-ness ±.010*
-3616	-C3616	-PD3616	-D3616	-PA3616	-A3616	-B3616					.090
		-PD4016L	-D4016L	-PA4016L	-A4016L						.016
-4016L								2-1/4	2.515	3.250	.032
-4016	-C4016	-PD4016	-D4016	-PA4016	-A4016	-B4016					.090

Code:

Material-designating letter or letters before dash number are as specified above under dash numbers.

Dash number from 3 to 10 is bolt size.

Dash number from 416 to 4016 indicates bolt diameter in 1/16 inch.

Example of part number:

AN960-716 = washer, cadmium-plated carbon steel, for 7/16-inch diameter bolt.

AN960PD10L = washer, light series, treated surface clad aluminum alloy, for number 10 bolt.

Material:

Carbon steel, Military Specification MIL-S-7952 or Federal Specification QQ-S-636.

Corrosion-resistant steel, Military Specification MIL-S-5059 or MIL-S-6721.

Aluminum, Federal Specification QQ-A-561.

Clad aluminum alloy, Federal Specification QQ-A-362.

Copper, Federal Specification QQ-C-576.

Finish:

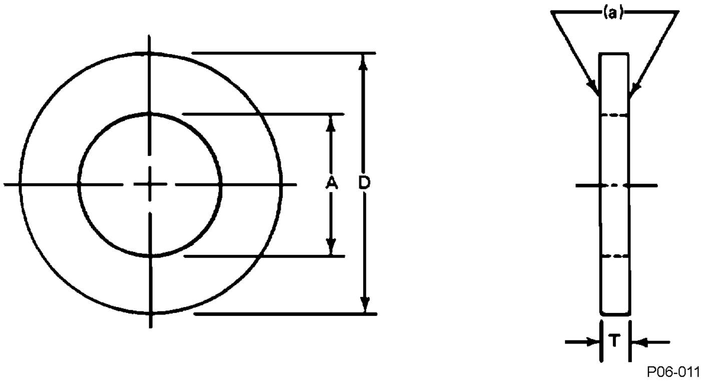
Anodize, Military Specification MIL-A-8625 or chemical treatment, Military Specification MIL-C-5541.

(For clad aluminum alloy and aluminum washers when specified.)

Cadmium plating, Federal Specification QQ-P-416. (For carbon steel washers only.)

*Unless otherwise specified, tolerances are as follows: Decimals ±.010, on thickness for aluminum or aluminum alloy washers; 0.016 ± 0.003; 0.032 ± 0.004; 0.064 ± 0.006; 0.090 ± 0.007.

Table 6-6. AN961 Washer



②

AN961 Dash No.	Thread Size	A Diameter	D Diameter +0.020 -0.005	T
-4S -4T	No. 4	0.125	0.312	
-6S -6T	No. 6	0.149		
-8S -8T	No. 8	0.174	0.375	0.032
-10S -10T	No. 10	0.203	0.438	
-416S -416T	1/4	0.265	0.500	
-516S -516T	5/16	0.328	0.562	
-616S -616T	3/8	0.390	0.625	0.064
-816S -816T	1/2	0.515	0.875	
-1016S -1016T	5/8	0.640	1.188	

(a) Washer shall be flat within 0.005 for 0.875 o.d. and under, within 0.010 for o.d. over 0.875.

Material:

Brass, specification QQ-W-321 (flat wire) comp. 7, temper 1/2 hard, or QQ-B-626, comp. 1, temper 1/2 hard.

Finish:

Tin plate, MIL-T-10727, type 1.

Silver plate, QQ-S-365, grade b.

Remove all burrs and sharp edges.

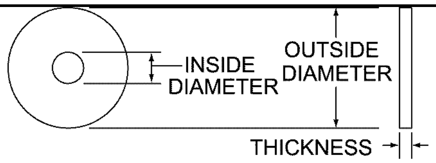
All dimensions in inches, unless otherwise specified. Decimals + 0.010.

Example part numbers:

AN961-4T = washer for no. 4 thread size, tin plated.

AN961-4S = washer for no. 4 thread size, silver plated.

Table 6-7. AN970 Washer



P06-012

Dash Number	Bolt Size	Inside Diameter ±.010	Outside Diameter ±.010	Thick-ness ±.010
-3	No. 10	.203	.875	.063
-4	1/4	.265	1.125	.063
-5	5/16	.328	1.375	.063
-6	3/8	.390	1.625	.063
-7	7/16	.453	1.812	.109
-8	1/2	.515	2.000	.109
-9	9/16	.578	2.188	.125
-10	5/8	.640	2.375	.125

Code:

Dash number indicates bolt diameter in 1/16 inch.

Example of part number:

AN970-4 = washer for 1/4-inch diameter bolt.

Material:

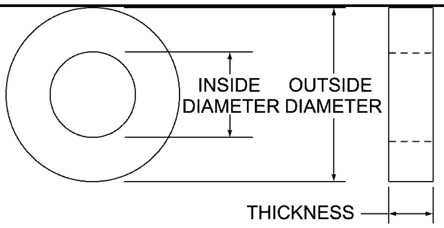
Steel.

Finish:

Cadmium plating, Federal Specification QQ-P-416.

The AN970 washer is used in wooden structures under both bolt head and nut to prevent crushing of the surface.

Table 6-8. AN122576 through AN122600, Washer



P06-013

Inside Diameter +.010 -.005	Outside Diameter ±.010	Thickness ±.005	Part Number
.119	.250	.031	AN122576
.135	.312	.031	AN122577
.150	.312	.043	AN122578
.159	.375	.043	AN122579
.184	.375	.050	AN122580
.213	.438	.062	AN122581
.276	.500	.062	AN122582
.338	.625	.062	AN122583
.401	.750	.078	AN122584
.463	.875	.094	AN122585
.526	1.000	.109	AN122586
.588	1.125	.125	AN122587
.651	1.250	.141	AN122588
.776	1.500	.172	AN122589
.901	1.750	.203	AN122590
1.026	2.000	.234	AN122591

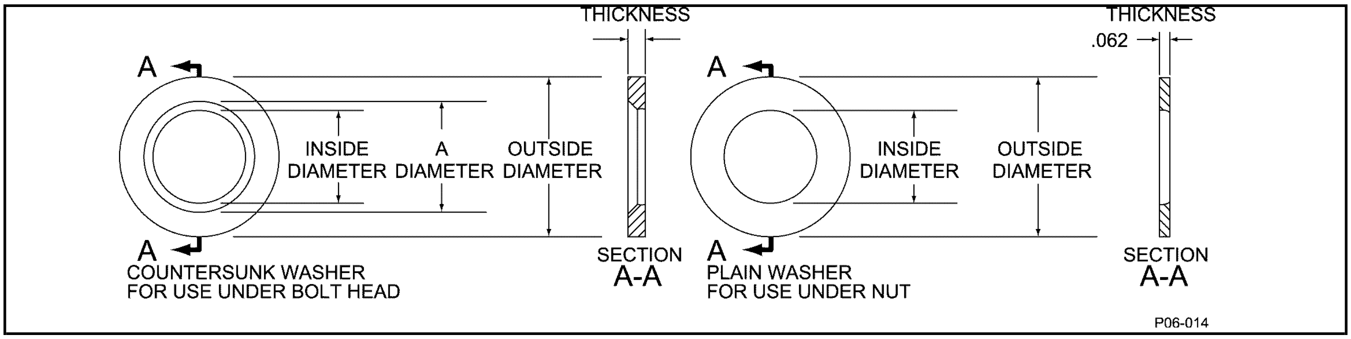
Material:

Steel, Aeronautical Material Specification AMS5045 or AMS6350.

Finish:

Cadmium plating, Federal Specification QQ-P-416.

Table 6-9. MS20002 Countersunk and Plain, High Strength Washer



Dash Number		Bolt Size	Inside Diameter ±.010		Outside Diameter ±.010	A Diameter ±.010		Thickness ±.010 Countersunk Washers Only
Countersunk	Plain		Max	Min		Max	Min	
-C4	-4	1/4	.260	.252	.531	.344	.334	.078
-C5	-5	5/16	.324	.315	.593	.406	.396	
-C6	-6	3/8	.388	.378	.687	.495	.483	
-C7	-7	7/16	.451	.441	.781	.557	.543	.078
-C8	-8	1/2	.515	.504	.875	.620	.604	
-C9	-9	9/16	.579	.568	.968	.687	.667	
-C10	-10	5/8	.643	.631	1.062	.785	.765	.078
-C12	-12	3/4	.770	.757	1.250	.910	.890	
-C14	-14	7/8	.897	.884	1.437	1.035	1.015	
-C16	-16	1	1.025	1.010	1.625	1.160	1.140	.078
-C18	-18	1-1/8	1.150	1.135	1.875	1.285	1.265	.078
-C20	-20	1-1/4	1.275	1.260	2.125	1.447	1.427	.094
-C22	-22	1-3/8	1.400	1.385	2.313	1.572	1.552	.094
-C24	-24	1-1/2	1.525	1.510	2.500	1.697	1.677	

Code:

Dash number indicates bolt diameter in 1/16 inch.

C before dash number indicates countersunk washer.

Example of part number:

MS20002 = washer, plain, for 1/4-inch diameter bolt.

MS20002-C4 = washer, countersunk, for 1/4-inch diameter bolt.

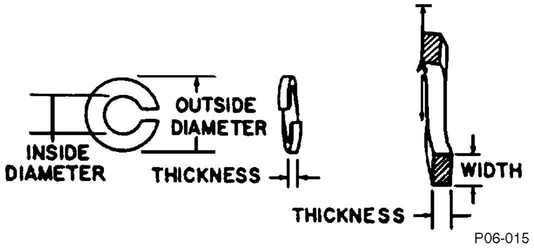
Material:

Steel, Military Specification MIL-S-18729.

Finish:

Cadmium plating, Federal Specification QQ-P-416.

Table 6-10. AN935 Lockwasher



Dash Number	Bolt Size	Inside Diameter -.000	Outside Diameter Max	Width Min	Thickness -.000
-2	No. 2	.088 +.009	.175	.035	.020 +.006
-2L			.165	.030	.015 +.006
-3	No. 3	.102 +.009	.212	.040	.025 +.006
-3L			.202	.035	.020 +.006
-4	No. 4	.115 +.009	.212	.040	.025 +.006
-4L			.202	.035	.020 +.006
-5	No. 5	.128 +.009	.239	.047	.031 +.006
-5L			.225	.040	.025 +.006
-6	No. 6	.141 +.010	.253	.047	.031 +.006
-6L			.239	.040	.025 +.006
-8	No. 8	.168 +.010	.296	.055	.040 +.006
-8L			.280	.047	.031 +.006
-10	No. 10	.194 +.011	.337	.062	.047 +.006
-10L			.323	.055	.040 +.006
-12	No. 12	.221 +.011	.380	.070	.056 +.006
-12L			.364	.062	.047 +.006
-416	1/4	.255 +.012	.493	.109	.062 +.010
-416L			.489	.107	.047 +.010
-516	5/16	.319 +.014	.591	.125	.078 +.010
-516L			.575	.117	.056 +.010
-616	3/8	.382 +.016	.688	.141	.094 +.010
-616L			.678	.136	.070 +.010
-716	7/16	.446 +.018	.784	.156	.109 +.010
-716L			.780	.154	.085 +.010
-816	1/2	.509 +.020	.879	.171	.125 +.010
-816L			.877	.170	.099 +.010
-916	9/16	.573 +.022	.979	.188	.141 +.010
-916L			.975	.186	.113 +.010
-1016	5/8	.636 +.024	1.086	.203	.156 +.010
-1016L			1.082	.201	.126 +.010
-1216	3/4	.763 +.028	1.279	.234	.188 +.010

Table 6-10. AN935 Lockwasher - Continued

Dash Number	Bolt Size	Inside Diameter -.000	Outside Diameter Max	Width Min	Thickness -.000
-1216L			1.277	.233	.153 +.010

Code:

Dash number from 2 to 12 is bolt size.

Dash number from 416 to 1216 indicates bolt diameter in 1/16 inch.

B before dash number indicates phosphor bronze or copper-silicon alloy washer.

Example of part number:

AN935-10 = lockwasher, cadmium-plated carbon steel, for number 10 bolt.

AN935B10L = lockwasher, light series, cadmium-plated phosphor bronze or copper-silicon alloy, for number 10 bolt.

Material:

Carbon steel, Federal Specification FF-W-84

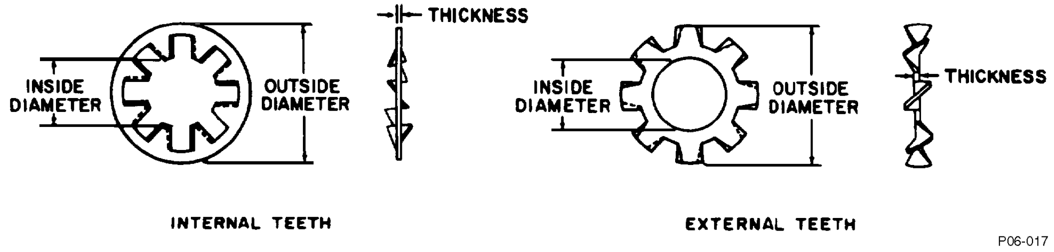
Phosphor bronze, Federal Specification QQ-P-330.

Copper-silicon alloy, Federal Specification QQ-C-591.

Finish:

Cadmium plating, Federal Specification QQ-P-416.

Table 6-11. AN936 Lockwasher



Dash Number		Bolt Size	Inside Diameter -.000	Outside Diameter +.000	Thickness ±.002	Dash Number		Bolt Size	Inside Diameter -.000	Outside Diameter +.000	Thickness ±.002
Steel	Bronze					Steel	Bronze				
-A2		No. 2	.089 +.006	.200 -.025	.012						
-A3		No. 3	.102 +.007	.232 -.017	.016	-B3	-B3B	No. 3	.102 +.007	.230 -.010	.014
-A4	-A4B	No. 4	.116 +.007	.270 -.015	.016	-B4	-B4B	No. 4	.116 +.007	.255 -.010	.016
-A6	-A6B	No. 6	.142 +.008	.288 -.010	.018	-B6	-B6B	No. 6	.142 +.008	.317 -.011	.020
-A8	-A8B	No. 8	.168 +.008	.336 -.011	.020	-B8	-B8B	No. 8	.168 +.008	.381 -.011	.020
-A10	-A10B	No. 10	.195 +.009	.381 -.011	.022	-B10	-B10B	No. 10	.195 +.009	.406 -.011	.022
-A416	-A416B	1/4	.256 +.011	.478 -.012	.025	-B416	-B416B	1/4	.256 +.011	.506 -.012	.025
-A416H			.256 +.011	.536 -.012	.038						
-A516	-A516B	5/16	.320 +.012	.607 -.013	.030	-B516	-B516B	5/16	.320 +.012	.601 -.013	.030
-A616	-A616B	3/8	.384 +.014	.692 -.014	.036	-B616	-B616B	3/8	.384 +.014	.695 -.015	.036
-A716	-A716B	7/16	.448 +.015	.789 -.042	.038	-B716	-B716B	7/16	.448 +.016	.760 -.020	.038
-A716S*	-A716BS*		.472 +.008	.607 -.014	.018						
-A816		1/2	.512 +.017	.883 -.016	.040	-B816		1/2	.512 +.017	.900 -.020	.040
-A916		9/16	.576 +.018	1.000 -.043	.040	-B916		9/16	.576 +.018	.985 -.020	.040
-A1016		5/8	.640 +.019	1.071 -.018	.045	-B1016		5/8	.641 +.022	1.070 -.025	.045
-A1216		3/4	.769 +.026	1.245 -.025	.050	-B1216		3/4	.768 +.022	1.260 -.045	.050
-A1416		7/8	.894 +.024	1.386 -.022	.056	-B1416		7/8	.879 +.030	1.410 -.030	.056
-A1616		1	1.019 +.024	1.637 -.024	.063	-B1616			1.025 +.035	1.620 -.030	.063

Table 6-11. AN936 Lockwasher - Continued

*This washer has alternate teeth twisted in a direction opposite to that of the other washer's teeth.

Code:

Dash number from 2 to 10 is bolt size.

Dash number from 416 to 1616 indicates bolt diameter in 1/16 inch.

B after dash number indicates bronze washer.

B before dash number indicates external teeth.

Example of part number:

AN936B416B = washer with external teeth, cadmium-plated bronze, for use with 1/4-inch diameter bolt.

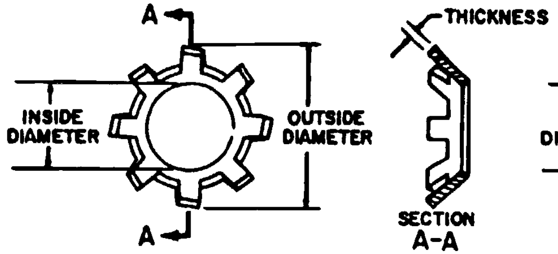
Material:

Steel.

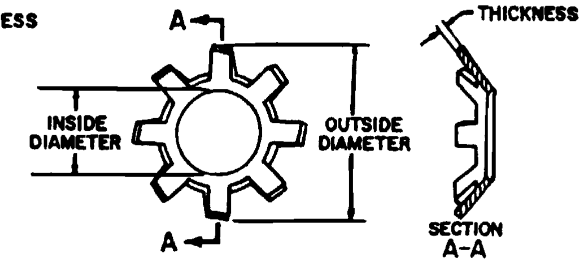
Bronze.

Finish:

Cadmium plating, Federal Specification QQ-P-416. (Type I, class C for steel, Type II, class C with supplementary chromate treatment for bronze.)



82° COUNTERSUNK EXTERNAL TEETH



100° COUNTERSUNK EXTERNAL TEETH

P06-019

Dash Number						Dash Number				
Steel	Bronze	Bolt Size	Inside Diameter -.000	Outside Diameter +.000	Thick-ness ±.002	Steel	Bolt Size	Inside Diameter -.000	Outside Diameter	Thick-ness ±.
-C2	-C2B	No. 2	.089 +.006	.183 -.013	.008	-D2	No. 2	.089 +.006	.190 -.013	.008
-C4	-C4B	No. 4	.116 +.007	.232 -.014	.016	-D4	No. 4	.116 +.007	.241 -.014	.016
-C6	-C6B	No. 6	.142 +.008	.300 -.015	.018	-D6	No. 6	.142 +.008	.287 -.016	.012
-C8	-C8B	No. 8	.168 +.008	.353 -.016	.018	-D8	No. 8	.168 +.008	.340 -.016	.016

Table 6-11. AN936 Lockwasher - Continued

-C10	-C10B	No. 10	.195 +.009	.370 -.017	.022	-D10	No. 10	.195 +.009	.394 -.017	.018
-C416	-C416B	1/4	.256 +.011	.478 -.020	.022					
-C516	-C516B	5/16	.320 +.012	.625 -.022	.025					
-C616	-C616B	3/8	.384 +.014	.801 -.025	.030					
-C716	-C716B	7/16	.448 +.015	.890 -.027	.036					

Code:

Dash number from 2 to 10 is bolt size.

Dash number from 416 to 716 indicates bolt diameter in 1/16 inch.

C before dash number indicates 82° countersunk washer.

D before dash number indicates 100° countersunk washer.

B after dash number indicates bronze washer.

Example of part number:

AN936-C2B = washer, 82° countersunk, cadmium-plated bronze, for number 2 bolt.

Material:

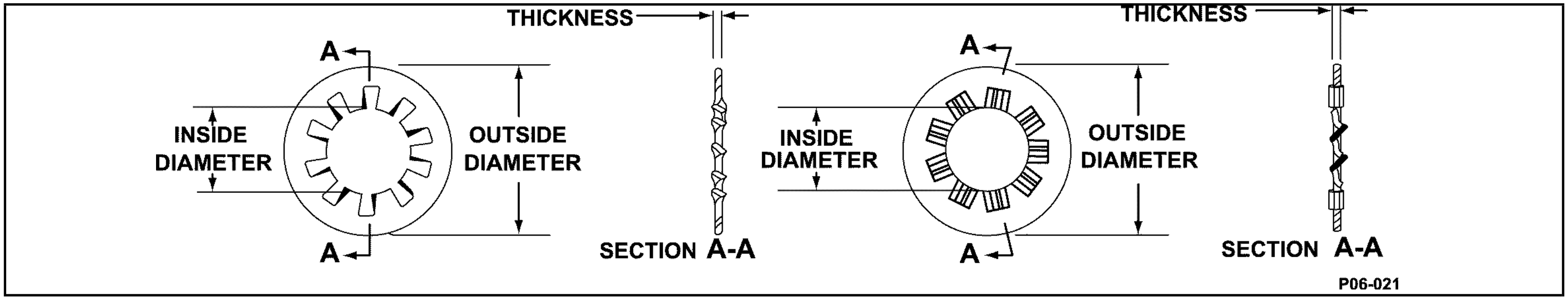
Steel.

Bronze.

Finish:

Cadmium plating, Federal Specification QQ-P-416.

Table 6-12. MS35333 Lockwasher



Dash Number						Bolt Size	Inside Diameter		Outside Diameter		Thickness	
Steel				Corrosion Resistant	Phosphor Bronze							
Plain (Uncoat-ed)	Cadmium or Zinc Optional	Cadmium	Phosphate	Passivated	Tinned		Max	Min	Max	Min	Max	Min
-1	-18	-35	-52	-69	-86	No. 2	.095	.089	.200	.175	.015	.010
-2	-19	-36	-53	-70	-87	No. 4	.123	.115	.270	.255	.019	.015
-3	-20	-37	-54	-71	-88	No. 6	.150	.141	.295	.275	.021	.017
-4	-21	-38	-55	-72	-89	No. 8	.176	.168	.340	.325	.023	.018
-5	-22	-39	-56	-73	-90	No. 10	.204	.195	.381	.365	.025	.020
-6	-23	-40	-57	-74	-91	1/4	.267	.256	.478	.460	.028	.023
-7	-24	-41	-58	-75	-92	5/16	.332	.320	.610	.594	.034	.028
-8	-25	-42	-59	-76	-93	3/8	.398	.384	.692	.670	.040	.032
-9	-26	-43	-60	-77	-94	7/16	.464	.448	.789	.740	.040	.032
-10	-27	-44	-61	-78	-95	1/2	.530	.512	.900	.867	.045	.037
-11	-28	-45	-62	-79	-96	9/16	.596	.576	.985	.957	.045	.037
-12	-29	-46	-63	-80	-97	5/8	.663	.640	1.071	1.045	.050	.042
-13	-30	-47	-64	-81	-98	3/4	.795	.769	1.245	1.220	.055	.047
-14	-31	-48	-65	-82	-99	7/8	.927	.894	1.410	1.364	.060	.052
-15	-32	-49	-66	-83	-100	1	1.060	1.019	1.637	1.590	.067	.059
-16	-33	-50	-67	-84	-101	1-1/8	1.192	1.144	1.830	1.799	.067	.059

Table 6-12. MS35333 Lockwasher - Continued

Dash Number						Bolt Size	Inside Diameter		Outside Diameter		Thickness	
Steel				Corrosion Resistant	Phosphor Bronze							
Plain (Uncoat-ed)	Cadmium or Zinc Optional	Cadmium	Phosphate	Passivated	Tinned		Max	Min	Max	Min	Max	Min
-17	-34	-51	-68	-85	-102	1-1/4	1.325	1.275	1.975	1.921	.067	.059

Material:

Carbon steel, Federal Specification QQ-S-633.

Corrosion-resistant steel, Federal Standard Number 66.

Phosphor bronze, Federal Specification QQ-P-330.

Finish:

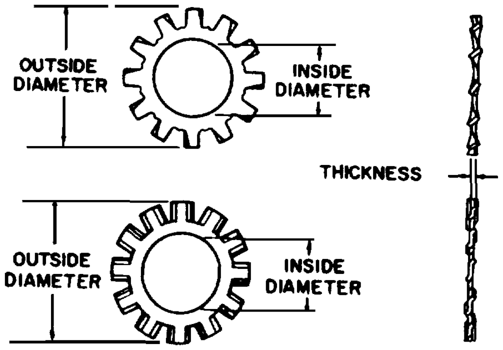
Cadmium plating, Federal Specification QQ-P-416.

Zinc plating, Federal Specification QQ-Z-325.

Phosphate coating, Military Specification MIL-C-16232.

Tin plating, Military Specification MIL-T-10727.

Table 6-13. MS35335 Lockwasher



Dash Number							Inside Diameter		Outside Diameter		Thickness	
Steel				Corrosion Resistant	Phosphor Bronze							
Plain (Uncoat-ed)	Cadmium or Zinc Optional	Cadmium	Phosphate	Passivated	Tinned	Bolt Size	Max	Min	Max	Min	Max	Min
-1	-15	-29	-43	-57	-71	No. 4	.123	.115	.260	.245	.019	.015
-2	-16	-30	-44	-58	-72	No. 6	.150	.141	.320	.305	.022	.016
-3	-17	-31	-45	-59	-73	No. 8	.176	.168	.381	.365	.023	.018
-4	-18	-32	-46	-60	-74	No. 10	.204	.195	.410	.395	.025	.020
-5	-19	-33	-47	-61	-75	1/4	.267	.256	.510	.494	.028	.023
-6	-20	-34	-48	-62	-76	5/16	.332	.320	.610	.588	.034	.028
-7	-21	-35	-49	-63	-77	3/8	.398	.384	.694	.670	.040	.032
-8	-22	-36	-50	-64	-78	7/16	.464	.448	.760	.740	.040	.032
-9	-23	-37	-51	-65	-79	1/2	.530	.513	.900	.880	.045	.037
-10	-24	-38	-52	-66	-80	9/16	.596	.576	.985	.960	.045	.037
-11	-25	-39	-53	-67	-81	5/8	.663	.641	1.070	1.045	.050	.042
-12	-26	-40	-54	-68	-82	3/4	.795	.768	1.260	1.220	.055	.047
-13	-27	-41	-55	-69	-83	7/8	.927	.897	1.410	1.380	.060	.052

Table 6-13. MS35335 Lockwasher - Continued

Dash Number						Bolt Size	Inside Diameter		Outside Diameter		Thickness	
Steel				Corrosion Resistant	Phosphor Bronze							
Plain (Uncoat-ed)	Cadmium or Zinc Optional	Cadmium	Phosphate	Passivated	Tinned		Max	Min	Max	Min	Max	Min
-14	-28	-42	-56	-70	-84	1	1.060	1.025	1.620	1.590	.067	.059

Material:

Carbon steel, Federal Specification QQ-S-633.

Corrosion-resistant steel, Federal Standard Number 66.

Phosphor bronze, Federal Specification QQ-P-330.

Finish:

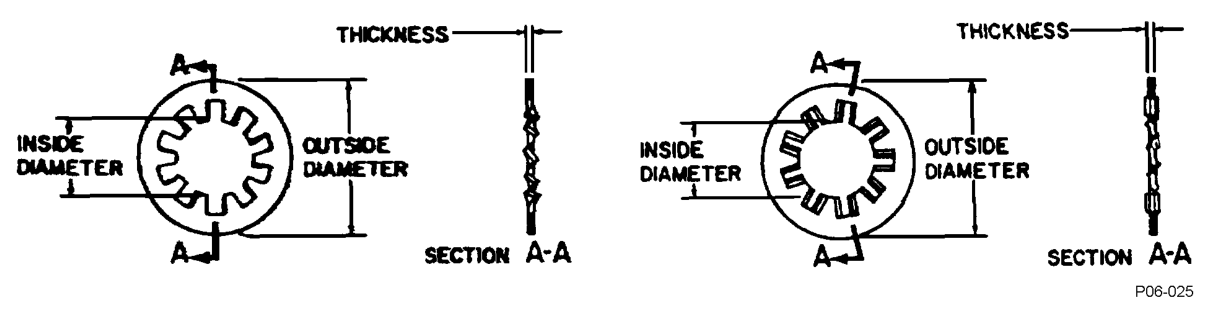
Cadmium plating, Federal Specification QQ-P-416.

Zinc plating, Federal Specification QQ-Z-325.

Phosphate coating, Military Specification MIL-C-16232.

Tin plating, Military Specification MIL-T-10727.

Table 6-14. MS35334 Lockwasher



P06-025

Dash Number					Inside Diameter		Outside Diameter		Thickness	
Steel										
Plain (Uncoated)	Cadmium or Zinc Optional	Cadmium	Phosphate	Bolt Size	Max	Min	Max	Min	Max	Min
-1	-10	-19	-28	1/4	.267	.256	.536	.500	.045	.035
-2	-11	-20	-29	5/16	.332	.320	.607	.590	.050	.040
-3	-12	-21	-30	3/8	.398	.384	.748	.700	.050	.042
-4	-13	-22	-31	7/16	.464	.448	.858	.800	.067	.050
-5	-14	-23	-32	1/2	.530	.512	.924	.880	.067	.055
-6	-15	-24	-33	9/16	.596	.576	1.034	.990	.067	.055
-7	-16	-25	-34	5/8	.663	.640	1.135	1.100	.067	.059
-8	-17	-26	-35	3/4	.795	.768	1.265	1.240	.084	.070
-9	-18	-27	-36	7/8	.927	.894	1.447	1.400	.084	.075

Material:

Carbon steel, Federal Specification QQ-S-633.

Finish:

Cadmium plating, Federal Specification QQ-P-416.

Zinc plating, Federal Specification QQ-Z-325.

Phosphate coating, Military Specification MIL-C-16232.

Table 6-15. MS35336 Lockwasher

P06-026

Dash Number						Bolt Size	Inside Diameter		Outside Diameter	Side Length		Thickness	
Carbon Steel				Corrosion Resistant	Phosphor Bronze								
Plain (Uncoated)	Cadmium or Zinc Optional	Cadmium	Phosphate	Passivated	Tinned		Max	Min		Max	Min	Max	Min
-1	-2	-3	-4	-5	-6	No. 4	.123	.113	.213	.065	.050	.019	.015
-7	-8	-9	-10	-11	-12	No. 6	.150	.140	.289	.092	.082	.021	.017
-13	-14	-15	-16	-17	-18	No. 8	.177	.167	.322	.105	.088	.021	.017
-19	-20	-21	-22	-23	-24	No. 10	.205	.195	.354	.099	.083	.025	.020
-25	-26	-27	-28	-29	-30	1/4	.267	.255	.454	.128	.113	.025	.020
-31	-32	-33	-34	-35	-36	5/16	.333	.318	.599	.192	.165	.028	.023
-37	-38	-39	-40	-41	-42	3/8	.398	.383	.765	.255	.242	.034	.028
-43	-44	-45	-46	-47	-48	7/16	.463	.448	.867	.270	.260	.045	.037
-49	-50	-51	-52	-53	-54	1/2	.529	.512	.976	.304	.294	.045	.037

Material:

Carbon steel, Federal Specification QQ-S-633.

Corrosion-resistant steel, Federal Standard Number 66.

Phosphor bronze, Federal Specification QQ-P-330.

Finish:

Cadmium plating, Federal Specification QQ-P-416.

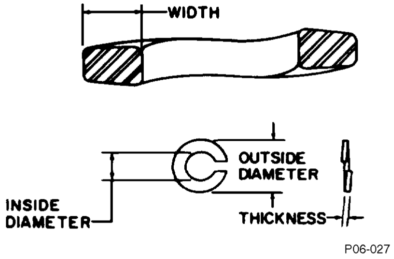
Table 6-15. MS35336 Lockwasher - Continued

Zinc plating, Federal Specification QQ-Z-325.

Phosphate coating, Military Specification MIL-C-16232.

Tin plating, Military Specification MIL-T-10727.

Table 6-16. MS35337 Lockwasher



Dash Number							Inside Diameter		Outside Diameter		Width	Thickness	
Steel				Corrosion Resistant	Phosphor Bronze								
Plain (Un-coated)	Cadmium or Zinc Optional	Cadmium	Phos-phate	Passivated	Cadmium	Bolt Size	Max	Min	Max	Min	Min	Max	Min
-1	-20	-39	-58	-77	-96	No. 2	.097	.088	.165		.030	.021	.015
-2	-21	-40	-59	-78	-97	No. 4	.124	.115	.202		.035	.026	.020
-3	-22	-41	-60	-79	-98	No. 6	.151	.141	.239		.040	.031	.025
-4	-23	-42	-61	-80	-99	No. 8	.178	.168	.280		.047	.037	.031
-5	-24	-43	-62	-81	-100	No. 10	.205	.194	.323		.055	.046	.040
-6	-25	-44	-63	-82	-101	1/4	.267	.255	.489		.107	.057	.047
-7	-26	-45	-64	-83	-102	5/16	.333	.319	.575		.117	.066	.056
-8	-27	-46	-65	-84	-103	3/8	.398	.382	.678		.136	.080	.070
-9	-28	-47	-66	-85	-104	7/16	.464	.446	.780		.154	.095	.085
-10	-29	-48	-67	-86	-105	1/2	.529	.509	.877		.170	.109	.099
-11	-30	-49	-68	-87	-106	9/16	.595	.573	.975		.186	.123	.113
-12	-31	-50	-69	-88	-107	5/8	.660	.636	1.082		.201	.136	.126
-13	-32	-51	-70	-89	-108	3/4	.791	.763	1.277		.233	.163	.153
-14	-33	-52	-71	-90	-109	7/8	.922	.890	1.470		.264	.199	.179
-15	-34	-53	-72	-91	-110	1	1.053	1.017	1.656		.289	.222	.202
-16	-35	-54	-73	-92	-111	1-1/8	1.184	1.144	1.837		.314	.244	.224

Table 6-16. MS35337 Lockwasher - Continued

Dash Number							Inside Diameter		Outside Diameter		Width	Thickness	
Steel				Corrosion Resistant	Phosphor Bronze								
Plain (Un-coated)	Cadmium or Zinc Optional	Cadmium	Phos-phate	Passivated	Cadmium	Bolt Size	Max	Min	Max	Min	Min	Max	Min
-17	-36	-55	-74	-93	-112	1-1/4	1.315	1.271	2.012		.336	.264	.244
-18	-37	-56	-75	-94	-113	1-3/8	1.446	1.398	2.183		.356	.284	.264
-19	-38	-57	-76	-95	-114	1-1/2	1.577	1.525	2.352		.375	.302	.282

Material:

Carbon steel, Federal Specification QQ-S-633.

Corrosion-resistant steel, Federal Standard Number 66.

Phosphor bronze, Federal Specification QQ-P-330.

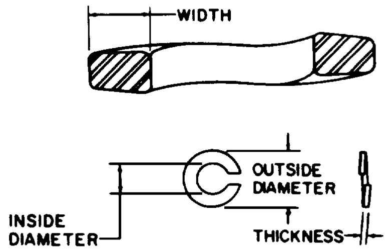
Finish:

Cadmium plating, Federal Specification QQ-P-416.

Zinc plating, Federal Specification QQ-Z-325.

Phosphate coating, Military Specification MIL-C-16232.

Table 6-17. MS35338 Lockwasher



P06-029

Dash Number								Inside Diameter		Out-side Diam-eter	Width	Thickness	
Steel				Corro-sion Re-sistant	Phos-phor Bronze	Nickel Copper Alloy							
Plain (Uncoat-ed)	Cadmium or Zinc Optional	Cadmi-um	Phos-phate	Passi-vated	Cadmi-um	Plain (Uncoat-ed)	Bolt Size	Max	Min	Max	Min	Max	Min
-1	-20	-39	-58	-77	-96	-115	No. 2	.097	.088	.175	.035	.026	.020
-2	-21	-40	-59	-78	-97	-116	No. 4	.124	.115	.212	.040	.031	.025
-3	-22	-41	-60	-79	-98	-117	No. 6	.151	.141	.253	.047	.037	.031
-4	-23	-42	-61	-80	-99	-118	No. 8	.178	.168	.296	.055	.046	.040
-5	-24	-43	-62	-81	-100	-119	No. 10	.205	.194	.337	.062	.053	.047
-6	-25	-44	-63	-82	-101	-120	1/4	.267	.255	.493	.109	.072	.062
-7	-26	-45	-64	-83	-102	-121	5/16	.333	.319	.591	.125	.088	.078
-8	-27	-46	-65	-84	-103	-122	3/8	.398	.382	.688	.141	.104	.094
-9	-28	-47	-66	-85	-104	-123	7/16	.464	.446	.784	.156	.119	.109
-10	-29	-48	-67	-86	-105	-124	1/2	.529	.509	.879	.171	.135	.125
-11	-30	-49	-68	-87	-106	-125	9/16	.595	.573	.979	.188	.151	.141
-12	-31	-50	-69	-88	-107	-126	5/8	.660	.636	1.086	.203	.166	.156
-13	-32	-51	-70	-89	-108	-127	3/4	.791	.763	1.279	.234	.198	.188
-14	-33	-52	-71	-90	-109	-128	7/8	.922	.890	1.474	.266	.239	.219

Table 6-17. MS35338 Lockwasher - Continued

Dash Number							Bolt Size	Inside Diameter		Outside Diameter	Width	Thickness	
Steel				Corrosion Resistant	Phosphor Bronze	Nickel Copper Alloy							
Plain (Uncoated)	Cadmium or Zinc Optional	Cadmium	Phosphate	Passivated	Cadmium	Plain (Uncoated)		Max	Min	Max	Min	Max	Min
-15	-34	-53	-72	-91	-110	-129	1	1.053	1.017	1.672	.297	.270	.250
-16	-35	-54	-73	-92	-111	-130	1-1/8	1.184	1.144	1.865	.328	.301	.281
-17	-36	-55	-74	-93	-112	-131	1-1/4	1.315	1.271	2.058	.359	.332	.312
-18	-37	-56	-75	-94	-113	-132	1-3/8	1.446	1.398	2.253	.391	.364	.344
-19	-38	-57	-76	-95	-114	-133	1-1/2	1.577	1.525	2.446	.422	.395	.375

Material:

Carbon steel, Federal Specification QQ-S-633.

Corrosion-resistant steel, Federal Standard Number 66

Phosphor bronze, Federal Specification QQ-P-330.

Nickel copper alloy, Federal Specification QQ-N-286.

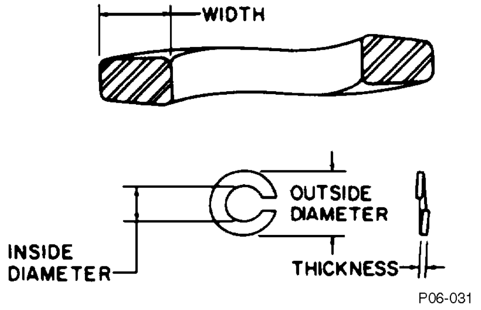
Finish:

Cadmium plating, Federal Specification QQ-P-416.

Zinc plating, Federal Specification QQ-Z-325.

Phosphate coating, Military Specification MIL-C-16232.

Table 6-18. MS35339 Lockwasher



Dash Number				Bolt Size	Inside Diameter		Outside Diameter	Width	Thickness	
Steel										
Plain (Uncoated)	Cadmium or Zinc Optional	Cadmium	Phosphate		Max	Min	Max	Min	Max	Min
-1	-20	-39	-58	No. 2	.097	.088	.185	.040	.031	.025
-2	-21	-40	-59	No. 4	.124	.115	.226	.047	.037	.031
-3	-22	-41	-60	No. 6	.151	.141	.269	.055	.046	.040
-4	-23	-42	-61	No. 8	.178	.168	.310	.062	.053	.047
-5	-24	-43	-62	No. 10	.205	.194	.353	.070	.062	.056
-6	-25	-44	-63	1/4	.267	.255	.495	.110	.087	.077
-7	-26	-45	-64	5/16	.333	.319	.601	.130	.107	.097
-8	-27	-46	-65	3/8	.398	.382	.696	.145	.125	.115
-9	-28	-47	-66	7/16	.464	.446	.792	.160	.143	.133
-10	-29	-48	-67	1/2	.529	.509	.889	.176	.161	.151
-11	-30	-49	-68	9/16	.595	.573	.989	.193	.180	.170
-12	-31	-50	-69	5/8	.660	.636	1.100	.210	.199	.189
-13	-32	-51	-70	3/4	.791	.763	1.299	.244	.236	.226
-14	-33	-52	-71	7/8	.922	.890	1.504	.281	.286	.266
-15	-34	-53	-72	1	1.053	1.017	1.716	.319	.326	.306
-16	-35	-54	-73	1-1/8	1.184	1.144	1.921	.256	.365	.345
-17	-36	-55	-74	1-1/4	1.315	1.271	2.126	.393	.404	.384
-18	-37	-56	-75	1-3/8	1.446	1.398	2.325	.427	.442	.422

Table 6-18. MS35339 Lockwasher - Continued

Dash Number				Bolt Size	Inside Diameter		Outside Diameter	Width	Thickness	
Steel										
Plain (Uncoated)	Cadmium or Zinc Optional	Cadmium	Phosphate		Max	Min	Max	Min	Max	Min
-19	-38	-57	-76	1-1/2	1.577	1.525	2.518	.458	.478	.458

Material:

Carbon steel, Federal Specification QQ-S-633.

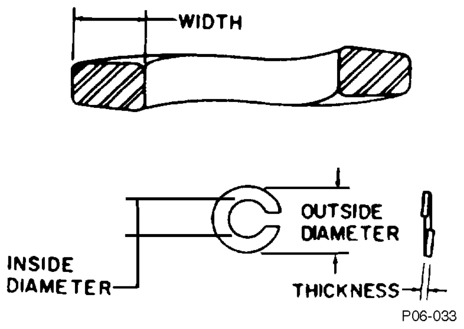
Finish:

Cadmium plating, Federal Specification QQ-P-416.

Zinc plating, Federal Specification QQ-Z-325.

Phosphate coating, Military Specification MIL-C-16232.

Table 6-19. MS35340 Lockwasher



Dash Number					Inside Diameter		Outside Diameter	Width	Thickness	
Carbon Steel										
Plain (Uncoated)	Cadmium or Zinc Optional	Cadmium	Phosphate	Bolt Size	Max	Min	Max	Min	Max	Min
-1	-20	-39	-58	No. 2	.097	.088	.211	.053	.033	.027
-2	-21	-40	-59	No. 4	.124	.115	.256	.062	.040	.034
-3	-22	-41	-60	No. 6	.151	.141	.317	.079	.051	.045
-4	-23	-42	-61	No. 8	.178	.168	.378	.096	.063	.057
-5	-24	-43	-62	No. 10	.205	.194	.437	.112	.074	.068
-6	-25	-44	-63	1/4	.267	.255	.539	.132	.094	.084
-7	-26	-45	-64	5/16	.333	.319	.627	.143	.118	.108
-8	-27	-46	-65	3/8	.398	.382	.746	.170	.133	.123
-9	-28	-47	-66	7/16	.464	.446	.844	.186	.153	.143
-10	-29	-48	-67	1/2	.529	.509	.945	.204	.172	.162
-11	-30	-49	-68	9/16	.595	.573	1.049	.223	.192	.182
-12	-31	-50	-69	5/8	.660	.636	1.164	.242	.212	.202
-13	-32	-51	-70	3/4	.791	.763	1.369	.279	.251	.241
-14	-33	-52	-71	7/8	.922	.890	1.586	.322	.305	.285
-15	-34	-53	-72	1	1.053	1.017	1.810	.366	.350	.330

Table 6-19. MS35340 Lockwasher - Continued

Dash Number					Inside Diameter		Outside Diameter	Width	Thickness	
Carbon Steel										
Plain (Uncoated)	Cadmium or Zinc Optional	Cadmium	Phosphate	Bolt Size	Max	Min	Max	Min	Max	Min
-16	-35	-54	-73	1-1/8	1.184	1.144	2.031	.411	.395	.375
-17	-36	-55	-74	1-1/4	1.315	1.271	2.244	.452	.437	.417
-18	-37	-56	-75	1-3/8	1.446	1.398	2.453	.491	.478	.458
-19	-38	-57	-76	1-1/2	1.577	1.525	2.654	.526	.516	.406

Material:

Carbon steel, Federal Specification QQ-S-633.

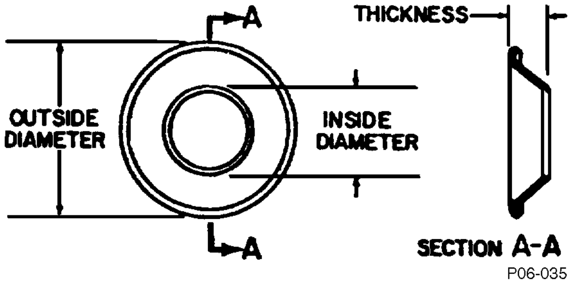
Finish:

Zinc plating, Federal Specification QQ-Z-325.

Phosphate coating, Military Specification MIL-C-16232.

Cadmium plating, Federal Specification QQ-P-416.

Table 6-20. NAS390 Flush Type, Finishing Washer



Dash Number	Screw Size	Inside Diameter	Outside Diameter	Thickness Max
-4	No. 4	.136	.246	.084
-6	No. 6	.167	.343	.093
-8	No. 8	.185	.430	.106
-10	No. 10	.203	.484	.115
-14	1/4 or No. 14 Wood Screw	.247	.659	.147
-16	No. 16 Wood Screw	.263	.706	.165

Code:

Dash number is screw size.

P after dash number indicates chromium-plated washer.

Example of part number:

NAS390-4 = washer, cadmium-plated steel or brass, for number 4 screw.

NAS390-4P = washer, chromium-plated steel or brass, for number 4 screw.

Material:

Steel.

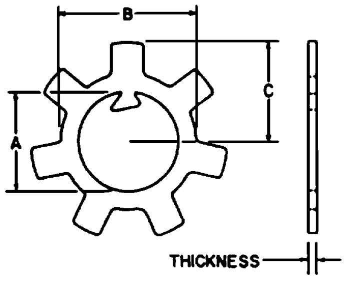
Brass.

Finish:

Cadmium plating, Federal Specification QQ-P-416.

Chromium plating.

Table 6-21. NAS460 Tab Type Washer



Dash Number	Eye Bolt Size ±.010	A ±.005	B ±.010	C ±.010	Thickness ±.010
-416	1/4	.256	.374	.317	.030
-516	5/16	.319	.436	.364	.030
-616	3/8	.381	.499	.411	.030
-716	7/16	.444	.560	.458	.030
-816	1/2	.506	.684	.546	.030
-916	9/16	.569	.773	.626	.048
-1016	5/8	.631	.896	.705	.048
-1216	3/4	.756	1.019	.798	.048
-1416	7/8	.881	1.206	.934	.048
-1616	1	1.006	1.367	1.057	.060
-1816	1-1/8	1.131	1.517	1.211	.060
-2016	1-1/4	1.256	1.698	1.361	.060
-2216	1-3/8	1.381	1.880	1.487	.060
-2416	1-1/2	1.506	2.029	1.623	.075
-2816	1-3/4	1.756	2.392	1.875	.075
-3216	2	2.006	2.754	2.127	.075

Code:

Dash number indicates bolt size in 1/16 inch.

Example of part number:

NAS460-416 = washer, low carbon steel, for 1/4-inch diameter bolt.

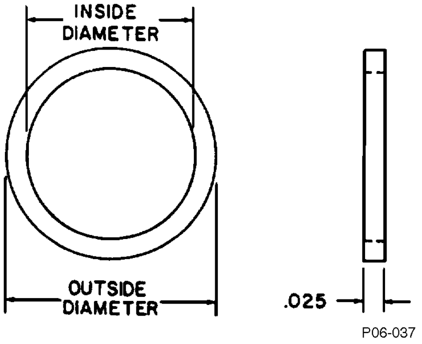
Material:

Low carbon steel, Federal Specification QQ-S-636.

Finish:

Cadmium plating, Federal Specification QQ-P-416.

Table 6-22. NAS535 Step-Up Washer (Flexible Tubing Adapter)



Dash Number	Nominal Tubing Inside Diameter	Inside Diameter	Outside Diameter	For Use With Coupling Nut
-3B	3/16	.266	.563	AN3054-4
-3C			.672	AN3054-6
-4B	1/4	.344	.672	AN3054-6
-4C			.813	AN3054-8
-6B	3/8	.484	.813	AN3054-8
-6C			.922	AN3054-10
-8B	1/2	.609	.922	AN3054-10
-8C			1.109	AN3054-12
-10B	5/8	.750	1.109	AN3054-12
-10C			1.359	AN3054-16
-12B	3/4	.891	1.359	AN3054-16
-12C			1.656	AN3054-20
-16B	1	1.141	1.656	AN3054-20
-16C			1.906	AN3054-24
-20B	1-1/4	1.422	1.906	AN3054-24
-20C			2.156	AN3054-28
-24B	1-1/2	1.688	2.156	AN3054-28
-24C			2.406	AN3054-32
-28B	1-3/4	1.953	2.406	AN3054-32
-28C			2.906	AN3054-40
-32B	2	2.250	2.906	AN3054-40

Code:

Dash number indicates nominal tubing inside diameter in 1/16 inch.

Example of part number:

NAS535-3B = washer for tubing with inside diameter of 3/16 inch.

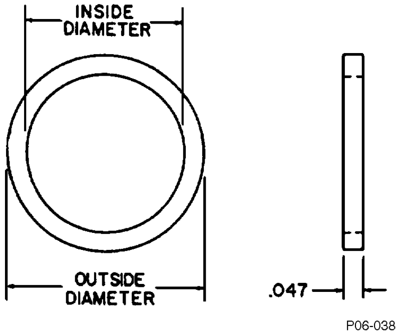
Material:

Clad aluminum alloy, Federal Specification QQ-A-362.

Finish:

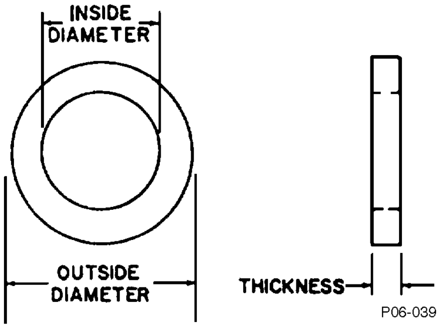
Anodize, Military Specification MIL-A-8625.

Table 6-23. NAS536 Retention Washer (Flexible Tubing Adapter)



Dash Number	Nominal Tubing Inside Diameter	Inside Diameter +.005 -.000	Outside Diameter +.000 -.005	For Use With Connector
-6	3/16	.238	.450	AN3064-6
-8	1/4	.316	.600	AN3064-8
-10	3/8	.441	.722	AN3064-10
-12	1/2	.566	.857	AN3064-12
-16	5/8	.707	1.138	AN3064-16
-20	3/4	.831	1.384	AN3064-20
-24	1	1.081	1.639	AN3064-24
-28	1-1/4	1.347	1.888	AN3064-28
-32	1-1/2	1.597	2.137	AN3064-32
-40	1-3/4	1.863	2.645	AN3064-40
Material: Phenolic-resin cotton base plastic, Military Specification MIL-P-15035.				

Table 6-24. NAS549 Flat, Phenolic Fiber Washer



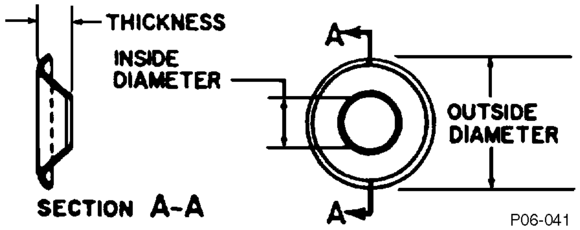
Dash Number	Bolt Size	Inside Diameter		Outside Diameter +.020 -.005	Thickness
-L3	No. 2 and 3	.105	±.005	.250	.031
-3					.063
-L4	No. 4	.125		.312	.031
-4					.063
-L6	No. 6	.149		.375	.031
-6					.063
-L8	No. 8	.174		.375	.031
-8					.063
-L10	No. 10	.203		.438	.031
-10					.063
-H10					.094
-L416	1/4	.265	±.010	.500	.031
-416					.063
-H416					.094
-L516	5/16	.328		.562	.031
-516					.063
-H516					.094
-L616	3/8	.390		.625	.031
-616					.063
-H616					.094
-L716	7/16	.453		.750	.031
-716					.063
-H716					.094
-L816	1/2	.515		.875	.031
-816					.063
-H816					.094
-L916	9/16	.578	±.010	1.062	.031
-916					.063
-H916					.094

Table 6-24. NAS549 Flat, Phenolic Fiber Washer - Continued

Dash Number	Bolt Size	Inside Diameter		Outside Diameter +.020 -.005	Thickness
-L1016	5/8	.640		1.188	.031
-1016					.063
-H1016					.094
-L1216	3/4	.765		1.312	.031
-1216					.063
-H1216					.094
-L1416	7/8	.890		1.500	.031
-1416					.063
-H1416					.094
-L1616	1	1.015		1.750	.031
-1616					.063
-H1616					.094

Code:
Dash number from 3 to 10 is bolt size.
Dash number from 416 to 1616 indicates bolt diameter in 1/16 inch.
Example of part number:
NAS549-10 = washer for number 10 bolt.
NAS549L516 = washer, light series, for 5/16-inch diameter bolt.
Material:
Phenolic-resin paper base plastic, Military Specification MIL-P-3115.

Table 6-25. NAS391 Countersunk Type, Finishing Washer



Dash Number	Screw Size	Inside Diameter	Outside Diameter	Thickness Max
-4	No. 4	.115	.360	.075
-6	No. 6	.169	.445	.082
-8	No. 8	.187	.520	.093
-10	No. 10	.228	.562	.100
-14	1/4 or No. 14 Wood Screw	.295	.725	.130
-16	No. 16 Wood Screw	.311	.760	.146

Code:

Dash number is screw size.

P after dash number indicates chromium-plated washer.

Example of part number;

NAS391-4 = washer, cadmium-plated steel or brass, for number 4 screw.

NAS391-4P = washer, chromium-plated steel or brass, for number 4 screw.

Material:

Steel.

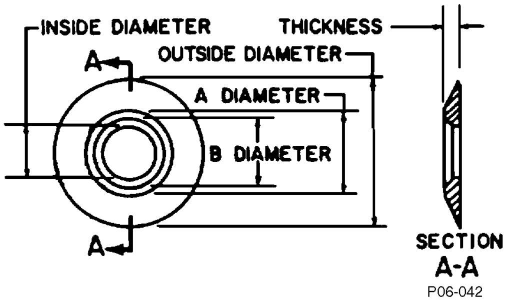
Brass.

Finish:

Cadmium plating, Federal Specification QQ-P-416.

Chromium plating.

Table 6-26. 950 Ball Socket Washer



Dash Number	Bolt Size	Inside Diam- eter .010	Outside Diameter ±.010	A Diameter ±.010	B Diameter ±.010	C Radius ±.005	Thickness +.010
-3	No. 10	.234	.750	.438	.375	.375	.078
-4	1/4	.297	1.000	.500	.438	.375	.094
-5	5/16	.375	1.000	.562	.500	.375	.094
-6	3/8	.438	1.125	.625	.562	.500	.094
-7	7/16	.500	1.250	.750	.688	.500	.125
-8	1/2	.562	1.500	.812	.750	.500	.125

Code:

Dash number indicates bolt diameter in 1/16 inch.

Example of part number:

950-4 = washer for 1/4-inch diameter bolt.

Material:

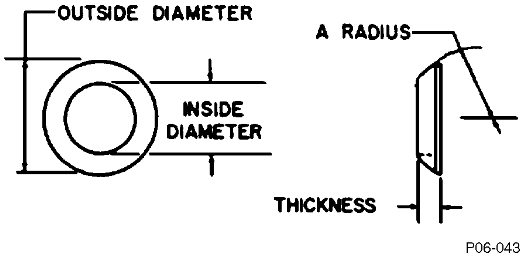
Steel.

Finish:

Cadmium plating, Federal Specification QQ-P-416.

Zinc plating, Federal Specification QQ-Z-325.

Table 6-27. 955 Ball Seat Washer



Dash Number	Bolt Size	Inside Diameter ±.010	Outside Diameter ±.010	A Radius ±.005	Thickness ±.010
-3	No. 10	.203	.375	.375	.062
-4	1/4	.266	.438	.375	.078
-5	5/16	.328	.500	.375	.094
-6	3/8	.391	.562	.500	.094
-7	7/16	.453	.688	.500	.156
-8	1/2	.516	.750	.500	.188

Code:

Dash number indicates bolt diameter in 1/16 inch.

Example of part number:

955-5 = washer for 5/16-inch diameter bolt.

Material:

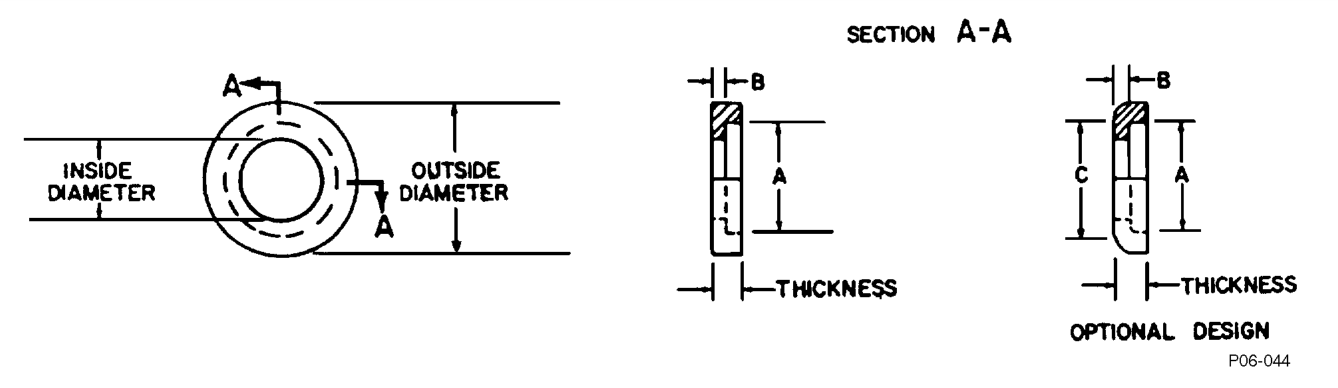
Steel:

Finish:

Cadmium plating, Federal Specification QQ-P-416.

Zinc Plating, Federal Specification QQ-Z-325.

Table 6-28. AN975 Taper Pin Washer



Dash Number	Bolt Size	Inside Diameter	Outside Diameter	A	B	C Diameter Min	Thickness
-3	No. 10	.203	.469	.688	.063	.375	.187
-4	1/4	.266	.563	.406	.078	.438	.203
-5	5/16	.328	.688	.531	.078	.500	.203
-6	3/8	.391	.781	.594	.078	.563	.203
-7	7/16	.453	.844	.656	.078	.625	.203
-8	1/2	.516	.938	.719	.094	.750	.219
-9	9/16	.578	1.094	.844	.094	.875	.219
-12	3/4	.766	1.281	1.000	.109	1.125	.234
-14	7/8	.891	1.469	1.188	.109	1.313	.234

Code:

Dash number indicates bolt diameter in 1/16 inch.

Example of part number:

AN975-5 = washer for 5/16-inch diameter boh.

Material:

Carbon steel, Federal Specification QQ-S-633.

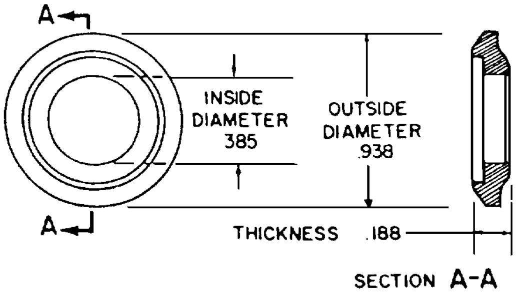
Low carbon steel, Federal Specification QQ-S-636.

Carbon steel, Military Specification MIL-S-7952.

Finish:

Cadmium plating, Federal Specification QQ-P-416

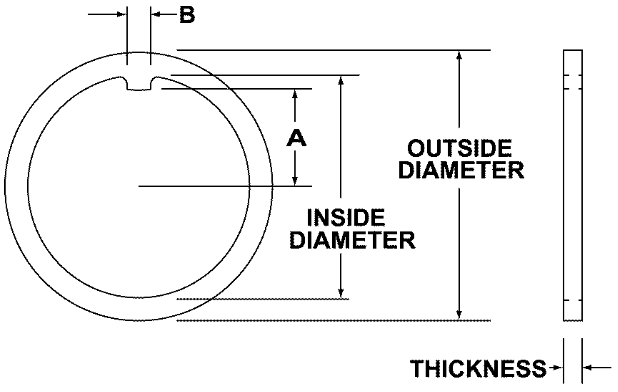
Table 6-29. AN4085 Double Type Magneto Coupling Washer



P06-045A

AN Part Number
AN4085-1
Material:
Steel, Military Specification MIL-S-6049.
Chrome-vanadium steel, Military Specification MIL-S-8503.
Zinc plating, Federal Specification QQ-Z-325.

Table 6-30. AN7503 Wheel Bearing Retaining Washer



P06-045B

Dash Number	A ±.005	B ±.010	Inside Diameter ±.005	Outside Diameter Min	Thickness ±.005
-15	.393	.125	.949	1.375	.093
-16	.424	.156	1.010	1.500	.125
-20	.546	.156	1.260	1.750	.125
-23	.635	.156	1.445	1.875	.125
-24	.670	.156	1.515	1.875	.125
-28	.755	.156	1.760	2.250	.125
-31	.850	.219	1.950	2.375	.125
-32	.880	.219	2.010	2.625	.125

Table 6-30. AN7503 Wheel Bearing Retaining Washer - Continued

Dash Number	A ±.005	B ±.010	Inside Diameter ±.005	Outside Diameter Min	Thickness ±.005
-39	1.105	.219	2.450	3.062	.125
-47	1.307	.281	2.948	3.688	.125
-55	1.557	.281	3.448	4.750	.125
-71	2.057	.281	4.450	5.375	.187

Material:

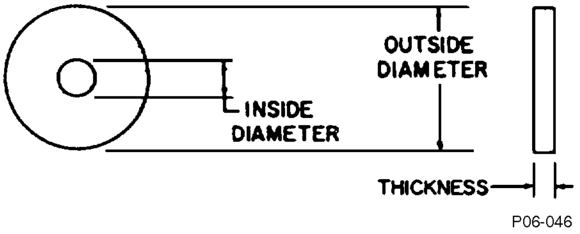
Steel.

Finish:

Cadmium plating, Federal Specification QQ-P-416.

Zinc plating, Federal Specification QQ-Z-325.

Table 6-31. AN8013 Vibration Insulator Stop Washer



Dash Number		Size	Inside Diameter +1/64 -0	Outside Diameter +1/64 -0	Thickness ±.005	
Steel	Aluminum Alloy				Steel	Aluminum Alloy
-1	-D1	1	.172	.875	.031	.032
-2	-D2	2	.266	1.375	.050	.051
-3	-D3	3	.391	1.875	.062	.064

Code:

Dash number is washer size.

D before dash number indicates aluminum alloy washer.

Example of part number:

AN8013D2 = washer, 24S aluminum alloy, size 2.

Material:

Steel, Military Specification MIL-S-7809.

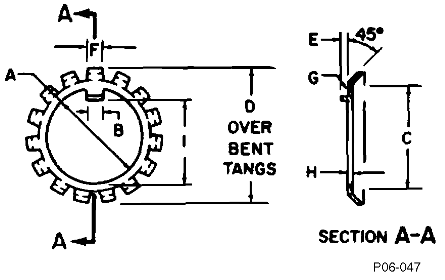
24S aluminum alloy, Federal Specification QQ-A-355.

Finish:

Cadmium plating, Federal Specification QQ-P-416 or zinc plating, Federal Specification QQ-Z-325 (steel washers only).

Anodize, Military Specification MIL-A-8625 (24S aluminum alloy washers only).

Table 6-32. MS172201 through 172235, Key, Bearing Retaining, Washer



Part Number	Nominal Bearing Bore Diameter	A ±.010	B ±.010	C +.020 -.000	D +.000 -.030	E ±.010	F ±.010	G ±.010	H ±.010	I +.020 -.000
MS172201	.3937	.406 -.421	.110 -.120	.531	.828	.062 -.094	.084 -.104	.016	.038 -.046	.333
MS172202	.4724	.484 -.499	.110 -.120	.625	.922	.062 -.094	.084 -.104	.016	.038 -.046	.411
MS172203	.5906	.601 -.616	.110 -.120	.750	1.094	.062 -.094	.084 -.104	.016	.038 -.046	.513
MS172204	.6693	.679 -.694	.110 - 120	.875	1.203	.062 -.094	.084 -.104	.016	.038 -.046	.591
MS172205	.7874	.801 -.816	.156 -.176	.969	1.344	.062 -.094	.146 -.166	.016	.038 -.046	.724
MS172206	.9843	.989 - 1.009	.156 -.176	1.188	1.562	.094 -.125	.146 -.166	.016	.046 -.054	.880
MS172207	1.1811	1.193 - 1.213	.156 -.176	1.438	1.859	.094 -.125	.146 -.166	.031	.046 -.054	1.084
MS172208	1.3780	1.396 - 1.416	.156 -.176	1.656	2.078	.094 -.125	.146 -.166	.031	.046 -.054	1.287
MS172209	1.5748	1.583 - 1.603	.280 -.300	1.844	2.250	.094 -.125	.204 -.234	.031	.053 -.063	1.474
MS172210	1.7717	1.792 - 1.817	.280 -.300	2.062	2.500	.125 -.156	.204 -.234	.031	.053 -.063	1.693
MS172211	1.9685	1.992 - 2.017	.280 -.300	2.250	2.688	.125 -.156	.204 -.234	.031	.053 -.063	1.880
MS172212	2.1654	2.182 - 2.207	.280 -.300	2.500	2.953	.125 -.156	.204 -.234	.031	.058 -.068	2.067
MS172213	2.3622	2.400 - 2.425	.280 -.300	2.688	3.188	.125 -.156	.204 -.234	.047	.058 -.068	2.225
MS172214	2.5591	2.588 - 2.613	.280 -.300	2.875	3.375	.125 -.156	.204 -.234	.047	.058 -.068	2.443
MS172215	2.7559	2.791 - 2.816	.280 -.300	3.094	3.594	.188 -.250	.204 -.234	.047	.058 -.068	2.631
MS172216	2.9528	2.973 - 3.003	.280 -.300	3.375	3.922	.188 -.250	.297 -.327	.047	.058 -.068	2.813
MS172217	3.1496	3.177 - 3.207	.340 -.360	3.594	4.141	.188 -.250	.297 -.327	.047	.058 -.068	3.017
MS172218	3.3465	3.395 - 3.425	.340 -.360	3.812	4.359	.188 -.250	.297 -.327	.047	.058 -.068	3.220

Table 6-32. MS172201 through 172235, Key, Bearing Retaining, Washer - Continued

Part Number	Nominal Bearing Bore Diameter	A	B	C	D	E	F	G	H	I
		±.010	±.010	+.020 -.000	+.000 -.030	±.010	±.010	±.010	±.010	+.020 -.000
MS172219	3.5433	3.582 - 3.612	.340 -.360	4.000	4.547	.188 -.250	.297 -.327	.047	.058 -.068	3.380
MS172220	3.7402	3.800 - 3.830	.340 -.360	4.219	4.812	.188 -.250	.297 -.327	.047	.058 -.068	3.579
MS172221	3.9370	3.988 - 4.018	.340 -.360	4.406	5.000	.250 -.312	.297 -.327	.047	.058 -.068	3.786
MS172222	4.1339	4.192 - 4.222	.340 -.360	4.594	5.188	.250 -.312	.360 -.390	.047	.058 -.068	4.071
MS172223	4.3307	4.395 - 4.425	.340 -.360	4.812	5.406	.250 -.312	.360 -.390	.047	.058 -.068	4.193

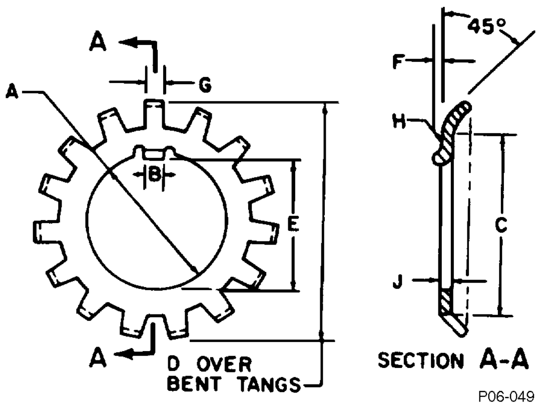
Material:

Steel, Aeronautical Material Specification AMS6357.

Finish:

Phosphate Treatment, Aeronautical Material Specification AMS2481.

Table 6-33. MS172271 through 172320, Key Washer



Part Number	Shaft Thread Diameter	A	B	C	D	E	F	G	H	J
		±.010	±.010	+.020 -.000	+.000 -.030	+.020 -.000	±.010	±.010	±.010	±.010
MS172271	.500	.515 -.530	.110 -.120	.859	1.156	.443	.062 -.094	.084 -.104	.016	.038 -.046
MS172272	.5625	.578 -.593	.110 -.120	.922	1.250	.505	.062 -.094	.084 -.104	.016	.038 -.046
MS172273	.625	.641 -.656	.110 -.120	.984	1.312	.567	.062 -.094	.084 -.104	.016	.038 -.046
MS172274	.6875	.708 -.723	.110 -.120	1.125	1.453	.630	.062 -.094	.084 -.104	.016	.038 -.046
MS172275	.750	.770 -.785	.156 -.176	1.203	1.578	.677	.062 -.094	.146 -.166	.016	.038 -.046
MS172276	.8125	.832 -.852	.156 -.176	1.281	1.656	.739	.094 -.125	.146 -.166	.016	.046 -.054
MS172277	.875	.895 -.915	.156 -.176	1.344	1.719	.802	.094 -.125	.146 -.166	.016	.046 -.054
MS172278	.9375	.958 -.978	.156 -.176	1.406	1.781	.864	.094 -.125	.146 -.166	.016	.046 -.054
MS172279	1.000	1.020 - 1.040	.156 -.176	1.469	1.891	.927	.094 -.125	.146 -.166	.016	.046 -.054
MS172280	1.0625	1.082 - 1.102	.156 -.176	1.562	1.984	.989	.094 -.125	.146 -.166	.031	.046 -.054
MS172281	1.125	1.145 - 1.165	.156 -.176	1.625	2.047	1.052	.094 -.125	.146 -.166	.031	.046 -.054
MS172282	1.1875	1.208 - 1.228	.156 -.176	1.688	2.109	1.114	.094 -.125	.146 -.166	.031	.046 -.054

Table 6-33. MS172271 through 172320, Key Washer - Continued

Part Number	Shaft Thread Diameter	A	B	C	D	E	F	G	H	J
		±.010	±.010	+.020 -.000	+.000 -.030	+.020 -.000	±.010	±.010	±.010	±.010
MS172283	1.250	1.270 - 1.290	.156 -.176	1.750	2.172	1.177	.094 -.125	.146 -.166	.031	.046 - 054
MS172284	1.3125	1.332 - 1.352	.156 -.176	1.812	2.234	1.239	.094 -.125	.146 -.166	.031	.046 -.054
MS172285	1.375	1.395 - 1.415	.156 -.176	1.875	2.297	1.302	.094 -.125	.146 -.166	.031	.046 -.054
MS172286	1.4375	1.458 - 1.478	.219 -.239	1.938	2.344	1.349	.094 -.125	.204 -.234	.031	.053 -.063
MS172287	1.500	1.520 - 1.540	.219 -.239	2.000	2.406	1.411	.094 -.125	.204 -.234	.031	.053 -.063
MS172288	1.5625	1.587 - 1.612	.219 -.239	2.062	2.469	1.474	.125 -.156	.204 -.234	.031	.053 -.063
MS172289	1.625	1.650 - 1.675	.219 -.239	2.125	2.562	1.536	.125 -.156	.204 -.234	.031	.053 -.063
MS172290	1.6875	1.713 - 1.738	.219 -.239	2.188	2.625	1.599	.125 -.156	.204 -.234	.031	.053 -.063
MS172291	1.750	1.775 - 1.800	.219 -.239	2.281	2.719	1.661	.125 -.156	.204 -.234	.031	.053 -.063
MS172292	1.8125	1.837 - 1.862	.219 -.239	2.344	2.781	1.724	.125 -.156	.204 -.234	.031	.053 -.063
MS172293	1.875	1.900 - 1.925	.219 -.239	2.406	2.844	1.786	.125 -.156	.204 -.234	.031	.053 -.063
MS172294	1.9375	1.963 - 1.988	.219 -.239	2.469	2.906	1.849	.125 -.156	.204 -.234	.031	.053 -.063
MS172295	2.000	2.025 - 2.050	.219 -.239	2.531	2.969	1.911	.125 -.156	.204 -.234	.031	.053 -.063
MS172296	2.0625	2.087 - 2.112	.219 -.239	2.594	3.047	1.974	.125 -.156	.204 -.234	.031	.058 -.068
MS172297	2.125	2.150 - 2.175	.219 -.239	2.656	3.109	2.036	.125 -.156	.204 -.234	.031	.058 -.068
MS172298	2.1875	2.219 - 2.244	.219 -.239	2.719	3.172	2.099	.125 -.156	.204 -.234	.047	.058 -.068

Table 6-33. MS172271 through 172320, Key Washer - Continued

Part Number	Shaft Thread Diameter	A	B	C	D	E	F	G	H	J
		±.010	±.010	+.020 -.000	+.000 -.030	+.020 -.000	±.010	±.010	±.010	±.010
MS172299	2.250	2.281 - 2.306	.219 -.239	2.781	3.234	2.161	.125 -.156	.204 -.234	.047	.058 -.068
MS172300	2.3125	2.343 - 2.368	.219 -.239	2.844	3.297	2.224	.125 -.156	.204 -.234	.047	.058 -.068
MS172301	2.375	2.406 - 2.431	.219 -.239	2.906	3.359	2.286	.125 -.156	.204 -.234	.047	.058 -.068
MS172302	2.4375	2.469 - 2.494	.219 -.239	2.969	3.422	2.349	.125 -.156	.204 -.234	.647	.058 -.068
MS172303	2.500	2.531 - 2.556	.219 -.239	3.031	3.484	2.411	.125 -.156	.204 -.234	.047	.058 -.068

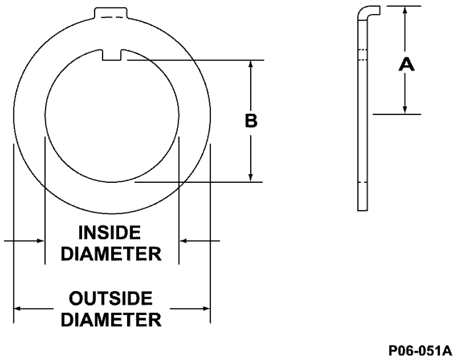
Material:

Steel, Aeronautical Material Specification AMS6357.

Finish:

Phosphate treatment, Aeronautical Material Specification AMS2481.

Table 6-34. MS25081 Key Way Washer



				B ±.005	
Dash Number	Inside Diameter ±.005	Outside Diameter ±.016	A ±.005	Max	Min
-1	.475	.719	.388	.440	.433
-2	.631	.938	.513	.597	.589
-3	.652	.875	.466	.605	.591

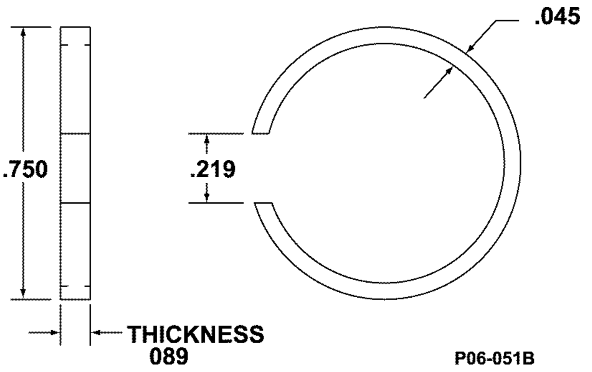
Material:

Low carbon steel, Federal Specification QQ-S-636.

Finish:

Cadmium plating, Federal Specification QQ-S-416.

Table 6-35. MS90136 Spring Tension Washer; Series N Connectors

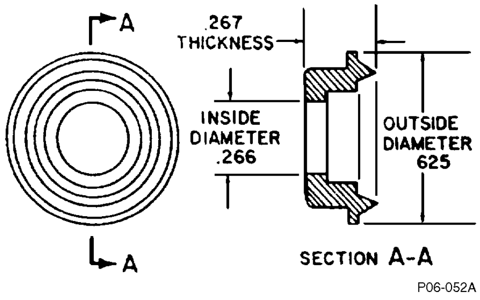


Part Number MS90136-1

Material:

Phosphor bronze, Federal Specification QQ-P-330.

Table 6-36. MS90139 Shouldered and Recessed Washer; Series N Connectors

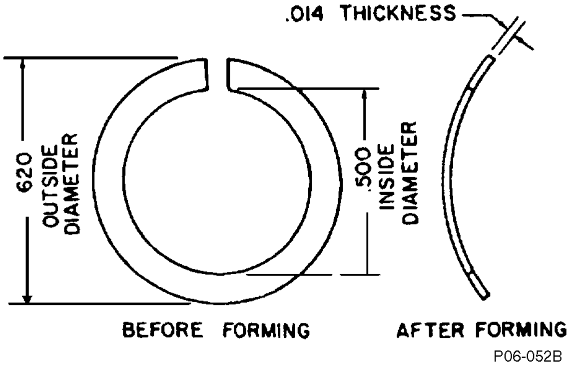


Part Number MS90139-1

Material:

Brass, Federal Specification QQ-B-613

Table 6-37. MS90217 Spring Washer; Part of Coaxial Connectors

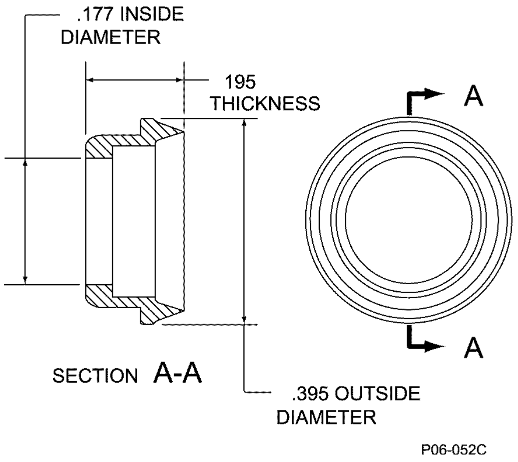


Part Number MS90217-1

Material:

Copper-beryllium alloy, Federal Specification QQ-C-533.

Table 6-38. MS90219 Shouldered and Recessed Washer; Part of RF Coaxial Connectors

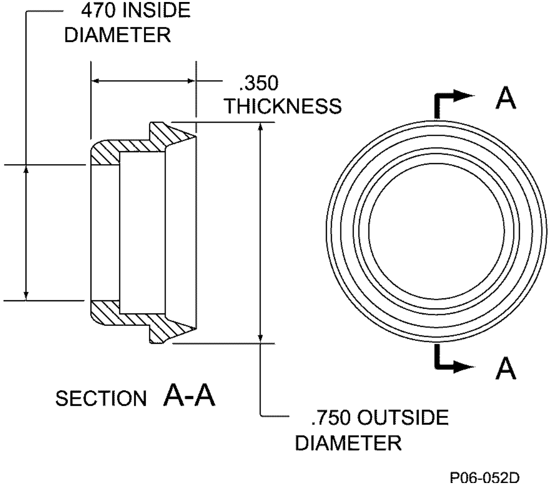


Part Number MS90219-1

Material:

Table 6-38. MS90219 Shouldered and Recessed Washer; Part of RF Coaxial Connectors - Continued

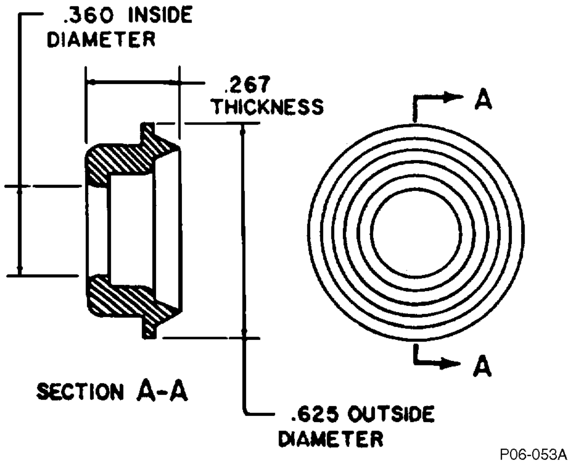
Brass, Federal Specification QQ-B-613.



Part Number MS90219-2

Material:

Brass, Federal Specification QQ-B-613.

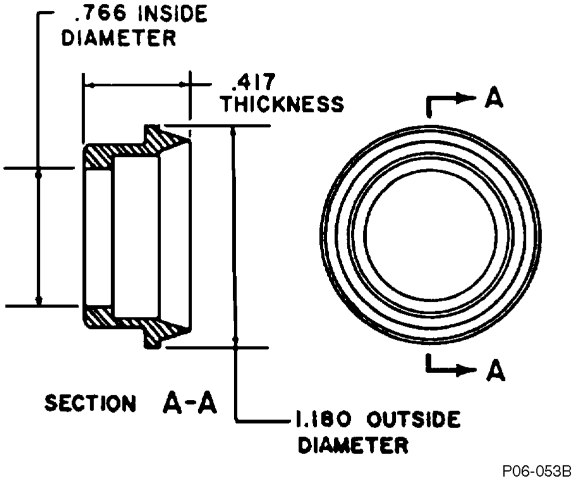


Part Number MS90219-3

Material:

Brass, Federal Specification QQ-B-613.

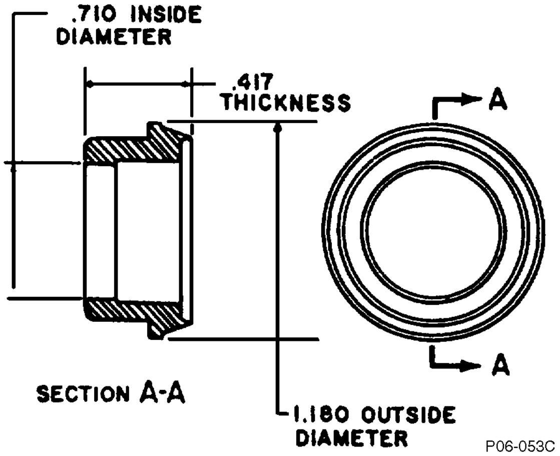
Table 6-38. MS90219 Shouldered and Recessed Washer; Part of RF Coaxial Connectors - Continued



Part Number MS90219-4

Material:

Brass, Federal Specification QQ-B-613.

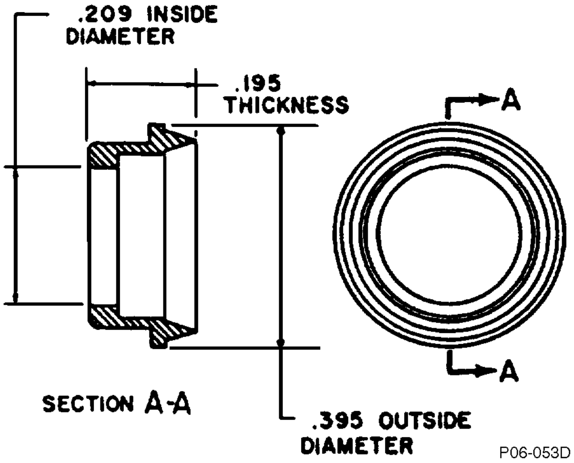


Part Number MS90219-5

Material:

Brass, Federal Specification QQ-B-613.

Table 6-38. MS90219 Shouldered and Recessed Washer; Part of RF Coaxial Connectors - Continued

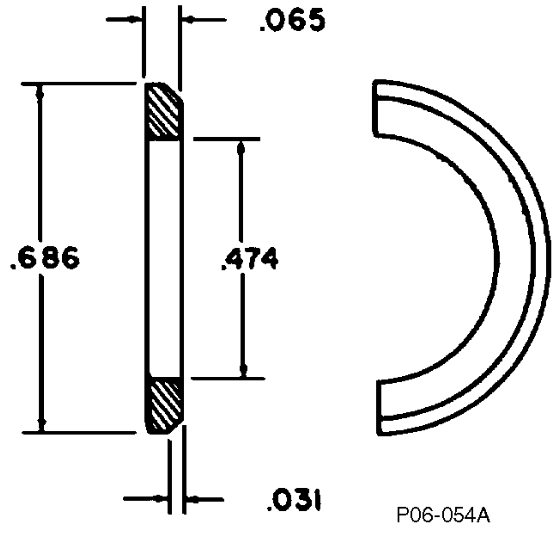


Part Number MS90219-6

Material:

Brass, Federal Specification QQ-B-613.

Table 6-39. MS90221 Half Washer; Part of Series C Connectors

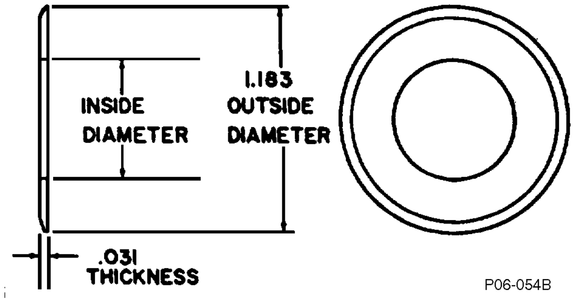


Part Number MS90221-1

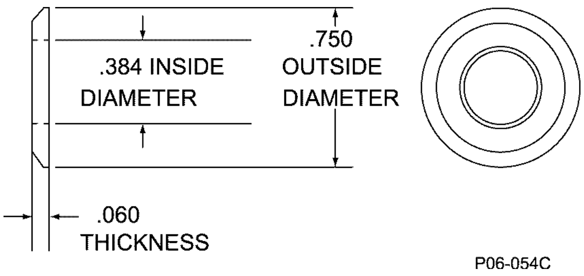
Material:

Brass, Federal Specification QQ-B-613.

Table 6-40. MS90235 Holding Washer; Part of RF Coaxial Connectors

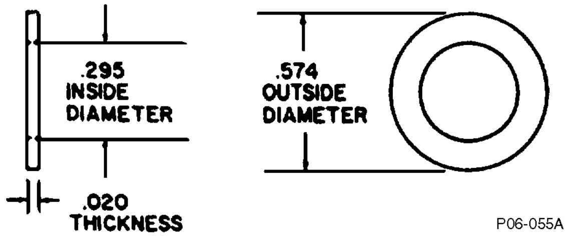


Part Number	Inside Diameter +.005 -.000
MS90235-2	.640
MS90235-3	.700



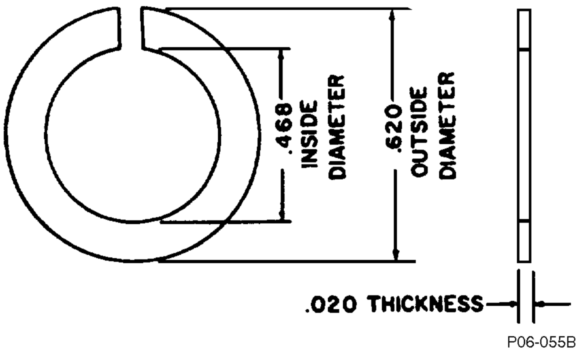
Part Number MS90235-1
Material:
Brass, Federal Specification QQ-B-613.

Table 6-41. MS90242 Holding Washer; Part of Coaxial Connectors



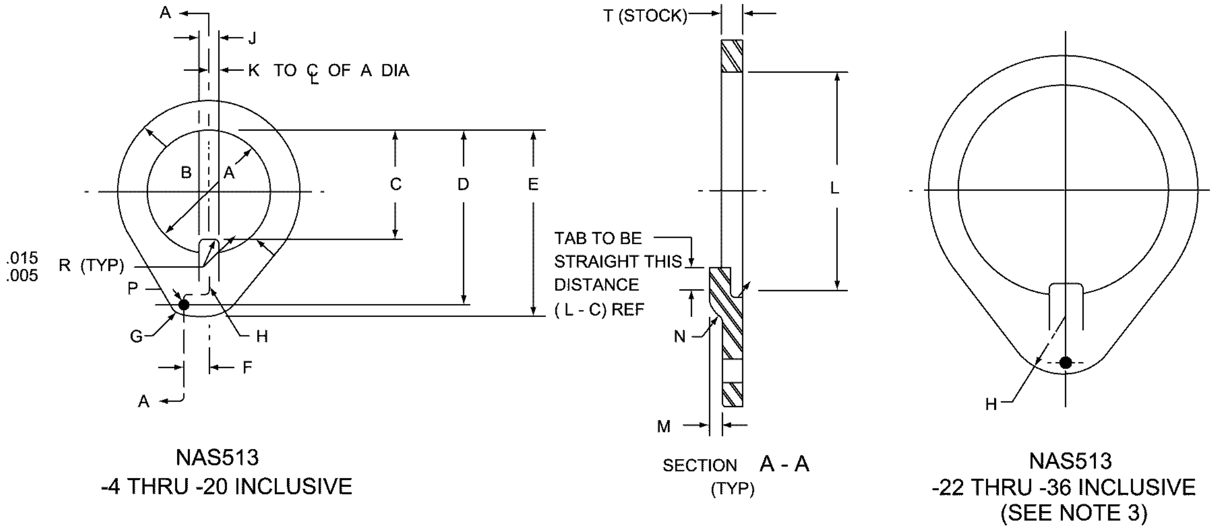
Material:
Soft copper, Federal Specification QQ-C-576.

Table 6-42. MS91820 Split Washer; Part of Series C Connectors



Part Number MS91820-1
Material:
Polytetrafluoroethylene.

Table 6-43. Washer-Rod End Locking



DASH NO.	TERMINAL THREAD SIZE (REF)	A DIA	B DIA +.02 -.00	C	D ±.016	E ±.016	F ±.031	G RAD	H RAD	J ±.005	K	L ±.031	M ±.005	N RAD	T	P DIA
4	1/4 - 28UNF-3A	.272 ±.005	.44	.214 ±.005	.406	.500	.125	.094	.094	.052	.026 ±.005	.293	.036	.031	.050	.062
5	5/16 - 24UNF-3A	.334 ±.005	.50	.273 ±.005	.484	.578	.125	.094	.094	.052	.026 ±.005	.355	.036	.031	.050	.062
6	3/8 - 24UNF-3A	.396 ±.008	.56	.327 ±.008	.562	.656	.125	.094	.094	.082	.041 ±.005	.418	.036	.031	.050	.062
7	7/16 - 20UNF-3A	.459 ±.008	.63	.386 ±.008	.625	.719	.125	.094	.094	.082	.041 ±.005	.463	.049	.031	.063	.062
8	1/2 - 20UNF-3A	.520 ±.008	.75	.450 ±.008	.719	.813	.156	.094	.156	.082	.041 ±.005	.542	.049	.031	.063	.062
9	9/16 - 18UNF-3A	.583 ±.008	.88	.496 ±.010	.812	.906	.188	.094	.156	.114	.057 ±.005	.597	.057	.062	.071	.071
10	5/8 - 18UNF-3A	.647 ±.010	1.00	.559 ±.010	.937	1.031	.188	.094	.188	.114	.057 ±.005	.675	.057	.062	.071	.071
12	3/4 - 16UNF-3A	.772 ±.010	1.12	.681 ±.010	1.062	1.156	.188	.094	.188	.114	.057 ±.005	.800	.057	.062	.071	.071
14	7/8 - 14UNF-3A	.897 ±.010	1.31	.795 ±.010	1.250	1.344	.188	.094	.250	.142	.071 ±.005	.944	.066	.062	.080	.080
16	1 - 14NS-3A	1.022 ±.010	1.50	.918 ±.010	1.422	1.516	.188	.094	.250	.142	.071 ±.005	1.088	.074	.062	.090	.090
18	1 1/8 - 12UNF-3A	1.147 ±.010	1.62	1.028 ±.010	1.547	1.656	.219	.109	.313	.174	.087 ±.007	1.213	.074	.062	.090	.090
20	1 1/4 - 12UNF-3A	1.272 ±.010	1.75	1.154 ±.010	1.687	1.796	.219	.109	.313	.174	.087 ±.007	1.280	.096	.094	.112	.112
22	1 3/8 - 12UNF-3A	1.397 ±.010	1.88	1.254 ±.010	1.859	1.969	–	–	.375	.236	.118 ±.007	1.405	.096	.094	.112	.112
24	1 1/2 - 12UNF-3A	1.518 ±.010	2.00	1.379 ±.010	1.969	2.078	–	–	.375	.236	.118 ±.007	1.530	.096	.094	.112	.112
26	1 5/8 - 12UN-3A	1.643 ±.010	2.12	1.495 ±.010	2.109	2.219	–	–	.375	.236	.118 ±.007	1.638	.109	.094	.125	.125
28	1 3/4 - 12UN-3A	1.766 ±.010	2.25	1.607 ±.010	2.266	2.375	–	–	.500	.298	.149 ±.007	1.763	.109	.094	.125	.125
30	1 7/8 - 12UN-3A	1.891 ±.010	2.38	1.732 ±.010	2.375	2.484	–	–	.500	.298	.149 ±.007	1.888	.109	.094	.125	.125
32	2 - 12UN-3A	2.016 ±.010	2.63	1.857 ±.010	2.594	2.703	–	–	.500	.298	.149 ±.007	2.076	.109	.094	.125	.125
34	2 1/8 - 12UN-3A	2.141 ±.010	2.75	1.973 ±.010	2.750	2.860	–	–	.500	.298	.149 ±.007	2.201	.109	.094	.125	.125
36	2 1/4 - 12UN-3A	2.266 ±.010	2.88	2.098 ±.010	2.875	2.984	–	–	.500	.298	.149 ±.007	2.326	.109	.094	.125	.125

MATERIAL: SPRING STEEL, 1095, SPEC MIL-S-7947 CONDITION A

HEAT TREAT: 180,000 TO 210,000 PSI. SPEC MIL-H-6875, ROCKWELL HARDNESS C40-45

FINISH: CADMIUM PLATE, SPEC QQ-P-416 TYPE 1, CLASS 2

CODE: DASH NUMBER DESIGNATES WASHER SIZE AS NOTED IN THE ABOVE TABLE

EXAMPLE OF PART NUMBER:

NAS513-4 = LOCKWASHER FOR USE WITH A 1/4-28UNF-3A ROD END TERMINAL AND AN NAS509-4 JAM NUT

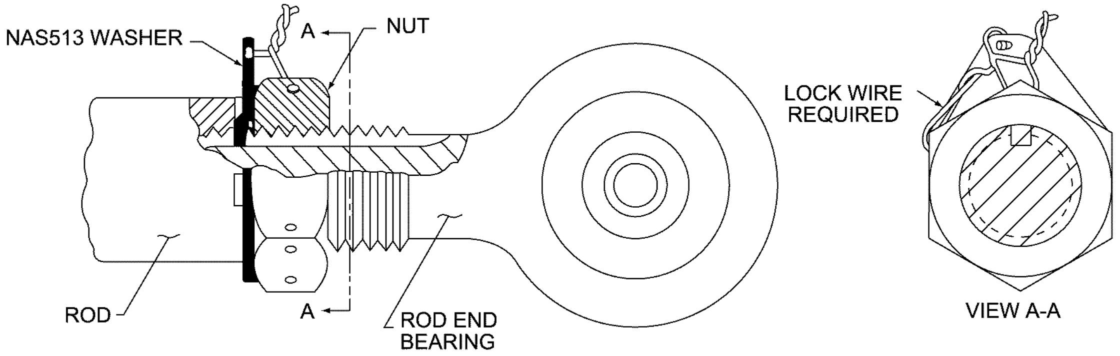
NOTES:

1. **THIS WASHER IS INTENDED FOR USE WITH THE NAS509 JAM NUT FOR POSITIVE LOCKING OF ROD END TERMINALS TO HYDRAULIC PISTON RODS**
2. **WASHER FACE SURFACES MUST BE FLAT WITHIN .010 INCH**
3. **DIMENSIONS OF NAS513-4 THROUGH -20 APPLY TO NAS513-22 THROUGH -36 UNLESS OTHERWISE SPECIFIED**
4. **TOLERANCES UNLESS OTHERWISE SPECIFIED, DECIMALS ±.010, ANGLES ±1°**

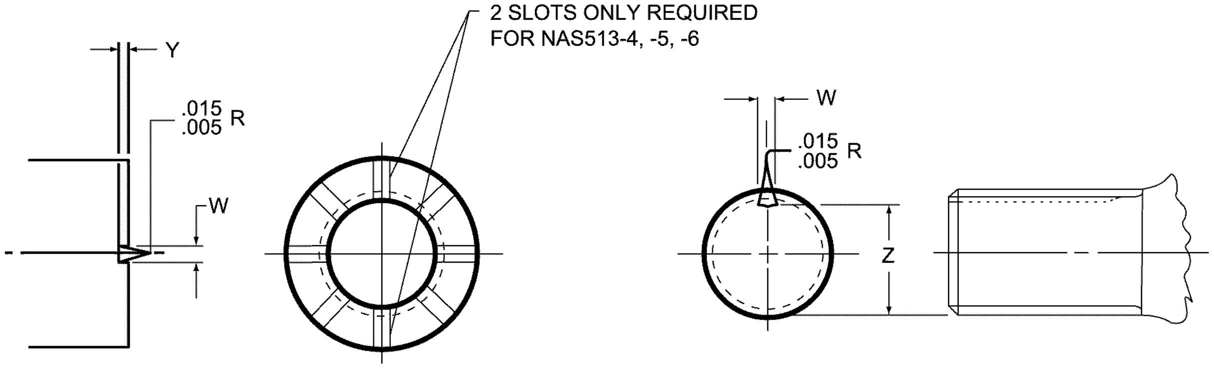
P06-056

Table 6-43. Washer-Rod End Locking - Continued

TYPICAL INSTALLATION



DESIGN INFORMATION



PISTON ROD

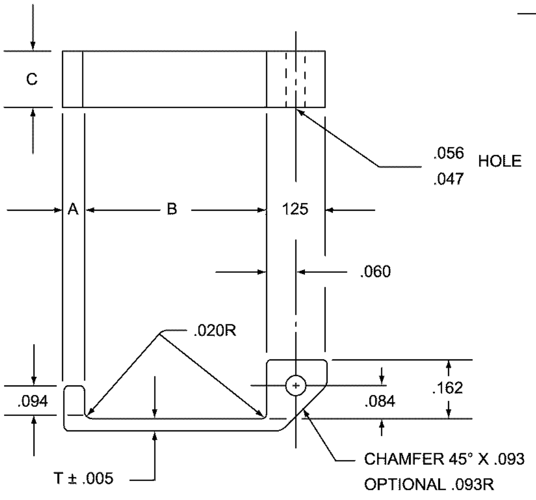
ROD END TERMINAL

WASHER DASH NO. (REF)	TERMINAL THREAD	W +.005 -.000	Y +.005 -.000	Z +.000 -.005
4	1/4 - 28UNF-3A	.062	.056	.201
5	5/16 - 24UNF-3A	.062	.056	.260
6	3/8 - 24UNF-3A	.093	.056	.311
7	7/16 - 20UNF-3A	.093	.069	.370
8	1/2 - 20UNF-3A	.093	.069	.436
9	9/16 - 18UNF-3A	.125	.077	.478
10	5/8 - 18UNF-3A	.125	.077	.541
12	3/4 - 16UNF-3A	.125	.077	.663
14	7/8 - 14UNF-3A	.156	.086	.777
16	1 -14NS-3A	.156	.094	.900
18	1 1/8 - 12UNF-3A	.187	.094	1.010
20	1 1/4 - 12UNF-3A	.187	.116	1.136
22	1 3/8 - 12UNF-3A	.250	.116	1.236
24	1 1/2 - 12UNF-3A	.250	.116	1.361
26	1 5/8 - 12UN-3A	.250	.129	1.477
28	1 3/4 - 12UN-3A	.312	.129	1.589
30	1 7/8 - 12UN-3A	.312	.129	1.714
32	2 -12UN-3A	.312	.129	1.839
34	2 1/8 - 12UN-3A	.312	.129	1.955
36	2 1/4 - 12UN-3A	.312	.129	2.080

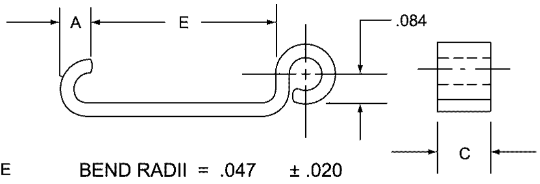
NOTE: THE INFORMATION INCLUDED ON THIS PAGE DEFINES THE SLOT DIMENSIONS OF THE PISTON ROD AND ROD END TERMINAL USED IN CONJUCTION WITH THE NAS513 WASHER.

P06-057

Table 6-44. Lock-Rod End (Key Type)

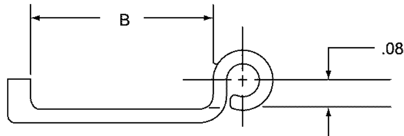


TYPE A



BEND RADII = .047 ± .020

TYPE B



BEND RADII = .047 ± .020

ALTERNATE TYPE A DESIGN

DASH NO.	THREAD OD (REF)	A ±.005	B ± .010	C ± .005	T ± .005
1	1/4 & 5/16	.036	.250	.055	.020*
2	3/8	.036	.281	.087	.020*
3	7/16 & 1/2	.049	.344	.087	.020
4	9/16 & 5/8	.057	.438	.118	.036
5	3/4	.057	.500	.118	.036
6	7/8 & 1	.066	.531	.149	.040
7	1 1/8	.074	.563	.180	.050
8	1 1/4	.096	.594	.180	.050
9	1 3/8 & 1 1/2	.096	.656	.242	.071
10	1 5/8	.109	.688	.242	.080
11	1 3/4 & 1 7/8	.109	.750	.305	.090
12	2, 2 1/8 & 2 1/4	.109	.832	.305	.090

(* TOLERANCE FOR -1 AND -2 TO BE +.001, -.005

MATERIAL: TYPE "A", ALLOY STEEL PER MIL-S-6758 (4130)
TYPE "B", ALLOY STEEL PER MIL-S-18729 (4130)

FINISH: CADMIUM PLATE PER SPEC QQ-P-416, TYPE 1, CLASS 2

HEAT TREAT: 180,000 TO 200,000 PSI PER SPEC MIL-H-6875 ROCKWELL HARDNESS C40-43

CODE: NO LETTER AFTER DASH NUMBER FOR TYPE A LOCK, MADE FROM BAR, RODS AND FORGING STOCK
ADD L AFTER DASH NUMBER FOR TYPE B LOCK, MADE FROM PLATE, SHEET AND STRIP

EXAMPLES OF PART NUMBERS: NAS559-5 = LOCK, TYPE A FOR USE WITH 3/4 INCH THREAD
NAS559-2L = LOCK, TYPE B FOR USE WITH 3/8 INCH THREAD

NOTES:

(1) DIMENSIONS IN INCHES UNLESS OTHERWISE SPECIFIED. TOLERANCES: DECIMALS ±.010. ANGLES ±0°30' UNLESS OTHERWISE SPECIFIED

(2) DASH NUMBERS SHOWN ON THIS NAS STANDARD ARE FOR TYPE A

(3) ALTERNATE METHOD OF FABRICATION FOR TYPE A: PROFILE IS MACHINED AND END CURLED TO FORM LOCKWIRE HOLE

(4) TYPE B IS FORMED FROM "T" SHEET

(5) LOCKS SHALL BE FREE FROM HANGING BURRS AND SLIVERS WHICH MIGHT BECOME DISLODGED UNDER USAGE

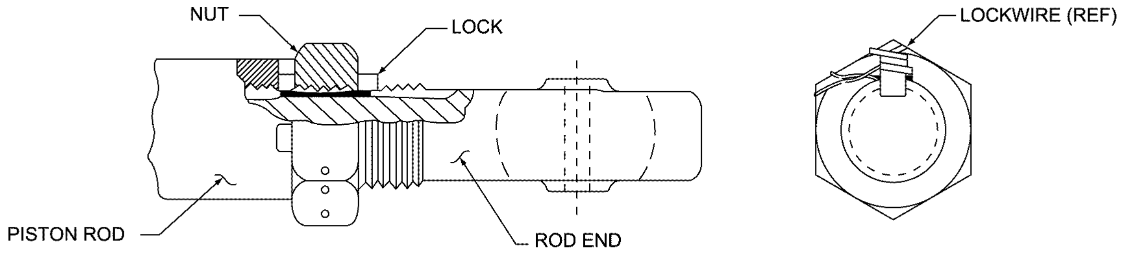
(6) REMOVE SHARP EDGE AROUND SAFETY WIRE HOLE

(7) THIS LOCK IS INTENDED FOR USE WITH NAS509 JAM NUT FOR POSITIVE LOCKING OF ROD END TERMINALS TO HYDRAULIC PISTON RODS, TIE RODS ENDS, PUSH PULL RODS, ETC.

(8) SEE SHEET 2 OF 2 FOR INSTALLATION INFORMATION

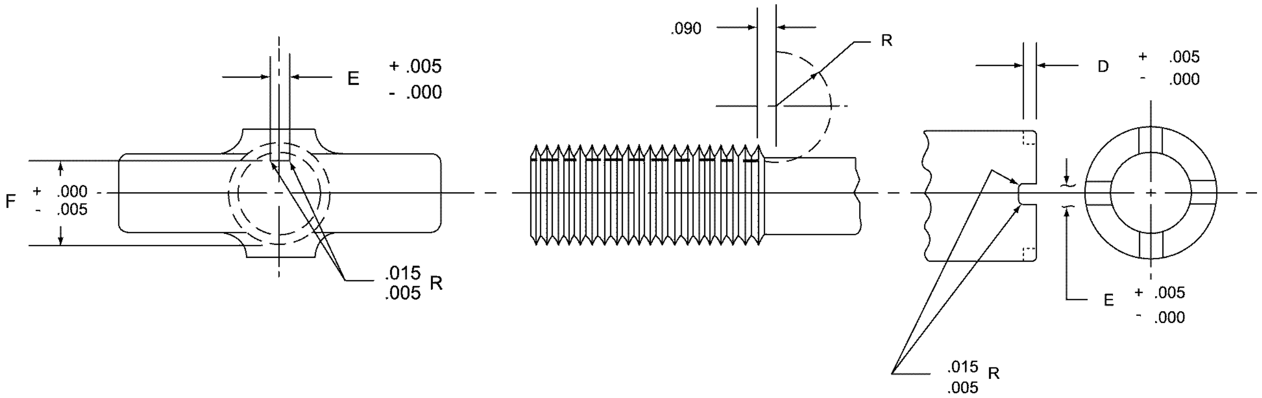
P06-058

Table 6-44. Lock-Rod End (Key Type) - Continued



TYPICAL INSTALLATION

DESIGN INFORMATION

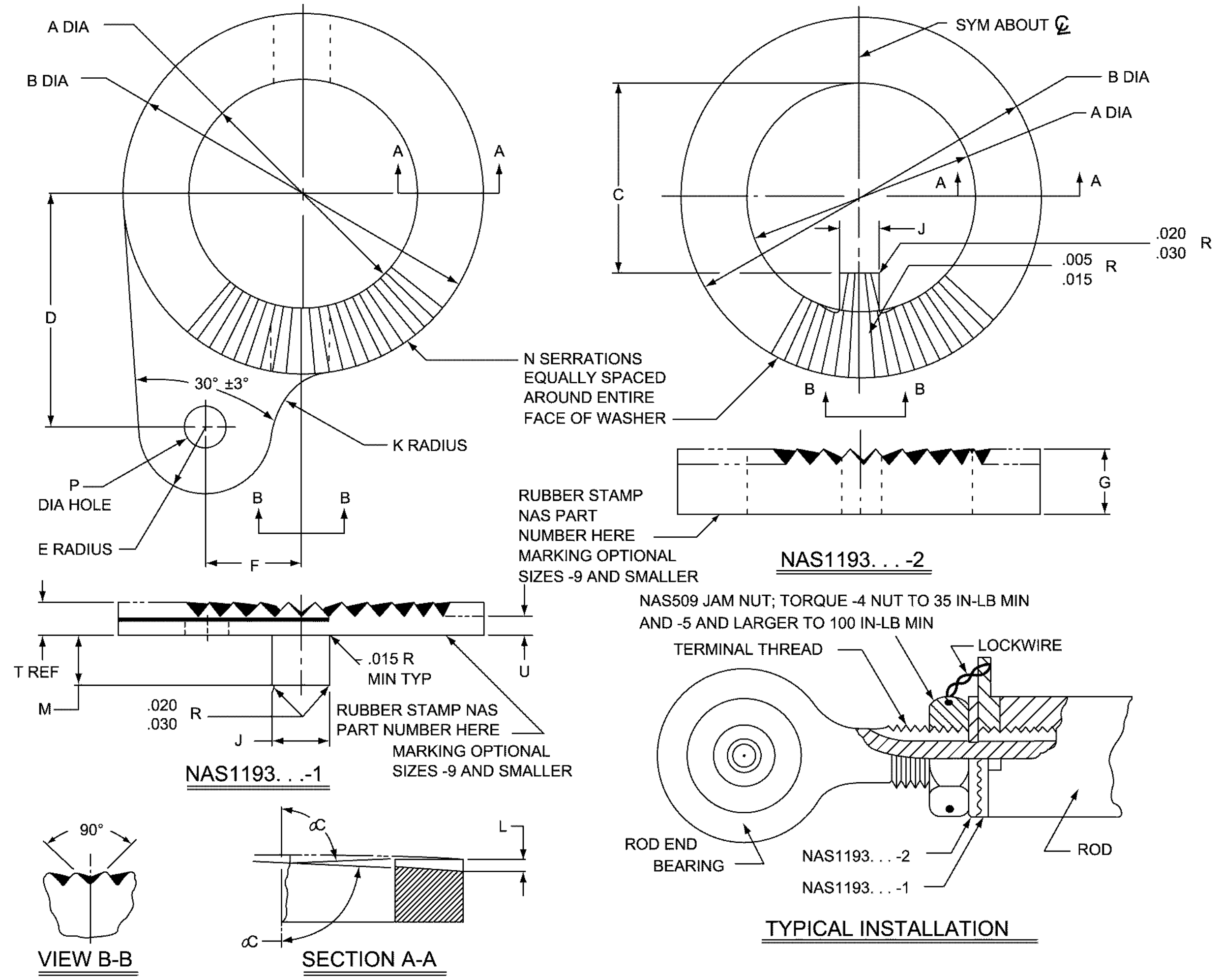


KEY DASH NO. (REF)	NUT (REF)	THREAD OD (REF)	D	E	F	R
1	NAS509-4	1/4	.056	.062	.201	.255
1	NAS509-5	5/16	.056	.062	.260	.255
2	NAS509-6	3/8	.056	.093	.311	.255
3	NAS509-7	7/16	.069	.093	.370	.255
3	NAS509-8	1/2	.069	.093	.436	.255
4	NAS509-9	9/16	.077	.125	.478	.255
4	NAS509-10	5/8	.077	.125	.541	.255
5	NAS509-12	3/4	.077	.125	.663	.255
6	NAS509-14	7/8	.086	.156	.777	.318
6	NAS509-16	1	.094	.156	.900	.318
7	NAS509-18	1 1/8	.094	.187	1.010	.382
8	NAS509-20	1 1/4	.116	.187	1.136	.382
9	NAS509-22	1 3/8	.116	.250	1.236	.445
9	NAS509-24	1 1/2	.116	.250	1.361	.445
10	NAS509-26	1 5/8	.129	.250	1.477	.445
11	NAS509-28	1 3/4	.129	.312	1.589	.508
11	NAS509-30	1 7/8	.129	.312	1.714	.508
12	NAS509-32	2	.129	.312	1.839	.508
12	NAS509-34	2 1/8	.129	.312	1.955	.508
12	NAS509-36	2 1/4	.129	.312	2.080	.508

NOTE: THE INFORMATION INCLUDED ON THIS PAGE DEFINES THE SLOT DIMENSIONS OF THE PISTON ROD AND ROD END TERMINAL USED IN CONJUNCTION WITH THE NAS559 LOCKING PIN

P06-059

Table 6-45. Locking Device - Positive Index



FIRST DASH NO.	TERMINAL THREAD SIZE REF	A DIA	B DIA +.02 -.00	C		D	E RAD.	F	G ±.005	J ±.005	K RAD.	L REF.	M ±.005	N NUMBER OF SERRA-TIONS	P DIA	T REF	U ±.005	∝C ±30'
4	.2500-28	.260 ±.005	.44	.211	+ .000 - .005	.330	.093	.127	.070	.052	.026	.019	.036	26	.062	.043	.022	87°30'
5	.3125-24	.323 ±.005	.50	.270		.330	.093	.157	.070	.052	.026	.018	.036	42	.062	.043	.023	87°51'
6	.3750-24	.385 ±.005	.56	.321		.335	.093	.187	.070	.082	.041	.021	.036	42	.062	.043	.022	87°51'
7	.4375-20	.448 ±.005	.63	.380		.360	.093	.222	.080	.082	.041	.020	.049	50	.062	.043	.023	88°12'
8	.5000-20	.510 ±.005	.75	.446		.440	.093	.282	.080	.082	.041	.024	.049	50	.062	.055	.031	88°12'
9	.5625-18	.575 ±.008	.88	.488		.510	.093	.347	.090	.114	.057	.025	.057	56	.071	.055	.031	89°50'
10	.6250-18	.638 ±.008	1.00	.551		.580	.106	.394	.090	.114	.057	.028	.057	56	.071	.062	.034	89°50'
12	.7500-16	.763 ±.008	1.12	.678	+ .000 - .010	.604	.106	.454	.100	.114	.057	.028	.057	64	.071	.062	.034	89°51'
14	.8750-14	.888 ±.008	1.31	.792		.698	.120	.535	.100	.142	.071	.029	.066	72	.080	.062	.033	89°53'
A16	1.0000-14	1.015 ±.010	1.50	.915		.715	.135	.615	.100	.142	.071	.033	.074	72	.090	.078	.044	89°53'
16	1.0000-12	1.015 ±.010	1.50	.915		.715	.135	.615	.100	.142	.071	.028	.074	84	.090	.072	.044	89°54'
18	1.1250-12	1.140 ±.010	1.62	1.030	+ .000 - .015	.836	.135	.675	.100	.174	.087	.030	.074	84	.090	.078	.048	89°54'
20	1.2500-12	1.265 ±.010	1.75	1.156		.942	.168	.707	.100	.174	.087	.033	.096	84	.112	.081	.048	89°54'
22	1.3750-12	1.390 ±.010	1.88	1.256		.982	.168	.772	.100	.236	.118	.035	.096	84	.112	.081	.043	89°54'
24	1.5000-12	1.515 ±.010	2.00	1.381		1.026	.168	.832	.100	.236	.118	.038	.096	84	.112	.081	.043	89°54'
26	1.6250-12	1.640 ±.010	2.12	1.502	+ .000 - .020	1.080	.175	.888	.100	.236	.118	.040	.109	84	.125	.083	.043	89°54'
28	1.7500-12	1.765 ±.010	2.25	1.615		1.130	.175	.950	.100	.298	.149	.042	.109	84	.125	.085	.043	89°54'
30	1.8750-12	1.890 ±.010	2.38	1.740		1.165	.175	1.013	.100	.298	.149	.045	.109	84	.125	.088	.043	89°54'
32	2.0000-12	2.015 ±.010	2.63	1.865		1.255	.175	1.138	.100	.298	.149	.049	.109	84	.125	.092	.043	89°54'
34	2.1250-12	2.140 ±.010	2.75	1.980		1.293	.175	1.200	.100	.298	.149	.051	.109	84	.125	.094	.043	89°54'
36	2.2500-12	2.265 ±.010	2.88	2.105		1.328	.175	1.263	.100	.298	.149	.054	.109	84	.125	.097	.043	89°54'

P06-060

Table 6-45. Locking Device - Positive Index - Continued

CODE:	8	THE CODE LETTER "K" FOLLOWING BASIC PART NUMBER DESIGNATES 17-4PH MATERIAL FOR USE UP TO 800°F. FIRST DASH NUMBER DESIGNATES TERIMANAL THREAD SIZE AS DESIGNATED IN TABLE. THE CODE LETTER "C" FOLLOWING THE FIRST DASH NUMBER DESIGNATES A COMPLETE LOCKING DEVICE CONSISTING OF THE -1 AND -2 HALVES. THE SECOND DASH NUMBER DESIGNATES LOCKING DEVICE HALF AS SHOWN IN FIGURE AND AS DIMENSIONED IN TABLE. THE SUFFIX LETTER "P" FOLLOWING THE "C" CODE OR SECOND DASH NUMBER DESIGNATES CADMIUM PLATE FINISH FOR USE UP TO 400°F.
EXAMPLE	8	NAS1993K5C DESIGNATES A POSITIVE INDEXING LOCKING DEVICE ASSEMBLY OF 17-4PH MATERIAL FOR USE ON A .3125-24 THREADED TERMINAL AND CONSISTING OF AN NAS1193K5-1 HALF AND AN NAS1193K5-2 HALF. NAS1193K5CP DESIGNATES A POSITIVE INDEXING LOCKING DEVICE ASSEMBLY OF CADMIUM PLATED 17-4PH MATERIAL FOR USE ON A.3125-24 THREADED TERMINAL AND CONSISTING OF AN NAS1193K5-1P HALF AND AN NAS1193K5-2P HALF. NAS1193K5-1 DESIGNATES A POSITIVE INDEXING LOCK WASHER HALF OF THE CONFIGURATION AS SHOWN IN FIGURE FOR USE WITH A.3125-24 THREADED TERMINAL. NAS1193K5-2 DESIGNATES A POSITIVE INDEXING LOCK WASHER HALF OF THE CONFIGURATION AS SHOWN IN FIGURE FOR USE WITH A.3125-24 THREADED TERMINAL.
MATERIAL:	8	"K" CODE: CORROSION RESISTANT STEEL INVESTMENT CASTING 17-4PH PER AMS5355 FOR USE UP TO 800°F.
FINISH:	8	17-4PH MATERIAL: NO CODE - NONE "P" CODE - CADMIUM PLATE PER QQ-P-416 TYPE II, CLASS 2
HEAT TREAT:	8	17-4PH MATERIAL: 180,000-200,000 PSI PER AMS5355 EXCEPT HARDNESS NOT TO EXCEED ROCKWELL C44 MAX
TOLERANCES:		CASTING TOLERANCES + .005/IN. ANGULAR TOLERANCES + 30'. CORE LOCATION AND DIMENSIONS + 30' OR + .01.
NOTES:		1. THIS LOCKING DEVICE IS INTENDED FOR USE WITH THE NAS509 JAM NUT OF AN EQUIVALENT DASH NUMBER WHERE CLOSE LINEAR TOLERANCES OR CLOSE ADJUSTMENT TO WITHIN .001 INCH OF ROD END LENGTH IS REQUIRED. 2. BREAK ALL SHARP EDGES EXCEPT AS NOTED. 3. TRIM GATES FLUSH. 4. SURFACE FINISH C-12 ALL OVER PER NAS823. 5. PENETRANT INSPECT PER MIL-C-6021 FOR CLASS 2 NON-MAGNETIC MATERIAL. 6. FOR PISTON ROD AND KEYWAY DETAIL, SEE NAS513 SHEET 2. 7. DIMENSIONS TO BE MET BEFORE CADMIUM PLATING. 8. THE NO CODE (TYPE 410 MATERIAL) PARTS ARE INACTIVE FOR DESIGN AFTER 29 SEPT. 1973 AND ARE SUPERSEDED BY "K" CODE PARTS. FOR DESCRIPTION OF STATUS NOTES, SEE NAS380.

P06-061

CHAPTER 7
PINS

7.1 PINS.

The types of pins used in aircraft structure are taper pins, flathead pins, cotter pins, lockpins, spring pins, and machine pins.

7.1.1 Taper Pins.

(Refer to Table 7-1 and Table 7-2.) Taper pins are used in joints that carry shear loads and where the absence of clearance is essential. The AN385 plain taper pin can be drilled or undrilled. The drilled plain taper pin is usually secured with safety wire. The AN386 threaded taper pin is used with an AN975 taper-pin washer and a shear nut if the taper pin is drilled or a self-locking nut is undrilled. When a shear nut is used with the threaded taper pin and washer, the nut is secured with a cotter pin. For the proper methods of securing with cotter pins, refer to Chapter 16, paragraph 16.5.

7.1.2 Flathead Pins.

(Refer to Table 7-3 and Table 7-4.) The flathead pin is used with tie rod terminals or secondary controls, which do not operate continuously. The flathead pin should be secured with cotter pin. The pin should be installed, when possible, with the head of the pin positioned up, forward, or inboard depending on the installation. When installed in this manner, should the securing device fail, the possibility of the pin falling out is greatly minimized.

7.1.3 Cotter Pins.

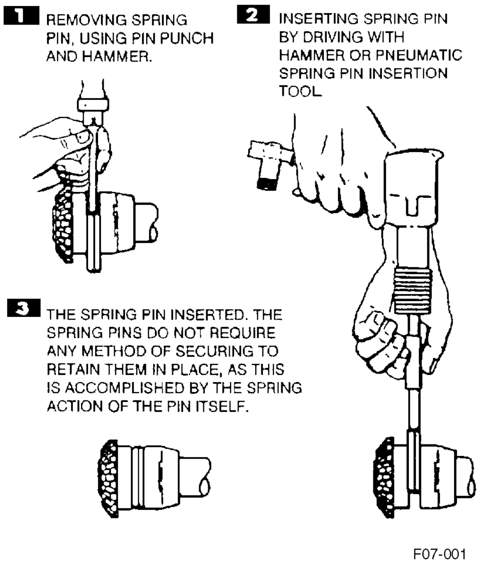
Cotter pins are used to secure bolts, screws, nuts, and pins, and in applications where such securing is required. Where nonmagnetic cotter pins are required or where resistance to corrosion is desired, NASM24665 cotter pins will be used. Cotter pins will not be re-used on aircraft and missiles.

7.1.4 Lockpins.

(Refer to Table 7-5 and Table 7-6.)

7.1.5 Spring Pins.

(Refer to Table 7-7 through Table 7-10.) The spring pin is a slotted or coiled and chamfered pin, heat-treated to achieve optimum toughness, resilience, and shear strength. Spring pins are manufactured with the diameter greater than the holes in which they are to be used. Spring pins are stronger than mild carbon steel straight pins, taper pins, or grooved pins of the equivalent size. The spring pin is compressed as it is driven into the hole, and exerts continuous spring pressure against the sides of the hole to prevent loosening by vibration. Spring pins are removed and replaced as shown in Figure 7-1. Spring pins require no other means of securing and can be used inside one another to increase shear strength. Be careful when using these pins, since spring pin performance depends entirely on the fit, and the permanence of the fit under vibration or repeated load conditions (especially in soft materials, such as aluminum alloys and magnesium) has not been established. They will not be used in an aircraft component or system where the loss or failure of the pin might endanger the safety of flight of the aircraft. The spring pin is designed for use in double shear applications. The proper bearing factors for double shear application shall be established for the material in which the spring pin is being used; that is, whether the material is heat-treated steel, corrosion-resistant steel, aluminum alloy, or magnesium. The joints where spring pins are used for fastening shall be designed like riveted and bolted joints. Spring pins should not be mixed with other structural fasteners in the same joint. These pins for primary structural applications should be used only where there will be no rotation or relative movement under load of the parts to be joined. Spring pins may be reused if a careful inspection reveals no deformation of the pin or hole. Be careful to observe that the hole has not enlarged or deformed preventing proper functioning of the spring pin. Where hole misalignment results in the pin gap closing or necessitates excess inserting force, the spring pin will not be used. Where temperatures are in excess of 337.8°C (500°F) non-corrosion-resistant steel spring pins will not be used; nor will corrosion-resistant steel pins be used where temperatures are in excess of 371.1°C (700°F). The spring pin will not be used as a substitute for a cotter pin nor in applications subjected to shock loading, unless the installation has been tested for fatigue life and proved satisfactory. The spring pin springback relative to span length and recommended hole sizes for clevis joint applications are given in Table 7-11. When the spring pin is used in a clevis joint, it is recommended that the pin be held by the outer members of the unit for maximum efficiency and reduced maintenance.



1 REMOVING SPRING PIN, USING PIN PUNCH AND HAMMER.

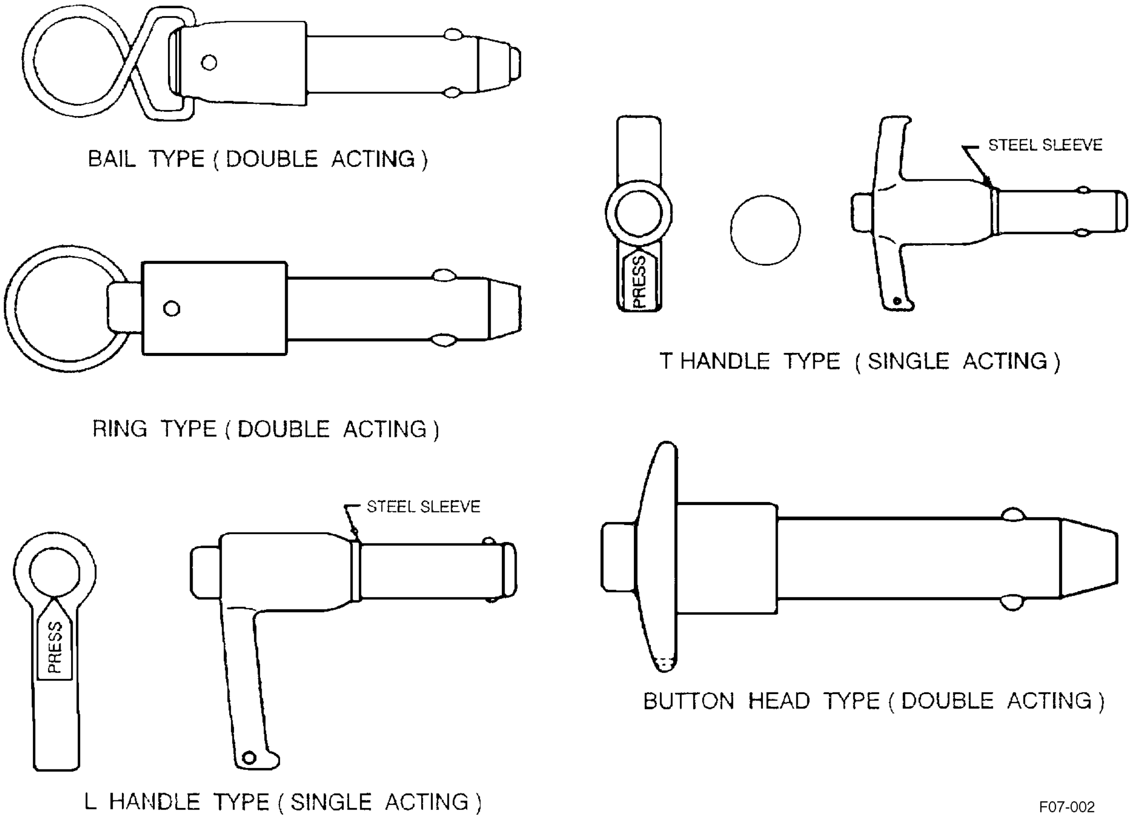
2 INSERTING SPRING PIN BY DRIVING WITH HAMMER OR PNEUMATIC SPRING PIN INSERTION TOOL.

3 THE SPRING PIN INSERTED. THE SPRING PINS DO NOT REQUIRE ANY METHOD OF SECURING TO RETAIN THEM IN PLACE, AS THIS IS ACCOMPLISHED BY THE SPRING ACTION OF THE PIN ITSELF.

Figure 7-1. Removing and Replacing Spring Pin

7.1.6 Machine Pins. (Refer to Table 7-12.)

7.1.7 Quick-Release Pins. (See Figure 7-2.) Quick-release pins are used in some applications where rapid removal and replacement of equipment is necessary. When equipment is secured with these pins, no binding of the spindle should be present. Spindle binding could cause the locking balls to remain in the open position with a resultant possibility of the pin falling out under vibration. Any spindle binding or if one or more of the locking balls fall out the pin is considered unserviceable and will be replaced. Ensure; a. No visible separation is allowed between the head and the shank; b. the balls will not separate from the shank; c. the head of the Quick Release Pin may spin on the shank as long as the criteria in a. and b. above are met.



BAIL TYPE (DOUBLE ACTING)

RING TYPE (DOUBLE ACTING)

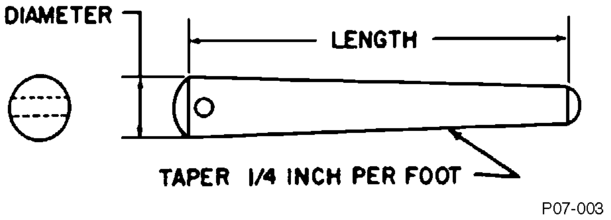
L HANDLE TYPE (SINGLE ACTING)

T HANDLE TYPE (SINGLE ACTING)

BUTTON HEAD TYPE (DOUBLE ACTING)

Figure 7-2. Quick-Release Pins

Table 7-1. AN385 Plain Taper Pin



Size Number	7/0	6/0	5/0	4/0	3/0	2/0	1/0	1	2	3	4	5	6
Diameter Large End	.062	.078	.094	.109	.125	.141	.156	.172	.193	.219	.250	.289	.341
Length +.000 -.020	Dash Numbers												
	7/0	6/0	5/0	4/0	3/0	2/0	1/0	1	2	3	4	5	6
.375	70-3	60-3	50-3	40-3									
.500	70-4	60-4	50-4	40-4	30-4								
.625	70-5	60-5	50-5	40-5	30-5	20-5	10-5	1-5					
.750	70-6	60-6	50-6	40-6	30-6	20-6	10-6	1-6	2-6				
.875	70-7	60-7	50-7	40-7	30-7	20-7	10-7	1-7	2-7	3-7			
1.000	70-8	60-8	50-8	40-8	30-8	20-8	10-8	1-8	2-8	3-8			
1.250	70-10	60-10	50-10	40-10	30-10	20-10	10-10	1-10	2-10	3-10			
1.500	70-12	60-12	50-12	40-12	30-12	20-12	10-12	1-12	2-12	3-12	4-12		
1.750					30-14	20-14	10-14	1-14	2-14	3-14	4-14	5-14	
2.000							10-16	1-16	2-16	3-16	4-1.6	5-16	6-16
2.250									2-18	3-18	4-18	5-18	6-18
2.500									2-20	3-20	4-20	5-20	6-20
2.750										3-22	4-22	5-22	6-22
3.000										3-24	4-24	5-24	6-24

Code:

H before the first dash number indicates drilled head.

A before the first dash number indicates alloy steel pins.

P before the second dash number indicates cadmium-plated pin.

Example of part number:

Table 7-1. AN385 Plain Taper Pin - Continued

AN385-60-4 = number 6/0 plain carbon steel pin, 0.500-inch long.

AN385H69-4 = number 6/0 drilled carbon steel pin, 0.500-inch long.

Material:

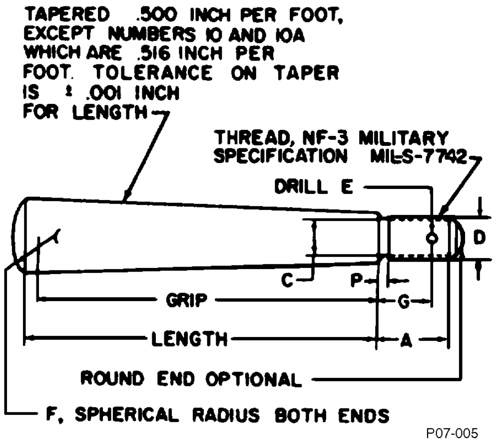
Steel, Military Specifications MIL-S-5626, MIL-S-6049, MIL-S-6050, MIL-S-6098, MIL-S-6758, and MIL-S-8695.

Carbon steel, Federal Specification QQ-S-633.

Finish:

Cadmium plating, Federal Specification QQ-P-416.

Table 7-2. AN386 Threaded Taper Pin



First Dash Number	1	2	3	4	5	6	7	8	9	10	10A
Thread	10-32	10-32	1/4-28	5/16-24	3/8-24	7/16-20	1/2-20	9/16-18	3/4-16	7/8-14	7/8-14
A	7/16	7/16	29/64	33/64	35/64	35/64	19/32	21/32	47/64	51/64	51/64
C ±.005	.141	.141	.196	.250	.313	.360	.422	.482	.660	.773	.773
D ±.002	.205	.255	.317	.355	.455	.505	.605	.755	.905	1.050	1.153
E	No. 50 (.070)	No. 50 (.070)	No. 48 (.076)	No. 48 (.076)	No. 36 (.106)	No. 36 (.106)	No. 36 (.106)	No. 28 (.141)	No. 28 (.141)	No. 28 (.141)	No. 28 (.141)
F	1/2	1/2	1/2	1/2	1/2	3/4	3/4	1	1	1-1/4	1-1/4
G	5/16	5/16	21/64	21/64	23/64	23/64	13/32	15/32	35/64	39/64	39/64
P	3/64	3/64	3/64	1/16	1/16	1/16	1/16	5/64	3/32	3/32	3/32

1st Dash Number			1	2	3	4	5	6	7	8	9	10	10A
2nd Dash Number			Length = Grip + 1/8				Length = Grip +3/16				Length = Grip +1/4		
Cotter Pin Hole	No Hole	Grip											
6	6A	3/4											
7	7A	7/8											
8	8A	1											
9	9A	1-1/8											

Table 7-2. AN386 Threaded Taper Pin - Continued

1st Dash Number			1	2	3	4	5	6	7	8	9	10	10A
2nd Dash Number			Length = Grip + 1/8				Length = Grip +3/16				Length = Grip +1/4		
Cotter Pin Hole	No Hole	Grip											
10	10A	1-1/4											
11	11A	1-3/8											
12	12A	1-1/2											
13	13A	1-5/8											
14	14A	1-3/4											
15	15A	1-7/8											
16	16A	2											
17	17A	2-1/8											
18	18A	2-1/4											
19	19A	2-3/8											
20	20A	2-1/2											
21	21A	2-5/8											
22	22A	2-3/4											
23	23A	2-7/8											
24	24A	3											
25	25A	3-1/8											
26	26A	3-1/4											
27	27A	3-3/8											
28	28A	3-1/2											
29	29A	3-5/8											
30	30A	3-3/4											
31	31A	3-7/8											
32	32A	4											
34	34A	4-1/4											
36	36A	4-1/2											
38	38A	4-3/4											

Do not specify pins longer than those listed between heavy lines. Listings cover full range obtainable from standard B&S taper reamers, the numbers of which are indicated by the first dash number. Number 10A requires number 10 reamers.

Table 7-2. AN386 Threaded Taper Pin - Continued

1st Dash Number			**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**10A**
2nd Dash Number			**Length = Grip + 1/8**				**Length = Grip +3/16**				**Length = Grip +1/4**		
Cotter Pin Hole	**No Hole**	**Grip**											
40	40A	5											
42	42A	5-1/4											
44	44A	5-1/2											
46	46A	5-3/4											
48	48A	6											

Code:

A after second dash number indicates no cotter pin hole.

Example of part number:

AN386-1-8 = pin, number 1 taper, 8/8 or 1-inch grip with cotter pin hole.

AN386-1-8A = pin, number 1 taper, 8/8 or 1-inch grip without cotter pin hole.

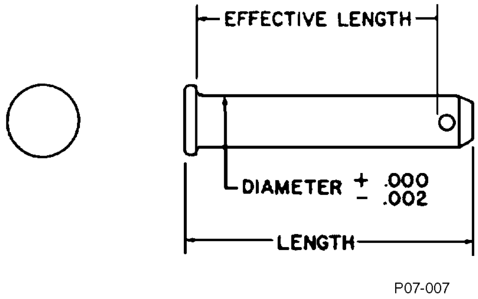
Material:

Steel, Military Specifications MIL-S-18732, MIL-S-6049, MIL-S-6050, MIL-S-6090, and MIL-S-8695.

Finish:

Cadmium plating, Federal Specification QQ-P-416.

Table 7-3. AN392 through AN406, Flathead Pins



Part Number	Size	Diameter	Single Shear (Pounds)	Dash Numbers (Odd Numbers Only)	
				From	To
AN392	1/8	.124	920	7	67
AN393	3/16	.186	2070	7	95
AN394	1/4	.248	3681	11	97
AN395	5/16	.311	5751	11	97
AN396	3/8	.373	8287	15	127
AN397	7/16	.436	11,272	15	127
AN398	1/2	.497	14,722	15	127
AN399	9/16	.560	18,637	15	127
AN400	5/8	.622	23,010	15	127
AN402	3/4	.747	33,135	15	127
AN404	7/8	.871	45,000	19	137
AN406	1	.996	58,905	19	137

Code:

Dash number indicates pin effective length in 1/32 inch and is also used to designate pin length.

Example of part number:

AN395-21 = pin, flathead, 5/16-inch diameter, effective length 21/32 inch.

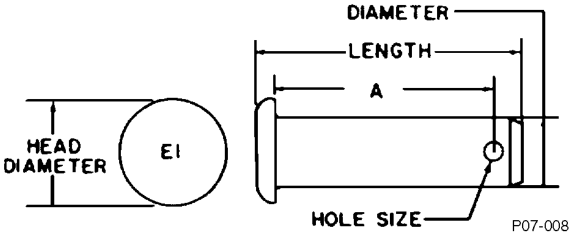
Material:

Steel, Military Specification MIL-S-6049, MIL-S-6050, MIL-S-6758, MIL-S-8503, MIL-S-8695, or MIL-S-18732.

Finish:

Cadmium plating, Federal Specification QQ-P-416 or zinc plating, Federal Specification QQ-Z-325.

Table 7-4. AN121601 through AN121621, AN121651 through, AN121671, AN121701 through AN121727, AN121751 through AN121777, AN121801 through AN121829, AN121851 through AN121891



Part Number	Diameter	Length	A	Hole Size	Head Diameter
AN121601	.125	.391	.253	No. 51 (.065 -.072)	.250
AN121602	.125	.453	.315	No. 51	.250
AN121603	.125	.516	.378	No. 51	.250
AN121604	.125	.578	.440	No. 51	.250
AN121605	.125	.641	.503	No. 51	.250
AN121606	.125	.703	.565	No. 51	.250
AN121607	.125	.766	.628	No. 51	.250
AN121608	.125	.828	.690	No. 51	.250
AN121609	.125	.891	.753	No. 51	.250
AN121610	.125	.953	.815	No. 51	.250
AN121611	.125	1.016	.878	No. 51	.250
AN121612	.125	1.078	.940	No. 51	.250
AN121613	.125	1.141	1.003	No. 51	.250
AN121614	.125	1.203	1.065	No. 51	.250
AN121615	.125	1.266	1.128	No. 51	.250
AN121616	.125	1.328	1.190	No. 51	.250
AN121617	.125	1.391	1.253	No. 51	.250
ANI21618	.125	1.453	1.315	No. 51	.250
AN121619	.125	1.516	1.378	No. 51	.250
AN121620	.125	1.578	1.440	No. 51	.250
AN121621	.125	1.641	1.503	No. 51	.250
AN121651	.187	.391	.253	No. 51 (.065 -.072)	.312
AN121652	.187	.453	.315	No. 51	.312
AN121653	.187	.516	.378	No. 51	.312
AN121654	.187	.578	.440	No. 51	.312
AN121655	.187	.641	.503	No. 51	.312
AN121656	.187	.703	.565	No. 51	.312
AN121657	.187	.766	.628	No. 51	.312
AN121658	.187	.828	.690	No. 51	.312
AN121659	.187	.891	.753	No. 51	.312
AN121660	.187	.953	.815	No. 51	.312
AN121661	.187	1.016	.878	No. 51	.312
AN121662	.187	1.078	.940	No. 51	.312

Table 7-4. AN121601 through AN121621, AN121651 through, AN121671, AN121701 through AN121727, AN121751 through AN121777, AN121801 through AN121829, AN121851 through AN121891 - Continued

Part Number	Diameter	Length	A	Hole Size	Head Diameter
AN121663	.187	1.141	1.003	No. 51	.312
AN121664	.187	1.203	1.065	No. 51	.312
AN121665	.187	1.266	1.128	No. 51	.312
AN121666	.187	1.328	1.190	No. 51	.312
AN121667	.187	1.391	1.253	No. 51	.312
AN121668	.187	1.453	1.315	No. 51	.312
AN121669	.187	1.516	1.378	No. 51	.312
AN121670	.187	1.578	1.440	No. 51	.312
AN121671	.187	1.641	1.503	No. 51	.312
AN121701	.250	.547	.378	No. 51	.375
AN121702	.250	.609	.440	No. 51	.375
AN121703	.250	.672	.503	No. 51	.375
AN121704	.250	.734	.565	No. 51	.375
AN121705	.250	.797	.628	No. 51	.375
AN121706	.250	.859	.690	No. 51	.375
AN121707	.250	.922	.753	No. 51	.375
AN121708	.250	.984	.815	No. 51	.375
AN121709	.250	1.047	.878	No. 51	.375
AN121710	.250	1.109	.940	No. 51	.375
AN121711	.250	1.172	1.003	No. 51	.375
AN121712	.250	1.234	1.065	No. 51	.375
AN121713	.250	1.297	1.128	No. 51	.375
AN121714	.250	1.359	1.190	No. 51	.375
AN121715	.250	1.422	1.253	No. 51	.375
AN121716	.250	1.484	1.315	No. 51	.375
AN121717	.250	1.547	1.378	No. 51	.375
AN121718	.250	1.609	1.440	No. 51	.375
AN121719	.250	1.672	1.503	No. 51	.375
AN121720	.250	1.734	1.565	No. 51	.375
AN121721	.250	1.797	1.628	No. 51	.375
AN121722	.250	1.859	1.690	No. 51	.375
AN121723	.250	1.922	1.753	No. 51	.375
AN121724	.250	1.984	1.815	No. 51	.375
AN121725	.250	2.047	1.878	No. 51	.375
AN121726	.250	2.109	1.940	No. 51	.375
AN121727	.250	2.172	2.003	No. 51	.375
AN121751	.312	.594	.392	No. 41 (.094 -.101)	.438
AN121752	.312	.656	.454	No. 41	.438
AN121753	.312	.719	.517	No. 41	.438
AN121754	.312	.781	.579	No. 41	.438
AN121755	.312	.844	.642	No. 41	.438
AN121756	.312	.906	.704	No. 41	.438

Table 7-4. AN121601 through AN121621, AN121651 through, AN121671, AN121701 through AN121727, AN121751 through AN121777, AN121801 through AN121829, AN121851 through AN121891 - Continued

Part Number	Diameter	Length	A	Hole Size	Head Diameter
AN121757	.312	.969	.767	No. 41	.438
AN121758	.312	1.031	.829	No. 41	.438
AN121759	.312	1.094	.892	No. 41	.438
AN121760	.312	1.156	.954	No. 41	.438
AN121761	.312	1.219	1.017	No. 41	.438
AN121762	.312	1.281	1.079	No. 41	.438
AN121763	.312	1.344	1.142	No. 41	.438
AN121764	.312	1.406	1.204	No. 41	.438
AN121765	.312	1.469	1.267	No. 41	.438
AN121766	.312	1.531	1.329	No. 41	.438
AN121767	.312	1.594	1.392	No. 41	.438
AN121768	.312	1.656	1.454	No. 41	.438
AN121769	.312	1.719	1.517	No. 41	.438
AN121770	.312	1.781	1.579	No. 41	.438
AN121771	.312	1.844	1.642	No. 41	.438
AN121772	.312	1.906	1.704	No. 41	.438
AN121773	.312	1.969	1.767	No. 41	.438
AN121774	.312	2.031	1.829	No. 41	.438
AN121775	.312	2.094	1.892	No. 41	.438
AN121776	.312	2.156	1.954	No. 41	.438
AN121777	.312	2.219	2.017	No. 41	.438
AN121801	.375	.719	.517	No. 41	.500
AN121802	.375	.781	.579	No. 41	.500
AN121803	.375	.844	.642	No. 41	.500
AN121804	.375	.906	.704	No. 41	.500
AN121805	.375	.969	.767	No. 41	.500
AN121806	.375	1.031	.829	No. 41	.500
AN121807	.375	1.094	.892	No. 41	.500
AN121808	.375	1.156	.954	No. 41	.500
AN121809	.375	1.219	1.017	No. 41	.500
AN121810	.375	1.281	1.079	No. 41	.500
AN121811	.375	1.344	1.142	No. 41	.500
AN121812	.375	1.406	1.204	No. 41	.500
AN121813	.375	1.469	1.267	No. 41	.500
AN121814	.375	1.531	1.329	No. 41	.500
AN121815	.375	1.594	1.392	No. 41	.500
AN121816	.375	1.656	1.454	No. 41	.500
AN121817	.375	1.719	1.517	No. 41	.500
AN121818	.375	1.781	1.579	No. 41	.500
AN121819	.375	1.844	1.642	No. 41	.500
AN121820	.375	1.906	1.704	No. 41	.500
AN121821	.375	1.969	1.767	No. 41	.500

Table 7-4. AN121601 through AN121621, AN121651 through, AN121671, AN121701 through AN121727, AN121751 through AN121777, AN121801 through AN121829, AN121851 through AN121891 - Continued

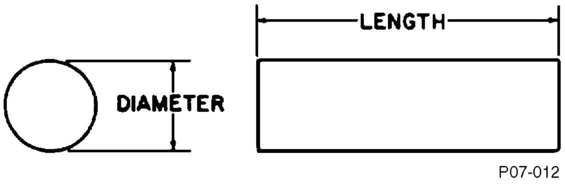
Part Number	Diameter	Length	A	Hole Size	Head Diameter
AN121822	.375	2.031	1.829	No. 41	.500
AN121823	.375	2.094	1.892	No. 41	.500
AN121824	.375	2.156	1.954	No. 41	.500
AN121825	.375	2.219	2.017	No. 41	.500
AN121826	.375	2.281	2.079	No. 41	.500
AN121827	.375	2.344	2.142	No. 41	.500
AN121828	.375	2.406	2.204	No. 41	.500
AN121829	.375	2.469	2.267	No. 41	.500
AN121851	.500	.750	.517	No. 41	.625
AN121852	.500	.812	.579	No. 41	.625
AN121853	.500	.875	.642	No. 41	.625
AN121854	.500	.938	.704	No. 41	.625
AN121855	.500	1.000	.767	No. 41	.625
AN121856	.500	1.062	.829	No. 41	.625
AN121857	.500	1.125	.892	No. 41	.625
AN121858	.500	1.188	.954	No. 41	.625
AN121859	.500	1.250	1.017	No. 41	.625
AN121860	.500	1.312	1.079	No. 41	.625
AN121861	.500	1.375	1.142	No. 41	.625
AN121862	.500	1.438	1.204	No. 41	.625
AN121863	.500	1.500	1.267	No. 41	.625
AN121864	.500	1.562	1.329	No. 41	.625
AN121865	.500	1.625	1.392	No. 41	.625
AN121866	.500	1.688	1.454	No. 41	.625
AN121867	.500	1.750	1.517	No. 41	.625
AN121868	.500	1.812	1.579	No. 41	.625
AN121869	.500	1.875	1.642	No. 41	.625
AN121870	.500	1.938	1.704	No. 41	.625
AN121871	.500	2.000	1.767	No. 41	.625
AN121872	.500	2.062	1.829	No. 41	.625
AN121873	.500	2.125	1.892	No. 41	.625
AN121874	.500	2.188	1.954	No. 41	.625
AN121875	.500	2.250	2.017	No. 41	.625
AN121876	.500	2.312	2.079	No. 41	.625
AN121877	.500	2.375	2.142	No. 41	.625
AN121878	.500	2.438	2.204	No. 41	.625
AN121879	.500	2.500	2.267	No. 41	.625
AN121880	.500	2.562	2.329	No. 41	.625
AN121881	.500	2.625	2.392	No. 41	.625
AN121882	.500	2.688	2.454	No. 41	.625
AN121883	.500	2.750	2.517	No. 41	.625
AN121884	.500	2.812	2.579	No. 41	.625

Table 7-4. AN121601 through AN121621, AN121651 through, AN121671, AN121701 through AN121727, AN121751 through AN121777, AN121801 through AN121829, AN121851 through AN121891 - Continued

Part Number	Diameter	Length	A	Hole Size	Head Diameter
AN121885	.500	2.875	2.642	No. 41	.625
AN121886	.500	2.938	2.704	No. 41	.625
AN121887	.500	3.000	2.767	No. 41	.625
AN121888	.500	3.062	2.829	No. 41	.625
AN121889	.500	3.125	2.892	No. 41	.625
AN121890	.500	3.188	2.954	No. 41	.625
AN121891	.500	3.250	3.017	No. 41	.625

Material:
Steel, Aeronautical Material Specification AMS6320.
Finish:
Cadmium plating, Aeronautical Material Specification AMS2400.
Hardness:
Rockwell C26-32.

Table 7-5. AN150201 through AN150300, Lockpins



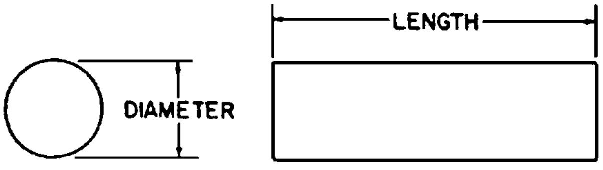
Length ±.010	Diameter and Part Numbers			
	.0625 ±.0005	.0938 ±.0005	.1250 ±.0005	.1875 ±.0005
.125	AN150206	AN150229	AN150252	
.188	AN150207	AN150230	AN150253	AN150276
.250	AN150208	AN150231	AN150254	AN150277
.312	AN150209	AN150232	AN150255	AN150278
.375	AN150210	AN150233	AN150256	AN150279
.438	AN150211	AN150234	AN150257	AN150280
.500	AN150212	AN150235	AN150258	AN150281
.562	AN150213	AN150236	AN150259	AN150282
.625	AN150214	AN150237	AN150260	AN150283
.688	AN150215	AN150238	AN150261	AN150284
.750	AN150216	AN150239	AN150262	AN150285
.812	AN150217	AN150240	AN150263	AN150286
.875	AN150218	AN150241	AN150264	AN150287
.938	AN150219	AN150242	AN150265	AN150288
1.000	AN150220	AN150243	AN150266	AN150289
1.062	AN150221	AN150244	AN150267	AN150290
1.125	AN150222	AN150245	AN150268	AN150291
1.188	AN150223	AN150246	AN150269	AN150292

Table 7-5. AN150201 through AN150300, Lockpins - Continued

	Diameter and Part Numbers			
Length ±.010	**.0625 ±.0005**	**.0938 ±.0005**	**.1250 ±.0005**	**.1875 ±.0005**
1.250	AN150224	AN150247	AN150270	AN150293
1.312		AN150248	AN150271	AN150294
1.375		AN150249	AN150272	AN150295
1.438		AN150250	AN150273	AN150296
1.500		AN150251	AN150274	AN150297

Example of part number:
AN150266 = Lockpin, 0.1250-inch diameter, 1.000-inch long.
Material:
Steel, Aeronautical Material Specification AMS5132.

Table 7-6. AN150301 through AN150400, Brass Lockpins



P07-013

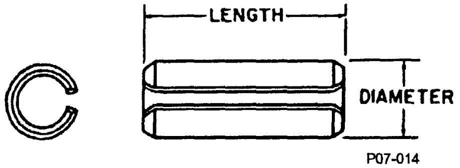
	Diameter and Part Numbers			
Length ±.010	**.0625 ±.0005**	**.0938 ±.0005**	**.1250 ±.0005**	**.1875 ±.0005**
.125	AN150306	AN150329	AN150352	
.188	AN150307	AN150330	AN150353	AN150376
.250	AN150308	AN150331	AN150354	AN150377
.312	AN150309	AN150332	AN150355	AN150378
.375	AN150310	AN150333	AN150356	AN150379
.438	AN150311	AN150334	AN150357	AN150380
.500	AN150312	AN150335	AN150358	AN150381
.562		AN150336	AN150359	AN150382
.625		AN150337	AN150360	AN150383
.688		AN150338	AN150361	AN150384
.750		AN150339	AN150362	AN150385
.812		AN150340	AN150363	AN150386
.875		AN150341	AN150364	AN150387
.938		AN150342	AN150365	AN150388
1.000		AN150343	AN150366	AN150389
1.062		AN150344	AN150367	AN150390
1.125		AN150345	AN150368	AN150391
1.188		AN150346	AN150369	AN150392
1.250		AN150347	AN150370	AN150393
1.312		AN150348	AN150371	AN150394
1.375		AN150349	AN150372	AN150395
1.438		AN150350	AN150373	AN150396

Table 7-6. AN150301 through AN150400, Brass Lockpins - Continued

Length ±.010	Diameter and Part Numbers			
	.0625 ±.0005	.0938 ±.0005	.1250 ±.0005	.1875 ±.0005
1.500		AN150351	AN150374	AN150397

Example of part number:
AN150366 = brass lock pin, 0.1250-inch diameter, 1.000-inch long.
Material:
Brass, Aeronautical Material Specification AMS4610.

Table 7-7. MS9047 Phosphate Finish Steel Spring Pin



	Diameter											
	.062	.078	.094	.125	.156	.188	.219	.250	.312	.375	.438	.500
	Recommended Hole Size											
Length	Min .062 Max .065	Min .078 Max .081	Min .094 Max .097	Min .125 Max .129	Min .156 Max .160	Min .187 Max .192	Min .219 Max .224	Min .250 Max .256	Min .312 Max .318	Min .375 Max .382	Min .437 Max .445	Min .500 Max .510
.188 ±.015	MS9047-002											
.250 ±.015	MS9047-003	MS9047-034	MS9047-065	MS9047-096								
.312 ±.015	MS9047-004	MS9047-035	MS9047-066	MS9047-097	MS9047-128	MS9047-159						
.375 ±.015	MS9047-005	MS9047-036	MS9047-067	MS9047-098	MS9047-129	MS9047-160	MS9047-191	MS9047-222				
.438 ±.015	MS9047-006	MS9047-037	MS9047-068	MS9047-099	MS9047-130	MS9047-161	MS9047-192	MS9047-223				
.500 ±.015	MS9047-007	MS9047-038	MS9047-069	MS9047-100	MS9047-131	MS9047-162	MS9047-193	MS9047-224				
.562 ±.015	MS9047-008	MS9047-039	MS9047-070	MS9047-101	MS9047-132	MS9047-163	MS9047-194	MS9047-225	MS9047-256	MS9047-287		
.625 ±.015	MS9047-009	MS9047-040	MS9047-071	MS9047-102	MS9047-133	MS9047-164	MS9047-195	MS9047-226	MS9047-257	MS9047-288		
.688 ±.015	MS9047-010	MS9047-041	MS9047-072	MS9047-103	MS9047-134	MS9047-165	MS9047-196	MS9047-227	MS9047-258	MS9047-289		
.750 ±.015	MS9047-011	MS9047-042	MS9047-073	MS9047-104	MS9047-135	MS9047-166	MS9047-197	MS9047-228	MS9047-259	MS9047-290		

H0401473

Table 7-7. MS9047 Phosphate Finish Steel Spring Pin - Continued

Length	Diameter											
	.062	.078	.094	.125	.156	.188	.219	.250	.312	.375	.438	.500
	Recommended Hole Size											
	Min .062 Max .065	Min .078 Max .081	Min .094 Max .097	Min .125 Max .129	Min .156 Max .160	Min .187 Max .192	Min .219 Max .224	Min .250 Max .256	Min .312 Max .318	Min .375 Max .382	Min .437 Max .445	Min .500 Max .510
.812 ±.015	MS9047-012	MS9047-043	MS9047-074	MS9047-105	MS9047-136	MS9047-167	MS9047-198	MS9047-229	MS9047-260	MS9047-291		
.875 ±.015	MS9047-013	MS9047-044	MS9047-075	MS9047-106	MS9047-137	MS9047-168	MS9047-199	MS9047-230	MS9047-261	MS9047-292		
.938 ±.015	MS9047-014	MS9047-045	MS9047-076	MS9047-107	MS9047-138	MS9047-169	MS9047-200	MS9047-231	MS9047-262	MS9047-293		
1.000 ±.015	MS9047-015	MS9047-046	MS9047-077	MS9047-108	MS9047-139	MS9047-170	MS9047-201	MS9047-232	MS9047-263	MS9047-294	MS9047-325	
1.125 ±.020	MS9047-016	MS9047-047	MS9047-078	MS9047-109	MS9047-140	MS9047-171	MS9047-202	MS9047-233	MS9047-264	MS9047-295	MS9047-326	
1.250 ±.020		MS9047-048	MS9047-079	MS9047-110	MS9047-141	MS9047-172	MS9047-203	MS9047-234	MS9047-265	MS9047-296	MS9047-327	MS9047-358
1.375 ±.020		MS9047-049	MS9047-080	MS9047-111	MS9047-142	MS9047-173	MS9047-204	MS9047-235	MS9047-266	MS9047-297	MS9047-328	MS9047-359
1.500 ±.020		MS9047-050	MS9047-081	MS9047-112	MS9047-143	MS9047-174	MS9047-205	MS9047-236	MS9047-267	MS9047-298	MS9047-329	MS9047-360
1.625 ±.020		MS9047-051	MS9047-082	MS9047-113	MS9047-144	MS9047-175	MS9047-206	MS9047-237	MS9047-268	MS9047-299	MS9047-330	MS9047-361
1.750 ±.020		MS9047-052	MS9047-083	MS9047-114	MS9047-145	MS9047-176	MS9047-207	MS9047-238	MS9047-269	MS9047-300	MS9047-331	MS9047-362
1.875 ±.020		MS9047-053	MS9047-084	MS9047-115	MS9047-146	MS9047-177	MS9047-208	MS9047-239	MS9047-270	MS9047-301	MS9047-332	MS9047-363
2.000 ±.020		MS9047-054	MS9047-085	MS9047-116	MS9047-147	MS9047-178	MS9047-209	MS9047-240	MS9047-271	MS9047-302	MS9047-333	MS9047-364

H0401474

Table 7-7. MS9047 Phosphate Finish Steel Spring Pin - Continued

	Diameter											
	.062	.078	.094	.125	.156	.188	.219	.250	.312	.375	.438	.500
	Recommended Hole Size											
Length	Min .062 Max .065	Min .078 Max .081	Min .094 Max .097	Min .125 Max .129	Min .156 Max .160	Min .187 Max .192	Min .219 Max .224	Min .250 Max .256	Min .312 Max .318	Min .375 Max .382	Min .437 Max .445	Min .500 Max .510
2.250 ±.025					MS9047-148	MS9047-179	MS9047-210	MS9047-241	MS9047-272	MS9047-303	MS9047-334	MS9047-365
2.500 ±.025					MS9047-149	MS9047-180	MS9047-211	MS9047-242	MS9047-273	MS9047-304	MS9047-335	MS9047-366
.750 ±.025						MS9047-181	MS9047-212	MS9047-243	MS9047-274	MS9047-305	MS9047-336	MS9047-367
3.000 ±.025						MS9047-182	MS9047-213	MS9047-244	MS9047-275	MS9047-306	MS9047-337	MS9047-368
3.250 ±.030						MS9047-183	MS9047-214	MS9047-245	MS9047-276	MS9047-307	MS9047-338	MS9047-369
3.500 ±.030						MS9047-184	MS9047-215	MS9047-246	MS9047-277	MS9047-308	MS9047-339	MS9047-370
3.750 ±.030									MS9047-278	MS9047-309	MS9047-340	MS9047-371
4.000 ±.030									MS9047-279	MS9047-310	MS9047-341	MS9047-372

Example of part number:

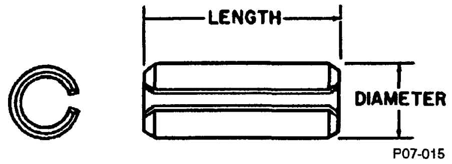
MS9047-170 = steel spring pin with phosphate finish, .188-inch diameter, 1.000-inch long.

Material:

Steel, Aeronautical Material Specification AMS5120 or AMS5121.

H0401475

Table 7-8. MS9048 Cadmium-Plated Steel Spring Pin



Length	Diameter											
	.062	.078	.094	.125	.156	.188	.219	.250	.312	.375	.438	.500
	Recommended Hole Size											
	Min .062 Max .065	Min .078 Max .081	Min .094 Max .097	Min .125 Max .129	Min .156 Max .160	Min .187 Max .192	Min .219 Max .224	Min .250 Max .256	Min .312 Max .318	Min .375 Max .382	Min .437 Max .445	Min .500 Max .510
.188 ±.015	MS9048-002											
.250 ±.015	MS9048-003	MS9048-034	MS9048-065	MS9048-096								
.312 ±.015	MS9048-004	MS9048-035	MS9048-066	MS9048-097	MS9048-128	MS9048-159						
.375 ±.015.	MS9048-005	MS9048-036	MS9048-067	MS9048-098	MS9048-129	MS9048-160	MS9048-191	MS9048-222				
.438 ±.015	MS9048-006	MS9048-037	MS9048-068	MS9048-099	MS9048-130	MS9048-161	MS9048-192	MS9048-223				
.500 ±.015	MS9048-007	MS9048-038	MS9048-069	MS9048-100	MS9048-131	MS9048-162	MS9048-193	MS9048-224				
.562 ±.015	MS9048-008	MS9048-039	MS9048-070	MS9048-101	MS9048-132	MS9048-163	MS9048-194	MS9048-225	MS9048-256	MS9048-287		
.625 ±.015	MS9048-009	MS9048-040	MS9048-071	MS9048-102	MS9048-133	MS9048-164	MS9048-195	MS9048-226	MS9048-257	MS9048-288		
.688 ±.015	MS9048-010	MS9048-041	MS9048-072	MS9048-103	MS9048-134	MS9048-165	MS9048-196	MS9048-227	MS9048-258	MS9048-289		
.750 ±.015	MS9048-011	MS9048-042	MS9048-073	MS9048-104	MS9048-135	MS9048-166	MS9048-197	MS9048-228	MS9048-259	MS9048-290		

H0401476

Table 7-8. MS9048 Cadmium-Plated Steel Spring Pin - Continued

Length	Diameter											
	.062	.078	.094	.125	.156	.188	.219	.250	.312	.375	.438	.500
	Recommended Hole Size											
	Min .062 Max .065	Min .078 Max .081	Min .094 Max .097	Min .125 Max .129	Min .156 Max .160	Min .187 Max .192	Min .219 Max .224	Min .250 Max .256	Min .312 Max .318	Min .375 Max .382	Min .437 Max .445	Min .500 Max .510
.812 ±.015	MS9048-012	MS9048-043	MS9048-074	MS9048-105	MS9048-136	MS9048-167	MS9048-198	MS9048-229	MS9048-260	MS9048-291		
.875 ±.015	MS9048-013	MS9048-044	MS9048-075	MS9048-106	MS9048-137	MS9048-168	MS9048-199	MS9048-230	MS9048-261	MS9048-292		
.938 ±.015	MS9048-014	MS9048-045	MS9048-076	MS904 8- 107	MS9048-138	MS9048-169	MS9048-200	MS9048-231	MS9048-262	MS9048-293		
1.000 ±.015	MS9048-015	MS9048-046	MS9048-077	MS9048-108	MS9048-139	MS9048-170	MS9048-201	MS9048-232	MS9048-263	MS9048-294	MS9048-325	
1.125 ±.020	MS9048-016	MS9048-047	MS9048-078	MS9048-109	MS9048-140	MS9048-171	MS9048-202	MS9048-233	MS9048-264	MS9048-295	MS9048-326	
1.250 ±.020		MS9048-048	MS9048-079	MS9048-110	MS9048-141	MS9048-172	MS904 8- 203	MS9048-234	MS9048-265	MS9048-296	MS9048-327	MS9048-358
1.375 ±.020		MS9048-049	MS9048-080	MS9048-111	MS9048-142	MS9048-173	MS9048-204	MS9048-235	MS9048-266	MS9048-297	MS9048-328	MS9048-359
1.500 ±.020		MS9048-050	MS9048-081	MS9048-112	MS9048-143	MS9048-174	MS9048-205	MS9048-236	MS9048-267	MS9048-298	MS9048-329	MS9048-360
1.625 ±.020		MS9048-051	MS9048-082	MS9048-113	MS9048-144	MS9048-175	MS9048-206	MS9048-23 7	MS9048-268	MS9048-299	MS9048-330	MS9048-361
1.750 ±.020		MS9048-052	MS9048-083	MS9048-114	MS9048-145	MS9048-176	MS9048-207	MS9048-238	MS904 8- 269	MS9048-300	MS9048-331	MS9048-362
1.875 ±.020		MS9048-053	MS9048-084	MS9048-115	MS9048-146	MS9048-177	MS9048-208	MS9048-239	MS9048-270	MS9048-301	MS9048-332	MS9048-363
2.000 ±.020		MS9048-054	MS9048-085	MS9048-116	MS9048-147	MS9048-178	MS9048-209	MS9048-240	MS9048-271	MS9048-302	MS9048-333	MS9048-364
2.250 ±.025					MS9048-148	MS9048-179	MS9048-210	MS9048-241	MS9048-272	MS9048-303	MS9048-334	MS9048-365

H0401477

Table 7-8. MS9048 Cadmium-Plated Steel Spring Pin - Continued

	Diameter											
	.062	.078	.094	.125	.156	.188	.219	.250	.312	.375	.438	.500
	Recommended Hole Size											
Length	Min .062 Max .065	Min .078 Max .081	Min .094 Max .097	Min .125 Max .129	Min .156 Max .160	Min .187 Max .192	Min .219 Max .224	Min .250 Max .256	Min .312 Max .318	Min .375 Max .382	Min .437 Max .445	Min .500 Max .510
2.500 ±.025					MS9048-149	MS9048-180	MS9048-211	MS9048-242	MS9048-273	MS9048-304	MS9048-335	MS9048-366
2.750 ±.025						MS9048-181	MS9048-212	MS9048-243	MS9048-274	MS9048-305	MS9048-336	MS9048- 367
3.000 ±.025						MS9048-182	MS9048-213	MS9048-244	MS9048-275	MS9048-306	MS9048-337	MS9048-368
3.250 ±.030						MS9048-183	MS9048-214	MS9048-245	MS9048-276	MS9048-307	MS9048-338	MS9048-369
3.500 ±.030						MS9048-184	MS9048-215	MS9048-246	MS9048-277	MS9048-308	MS9048-339	MS9048-370
3.750 ±.030									MS9048-278	MS9048-309	MS9048-340	MS9048-371
4.000 ±.030									MS9048-279	MS9048-310	MS9048-341	MS9048-372

Example of part number:

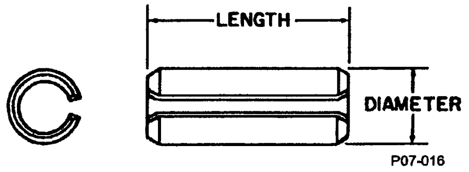
MS9048-232 = cadmium-plated steel spring pin, .250-inch diameter, 1.000-inch long.

Material:

Steel, Aeronautical Material Specification AMS5120 or AMS5121.

H0401478

Table 7-9. MS171401 through MS171900, Spring Pins



Length	Diameter											
	.062	.078	.094	.125	.156	.188	.219	.250	.312	.375	.438	.500
	Recommended Hole Size											
	Min .062 Max .065	Min .078 Max .081	Min.094 Max .097	Min .125 Max .129	Min.156 Max .160	Min.187 Max .192	Min .219 Max .224	Min .250 Max .256	Min .312 Max .318	Min .375 Max .382	Min .437 Max .445	Min .500 Max .510
.188 ±.015	MS171431											
.250 ±.015	MS171432	MS171462	MS171492	MS171522								
.312 ±.015	MS171433	MS171463	MS171493	MS171523	MS171553	MS171583						
.375 ±.015	MS171434	MS171464	MS171494	MS171524	MS171554	MS171584	MS171614	MS171644				
.438 ±.015	MS171435	MS171465	MS171495	MS171525	MS171555	MS171585	MS171615	MS171645				
.500 ±.015	MS171436	MS171466	MS171496	MS171526	MS171556	MS171586	MS171616	MS171646				
.562 ±.015	MS171437	MS171467	MS171497	MS171527	MS171557	MS171587	MS171617	MS171647	MSI71677	MS171707		
.625 ±.015	MS171438	MS171468	MS171498	MS171528	MS171558	MS171588	MS171618	MS171648	MS171678	MS171708		
.688 ±.015	MS171439	MS171469	MS171499	MS171529	MS171559	MS171589	MS171619	MS171649	MS171679	MS171709		
.750 ±.015	MS171449	MS171470	MS171500	MS171530	MS171560	MS171590	MS171620	MS171650	MS171680	MS171710		

H0401479

Table 7-9. MS171401 through MS171900, Spring Pins - Continued

Length	Diameter											
	.062	.078	.094	.125	.156	.188	.219	.250	.312	.375	.438	.500
	Recommended Hole Size											
	Min .062 Max .065	Min .078 Max .081	Min .094 Max .097	Min .125 Max .129	Min .156 Max .160	Min .187 Max .192	Min .219 Max .224	Min .250 Max .256	Min .312 Max .318	Min .375 Max .382	Min .437 Max .445	Min .500 Max .510
.812 ±.015	MS171441	MS171471	MS171501	MS171531	MS171561	MS171591	MS171621	MS171651	MS171681	MS171711		
.875 ±.015	MS171442	MS171472	MS171502	MS171532	MS171562	MS171592	MS171622	MS171652	MS171682	MS171712		
.938 ±.015	MS171443	MS171473	MS171503	MS171533	MS171563	MS171593	MS171623	MS171653	MS171683	MS171713		
1.000 ±.015	MS171444	MS171474	MS171504	MS171534	MS171564	MS171594	MS171624	MS171654	MS171684	MS171714	MS171744	
1.125 ±.020	MS171445	MS171475	MS171505	MS171535	MS171565	MS171595	MS171625	MS171655	MS171685	MS171715	MS171745	
1.250 ±.020		MS171476	MS171506	MS171536	MS171566	MS171596	MS171626	MS171656	MS171686	MS171716	MS171746	MS171776
1.375 ±.020		MS171477	MS171507	MS171537	MS171567	MS171597	MS171627	MS171657	MS171687	MS171717	MS171747	MS171777
1.500 ±.020		MS171478	MS171508	MS171538	MS171568	MS171598	MS171628	MS171658	MS171688	MS171718	MS171748	MS171778
1.625 ±.020		MS171479	MS171509	MS171539	MS171569	MS171599	MS171629	MS171659	MS171689	MS171719	MS171749	MS171779
1.750 ±.020		MS171480	MS171510	MS171540	MS171570	MS171600	MS171630	MS171660	MS171690	MS171720	MS171750	MS171780
1.875 ±.020		MS171481	MS171511	MS171541	MS171571	MS171601	MS171631	MS171661	MS171691	MS171721	MS171751	MS171781
2.000 ±.020		MS171482	MS171512	MS171542	MS171572	MS171602	MS171632	MS171662	MS171692	MS171722	MS171752	MS171782
2.250 ±.025					MS171573	MS171603	MS171633	MS171663	MS171693	MS171723	MS171753	MS171783

H0401480

Table 7-9. MS171401 through MS171900, Spring Pins - Continued

	Diameter											
	.062	.078	.094	.125	.156	.188	.219	.250	.312	.375	.438	.500
	Recommended Hole Size											
Length	Min .062 Max .065	Min .078 Max .081	Min .094 Max .097	Min .125 Max .129	Min .156 Max .160	Min .187 Max .192	Min .219 Max .224	Min .250 Max .256	Min .312 Max .318	Min .375 Max .382	Min .437 Max .445	Min .500 Max .510
2.500 ±.025					MS171574	MS171604	MS171634	MS171664	MS171694	MS171724	MS171754	MS171784
2.750 ±.025						MS171605	MS171635	MS171665	MS171695	MS171725	MS171755	MS171785
3.000 ±.025						MS171606	MS171636	MS171666	MS171696	MS171726	MS171756	MS171786
3.250 ±.030						MS171607	MS171637	MS171667	MS171697	MS171727	MS171757	MS171787
3.500 ±.030						MS171608	MS171638	MS171668	MS171698	MS171728	MS171758	MS171788
3.750 ±.030									MS171699	MS171729	MS171759	MS171789
4.000 ±.030									MS171700	MS171730	MS171760	MS171790

Example of part number:

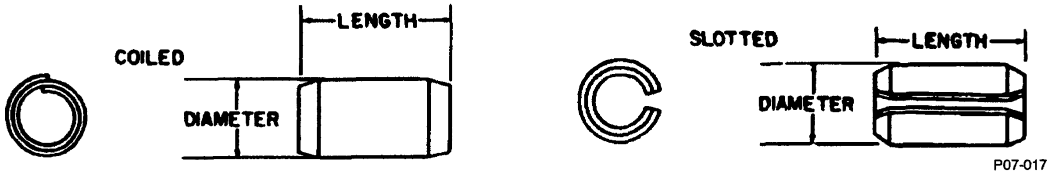
MS171534 = spring pin, .125-inch diameter, 1.000 inch long.

Material:

Corrosion-resistant steel, Aeronautical Material Specification AMS5506.

H0401481

Table 7-10. NAS561 Heavy Duty Spring Pin



	Diameter										
	.062	.094	.125	.156	.188	.219	.250	.312	.375	.437	.500
	Min Max	Min Max	Min Max	Min Max	Min Max	Min Max	Min Max	Min Max	Min Max	Min Max	Min Max
Slotted Pin Diameter	.066 .069	.099 .103	.131 .135	.162 .167	.194 .199	.226 .232	.258 .264	.321 .328	.385 .392	.448 .456	.513 .521
Coiled Pin Diameter	.066 .068	.098 .100	.130 .132	.161 .163	.194 .197	.226 .229	.258 .261	.327 .340	.391 .407	.457 .475	.522 .542
Recom-mended Hole Size	.062 .065	.094 .097	.125 .129	.156 .160	.187 .192	.219 .224	.250 .256	.312 .318	.375 .382	.437 .445	.500 .510
Minimum Double Shear Strength (Pounds)	425	1000	1800	2880	4140	5640	7360	11,500	16,580	22,540	25,800
Length	Part Numbers										
*.188 ±.015	2-3										
.250 ±.015	2-4	3-4									
*.312 ±.015	2-5	3-5									
.375 ±.015	2-6	3-6	4-6								
*.438 ±.015	2-7	3-7	4-7								
.500 ±.015	2-8	3-8	4-8	5-8	6-8						
*.562 ±.015	2-9	3-9	4-9	5-9	6-9						
*.625 ±.015	2-10	3-10	4-10	5-10	6-10						
*.688 ±.015	2-11	3-11	4-11	5-11	6-11						

H0401482

Table 7-10. NAS561 Heavy Duty Spring Pin - Continued

	Diameter										
	.062	.094	.125	.156	.188	.219	.250	.312	.375	.437	.500
	Min Max	Min Max	Min Max	Min Max	Min Max	Min Max	Min Max	Min Max	Min Max	Min Max	Min Max
Slotted Pin Diameter	.066 .069	.099 .103	.131 .135	.162 .167	.194 .199	.226 .232	.258 .264	.321 .328	.385 .392	.448 .456	.513 .521
Coiled Pin Diameter	.066 .068	.098 .100	.130 .132	.161 .163	.194 .197	.226 .229	.258 .261	.327 .340	.391 .407	.457 .475	.522 .542
Recom-mended Hole Size	.062 .065	.094 .097	.125 .129	.156 .160	.187 .192	.219 .224	.250 .256	.312 .318	.375 .382	.437 .445	.500 .510
Minimum Double Shear Strength (Pounds)	425	1000	1800	2880	4140	5640	7360	11,500	16,580	22,540	25,800
Length	Part Numbers										
.750 ±.015	2-12	3-12	4-12	5-12	6-12	7-12	8-12				
*.812 ±.015		3-13	4-13	5-13	6-13						
.875 ±.015		3-14	4-14	5-14	6-14	7-14	8-14				
*.938 ±.015		3-15	4-15	5-15	6-15						
1.000 ±.015		3-16	4-16	5-16	6-16	7-16	8-16	10-16			
*1.125 ±.020		3-18	4-18	5-18	6-18	7-18	8-18				
1.250 ±.020		3-20	4-20	5-20	6-20	7-20	8-20	10-20	12-20		
*1.375 ±.020		3-22	4-22	5-22	6-22	7-22	8-22				
1.500 ±.020		3-24	4-24	5-24	6-24	7-24	8-24	10-24	12-24	14-24	16-24
*1.625 ±.020			4-26	5-26	6-26	7-26	8-26				
1.750 ±.020			4-28	5-28	6-28	7-28	8-28	10-28	12-28	14-28	16-28
*1.875 ±.020				5-30	6-30	7-30	8-30				
2.000 ±.020				5-32	6-32	7-32	8-32	10-32	12-32	14-32	16-32
2.250 ±.025						7-36	8-36	10-36	12-36	14-36	16-36

H0401483

Table 7-10. NAS561 Heavy Duty Spring Pin - Continued

	Diameter										
	.062	.094	.125	.156	.188	.219	.250	.312	.375	.437	.500
	Min Max	Min Max	Min Max	Min Max	Min Max	Min Max	Min Max	Min Max	Min Max	Min Max	Min Max
Slotted Pin Diameter	.066 .069	.099 .103	.131 .135	.162 .167	.194 .199	.226 .232	.258 .264	.321 .328	.385 .392	.448 .456	.513 .521
Coiled Pin Diameter	.066 .068	.098 .100	.130 .132	.161 .163	.194 .197	.226 .229	.258 .261	.327 .340	.391 .407	.457 .475	.522 .542
Recom-mended Hole Size	.062 .065	.094 .097	.125 .129	.156 .160	.187 .192	.219 .224	.250 .256	.312 .318	.375 .382	.437 .445	.500 .510
Minimum Double Shear Strength (Pounds)	425	1000	1800	2880	4140	5640	7360	11,500	16,580	22,540	25,800
Length	Part Numbers										
2.500 ±.025							8-40	10-40	12-40	14-40	16-40
2.750 ±.025							8-44	10-44	12-44	14-44	16-44
3.000 ±.025							8-48	10-48	12-48	14-48	16-48
3.250 ±.030							8-52	10-52	12-52	14-52	16-52
3.500 ±.030								10-56	12-56	14-56	16-56
3.750 ±.030								10-60	12-60	14-60	16-60
4.000 ±.030								10-64	12-64	14-64	16-64

* The asterisk in the length column indicates lengths of coiled pins that are not available.

Code:

C after basic part number indicates a corrosion-resistant steel, slotted spring pin.

F after basic part number indicates a carbon steel coiled pin with black oiled finish.

P after basic part number indicates a carbon steel, cadmium-plated, slotted spring pin.

PF after basic pan number indicates a carbon steel, cadmium plated, coiled spring pin.

CF after basic part number indicates a corrosion-resistant steel, coiled spring pin.

First dash number designates diameter in 1/32 inch.

H0401484

Table 7-10. NAS561 Heavy Duty Spring Pin - Continued

Second dash number designates the length in 1/16 inch.

Example of part number:

NAS561CF4-6 = coiled pin, corrosion-resistant steel, .125-inch diameter, .375-inch long.

Material:

Corrosion-resistant steel.

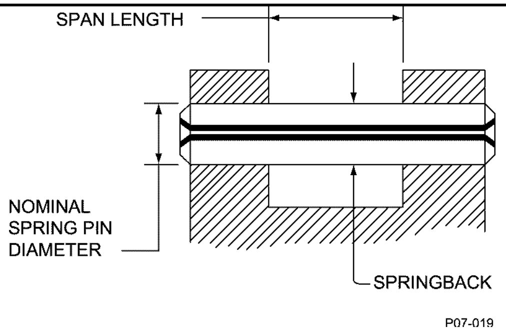
Carbon steel, Military Specification MIL-S-7949.

Finish:

Cadmium plating, Federal Specification QQ-P-416. (For carbon steel only.)

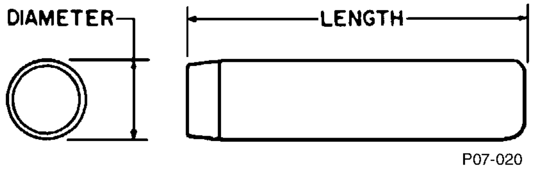
H0401485

Table 7-11. Recommended Spring Pin Sizes for Clevis Joint Applications



Nominal Spring Pin Diameter	Hole Diameter	Span Length (Inches)													
		1/8	1/4	3/8	1/2	5/8	3/4	7/8	1	1-1/4	1-1/2	1-3/4	2	2-1/2	3
		Springback													
.125	Min .125	.127	.129	.129	.130	.130	.130	.131	.131						
	Max .129	.129	.130	.130	.130	.131	.131	.131	.131						
.156	Min .156	.158	.159	.160	.161	.162	.162	.163	.163	.163	.163				
	Max .160	.160	.161	.161	.162	.162	.162	.163	.163	.163	.163				
.189	Min .187	.188	.189	.190	.191	.192	.193	.194	.195	.195	.195	.195	.195		
	Max .192	.192	.193	.193	.194	.194	.194	.195	.195	.195	.195	.195	.195		
.219	Min .219	.220	.221	.222	.223	.223	.224	.225	.225	.226	.226	.226	.226		
	Max .224	.224	.225	.225	.225	.225	.226	.226	.226	.226	.226	.226	.226		
.250	Min .250	.252	.254	.255	.256	.256	.257	.258	.258	.259	.260	.260	.260		
	Max .256	.257	.258	.258	.259	.259	.260	.260	.260	.260	.260	.260	.260		
.312	Min .312	.313	.313	.313	.314	.315	.315	.316	.317	.317	.318	.319	.320	.321	.321
	Max .318	.319	.319	.319	.319	.319	.319	.320	.320	.320	.320	.320	.321	.321	.321
.375	Min .375	.376	.376	.376	.376	.377	.378	.379	.380	.382	.383	.384	.384	.385	.385
	Max .382	.383	.383	.383	.383	.383	.383	.384	.384	.384	.384	.385	.385	.365	.385
.500	Min .500	.501	.502	.502	.503	.504	.504	.505	.506	.507	.508	.510	.512	.514	.514
	Max .510	.511	.511	.511	.512	.512	.512	.512	.513	.513	.513	.514	.514	.514	.514

Table 7-12. NAS607 Machine Pin (Dowel)



Diameter	Part Number Dash Numbers																		
	Length																		
	1/4	3/8	1/2	5/8	3/4	7/8	1	1-1/4	1-1/2	1-3/4	2	2-1/4	2-1/2	3	3-1/2	4	4-1/2	5	6
1/16	1-3	1-3	1-4	1-5	1-6														
1/8		2-3	2-4	2-5	2-6	2-7	2-8	2-10	2-12	2-14	2-16								
3/16			3-4	3-5	3-6	3-7	3-8	3-10	3-12	3-14	3-16								
1/4			4-4	4-5	4-6	4-7	4-8	4-10	4-12	4-14	4-16	4-18	4-20						
5/16			5-4	5-5	5-6	5-7	5-8	5-10	5-12	5-14	5-16	5-18	5-20	5-24					
3/8			6-4	6-5	6-6	6-7	6-8	6-10	6-12	6-14	6-16	6-18	6-20	6-24					
7/16							7-8	7-10	7-12	7-14	7-16		7-20	7-24					
1/2					8-6		8-8	8-10	8-12	8-14	8-16	8-18	8-20	8-24	8-28	8-32			
5/8							10-8	10-10	10-12	10-14	10-16	10-18	10-20	10-24	10-28	10-32	10-36	10-40	
3/4											12-16		12-20	12-24	12-28	12-32	12-36	12-40	
7/8											14-16		14-20	14-24	14-28	14-32	14-36	14-40	14-48
1											16-16		16-20	16-24	16-28	16-32	16-36	16-40	16-48

Code:

First dash number indicates pin diameter in 1/16 inch.

Second dash number indicates pin length in 1/8 inch.

P following second dash number indicates plated pin.

Example of part number:

NAS607-4-4P = pin, cadmium plated, 1/4-inch diameter, 1/2-inch long.

Material:

Steel, case hardened.

Table 7-12. NAS607 Machine Pin (Dowel) - Continued

Finish: Cadmium plating, Federal Specification QQ-P-416. Corrosion-preventive, Military Specification MIL-C-16173. (Unplated pins only.)

CHAPTER 8
BUSHINGS

8.1 BUSHINGS.

Bushed holes used in aircraft assemblies help to maintain desired tolerances and close fits. Because of close hole tolerances usually used, it is improbable that any appreciable wear will develop in bushings if kept properly lubricated; however, if wear should occur inside the bushing, replacement is necessary. Wear and elongation, damage from gunfire, hard landings, sandstorms, etc., can be cause for bushing replacement. Therefore, all bushings throughout an aircraft should be checked for proper functioning. When fitting new bushings, it is essential that they be of the same type and material, or suitable substitute material, as those they replace. See Table 8-1 through Table 8-6 for information on NAS bushings. The material and length of a bushing are equally as important as its diameter.

8.1.1 Removing Bushings. Removing worn or damaged bushings is best done by using an arbor press fitted with a support plate with openings of various sizes to accommodate different diameter bushings. Remove the bushings as follows:

a. Place the assembly containing the bushing in position over an appropriate-sized opening of the support plate (Figure 8-1).

NOTE

When removing plain, symmetrical bushings which extend through the assembly, the driving force may be applied from either side. On flanged bushings, the flange must be placed opposite the driving force.

b. Select a drive pin of proper diameter and place it in position on the bushing. The shoulder of the drive pin should be smaller than the hole in the assembly, but larger than the hole in the bushing. This differential will be dependent upon the bushing wall thickness. The pilot on the drive pin should be large enough to keep the shoulder centered on the bushing. However, if care is taken in centering the drive pin on the bushing, no pilot is needed.

c. While holding the assembly firmly with one hand, rotate the actuating lever of the arbor press to bring the trust arm against the drive pin (Figure 8-2).

d. With a steady pull on the actuating lever, or by a driving action with the thrust arm of the press, force the bushing out of the assembly.

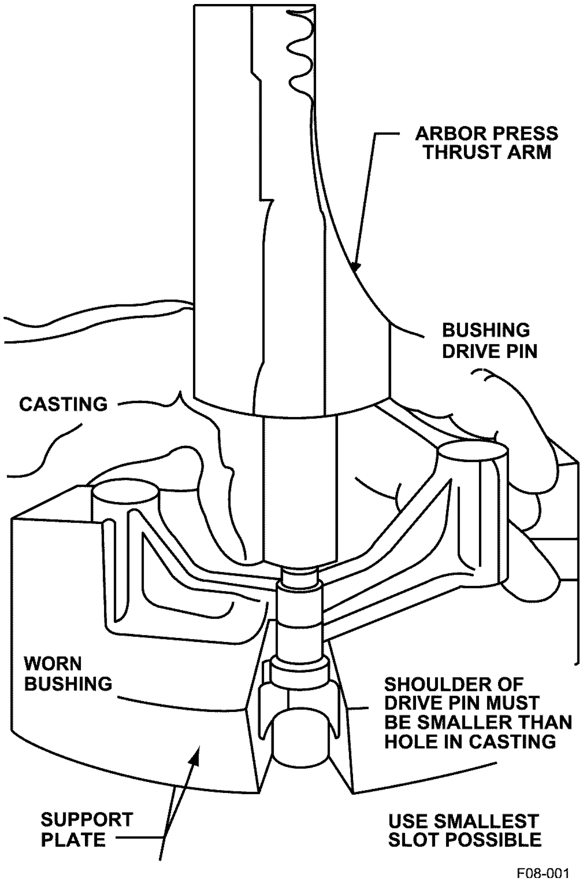


Figure 8-1. Bushing Extraction Detail

8.1.2 Reaming Holes for Bushings. When replacing worn or damaged bushings, the hole in the assembly will normally not require reaming. However, if a new assembly is to be used, or if the hole from which the worn bushing was removed is exceedingly scored, nicked, or otherwise imperfect, the hole should be reamed. Where bushing alignment is critical, bushings should be line-reamed with a machine as it is difficult to obtain satisfactory results with a hand reamer. Where hand reaming is required, ream as follows:

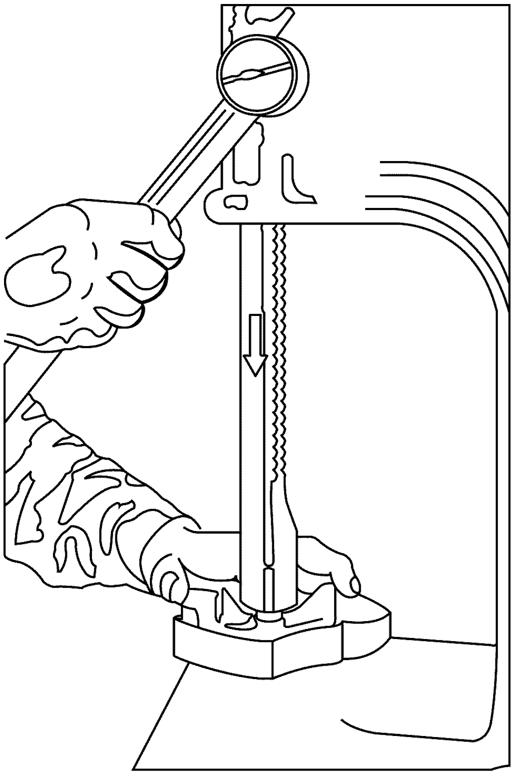


Figure 8-2. Bushing Extraction - Arbor Press Method

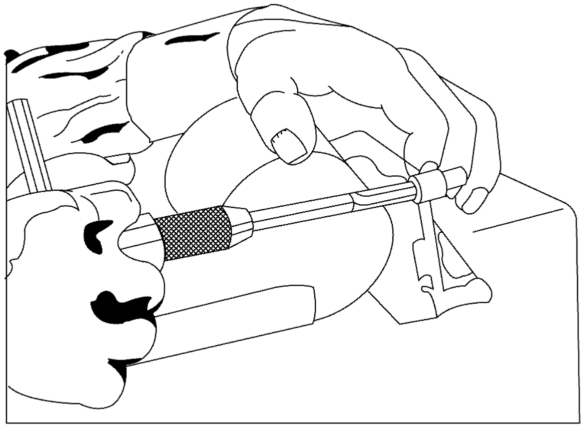


Figure 8-3. Reaming Bushing With Spiral Reamer

a. Clamp the assembly securely in a vise, or provide some means of holding it securely. Position the assembly to provide clearance for manipulation of the reaming tools.

b. Insert the correct-size reamer into a tap wrench or other driving tool (Figure 8-3).

c. Keep the reamer directly in line with the sides of the hole in the assembly and ream to the dimension applicable for the particular bushing.

8.1.3 Pressing in New Bushings. The four methods outlined for pressing bushings into place in assemblies are listed in the order of their preference: the arbor press, draw-in, vise, and the mallet methods. The arbor press method is preferred because it provides greater control of the driving force with less danger of damaging the bushing or assembly

NOTE

Any of the four methods outlined can be facilitated by the use of heat applied to the assembly, by cooling the bushing for contraction, or by simultaneous application of heating and cooling to the respective parts.

8.1.4 Arbor Press Method.

CAUTION

When heat is applied to the assembly it is preferably done in a circulating oil bath, and care must be exercised not to heat the assembly over 93°C (200°F). Torches shall not be used for the purpose of heating.

a. Place a suitable anvil on the arbor press and center the hole in the assembly over the anvil (Figure 8-4). If the assembly is of a regular shape, the use of an anvil is not always required.

b. Place the chamfered edge of the bushing in the hole. Carefully align the bushing with sides of the hole so that when the driving pressure is applied, the bushing will be squarely stated into the hole.

c. Place a drive pin in position in the new bushing.

d. Operate the actuating lever of the arbor press to bring the thrust arm down against the drive pin.

e. Hold casting firmly in place on the anvil, with a steady pull on the actuating lever, press the bushing into place.

f. Release pressure and remove the drive pin.

8.1.5 Draw-In Method. Use a puller arrangement. If a puller is not available, use a combination of stud or bolt with appropriate size washers and nut, and tighten with a wrench.

8.1.6 Vise Method. Follow procedures as outlined in paragraph 8.1.4, steps a through c, of the arbor press method. Because of the limited opening of the jaws of most machinists' vises, the drive pin and anvil must be relatively shorter or eliminated entirely. The size and shape of the assembly will regulate their use. To eliminate damage to the assembly or bushing, it is preferable to use jaw pads of soft material.

a. Operate the handle of the vise until bushing is pressed into place (Figure 8-5).

b. Open vise and remove assembly.

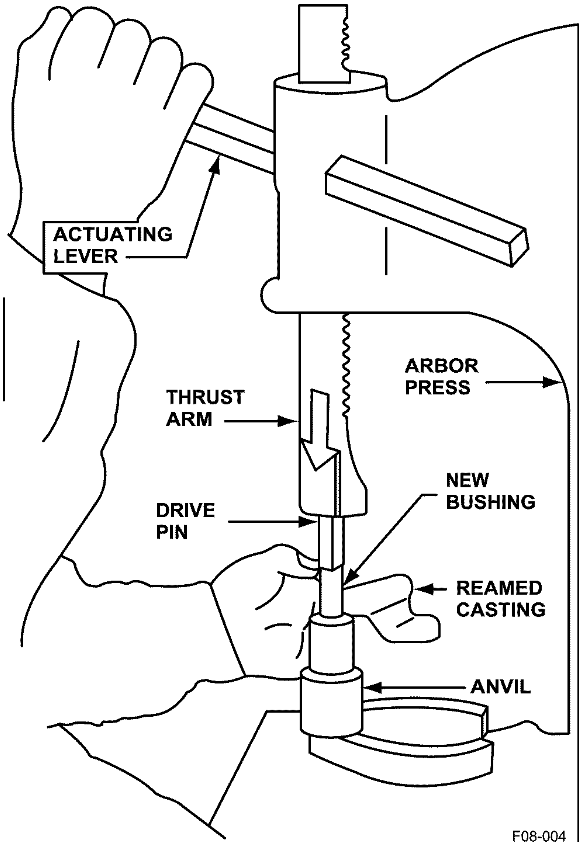


Figure 8-4. Inserting Bushing - Arbor Press Method

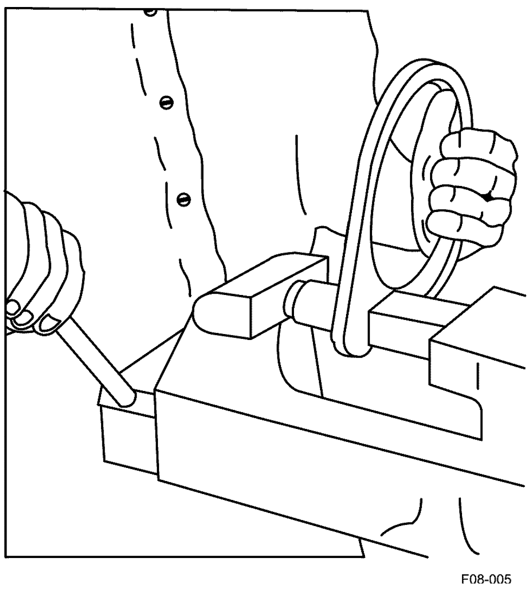
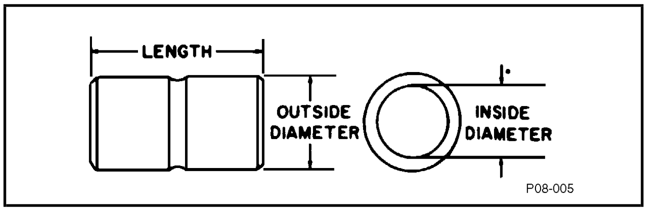


Figure 8-5. Inserting Bushing - Vise

Table 8-1. NAS72, 73, 74 Clamp-Up, Steel Bushing



First Dash Number	Inside Diameter	Outside Diameter
-3	.190	.373
-4	.250	.4355
-5	.3125	.498
-6	.375	.5605
-7	.4375	.623
-8	.500	.6855
-9	.5625	.748
-10	.625	.873
-12	.750	.998
-14	.875	1.123
-16	1.000	1.248

Second Dash Number	Length
002	.135
003	.197

Second Dash Number	Length
004	.260
005	.322
006	.385
007	.447
008	.510
009	.572
010	.635
011	.697
012	.760
013	.822
014	.885
015	.947
100	1.010
101	1.072
102	1.135
103	1.197
104	1.260
105	1.322
106	1.385
107	1.447
108	1.510
109	1.572
110	1.635
111	1.697
112	1.760
113	1.822
114	1.885
115	1.947
200	2.010
201	2.072
202	2.135
203	2.197
204	2.260
205	2.322
206	2.385
207	2.447
208	2.510
209	2.572
210	2.635
211	2.697
212	2.760
213	2.822
214	2.885
215	2.947
300	3.010
301	3.072
302	3.135
303	3.197
304	3.260
305	3.322
306	3.385
307	3.447
308	3.510
309	3.572
310	3.635
311	3.697
312	3.760
313	3.822
314	3.885
315	3.947

1. Bushing under 3/8 inch in length shall not be grooved.

2. These bushings are not intended for reaming on assembly.

3. These bushings are designed for clamping to the shaft, with relative motion occurring on the bushing outside diameter only.

Code:

First dash number designates size.

Second dash number designates length.

E after first dash number designates bushing without groove for bushing lengths 3/8 inch and longer.

Example of part number:

NAS73-8-012 = bushing .500-inch inside diameter x 0.760-inch long with groove.

NAS73-8E012 = bushing .500-inch inside diameter x.760-inch long without groove.

Material:

Steel, Military Specification MIL-S-6050 (NAS73 cadmium plated, NAS72 chrome plated).

Steel, Military Specification MIL-S-6758 (NAS73 cadmium plated, NAS72 chrome plated).

Aluminum bronze, Military Specification MIL-B-6946 (NAS74).

8.1.7 Mallet Method.

CAUTION

Do not use this method for installing thin-walled bushings.

NOTE

This method of installation is not recommended except in extreme emergencies where proper installation facilities are not available.

a. Follow procedures as outlined in paragraph 8.1.4, steps a through c, of the arbor press method. Rest the assembly on a firm base in a suitable manner so that the blows will not mar the assembly.

b. Tap the bushing into position with uniform blows of the mallet, hitting the bushing or drive pin as squarely as possible, making certain that the bushing is in line with the hole before each blow (Figure 8-6).

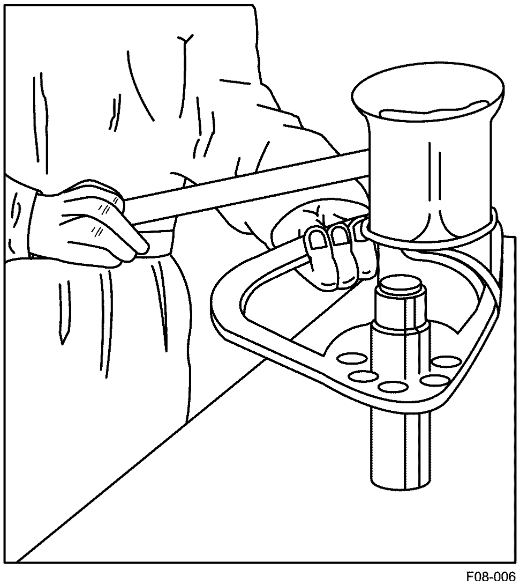


Figure 8-6. Inserting Bushing - Mallet Method

8.2 REAMING NEW BUSHINGS.

CAUTION

Extreme care must be exercised to prevent damage to flanged bushings.

New bushings which cannot be used in their standard reamed condition must be checked and reamed after installation. In general, the procedures for hand reaming a bushing are the same as those for reaming holes in assemblies prior to the insertion of bushings.

a. Clamp the assembly in a vise or provide some other means of holding the assembly securely. The assembly must be clamped in a position that will provide clearance for manipulation of the reaming tools.

b. Insert the correct-size reamer into a tap wrench or other driving tool (Figure 8-3).

c. Keep the reamer directly in line with the sides of the bushing, and ream.

Table 8-2. NAS75, 76 Plain, Press Fit Bushing

Size Dash Number	Bolt (Size)	Inside Diameter	Outside Diameter
-3	10	.190	.3136 +.0000 -.0005
-4	1/4	.250	.3761 +.0000 -.0005
-5	5/16	.3125	.4386 +.0000 -.0005
-6	3/8	.375	.5013 +.0000 -.0007
-7	7/16	.4375	.5638 +.0000 -.0007
-8	1/2	.500	.6265 +.0000 -.0008
-9	9/16	.5625	.6892
-10	5/8	.625	.8142
-11		.6875	.8767
-12	3/4	.750	.9393
-14	7/8	.875	1.0648
-16	1	1.000	1.1898
-18		1.125	1.3148
-20		1.250	1.4399

1. These bushings are not intended for reaming on assembly.

Code:

Length to be specified in inches and thirty-seconds of an inch.

NAS75 - (Size Dash Number) - (Length Dash Number)

For aluminum bronze material, suffix the letter A to basic part number (NAS76).

For cadmium-plated finish, suffix the letter P to the last dash number (NAS76).

Example of part number:

NAS75-8-009 = steel bushing - .500-inch inside diameter, 9/32-inch long.

NAS75-8-015 = steel bushing - .500-inch inside diameter, 15/32-inch long.

NAS75-8-309 = steel bushing - .500-inch inside diameter, 3-9/32 inch long.

NAS75-8-315 = steel bushing - .500-inch inside diameter, 3-15/32 inch long.

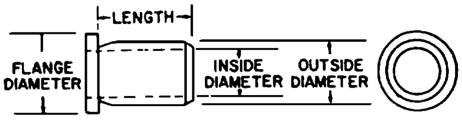
Material:

Steel, Military Specification MIL-S-6050 (NAS75).

Steel, Military Specification MIL-S-6758 (NAS75).

Aluminum bronze, Military Specification MIL-B-6946 (NAS76).

Table 8-3. NAS77 Flanged, Press Fit, Steel and Bronze Bushing



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Size Dash Number	Bolt (Size)	Inside Diameter	Outside Diameter	Flange Diameter
-3	10	.190	.3136 +.0000 -.0005	.437
-4	1/4	.250	.3761 +.0000 -.0005	.500
-5	5/16	.3125	.4386 +.0000 -.0005	.562
-6	3/8	.375	.5013 +.0000 -.0007	.625
-7	7/16	.4375	.5638 +.0000 -.0007	.687
-8	1/2	.500	.6265 +.0000 -.0008	.750
-9	9/16	.5625	.6892	.812
-10	5/8	.625	.8142	1.000
-11		.6875	.8767	1.062
-12	3/4	.750	.9393	1.125
-14	7/8	.875	1.0648	1.250
-16	1	1.000	1.1898	1.375
-18	1-1/8	1.125	1.3148	1.500
-20	1-1/4	1.250	1.4399	1.625

1. These bushings are not intended for reaming on assembly.

Code:

Length to be specified in 0.01-inch increments.

A after basic part number designates aluminum bronze material. No letter indicates steel.

All steel bushings shall be cadmium plated. For a cadmium-plated finish on bronze bushings, suffix the letter P to the last dash number.

Example of part number.

NAS77-8-15 = cadmium-plated steel bushing, 0.500-inch inside diameter, 0.150-inch long.

NAS77A-8-15 = aluminum bronze bushing, 0.500-inch inside diameter,.150-inch long.

NAS77A-8-167P = aluminum bronze bushing, .500-inch inside diameter, 1.670-inches long, cadmium plated.

Material:

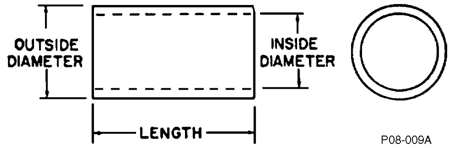
Steel, Military Specification MIL-S-6050.

Steel, Military Specification MIL-S-6758.

Table 8-3. NAS77 Flanged, Press Fit, Steel and Bronze Bushing - Continued

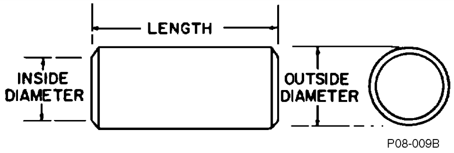
Size Dash Number	Bolt (Size)	Inside Diameter	Outside Diameter	Flange Diameter
Aluminum bronze, Military Specification MIL-B-6946.				

Table 8-4. NAS382 Plain Bearing, Pulley Bushing



Dash Number	Outside Diameter	Length	Inside Diameter
-1	.250 +.000 -.001	.312 +.015 -.000	11 (.191) +.003 -.000
-2	.375 +.000 -.002	.468 +.003 -.003	.250 +.003 -.000
Material:			
Steel, Military Specification MIL-S-6050.			

Table 8-5. NAS537 Plain, Press Fit, Undersize Inside Diameter Bushing



Size First Dash Number	Diameter for Ream Hole	Inside Diameter UD (Undersize)		Outside Diameter	
		Diameter	Tolerance -.0000	Diameter	Tolerance +.0000
-3	.190	.1790	+.0050	.3136	-.0005
-4	.250	.2380	+.0050	.3761	-.0005
-5	.312	.3010	+.0050	.4386	-.0005
-6	.375	.3590	+.0070	.5013	-.0007
-7	.437	.4220	+.0070	.5638	-.0007
-8	.500	.4840	+.0070	.6265	-.0008
-9	.562	.5460	+.0070	.6892	-.0010
-10	.625	.6090	+.0070	.8142	-.0010
-11	.687	.6710	+.0070	.8767	-.0010
-12	.750	.7340	+.0070	.9393	-.0010
-14	.875	.8590	+.0070	1.0648	-.0010
-16	1.000	.9840	+.0070	1.1898	-.0010
-18	1.125	1.0940	+.0120	1.3148	-.0010
-20	1.250	1.2190	+.0120	1.4399	-.0010

1. These bushings are intended for reaming on assembly.

Code:

Length shall be specified in 0.01-inch increments, following the first dash number, and/or the finish code.

For aluminum bronze material, suffix the letter B to basic part number.

For cadmium-plated finish, suffix the letter P to first dash number.

Table 8-5. NAS537 Plain, Press Fit, Undersize Inside Diameter Bushing - Continued

Size First Dash Number	Diameter for Ream Hole	Inside Diameter		Outside Diameter	
		UD (Undersize)			
		Diameter	Tolerance -.0000	Diameter	Tolerance +.0000

Example of part number:

NAS537B8P-175 - aluminum bronze bushing, 0.500-inch inside diameter, cadmium plated, 1.75 inches long.

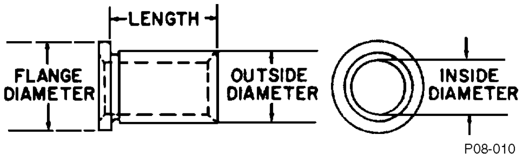
Material:

Steel, Military Specification MIL-S-6050.

Steel, Military Specification MIL-S-6758.

Aluminum bronze, Military Specification MIL-B-6946.

Table 8-6. NAS538 Flanged, Press Fit, Undersize Inside Diameter Bushing



First Dash Number	Diameter for Ream Hole	Inside Diameter		Outside Diameter		Flange Diameter	
		Diameter	Tolerance -.0000	Diameter	Tolerance +.0000	Diameter	Tolerance +.0000
-3	.190	.1790	+.0050	.3136	-.0005	.447	-.020
-4	.250	.2380	+.0050	.3761	-.0005	.510	-.020
-5	.312	.3010	+.0050	.4386	-.0005	.572	-.020
-6	.375	.3590	+.0070	.5013	-.0007	.635	-.020
-7	.437	.4220	+.0070	.5638	-.0007	.697	-.020
-8	.500	.4840	+.0070	.6265	-.0008	.760	-.020
-9	.562	.5460	+.0070	.6892	-.0010	.822	-.020
-10	.625	.6090	+.0070	.8142	-.0010	1.010	-.020
-11	.687	.6710	+.0070	.8767	-.0010	1.072	-.020
-12	.750	.7340	+.0070	.9393	-.0010	1.135	-.020
-14	.875	.8590	+.0070	1.0648	-.0010	1.260	-.020
-16	1.000	.9840	+.0070	1.1898	-.0010	1.385	-.020
-18	1.125	1.0940	+.0120	1.3148	-.0010	1.510	-.020
-20	1.250	1.2190	+.0120	1.4399	-.0010	1.635	-.020

1. These bushings are intended for reaming on assembly.

Code:

Length shall be specified in 0.01-inch increments, following the first dash number, and/or the finish code.

For aluminum bronze material, suffix the letter B to basic part number.

For cadmium-plated finish, suffix the letter P to first dash number.

Example of part number:

NAS538B8P-175 = aluminum bronze bushing, 0.500-inch inside diameter, cadmium-plated, 1.75 inches long.

Table 8-6. NAS538 Flanged, Press Fit, Undersize Inside Diameter Bushing - Continued

First Dash Number	Diameter for Ream Hole	Inside Diameter		Outside Diameter		Flange Diameter	
		Diameter	Tolerance -.0000	Diameter	Tolerance +.0000	Diameter	Toler-ance +.0000
Material: Steel, Military Specification MIL-S-6050. Steel, Military Specification MIL-S-6758. Aluminum bronze, Military Specification MIL-B-6946.							

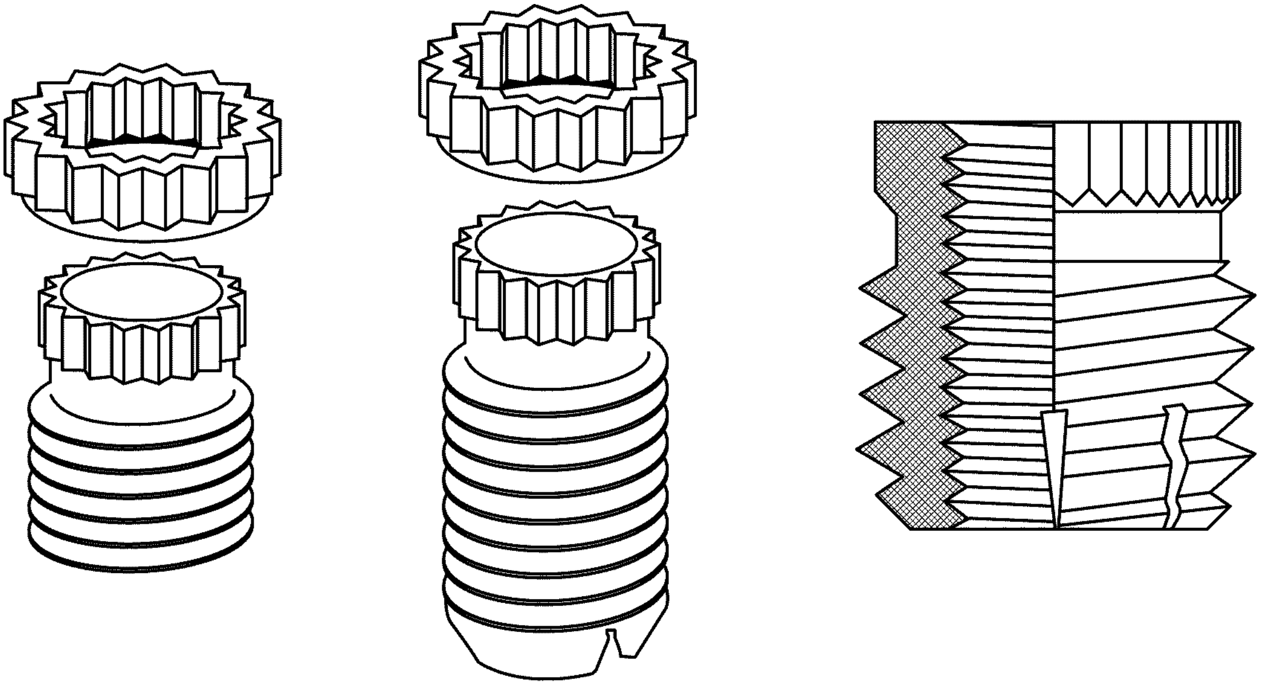
CHAPTER 9
THREADED INSERTS

9.1 THREADED INSERTS.

Threaded inserts are commonly used in design of aircraft, engines, and accessories to protect and strengthen tapped threads in light materials, metals, and plastics, particularly in locations requiring frequent assembly and disassembly. The different kinds of threaded inserts are the lockring threaded inserts, clinch nuts, and one-piece threaded inserts.

9.1.1 Lockring Threaded Inserts.

(See Figure 9-1.) Lockring standard and self-tapping threaded inserts can be installed in any material which can be drilled and tapped. The inserts provide a strong steel thread in which threaded fasteners can be installed and removed any number of times without damage to the parent material. The lockring prevents the insert from coming loose under all conditions including vibrations, stress, and temperature change. Placing the lockring over the insert automatically engages the inner serrations of the ring with those of the insert. When driven, the outer serrations accurately broach their way into the parent material without distortion or concentrated stress. (See Figure 9-2.) This creates not only a secure lock, but also a perfect fit between the serrations of the lockring and those of the parent material. Although lockring inserts have a special pitch diameter on the threads mating with the parent material, they require only a national class 3 tapped hole for installation. This special pitch diameter results in maximum incidence of line-to-line or slight-interference fit between the insert and the parent material. Lockring inserts which incorporate a locking feature are also available. The locking effect is accomplished by cutting several slots diametrically into the base of the insert and closing the slots together. Lockring inserts may be installed anywhere with ordinary standard tools. However, special removal and installation tools are available.



STANDARD SELF - TAPPING WITH LOCKING FEATURE

Figure 9-1. Lockring Threaded Inserts

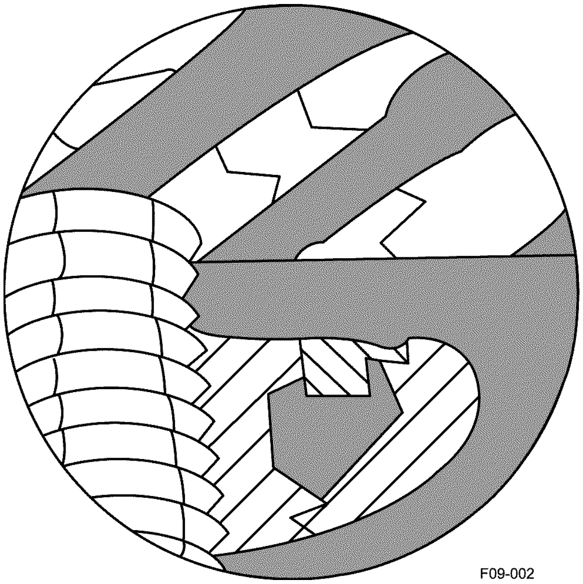


Figure 9-2. Lockring Installed

9.1.2 Installation of Lockring Threaded Inserts.

a. Drill, counterbore, chamfer 45° by outside diameter of counterbore, and tap Class 3 thread. (See A, Figure 9-3.)

NOTE

Tapping is not required when installing lockring self-tapping inserts.

b. Install lockring inserts to a depth of 0.010 to 0.020-inch below surface. (See B, Figure 9-3.)

c. Install lockring to a depth of 0.005 to 0.010-inch below surface. (See C, Figure 9-3.)

NOTE

Make sure that inner serrations of lockring engage with serrations of insert before driving in ring.

9.1.3 Removal of Lockring Threaded Inserts.

a. Drill out serrated collar of insert. (See A, Figure 9-4.)

NOTE

Diameter of drill should be same as diameter of collar serrations.

b. Drive in square removal tool and remove insert. (See B, Figure 9-4.)

c. If lockring fails to come out as insert is unscrewed, collapse remaining portion of ring with punch. (See C, Figure 9-4.)

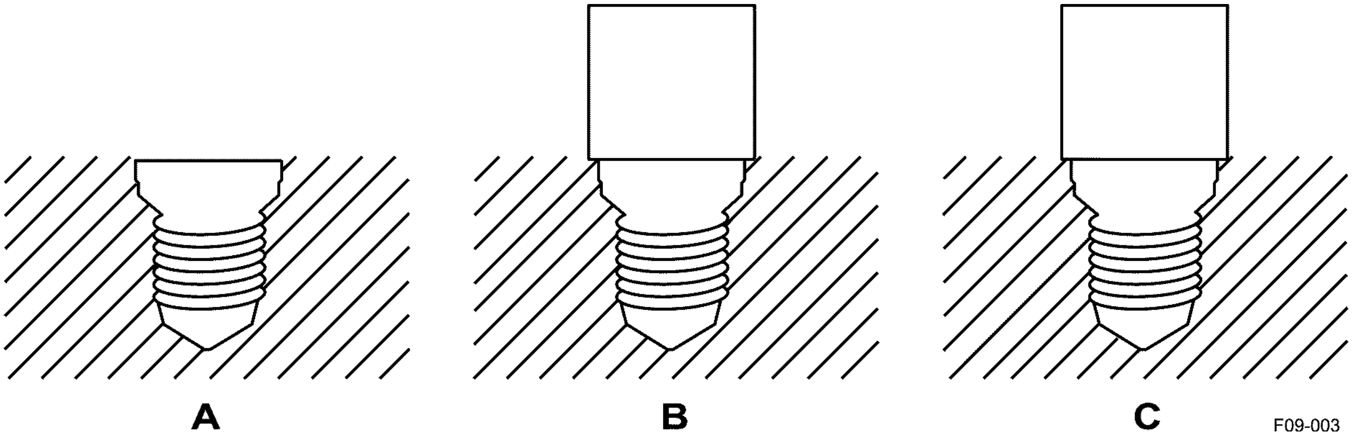


Figure 9-3. Installation of Lockring Threaded Inserts

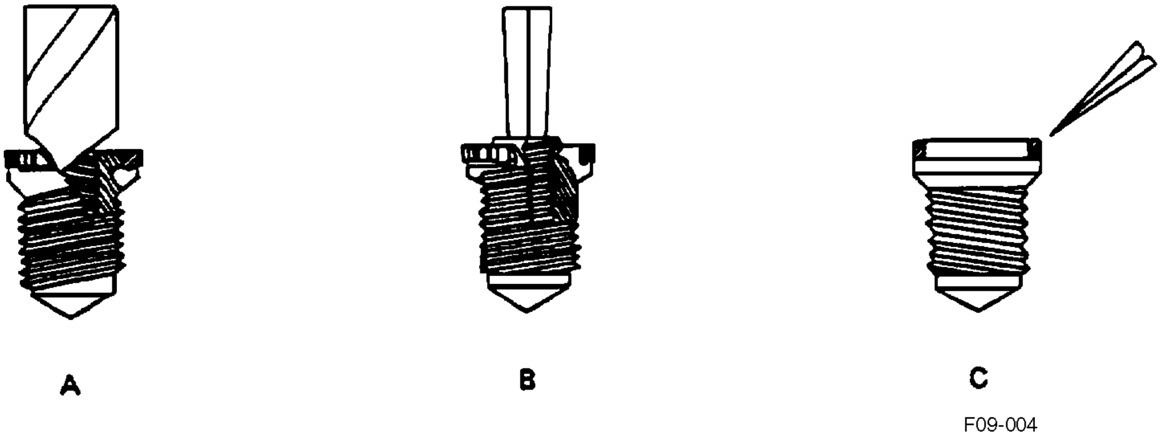


Figure 9-4. Removal of Lockring Threaded Inserts

9.2 CLINCH NUTS.

(See Figure 9-5.) Clinch nuts provide permanent fasteners for installations where it is desirable that the nut remain fixed in place in order to simplify and speed up assembly, disassembly, and maintenance of the unit. These shank-type fasteners are easily installed by a simple clinching or swaging operation, using hand tools or light power presses and are intended to become fixed or permanent fasteners suitable for attaching small parts to thin metal or plastic panels. Clinch nuts are available in a variety of materials, finishes, and sizes. Standard clinch nuts require no more space than a regular hex nut. Miniature clinch nuts require less space than the standard clinch nut. Clinch nuts are made with nylon locking inserts or with an all-metal offset crown closure.

9.2.1 Selection of Clinch Nuts.

Clinch nuts are available in a variety of materials and finishes for compatibility with the work or conditions of use. Both the standard and miniature clinch nuts are designed for installation in aluminum or soft steel sheet. Two self-locking devices are available. The nongalling, nondestructive locking action of the nylon insert is highly suitable for electrical applications because it eliminates the possibility of cadmium flaking from screws. Nylon's wear resistance assures extended reusability; it is satisfactory for use up to 250°F for standard clinch nuts, or up to 350°F for miniature clinch nuts. For temperatures up to 550°F, the all-metal clinch nuts may be used.

9.2.2 Installation of Clinch Nuts.

a. Drill or punch installation holes to tolerances indicated in Table 9-1.

b. Counterbore installation hole to diameter shown in Table 9-1 to depth of .045 inch for flush mounting.

NOTE

Miniature clinch nuts are automatically flush mounting and require no counterboring.

Table 9-1. Installation Hole Sizes For Clinch Nuts

Thread Size	Hole Diameter Minimum	Hole Diameter Maximum	Minimum Counter-bore Diameter
4	.184	.186	.501
6	.217	.219	.501
8	.268	.271	.563
10	.268	.271	.563
1/4	.352	.355	.626
5/16	.408	.412	.688

c. Insert clinch nut shank completely into hole.

d. Use dolly as bottom tool to hold nut crown squarely in place, and center punch from above for swaging and controlled pressure. (See Figure 9-6.)

e. Swage shank to approximately 45 degrees from vertical.

NOTE

Use internal flaring or flush-mounting punch with miniature clinch nuts.

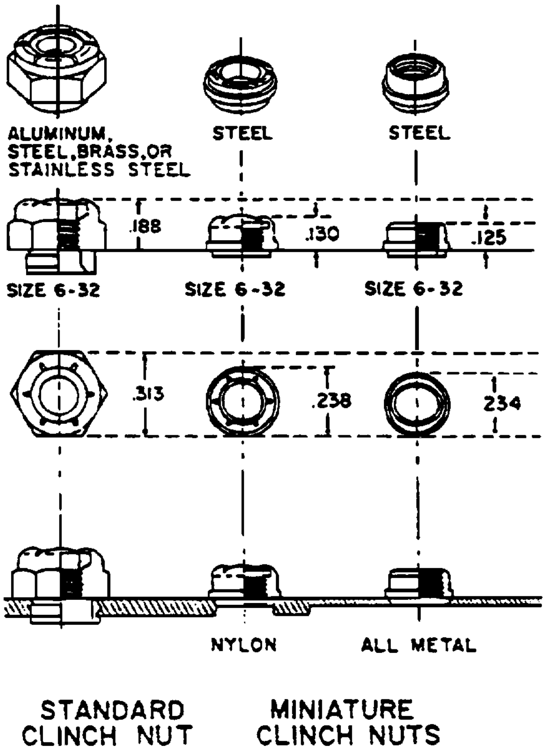


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Figure 9-5. Clinch Nuts

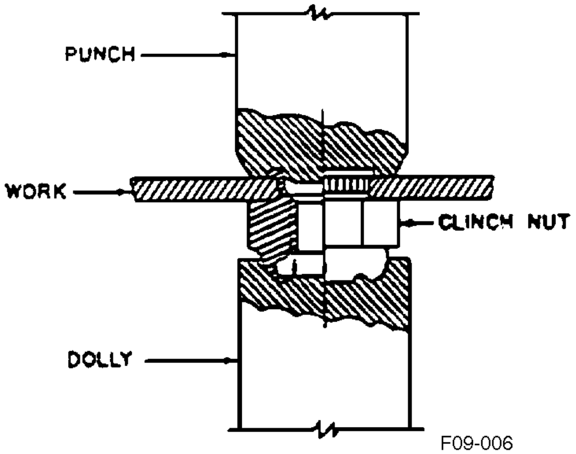

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Figure 9-6. Installing Clinch Nut

9.3 HELICAL COIL INSERTS.

The purpose of the following paragraphs is to provide maintenance activities with general instructions for using Helical Coil Inserts and appropriate tools to repair parts and assemblies with worn or damaged threads. The repair process is simple and requires three basic steps: drilling, tapping, and installing (See Figure 9-7.) Typical types of repair are:

a. Permanent restoration of stripped or damaged threads to their original size in a parent metal not previously protected.

b. Replacement of Helical Coil Inserts damaged by improper use.

c. Repair of solid bushings which have become worn or damaged.

d. Repair of corroded tapped holes, which can be accomplished by using Standard or Screw-Locking Inserts, Oversize Inserts, or Twinserts. For future protection, it is suggested that liquid epoxy primer per FED. SPEC. MIL-P-23377 be applied sparingly to the tapped hole immediately prior to installation of the insert. The use of cadmium plated or dry film lubricated inserts may also be desirable in some cases.

9.3.1 Military Standards. Helical Coil Inserts and tools comply with the following Military Standards and Specifications:

MS122076 through MS122275 -	Insert, Helical Coil, Coarse Thread (free-running).
MS124651 through MS124850 -	Insert, Helical Coil, Fine Thread (free-running).
MS21209 -	Insert, Screw Thread, Coarse and Fine (screw-locking).
MS33537 -	Tapped Threads and Assembly.
MIL-I-8846 -	Inserts, Helical Coil.
MIL-T-21309 -	Tools for Inserting and Extracting Helical Coil Inserts.
MS9018 -	Insert, 18 - 1.5mm Aviation Spark Plug.
MS9071 -	18 - 1.5mm Boss Thread Dimensions.
AS1229 -	Insert, Helical Coil, Stud Locking Performance Standard.
AS3080 through AS3083 -	Insert, Helical Coil (stud locking).

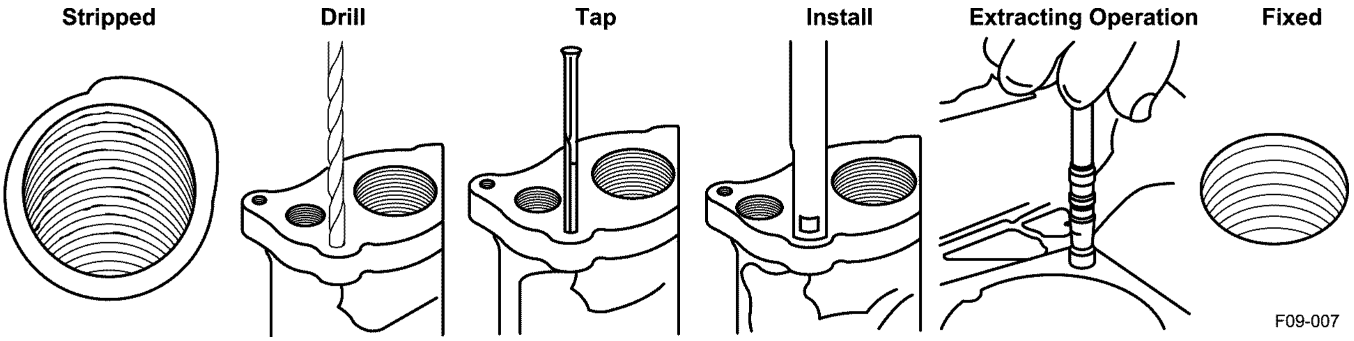


Figure 9-7. Helical Coil Insert Repair Process

9.3.2 Description. Helical Coil Inserts are precision coils of 18-8 stainless steel wire cold-worked to a tensile strength of 200,000 psi (Rockwell C43-50), diamond shaped, and agree with AMS 7245D and MIL-I-8846 specifications.

NOTE

Helical Coil Inserts are also made, on special order, of phosphor bronze (per AMS7247), of Inconel X-750 (per AMS7246), and of other materials to meet special requirements. Only stainless steel inserts are regularly supplied.

Each insert has a driving tang with a notch to facilitate removal of the tang after the insert is screwed into a Helical Coil tapped hole. They are used as screw thread bushings. In addition to being used to restore damaged threads, they are used in the original design of missiles, aircraft engines, and all types of mechanical equipment and accessories to protect and strengthen tapped threads in light materials, metals, and plastics, particularly in locations which require frequent assembly and disassembly, and/or where a screw-locking action is desired.

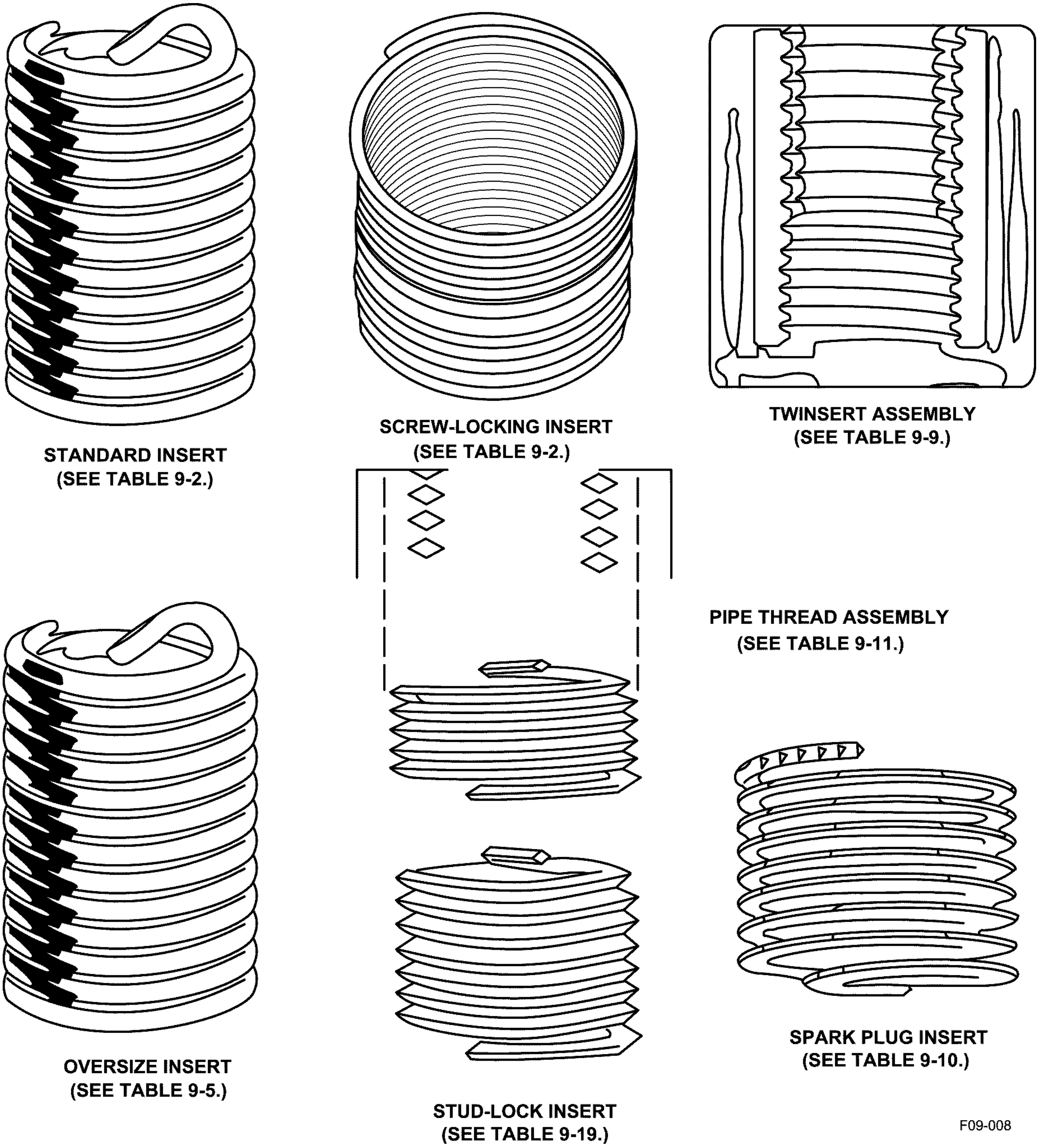
9.3.3 Insert Types. Helical Coil Standard and Screw-Locking Inserts are identical except for a number of flats formed on the middle coil or coils of the Screw-Locking Insert. Helical Coil Screw-Locking Inserts (dyed red) are used to secure screws and bolts against loosening under impact and vibration in both ferrous and non-ferrous materials, and conform to MIL-I-8846. They eliminate lock wiring, lock nuts, and other supplementary locking devices. Inserts are available in Unified Coarse and Fine thread sizes in screw thread and Screw-Locking types, Stud-Lock, Oversize and Twinsert, 14 and 18mm spark plug sizes, and tapered pipe thread sizes. Later paragraphs of this chapter outline specific installation instructions for each type of insert.

9.4 SCREW THREAD AND SCREW-LOCKING INSERTS - UNIFIED COARSE AND FINE THREAD SIZES.

9.4.1 General Instructions.

a. Determine the original tapped hole thread size, whether Unified Coarse or Fine, and whether a standard screw thread or Screw-Locking type of insert is required. Next determine the length of damaged or stripped thread to be replaced and whether the application is in a through hole or a blind hole. A through hole requires that the driving tang be removed. This is not necessary in a blind hole provided the length of the insert permits the tang to clear the point of the screw when the parts are assembled.

b. Insert Selection. Use the original nominal thread size and length of the tapped hole, as determined above, to select the proper insert from Table 9-2. The proper insert length for blind holes will permit full screw engagement without interference if the driving tang is retained. Because all inserts are notched for tang break-off, the tangs should be removed where possible.



STANDARD INSERT
(SEE TABLE 9-2.)

SCREW-LOCKING INSERT
(SEE TABLE 9-2.)

TWINSERT ASSEMBLY
(SEE TABLE 9-9.)

PIPE THREAD ASSEMBLY
(SEE TABLE 9-11.)

OVERSIZE INSERT
(SEE TABLE 9-5.)

STUD-LOCK INSERT
(SEE TABLE 9-19.)

SPARK PLUG INSERT
(SEE TABLE 9-10.)

Figure 9-8. Types of Helical Coil Screw Thread Inserts

CAUTION

- Only use bolts with correct grip lengths for thickness of work to be held, and with enough thread length to assemble with full thread engagement into Screw-Locking Insert (e.g., an AN single-digit bolt should not be used with inserts of lengths equal to 1 1/2 and 2 times bolt size).
- When unplated, heat-treated steel screws or stainless steel screws are used with a Screw-Locking Insert, an antiseize compound should be applied to the screw to minimize galling and to obtain maximum cycle life. Also available are inserts plated with cadmium (code letter ''P'') or dry film lubricant (''L'') per MS21209.

NOTE

An insert assembled in a blind hole, with the tang retained, should be longer than the required bolt thread engagement by 1/2 the nominal thread diameter or bolt size.

c. Insert Tolerance. The same insert is used for all classes of thread fits or thread tolerance ranges. Each variation in fit is determined by the tolerance of the tapped thread used. The free insert, before assembly, has a larger diameter than the tapped hole which will receive it. The tapped hole reduces the insert in diameter as it is assembled. This makes the insert conform to the tapped hole tolerance or class of fit. This snug fit also locks the insert in position.

9.5 REPAIR PROCEDURE.

a. Drilling. Drill out stripped or damaged threads to the minimum depth specified in Table 9-3 under ''Drilling Data.'' The minimum depth specified must be equaled or exceeded, and will not include depths of countersinks, if any.

NOTE

Recommended minimum edge distance after drilling and tapping for installation of insert is the nominal diameter of bolt, screw, stud, etc., measured from the centerline of the tapped hole.

b. Tapping. Select the tap of the required nominal thread size as given in Table 9-3 under ''Tapping.'' Class 3B taps are standard. The tapping procedure is the same as standard thread tapping. The full tapped thread depth must equal or exceed the nominal insert length, ''L.'' After tapping, clean out all metal chips.

c. Gage. Threads may be checked with a Helical Coil gage selected from Table 9-3.

d. Insert Assembly. Select the correct size inserting tool from Table 9-3 in the ''Inserting Tool'' column. Follow procedure outlined for specific types of inserting tools in paragraph 9.5.1. For repair of tapped hole without counter sunk, locate the top coil of the insert 1/4 to 1/2 turn below top surface of hole. For repair of tapped hole with counter sunk, locate the top coil of the insert 1 to 1 1/2 turns below top surface of hole. When inserts are installed in small items which can be held in the hand, it is preferable that the inserting tool be mounted in a vise and the work brought to the tool.

e. Tang Break-Off. Select proper tang break-off tool from Table 9-3. Tangs should be removed from inserts in through holes. In blind holes the tangs may be removed when necessary if enough hole depth is provided below the tang of the installed insert. Follow procedure described in paragraph 9.6.

9.5.1 Inserting Tool Instructions.

a. Type III, Class 1, Style A Threaded Mandrel Prewinder Type used for sizes 4″ through 1/2″ UNF and UNC. (Ref. MIL-T-21309E) (See Figure 9-9.)

(1) Place insert in well, tang end toward tip. Place finger lightly over the insert and rotate mandrel through insert until the insert projects beyond the tip one thread.

(2) Place tool squarely against tapped hole and wind insert in to desired depth. Depth control can be adjusted by the depth control stop collar.

(3) Retract mandrel by rotating counterclockwise.

b. Type III, Class 1, Style B Threaded Non-captive Mandrel Prewinder Type used for sizes UNF 9/16″ through 1 1/2″. (Ref. MIL-T-21309E) (See Figure 9-10.)

(1) Keeping knurled body in contact with sleeve, loosen set screw on stop collar and slide mandrel forward until it projects a distance equal to insert length. Tighten set screw. Remove body, place insert on mandrel, and replace body.

(2) Holding body, install insert until shoulder contacts body.

NOTE

If the mandrel binds during installation, reverse the direction of prewinder rotation only 1/4 turn to relieve spring tension, then continue assembly.

(3) Readjust depth if necessary.

c. Type III, Class 2, Style B Threaded Mandrel Type used for sizes UNC 9/16″ through 1 1/2″. (Ref. MIL-T-21309E) (See Figure 9-11.)

d. Type III, Class 2, Style A Mandrel Type used for sizes #2 and #3 UNC. (Ref. MIL-T-21309E) (See Figure 9-12.)

(1) Screw the insert onto the tool. Be sure the tang of the insert is properly engaged in the driving contour of the tool.

(2) Position the insert and tool squarely over the tapped hole.

(3) Rotate the tool, exerting slight pressure against the work until the insert is located the prescribed distance below the work surface.

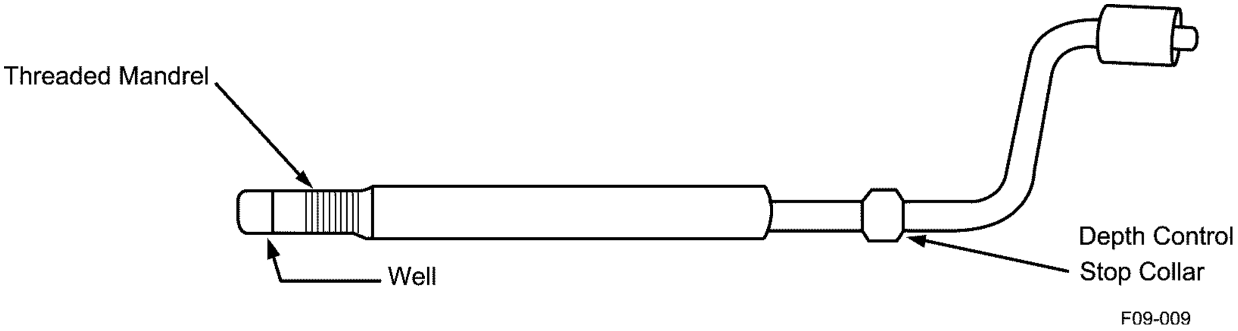


Figure 9-9. Type III, Class 1, Style A Threaded Mandrel Prewinder Type

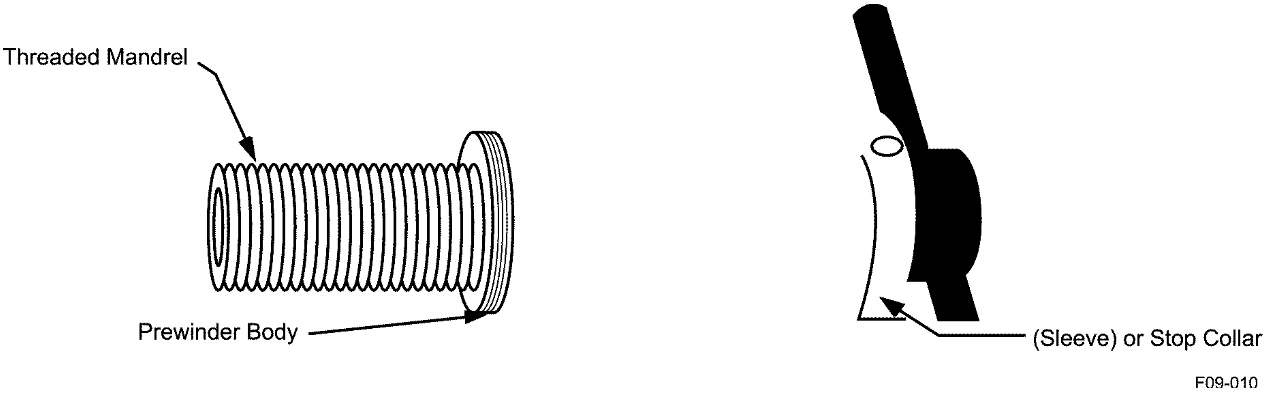


Figure 9-10. Type III, Class 1, Style B Threaded Non-Captive Mandrel Prewinder Type

Table 9-2. Helical Coil Screw Thread Inserts, Standard and Screw-Locking

	Insert Nominal Length "L"*					Free Outside Diameter		Number of Free Coils ±1/4 Coil				
Nominal Thread Size	**1 Dia.**	**1 1/2 Dia.**	**2 Dia.**	**2 1/2 Dia.**	**3 Dia.**	**Min.**	**Max.**	**1 Dia.**	**1 1/2 Dia.**	**2 Dia.**	**2 1/2 Dia.**	**3 Dia.**
Unified Coarse												
2 (.086)-56	0.086	0.129	0.172	0.215	0.258	.110	.119	3	5-1/4	7-3/8	9-5/8	11-7/8
3 (.099)-48	0.099	0.148	0.198	0.248	0.297	.128	.139	2-7/8	5	7-1/4	9-3/8	11-1/2
4 (.112)-40	0.112	0.168	0.224	0.280	0.336	.144	.159	2-3/4	4-3/4	6-3/4	8-7/8	10-7/8
5 (.125)-40	0.125	0.188	0.250	0.312	0.375	.158	.173	3-1/4	5-1/2	7-3/4	10	12-1/4
6 (.138)-32	0.138	0.207	0.276	0.345	0.414	.178	.193	2-3/4	4-3/4	6-7/8	8-7/8	10-7/8
8 (.164)-32	0.164	0.246	0.328	0.410	0.492	.205	.220	3-1/2	6	8-3/8	10-3/4	13-1/4
10 (.190)-24	0.190	0.285	0.380	0.475	0.570	.244	.259	2-7/8	5	7-1/8	9-1/4	11-3/8
12 (.216)-24	0.216	0.324	0.432	0.540	0.648	.270	.285	3-1/2	6	8-3/8	10-5/8	13-1/8
1/4 (.250)-20	0.250	0.375	0.500	0.625	0.750	.310	.330	3-3/8	5-3/4	8	10-3/8	12-3/4
5/16 (.3125)-18	0.312	0.469	0.625	0.781	0.938	.380	.400	4	6-5/8	9-1/4	11-7/8	14-5/8
3/8 (.3750)-16	0.375	0.562	0.750	0.938	1.125	.452	.472	4-3/8	7-1/4	10	12-7/8	15-3/4
7/16 (.4375)-14	0.438	0.656	0.875	1.094	1.312	.526	.551	4-1/2	7-3/8	10-1/4	13-1/8	16-1/8
1/2 (.5000)-13	0.500	0.750	1.000	1.250	1.500	.597	.622	4-7/8	7-7/8	11	14-1/8	17-1/8
9/16 (.5625)-12	0.562	0.844	1.125	**1.406**	**1.688**	.669	.694	5-1/8	8-1/4	11-1/2	14-3/4	17-7/8
5/8 (.6250)-11	0.625	0.938	1.250	**2.562**	**1.875**	.742	.767	5-1/4	8-1/2	11-3/4	15	18-3/8
3/4 (.7500)-10	0.750	1.125	1.500	**1.875**	**2.250**	.881	.906	5-7/8	9-3/8	13	16-1/2	20-1/8
7/8 (.8750)- 9	0.875	1.312	1.750	**2.188**	**2.625**	1.022	1.052	6-1/4	10	13-3/4	17-1/2	21-1/4
1 (1.0000)-8	1.000	1.500	2.000	**2.500**	**3.000**	1.166	1.196	6-3/8	10-1/8	14	17-3/4	21-5/8
1-1/8 (1.1250)-7	1.125	1.688	2.250	**2.812**	**3.375**	1.315	1.355	6-1/8	9-7/8	13-5/8	17-1/2	21-1/4
1-1/4 (1.2500)-7	1.250	1.875	2.500	**3.125**	**3.750**	1.443	1.483	7	11-1/4	15-3/8	19-1/2	23-3/4
1-3/8 (1.3750)-6	1.375	2.062	2.750	**3.438**	**4.125**	1.598	1.643	6-1/2	10-1/2	14-3/8	18-3/8	22-1/4

Table 9-2. Helical Coil Screw Thread Inserts, Standard and Screw-Locking - Continued

	Insert Nominal Length "L"*					Free Outside Diameter		Number of Free Coils ±1/4 Coil				
Nominal Thread Size	**1 Dia.**	**1 1/2 Dia.**	**2 Dia.**	**2 1/2 Dia.**	**3 Dia.**	**Min.**	**Max.**	**1 Dia.**	**1 1/2 Dia.**	**2 Dia.**	**2 1/2 Dia.**	**3 Dia.**
1-1/2 (1.5000)- 6	1.500	2.250	3.000	**3.750**	**4.500**	1.727	1.772	7-1/4	11-1/2	15-7/8	20-1/8	24-1/2
Unified Fine												
3 (.099)-56	0.099	0.148	0.198	0.248	0.297	.131	.146	3-3/8	5-5/8	8	10-3/8	12-5/8
4 (.112)-48	0.112	0.168	0.224	0.280	0.336	.147	.162	3-3/8	5-5/8	7-7/8	10-1/4	12-1/2
6 (.138)-40	0.138	0.207	0.276	0.345	0.414	.173	.193	3-1/2	6	8-3/8	10-3/4	13-1/4
8 (.164)-36	0.164	0.246	0.328	0.410	0.492	.204	.224	3-7/8	6-1/2	9-1/8	11-5/8	14-1/4
10 (.190)-32	0.190	0.285	0.380	0.475	0.570	.236	.256	4-1/8	6-7/8	9-1/2	12-1/4	14-7/8
1/4 (.2500)-28	0.250	0.375	0.500	0.625	0.750	.306	.326	5	8-1/4	11-3/8	14-1/2	17-5/8
5/16 (.3125)-24	0.312	0.469	0.625	0.781	0.938	.380	.400	5-1/2	8-7/8	12-1/4	15-5/8	19
3/8 (.3750)-24	0.375	0.562	0.750	0.938	1.125	.448	.468	6-7/8	11	15	19-1/8	23-1/8
7/16 (.4375)-20	0.438	0.656	0.875	1.094	1.312	.524	.549	6-5/8	10-5/8	14-5/8	18-1/2	22-1/2
1/2 (.5000)-20	0.500	0.750	1.000	1.250	1.500	.592	.617	7-7/8	12-3/8	16-7/8	21-3/8	25-7/8
9/16 (.5625)-18	0.562	0.844	1.125	**1.406**	**1.688**	.666	.691	8	12-1/2	17-1/8	21-3/4	26-1/4
5/8 (.6250)-18	0.625	0.938	1.250	**1.562**	**1.875**	.733	.758	9	14-1/8	19-1/4	24-1/4	29-3/8
3/4 (.7500)-16	0.750	1.125	1.500	**1.875**	**2.250**	.876	.901	9-3/4	15-1/8	20-5/8	26	31-1/2
7/8 (.8750)-14	0.875	1.312	1.750	**2.188**	**2.625**	1.021	1.051	9-7/8	15-1/2	21-1/8	26-5/8	32-1/4
1 (1.0000)-14	1.000	1.500	2.000	**2.500**	**3.000**	1.156	1.186	11-1/2	17-7/8	24-1/4	30-5/8	37
1 (1.0000)-12	1.000	1.500	2.000	**2.500**	**3.000**	1.169	1.199	9-5/8	15	20-1/2	26	31-1/2
1-1/8 (1.1250)-12	1.125	1.688	2.250	**2.812**	**3.375**	1.304	1.334	11-1/8	17-1/4	23-3/8	29-1/2	35-3/4
1-1/4 (1.2500)-12	1.250	1.875	2.500	**3.125**	**3.750**	1.439	1.469	12-1/2	19-3/8	26-1/4	33	39-7/8

Table 9-2. Helical Coil Screw Thread Inserts, Standard and Screw-Locking - Continued

	Insert Nominal Length "L"*					Free Outside Diameter		Number of Free Coils ±1/4 Coil				
Nominal Thread Size	**1 Dia.**	**1 1/2 Dia.**	**2 Dia.**	**2 1/2 Dia.**	**3 Dia.**	**Min.**	**Max.**	**1 Dia.**	**1 1/2 Dia.**	**2 Dia.**	**2 1/2 Dia.**	**3 Dia.**
1-3/8 (1.3750)-12	1.375	2.062	2.750	**3.438**	**4.125**	1.575	1.610	13-3/4	21-3/8	28-7/8	36-1/2	44
1-1/2 (1.5000)-12	1.500	2.250	3.000	**3.750**	**4.500**	1.710	1.745	15-1/4	23-1/2	31-5/8	39-7/8	48-1/8

Non-Stock Items Available On Special Order Only Are Shown In Bold

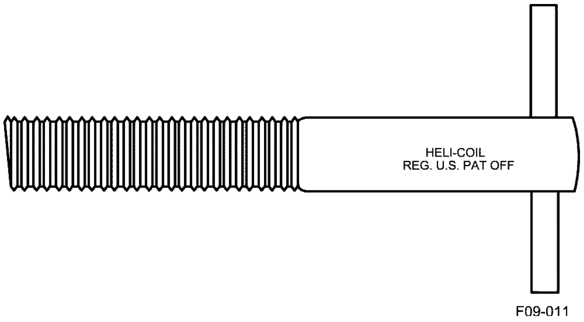


Figure 9-11. Type III, Class 2, Style B Threaded Mandrel Type

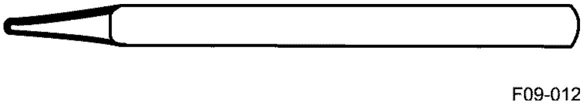


Figure 9-12. Type III, Class 2, Style A Mandrel Type

9.6 TANG REMOVAL INSTRUCTIONS.

a. Tangs should be removed from inserts in through hole installations. Select proper tang break-off tool from Table 9-3. Place the punch of the tool in the installed insert and let the punch contact the tang. (See Figure 9-14.)

b. In the case of the 4156 series tool, the tang is snapped off clean by striking the top of the punch a sharp blow with a hammer. In blind holes, the tang may be removed in the same manner if enough hole depth is provided below the tang with the insert installed.

c. These instructions also apply to the series 3690 tang break-off tools except the preloaded sleeve is pressed down to release the punch, eliminating the use of the hammer.

d. The tang may also be removed in 9/16″ and larger diameter assemblies by grasping it firmly with long-nose pliers and bending it slightly up and down without disturbing the last coil of the insert. It will break off cleanly without a burr.

9.7 GAGING OF ASSEMBLED INSERT.

The installed insert need not be gaged; it is inspected by the manufacturer to established tolerances. If the tapped hole is gaged after tapping, the installed insert will automatically be within the thread tolerance. The insert may not always seat itself when first installed; however, when a bolt or stud is installed and tightened, the insert will find its proper place and seat itself. Accuracy of the finished thread is dependent upon the accuracy of the tapped hole.

9.8 INSERT REMOVAL INSTRUCTIONS.

If it should be desired to remove an insert, select the correct size extracting tool listed in Table 9-3 and place the blade of the tool into the hole so that one side of the blade is a quarter-turn from the end of the insert. (See Figure 9-15.) Strike the head of the tool lightly with a hammer to dig the blade into the top coil of the insert. Bearing down hard on the handle of the tool, turn it slowly counterclockwise, firmly maintaining pressure as the insert backs out. (See Figure 9-16.) Proper removal of the insert does not damage the tapped thread.

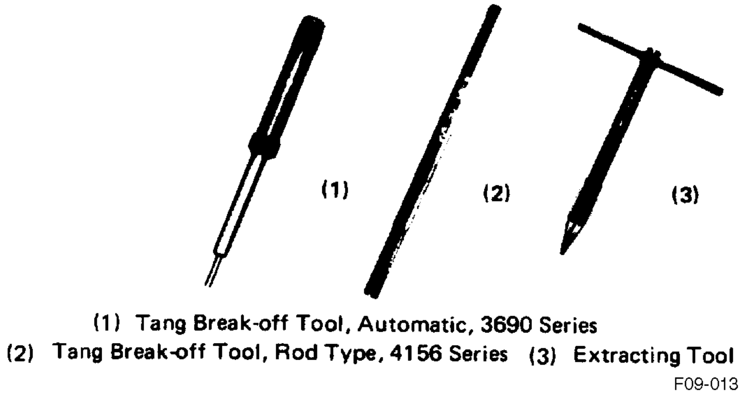


Figure 9-13. Helical Coil Tang Break-Off Tools and Extracting Tod

Table 9-3. Helical Coil Insert Tapped Hole and Tooling Data

	Drilling Data				* Class 38 Tapping Data							* Gages and Installations Data				
	Suggested Drill Size		Min. Depth = Insert Length "L" +		Min. Depth Full Tapped Thread = Insert Length "L"									Break-Off Tool No.		
								Pitch Diameter		Minor Diameter (After Tapping)						
Nominal Thread Size	Aluminum	Steel Magnesium Plastic	For Plug Taps	For Bott. Taps	Fin. Plug Tap No.	Fin. Bott. Tap No.	Tap Major Dia. Max.	Min.	Max.	Min.	Max.	Thread Plug Gages	Inserting Tool No.	Automatic	Manual	Extracting Tool No.
Unified Coarse																
2 (.086) - 56	3/32 (.0938)	No. 41 (.0960)	.098	.045	02CPB	02CBB	.1117	.0976	.0989	.0899	.0961	1688-02	551-02	3695-02	4156-02	1227-02
3 (.099) - 48	No. 36 (.1065)	7/64 (.1094)	.115	.052	031CPB	031CBB	.1289	.1126	.1140	.1036	.1104	1688-031	551-031	3695-02	4156-02	1227-06
4 (.112) - 40	No. 31 (.1200)	No. 31 (.1200)	.138	.063	04CPB	04CBB	.1473	.1283	.1299	.1175	.1252	1688-04	7551-04	3695-04	4156-04	1227-06
5 (.125) - 40	No. 30 (.1290)	No. 29 (.1360)	.138	.063	05CPB	05CBB	.1603	.1413	.1430	.1305	.1373	1688-05	7551-05	3695-04	4156-05	1227-06
6 (.138) - 32	No. 26 (.1470)	No. 25 (.1495)	.172	.078	06CPB	06CBB	.1817	.1583	.1601	.1448	.1527	1688-06	7551-06	3695-06	4156-06	1227-06
8 (.164) - 32	No. 17 (.1730)	No. 16 (.1770)	.172	.078	2CPB	2CBB	.2077	.1843	.1862	.1708	.1781	1688-2	7551-2	3695-2	4156-2	1227-06
10 (.190) - 24	13/64 (.2031)	No. 5 (.2055)	.229	.104	3CPB	3C8B	.2475	.2170	.2192	.1990	.2080	1688-3	7551-3	3695-3	4156-3	1227-6
12 (.216) - 24	No. 1 (.2280)	No. 1 (.2280)	.229	.104	1CPB	1CBB	.2735	.2430	.2453	.2250	.2340	1688-1	7551-1	3695-3	4156-1	1227-6

Table 9-3. Helical Coil Insert Tapped Hole and Tooling Data - Continued

	Drilling Data				* Class 38 Tapping Data							* Gages and Installations Data				
	Suggested Drill Size		Min. Depth = Insert Length "L" +		Min. Depth Full Tapped Thread = Insert Length "L"									Break-Off Tool No.		
								Pitch Diameter		Minor Diameter (After Tapping)						
Nominal Thread Size	Aluminum	Steel Magnesium Plastic	For Plug Taps	For Bott. Taps	Fin. Plug Tap No.	Fin. Bott. Tap No.	Tap Major Dia. Max.	Min.	Max.	Min.	Max.	Thread Plug Gages	Inserting Tool No.	Auto-matic	Manual	Extracting Tool No.
1/4 (.250) - 20	H (.2660)	H (.2660)	.275	.125	4CPB	4CBB	.3187	.2825	.2851	.2608	.2704	1688-4	7551-4	3695 -4	4156 -4	1227 -6
5/16 (.3125) -18	Q (.3320)	Q (.3320)	.306	.139	5CPB	5CBB	.3884	.3486	.3515	.3245	.3342	1688-5	7551-5	3695 -5	4156 -5	1227 -6
3/8 (.3750) -16	X (.3970)	X (.3970)	.344	.156	6CPB	6CBB	.4602	.4156	.4189	.3885	.3987	1688-6	7551-6	3695 -6	4156 -6	1227 -6
7/16 (.4375) -14	29/64 (.4531)	29/64 (.4531)	.393	.179	7CPB	7CBB	.5343	.4839	.4875	.4530	.4639	1688-7	7551-7	3695 -7	4156 -7	1227 -16
1/2 (.5000) -13	33/64 (.5156)	17/32 (.5312)	.423	.192	8CPB	8CBB	.6042	.5499	.5537	.5166	.5273	1688-8	7551-8	3695 -8	4156 -8	1227 -16
9/16 (.5625) -12	37/64 (.5781)	19/32 (.5938)	.458	.208	187-9	4187-9	.6751	.6167	.6208	.5806	.5918	1688-9	3724-9			1227 -16
5/8 (.6250) -11	21/32 (.6562)	21/32 (.6562)	.500	.227	8187-10	10187 -10	.7477	.6841	.6885	.6447	.6564	1688-10	3724-10			1227 -16
3/4 (.7500) -10	25/32 (.7812)	25/32 (.7812)	.550	.250	8187-12	10187 -12	.8850	.8149	.8196	.7716	.7838	1688-12	3724-12			1227 -16

Table 9-3. Helical Coil Insert Tapped Hole and Tooling Data - Continued

	Drilling Data				* Class 38 Tapping Data							* Gages and Installations Data				
	Suggested Drill Size		Min. Depth = Insert Length “L” +		Min. Depth Full Tapped Thread = Insert Length “L”									Break-Off Tool No.		
								Pitch Diameter		Minor Diameter (After Tapping)						
Nominal Thread Size	Aluminum	Steel Magnesium Plastic	For Plug Taps	For Bott. Taps	Fin. Plug Tap No.	Fin. Bott. Tap No.	Tap Major Dia. Max.	Min.	Max.	Min.	Max.	Thread Plug Gages	Inserting Tool No.	Automatic	Manual	Extracting Tool No.
7/8 (.8750) -9	29/32 (.9062)	29/32 (.9062)	.611	.278	8187-14	10187-14	1.0247	.9471	.9522	.8990	.9119	1688-14	3724-14			1227-16
1 (1.0000) -8	1-1/32 (1.0312)	1-1/32 (1.0312)	.688	.313	8187-16	10187-16	1.1681	1.0812	1.0868	1.0271	1.0421	1688-16	3724-16			1227-16
1-1/8 (1.1250) -7	1-11/64 (1.1719)	1-11/64 (1.1719)	.786	.357	8187-18	10187-18	1.3171	1.2178	1.2239	1.1559	1.1730	1688-18	3724-18			1227-24
1-1/4 (1.2500) -7	1-19/64 (1.2969)	1-19/64 (1.2969)	.786	.357	8187-20	10187-20	1.4421	1.3428	1.3490	1.2809	1.2980	1688-20	3724-20			1227 24
1-3/8 (1.3750) -6	1-27/64 (1.4219)	1-27/64 (1.4219)	.917	.417	8187-22	10187-22	1.5982	1.4832	1.4900	1.4110	1.4310	1688-22	3724-22	**	**	1227-24
1-1/2 (1.5000) -6	1-35/64 (1.5469)	1-35/64 (1.5469)	.917	.417	8187-24	10187-24	1.7232	1.6082	1.6151	1.5360	1.5560	1688-24	3724-24			1227-24
Unified Fine																
3 (.099) - 56	No. 37 (.1040)	No. 36 (.1065)	.098	.045	03FPB	03FBB	.1247	.1106	.1119	.1029	.1086	1694-03	7552-03	3695-02	4156-02	1227-06
4 (.112) - 48	No. 31 (.1200)	No. 31 (.1200)	.115	.052	041FPB	041FBB	.1419	.1256	.1271	.1166	.1229	1694-041	7552-041	3695-04	4156-04	1227-06

Table 9-3. Helical Coil Insert Tapped Hole and Tooling Data - Continued

	Drilling Data				* Class 38 Tapping Data							* Gages and Installations Data				
	Suggested Drill Size		Min. Depth = Insert Length "L" +		Min. Depth Full Tapped Thread = Insert Length "L"									Break-Off Tool No.		
								Pitch Diameter		Minor Diameter (After Tapping)						
Nominal Thread Size	Aluminum	Steel Magnesium Plastic	For Plug Taps	For Bott. Taps	Fin. Plug Tap No.	Fin. Bott. Tap No.	Tap Major Dia. Max.	Min.	Max.	Min.	Max.	Thread Plug Gages	Inserting Tool No.	Automatic	Manual	Extracting Tool No.
6 (.138) - 40	No. 26 (.1470)	No. 25 (.1495)	.138	.063	06FPB	06FBB	.1733	.1543	.1560	.1435	.1503	1694-06	7552-06	3695-06	4156-06	1227-06
8 (.164) - 36	No. 17 (.1730)	No. 16 (.1770)	.153	.069	2FPB	2FBB	.2032	.1821	.1840	.1701	.1771	1694-2	7552-2	3695-2	4156-2	1227-06
10 (.190) - 32	No. 7 (.2010)	13/64 (.2031)	.172	.078	3FPB	3FBB	.2337	.2103	.2123	.1968	.2041	1694-3	75523	3695-3	4156-3	1227-6
1/4 (.2500) -28	G (.2610)	17/64 (.2660)	.196	.089	4FPB	4FBB	.2995	.2732	.2754	.2577	.2646	1694-4	7552-4	3695-4	4156-4	1227-6
5/16 (.3125 -24	21/64 (.3281)	21/64 (.3281)	.229	.104	5FPB	5FBB	.3700	.3395	.3421	.3215	.3288	1694-5	7552-5	3692-5	4156-5	1227-6
3/8 (3750) - 24	25/64 (.3906)	25/64 (.3906)	.229	.104	6FPB	6FBB	.4325	.4020	.4047	.3840	.3910	1694-6	7552-6	3692-6	4156-6	1227-6
7/16 (.4375) -20	29/64 (.4531)	29/64 (.4531)	.275	.125	7FPB	7FBB	.5062	.4700	.4731	.4483	.4561	1694-7	7552-7	3692-7	4156-7	1227-16
1/2 (.5000) -20	33/64 (.5156)	33/64 (.5156)	.275	.125	8FPB	8FBB	.5687	.5325	.5357	.5108	.5186	1694-8	7552-8	3692-8	4156-8	1227-16

Table 9-3. Helical Coil Insert Tapped Hole and Tooling Data - Continued

	Drilling Data				* Class 38 Tapping Data							* Gages and Installations Data				
	Suggested Drill Size		Min. Depth = Insert Length "L" +		Min. Depth Full Tapped Thread = Insert Length "L"									Break-Off Tool No.		
								Pitch Diameter		Minor Diameter (After Tapping)						
Nominal Thread Size	Aluminum	Steel Magnesium Plastic	For Plug Taps	For Bott. Taps	Fin. Plug Tap No.	Fin. Bott. Tap No.	Tap Major Dia. Max.	Min.	Max.	Min.	Max.	Thread Plug Gages	Inserting Tool No.	Automatic	Manual	Extracting Tool No.
9/16 (.5625) -18	37/64 (.5781)	37/64 (.5781)	.306	.139	38193-9	43193-9	.6384	.5986	.6020	.5745	.5826	1694-9	535-9			1227-16
5/8 (.6250) -18	41/64 (.6406)	41/64 (.6406)	.306	.139	8193 -10	10193-10	.7009	.6611	.6646	.6370	.6451	1694-10	535-10			1227-16
3/4 (.7500) -16	49/64 (.7656)	49/64 (.7656)	.344	.156	8193 -12	10193-12	.8352	.7906	.7945	.7635	.7720	1694-12	535-12			1227-16
7/8 (.8750) -14	57/64 (.8906)	57/64 (.8906)	.393	.179	8193 -14	10193-14	.9718	.9214	.9257	.8905	.8994	1694-14	535-14			1227-16
1 (1.0000) -14	1-1/64 (1.0156)	1-1/32 (1.0312)	.393	.179	8193 -16	10193-16	1.0968	1.0464	1.0508	1.0155	1.0243	1694-16	535-16			1227-16
1 (1.0000) -12	1-1/64 (1.0156)	1-1/32 (1.0312)	.458	.208	8193 -161	10193-161	1.1126	1.0542	1.0589	1.0181	1.0281	1694-161	535-161			1227-16
1-1/8 (1.1250) -12	1 9/64 (1.1406)	1-5/32 (1.1562)	.458	.208	8193 -18	10193-18	1.2376	1.1792	1.1841	1.1431	1.1531	1694-18	535-18			1227-24
1-1/4 (1.2500) -12	1-17/64 (1.2656)	1-9/32 (1.2812)	.458	.208	8193 -20	10193-20	1.3626	1.3042	1.3092	1.2681	1.2781	1694-20	535-20			1227-24

Table 9-3. Helical Coil Insert Tapped Hole and Tooling Data - Continued

	Drilling Data				* Class 38 Tapping Data							* Gages and Installations Data				
	Suggested Drill Size		Min. Depth = Insert Length "L" +		Min. Depth Full Tapped Thread = Insert Length "L"									Break-Off Tool No.		
								Pitch Diameter		Minor Diameter (After Tapping)						
Nominal Thread Size	Aluminum	Steel Magnesium Plastic	For Plug Taps	For Bott. Taps	Fin. Plug Tap No.	Fin. Bott. Tap No.	Tap Major Dia. Max.	Min.	Max.	Min.	Max.	Thread Plug Gages	Inserting Tool No.	Automatic	Manual	Extracting Tool No.
1-3/8 (1.3750) -12	1-25/64 (1.3906)	1-13/32 (1.4062)	.458	.208	8193 - 22	0193 - 22	1.4876	1.4292	1.4343	1.3931	1.4031	1694-22	535-22			1227-24
1-1/2 (1.5000) -12	1-33/64 (1.5156)	1-17/32 (1.5312)	.458	.208	8193 - 24	0193 - 24	1.6126	1.5542	1.5595	1.5181	1.5281	1694-24	535-24	**	**	1227-24

* Part Numbers per CAGE 01556.

**For Sizes over 1/2″ use long-nosed pliers. Bend tang up and down to snap off at notch.

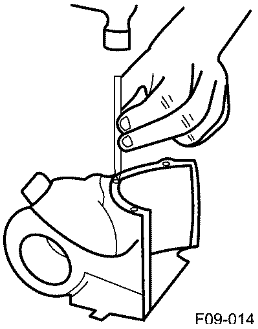


Figure 9-14. Tang Break-Off

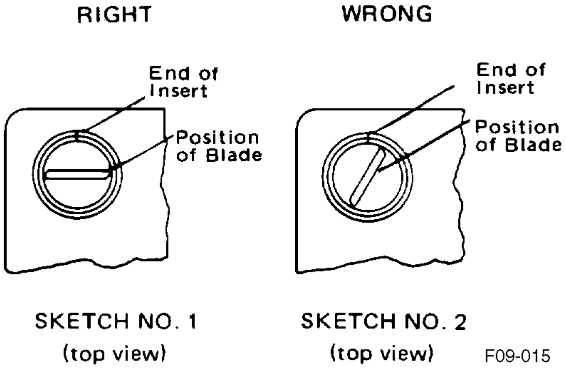


Figure 9-15. Positioning Extractor Blade

9.8.1 Oversize Inserts. Oversize Inserts, both free-running and Screw-Locking, are made of slightly larger wire and are identified by yellow marking on the tang and first coil. They are used to repair oversize insert assemblies where an error has occurred in tapping for installation of inserts. Out-of-round tapped holes, tapered, and bell-mouth conditions may also be corrected by installing Oversize Inserts. Oversize Insert Repair Packs for each size are shown in Table 9-14. Each pack contains a special oversize bottoming tap and a quantity of 1 1/2 and 2 diameter length Standard and Screw-Locking Inserts. See Table 9-5 for individual items.

9.8.2 Twinserts. Twinserts consist of two inserts: an outer insert, always free-running; and an inner insert, which may be either free-running or Screw-Locking, depending on the application. Twinserts are recommended for restoring screw thread insert tapped holes that are stripped, off-center, or damaged. In addition, they should be used when the oversize condition is beyond the corrective range of the Oversize Insert. Twinsert assemblies will restore the thread within a Class 2B fit. Follow Twinsert installation procedure in Table 9-6. Twinsert taps and tools are listed in Table 9-7.

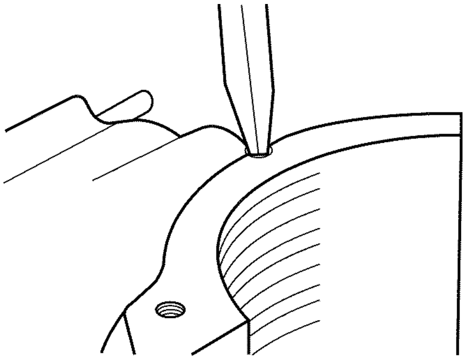


Figure 9-16. Extracting Insert

Table 9-4. Oversize Insert Installation

Number	Operation Description
10	Determine first whether Standard or Screw-Locking Insert is involved.
20	If necessary remove insert from assembly and clean out hole.
30	Retap with Oversize tap.
40	Install selected Oversize Insert with correct inserting tool for desired thread size, and break off tang.
50	Check assembly with appropriate standard thread gage. If hole is still oversize, remove insert and repair with a Twinsert assembly, following procedure in Table 9-6.

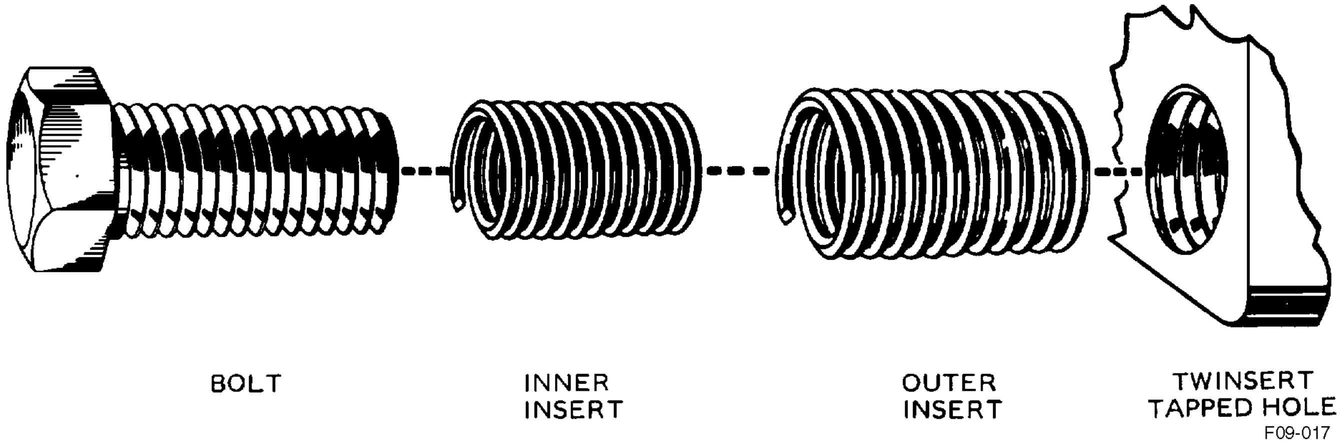


Figure 9-17. Helical Coil Screw Thread or Screw-Locking Twinset Assembly

Table 9-5. Oversize Screw Thread and Screw-Locking Inserts and Taps***

Nominal Thread Size	Screw Thread Insert Part Number*	Screw-Lock Insert Part Number*	Insert Nom. Length*		Oversize Bottom Tap Part Number	Approximate Oversize Correction**
			1 1/2 Dia.	2 Dia.		
Unified Coarse						
4-40	8185-04CN	3885-04CN	.168	.224	56187-04-2	.0034
5-40	8185-05CN	3885-05CN	.188	.250	56187-05-2	.0034
6-32	8185-06CN	3885-06CN	.207	.276	56187-06-2	.0040
8-32	8185-2CN	3885-2CN	.246	.328	56187-2-2	.0040
10-24	8185-3CN	3885-3CN	.285	.380	56187-3-2	.0050
12-24	8185-1CN		.324	.432	56187-1-2	.0050
1/4-20	8185-4CN	3885-4CN	.375	.500	56187-4-2	.0060
5/16-18	8185-5CN	3885-5CN	.469	.625	56187-5-2	.0060
3/8-16	8185-6CN	3885-6CN	.562	.750	56187-6-2	.0066
7/16-14	8185-7CN	3885-7CN	.656	.875	56187-7-2	.0074
1/2-13	8185-8CN	3885-8CN	.750	1.000	56187-8-2	.0056
Unified Fine						
6-40	8191-06CN	3891-06CN	.207	.276	56193-06-2	.0034
10-32	8191-3CN	3891-3CN	.285	.380	56193-3-2	.0040
1/4-28	8191-4CN	3891-4CN	.375	.500	56193-4-2	.0042
5/16-24	8191-5CN	3891-5CN	.469	.625	56193-5-2	.0050
3/8-24	8191-6CN	3891-6CN	.562	.750	56193-6-2	.0050
7/16-20	8191-7CN	3891-7CN	.656	.875	56193-7-2	.0060
1/2-20	8191-8CN	3891-8CN	.750	1.000	56193-8-2	.0060

*Add length to complete part number (e.g., B185-4CN 0500).

**Effective correction to oversize pitch diameter.

***Part numbers per CAGE 01556.

Table 9-6. Twinsert Installation

Number	Operation Description	Reference
10	Drill minor diameter within minimum and maximum specifications. Drill to same depth as for original insert.	Table 9-8
20	Tap thread for Twinsert. Full tapped thread length should be the same as for original insert.	Table 9-8 and Table 9-9
30	Remove chips.	
40	Install outside Twinsert 1/4 to 1/2 pitch below surface with Twinsert inserting tool.	Paragraph 9.5.1
50	Break off outside Twinsert driving tang with tang break-off tool.	Paragraph 9.6
60	Install selected Standard or Screw-Locking Insert. Position end of insert flush with end of outside Twinsert, using the same installation tool that was used for the original Helical Coil Insert.	Paragraph 9.5.1
70	Break off insert driving tang with tang break-off tool.	Paragraph 9.6

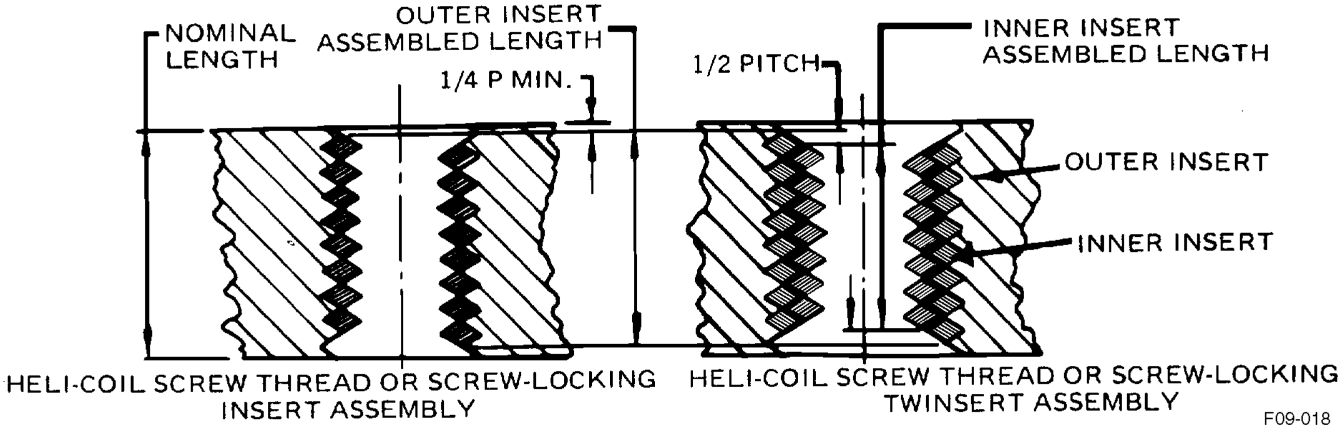


Figure 9-18. Cross-Sectional Views of Helical Coil Insert and Twinsert Assemblies

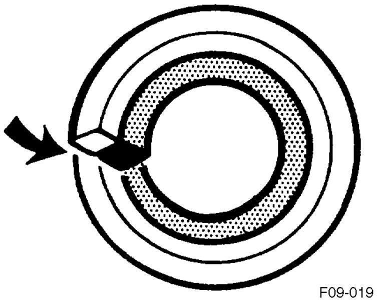


Figure 9-19. Top View of Outer and Inner Inserts (ends must be adjacent as shown)

Table 9-7. Twinsert Tool Numbers *

Nominal Size	Tap Part No.	Inserting Tool Part No.	Tang Break-Off Tool No.
Unified Coarse			
2-56	3887-02	2698-02	4032-02
3-48	3887-031	2698-031	4032-04
4-40	3887-04	2698-04	4032-04
5-40	3887-05	2698-05	4032-05
6-32	3887-06	2698-06	4032-06
8-32	3887-2	2698-2	4032-2
10-24	3887-3	2698-3	4032-3
12-24	3887-1	2698-1	4032-1
1/4-20	3987-4	2698-4	4032-4
5/16-18	3987-5	2698-5	4032-5
3/8-16	3987-6	2698-6	4032-6
7/16-14	4087-7	2698-7	4032-7
1/2-13	4087-8	2698-8	4032-8
9/16-12	4087-9	2698-9	
5/8-11	4087-10	2698-10	
3/4-10	4087-12	2698-12	
Unified Fine			
4-48	3893-041	2705-041	4032-04
6-40	3893-06	2705-06	4032-06
8-36	3893-2	2705-3	4032-04
10-32	3893-3	2705-3	4032-3
1/4-28	3893-4	2705-4	4032-4
5/16-24	3893-5	2705-5	4032-5
3/8-24	3993-6	2705-6	4032-6
7/16-20	3993-7	2705-7	4032-7
1/2-20	3993-8	2705-8	4032-8
9/16-18	3993-9	2705-9	
5/8-18	3993-10	2705-10	
3/4-16	3993-12	2705-12	

*Part numbers per CAGE 01556.

Table 9-8. Twinsert Tapped Hole Dimensions

Coarse Series Class 2B

Nominal Thread Size	Minor Dia. After Tapping		Suggested Drill Size		Tap Major Dia.	Pitch Dia.	
	Min.	Max.	Alum.	Steel	Max.	Min.	Max.
2-56	.1131	.1184	32 (.1160)	32 (.1160)	.1349	.1208	.1220
3-48	.1306	.1362	30 (.1285)	29 (.1360)	.1559	.1396	.1410
4-40	.1500	.1568	24 (.1520)	23 (.1540)	.1798	.1608	.1625
5-40	.1630	.1692	19 (.1660)	18 (.1695)	.1928	.1738	.1755
6-32	.1854	.1927	12 (.1890)	11 (.1910)	.2223	.1989	.2008
8-32	.2114	.2181	3 (.2130)	7/32 (.2138)	.2483	.2249	.2269
10-24	.2531	.2611	‘‘F’’ (.2570)	‘‘G’’ (.2610)	.3016	.2711	.2734
12-24	.2791	.2871	9/32 (.2812)	9/32 (.2812)	.3276	.2971	.2995
1/4-20	.3258	.3346	21/64 (.3281)	‘‘Q’’ (.3320)	.3836	.3474	.3502
5/16-18	.3966	.4057	‘‘X’’ (.3970)	‘‘Y’’ (.4040)	.4605	.4207	.4240
3/8-16	.4697	.4789	15/32 (.4688)	15/32 (.4688)	.5414	.4968	.5005
7/16-14	.5458	.5558	35/64 (.5469)	9/16 (.5625)	.6271	.5767	.5808
1/2-13	.6165	.6265	5/8 (.6250)	5/8 (.6250)	.7041	.6498	.6543
9/16-12	.6888	.6997	11/16 (.6875)	45/64 (.7031)	.7833	.7249	.7297
5/8-11	.7628	.7728	49/64 (.7656)	49/64 (.7656)	.8658	.8022	.8074
3/4-10	.9015	.9135	29/32 (.9062)	29/32 (.9062)	1.0149	.9448	.9505

Fine Series Class 2B

Nominal Thread Size	Minor Dia. After Tapping		Suggested Drill Size		Tap Major Dia.	Pitch Dia.	
	Min.	Max.	Alum.	Steel	Max.	Min.	Max.
3-56	.1266	.1319	30 (.1285)	30 (.1285)	.1479	.1338	.1350
4-48	.1436	.1492	26 (.1470)	26 (.1470)	.1689	.1526	.1541
6-40	.1760	.1822	15 (.1800)	14 (.1820)	.2058	.1868	.1886
10-32	.2374	.2441	‘‘C’’ (.2420)	‘‘D’’ (.2460)	.2743	.2509	.2530
1/4-28	.3041	.3110	5/16 (.3125)	5/16 (.3125)	.3459	.3196	.3219
5/16-24	.3756	.3826	‘‘V’’ (.3770)	‘‘V’’ (.3770)	.4241	.3936	.3964
3/8-24	.4381	.4451	7/16 (.4375)	7/16 (.4375)	.4866	.4561	.4590
7/16-20	.5132	.5210	33/64 (.5156)	33/64 (.5156)	.5711	.5349	.5383
1/2-20	.5758	.5836	37/64 (.5781)	37/64 (.5781)	.6336	.5974	.6010
9/16-18	.6466	.6547	41/64 (.6406)	21/32 (.6562)	.7105	.6707	.6746
5/8-18	.7092	.7173	45/64 (.7031)	23/32 (.7188)	.7730	.7332	.7372
3/4-16	.8447	.8532	27/32 (.8438)	55/64 (.8594)	.9164	.8718	.8763

9.9 SPARK PLUG THREAD SIZES.

9.9.1 Instructions. Following are instructions for repair of stripped 14 and 18mm spark plug threads using Helical Coil Spark Plug Inserts. Helical Coil 18-1.5mm inserts comply with MS9018 and MS9071:

a. Drill out the tapped 14 or 18mm damaged threads using drill size suggested in Table 9-10, keeping within the drilled hole limits shown in the table. If necessary, change drill to another size to meet limits. If Helical Coil Spark Plug Inserts were used originally and are to be replaced by new ones, remove the old ones by lifting the top coil, which is staked, from the cylinder head with a tool such as a scriber or a sharp-bladed screwdriver. Then use the extracting tool listed in Table 9-10, following instructions in paragraph 9.8. After removing the insert, use a Helical Coil Finishing Tap in the threaded hole to remove any burrs. If conditions warrant, use the oversize tap and install Oversize Inserts.

b. Tap with the 14 or 18 mm finishing tap (roughing tap optional).

c. Remove any chips. Blow them out and clean the threads thoroughly.

d. Gage tapped threads with appropriate gage.

e. Install the correct insert with inserting tool listed in Table 9-10, using the method described in paragraph 9.5.1 on installing inserts; however, the serrated end of the coil should be 1 to 1 1/4 pitch below the top surface of the hole for satisfactory staking of the serrated coil. If the insert has been driven deeper than this, drive it all the way through the hole and start it again. No portion of the insert should extend into the combustion chamber.

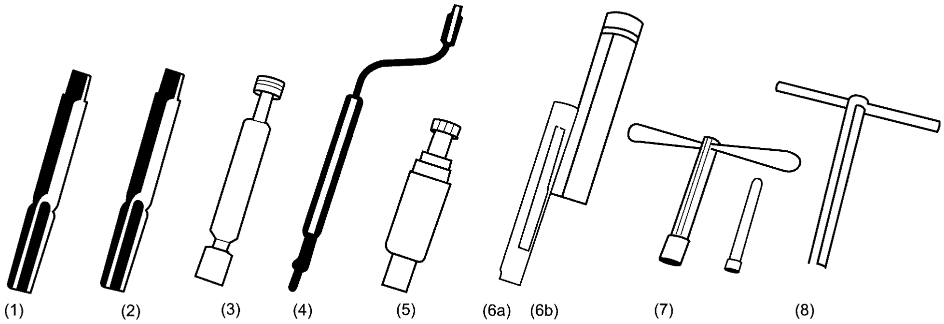
f. Remove the tang. Use a pair of long-nose pliers: Grasp tang near the notch, and, with an up-and-down bending motion, being careful not to remove the last coil of the insert from the tapped thread, break off the tang and discard it.

g. Expand the insert with the correct expanding tool selected from Table 9-10 and screw it into the installed insert as far as it will go. Set the adjustment nut to permit adequate expanding action. Tap the head of the plunger with a small hammer until the insert is firmly seated in the tapped threads of the spark plug hole. Draw out the plunger by turning down the adjustment nut, then back out the body of the expanding tool.

h. Gage the assembly with a conventional 14 or 18 mm gage. If the pitch diameter is too small, use the expander again, resetting the adjustment nut for additional expansion if necessary. When, gaging, if the pitch diameter of the assembled insert is found to be too large, the insert may be replaced by an oversize increment insert.

i. Offset and stake the serrated portion of the insert. The offset and staking tool (Table 9-10) is a combination tool, the offset portion of which is used to embed the teeth of the serrated coil of the insert into the parent material, and the staking part being used to anchor the teeth in that position. Screw the offsetting portion of the tool all the way into the insert until the run-out thread of the tool has engaged the top coil of the insert. Using a wrench, continue to turn the offsetting tool (Figure 9-21) until the scribed index line on the shank has moved clockwise approximately 1/4″ past the end of the insert. A rapid increase in torque will be simultaneously evident, which assures that the end of the top coil is sufficiently offset.

j. Slip the sleeve or staking portion of the offset and staking tool over the offsetting tool still in position as described at the end of step i (Figure 9-22). Tap the sleeve lightly with a hammer, rotating it between taps, to further anchor the serrated section of the insert into the parent material.



(1) Roughing Tap (2) Finishing Tap (3) Plug Gage (4) Inserting Tool (5) Expanding Tool (6a) Offsetting Tool (6b) Staking Sleeve (7) Spot-Facing Tool (8) Extracting Tool

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Figure 9-20. Spark Plug Tools and Gages

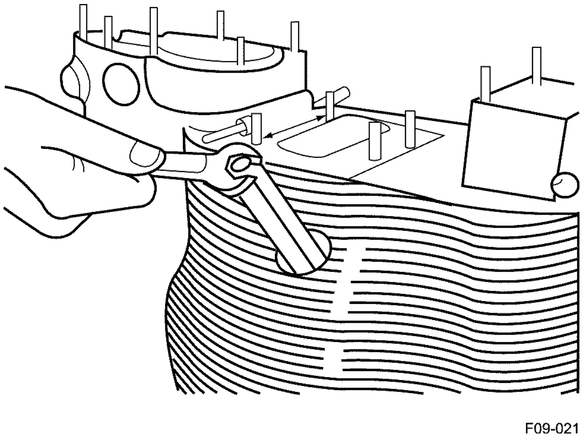


Figure 9-21. Using Offsetter

k. The face of the hole on which the spark plug gasket is to rest should be inspected for misalignment and corrected for rough or high spots, which can be removed with a spot-facing tool (Figure 9-23, Table 9-10) in the following manner: Remove the expanding mandrel from the cutter sleeve of the spot-facing tool with the mandrel in a collapsed position. Install the threaded portion 2 or 3 turns below the top of the insert and tighten the nut at the top of the mandrel, locking it securely into the installed insert. Place the cutter over the mandrel and rotate the cutter until the bearing surface around the threaded hole is square with the installed Spark Plug Insert.

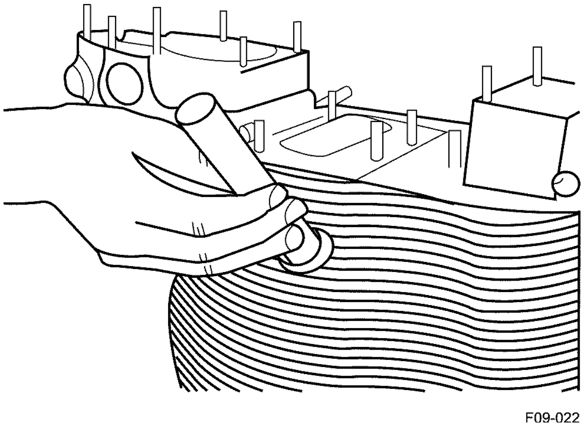


Figure 9-22. Mounting Staking Sleeve

9.10 TAPERED PIPE THREAD SIZES.

9.10.1 Instructions. Damaged or stripped tapered pipe threads are repaired and replaced with the tools and inserts listed in Table 9-11 and the tools are also pictured in Figure 9-24.

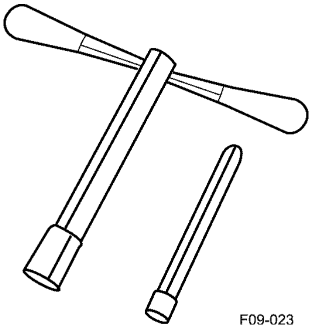


Figure 9-23. Spot-Facer

a. Determine the original tapered pipe thread size and use the recommended drill (Table 9-11) for opening the hole.

b. Ream the drilled hole within indicated limits by using the correct listed tapered reamer.

c. Use an STI Taper Pipe Thread Tap for the required thread size. Tap the thread to the depth permitted by wire wrapped around the thread of the tap.

d. Blow out chips. Clean the hole thoroughly, removing all chips and foreign matter.

e. Gaging tapered pipe threads is different from gaging straight threads and involves three plug gages per thread size, as shown in Table 9-11: a thread gage to check the tapered threads at the larger end of the taper, a thread gage to check the threads at the small end of the taper, and a plain tapered plug gage to check the thread truncation or minor thread diameter. Gaging procedure conforms to conventional taper pipe thread practice.

f. Gage by using the 330 and 331 thread gages, which have three steps or shoulders ground on the gage. When using the 330 gage to check the taper threads at the larger end of the tapped hole, the gage may be assembled in the tapped thread up to the Basic step or notch, plus or minus one turn. After a reading is obtained with the 330 gage, the 331 gage is screwed into the tapped hole to check the smaller end. The reading of the 331 gage must correspond to the reading obtained on the 330 gage plus or minus one-half turn in order to have an acceptable assembly, provided the 331 gage does not vary from its Basic reading by more than plus or minus one turn.

Table 9-9. Helical Coil Screw Thread and Screw-Locking Twinserts

Unified Coarse												
Nominal Thread Size	Insert Part Number*		Insert Length* (L)				Outside Diameter		Number of Free Coils			
			1-1/2 Dia.	2 Dia.	2-1/2 Dia.	3 Dia.	Min.	Max.	1-1/2 Dia.	2 Dia.	2-1/2 Dia.	3 Dia.
Outer Insert												
2-56	2385-02		.129	.172	.215	.258	.131	.146	5-1/4	7-1/2	9-5/8	11-7/8
3-48	2385-031		.148	.198	.248	.297	.157	.175	4-7/8	7	9	11-1/8
4-40	2385-04		.168	.224	.280	.336	.173	.193	4-3/4	6-7/8	8-7/8	11
5-40	2385-05		.188	.250	.312	.375	.186	.206	5-5/8	7-7/8	10-1/8	12-1/2
6-32	2385-06		.207	.276	.345	.414	.215	.235	4-3/4	6-3/4	8-3/4	10-7/8
8-32	2385-2		.246	.328	.410	.492	.241	.261	6	8-3/8	10-7/8	13-1/4
10-24	2385-3		.285	.380	.475	.570	.294	.314	5	7-1/8	9-1/4	11-3/8
12-24	2385-1		.324	.432	.540	.648	.321	.341	5-7/8	8-3/8	10-3/4	13-1/8
1/4-20	2385-4		.375	.500	.625	.750	.374	.396	5-5/8	8	10-3/8	12-3/4
5/16-18	2385-5		.469	.625	.781	.938	.454	.474	6-5/8	9-1/4	11-7/8	14-1/2
3/8-16	2385-6		.562	.750	.938	1.125	.536	.556	7-1/8	10	12-3/4	15-5/8
7/16-14	2385-7		.656	.875	1.094	1.312	.622	.647	7-1/4	10-1/8	13-1/8	16
1/2-13	2385-8		.750	1.000	1.250	1.500	.700	.725	7-7/8	10-7/8	14	17
9/16-12	2385-9		.844	1.125	1.406	1.688	.780	.790	8-1/4	11-3/8	14-5/8	17-7/8
5/8-11	2385-10		.938	1.250	1.562	1.875	.863	.880	8-3/8	11-5/8	14-7/8	18-1/8
3/4-10	2385-12		1.125	1.500	1.875	2.250	1.014	1.039	9-1/4	12-7/8	16-1/2	20
Unified Coarse												
Inner Insert												
	Screw Thread*	Screw-Locking*										
2-56	4485-02	4685-02	.111	.154	.197	.240	.110	.119	4-1/4	6-1/2	8-3/4	10-7/8
3-48	4485-031	4685-031	.127	.177	.227	.276	.128	.139	4-1/8	6-1/4	8-1/2	10-5/8
4-40	4485-04	4685-04	.143	.199	.255	.311	.144	.159	3-7/8	5-7/8	7-7/8	10
5-40	4485-05	4685-05	.163	.225	.288	.350	.158	.173	4-5/8	6-7/8	9-1/8	11-3/8
6-32	4485-06	4685-06	.176	.245	.314	.383	.178	.193	3-3/4	5-3/4	7-3/4	9-7/8
8-32	4485-2	4685-2	.215	.297	.379	.461	.205	.220	5	7-3/8	9-3/4	12-1/8

Table 9-9. Helical Coil Screw Thread and Screw-Locking Twinserts - Continued

Unified Coarse											
Nominal Thread Size	Insert Part Number*		Insert Length* (L)				Outside Diameter		Number of Free Coils			
			1-1/2 Dia.	2 Dia.	2-1/2 Dia.	3 Dia.	Min.	Max.	1-1/2 Dia.	2 Dia.	2-1/2 Dia.	3 Dia.
Inner Insert												
10-24	4485-3	4685-3	.243	.338	.433	.528	.244	.259	4	6-1/8	8-1/4	10-3/8
12-24	4485-1	4685-1	.282	.390	.498	.606	.270	.285	4-7/8	7-3/8	9-3/4	12-1/8
1/4-20	4485-4	4685-4	.325	.450	.575	.700	.310	.330	4-5/8	7	9-3/8	11-5/8
5/16-18	4485-5	4685-5	.413	.569	.726	.882	.380	.400	5-5/8	8-1/4	10-7/8	13-1/2
3/8-16	4485-6	4685-6	.500	.688	.875	1.062	.452	.472	6-1/8	9	11-7/8	14-3/4
7/16-14	4485-7	4685-7	.585	.804	1.022	1.241	.526	.551	6-3/8	9-1/4	12-1/8	15
1/2-13	4485-8	4685-8	.673	.923	1.173	1.423	.597	.622	6-7/8	9-7/8	13	16
9/16-12	4485-9	4685-9	.761	1.042	1.323	1.605	.669	.694	7-1/4	10-3/8	13-5/8	16-7/8
5/8-11	4485-10	4685-10	.847	1.159	1.471	1.784	.742	.767	7-3/8	10-5/8	13-7/8	17-1/8
3/4-10	4485-12	4685-12	1.025	1.400	1.775	2.150	.881	.906	8-3/8	11-7/8	15-1/2	19
Outer Insert												
4-48	2391-041		.168	.224	.280	.336	.176	.196	5-1/2	7-3/4	10-1/8	12-3/8
6-40	2391-06		.207	.276	.345	.414	.208	.228	6	8-1/2	10-7/8	13-3/8
10-32	2391-3		.285	.380	.475	.570	.280	.300	6-3/4	9-1/2	12-1/4	15
1/4-28	2391-4		.375	.500	.625	.750	.356	.376	8-1/8	11-1/4	14-3/8	17-1/2
5/16-24	2391-5		.469	.625	.781	.938	.438	.458	8-7/8	12-1/4	15-5/8	19
3/8-24	2391-6		.562	.750	.938	1.125	.506	.526	10-7/8	15	19	23-1/8
7/16-20	2391-7		.656	.875	1.094	1.312	.594	.619	10-1/2	14-1/2	18-1/2	22-3/8
1/2-20	2391-8		.750	1.000	1.250	1.500	.662	.687	12-1/4	16-7/8	21-3/8	26
9/16-18	2391-9		.844	1.125	1.406	1.688	.744	.769	12-3/8	17	21-5/8	26-1/4
5/8-18	2391-10		.938	1.250	1.562	1.875	.811	.836	14	19-1/8	24-1/4	29-3/8
3/4-16	2391-12		1.125	1.500	1.875	2.250	.967	.992	15	20-1/2	25-7/8	31-3/8
Unified Fine												
Inner Insert												
4-48	4491-041	4691-041	.147	.203	.259	.315	.147	.162	4-3/4	7	9-3/8	11-5/8
6-40	4491-06	4691-06	.182	.251	.320	.389	.173	.193	5-1/8	7-1/2	9-7/8	12-3/8
10-32	4491-3	4691-3	.254	.349	.444	.539	.236	.256	5-7/8	8-5/8	11-1/4	14

Table 9-9. Helical Coil Screw Thread and Screw-Locking Twinserts - Continued

Unified Coarse												
Nominal Thread Size	Insert Part Number*		Insert Length* (L)				Outside Diameter		Number of Free Coils			
			1-1/2 Dia.	2 Dia.	2-1/2 Dia.	3 Dia.	Min.	Max.	1-1/2 Dia.	2 Dia.	2-1/2 Dia.	3 Dia.
		Inner Insert										
1/4-28	4491-4	4691-4	.339	.464	.589	.714	.306	.326	7-1/8	10-1/4	13-3/8	16-1/2
5/16-24	4491-5	4691-5	.427	.583	.740	.896	.380	.400	7-7/8	11-1/4	14-5/8	18
3/8-24	4491-6	4691-6	.521	.708	.896	1.083	.448	.468	10	14	18-1/8	22-1/8
7/16-20	4491-7	4691-7	.606	.825	1.044	1.262	.524	.549	9-5/8	13-1/2	17-1/2	21-3/8
1/2-20	4491-8	4691-8	.700	.950	1.200	1.450	.592	.617	11-1/4	15-7/8	20-3/8	24-7/8
9/16-18	4491-9	4691-9	.788	1.069	1.350	1.632	.666	.691	11-1/2	16-1/8	20-5/8	25-1/4
5/8-18	4491-10	4691-10	.882	1.194	1.506	1.819	.733	.758	13-1/8	18-1/8	23-1/4	28-3/8
3/4-16	4491-12	4691-12	1.063	1.438	1.813	2.188	.876	.901	14-1/8	19-5/8	25-1/8	30-1/2

* Include the length of the insert as a suffix to the part number, e.g., 4491-4CN 0500, part numbers per CAGE 01556.

Table 9-10. Spark Plug Insert Installation and Tool Data

		Nominal Size	14-1.25 Mm		18-1.5 Mm		18-1.5 Mm +.003 Oversize		18-1.5 Mm +.005 Oversize		18-1.5 Mm +.010 Oversize		18-1.5 Mm +.015 Oversize	18-1.5 Mm +.020 Oversize	18-1.5 Mm +.025 Oversize
		Reach	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Long	Long
		Assembled Lgth	.359	.346	.683	.334	.683	.334	.683	.334	.683	.334	.683	.683	.683
		MS Number	* 137 -22	* 137 -23	9018 - 01	9018 - 05	9018 - 02	9018 - 06	9018 - 03	9018 - 07	9018 - 04	9016 - 08	9018 - 09	9018 - 10	9018 -11
Free Insert	Outside Dia.	Min.	.678		.885		.885		.885		.885		.905	.905	.905
		Max.	.698		.905		.905		.905		.905		.925	.925	.925
	Inside Dia.	Min.	.566		.728		.725		.723		.718		.733	.728	.723
		Max.	.594		.756		.753		.751		.746		.761	.756	.751
	No. Of Coils	(Approx.)	5-7/8	5-1/2	9-1/2	4-3/8	9-1/2	4-3/8	9-1/2	4-3/8	9-1/2	4-3/8	9-1/2	9-1/2	9-1/2
Suggested Drill Size			9/16		23/32		23/32		23/32		23/32		23/32	23/32	23/32
Drill Hole Dia.		Min.	.562		.718		.718		.718		.718		.718	.718	.718
		Max.	.567		.723		.723		.723		.723		.723	.723	.723
Tapped Thread Major Diameter		Min.	.613		.793		.796		.798		.803		.808	.813	.818
Tapped Thread Pitch Diameter		Min.	.5892		.7523		.7553		.7573		.7623		.7673	.7723	.7773
		Max.	.5917		.7543		.7573		.7593		.7643		.7693	.7743	.7793
Finishing Tap Major Diameter		Max.	.6218		.7994		.8029		.8049		.8099		.8144	.8194	.8244
Length Full Tapped Thread		Min.	.433	.420	.772	.423	.772	.423	.772	.423	.772	.423	.772	.772	.772
Roughing Tap		* Part No.	137-12		2-22		2-22		2-22		2-22		2-22	2-22	2-22
Finishing Tap		* Part No.	137-11		2-21		2-55		2-56		2-57		2-82	2-95	2-97

Table 9-10. Spark Plug Insert Installation and Tool Data - Continued

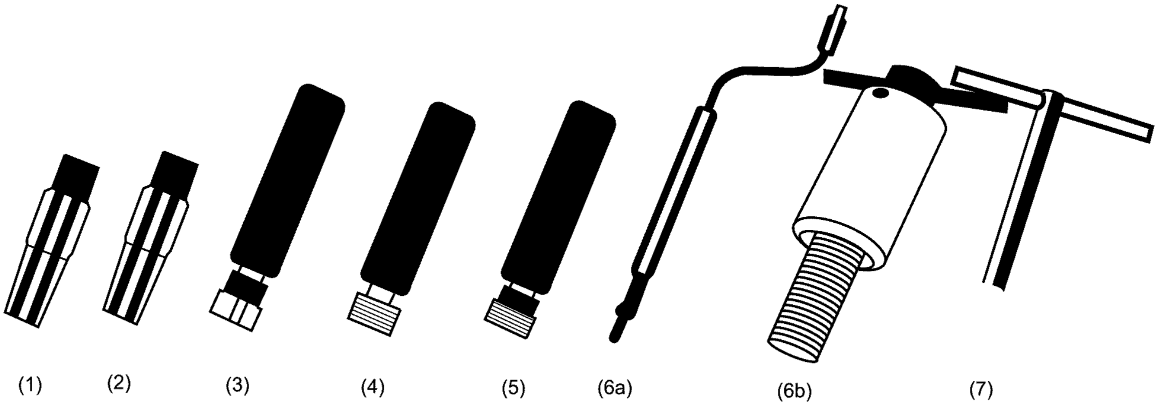
	Nominal Size	14-1.25 Mm		18-1.5 Mm		18-1.5 Mm +.003 Oversize		18-1.5 Mm +.005 Oversize		18-1.5 Mm +.010 Oversize		18-1.5 Mm +.015 Oversize	18-1.5 Mm +.020 Oversize	18-1.5 Mm +.025 Oversize
	Reach	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Long	Long
	Assembled Lgth	.359	.346	.683	.334	.683	.334	.683	.334	.683	.334	.683	.683	.683
	MS Number	* 137 -22	* 137 -23	9018 - 01	9018 - 05	9018 - 02	9018 - 06	9018 - 03	9018 - 07	9018 - 04	9016 - 08	9018 - 09	9018 - 10	9018 -11
Gage	* Part No.	137-2		2-1		2-58		2-59		2-60		2-83	2-96	2-98
Inserting Tool**	* Part No.	4889-14		4889-18		4889-18		4889-18		4889-18		1889	1889	1889
Expanding Tool	* Part No.	436		422		422		422		422		422	422	422
Offset And Staking Tool	* Part No.	468		520		520		520		520		520	520	520
Spot-Facing Tool	* Part No.			831		831		831		831		831	831	831
Extracting Tool	* Part No.	1227-16		1227-16		1227-16		1227-16		1227-16		1227 - 16	1227 - 16	1227 -16

* Part numbers per CAGE 01556.

** Ratchet type inserting tool also available.

Table 9-11. Taper Pipe Thread Insert Installation and Tool Data

		Nominal Size	**1/8-27**	**1/4-18**	**3/8-18**	**1/2-14**	**3/4-14**	**1-11-1/2**	**1-1/4- 11-1/2**	**1-1/2-11-1/2**
		Basic Insert Lgth. Assembled	**.273**	**.394**	**.407**	**.534**	**.553**	**.661**	**.681**	**.681**
		*** Insert Part No.**	**327-2**	**327-4**	**327-6**	**327-8**	**327-12**	**327-16**	**327-20**	**327-24**
Dimensional Data										
Free Insert	Outside Dia.	Min.	.486	.655	.803	1.005	1.232	1.540	1.912	2.170
		Max.	.511	.680	.828	1.035	1.262	1.575	1.947	2.205
	Number of Free Coils	±1/4 Turn (Approx.)	5-1/8	5	5-1/4	5-3/8	5-5/8	5-1/2	5-3/4	5-7/8
Suggested Drill Size			U (.3680)	31/64 (.4844)	5/8 (.625)	25/32 (.7812)	63/64 (.9844)	1-1/4 (1.2500)	1-19/32 (1.5937)	1-13/16 (1.8125)
Drilled Hole Depth-Minimum			19/32	27/32	27/32	1-1/16	1-1/16	1-5/16	1-11/32	1-11/32
Gage and Tool Part Numbers										
Reaming	Taper Reamer	* Part No.	334-2	334-4	334-6	334-8	334-12	334-16	334-20	334-24
Tapping	Tap	* Part No.	328-2	328-4	328-6	328-8	328-12	328-16	328-20	328-24
Gaging	Plain Taper Plug Gage	* Part No.	332-2	332-4	332-6	332-8	332-12	332-16	332-20	332-24
	Thread Plug Gage (Large End)	* Part No.	330-2	330-4	330-6	330-8	330-12	330-16	330-20	330-24
	Thread Plug Gage (Small End)	* Part No.	331-2	331-4	331-6	331-8	331-12	331-16	331-20	331-24
Hand Inserting Tool		* Part No.	3371-2	3371-4	3371-6	3371-8	3371-12	3371-16	3371-20	3371-24
Extracting Tool		* Part No.	1227-16	1227-16	1227-16	1227-16	1227-24	1227-24	1227-32	1227-32
* Part numbers per CAGE 01556.										



(1) Reamer (2) Tap (3) Plain Taper Gage (4) L_1 Thread Plug Gage (5) L_3 Thread Plug Gage
(6a) Inserting Tool (Prewinder type) (6b) Inserting Tool (Non-captive mandrel type) (7) Extracting Tool

Figure 9-24. Taper Pipe Thread Tools and Gages

g. Use the plain tapered plug gage for checking the tapered thread minor diameter or thread truncation. There are six steps on this gage marked B and Bt (basic size), MX and MXt (maximum limit), and MN and MNt (minimum limit). When the 330 gage reading is Basic, the plain taper plug gage must read between the basic limits of B and Bt. When the 330 gage reading is basic plus one turn, or the maximum limit, the plain taper plug must read between the maximum limits of MX and MXt. This procedure agrees with standard practice for conventional tapered pipe threads. Tapered pipe threads may be checked by using only the 330 thread plug gage when gaging practice must be reduced to minimum requirements.

h. Install insert by inserting with correct Inserting Tool listed in Table 9-11, using the method described in paragraph 9.5.1 on installing inserts for the specific type of tool for the size being repaired. Locate the top coil of the insert 1/4 to 1/2 turn below the top surface of the work.

i. To remove tang, use a pair of long-nose pliers. Grasp tang near the notch and with an up-and-down bending motion, being careful not to remove the last coil of the insert from the tapped thread, break off the tang.

9.11 THREAD REPAIR PACKS.

9.11.1 Available Packs and Kits.

a. Field Service Thread Repair Kits are available meeting MIL-T-21309 specifications in Unified Coarse and Unified Fine thread series, spark plug, oversize, Twinsert, taper pipe thread, and Stud-Lock.

b. This equipment is useful for each weapon system and each group of support equipment that must be disassembled and reassembled in the field for either periodic reliability check or for training personnel assigned to their operation, maintenance, and repair. Instructions are included with each Pack and Kit.

c. Tools and inserts are packaged in standard module metal boxes as listed in Table 9-12. Several of these module boxes for each size may be stored in the compartmentalized Portable Tool Box: 22 in. long x 8 in. wide x 9 in. deep, with two racks, eight flat dividers, and six ‘‘T’’ dividers as shown in Figure 9-25 (FSN 5140-935-0718).

d. Both Unified Coarse and Unified Fine Packs, for all sizes, are listed in Table 9-13, with authorized contents shown.

9.11.2 Oversize Insert Packs.

Oversize Insert Repair Packs for each size are shown in Table 9-14. Each pack contains special oversize bottoming tap(s) (sizes 1/4″ and under have two taps) and a quantity of 1 1/2 and 2 diameter length Standard (free-running), and Screw-Locking.

9.11.3 Twinsert Packs.

a. Twinsert Repair Packs are listed in Table 9-15. A Twinsert assembly consists of two inserts: an outer insert which is always a free-running type, and an inner insert which may be either free-running or screw-locking. Twinserts are installed in an oversize tapped hole produced with a special Twinsert tap.

Table 9-12. Metal Module Boxes

Box Size No.	FSN	Description
1	5140-935-4519	Tool Box Module: 8-5/8″ long x 7-3/8″ wide x 2-15/16″ deep
2	5140-935-4518	Tool Box Module: 8-5/8″ long x 7-3/8″ wide x 1-15/16″ deep
3	5140-935-0719	Tool Box Module: 8-5/8″ long x 7-3/8″ wide x 1-7/16″ deep
4	5140-935-0720	Tool Box Module: 8-5/8″ long x 3-5/8″ wide x 15/16″ deep

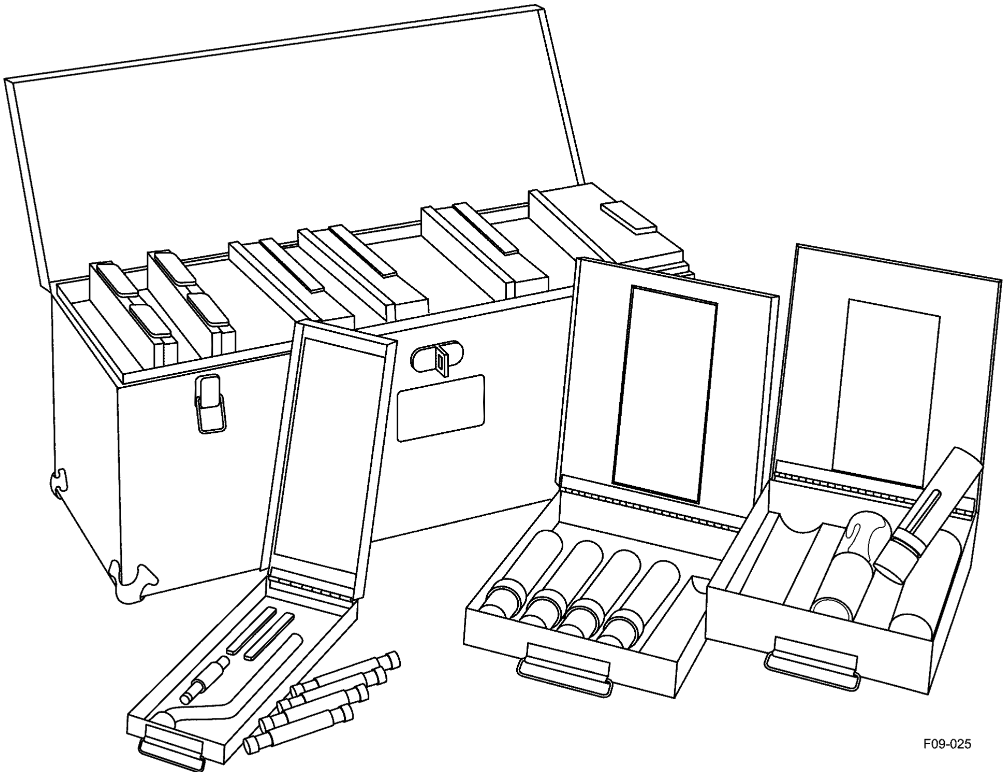


Figure 9-25. Picture from CAGE 01556

Table 9-13. Thread Repair Packs

Thread Size	National Stock No. 5180-00-	* Pack Part No.	Insert Qty. Each Styles Length	Insert Length (L)		* Tap Part No.	* Insert Tool Part No.	* Tang Break-Off Tool Part No.	* Ex-tracting Tool Part No.
				1 1/2 Dia.	2 Dia.				
Unified Coarse									
2 (.086)-56		4131-02-1	15	.129	.172	02CPA	551-02	4156-02	1227-02
3 (.099)-48		4131-031-1	15	.148	.198	031CPA	551-031	4156-03	1227-06
4 (.112)-40	054-7506	4131-04-1	15	.168	.224	04CPB	7551-04	4156-04	1227-06
5 (.125)-40	054-7524	4131-05-1	15	.188	.250	05CPB	7551-05	4156-05	1227-06
6 (.138)-32	054-7507	4131-06-1	10	.207	.276	06CPB	7551-06	4156-06	1227-06
8 (.164)-32	935-0730	4131-2-1	10	.246	.328	2CPB	7551-2	4156-2	1227-06
10 (.190)-24	935-0731	4131-3-1	10	.285	.380	3CPB	7551-3	4156-3	1227-6
12 (.216)-24	054-7526	4131-1-1	10	.324	.432	1CPB	7551-1	4156-1	1227-6
1/4 (.2500)-20	935-0732	4131-4-1	10	.375	.500	4CPB	7551-4	4156-4	1227-6
5/16 (.3125)-18	935-0733	4131-5-1	8	.469	.625	5CPB	7551-5	4156-5	1227-6
3/8 (.3750)-16	935-0734	4131-6-1	8	.562	.750	6CPB	7551-6	4156-6	1227-6
7/16 (.4375)-14	054-7503	4131-7-1	6	.656	.875	7CPB	7551-7	4156-7	1227-16
1/2 (.5000)-13	051-5024	4131-8-1	6	.750	1.000	8CPB	7551-8	4156-8	1227-16
9/16 (.5625)-12	059-4829	4131-9-1	5	.844	1.125	187-9	3724-9	FOR SIZES 9/16 & OVER USE LONG-NOSE PLIERS	1227-16
5/8 (.6250)-11	054-7514	4131-10-1	5	.938	1.250	8187-10	3724-10		1227-16
3/4 (.7500)-10	051-5025	4131-12-1	4	1.125	1.500	8187-12	3724-12		1227-16
7/8 (.8750)-9	054-7515	4131-14-1	4	1.312	1.750	8187-14	3724-14		1227-16
1 (1.0000)-8	051-5026	4131-16-1	4	1.500	2.000	8187-16	3724-16		1227-16
1 1/8 (1.1250)-7	054-7527	4131-18-1	3	1.688	2.250	8187-18	3724-18		1227-24

Table 9-13. Thread Repair Packs - Continued

Thread Size	National Stock No. 5180-00-	* Pack Part No.	Insert Qty. Each Styles Length	Insert Length (L)		* Tap Part No.	* Insert Tool Part No.	* Tang Break-Off Tool Part No.	* Ex-tracting Tool Part No.
				1 1/2 Dia.	2 Dia.				
1 1/4 (1.2500)-7	054-7528	4131-20-1	3	1.875	2.500	8187-20	3724-20		1227-24
1 3/8 (1.3750)-6	051-5027	4131-22-1	3	2.062	2.750	8187-22	3724-22		1227-24
1 1/2 (1.5000)-6	051-5030	4131-24-1	3	2.250	3.000	8187-24	3724-24		1227-24
Unified Fine									
4 (.112)-48		4132-041-1	15	.168	.224	041FPA	7552-041	4156-04	1227-06
6 (.138)-40	054-7525	4132-06-1	10	.207	.276	06FPB	7552-06	4156-06	1227-06
8 (.164)-36		4132-2-1	10	.246	.328	2FPB	7552-2	4156-2	1227-06
10 (.190)-32	935-0735	4132-3-1	10	.285	.380	3FPB	7552-3	4156-3	1227-6
1/4 (.2500)-28	935-0736	4132-4-1	10	.375	.500	4FPB	7552-4	4156-4	1227-6
5/16 (.3125)-24	935-0737	4132-5-1	8	.469	.625	5FPB	7552-5	4156-5	1227-6
3/8 (.3750)-24	935-0738	4132-6-1	8	.562	.750	6FPB	7552-6	4156-6	1227-6
7/16 (.4375)-20	935-0739	4132-7-1	6	.656	.875	7FPB	7552-7	4156-7	1227-16
1/2 (.5000)-20	054-7505	4132-8-1	6	.750	1.000	8FPB	7552-8	4156-8	1227-16
9/16 (.5625)-18	054-7516	4132-9-1	5	.844	1.125	38193-9	535-9	FOR SIZES	1227-16
5/8 (.6250)-18	054-7512	4132-10-1	5	.938	1.250	8193-10	535-10	9/16 &	1227-16
3/4 (.7500)-16	054-7513	4132-12-1	4	1.125	1.500	8193-12	535-12	OVER USE	1227-16
7/8 (.8750)-14	054-7519	4132-14-1	4	1.312	1.750	8193-14	535-14	LONG-NOSE	1227-16

Table 9-13. Thread Repair Packs - Continued

Thread Size	National Stock No. 5180-00-	* Pack Part No.	Insert Qty. Each Styles Length	Insert Length (L)		* Tap Part No.	* Insert Tool Part No.	* Tang Break-Off Tool Part No.	* Ex-tracting Tool Part No.
				1 1/2 Dia.	2 Dia.				
1 (1.0000)-14	054-7521	4132-16-1	4	1.500	2.000	8193-16	535-16	PLIERS	1227-16
1 (1.0000)-12	054-7520	4132-161-1	4	1.500	2.000	8193-161	535-161		1227-16
1 1/8 (1.1250)-12	054-7522	4132-18-1	3	1.688	2.250	8193-18	535-18		1227-24
1 1/4 (1.2500)-12	054-7523	4132-20-1	3	1.875	2.500	8193-20	535-20		1227-24
1 3/8 (1.3750)-12	051-5028	4132-22-1	3	2.062	2.750	8193-22	535-22		1227-24
1 1/2 (1.5000)-12	054-7529	4132-24-1	3	2.250	3.000	8193-24	535-24		1227-24

*Part numbers per CAGE 01556.

NOTES:

1. Packs 1/4″ and smaller have two taps.
2. Packs 1/2″ through 1″ contain only 1 1/2 diameter standard and Screw-Locking Inserts.
3. Packs over 1″ contain only 1 1/2 diameter Standard Inserts.

b. Twinsert Packs contain a quantity of 1 1/2 diameter length insert sets, an inserting tool for the outer insert, a tang break-off tool for the outer insert, and special Twinsert tap(s). Tools to install the inner inserts are available in regular UNC and UNF Packs. Two diameter length Twinsert sets may be ordered separately.

9.11.4 Taper Pipe Thread Packs. Two types of Helical Coil Pipe Thread Repair Packs are available. Pack A is recommended for use in repairing ANPT and NPT pipe thread assemblies in which wire thread inserts were not previously installed. This Pack contains a taper reamer, a screw thread insert taper tap (wired), a plain taper plug gage, an L_1 thread plug gage, an L_3 thread plug gage, an inserting tool, an extracting tool, and a quantity of Pipe Thread Inserts. Pack B is used to repair pipe thread assemblies in which the previously installed Helical Coil Insert is damaged and requires replacement. This Pack contains a tap, an inserting tool, an extracting tool, and a quantity of Pipe Thread Inserts. Detailed installation instructions are furnished in each Pack.

9.12 AUTOMOTIVE AND AIRCRAFT SPARK PLUG PACKS.

Two types of Helical Coil Spark Plug Inserts and tools are available for repairing damaged or stripped spark plug threads in engine cylinder heads. Non-serrated inserts (Table 9-17) are used for automotive, industrial, marine, and all other gasoline engines except aircraft. Serrated Spark Plug Inserts, listed in Table 9-18, are used exclusively for aircraft engine repair.

Table 9-14. Oversize Packs

Thread Size (NC)	Inserts Per Pack*	Oversize **Pack Part No.	Thread Size (Nf)	Inserts Per Pack*	Pack Part ** No.
4-40	60	3167-04-1			
5-40	60	3167-05-1			
6-32	40	3167-06-1	6-40	40	3169-06-1
8-32	40	3167-2-1			
10-24	40	3167-3-1	10-32	40	3169-3-1
12-24	40	3167-1-1			
1/4-20	40	3167-4-1	1/4-28	40	3169-4-1
5/16-18	32	3167-5-1	5/16-24	32	3169-5-1
3/8-16	32	3167-6-1	3/8-24	32	3169-6-1
7/16-14	24	3167-7-1	7/16-20	24	3169-7-1
1/2-13	24	3167-8-1	1/2-20	24	3169-8-1

*Each Pack contains an equal number of 1 1/2 dia. Standard Inserts, 2 dia. Standard Inserts, 1 1/2 dia. Screw-locking Inserts.

**Part numbers per CAGE 01556.

Table 9-15. Twinsert Packs

Thread Size (NC)	No. Of Insert Sets* Per Pack	Pack Part No. **	Thread Size (NF)	No. Of Insert Sets* Per Pack	Pack Part No. **
4-40	25	4146-04-1			
5-40	25	4146-05-1			
6-32	25	4146-06-1	6-40	25	4147-06-1
8-32	25	4146-2-1			
10-24	25	4146-3-1	10-32	25	4147-3-1
12-24	25	4146-1-1			
1/4-20	25	4146-4-1	1/4-28	25	4147-4-1
5/16-18	20	4146-5-1	5/16-24	20	4147-5-1
3/8-16	15	4146-6-1	3/8-24	15	4147-6-1
7/16-14	10	4146-7-1	7/16-20	10	4147-7-1
1/2-13	10	4146-8-1	1/2-20	10	4147-8-1
9/16-12	5	4146-9-1	9/16-18	5	4147-9-1
5/8-11	4	4146-10-1	5/8-18	4	4147-10-1
3/4-10	4	4146-12-1	3/4-16	4	4147-12-1

*A set consists of 1 outer Insert and 2 inner Inserts - one Standard (free-running) and one Screw-Locking (internal locking).

**Part numbers per CAGE 01556.

Table 9-16. Taper Pipe Thread Repair Packs

Size	Type “A” Part No. *	Type “B” Part No. *	Insert Part Number *	Inserts Per Pack
1/8-27	4148-2-1	4149-2-1	327-2	10
1/4-18	4148-4-1	4149-4-1	327-4	10
3/8-18	4148-6-1	4149-6-1	327-6	10
1/2-14	4148-8-1	4149-8-1	327-8	10
3/4-14	4148-12-1	4149-12-1	327-12	10
1-11 1/2	4148-16-1	4149-16-1	327-16	5
1 1/4-11 1/2	4148-20-1	4149-20-1	327-20	5
1 1/2-11 1/2	4148-24-1	4149-24-1	327-24	5

*Part numbers per CAGE 01556.

Table 9-17. Automotive Spark Plug Packs: 14-1.25mm and 18-1.5mm

				Spark Plug Insert*	
Size	Pack Part No. **	Tap Part No. **	Tool Part No. **	Plug Reach	Insert Part No. **
14-1.25mm	4194 (NSN 5180-00-935-4600)	1030-14	4889-14	3/8	512
				7/16	513
				1/2	513-13
				3/4	513-10

Table 9-17. Automotive Spark Plug Packs: 14-1.25mm and 18-1.5mm - Continued

Size	Pack Part No. **	Tap Part No. **	Tool Part No. **	Spark Plug Insert*	
				Plug Reach	Insert Part No. **
18-1.5mm	4195 (NSN 5180-00-494-8156)	1030-18	4889-18	27/64	514
				1/2	514-6

*14 -1.25mm pack contains 6 of each reach Insert, tap, and tool.

18-1.5mm pack contains 10 of each reach Insert, tap, and tool.

**Part numbers per CAGE 01556.

Table 9-18. Aviation Spark Plug Packs: 14-1.25mm and 18-1.5mm

Size	Basic Pack Part No. ***	Plug Reach	Assembled Length	Insert Part No. ***
14-1.25mm*	4260-14-1 (NSN 5180-00-935-4553)	Long	.359	137-22
		Short	.346	137-23
18-1.5mm**	4260-18-1 (NSN 5180-00-935-4552)	Long	.683	2-50
		Short	.334	2-52

* 14-1.25mm pack contains 15 inserts, short and long reach; inserting tool; tap; offset-staking tool; and extracting tool.

** 18-1.5mm pack contains 10 inserts each, short and long reach; inserting tool; tap; offset-staking tool; expanding tool; spot-face tool; extracting tool; Helical Coil Thread Plug Gage; and standard thread plug gage.

***Part numbers per CAGE 01556.

9.13 STUD-LOCKING INSERTS - UNIFIED COARSE AND UNIFIED FINE.

9.13.1 General Description. Higher torque inserts for studs are an extension of the Screw-Lock Insert and are designed to provide stud assembly torques complying with AS1229 and AS3080 standards as well as ANS1B1.12 values for interference stud fits. The stud locking torque is controlled within the range shown in Table 9-19 for a minimum of three cycles of installing and removing the stud. A new stud may be used for each cycle; in practice, however, the same stud can be reinstalled until the torque falls below minimum, at which point the installation of a new stud will increase the locking torque because the wear is primarily on the stud. The locking torque for step studs (which have the ‘‘nut end’’ one size smaller than the ‘‘stud end’’ or ‘‘fast end’’) is also shown in Table 9-19. Compliance with AS1229 and AS3080 standards presumes installation in magnesium with Class 3A steel (RC26-32) studs (per MIL-S-7742 (UN) or MIL-S-8879 (UNJ)) and cadmium plated per AMS2400. When using these studs, no additional lubrication is required. When using studs and parent materials other than as specified in AS1229, it may be necessary to determine that the torque values meet the desired results. Class 5 interference fit (UNC) studs may be used because of the resilient locking chords; however, the driving torque will be higher than for Class 3A studs but will still conform to ANSIB1.12 and H28 values when a lubricant such as MIL-T-5544 type grease is applied to the stud. Tapped hole preparation is identical to that for Standard and Screw-Locking Insert assemblies. The class of fit should be 3B. Installation tools for Stud-Locking Inserts have a reduced pitch diameter to accommodate the deeper grip coil configuration. All other tools are the same as for Standard and Screw-Locking Inserts. Packs, complete for each size are available and are listed in Table 9-20.

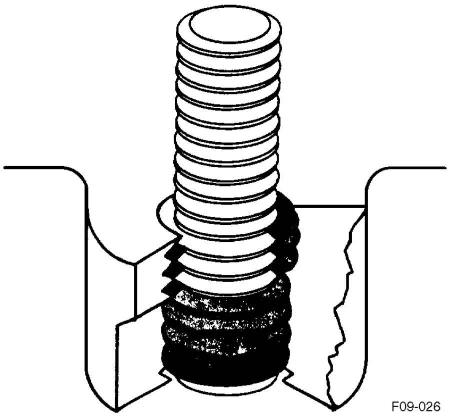


Figure 9-26. Assembled Stud-Locking Insert and Stud

Table 9-19. Stud-Locking Torque

	Straight Studs Per As 1229-1				Step Studs Per As 1229-2					Installation Tooling	
Nominal Thread Size	Insert Part Number *		Maximum Locking Torque	Mini-mum Break-away Torque	Insert Part Number **		Maximum Locking Torque	Minimum Break-away Torque	Nut End Thread Size	Hand	Power (F.E. Assy.)
10 (.190)-24	3758-3CN	0285	45 lbf-in	23 lbf-in						5551 -3	5651-3
10 (.190)-32	3759-3CN	0380								5552-3	5652-3
		0475									
		0570									
1/4 (.250)-20	3758-4CN	0375	90	52	5758-4CN	0375	45 lbf-in.	23 lbf-in	10-24	5551-4	5651-4
1/4 (.250)-28	3759-4CN	0500			5759-4CN	0500			10-32	5552-4	5652-4
		0625				**0625**					
		0750				**0750**					
5/16 (.3125)-18	3758-5CN	0469	180	105	5758-5CN	0469	90	52	1/4-20	5551-5	5651 -5
5/16 (.3125)-24	3759-5CN	0625			5759-5CN	0625			1/4-28	5552-5	5652-5
		0781				**0781**					
		0938				**0938**					
3/8 (.375)-16	3758-6CN	0562	240	140	5758-6CN	0562	180	105	5/16-18	5551-6	5651-6
3/8 (.375)-24	3759-6CN	0750			5759-6CN	0750			5/16-24	5552-6	5652-6
		0938				**0938**					
		1125				**1125**					
7/16 (.4375)-14	3758-7CN	0656	300	175	5758-7CN	0656	240	140	3/8-16	5551-7	5651-7
7/16 (.4375)-20	3759-7CN	0875			5759-7CN	0875			3/8-24	5552-7	5652-7
		1094				**1094**					
		1312				**1312**					

Table 9-19. Stud-Locking Torque - Continued

Nominal Thread Size	Straight Studs Per As 1229-1				Step Studs Per As 1229-2					Installation Tooling	
	Insert Part Number *		Maximum Locking Torque	Mini-mum Break-away Torque	Insert Part Number **		Maximum Locking Torque	Minimum Break-away Torque	Nut End Thread Size	Hand	Power (F.E. Assy.)
1/2 (.500)-13	3758-8CN	0750	450	260	5758-8CN	0750	300	175	7/16-14	5551-8	5651-8
1/2 (.500)-20	3759-8CN	1000			5759-8CN	1000			7/16-20	5552-8	5652-8
		1250				**1250**					
		1500				**1500**					

For Identification:

* 3758 and 3759 series Inserts are dyed green.

**5758 and 5759 series Inserts are dyed lavender.

NOTE: Insert and Installation Tooling Part numbers per CAGE 01556. Non-stock items; available on special order.

Bold Numbers Denote Non-Stock Items; Available On Special Order.

Table 9-20. Stud-Locking Insert Repair Packs

Thread Size	* Pack Part No.	Insert Qty. Each Length	* Insert Size Designation	Insert Length “L”		Tap Part No. **	Inserting Tool Part No. *	Tang Break-Off Tool Part No. *	Extracting Tool Part No. *
				1 1/2 Dia.	2 Dia.				
Unified Coarse									
10 (.190)-24	4151-3-1	25	3758-3CN	.285	.380	3CBB	5551-3	4156-3	1227-6
1/4 (.2500) - 20	4151-4-1	25	3758-4CN	.375	.500	4CBB	5551-4	4156-4	1227-6
5/16 (.3125)-18	4151-5-1	25	3758-5CN	.469	.625	5CBB	5551-5	4156-5	1227-6
3/8 (.3750)-16	4151-6-1	20	3758-6CN	.562	.750	6CBB	5551-6	4156-6	1227-6
7/16 (.4375)-14	4151-7-1	20	3758-7CN	.656	.875	7CBB	5551-7	4156-7	1227-16
1/2 (.5000)-13	4151-8-1	15	3758-8CN	.750	1.000	8CBB	5551-8	4156-8	1227-16
Unified Fine									
10 (.190)-32	4152-3-1	25	3759-3CN	.285	.380	3FBB	5552-3	4156-3	1227-6
1/4 (.2500)-28	4152-4-1	25	3759-4CN	.375	.500	4FBB	5552-4	4156-4	1227-6
5/16 (.3125)-24	4152-5-1	25	3759-5CN	.469	.625	5FBB	5552-5	4156-5	1227-6
3/8 (.3750)-24	4152-6-1	20	3759-6CN	.562	.750	6FBB	5552-6	4156-6	1227-6
7/16 (.4375)-20	4152-7-1	20	3759-7CN	.656	.875	7FBB	5552-7	4156-7	1227-16
1/2 (.5000)-20	4152-8-1	15	3759-8CN	.750	1.000	8FBB	5552-8	4156-8	1227-16

*Part numbers per CAGE 01556.

**Packs 1/4″ and smaller contain 2 taps, part numbers per CAGE 01556.

Table 9-21. Helical Coil Screw Thread Inserts

Size	Length	Part Number		National Stock No.	Your Reference
		Heli-Coil	Military Standard No.		
Standard Unified Coarse - Free Running					
2 (.086)-56	.086	1185-02CN 0086	MS122095	5340-00-850-6847	
2 (.086)-56	.129	1185-02CN 0129	MS122135	5340-00-850-6848	
2 (.086)-56	.172	1185-02CN 0172	MS122175	5340-00-834-8372	
2 (.086)-56	.215	1185-02CN 0215	MS122215		
2 (.086)-56	.258	1185-02CN 0258	MS122255	5340-01-051-0589	
3 (.099)-48	.099	1185-031CN 0099	MS122115		
3 (.099)-48	.148	1185-031CN 0148	MS122155	5340-00-623-4854	
3 (.099)-48	.198	1185-031CN 0198	MS122195	5340-00-137-3025	
3 (.099)-48	.248	1185-031CN 0248	MS122235		
3 (.099)-48	.297	1185-031CN 0297	MS122275		
4 (.112)-40	.112	1185-04CN 0112	MS122076	5340-00-826-4023	
4 (.112)-40	.168	1185-04CN 0168	MS122116	5340-00-842-5920	
4 (.112)-40	.224	1185-04CN 0224	MS122156	5340-00-223-0677	
4 (.112)-40	.280	1185-04CN 0280	MS122196	5340-00-664-4157	
4 (.112)-40	.336	1185-04CN 0336	MS122236	5340-00-660-1513	
5 (.125)-40	.125	1185-05CN 0125	MS122077	5340-00-058-4137	
5 (.125)-40	.188	1185-05CN 0188	MS122117	5340-00-619-3138	
5 (.125)-40	.250	1185-05CN 0250	MS122157	5340-00-928-9816	
5 (.125)-40	.312	1185-05CN 0312	MS122197		
5 (.125)-40	.375	1185-05CN 0375	MS122237		
6 (.138)-32	.138	1185-06CN 0138	MS122078	5340-00-843-0003	
6 (.138)-32	.207	1185-06CN 0207	MS122118	5340-00-734-5525	
6 (.138)-32	.276	1185-06CN 0276	MS122158	5340-00-825-4826	
6 (.138)-32	.345	1185-06CN 0345	MS122198	5340-00-200-7755	
6 (.138)-32	.414	1185-06CN 0414	MS122238	5340-00-061-4793	
8 (.164)-32	.164	1185-2CN 0164	MS122079	5340-00-368-4708	
8 (.164)-32	.246	1185-2CN 0246	MS122119	5340-00-479-9197	
8 (.164)-32	.328	1185-2CN 0328	MS122159	5340-00-473-3887	
8 (.164)-32	.410	1185-2CN 0410	MS122199	5340-00-721-7906	
8 (.164)-32	.492	1185-2CN 0492	MS122239	5340-00-291-3479	
10 (.190)-24	.190	1185-3CN 0190	MS122080	5340-00-290-4482	
10 (.190)-24	.285	1185-3CN 0285	MS122120	5340-00-597-3304	
10 (.190)-24	.380	1185-3CN 0380	MS122160	5340-00-551-7614	
10 (.190)-24	.475	1185-3CN 0475	MS122200	5340-00-597-3305	
10 (.190)-24	.570	1185-3CN 0570	MS122240	5340-00-291-3482	
12 (.216)-24	.216	1185-1CN 0216		5340-00-969-6086	
12 (.216)-24	.324	1185-1CN 0324		5340-00-863-8119	
12 (.216)-24	.432	1185-1CN 0432		5340-00-863-8118	
12 (.216)-24	.540	1185-1CN 0540			
12 (.216)-24	.648	1185-1CN 0648			

Table 9-21. Helical Coil Screw Thread Inserts - Continued

		Part Number			
Size	Length	Heli-Coil	Military Standard No.	National Stock No.	Your Reference
1/4 (.2500)-20	.250	1185-4CN 0250	MS122081	5340-00-200-7224	
1/4 (.2500)-20	.375	1185-4CN 0375	MS122121	5340-01-030-6854	
1/4 (.2500)-20	.500	1185-4CN 0500	MS122161	5340-00-286-2458	
1/4 (.2500)-20	.625	1185-4CN 0625	MS122201	5340-00-290-4515	
1/4 (.2500)-20	.750	1185-4CN 0750	MS122241	5340-00-290-4489	
5/16 (.3125)-18	.312	1185-5CN 0312	MS122082	5340-00-290-4550	
5/16 (.3125)-18	.469	1185-5CN 0469	MS122122	5340-00-290-4521	
5/16 (.3125)-18	.625	1185-5CN 0625	MS122162	5340-00-290-4520	
5/16 (.3125)-18	.781	1185-5CN 0781	MS122202	5340-00-290-4490	
5/16 (.3125)-18	.938	1185-5CN 0938	MS122242	5340-00-820-9629	
3/8 (.3750)-16	.375	1185-6CN 0375	MS122083	5340-00-331-4774	
3/8 (.3750)-16	.562	1185-6CN 0562	MS122123	5340-00-290-4518	
3/8 (.3750)-16	.750	1185-6CN 0750	MS122163	5340-00-990-7157	
3/8 (.3750)-16	.938	1185-6CN 0938	MS122203	5340-00-290-4492	
3/8 (.3750)-16	1.125	1185-6CN 1125	MS122243	5340-00-682-1453	
7/16 (.4375)-14	.438	1185-7CN 0438	MS122084	5340-01-019-7177	
7/16 (.4375)-14	.656	1185-7CN 0656	MS122124	5340-00-290-4506	
7/16 (.4375)-14	.875	1185-7CN 0875	MS122164	5340-00-598-5638	
7/16 (.4375)-14	1.094	1185-7CN 1094	MS122204	5340-00-993-7229	
7/16 (.43751-14	1.312	1185-7CN 1312	MS122244	5340-00-993-8194	
1/2 (.5000)-13	.500	1185-8CN 0500	MS122085	5340-00-290-4505	
1/2 (.5000)-13	.750	1185-8CN 0750	MS122125	5340-00-290-4504	
1/2 (.5000)-13	1.000	1185-8CN 1000	MS122165	5340-00-990-7158	
1/2 (.5000)-13	1.250	1185-8CN 1250	MS122205	5340-00-855-0802	
1/2 (.5000)-13	1.500	1185-8CN 1500	MS122245	5340-00-603-0365	
9/16 (.5625)-12	.562	1185-9CN 0562	MS122086	5340-00-993-7237	
9/16 (.5625)-12	.844	1185-9CN 0844	MS122126	5340-00-518-7744	
9/16 (.5625)-12	1.125	1185-9CN 1125	MS122166	5340-00-993-7245	
9/16 (.5625)-12	1.406	1185-9CN 1406	MS122206	5340-00-726-9499	
9/16 (.5625)-12	1.688	1185-9CN 1688	MS122246	5340-00-993-8196	
5/8 (.6250)-11	.625	1185-10CN 0625	MS122087	5340-00-682-1666	
5/8 (.6250)-11	.938	1185-10CN 0938	MS122127	5340-00-290-4494	
5/8 (.6250)-11	1.250	1185-10CN 1250	MS122167	5340-00-807-3488	
5/8 (.6250)-11	1.562	1185-10CN 1562	MS122207	5340-00-993-7231	
5/8 (.6250)-11	1.875	1185-10CN 1875	MS122247	5340-01-033-3126	
3/4 (.7500)-10	.750	1185-12CN 0750	MS122088	5340-00-290-4503	
3/4 (.7500)-10	1.125	1185-12CN 1125	MS122128	5340-00-045-2812	
3/4 (.7500)-10	1.500	1185-12CN 1500	MS122168	5340-00-721-8356	
3/4 (.7500)-10	1.875	1185-12CN 1875	MS122208	5340-00-826-7864	
3/4 (.7500)-10	2.250	1185-12CN 2250	MS122248	5340-00-993-8197	
7/8 (.8750)-9	.875	1185-14CN 0875	MS122089	5340-00-993-7236	
7/8 (.8750)-9	1.312	1185-14CN 1312	MS122129	5340-00-682-2216	

Table 9-21. Helical Coil Screw Thread Inserts - Continued

Size	Length	Part Number		National Stock No.	Your Reference
		Heli-Coil	Military Standard No.		
7/8 (.8750)-9	1.750	1185-14CN 1750	MS122169	5340-00-664-8332	
7/8 (.8750)-9	2.188	1185-14CN 2188	MS122209	5340-00-993-7232	
7/8 (.8750)-9	2.625	1185-14CN 2625	MS122249	5340-00-993-8198	
1 (1.0000)-8	1.000	1185-16CN 1000	MS122090	5340-00-200-2414	
1 (1.0000)-8	1.500	1185-16CN 1500	MS122130	5340-00-530-5603	
1 (1.0000)-8	2.000	1185-16CN 2000	MS122170	5340-00-993-7246	
1 (1.0000)-8	2.500	1185-16CN 2500	MS122210	5340-00-993-7233	
1 (1.0000)-8	3.000	1185-16CN 3000	MS122250	5340-00-993-8199	
1-1/8 (1.1250)-7	1.125	1185-18CN 1125	MS122091		
1-1/8 (1.1250)-7	1.688	1185-18CN 1688	MS122131		
1-1/8 (1.1250)-7	2.250	1185-18CN 2250	MS122171		
1-1/8 (1.1250)-7	2.812	11B5-18CN 2812	MS122211		
1-1/8 (1.1250)-7	3.375	1185-18CN 3375	MS122251		
1-1/4 (1.2500)-7	1.250	1185-20CN 1250	MS122092		
1-1/4 (1.2500)-7	1.875	1185-20CN 1875	MS122132		
1-1/4 (1.2500)-7	2.500	1185-20CN 2500	MS122172		
1-1/4 (1.2500)-7	3.125	1185-20CN 3125	MS122212		
1-1/4 (1.2500)-7	3.750	1185-20CN 3750	MS122252		
1-3/8 (1.3750)-6	1.375	1185-22CN 1375	MS122093		
1-3/8 (1.3750)-6	2.062	1185-22CN 2062	MS122133		
1-3/8 (1.3750)-6	2.750	1185-22CN 2750	MS122173		
1-3/8 (1.3750)-6	3.438	1185-22CN 3438	MS122213		
1-3/8 (1.3750)-6	4.125	1185-22CN 4125	MS122253		
1-1/2 (1.5000)-6	1.500	1185-24CN 1500	MS122094	5340-00-059-2379	
1-1/2 (1.5000)-6	2.250	1185-24CN 2250	MS122134		
1-1/2 (1.5000)-6	3.000	1185-24CN 3000	MS122174		
1-1/2 (1.5000)-6	3.750	1185-24CN 3750	MS122214		
1-1/2 (1.5000)-6	4.500	1185-24CN 4500	MS122254		
Standard Unified Fine - Free Running					
3 (.099)-56	.099	1191-03CN 0099	MS124670		
3 (.099)-56	.148	1191-03CN 0148	MS124710		
3 (.099)-56	.198	1191-03CN 0198	MS124750		
3 (.099)-56	.248	1191-03CN 0248	MS124790		
3 (.099)-56	.297	1191-03CN 0297	MS124830		
4 (.112)-48	.112	1191-041CN 0112	MS124671		
4 (.112)-48	.168	1191-041CN 0168	MS124711		
4 (.112)-48	.224	1191-041CN 0224	MS124751		
4 (.112)-48	.280	1191-041CN 0280	MS124791		
4 (.112)-48	.336	1191-041CN 0336	MS124831		
6 (.138)-40	.138	1191-06CN 0138	MS124653	5340-00-045-3553	
6 (.138)-40	.207	1191-06CN 0207	MS124693	5340-00-982-7842	
6 (.138)-40	.276	1191-06CN 0276	MS124733	5340-00-045-3555	

Table 9-21. Helical Coil Screw Thread Inserts - Continued

		Part Number			
Size	Length	Heli-Coil	Military Standard No.	National Stock No.	Your Reference
6 (.138)-40	.345	1191-06CN 0345	MS124773	5340-00-726-3547	
6 (.138)-40	.414	1191-06CN 0414	MS124813	5340-00-833-7459	
8 (.164)-36	.164	1191-2CN 0164	MS124654	5340-01-022-9232	
8 (.164)-36	.246	1191-2CN 0246	MS124694	5340-00-097-6337	
8 (.164)-36	.328	1191-2CN 0328	MS124734	5340-00-141-6688	
8 (.164)-36	.410	1191-2CN 0410	MS124774		
8 (.164)-36	.492	1191-2CN 0492	MS124814		
10 (.190)-32	.190	1191-3CN 0190	MS124655	5340-00-986-2929	
10 (.190)-32	.285	1191-3CN 0285	MS124695	5340-00-597-3302	
10 (.190)-32	.380	1191-3CN 0380	MS124735	5340-00-290-4480	
10 (.190)-32	.475	1191-3CN 0475	MS124775	5340-00-597-3306	
10 (.190)-32	.570	1191-3CN 0570	MS124815	5340-00-663-3267	
1/4 (.250)-28	.250	1191-4CN 0250	MS124656	5340-00-286-6600	
1/4 (.250)-28	.375	1191-4CN 0375	MSI24696	5340-00-291-3484	
1/4 (.250)-28	.500	1191-4CN 0500	MS124736	5340-00-290-4497	
1/4 (.250)-28	.625	1191-4CN 0625	MS124776	5340-00-290-4502	
1/4 (.250)-28	.750	1191-4CN 0750	MS124816	5340-00-290-4501	
5/16 (.3125)-24	.312	1191-5CN 0312	MS124657	5340-00-045-2676	
5/16 (.3125)-24	.469	1191-5CN 0469	MS124697	5340-00-291-3495	
5/16 (.3125)-24	.625	1191-5CN 0625	MS124737	5340-00-514-2321	
5/16 (.3125)-24	.781	1191-5CN 0781	MS124777	5340-00-680-3131	
5/16 (.3125)-24	.938	1191-5CN 0938	MS124817	5340-00-291-3483	
3/8 (.3750)-24	.375	1191-6CN 0375	MS124658	5340-00-291-3493	
3/8 (.3750)-24	.562	1191-6CN 0562	MS124698	5340-00-291-3492	
3/8 (.3750)-24	.750	1191-6CN 0750	MS124738	5340-01-031-4286	
3/8 (.3750)-24	.938	1191-6CN 0938	MS124778	5340-00-597-3328	
3/8 (.3750)-24	1.125	1191-6CN 1125	MS124818	5340-00-291-3491	
7/16 (.4375)-20	.438	1191-7CN 0438	MS124659	5340-00-421-1189	
7/16 (.4375)-20	.656	1191-7CN 0656	MS124699	5340-00-634-7860	
7/16 (.4375)-20	.875	1191-7CN 0875	MS124739	5340-00-290-4511	
7/16 (.4375)-20	1.094	1191-7CN 1094	MS124779	5340-00-993-8180	
7/16 (.4375)-20	1.312	1191-7CN 1312	MS124819	5340-00-993-7207	
1/2 (.5000)-20	.500	1191-8CN 0500	MS124660	5340-00-598-5634	
1/2 (.5000)-20	.750	1191-8CN 0750	MS124700	5340-00-291-3488	
1/2 (.5000)-20	1.000	1191-8CN 1000	MS124740	5340-01-011-6864	
1/2 (.5000)-20	1.250	1191-8CN 1250	MS124780	5340-00-290-4507	
1/2 (.5000)-20	1.500	1191-8CN 1500	MS124820	5340-00-845-1982	
9/16 (.5625)-18	.562	1191-9CN 0562	MS124661	5340-00-290-5144	
9/16 (.5625)-18	.844	1191-9CN 0844	MS124701	5340-00-291-3487	
9/16 (.5625)-18	1.125	1191-9CN 1125	MS124741	5340-00-200-7223	
9/16 (.5625)-18	1.406	1191-9CN 1406	MS124781	5340-00-810-9943	
9/16 (.5625)-18	1.688	1191-9CN 1688	MS124821	5340-00-291-3486	

Table 9-21. Helical Coil Screw Thread Inserts - Continued

Size	Length	Part Number		National Stock No.	Your Reference
		Heli-Coil	Military Standard No.		
5/8 (.6250)-18	.625	1191-10CN 0625	MS124662	5340-00-598-5643	
5/8 (.6250)-18	.938	1191-10CN 0938	MS124702	5340-00-530-7948	
5/8 (.6250)-18	1.250	1191-10CN 1250	MS124742	5340-00-597-5157	
5/8 (.6250)-18	1.562	1191-10CN 1562	MS124782	5340-00-993-8181	
5/8 (.6250)-18	1.875	1191-10CN 1875	MS124822	5340-00-993-7209	
3/4 (.7500)-16	.750	1191-12CN 0750	MS124663	5340-00-141-6710	
3/4 (.7500)-16	1.125	1191-12CN 1125	MS124703	5340-00-655-7971	
3/4 (.7500)-16	1.500	1191-12CN 1500	MS124743	5340-00-200-7222	
3/4 (.7500)-16	1.875	1191-12CN 1875	MS124783	5340-00-993-8182	
3/4 (.7500)-16	2.250	1191-12CN 2250	MS124823	5340-00-993-7210	
7/8 (.8750)-14	.875	1191-14CN 0875	MS124664	5340-00-598-5644	
7/8 (.8750)-14	1.312	1191-14CN 1312	MS124704	5340-00-045-2848	
7/8 (.8750)-14	1.750	1191-14CN 1750	MS124744	5340-00-993-8183	
7/8 (.8750)-14	2.188	1191-14CN 2188	MS124784		
7/8 (.8750)-14	2.625	1191-14CN 2625	MS124824	5340-00-993-7211	
1 (1.00001-14	1.000	1191-16CN 1000	MS124665	5340-00-045-2868	
1 (1.0000)-14	1.500	1191-16CN 1500	MS124705	5340-00-993-7250	
1 (1.0000)-14	2.000	1191-16CN 2000	MS124745	5340-00-993-7257	
1 (1.0000)-14	2.500	1191-16CN 2500	MS124785	5340-00-993-8184	
1 (1.0000)-14	3.000	1191-16CN 3000	MS124825	5340-00-993-7212	
1 (1.0000)-12	1.000	1191-161CN 1000	MS124651	5340-00-044-4971	
1 (1.0000)-12	1.500	1191-161CN 1500	MS124691		
1 (1.0000)-12	2.000	1191-161CN 2000	MS124731		
1 (1.0000)-12	2.500	1191-161CN 2500	MS124771		
1 (1.0000)-12	3.000	1191-161CN 3000	MS124811		
1-1/8 (1.1250)-12	1.125	1191-18CN 1125	MS124666	5340-00-598-5599	
1-1/8 (1.1250)-12	1.688	1191-18CN 1688	MS124706		
1-1/8 (1.1250)-12	2.250	1191-18CN 2250	MS124746	5340-00-059-2386	
1-1/8 (1.1250)-12	2.812	1191-18CN 2812	MS124786		
1-1/8 (1.1250)-12	3.375	1191-18CN 3375	MS124826		
1-1/4 (1.2500)-12	1.250	1191-20CN 1250	MS124667	5340-00-200-4033	
1-1/4 (1.2500)-12	1.875	1191-20CN 1875	MS124707	5340-00-558-3435	
1-1/4 (1.2500)-12	2.500	1191-20CN 2500	MS124747		
1-1/4 (1.2500)-12	3.125	1191-20CN 3125	MS124787		
1-1/4 (1.2500)-12	3.750	1191-20CN 3750	MS124827		
1-3/8 (1.3750)-12	1.375	1191-22CN 1375	MS124668		
1-3/8 (1.3750)-12	2.062	1191-22CN 2062	MS124708		
1-3/8 (1.3750)-12	2.750	1191-22CN 2750	MS124748		
1-3/8 (1.3750)-12	3.438	1191-22CN 3438	MS124788		
1-3/8 (1.3750)-12	4.125	1191-22CN 4125	MS124828		
1-1/2 (1.5000)-12	1.500	1191-24CN 1500	MS124669	5340-00-836-1941	
1-1/2 (1.5000)-12	2.250	1191-24CN 2250	MS124709		

Table 9-21. Helical Coil Screw Thread Inserts - Continued

Size	Length	Part Number		National Stock No.	Your Reference
		Heli-Coil	Military Standard No.		
1-1/2 (1.5000)-12	3.000	1191-24CN 3000	MS124749		
1-1/2 (1.5000)-12	3.750	1191-24CN 3750	MS124789		
1-1/2 (1.5000)-12	4.500	1191-24CN 4500	MS124829		
Lock Inserts - Unified Coarse					
2 (.086)-56	.086	3585-02CN 0086	21209-C0210	5340-00-855-7892	
2 (.086)-56	.129	3585-02CN 0129	21209-C0215	5340-00-215-0248	
2 (.086)-56	.172	3585-02CN 0172	21209-C0220	5340-00-462-4226	
2 (.086)-56	.215	3585-02CN 0215	21209-C0225	5340-00-716-6615	
2 (.086)-56	.258	3585-02CN 0258	21209-C0230	5340-01-044-3522	
3 (.099)-48	.099	3585-031CN 0099	21209-C0310		
3 (.099)-48	.148	3585-031CN 0148	21209-C0315		
3 (.099)-48	.198	3585-031CN 0198	21209-C0320	5340-01-021-1751	
3 (.099)-48	.248	3585-031CN 0248	21209-C0325		
3 (.099)-48	.297	3585-031CN 0297	21209-C0330		
4 (.112)-40	.112	3585-04CN 0112	21209-C0410	5340-00-263-8728	
4 (.112)-40	.168	3585-04CN 0168	21209-C0415	5340-00-631-7894	
4 (.112)-40	.224	3585-04CN 0224	21209-C0420	5340-00-827-4024	
4 (.112)-40	.280	3585-04CN 0280	21209-C0425	5340-00-631-7889	
4 (.112)-40	.336	3585-04CN 0336	21209-C0430	5340-00-721-7849	
5 (.125)-40	.125	3585-05CN 0125	21209-C0510		
5 (.125)-40	.188	3585-05CN 0188	21209-C0515	5340-00-863-8121	
5 (.125)-40	.250	3585-05CN 0250	21209-C0520	5340-00-863-8120	
5 (.125)-40	.312	3585-05CN 0312	21209-C0525		
5 (.125)-40	.375	3585-05CN 0375	21209-C0530		
6 (.138)-32	.138	3585-06CN 0138	21209-C0610	5340-00-245-5195	
6 (.138)-32	.207	3585-06CN 0207	21209-C0615	5340-00-815-4930	
6 (.138)-32	.276	3585-06CN 0276	21209-C0620	5340-00-558-8826	
6 (.138)-32	.345	3585-06CN 0345	21209-C0625	5340-00-213-8727	
6 (.138)-32	.414	3585-06CN 0414	21209-C0630	5340-00-008-7100	
8 (.164)-32	.164	3585-2CN 0164	21209-C0810	5340-00-631-7891	
8 (.164)-32	.246	3585-2CN 0246	21209-C0815	5340-00-815-4929	
8 (.164)-32	.328	3585-2CN 0328	21209-C0820	5340-00-721-6936	
8 (.164)-32	.410	3585-2CN 0410	21209-C0825	5340-00-215-0249	
8 (.164)-32	.492	3585-2CN 0492	21209-C0830	5340-00-079-9570	
10 (.190)-24	.190	3585-3CN 0190	21209-C1-10	5340-00-589-5335	
10 (.190)-24	.285	3585-3CN 0285	21209-C1-15	5340-00-680-3762	
10 (.190)-24	.380	3585-3CN 0380	21209-C1-20	5340-00-990-8643	
10 (.190)-24	.475	3585-3CN 0475	21209-C1-25	5340-01-004-9794	
10 (.190)-24	.570	3585-3CN 0570	21209-C1-30		
12 (.216)-24	.216	3585-1CN 0216	21209-C2-10		
12 (.216)-24	.324	3585-1CN 0324	21209-C2-15	5340-00-863-8116	
12 (.216)-24	.432	3585-1CN 0432	21209-C2-20	5340-00-863-8113	

Table 9-21. Helical Coil Screw Thread Inserts - Continued

		Part Number			
Size	Length	Heli-Coil	Military Standard No.	National Stock No.	Your Reference
12 (.216)-24	.540	3585-1CN 0540	21209-C2-25		
12 (.216)-24	.648	3585-1CN 0648	21209-C2-30		
1/4 (.2500)-20	.250	3585-4CN 0250	21209-C4-10	5340-00-999-1181	
1/4 (.2500)-20	.375	3585-4CN 0375	21209-C4-15	5340-00-754-0847	
1/4 (.2500)-20	.500	3585-4CN 0500	21209-C4-20	5340-00-721-8352	
1/4 (.2500)-20	.625	3585-4CN 0625	21209-C4-25		
1/4 (.2500)-20	.750	3585-4CN 0750	21209-C4-30	5340-01-013-8609	
5/16 (.3125)-18	.312	3585-5CN 0312	21209-C5-10	5340-00-205-3119	
5/16 (.3125)-18	.469	3585-5CN 0469	21209-C5-15	5340-00-803-5574	
5/16 (.3125)-18	.625	3585-5CN 0625	21209-C5-20	5340-00-825-6938	
5/16 (.3125)-18	.781	3585-5CN 0781	21209-C5-25		
5/16 (.3125)-18	.938	3585-5CN 0938	21209-C5-30		
3/8 (.3750)-16	.375	3585-6CN 0375	21209-C6-10	5340-00-210-3935	
3/8 (.3750)-16	.562	3585-6CN 0562	21209-C6-15	5340-00-754-1976	
3/8 (.3750)-16	.750	3585-6CN 0750	21209-C6-20	5340-00-812-1894	
3/8 (.3750)-16	.938	3585-6CN 0938	21209-C6-25		
3/8 (.3750)-16	1.125	3585-6CN 1125	21209-CC-30	5340-01-048-6353	
7/16 (.4375)-14	.438	3585-7CN 0438	21209-C7-10		
7/16 (.4375)-14	.656	3585-7CN 0656	21209-C7-15	5340-00-701-3811	
7/16 (.4375)-14	.875	3585-7CN 0875	21209-C7-20	5340-00-723-6775	
7/16 (.4375)-14	1.094	3585-7CN 1094	21209-C7-25		
7/16 (.4375)-14	1.312	3585-7CN 1312	21209-C7-30		
1/2 (.5000)-13	.500	3585-8CN 0500	21209-C8-10		
1/2 (.5000)-13	.750	3585-8CN 0750	21209-C8-15	5340-00-814-9865	
1/2 (.5000)-13	1.000	3585-8CN 1000	21209-C8-20	5340-00-812-1900	
1/2 (.5000)-13	1.250	3585-8CN 1250	21209-C8-25		
1/2 (.5000)-13	1.500	3585-8CN 1500	21209-C8-30		
9/16 (.5625)-12	.562	3585-9CN 0562	21209-C9-10	5340-00-026-2017	
9/16 (.5625)-12	.844	3585-9CN 0844	21209-C9-15	5340-00-723-6776	
9/16 (.5625)-12	1.125	3585-9CN 1125	21209-C9-20		
9/16 (.5625)-12	1.406	3585-9CN 1406	21209-C9-25		
9/16 (.5625)-12	1.688	3585-9CN 1688	21209-C9-30		
5/8 (.6250)-11	.625	3585-1CCN 0625	21209-C1010	5340-00-772-4849	
5/8 (.6250)-11	.938	3585-10CN 0938	21209-C1015	5340-00-811-9469	
5/8 (.6250)-11	1.250	3585-10CN 1250	21209-C1020	5340-00-812-1895	
5/8 (.6250)-11	1.562	3585-10CN 1562	21209-C1025		
5/8 (.6250)-11	1.875	3585-10CN 1875	21209-C1030		
3/4 (.7500)-10	.750	3585-12CN 0750	21209-C1210	5340-00-753-3497	
3/4 (.7500)-10	1.125	3585-12CN 1125	21209-C1215	5340-00-723-6779	
3/4 (.7500)-10	1.500	3585-12CN 1500	21209-C1220	5340-00-800-1676	
3/4 (.7500)-10	1.875	3585-12CN 1875	21209-C1225		
3/4 (.7500)-10	2.250	3585-12CN 2250	21209-C1230		

Table 9-21. Helical Coil Screw Thread Inserts - Continued

		Part Number			
Size	**Length**	**Heli-Coil**	**Military Standard No.**	**National Stock No.**	**Your Reference**
7/8 (.8750)-9	.875	3585-14CN 0875	21209-C1410		
7/8 (.8750)-9	1.312	3585-14CN 1312	21209-C1415	5340-00-724-1920	
7/8 (.8750)-9	1.750	3585-14CN 1750	21209-C1420		
7/8 (.8750)-9	2.188	3585-14CN 2188	21209-C1425		
7/8 (.8750)-9	2.625	3585-14CN 2625	21209-C1430		
1 (1.0000)-8	1.000	3585-16CN 1000	21209-C1610		
1 (1.0000)-8	1.500	3585-16CN 1500	21209-C1615	5340-00-863-8111	
1 (1.0000)-8	2.000	3585-16CN 2000	21209-C1620	5340-00-812-1897	
1 (1.0000)-8	2.500	3585-16CN 2500	21209-C1625		
1 (1.0000)-8	3.000	3585-16CN 3000	21209-C1630		
1-1/8 (1.1250)-7	1.125	3585-18CN 1125	21209-C1810		
1-1/8 (1.1250)-7	1.688	3585-18CN 1688	21209-C1815		
1-1/8 (1.1250)-7	2.250	3585-18CN 2250	21209-C1820		
1-1/8 (1.1250)-7	2.812	3585-18CN 2812	21209-C1825		
1-1/8 (1.1250)-7	3.375	3585-18CN 3375	21209-C1830		
1-1/4 (1.2500)-7	1.250	3585-20CN 1250	21209-C2010	5340-00-812-3008	
1-1/4 (1.2500)-7	1.875	3585-20CN 1875	21209-C2015		
1-1/4 (1.2500)-7	2.500	3585-20CN 2500	21209-C2020		
1-1/4 (1.2500)-7	3.125	3585-20CN 3125	21209-C2025		
1-1/4 (1.2500)-7	3.750	3585-20CN 3750	21209-C2030		
1-3/8 (1.3750)-6	1.375	3585-22CN 1375	21209-C2210		
1-3/8 (1.3750)-6	2.062	3585-22CN 2062	21209-C2215		
1-3/8 (1.3750)-6	2.750	3585-22CN 2750	21209-C2220		
1-3/8 (1.3750)-6	3.438	3585-22CN 3438	21209-C2225		
1-3/8 (1.3750)-6	4.125	3585-22CN 4125	21209-C2230		
1-1/2 (1.5000)-6	1.500	3585-24CN 1500	21209-C2410	5340-01-024-7198	
1-1/2 (1.5000)-6	2.250	3585-24CN 2250	21209-C2415		
1-1/2 (1.5000)-6	3.000	3585-24CN 3000	21209-C2420		
1-1/2 (1.5000)-6	3.750	3585-24CN 3750	21209-C2425		
1-1/2 (1.5000)-6	4.500	3585-24CN 4500	21209-C2430		
Lock Inserts - Unified Fine					
3 (.099)-56	.099	3591-03CN 0099	21209-F0310		
3 (.099)-56	.148	3591-03CN 0148	21209-F0315		
3 (.099)-56	.198	3591-03CN 0198	21209-F0320		
3 (.099)-56	.248	3591-03CN 0248	21209-F0325		
3 (.099)-56	.297	3591-03CN 0297	21209-F0330		
4 (.112)-48	.112	3591-041CN 0112	21209-F0410	5340-01-008-7714	
4 (.112)-48	.168	3591-041CN 0168	21209-F0415	5340-01-008-7715	
4 (.112)-48	.224	3591-041CN 0224	21209-F0420	5340-01-022-2325	
4 (.112)-48	.280	3591-041CN 0280	21209-F0425		
4 (.112)-48	.336	3591-041CN 0336	21209-F0430		
6 (.138)-40	.138	3591-06CN 0138	21209-F0610	5340-00-288-1921	

Table 9-21. Helical Coil Screw Thread Inserts - Continued

		Part Number			
Size	Length	Heli-Coil	Military Standard No.	National Stock No.	Your Reference
6 (.138)-40	.207	3591-06CN 0207	21209-F0615	5340-00-480-3654	
6 (.138)-40	.276	3591-06CN 0276	21209-F0620	5340-00-813-2162	
6 (.138)-40	.345	3591-06CN 0345	21209-F0625		
6 (.138)-40	.414	3591-06CN 0414	21209-F0630		
8 (.164)-36	.164	3591-2CN 0164	21209-F0810	5340-01-009-7448	
8 (.164)-36	.246	3591-2CN 0246	21209-F0815	5340-00-324-9146	
8 (.164)-36	.328	3591-2CN 0328	21209-F0820		
8 (.164)-36	.410	3591-2CN 0410	21209-F0825		
8 (.164)-36	.492	3591-2CN 0492	21209-F0830		
10 (.190)-32	.190	3591-3CN 0190	21209-F1-10	5340-00-684-9501	
10 (.190)-32	.285	3591-3CN 0285	21209-F1-15	5340-00-800-7874	
10 (.190)-32	.380	3591-3CN 0380	21209-F1-20	5340-00-721-7653	
10 (.190)-32	.475	3591-3CN 0475	21209-F1-25	5340-00-229-4873	
10 (.190)-32	.570	3591-3CN 0570	21209-F1-30	5340-01-038-2467	
1/4 (.2500)-28	.250	3591-4CN 0250	21209-F4-10	5340-00-210-3920	
1/4 (.2500)-28	.375	3591-4CN 0375	21209-F4-15	5340-00-829-2141	
1/4 (.2500)-28	.500	3591-4CN 0500	21209-F4-20	5340-00-721-7498	
1/4 (.2500)-28	.625	3591-4CN 0625	21209-F4-25	5340-00-410-2476	
1/4 (.2500)-28	.750	3591-4CN 0750	21209-F4-30	5340-01-018-6037	
5/16 (.3125)-24	.312	3591-5CN 0312	21209-F5-10	5340-00-218-1518	
5/16 (.3125)-24	.469	3591-5CN 0469	21209-F5-15	5340-00-847-0734	
5/16 (.3125)-24	.625	3591-5CN 0625	21209-F5-20	5340-00-582-7256	
5/16 (.3125)-24	.781	3591-5CN 0781	21209-F5-25	5340-00-819-2448	
5/16 (.3125)-24	.938	3591-5CN 0938	21209-F5-30	5340-01-037-1101	
3/8 (.3750)-24	.375	3591-6CN 0375	21209-F6-10	5340-00-754-1817	
3/8 (.3750)-24	.562	3591-6CN 0562	21209-F6-15	5340-00-680-8768	
3/8 (.3750)-24	.750	3591-6CN 0750	21209-F6-20	5340-00-678-3311	
3/8 (.3750)-24	.938	3591-6CN 0938	21209-F6-25	5340-00-059-4685	
3/8 (.3750)-24	1.125	3591-6CN 1125	21209-F6-30		
7/16 (.4375)-20	.438	3591-7CN 0438	21209-F7-10	5340-00-716-9148	
7/16 (.4375)-20	.656	3591-7CN 0656	21209-F7-15	5340-00-678-3310	
7/16 (.4375)-20	.875	3591-7CN 0875	21209-F7-20	5340-00-619-4227	
7/16 (.4375)-20	1.094	3591-7CN 1094	21209-F7-25	5340-00-067-7814	
7/16 (.4375)-20	1.312	3591-7CN 1312	21209-F7-30		
1/2 (.5000)-20	.500	3591-8CN 0500	21209-F8-10	5340-00-803-7150	
1/2 (.5000)-20	.750	3591-8CN 0750	21209-F8-15	5340-00-678-3309	
1/2 (.5000)-20	1.000	3591-8CN 1000	21209-F8-20	5340-00-721-7915	
1/2 (.5000)-20	1.250	3591-8CN 1250	21209-F8-25		
1/2 (.5000)-20	1.500	3591-8CN 1500	21209-F8-30		
9/16 (.5625)-18	.562	3591-9CN 0562	21209-F9-10	5340-00-686-0152	
9/16 (.5625)-18	.844	3591-9CN 0844	21209-F9-15	5340-00-685-0693	
9/16 (.5625)-18	1.125	3591-9CN 1125	21209-F9-20	5340-00-726-8526	

Table 9-21. Helical Coil Screw Thread Inserts - Continued

Size	Length	Part Number		National Stock No.	Your Reference
		Heli-Coil	Military Standard No.		
9/16 (.5625)-18	1.406	3591-9CN 1406	21209-F9-25		
9/16 (.5625)-18	1.688	3591-9CN 1688	21209-F9-30		
5/8 (.6250)-18	.625	3591-10CN 0625	21209-F1010	5340-00-815-8338	
5/8 (.6250)-18	.938	3591-10CN 0938	21209-F1015	5340-00-834-8362	
5/8 (.6250)-18	1.250	3591-10CN 1250	21209-F1020		
5/8 (.6250)-18	1.562	3591-10CN 1562	21209-F1025		
5/8 (.6250)-18	1.875	3591-10CN 1875	21209-F1030		
3/4 (.7500)-16	.750	3591-12CN 0750	21209-F1210	5340-00-514-8478	
3/4 (.7500)-16	1.125	3591-12CN 1125	21209-F1215	5340-00-723-6780	
3/4 (.7500)-16	1.500	3591-12CN 1500	21209-F1220	5340-00-836-2941	
3/4 (.7500)-16	1.875	3591-12CN 1875	21209-F1225		
3/4 (.7500)-16	2.250	3591-12CN 2250	21209-F1230		
7/8 (.8750)-14	.875	3591-14CN 0875	21209-F1410	5340-00-985-6568	
7/8 (.8750)-14	1.312	3591-14CN 1312	21209-F1415	5340-00-068-1286	
7/8 (.8750)-14	1.750	3591-14CN 1750	21209-F1420	5340-01-014-4621	
7/8 (.8750)-14	2.188	3591-14CN 2188	21209-F1425		
7/8 (.8750)-14	2.625	3591-14CN 2625	21209-F1430		
1 (1.0000)-12	1.000	3591-161CN 1000	21209-F1610		
1 (1.0000)-12	1.500	3591-161CN 1500	21209-F1615	5340-00-045-0514	
1 (1.0000)-12	2.000	3591-161CN 2000	21209-F1620		
1 (1.0000)-12	2.500	3591-161CN 2500	21209-F1625		
1 (1.0000)-12	3.000	3591-161CN 3000	21209-F1630		
1-1/8 (1.1250)-12	1.125	3591-18CN 1125	21209-F1810	5340-01-048-6352	
1-1/8 (1.1250)-12	1.688	3591-18CN 1688	21209-F1815	5340-00-421-9354	
1-1/8 (1.1250)-12	2.250	3591-18CN 2250	21209-F1820		
1-1/8 (1.1250)-12	2.812	3591-18CN 2812	21209-F1825		
1-1/8 (1.1250)-12	3.375	3591-18CN 3375	21209-F1830		
1-1/4 (1.2500)-12	1.250	3591-20CN 1250	21209-F2010		
1-1/4 (1.2500)-12	1.875	3591-20CN 1875	21209-F2015		
1-1/4 (1.2500)-12	2.500	3591-20CN 2500	21209-F2020		
1-1/4 (1.2500)-12	3.125	3591-20CN 3125	21209-F2025		
1-1/4 (1.2500)-12	3.750	3591-20CN 3750	21209-F2030		
1-3/8 (1.3750)-12	1.375	3591-22CN 1375	21209-F2210		
1-3/8 (1.3750)-12	2.062	3591-22CN 2062	21209-F2215		
1-3/8 (1.3750)-12	2.750	3591-22CN 2750	21209-F2220		
1-3/8 (1.3750)-12	3.438	3591-22CN 3438	21209-F2225		
1-3/8 (1.3750)-12	4.125	3591-22CN 4125	21209-F2230		
1-1/2 (1.5000)-12	1.500	3591-24CN 1500	21209-F2410		
1-1/2 (1.5000)-12	2.250	3591-24CN 2250	21209-F2415		
1-1/2 (1.5000)-12	3.000	3591-24CN 3000	21209-F2420		
1-1/2 (1.5000)-12	3.750	3591-24CN 3750	21209-F2425		
1-1/2 (1.5000)-12	4.500	3591-24CN 4500	21209-F2430		

Table 9-22. Helical Coil 18-1.5mm

Part Description	National Stock No.	Military Standard
Long Reach - Length .683		
Standard Insert	5340-00-532-7727	9018-01
+.003 Oversize Insert	5340-00-037-5252	9018-02
+.005 Oversize Insert	5340-00-037-5253	9018-03
+.010 Oversize Insert	5340-00-597-5470	9018-04
+.015 Oversize Insert		9018-09
+.020 Oversize Insert		9018-10
+.025 Oversize Insert		9018-11
Short Reach - Length .334		
Standard Insert		9018-05
+.003 Oversize Insert		9018-06
+.005 Oversize Insert		9018-07
+.010 Oversize Insert		9018-08

Table 9-23. Helical Coil Stud-Locking Inserts

Size	Length	* Part No.	Aerospace Std. No.	National Stock No.
Unified Coarse				
10 (.190)-24	.285	3758-3CN 0285	*	
10 (.190)-24	.380	3758-3CN 0380		
10 (.190)-24	.475	37S83CN 0475		
10 (.190)-24	.570	37583CN 0570		
1/4 (.250)-20	.375	3758-4CN 0375		5340-01-014-7388
1/4 (.250)-20	.500	3758-4CN 0500		
1/4 (.250)-20	.625	3758-4CN 0625		
1/4 (.250)-20	.750	3758-4CN 0750		
5/16 (.312)-18	.469	3758-5CN 0469		5340-00-505-3634
5/16 (.312)-18	.625	3758-5CN 0625		5340-00-191-9407
5/16 (-312)-18	.781	3758-5CN 0781		5340-00-453-8736
5/16 (.312)-18	.938	3758-5CN 0938		
3/8 (.375)-16	.562	3758-6CN 0562		5340-01-014-7389
3/8 (.375)-16	.750	3758-6CN 0750		
3/8 (.375)-16	.938	3758-6CN 0938		5340-00-441-2383
3/8 (.375)-16	1.125	3758-6CN 1125		
7/16 (.438)-14	.656	3758-7CN 0656		
7/16 (.438)-14	.875	3758-7CN 0875		
7/16 (.438)-14	1.094	3758-7CN 1094		
7/16 (.438)-14	1.312	37587CN 1312		
1/2 (.500)-13	.750	3758-8CN 0750		
1/2 (.500)-13	1.000	3758-8CN 1000		
1/2 (.500)-13	1.250	3758-8CN 1250		
1/2 (.500)-13	1.500	3758-8CN 1500		

Table 9-23. Helical Coil Stud-Locking Inserts - Continued

Size	Length	* Part No.	Aerospace Std. No.	National Stock No.
Unified Fine				
10 (.190)-32	.285		AS 3080-03	
10 (.190)-32	.380		AS 3081-03	
10 (.190)-32	.475		AS 3082-03	
10 (.190)-32	.570		AS 3083-03	
1/4 (.250)-28	.375		AS 3080-04	
1/4 (.250)-28	.500		AS 3081-04	
1/4 (.250)-28	.625		AS 3082-04	
1/4 (.250)-28	.750		AS 3083-04	
5/16 (.312)-24	.469		AS 3080-05	
5/16 (.312)-24	.625		AS 3081-05	
5/16 (.312)-24	.781		AS 3082-05	
6/16 (.312)-24	.938		AS 3083-05	
3/8 (.375)-24	.562		AS 3080-06	
3/8 (.375)-24	.750		AS 3081-06	
3/8 (.375)-24	.938		AS 3082-06	
3/8 (.375)-24	1.125		AS 3083-06	
7/16 (.438)-20	.656		AS 3080-07	
7/16 (438)-20	.875		AS 3081-07	
7/16 (.438)-20	1.094		AS 3082-07	
7/16 (438)-20	1.312		AS 3083 07	
1/2 (.500)-20	.750		AS 3080-08	
1/2 (.500)-20	1.000		AS 3081-08	
1/2 (.500)-20	1.250		AS 3082-08	
1/2 (.500)-20	1.500		AS 3083-08	
*Use Part number per CAGE No. 01556 to order Unified Coarse Stud-Lock Inserts				

CHAPTER 10

PANEL AND QUICK-RELEASE FASTENERS

10.1 PANEL AND QUICK-RELEASE FASTENERS.

CAUTION

- To prevent fastener damage, use proper tools. (See Chapter 3 for driver selection.)
- To prevent damage to structure or fastener components, always use proper grip-length fasteners.
- To prevent damage to structure or fastener components, do not exceed manufacturer's recommended installation torque.
- To prevent damage to structure, do not allow screwdriver or wrench to slip out of driving recess.

These fasteners are used to secure cowling, plates, panels and doors which require quick and frequent removal and replacement. The primary difference between the 2 types of fasteners is their method of installation and load-carrying ability. Quick-release fasteners are not generally designed to carry primary structural loads. Quick-release fasteners are (as the name implies) easily installed and removed, generally with only a one-quarter turn of the stud. Panel fasteners are designed to carry structural loads and require several turns of the multiple lead screw for installation and release. Cautions apply to the usage of both types of fasteners.

10.2 STRUCTURE ASSEMBLY USING PANEL AND QUICK-RELEASE FASTENERS.

Ease of assembly as well as reduced damage to structure and fasteners can best be achieved by following the steps below:

a. Be sure all studs are pulled out to the fully retracted position.

b. Place panel in position and align studs with holes.

NOTE

DO NOT use studs as handles.

c. Push studs in and engage by hand before applying torque.

d. Make sure that all of the fasteners in the panel are started before running down any of the fasteners in the pattern.

e. Apply torque using the proper tools (see Chapter 3), in a smooth uniform manner. DO NOT snap load or over torque. See the dash 3 of the applicable System Technical Order for proper torque values.

f. Check the installation for gaps, bulges, and misalignment. Should any be present, disassemble the unit, check studs and receptacles for proper operation, check alignment, and insure that no foreign material is present in the joint area - then reassemble.

10.3 STRUCTURE DISASSEMBLY USING PANEL AND QUICK-RELEASE FASTENERS.

Care should be taken when disassembling structure which is held in place with panel and quick-release fasteners. Damage to structure and fasteners can be avoided by following the steps shown below.

a. Select the proper tool for the fastener recess. (See Chapter 3 for driver selection.)

b. Back the fasteners out.

c. Pull the studs out to the fully retracted position.

d. Remove the panel. DO NOT USE the studs as handles.

e. Check receptacles for damage.

10.4 QUICK-RELEASE FASTENERS.

There are three basic styles of quick-release fasteners available for aircraft use, covered here as Style I, Style II, and Style III. The flush-head, quick-release fastener is used on the exterior of aircraft; oval and winged head fasteners are used in the interior.

10.4.1 Style I Quick-Release Fastener.

CAUTION

To prevent fastener damage, use proper tools.

The Style I quick-release fastener consists of a stud assembly, a grommet, and a receptacle. There are two types of Style I fasteners used on aircraft. The light-duty type is used on box doors and panels, plates, and light fairing sections, and a heavy-duty type is generally used on cowling and heavy fairing.

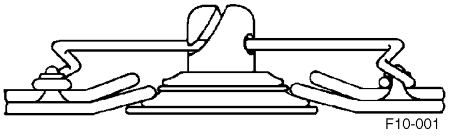


Figure 10-1. Style I Quick-Release Fastener

10.4.1.1 Removal and Replacement of Style I Quick-Release Fastener.

10.4.1.2 Winged Type or Small Oval Head Type. Style I quick-release fasteners, shown in Figure 10-1, are removed and replaced by Style I fastener tools. Winged type or small oval head type Style I fasteners should be removed as follows:

a. Center damaged quick-release fastener over hole in anvil.

b. Drive out old fastener as shown in detail A of Figure 10-2. The hole will be too large and will be dimpled on the wrong side after the damaged fastener has been driven out.

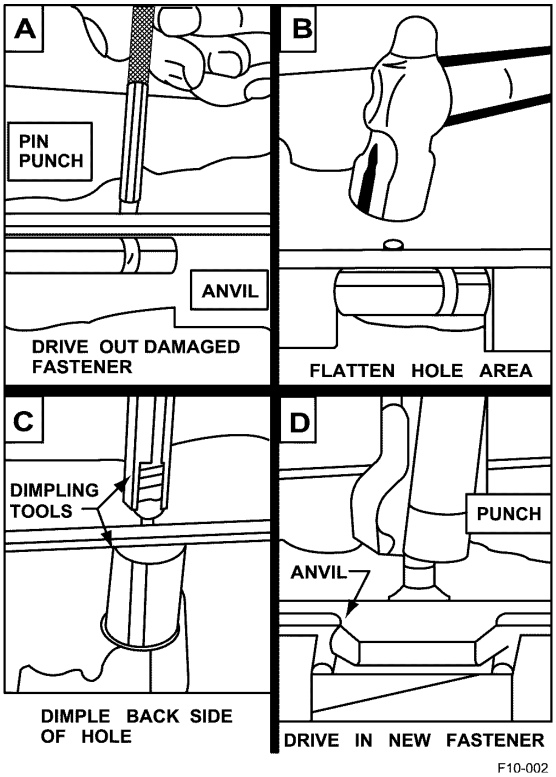


Figure 10-2. Removal and Replacement of Style I Quick-Release Fastener

c. Flatten hole area as shown in detail B of Figure 10-2.

d. Redimple back side of hole as shown in detail C of Figure 10-2.

e. Drive in new quick-release fastener as shown in detail D of Figure 10-2.

10.4.1.3 Heavy-Duty Style I. Remove and replace flush-type, heavy-duty Style I quick-release fastener as follows:

a. Remove grommet and damaged fastener by cutting away grommet as shown in Figure 10-3.

b. Install new grommet and fastener by inserting fastener into grommet and flaring grommet as shown in Figure 10-4.

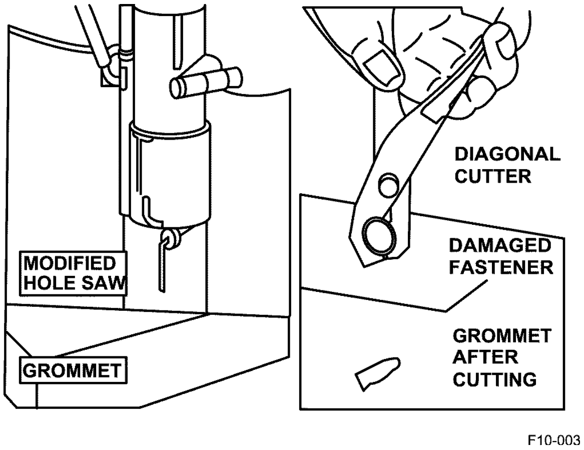


Figure 10-3. Removal of Flush-Type, Heavy-Duty, Style I Quick-Release Fastener

10.4.1.3.1 Repair of Heavy-Duty Style I Quick-Release Fastener Hole. When the hole is too badly damaged to permit reinstallation of the same size heavy-duty, Style I quick-release fastener, repair as follows:

a. Drill hole in panel approximately 1/8-inch-larger diameter than required for fastener.

b. Fabricate a plate approximately 1/1/2-inches square of same material and thickness as panel.

c. Bevel edges of plate and dimple to dimension equal to thickness of plate and same diameter as hole in panel.

d. Place plate on panel so that dimple fits into hole prepared in a above.

e. Drill holes and secure plate to panel with rivets.

f. Drill correct size hole in plate dimple that will accommodate fastener to be installed.

g. Install grommet and fastener.

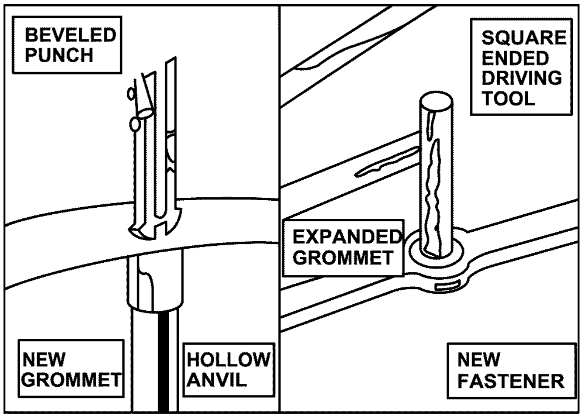


Figure 10-4. Replacement of Flush-Type, Heavy-Duty, Style I Quick-Release Fastener

10.4.2 Style II Quick-Release Fastener. The Style II quick-release fasteners covered in this section are used to secure aircraft cowling and fairing. The Style II fastener consists of three parts: a stud assembly, a grommet, and a receptacle. (See Figure 10-5.) There are two types of receptacles - the rigid and the floating. The rigid receptacle is not used to a great extent on cowling. When repair or replacement is necessary, the rigid receptacle should be replaced with a floating type. The receptacle shown in Figure 10-5 consists of an aluminum alloy forging mounted in a stamped sheet metal base. The forging has room for approximately 1/8-inch float. The receptacle is riveted to the panel support or panel. The grommet shown in Figure 10-5 is a flanged ring made to fit into a dimple in the outside panel. Grommets are furnished in various lengths to accommodate the varying thickness of panels. The stud assembly shown in Figure 10-5 consists of a stud, cross pin, spring, and spring cup. The stud assemblies are assembled at the factory and should not be disassembled. To install the stud assembly, compress the spring and insert the stud assembly into the grommet. Once installed in the grommet, the stud assembly cannot be removed unless the spring is again compressed. A Style II fastener assembly in the locked and unlocked position is shown in Figure 10-6 and Figure 10-7.

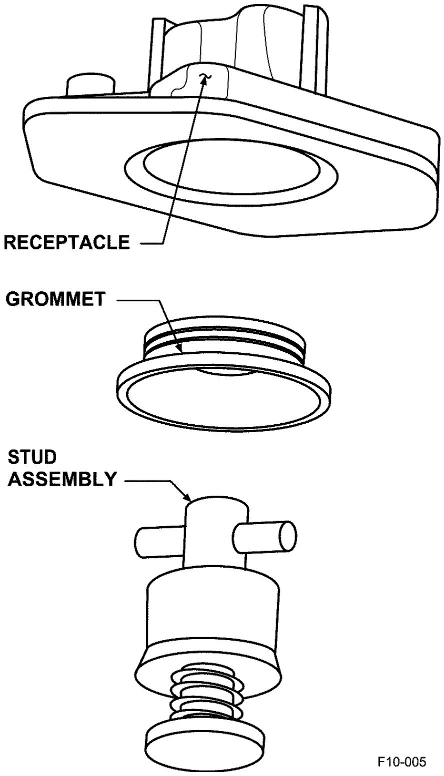


Figure 10-5. Style II Quick-Release Fastener

10.4.2.1 Removal and Replacement of Style II Quick-Release Fastener.

10.4.2.2 Style II Quick-Release Fastener Receptacle. If the panel or panel support is damaged, it may be necessary to install a new section on which the receptacle can be riveted. When it becomes necessary to replace the receptacle, proceed as follows:

a. Remove damaged receptacle by drilling out rivets.

b. Install new receptacle by riveting into place.

10.4.2.3 Style II Quick-Release Fastener Grommet. When it becomes necessary to replace a grommet, proceed as follows:

a. Cut away old grommet or, by applying pressure from the top, press out old grommet, thus enlarging the dimple.

b. Insert new grommet and press dimple back into its original shape.

10.4.3 Style II Quick-Release Fastener Stud Assembly. Insert stud assembly into grommet as follows:

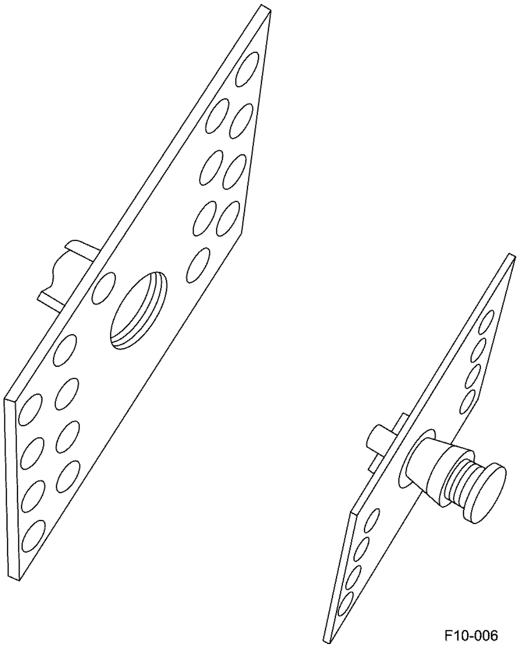


Figure 10-6. Style II Quick-Release Fastener, Unlocked Position

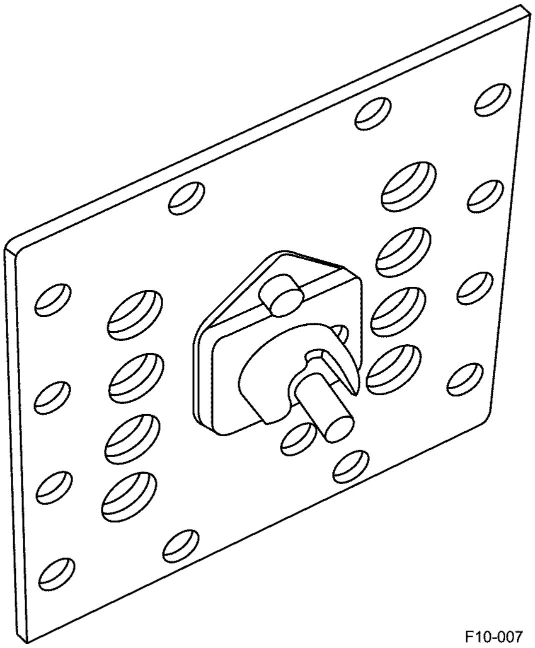


Figure 10-7. Style II Quick-Release Fastener, Locked Position

a. Compress spring of stud assembly. Pliers shown in Figure 10-8 are used for this operation; however, any pliers may be ground to a similar shape, or an improvised metal extractor may be used.

b. Insert stud assembly through grommet. Use the shortest stud assembly that will lock and unlock without binding. (See System TO for proper stud length.)

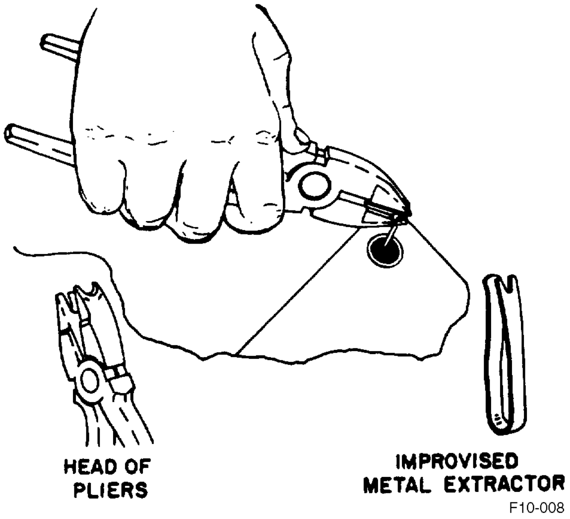


Figure 10-8. Style II Quick-Release Fastener Plier

10.4.4 Style III Quick-Release Fastener. The Style III fastener, shown in Figure 10-9, consists of three parts: a spring or stud receptacle, the stud, and the cross pin. These fasteners are manufactured in three sizes, 3/4-inch, 1-inch, and 1-3/8-inch. The size designation is based on the center distances between the receptacle rivet holes and the relative tensile strengths. These correspond to the general size designations of numbers 2, 5, and 7, respectively. (Refer to Table 10-1.) The two types of Style III receptacles used on aircraft are the rigid and floating types; they are shown in Figure 10-10. Both types are manufactured from high-carbon, heat-treated steel. The receptacles are riveted into place. An upper wing provides ejection of the stud when the fastener is unlocked and permits the cross pin to be held in a locked position between the upper wing, the cam, the stop, and the wing indention. The Type III studs shown in Figure 10-11 are manufactured of steel, case-hardened to eliminate excessive wear. The stud hole is reamed for a press fit of the cross pin in the stud hole. The cross pin shown in Figure 10-11 is made of chrome-vanadium steel, heat treated to provide maximum strength, wear, and holding power.

10.4.5 Removal and Replacement of Style III Quick-Release Fastener.

10.5 STYLE III QUICK-RELEASE FASTENER RECEPTACLE.

If the panel or sheet is damaged, it may be necessary to install a new section on which the receptacle can be installed. Receptacles shown in Figure 10-10 are riveted to the inner surface of the inner sheet. The rivets must be flush with the outer surface of the inner sheet. When installing receptacles, it is important that the correct size rivets be used. With 3/4-inch receptacle, use 3/32-inch rivets; with 1-inch receptacles, use 1/8 or 3/32-inch rivets; and with 1-3/8-inch receptacles, use 1/8-inch rivets. Receptacles with plain rivet holes may be replaced by receptacles with countersunk rivet holes. Remove and replace receptacles as follows:

a. Drill out rivets, being careful not to damage the sheet or panel.

b. Select the proper size and type receptacle and rivet in place. Make sure the correct size rivets are used.

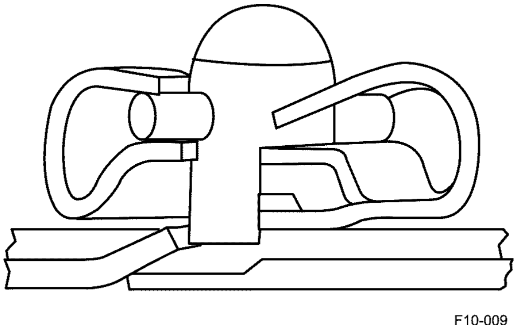


Figure 10-9. Style III Quick-Release Fastener

Table 10-1. Size Designations

Size	Stud Shank Diameter	Cross Pin Length
No. 2 (3/4-Inch)	11/64	0.313
No. 5 (1-Inch)	17/64	0.453
No. 7 (1-3/8-Inches)	5/16	0.600

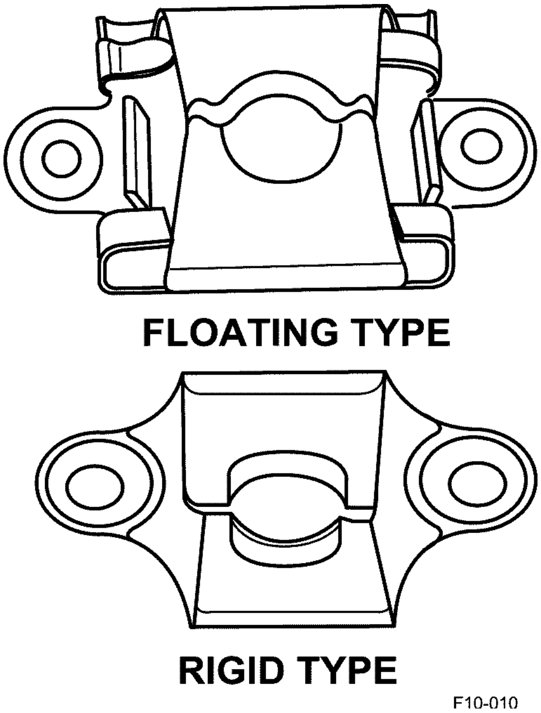


Figure 10-10. Style III Quick-Release Fastener Receptacles

10.6 STYLE III QUICK-RELEASE FASTENER STUD.

Remove and replace Style III studs as follows:

a. Remove cross pin from stud. (See Figure 10-11.)

b. Remove stud.

CAUTION

Do not reuse old cross pins or studs because the cross pin will not be sufficiently tight in the stud.

c. Select correct stud size and length.

d. Insert new stud into panel or sheet and insert new cross pin.

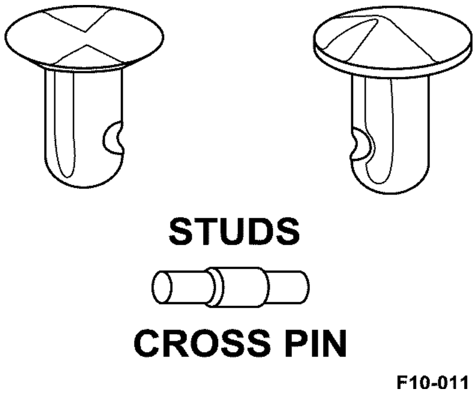


Figure 10-11. Style III Quick-Release Fastener Studs and Cross Pins

10.7 STYLE III QUICK-RELEASE FASTENER CROSS PINS.

The cross pins are removed either by clipping off or by pressing out. The cross pins for 1-3/8 and 1-inch studs are to be pressed out. The standard hand pliers shown in Figure 10-12 may be used for this operation. These pliers are available for each size Style III fastener. The cross pin for 3/4-inch studs may be clipped off. A method of inserting cross pins is shown in Figure 10-13.

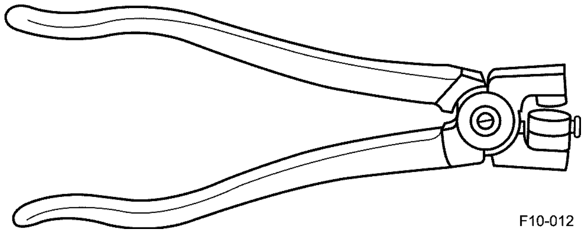


Figure 10-12. Hand Pliers for Removing Cross Pins

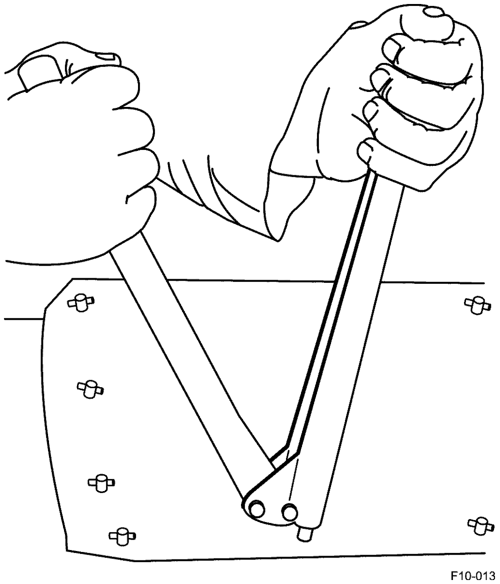


Figure 10-13. Inserting Cross Pin Using Hand Tool

10.8 STYLE III QUICK-RELEASE FASTENER STUD SELECTION.

Before the stud shown in Figure 10-11 can be installed, the sheet in which the stud is to be installed must be dimpled, if dimpling is required. There are two methods of dimpling: machine dimpling and hand dimpling, as shown in Figure 10-14 and Figure 10-15. Dimpling tools, as well as tool holders, are available for all sizes of Style III fasteners. If roundhead studs are not available, the outer sheet may be dimpled and a countersunk head stud substituted. Style III studs come in lengths varying ten-thousandths of an inch. When a new stud is to be installed, be sure that the proper length stud is selected. The stud length is stamped on the stud head. To determine correct stud length, proceed as follows:

a. Select proper head type: flush head or winged.

b. Determine total applicable thickness. Add thickness of inner (structure) and outer (panel, door, etc.) sheets, including gaskets and reinforcements, in thousandths of an inch. Add 0.010 inch to allow for wrinkling, warpage, etc.

c. Take the nearest even 0.010 inch above the total obtained in b above. This total is the correct stud length to use.

NOTE

- An additional 0.020 inch must be added to the values obtained in step b above when selecting studs for number 2 floating receptacles. For numbers 5 and 7 floating receptacles, add 0.030 inch. (Refer to Table 10-2.)
- Sometimes severe warpage of wrinkling makes it difficult to engage the receptacle requiring a stud 0.010 or 0.020 inch longer.

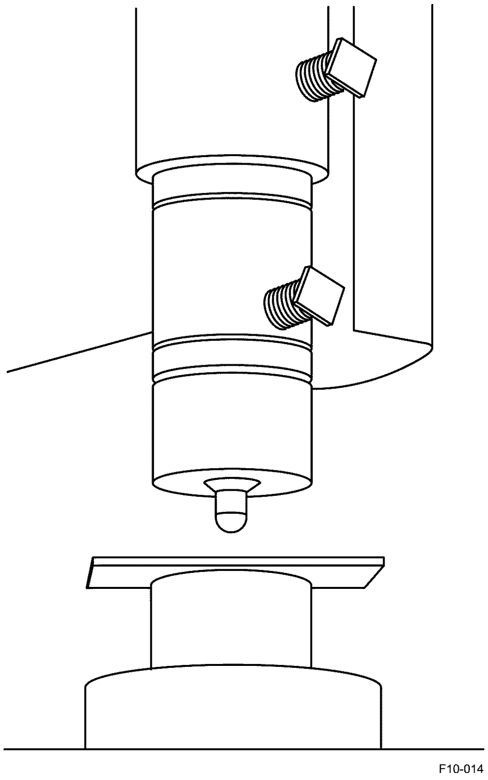


Figure 10-14. Machine Dimpling

10.8.1 Style III Quick-Release Fastener Maintenance. When a Style III fastener does not fasten properly and the stud length is known to be correct, excess misalignment is usually the cause. This condition can often be corrected by removing the panel and fastening the studs in a different sequence -- either fastening the difficult studs first, or by starting in the middle of the panel and working toward each end.

CAUTION

When replacing Style III studs, do not hammer the stud head because the cross pin may fracture the cam of the receptacle. Be sure the cross pin is centered in the stud.

a. In an extreme case of misalignment, a slightly larger stud hole may correct the condition. However, care must be used so that the stud holes do not exceed 27/64-inch for the number 7 stud, 5/16-inch for the number 5 stud, and 7/32 inch for the number 2 stud; otherwise the stud will fall out of the panel. If a rigid type receptacle is being used, a floating type may correct the condition. When floating type receptacles are used, it is necessary to enlarge the receptacle hole to 7/8-inch for the number 7 receptacle, 11/16-inch for the number 5 receptacle, and 15/32-inch for the number 2 receptacle. This will permit maximum float or misalignment takeup.

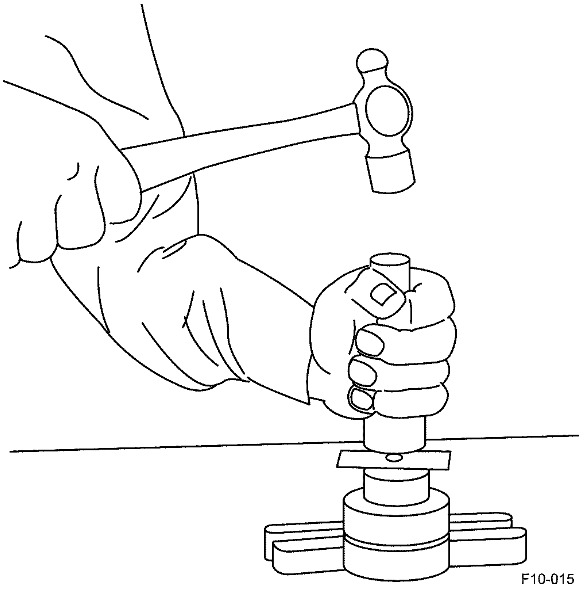


Figure 10-15. Hand Dimpling

Table 10-2. Example of Style III Quick-Release Fastener Stud Length Selection

	For All Stationary Receptacles	For No. 2 Floating Receptacles	For No. 5 and No. 7 Floating Receptacles
Inner Sheets	0.064	0.064	0.064
Outer Sheets	0.080	0.080	0.080
Reinforcement	0.016	0.016	0.016
Gasket	0.038	0.038	0.038
	0.198	0.198	0.198
Plus Allowance for Warpage, Wrinkling, etc.	0.010	0.010	0.010
Plus Allowance for Floating Type		0.020	0.030
	0.208	0.228	0.238
Stud Length to be Used	0.210	0.230	0.240

10.9 OTHER QUICK-RELEASE FASTENERS.

There are numerous styles of quick-release fasteners that provide installation and removal in one-quarter turn. In general, they require a stud, some means of retaining the stud, and a receptacle.

10.9.1 Dzus Panel Line Fasteners. This type fastener provides a stud loaded in a cup (see Figure 10-16). The cup is retained in the upper panel by a flaring operation on the under side of the panel. The stud is retained by clinching the top of the cup to conform to the stud head profile. There are several receptacles available, all employing the spring wire principle shown in Figure 10-1. For installation of pre-assembled type PFSC 3 1/2 Panel Line Fasteners, use power tool P/N PT3 1/2A, NSN 5120-00-152-2275.

10.9.2 Camloc Fasteners. Camloc fasteners are semi-structural type and are of relatively high strength. They are used in areas for access panels and inspection doors which are frequently removed and which do not carry primary aircraft structural stresses. The camloc fastener (see Figure 10-20) has three basic parts. The stud, the retaining ring and the receptacle. The stud is held in the access panel or door with the retaining ring, and the receptacle is riveted to the substructure. There are four types of receptacles used with the Camloc fastener. Two types used with the 4002 series shear-type fastener are 214-16, which is a rigid-type receptacle, and 244-16, which is a floating-type receptacle. Types 4R41-1 and 4R1-16 are used with the stressed-panel fastener, and are both floating-type receptacles.

10.9.3 Paneloc Quarter-Turn Fasteners. These fasteners are available in three sizes. They consist of a stud, retaining ring, and receptacle (see Figure 10-21). A shear washer is used when added strength is required. Table 10-3 presents a stud length selection table and typical installation instructions.

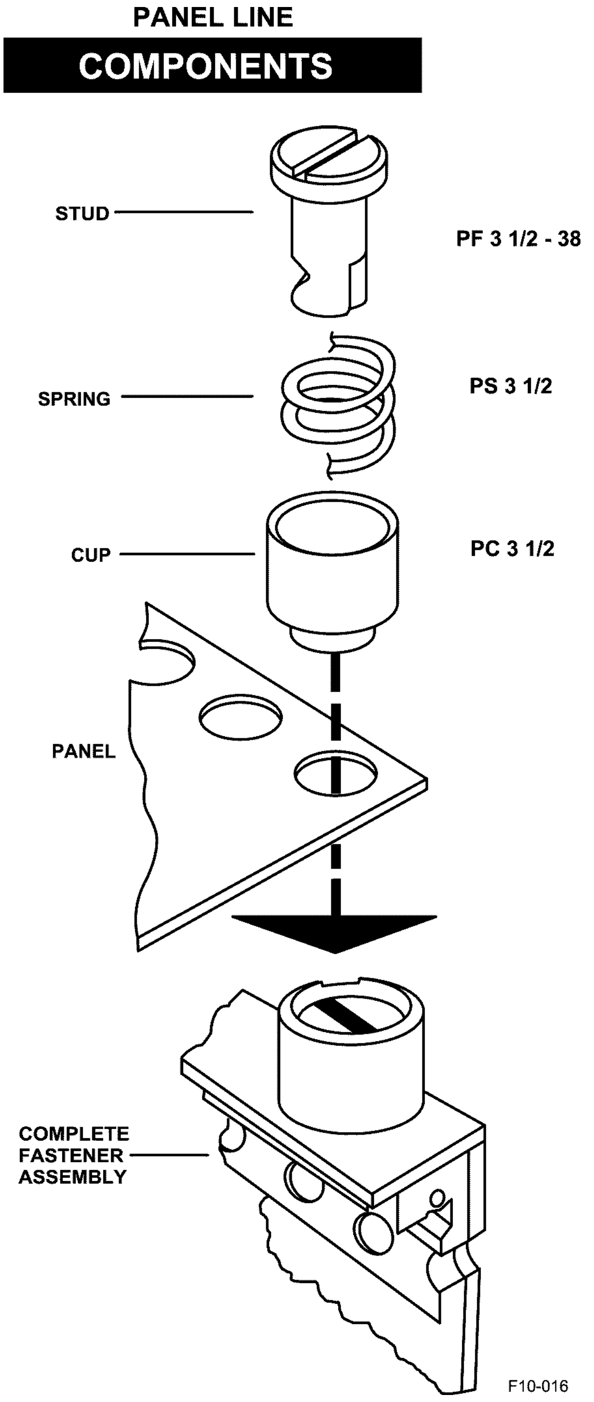


Figure 10-16. Typical Installation for Dzus PF 3 1/2-38 Stud, PC 3 1/2 Cup, and PS 3 1/2 Spring

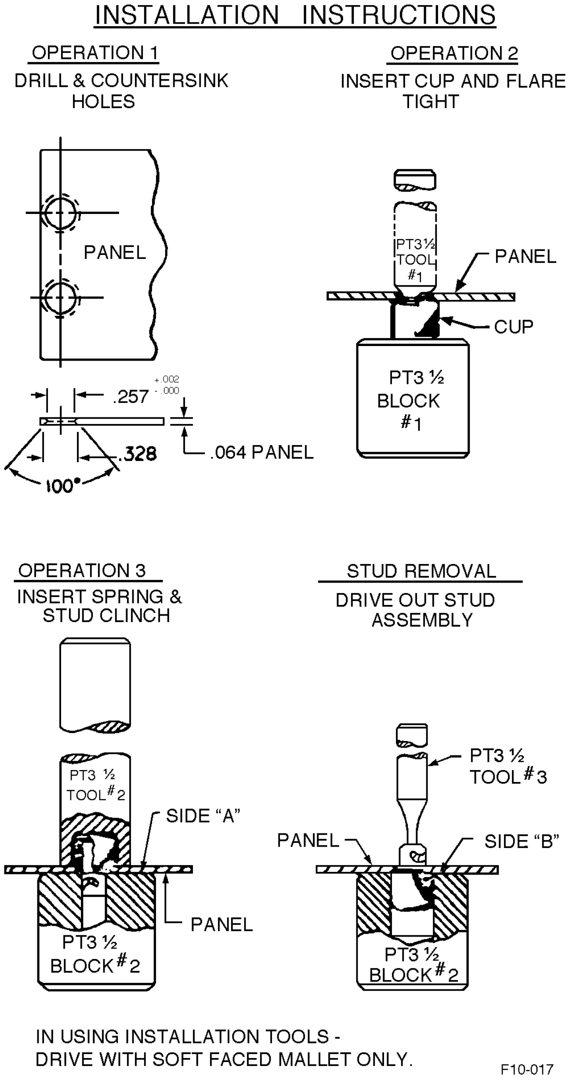
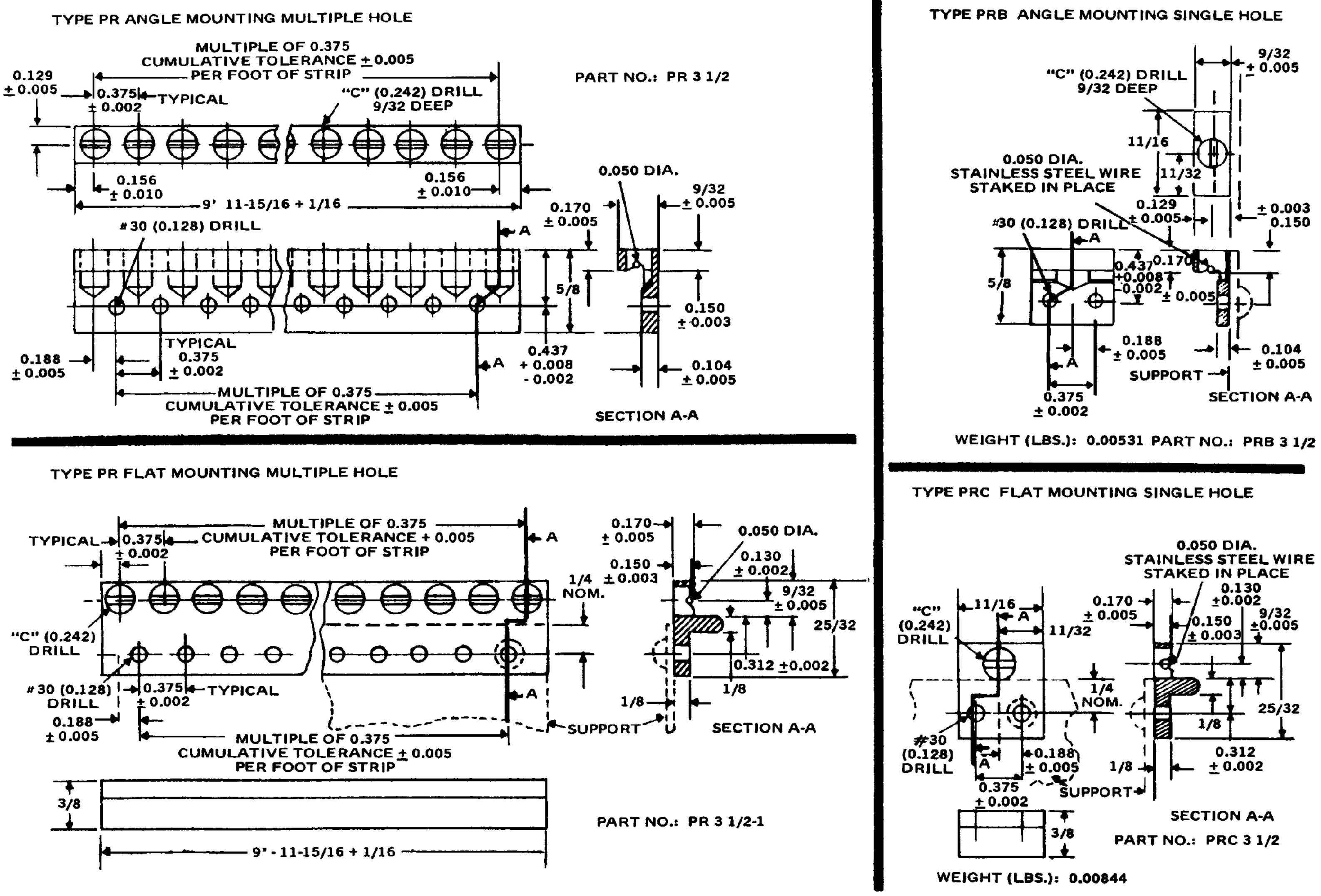


Figure 10-17. Installation and Removal Instructions for Dzus PF 3 1/2-38 Stud, PC 3 1/2 Cup, and PS 3 1/2 Spring

RECEPTACLES

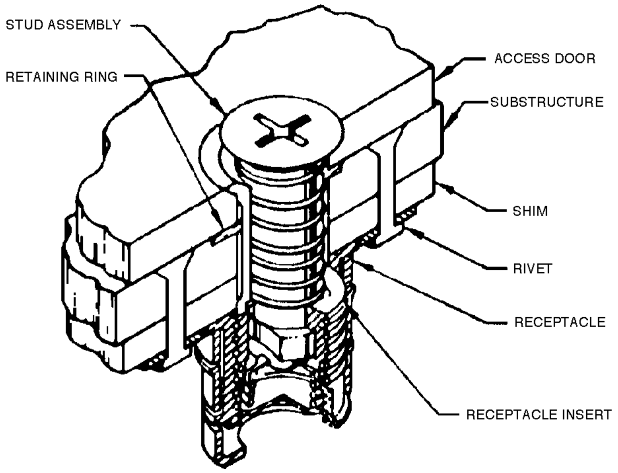
MATERIALS: EXTRUSION-6061 T6 ALUMINUM ALLOY TO FEDERAL SPECIFICATION QQ-A-200/8b — COND. T6. WIRE — 0.050 DIAMETER STAINLESS STEEL PER QQ-W-423/TYPE FS-316 CONDITION B SPRING TEMPER.



F10-018

Figure 10-18. Receptacles

CAMLOC FASTENERS INSTALLATION AND REMOVAL

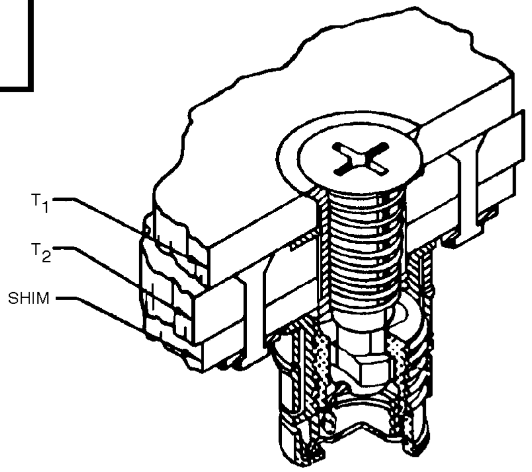


VIEW SHOWING CAMLOC STUD ENGAGED, LEAVING STUD HEAD SLIGHTLY ABOVE MOLD LINE

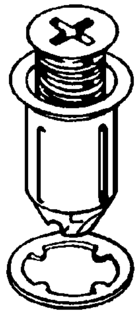
INSTALLATION AND REMOVAL

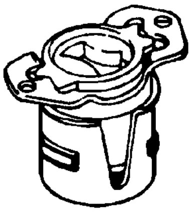
To engage stud assembly, push stud in and turn right one quarter turn. If the stud does not rotate freely for the first quarter turn, it may not be engaged, and must be turned left to reset receptacle insert enough to permit free rotation for the first quarter turn to the right. After stud engagement, torque stud to about 40 inch-pounds.

To disengage stud, rotate stud left at least one-half turn.



VIEW SHOWING CAMLOC IN INSTALLED POSITION





NOTE Hole size must be as follows:

a. For countersunk applications, use drill W (0.3860 inch).

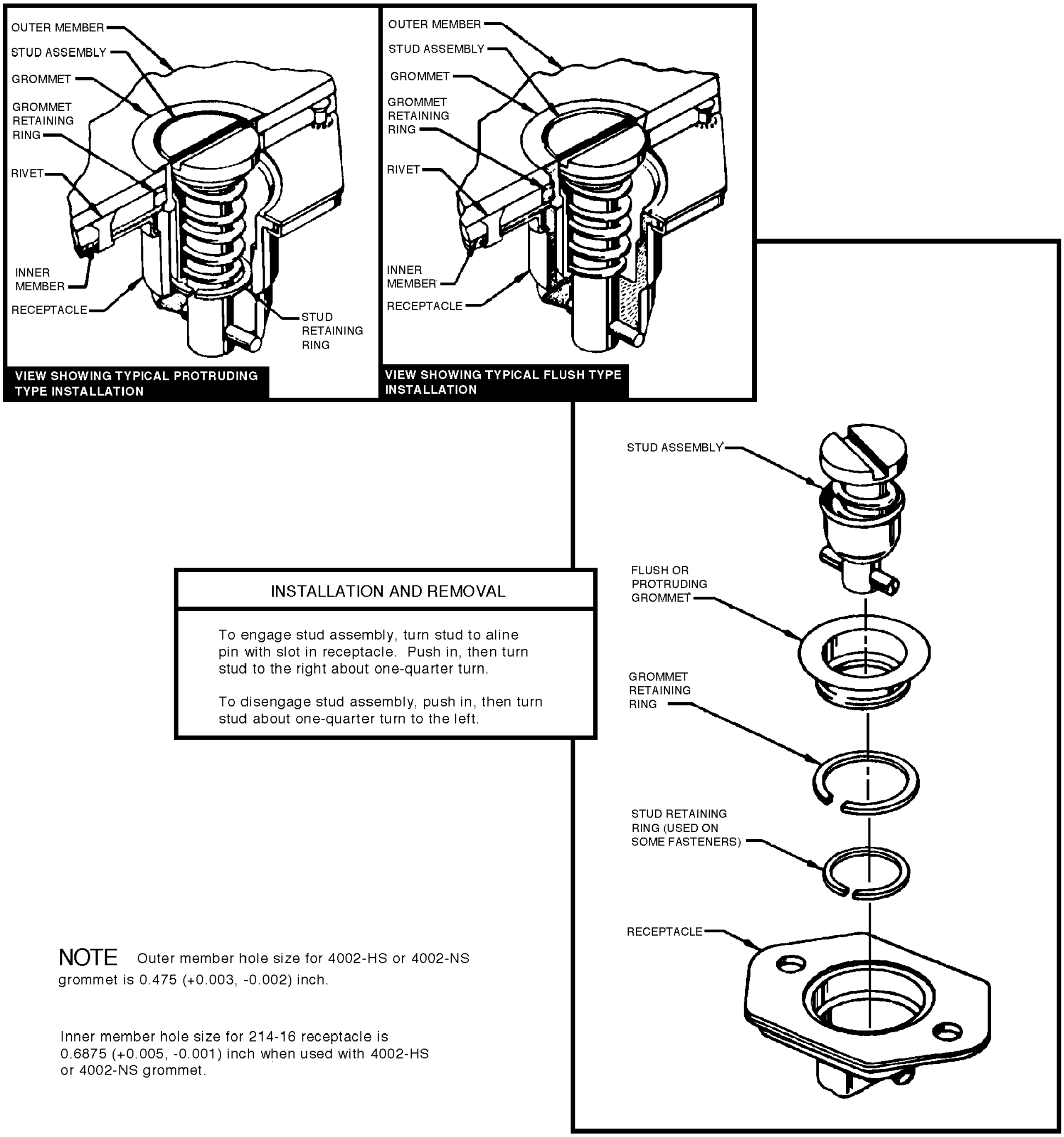
b. For dimpled applications, predrill 9/32-Inch, dimple, and redrill, using drill W (0.3860 inch).

- Use retaining ring 4S9-2 for countersunk applications; use retaining ring 4S10-1 for dimpled applications.
- Shim is required only when $T_1 + T_2$ is less than 0.158 inch.

F10-019

Figure 10-19. Camloc 4F Series Stressed Panel Fastener

CAMLOC FASTENERS INSTALLATION AND REMOVAL



INSTALLATION AND REMOVAL

To engage stud assembly, turn stud to aline pin with slot in receptacle. Push in, then turn stud to the right about one-quarter turn.

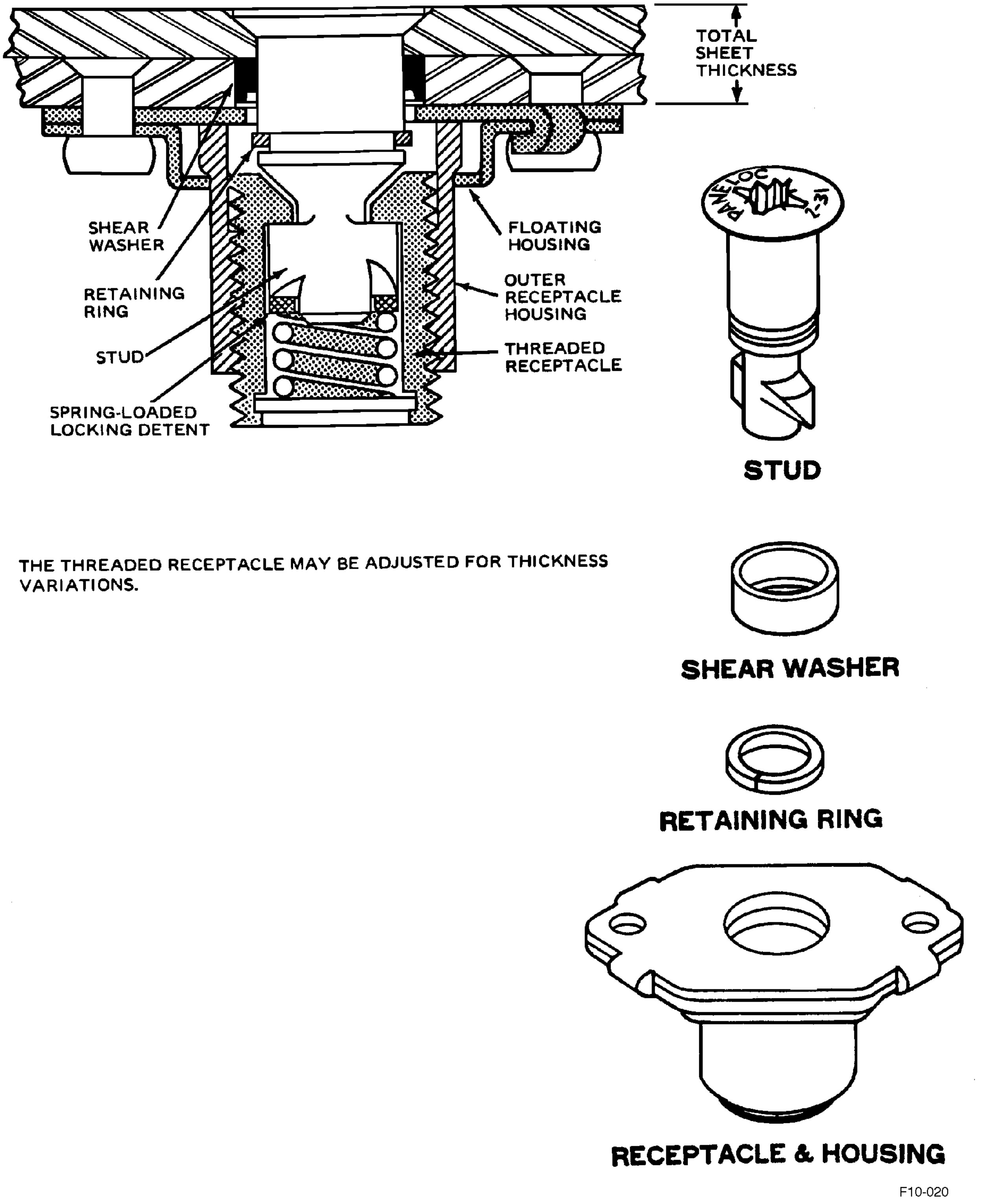
To disengage stud assembly, push in, then turn stud about one-quarter turn to the left.

NOTE Outer member hole size for 4002-HS or 4002-NS grommet is 0.475 (+0.003, -0.002) inch.

Inner member hole size for 214-16 receptacle is 0.6875 (+0.005, -0.001) inch when used with 4002-HS or 4002-NS grommet.

F10-019A

Figure 10-20. Camloc 4002 Series Fastener



THE THREADED RECEPTACLE MAY BE ADJUSTED FOR THICKNESS VARIATIONS.

Figure 10-21. Paneloc Quarter-Turn Fasteners

Table 10-3. Stud Length Selection, Installation, and Receptacle Installation for Paneloc Fasteners

Dash Number (Use as Suffix to Stud Part No.)	Total Sheet Thickness				
	Studs			Studs With Grommet Assembly	
	No. 10	No. 1	No. 2	No. 1	No. 2
-3 Oval Head Only	0.000 - 0.060	- -	- -	- -	- -
-6	0.060 - 0.090	0.040 - 0.102	- -	0.040 - 0.060	- -
-9	0.090 - 0.125	0.071 - 0.133	- -	0.071 - 0.101	- -
-12	0.125 - 0.160	0.102 - 0.165	0.078 - 0.203	0.102 - 0.133	0.078 - 0.158
-15	0.160 - 0.190	0.133 - 0.196	- -	0.133 - 0.164	- -
-18	0.190 - 0.220	0.165 - 0.227	0.141 - 0.266	0.165 - 0.195	0.141 - 0.221
-21	0.220 - 0.250	0.196 - 0.258	- -	0.196 - 0.226	- -
-25	0.250 - 0.280	0.227 - 0.290	0.203 - 0.328	0.227 - 0.258	0.203 - 0.283
-28	0.280 - 0.310	0.258 - 0.321	- -	0.258 - 0.289	- -
-31	0.310 - 0.340	0.290 - 0.352	0.266 - 0.391	0.290 - 0.320	0.266 - 0.346
-34	0.340 - 0.370	0.321 - 0.383	- -	0.321 -0.351	- -
-37	0.370 - 0.400	0.352 - 0.415	0.328 - 0.453	0.352 - 0.383	0.328 - 0.408
-40	0.400 - 0.430	0.383 - 0.446	- -	0.383 - 0.414	- -
-43	0.430 - 0.470	0.415 - 0.477	0.391 - 0.516	0.415 - 0.445	0.391 - 0.471
-46	0.470 - 0.500	0.446 - 0.508	- -	0.446 - 0.476	- -
-50	0.500 - 0.530	0.477 - 0.540	0.453 - 0.578	0.477 - 0.508	0.453 - 0.533

Stud Length Selection Table

The stud length dash number suffixes given above indicate total sheet thickness accommodated by each length. Each Paneloc high-performance fastener can be used over a wide range combining sheet and gasket thicknesses. Thus a 6200-18 No. 10 size flush-head stud may be used for high-performance fastening of systems with total sheet thicknesses ranging from 0.190 to 0.220 inch. A 57300-F1-18 No. 2 size flush-head stud accommodates combining thicknesses totaling from 0.141 to 0.266 inch.

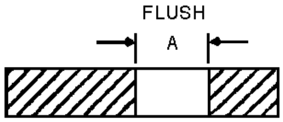
Stud and Grommet Assemblies

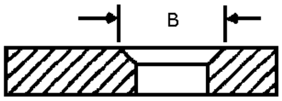
For thin sheet applications, flush-head studs are available with grommets providing six times as much support area.

Stud Installation

1. Drill Outer Panel following ‘‘A’’ dimension.

2. Countersink for flush-head styles only using dimension ‘‘B’’ for appropriate stud size.





3. Insert Stud in Panel.

Table 10-3. Stud Length Selection, Installation, and Receptacle Installation for Paneloc Fasteners - Continued

4. If Shear Washer is used, drop it over the wings of the stud with its recess up.
5. Drop the retaining ring over wings of stud and push ring down until it snaps into retaining groove on stud.

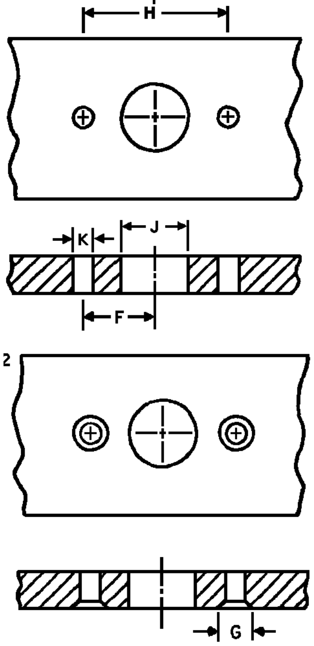
Retaining Ring Attaching Tool

Installation can be accomplished without special tools. To facilitate the installation of retaining rings and speed up production, a simple hand tool is available. Order tool by National Stock Number for the size ring to be installed.

High Performance Stud Size	No. 10	No. 1	No. 2	No. 1 With Grommet	No. 1 With Grommet	No. 1 With MS Flush-head Bushing	No. 1 With MS Protruding-Head Bushing
Hole Diameter ''A''	.192 -.197	.251 -.258	.314 -.321	.500	.6094	.413	.413
Countersink Diameter ''B''	.352 -.357	.407 -.422	.509 -.524	- - -	- - -	.5312	- - -
Attaching Tool Part No.	6219	RT4650-1	RT7300-1	- - -	- - -	- - -	- - -

Standard Receptacle Housing Installation

1. Drill holes per dimensions given below.
2. Countersink rivet holes per dimensions given below.



3. Attach with rivets.

Size	F	G	H	J	K
10	.375	3/16	.750 ±.002	.290/.285	.103/.098
1	.438	3/16	.875 ±.005	.353/.346	.103/.098
2	.500	7/32	1.000 ±.005	.415/.408	.135/.130

10.9.4 Threaded Panel Fasteners.

CAUTION

- To prevent fastener damage, use proper tools.
- To prevent damage to structure or fastener components, always use proper grip-length fasteners.
- Inspect all fasteners for serviceable running torque prior to final torquing.
- To prevent damage to structure or fastener components, do not exceed manufacturer's recommended installation torque.
- To prevent damage to structure or fastener components, insure that proper counterbore size is provided for fastener retaining rings, or that proper thickness spacers are used. IN NO CASE shall a formed-in-place gasket substitute for a spacer.

Threaded panel fasteners are generally used in areas where structural loads must be transmitted through the fastened joint. The multiple-lead threads employed in these fasteners provide for quick operation in addition to increased vibration resistance and load-carrying capability. Generally these fasteners are made up of a stud, a stud retainer, and a receptacle held in place by rivets (See Figure 10-22). There are numerous styles of threaded panel fasteners available, many of which are self sealing; however, the cautions above apply to all.

10.9.4.1 Threaded Panel Fastener Selection and Installation. (See Figure 10-23 and Figure 10-24).

a. Select fastener size and style.

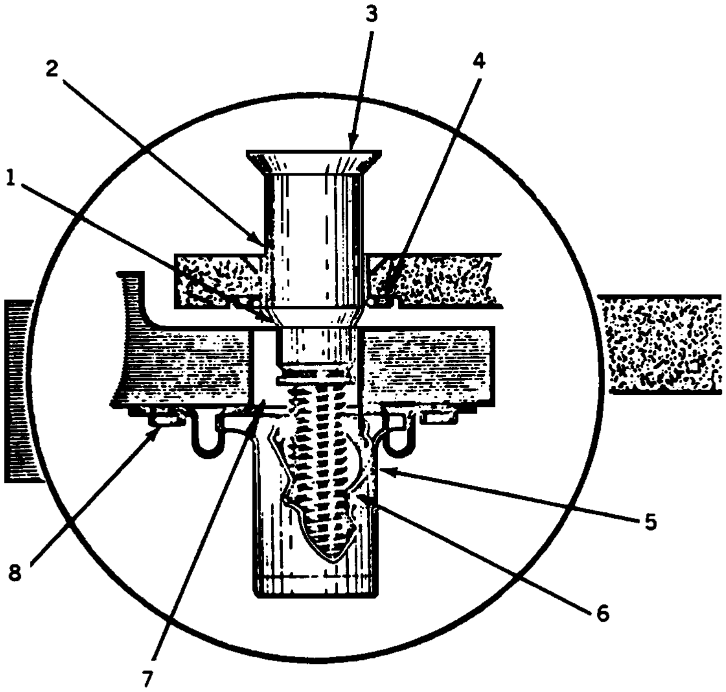
b. Determine thickness of upper and lower sheets.

c. Select proper stud and receptacle based on thickness of sheets.

d. Drill panel and substructure for diameter of stud selected.

NOTE

Countersink panel when using flush-head studs.



1. Stepped studs facilitate alignment.
2. Stud.
3. Flush or protruding head styles available with various recess configurations.
4. Stud retainer in counterbore.
5. Receptacle.
6. Multiple-lead threads.
7. Oversize hole in lower sheet for alignment.
8. Receptacle attachment rivets.

F10-022

Figure 10-22. Features of Threaded Panel Fastener

e. Counterbore panel or substructure (depending upon fastener type) for retainer ring.

f. Drill and countersink substructure for rivet attachment of receptacle.

g. Attach receptacle.

h. Insert stud in panel.

i. Install retainer ring using appropriate installation tool.

NOTE

Insure that proper retaining is used. DO NOT overexpand retainer ring.

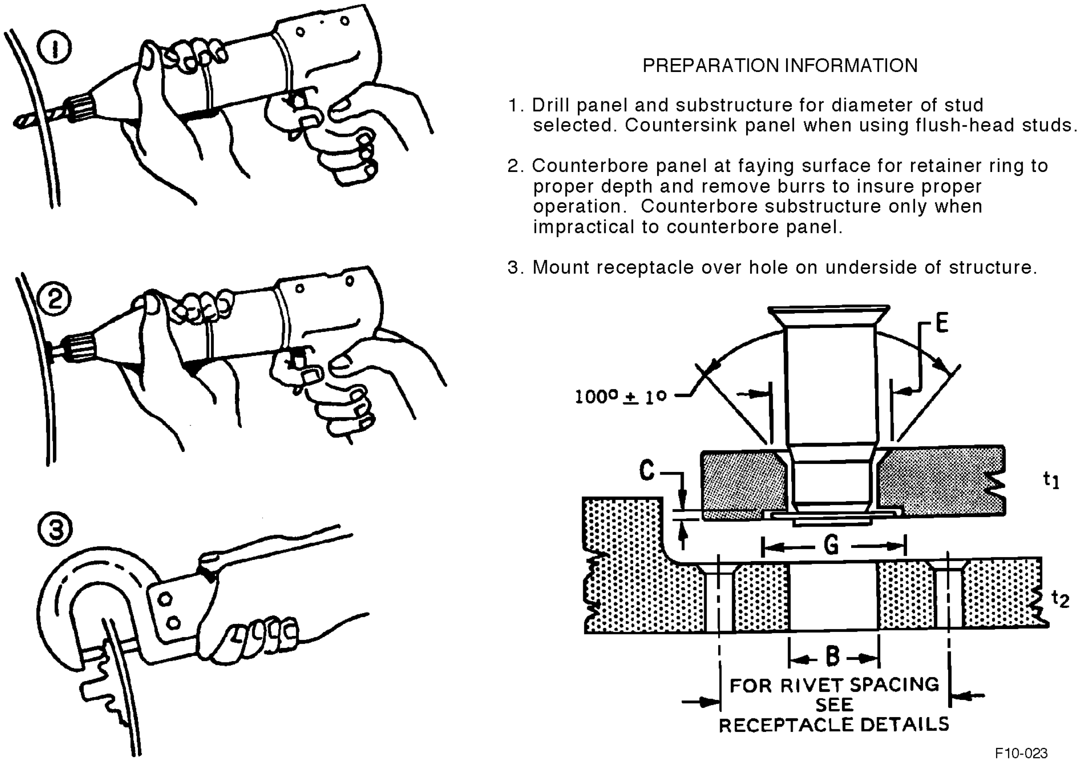
j. Position panel above mating structure and press all studs to the engaged position.

k. Torque studs as specified.

l. Begin torquing at one point on the panel and continue in one or both directions.

10.9.5 Threaded Panel Fastener Removal. The receptacle of a panel fastener is removed by drilling out the attachment rivets. The stud is removed by pulling off the retaining ring and withdrawing the stud from the panel.

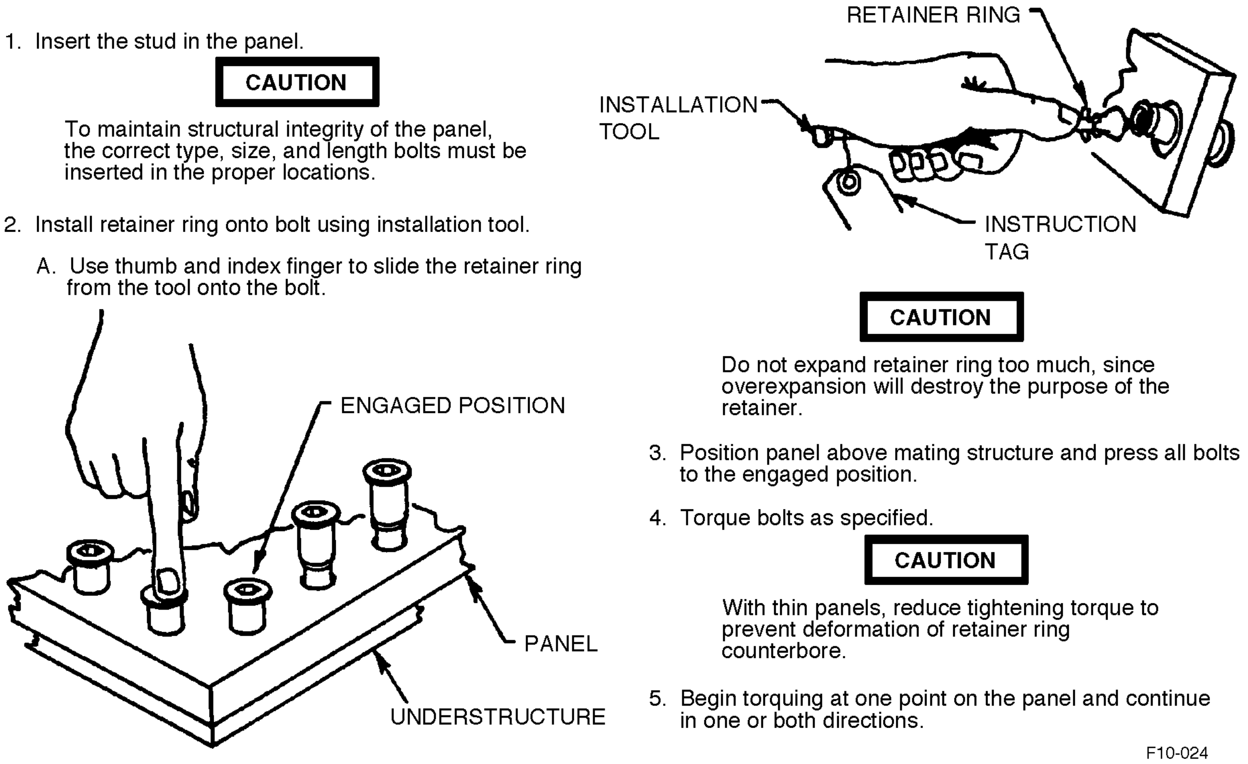
10.9.6 Threaded Panel Fasteners - Maintenance. Problems with panel fasteners are generally caused by retainer rings. Proper selection, application, and treatment of retainer rings will reduce problems (See Figure 10-25). In some cases, formed-in-place gaskets are improperly used as spacers to form liquid seals. If used as spacers, the gaskets creep during usage and trap retainer rings.



PREPARATION INFORMATION

1. Drill panel and substructure for diameter of stud selected. Countersink panel when using flush-head studs.
2. Counterbore panel at faying surface for retainer ring to proper depth and remove burrs to insure proper operation. Counterbore substructure only when impractical to counterbore panel.
3. Mount receptacle over hole on underside of structure.

Figure 10-23. Hole Preparation and Receptacle Attachment



1. Insert the stud in the panel.

CAUTION

To maintain structural integrity of the panel, the correct type, size, and length bolts must be inserted in the proper locations.

2. Install retainer ring onto bolt using installation tool.
   A. Use thumb and index finger to slide the retainer ring from the tool onto the bolt.

CAUTION

Do not expand retainer ring too much, since overexpansion will destroy the purpose of the retainer.

3. Position panel above mating structure and press all bolts to the engaged position.
4. Torque bolts as specified.

CAUTION

With thin panels, reduce tightening torque to prevent deformation of retainer ring counterbore.

5. Begin torquing at one point on the panel and continue in one or both directions.

Figure 10-24. Stud and Panel Installation

10.9.7 Milson Panel Fasteners.

CAUTION

In no case shall formed-in-place gaskets be substituted for a spacer.

The Milson panel fastener is available with both flush- and protruding-head studs and several receptacle configurations. Selection of Milson fasteners is shown in Figure 10-26, and hole preparation is shown in Figure 10-27. If for some reason it may be necessary to remove the barrel from the receptacle in order to facilitate repair, barrel removal and replacement procedures are shown in Figure 10-28.

10.9.8 Mil-Loc and Zip-Loc Panel Fasteners. The Mil-Loc and Zip-Loc panel fasteners function similarly to the Milson fastener except that serrated mating surfaces are provided for the stud and receptacle to increase vibration resistance. Critical assembly dimensions are as shown in Figure 10-29, Figure 10-30, and Figure 10-31.

10.9.9 Calfax Live-Lock Panel Fastener. The Live-Lock panel fastener functions similarly to the Milson fastener except that serrated mating surfaces are provided for the standard receptacle to increase vibration resistance and several retaining rings are available. Critical assembly dimensions and data are as shown in Figure 10-32.

10.9.10 Calfax Mark IV Panel Fastener. The Mark IV panel fastener differs from most other types in that the receptacle is similar to a floating nut plate and the stud is retained in the panel by a grooved retaining ring held in place by a plug in the end of the stud (see Figure 10-33 and Figure 10-34). This fastener is not susceptible to dirt and gasket debris to the degree that most other barrel-type panel fasteners are. Proper hole preparation is shown in Figure 10-35.

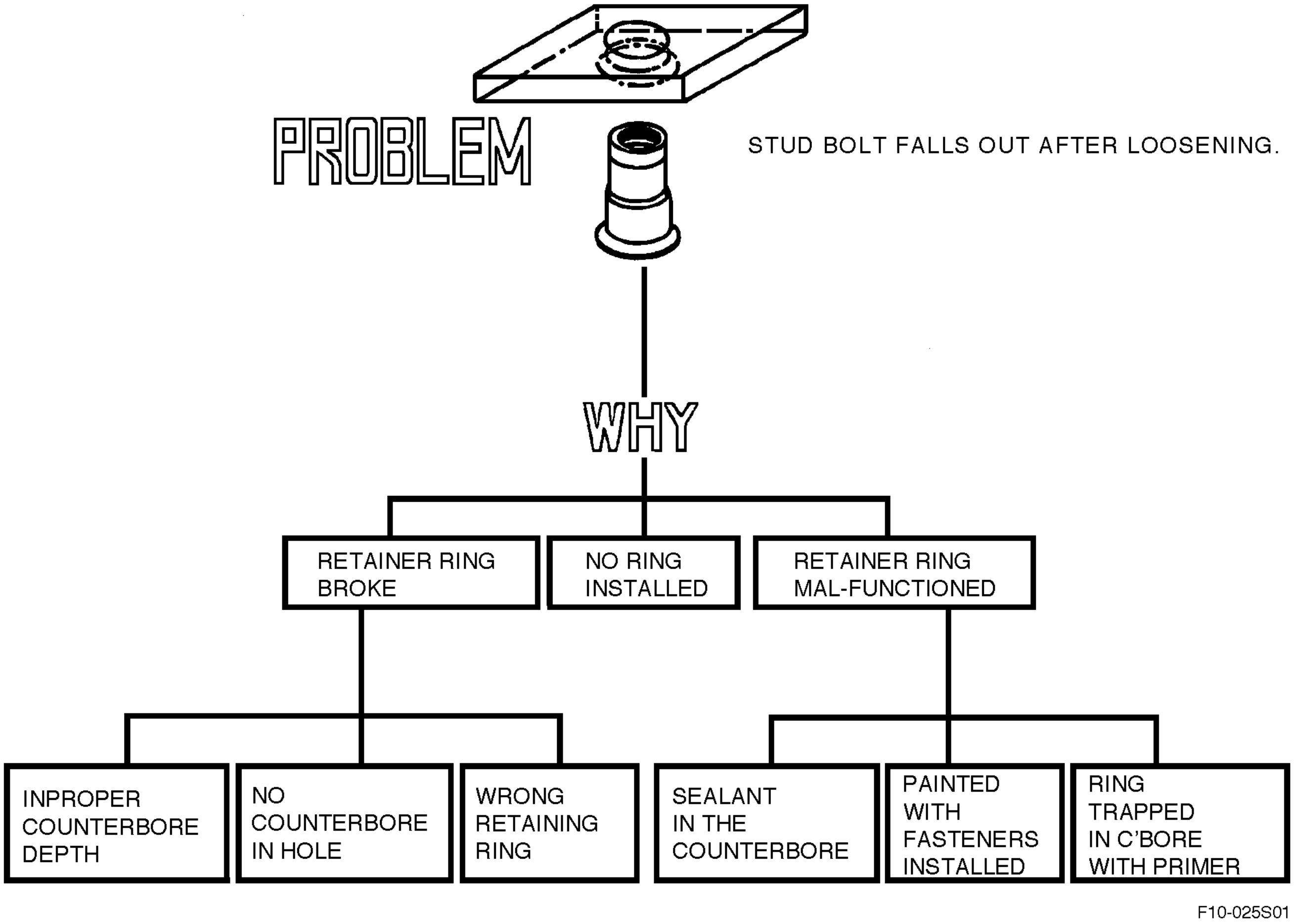


Figure 10-25. Panel Fastener Retainer Ring Problems (Sheet 1 of 2)

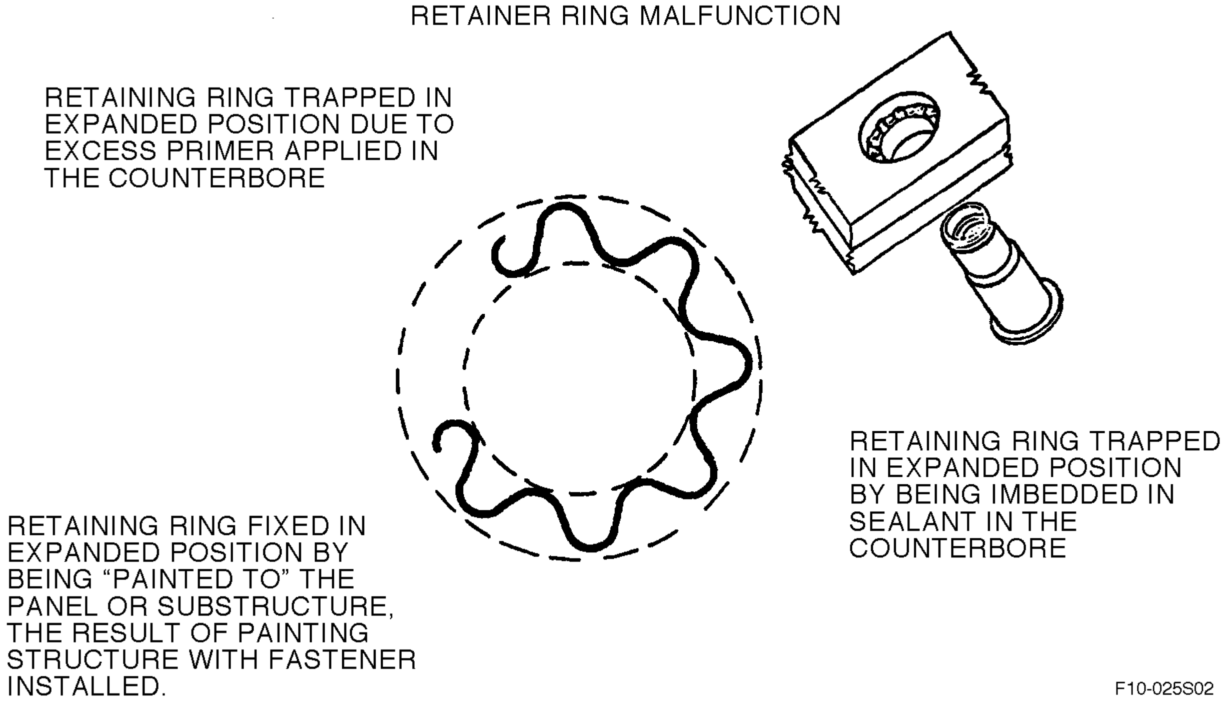


Figure 10-25. Panel Fastener Retainer Ring Problems (Sheet 2)

MECHANICAL PROPERTIES

Part Number	Shank Diameter of Sleeve Bolt	Tensile Strength	Shear Strength	Installation Torque in. -lbs.
		lbs. - min.	Single min.	First Installation
19XX-4 19XXS-4	1/4	2000	2250	25
19XXSS-4		1800	2100	
19XX5 19XXS-5	5/16	3500	4750	45
19XXSS-5		2200	3200	
19XXS-6 19XXS-6	3/8	6000	6500	100
19XXSS-6		3300	4800	

CALLOUT PROCEDURE

1. Select sleeve bolt size and style, next select grip length. Generally the sleeve bolt grip should be equal to the total material thickness. However, if structural requirements permit, consider using a shorter grip bolt for weight and cost reduction. This is usually possible when the panel thickness is less than the substructure thickness.
2. Choose, receptacle desired, next select second and third receptacle dash numbers (barrel height and stud protrusion) by using the tables.
3. Diameter of sleeve bolt will determine retainer ring to be used.

NOTE: Make callout of sleeve bolt, retainer ring, and receptacle assembly separately.

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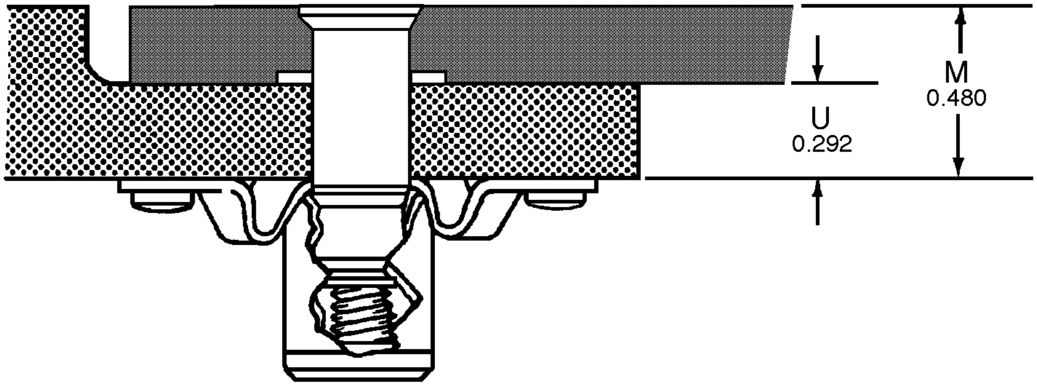
Figure 10-26. Milson Panel Fastener Selection (Sheet 1 of 2)

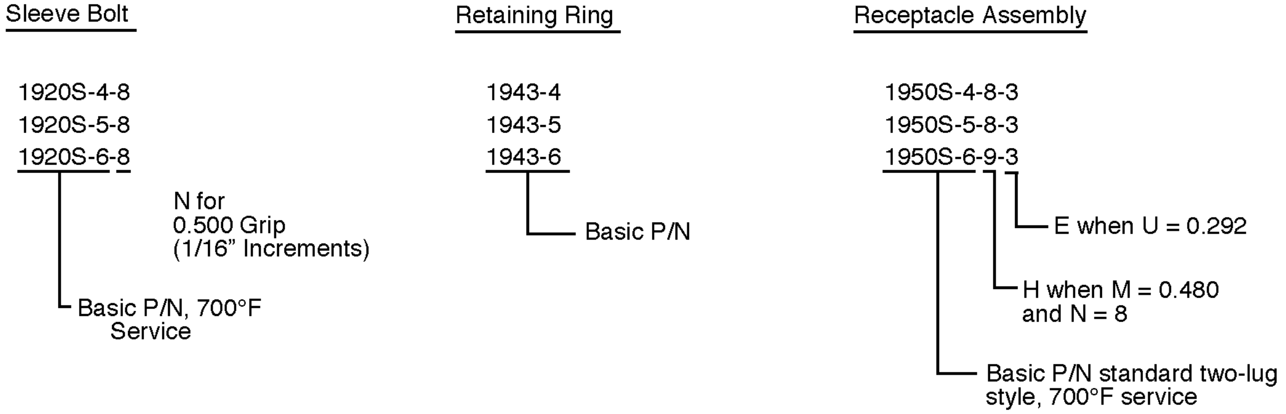


Component	Basic Part Number	Description
Sleeve Bolt (Stud)	1910	Pan Head, Hex Drive
Sleeve Bolt (Stud)	1920	Flush Head, Hex Drive
Retainer Ring	1943	Retainer Ring
Receptacle	1950	2 Lug Assembly
Receptacle	1955	Reduced-Rivet Spacing Assembly
Receptacle	1960	Corner Assembly
Receptacle	1970	Self-Sealing Assembly
Receptacle	1980	Self-Sealing Corner Assembly

EXAMPLE: Standard two-lug receptacle for service at 700°F with structural dimensions as shown above.

M = Total material thickness.

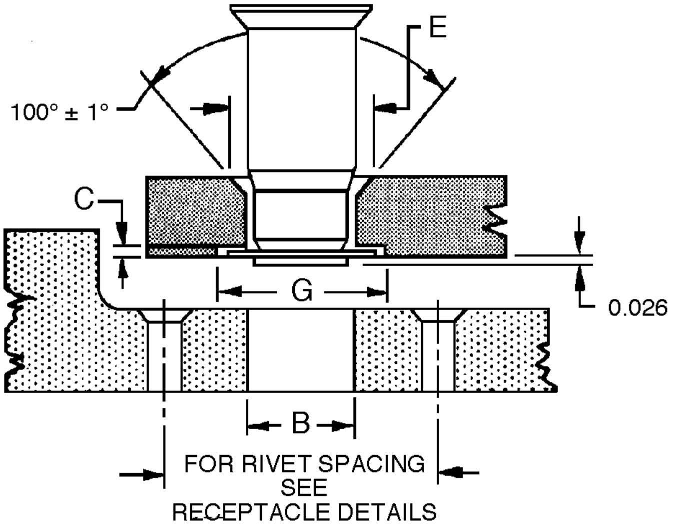
U = Total substructure thickness.



F10-26S02

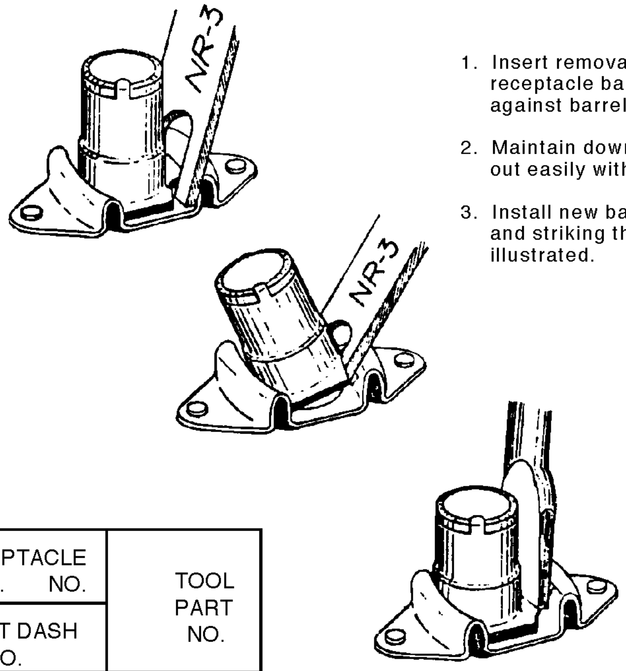
Figure 10-26. Milson Panel Fastener Selection (Sheet 2)

SIZE	B	C	E	G
	+.004 -.000	MIN.	DIA.	+.010 -.000
-4	.250	.032	.358	.450
-5	.312	.034	.441	.537
-6	.375	.035	.523	.625



F10-027

Figure 10-27. Milson Panel Fastener Hole Preparation



1. Insert removal tool with downward pressure between receptacle barrel assembly and shell as shown. Lean against barrel assembly to resume engagement.
2. Maintain downward pressure. Barrel assembly will snap out easily with a simple prying motion.
3. Install new barrel assembly by inserting one lug in shell and striking the opposite lug with a screwdriver as illustrated.

RECEPTACLE ASSY. NO.	TOOL PART NO.
FIRST DASH NO.	
-4	NR-2
-5	NR-1
-6	NR-3

F10-028

Figure 10-28. Barrel Removal and Assembly

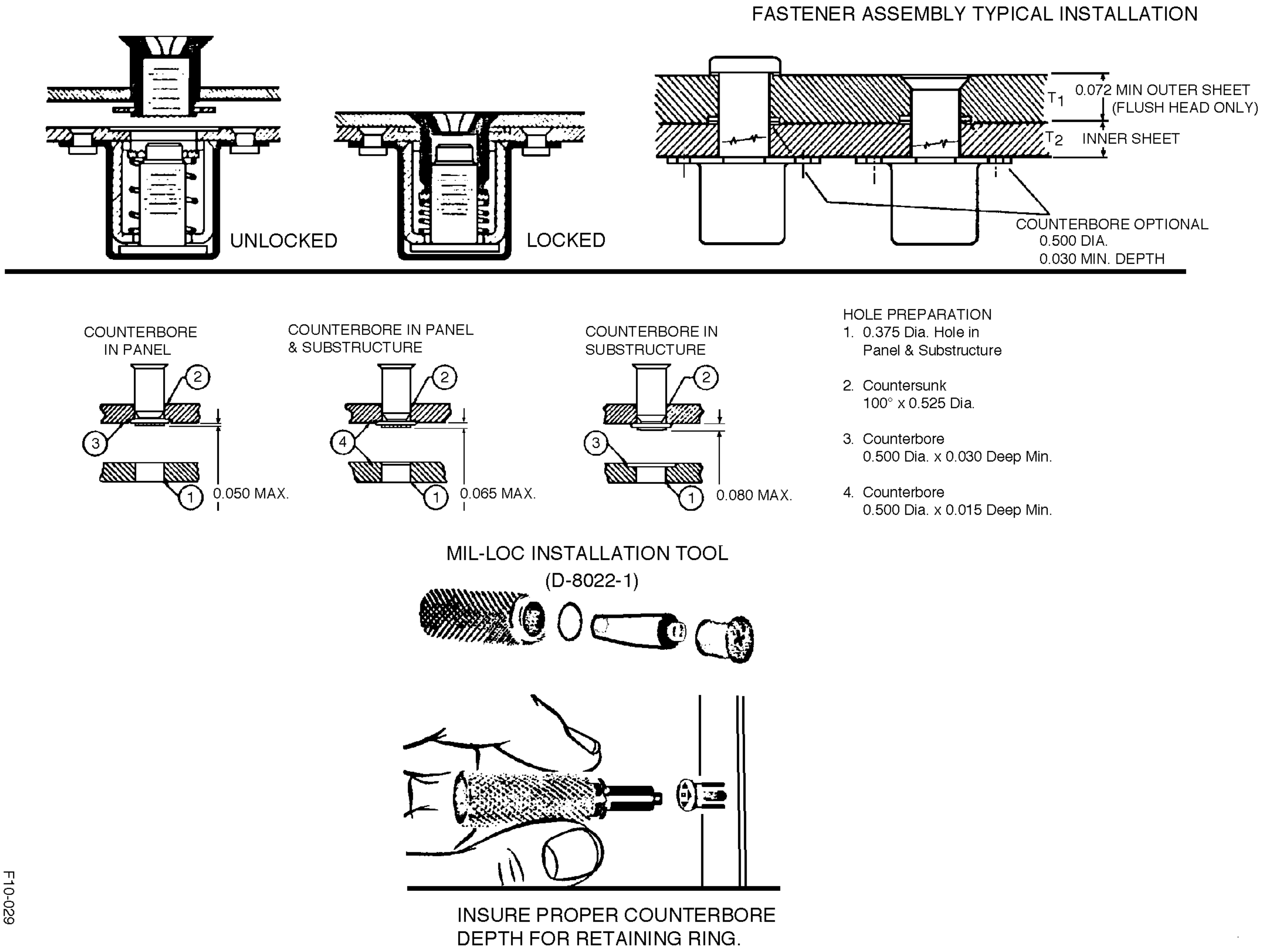
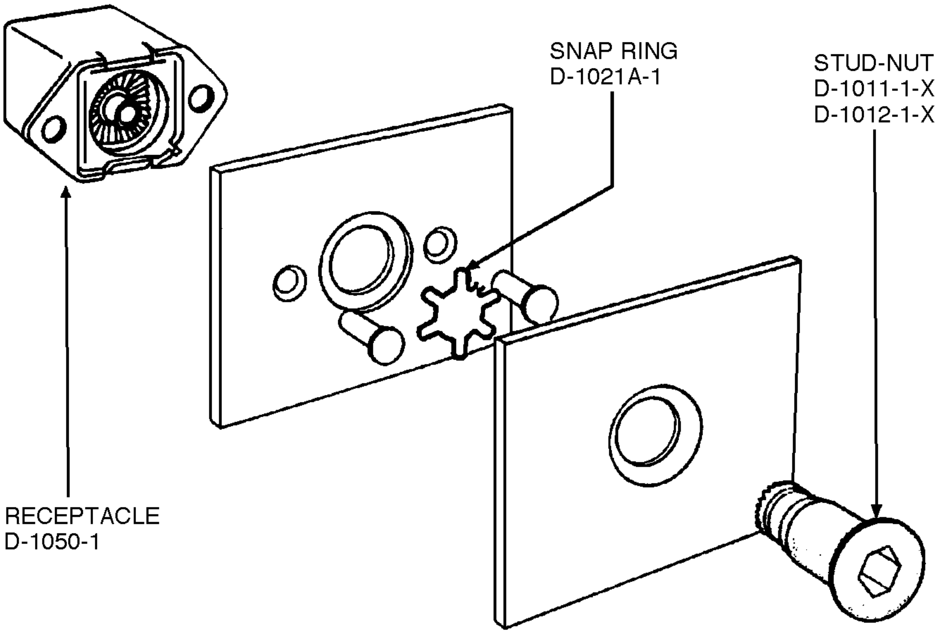
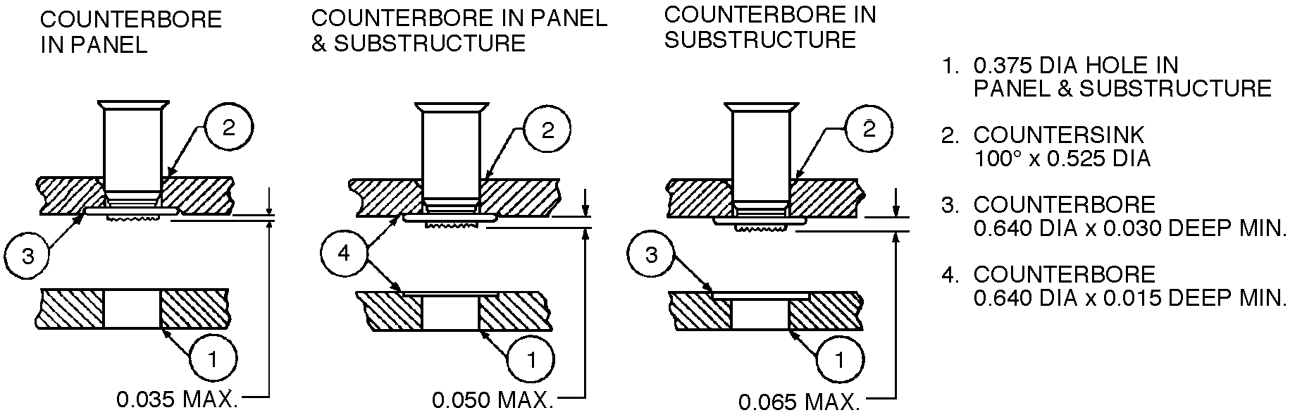


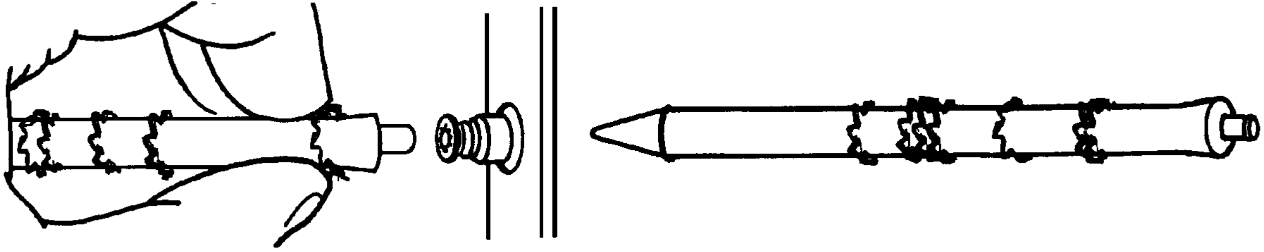
Figure 10-29. MIL-LOC Panel Fastener



Zip-Loc Stud-Nut Installation



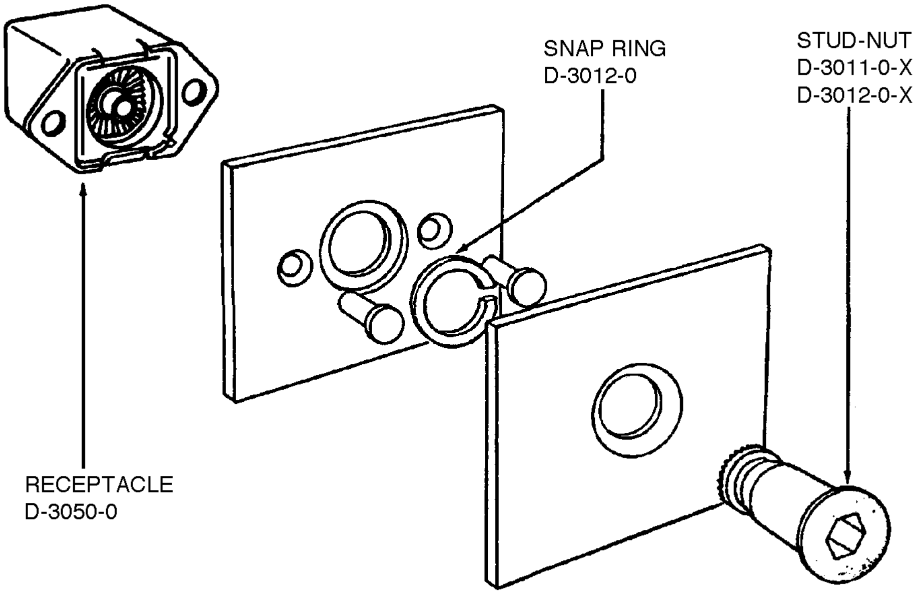
Zip-Loc Retaining Snap Ring Installation



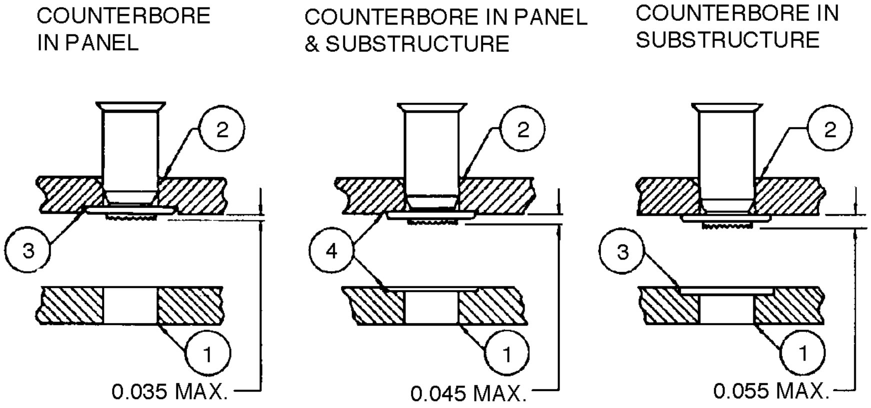
DEFCO INSTALLATION TOOLS ARE SHIPPED WITH RETAINING SNAP RINGS

F10-030

Figure 10-30. ZIP-LOC Panel Fastener

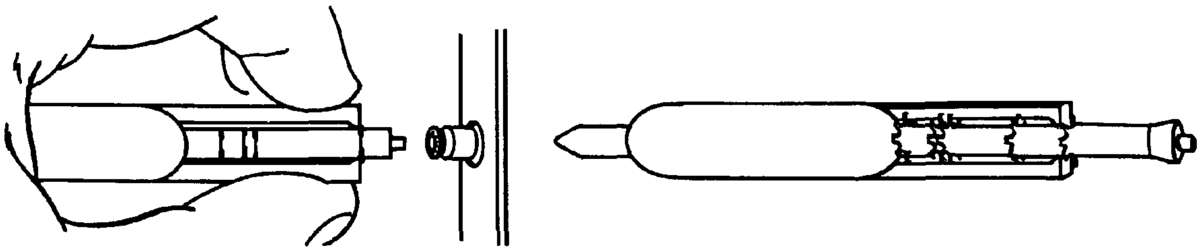


Miniature Zip-Loc Stud-Nut Installation



1. 0.219 (7/32") DIA HOLE IN PANEL & SUBSTRUCTURE
2. COUNTERBORE 0.297 DIA x 0.315 DEEP MIN.
3. COUNTERBORE 0.297 DIA x 0.016 DEEP MIN.
4. COUNTERBORE 0.297 DIA x 0.008 DEEP MIN.

Miniature Zip-Loc Retaining Snap-Ring Installation



DEFCO INSTALLATION TOOLS ARE SHIPPED WITH RETAINING SNAP RINGS

F10-031

Figure 10-31. Miniature ZIP-LOC Panel Fastener

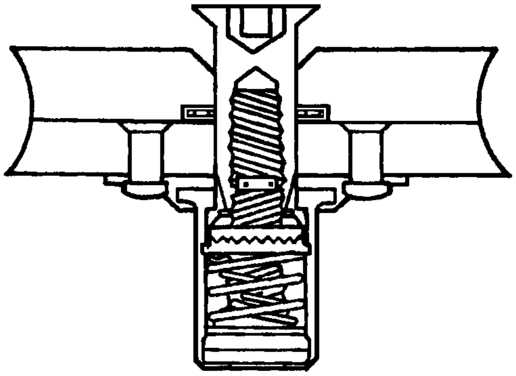
ENGINEERING DATA: RECOMMENDED TIGHTENING TORQUES

CA1700 Series 40-in. lbs.
CA1800 Series 30-in. lbs.
CA2000 Series 15-in. lbs.

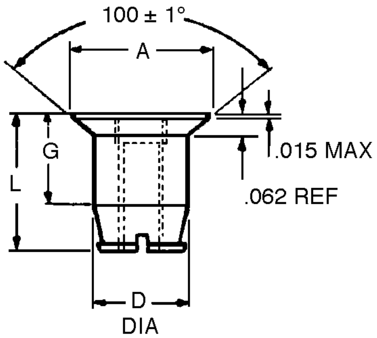
RECOMMENDED MAXIMUM OPERATING TEMPERATURES: 500°F

SPECIAL DESIGN AVAILABLE FOR TEMPERATURES TO 1000°F

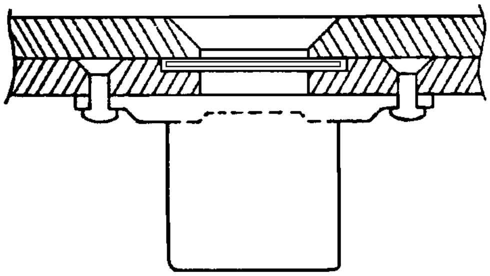
MATERIALS:
Stud Nuts 300 Series cres per MIL-S7720.
Receptacle Assembly 300 Series cres per MIL-S7720 except for Receptacle Screw which is A-286 (AMS 5735) and Heat Treated Stainless Ratchet Components.



FLUSH HEAD STUD NUT



TYPICAL FLUSH HEAD INSTALLATION

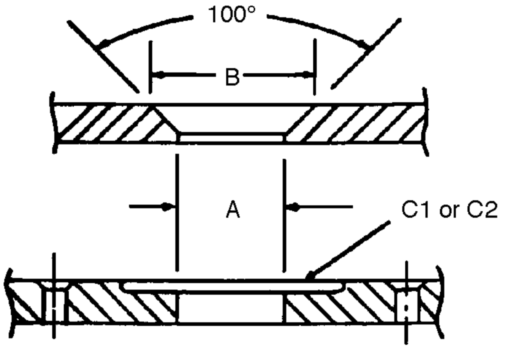


Stud Nut P/N		Basic Thread	G Grip	Hex recess	'A' Dim. Theoretic	'D' Dia.	Receptacle P/N		Retaining Ring	
Dble. Ld.	Quad. Ld.						Dble. Ld.	Quad. Ld.	Open	Caged
	CA1721-1	10-32	.180 .250	3/16	.520	.3745 .3730		CA1711	CA1727	CA1727-2
	-2	↑	.251 .343	↑	↑ max.	↑ max.		↑	↑	↑
	-3	↓	.344 .437	↓	sharp ↓	min. ↓		↓	↓	↓
	-4	10-32	.438 .531	3/16	.520	.3745 .3730		CA1711	CA1727	CA1727-2
	CA1820-1	8-32	.156 .250	5/32	.399	.249 .247		CA1810	CA1825	CA1826-1
	-2	↑	.251 .343	↑	↑ max.	↑ max.		↑	↑	↑
	-3	↓	.344 .437	↓	sharp ↓	min. ↓		↓	↓	↓
	-4	8-32	.438 .531	5/32	.399	.249 .247		CA1810	CA1825	CA1826-1
CA2020-0		4-40	.065 .124	3/32	.342	.186 .184	CA2010		CA2025	
-1		↑	.125 .187	↑	↑	↑	↑		↑	
-2			.188 .250		max. sharp	max. min.				
-3		↓	.251 .312	↓	↓	↓	↓		↓	
-4		4-40	.313 .375	3/32	.342	.186 .184	CA2010		CA2025	

*Addition of suffix "T.S." changes standard Hex Socket recess to Torq-Set recess.

F10-032S01

Figure 10-32. Calfax Live-Lock Panel Fastener (Sheet 1 of 2)



Series	A	B	RETAINING RING		Rivet Spacing ±.002	Rivet Hole Dia
			Open Type C1	Caged Type C2		
CA1700	.380 +.005 -.000	.525 ±.003	.625 Min. Dia. .025 Min. Depth	.656 Min. Dia. .055 Min. Depth	.875	.098
CA1800	.250 +.005 -.000	.406 ±.003	.437 Min. Dia. .025 Min. Depth	.468 Min. Dia. .045 Min. Depth	.687	.098
CA2000	.187 +.005 -.000	.337 ±.002	.281 Min. Dia. .025 Min. Depth		.437	.066

F10-032S02

Figure 10-32. Calfax Live-Lock Panel Fastener (Sheet 2)

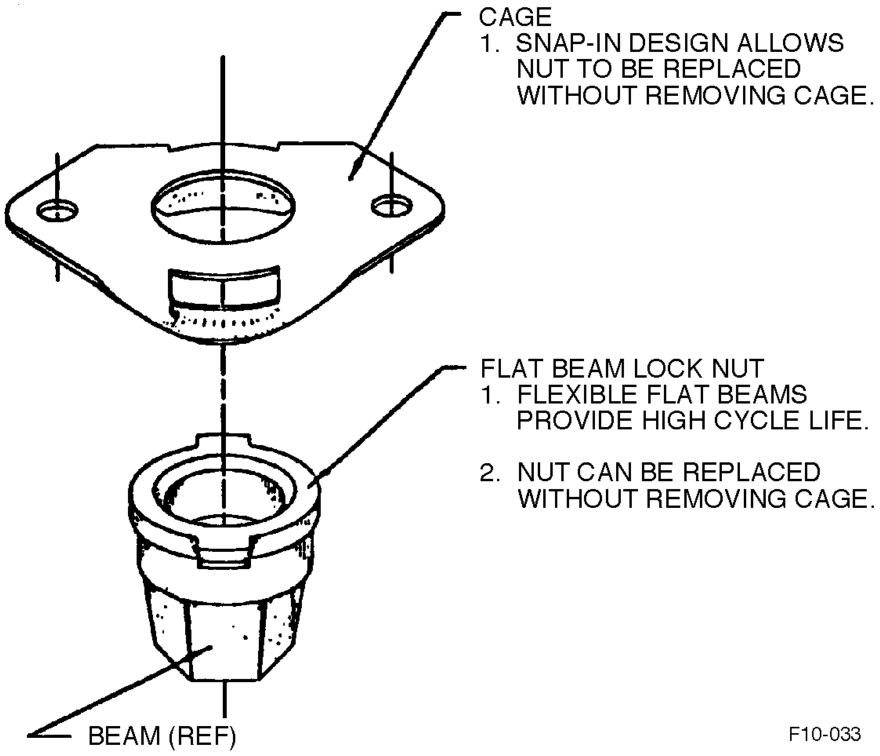
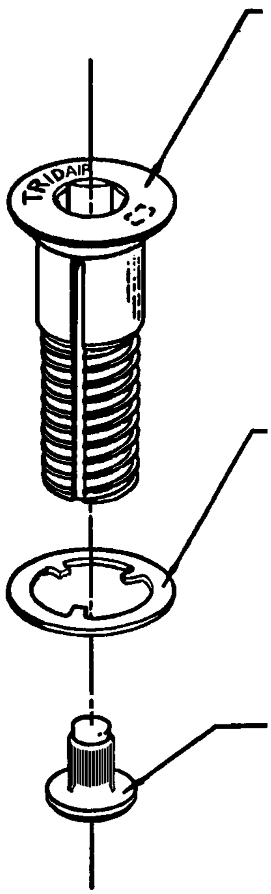


Figure 10-33. Calfax Mark IV Receptacle



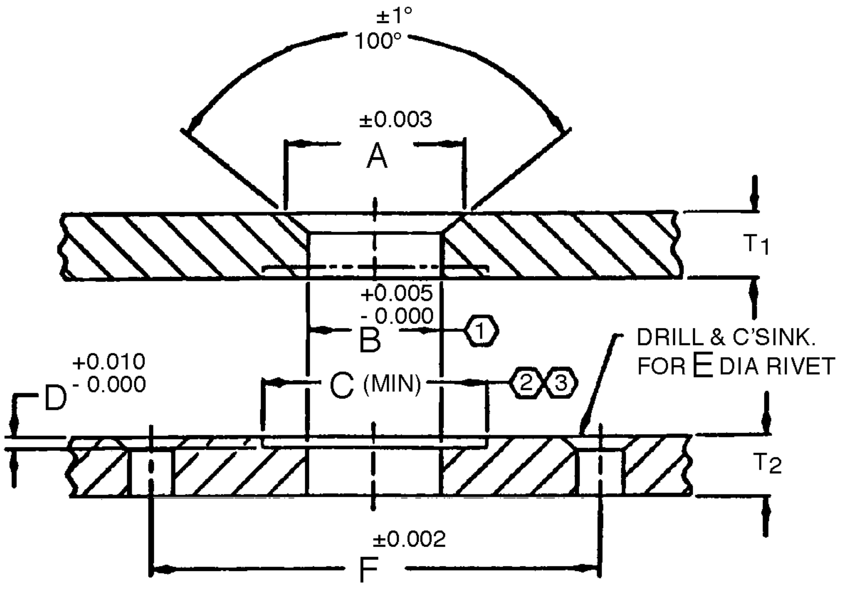
STUD BOLT
1. DOUBLE LEAD FOR QUICK INSTALLATION.
2. HEX SOCKET FOR RELIABLE, HIGH TORQUE TRANSFER CAPABILITY WITHOUT CAMOUT.
3. USED TO ATTACH REMOVABLE PANELS TO AIRCRAFT FRAMEWORK.
4. CARRIES HIGH SHEAR AND TENSION LOADS AT JOINT.

RETAINING RING
1. NON-STRESSED.
2. CAPTIVATES STUD BOLT TO PANEL TO PREVENT:
   A. LOSS
   B. INSTALLATION INTO WRONG HOLES SHOULD MORE THAN ONE FALL OFF.
   C. FOREIGN OBJECT DAMAGE.

PLUG
1. POSITIVELY CAPTIVATES RETAINING RING TO STUD.

F10-034

Figure 10-34. Calfax Mark IV Stud



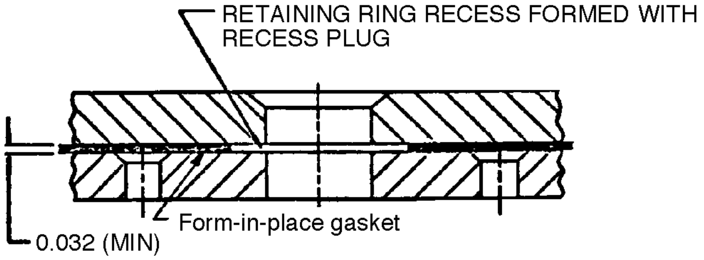
STUD BASIC DIA.	A C'SINK DIA.	B HOLD DIA.	C C'BORE DIA.	D C'BORE DEPTH	E RIVET DIA.	F RIVET SPACING
1/4	0.406	0.250	0.406	0.030	3/32	0.687
3/8	0.523	0.375	0.531	0.030	1/8	0.875

① B DIA. IN T_2 MAY BE INCREASED TO .300 DIA. TO ALLOW FOR HOLE MISALIGNMENT - SUBJECT TO APPROVAL OF STRUCTURES GROUP.

② COUNTERBORE IN T_1 OPTIONAL IF THICKNESS ALLOWS.

③ IF B DIA. IN T_2 IS INCREASED, C DIA. MUST BE INCREASED ACCORDINGLY.

PANEL PREPARATION
(WITHOUT FORM-IN-PLACE GASKET)



PANEL PREPARATION
USING
FORM-IN-PLACE GASKET

F10-035

Figure 10-35. Calfax Mark IV Hole Preparation

CHAPTER 11
CABLES, TURNBUCKLES, AND CABLE TERMINALS

11.1 CABLES, TURNBUCKLES, AND CABLE TERMINALS.

This chapter presents information about cables, cable damage, cable tension, cable hardware, and cable fabrication. Instructions contained in this manual are only general guidelines. Specific instructions contained in aircraft manuals or aircraft workcards may override any general instructions contained in this technical order.

11.1.1 Cables.

11.1.2 Cable Definitions.

The following cable definitions are in accordance with Military Specification MIL-W-83420, MIL-C-18375, and MIL-W-87161.

a. wire - Each individual cylindrical steel rod or thread shall be designated as a wire.

b. strand - Each group of wires helically twisted or laid together shall be designated as a strand.

c. cable or wire rope - A group of strands helically twisted or laid about a central core shall be designated as a cable. The strands and the core shall act as a unit.

d. preformed type - Cable consisting of wires and strands shaped prior to fabrication of the cable to conform to the form or curvature which they take in the finished cable shall be designated as preformed type.

e. diameter - The diameter of cable is the diameter of the circumscribed circle.

f. lay or twist - The helical form taken by the wires in the strand and by the strands in the cable is characterized as the lay or twist of the strand or cable respectively. In a right-hand lay, the wires or strands are in the same direction as the thread on a right-hand screw; and for a left-hand lay, they are in the opposite direction.

g. pitch (or length of lay) - The distance parallel to the axis of the strand or cable in which a wire or strand makes one complete turn about that axis is designated as the pitch (or length of lay) of the strands or cable respectively.

h. wire center - The center of all strands shall be an individual wire ad shall be designated as a wire center.

i. strand center - A strand center shall consist of a single, straight strand made of preformed wires, similar to the other strands comprizing the cable in arrangement and number of wires.

j. independent wire rope center (IWRC) 7 x 7 - A 7 x 7 independent wire rope center as specified herein shall consist of a cable or wire rope of six strands of seven wires each, twisted or laid around a strand center or core consisting of seven wires.

k. popped core - A popped core is a condition where one end of the core of a wire rope has been pulled inside the outer strands at that end, and has protruded through the outer strands some distance form the end of the rope.

11.1.3 Flexible Cables.

(Refer to Table 11-1 and see Figure 11-1.) Flexible, preformed, carbon steel, Type I, Composition A cables, Military Specification MIL-W-83420, are manufactured from steel made by the acid-open-hearth, basic-open hearth, or electric furnace process. Throughout the manufacturing operation, every precaution is taken to keep the cable made from different batches of steel separate and identifiable. The wire used in construction of the cable is coated with pure tin or zinc. Flexible, preformed, corrosion-resistant steel, Type I, Composition B cables, Military Specification MIL-W-87161, MIL-W-83420, and MIL-C-18375 are manufactured from steel made by the electric furnace process. These cables are of the 3 x 7, 7 x 7, 7 x 19, or 6 x 19 (IWRC) construction, according to the diameter as specified in Table 11-1. The 3 x 7 cable consists of three strands of seven wires each. There is no core in this construction. The 3 x 7 cable has a length of lay of not more than eight times nor less than five times the nominal cable diameter. The 7 x 7 cable consists of six strands of seven wires each, laid around a center strand of seven wires. The wire is laid so as to develop a cable which has the greatest bending and wearing properties. The 7 x 7 cable has a length of lay of not more than eight times nor less than six times the cable diameter. The 7 x 19 cable consists of six strands laid around a center strand in a clockwise direction. The wire composing the seven individual strands is laid around a central wire in two layers. The center core strand consists of a layer of six wires laid around the central wire in a clock-wise direction and a layer of 12 wires laid around this in a clockwise direction. The six outer strands of the cable consists of a layer of six wires laid around the central wire in a counterclockwise direction and a layer of 12 wires laid around this in a counterclockwise direction. The 6 x 19 (IWRC) cable consists of six strands of 19 wires each, laid around a 7 x 7 independent wire rope center. MIL-C-18375 cable, although not as strong as MIL-W-83420, is equal in corrosion resistance and superior in non magnetic and coefficient of thermal expansion properties.

11.1.4 Nylon Coated Cable. Nylon jacketed cable is made by extruding a flexible nylon coating over corrosion resistant steel (CRES) cable. The bare CRES cable must conform and be qualified to MIL-W-83420. After coating, the jacketed cable must conform to MIL-W-83420.

a. The service life of jacketed cable is much greater than the service life of the same cable when used bare. Most cable wear occurs at pulleys where the cable bends. The wear is caused by friction between strands and between wires. In bare cable, this is aggravated by dirt grit working its way into the cable and the lubricant working its way out, leaving dry dirty wires to rub against each other. In long straight runs of cable, vibration work hardens the wires causing the brittle wires to fracture with eventual separation of the cable.

b. The nylon jacket protects the cable in a threefold manner. It keeps the lubricant from oozing out and evaporating, it keeps dirt grit out, and it dampens the vibrations, thereby greatly reducing their effect on the cable.

Table 11-1. Flexible Cable Construction and Physical Properties

Nominal Diameter of Wire Rope	Construction	Tolerance on Diameter (Plus Only)	Allowable Increase of Diameter at Cut End	Minimum Breaking Strength (Pounds) MIL-W-83420 Comp A	MIL-W-83420 Comp B (CRES)	MIL-C-18375 (CRES)
Inches		Inches	Inches	Lbs	Lbs	Lbs
1/32	3 x 7	0.006	0.006	110	110	
3/64	7 x 7	0.008	0.008	270	270	
1/16	7 x 7	0.010	0.009	480	480	360
1/16	7 x 19	0.010	0.009	480	480	
3/32	7 x 7	0.012	0.010	920	920	700
3/32	7 x 19	0.012	0.010	1,000	920	
1/8	7 x 19	0.014	0.011	2,000	1,760	1,300
5/32	7 x 19	0.016	0.017	2,800	2,400	2,000
3/16	7 x 19	0.018	0.019	4,200	3,700	2,900
7/32	7 x 19	0.018	0.020	5,600	5,000	3,800
1/4	7 x 19	0.018	0.021	7,000	6,400	4,900
9/32	7 x 19	0.020	0.023	8,000	7,800	6,100
5/16	7 x 19	0.022	0.024	9,800	9,000	7,600
11/32	7 x 19	0.024	0.025	12,500		
3/8	7 x 19	0.026	0.027	14,400	12,000	11,000
7/16	6 x 19 IWRC	0.030	0.030	17,600	16,300	14,900
1/2	6 x 19 IWRC	0.033	0.033	22,800	22,800	19,300
9/16	6 x 19 IWRC	0.036	0.036	28,500	28,500	24,300
5/8	6 x 19 IWRC	0.039	0.039	35,000	35,000	30,100
3/4	6 x 19 IWRC	0.045	0.045	49,600	49,600	42,900
7/8	6 x 19 IWRC	0.048	0.048	66,500	66,500	58,000
1-	6 x 19 IWRC	0.050	0.050	85,400	85,400	75,200
1-1/8	6 x 19 IWRC	0.054	0.054	106,400	106,400	
1-1/4	6 x 19 IWRC	0.057	0.057	129,400	129,400	
1-3/8	6 x 19 IWRC	0.060	0.060	153,600	153,600	
1-1/2	6 x 19 IWRC	0.062	0.062	180,500	180,500	

11.1.5 Nonflexible Cables. (Refer to Table 11-2 and see Figure 11-2.) Nonflexible, preformed, carbon steel cables, Military Specification MIL-W-87161, Composition A, are manufactured by the same processes listed for Military Specification MIL-W-83420, Composition A, carbon steel cables. The wire used in construction of the cable is coated with pure zinc. Nonflexible, preformed, corrosion-resistant steel cables, Military Specification MIL-W-87161, are manufactured by the same process and have the same composition as listed for Military Specification MIL-W-83420, Composition B, corrosion resistant steel cables. The nonflexible steel cables are of the 1 x 7 (Type I) or 1 x 19 (Type II) construction according to the diameter as specified in Table 11-2. The 1 x 7 cable consists of six wires laid around a center wire in a counterclockwise direction. The 1 x 19 cable consists of a layer of six wires laid around a center wire in a clockwise direction plus twelve wires laid around the inner strand in a counterclockwise direction.

11.2 CABLE DAMAGE.

11.2.1 Broken Wires. At each regular inspection period, cables must be inspected for broken wires. Any cable assembly that has (1) one broken or loose wire located in a CRITICAL FATIGUE AREA must be replaced.

11.2.1.1 A CRITICAL FATIGUE AREA is defined as the working length of a cable where the cable runs over, under or around a pulley, sheave or through a fairlead. Or any section where the cable is flexed, rubbed or worked in any manner.

11.2.1.2 A CRITICAL FATIGUE AREA is also located at any point within one foot of a swaged on fitting. A swaged on fitting could be an eye, fork, ball, ball and shank, ball and double shank, threaded stud, threaded stud and turnbuckle, compression sleeve or any hardware used as a termination or end fitting on the cable. These fittings may be attached by various swaging methods such as rotary swaging, roll swaging, hydraulic pressing, and hand swaging tools. (See MIL-T-781.) The pressures exerted on the fittings during the swaging process sometimes pinch the small wires in the cable. This will cause premature failure of the pinched wires resulting in broken wires.

11.2.1.3 Close inspection in these CRITICAL FATIGUE AREAS, must be made by passing a cloth over the area to snag on broken wires. Also, a very careful visual inspection must be made since a broken wire will not always protrude or stick out but may lie in the strand and remain in the position of the helix as it was manufactured. Broken wires of this type may show up as a hairline crack in the wire. If a broken wire of this type is suspected, further inspection with a magnifying glass of 7 power or greater is recommended.

11.2.1.4 A CABLE ASSEMBLY is defined as a length of cable with fittings swaged on each end. The length of a cable assembly will vary from less than one foot to several hundred feet. The complete assembly must be replaced when one (1) broken or loose wire is found in a CRITICAL FATIGUE AREA as defined above.

11.2.1.5 Any cable assembly that has three (3) broken or loose wires in UNCRITICAL AREAS must be replaced. UNCRITICAL AREAS are those where the cable is not flexed, rubbed or worked in any manner other than a straight pulling motion. The discovery of only one broken wire in an UNCRITICAL AREA should be noted in your inspection report.

11.2.2 Kinked Cable. Kinking of wire cable can be avoided if properly handled and installed. Kinking is caused by the cable taking a spiral shape as the result of unnatural twist. One of the most common causes for this twist is improper unreeling and uncoiling. Strands and wires are out of position, which creates unequal tension and brings excessive wear at this part of the rope. Even though the kink may be straightened so that the damage appears to be slight, the relative adjustment between the strands has been disturbed so that the rope cannot give maximum service and should be replaced. Inspect cables for popped core or loose strands. Replace any cable that has a popped core or loose strands regardless of wear or broken wires.

11.2.3 Cracks In Nylon Jacket. Nylon jacketed cable with any cracks or necking down in diameter in the jacket shall be replaced. Usable cable life is over when these conditions begin to appear in the nylon jacket.

11.2.4 Severed Cables. Completely severed cables, or those so damaged or kinked in one place that the strength is obviously below the minimum allowable, must be replaced. A temporary repair may be done by use of a swaged-type male eye terminal, AN668 or MS20668, bolted to a swaged-type female fork terminal, AN667 or MS20667. If adjustment is desired, a turnbuckle may be used. However, either assembly can only be used where the cable does not pass over pulleys or through fairleads. (See Figure 11-3.)

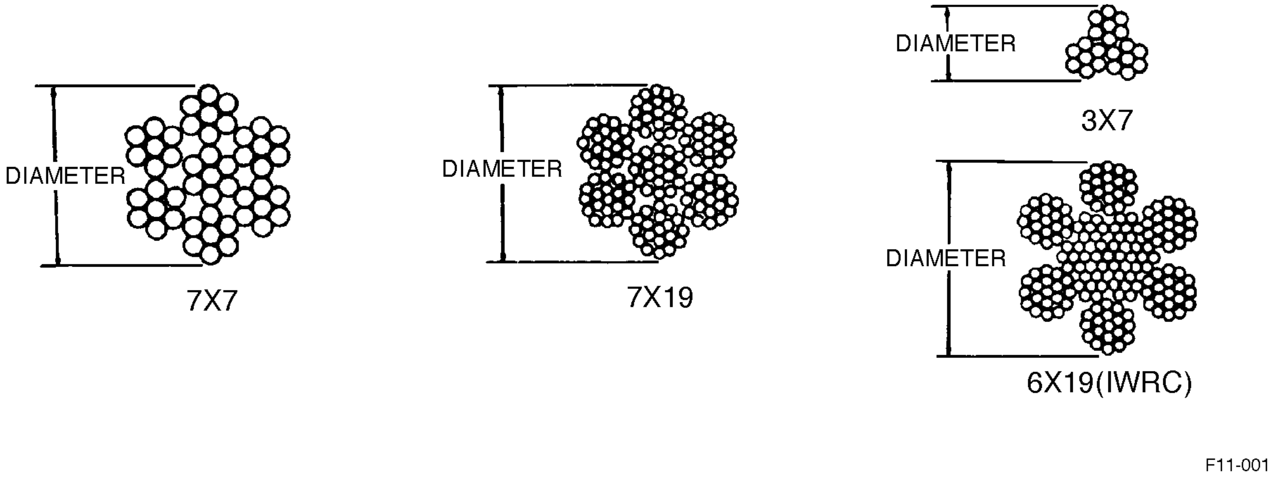


Figure 11-1. Flexible Cable Cross Section

Table 11-2. Nonflexible Cable Construction and Physical Properties

Strand Type	Nominal Diameter of Wire Strand	Tolerance on Diameter (Plus Only)	Allowable Increase in Diameter at the End	Construction	MIL-W-87161 Minimum Break Strength Comp A and B
	In.	In.	In.		Lbs
I	1/32	0.003	0.006	1 x 7	185
I	3/64	0.005	0.008	1 x 7	375
II	3/64	0.005	0.008	1 x 19	375
I	1/16	0.006	0.009	1 x 7	500
II	1/16	0.006	0.009	1 x 19	500
II	5/64	0.008	0.009	1 x 19	800
II	3/32	0.009	0.010	1 x 19	1,200
II	7/64	0.009	0.010	1 x 19	1,600
II	1/8	0.013	0.011	1 x 19	2,100
II	5/32	0.013	0.016	1 x 19	3,300
II	3/16	0.013	0.019	1 x 19	4,700
II	7/32	0.015	0.020	1 x 19	6,300
II	1/4	0.018	0.021	1 x 19	8,200
II	5/16	0.022	0.024	1 x 19	12,500
II	3/8	0.026	0.027	1 x 19	17,500

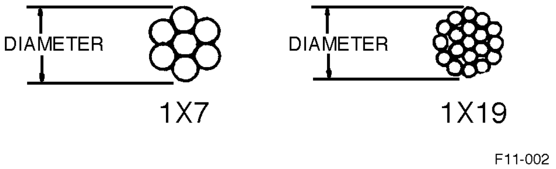


Figure 11-2. Nonflexible Cable Cross Section

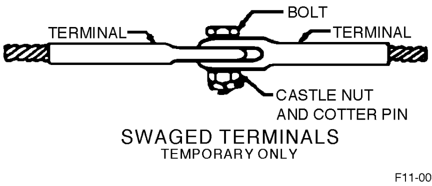


Figure 11-3. Repair of Severed Cable

11.2.5 Control Cable External Wear Patterns.

CAUTION

- Do not force open a cable that is designed to function under extensive tension. Use of the above methods weakens the cable and may result in premature failure.
- Do not use metallic wools or solvents to clean cables. Use of metallic wool will imbed dissimilar metal particles in the cables and create further corrosion problems. Solvents will remove internal cable lubricant allowing cable strands to abrade and further corrode.

Wear will normally extend along the cable equal to the distance the cable moves at that location and may occur on one side of the cable only or on its entire circumference. Replace flexible and non-flexible cables when the individual wire in each strand exceeds the wear limits as depicted in Figure 11-4. Actual instances of cable wear beyond recommended replacement point are shown in Figure 11-4.

11.2.5.1 Corrosion Treatment for Steel Cables. If the surface at the cable is corroded, relieve cable tension and carefully force the cable open by reverse twisting and visually inspect the interior. Corrosion on the interior strands of the cable constitutes failure, and the cable must be replaced. If no internal corrosion is detected, remove loose external rust and corrosion with a clean, dry, course-weave rag or fiber brush. After thorough cleaning, apply specification MIL-C-16173, Grade 4, corrosion preventive compound to cable sparingly. Do not apply the material so thick that it will interfere with the operation of cables at fairleads, pulleys, or grooved bellcrank areas. After accomplishing the above procedures perform a rag method inspection. Replace this cable when a new cable is available.

11.2.5.2 Interchangeability of Flexible Cables.

a. Carbon steel cable MIL-W-83420, Composition A shall not be substituted for corrosion resistant steel cable MIL-W-83420, Composition B or MIL-C-18375 for aircraft use.

NOTE

If there is any doubt about a substitution, consult a materials engineer. Also if a substitution is made, the item will be marked on the calendar inspection schedule of the AFTO Form 781K, Aircraft Inspection and Maintenance Status Record. The frequency of inspection will be one half the time of normal inspections. Characteristics of some aircraft will not allow substitution of cable; therefore, always refer to applicable maintenance manual for aircraft concerned for specific cable and tension.

b. When carbon steel cable MIL-W-83420, Composition A, is not available corrosion resistant cable, MIL-W-83420, Composition B, may be substituted in the following diameters only: 1/16, 3/32, 1/2, 9/16, 5/8, 3/4. Other diameters of MIL-W-83420, Composition B, will not be used as substitutes for composition A for lack of equal strength.

11.3 CABLE TENSION.

11.3.1 Checking Cable Tension.

NOTE

Refer to the Maintenance Handbook for the aircraft concerned for specific information on the cable tension.

For rigging the control surface cables and for checking the cable tensions in an aircraft that has been rigged, a tensiometer is used. One type of tensiometer is shown in Figure 11-5. This instrument works on the principle of measuring the amount of force required to deflect a cable a certain distance at right angles to its axis. The cable to be tested is placed under the two blocks on the instrument, and the lever on the side of the instrument is pulled down. Movement of this lever pushes up on the center block, called a riser, which pushes the cable at right angles to the two clamping points. The force required to do this is indicated by a pointer on the dial. Different risers are used with different size cables. Each riser carries an identifying number and is easily inserted in the instrument. Each tensiometer is supplied with a calibration table to convert the dial readings into pounds. One of these calibration tables is illustrated in Figure 11-5. For example, in using a number 2 riser with a 3/16-inch diameter cable, if the pointer on the dial indicates 48, the actual tension in the cable is 70 pounds. It will be noted that in the case of this particular instrument, the number 1 riser is used with 1/16-, 3/32-, and 1/8-inch diameter cables. It should be noted that the calibration table applies to a particular instrument only and cannot be used with any other. For this reason, the calibration chart is pasted inside of the cover of the box in which the instrument is kept. The tensiometer, like any other measuring instrument, is a delicate piece of equipment and should be handled carefully. During the adjustment of turnbuckles, the calibration chart must be used to obtain the desired tension in a cable. For example, if it is desired to obtain a tension of 110 pounds in a 3/16-inch diameter cable, the number 2 riser is inserted in the instrument and the figure opposite 110 pounds is read from the calibration chart. In this case, the figure is 66. The turnbuckle is then adjusted until the pointer indicates 66 on the dial. In some cases the position of the tensiometer on the cable is such that the face of the instrument cannot be seen by the operator. In such cases, after the lever has been set and the pointer moved on the dial, a button on the top of the instrument is pushed into hold the pointer in place. Then the lever is released and the instrument removed from the cable, the pointer remaining in position. After the reading has been taken, the button is pulled out, and the pointer will return to zero.

11.3.2 Aircraft Cable Temperature Considerations. When a temperature is encountered that is lower than the one at which the aircraft was rigged, the aircraft structure shrinks more than the cables, and the cables go slack. When temperatures higher than the one at which aircraft was rigged are encountered, aircraft structure expands more than the cables, and the cable tension is increased. Use of cable, MIL-C-18375, where required by design and service specifications, can greatly alleviate this condition. Its coefficient of expansion is approximately 30% higher than MIL-W-83420 therefore closer to that of the air-frame structure; consequently changes in tension due to ambient temperature variations are less.

NOTE

In control systems in which temperature regulators are installed, the rigging tensions should be as called for in the aircraft Maintenance Handbook regardless of temperatures encountered.

11.4 CABLE HARDWARE.

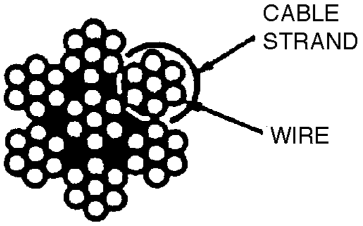
11.4.1 Turnbuckles. (Refer to Table 11-3 through Table 11-10.) A turnbuckle is a device used in cable systems to provide a means of adjusting tension. Turnbuckles have barrel-shaped sleeves with internal left- and right-hand threads at opposite ends into which the threaded cable terminals are screwed. The cables, with terminals attached, are made to such a length that, when the turnbuckle is adjusted to give the specified cable tension, a sufficient number of threads on the terminal ends are screwed into the barrel to hold the load. The clip-locking turnbuckle and its associated parts are identical to standard AN and MS parts except for a slot grooved on the interior of the barrel and the shanks of the forks, eyes, etc. The clip-locking turnbuckle parts have the following drawing numbers: MS21251, turnbuckle body; MS21252, turnbuckle clevis end; MS21253, turnbuckle clevis end (for bearing); MS21254, turnbuckle eye and (for pin); MS21255, turnbuckle eye end (for wire rope); MS21256, turnbuckle locking clip; MS21260, terminal, wire rope, stud. For information on the assembly and securing of clip-locking turnbuckle assemblies refer to paragraph 16.3.4.

NOTE

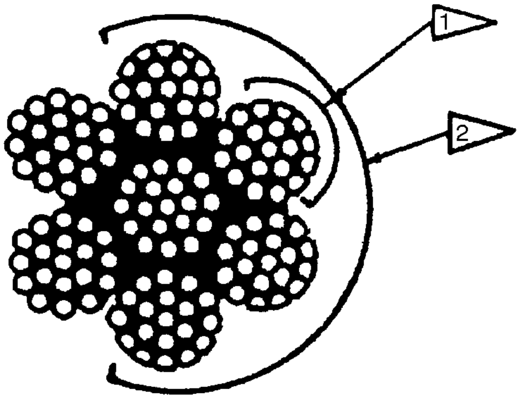
Turnbuckles showing signs of thread distortion/bending should be replaced. Turnbuckle ends are designed for providing the specified cable tension on a cable system, and a bent turnbuckle would place undesirable stress on the cable, impairing the function of the turnbuckle.

11.4.2 Turnbuckle Installation. (See Figure 11-6.) When installing cable system turnbuckles, it is necessary to screw both threaded terminals into the turnbuckle barrel an equal amount. It is essential that turnbuckle terminals be screwed into the barrel so that not more than three threads on the terminal are exposed (Figure 11-6, Detail A.) On initial installation, the turnbuckle terminals should not be screwed inside the turnbuckle barrel more than four threads. (Figure 11-6, Detail B.)

CABLE SIZE	PERCENT ALLOWABLE WEAR OF OUTER WIRES BEFORE REPLACEMENT
1/8 7 x 19	30
3/32 7 x 7	30
3/16 7x19	30



7 x 7 CABLE



7 x 19 CABLE

OUTER WIRES INDICATED BY SHADING

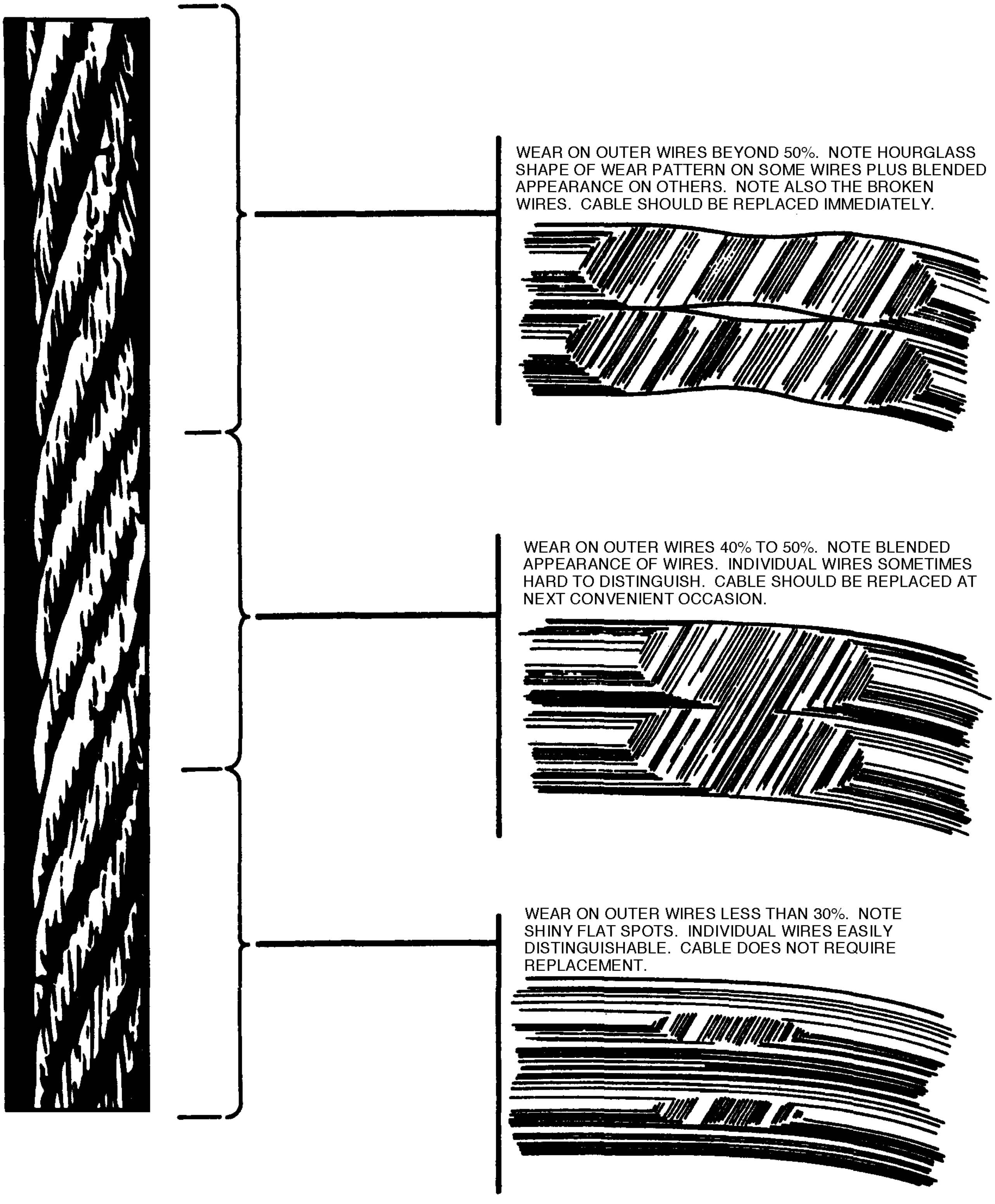
1 TYPICAL OUTER WIRE WEAR AREA ON CABLE STRAND. HAIRLINE CRACKS BETWEEN WIRES OR FULLY BLENDED SURFACE APPEARANCE OF APPROXIMATELY SIX WIRES PER OUTER CABLE STRAND INDICATES 30 PERCENT WIRE WEAR. IF THIS APPEARANCE IS VISIBLE, THE CABLE SHOULD BE REPLACED.

2 TYPICAL CABLE WEAR MAY OCCUR ON ONE SIDE ONLY OR ON FULL CIRCUMFERENCE AND MY EXTEND ALONG THE CABLE FOR A DISTANCE EQUAL TO NORMAL CABLE MOVEMENT.

WHENEVER CABLE WEAR IS FOUND, CAUSE FOR WEAR MUST BE DETERMINED AND CORRECTED.

F11-004S01

Figure 11-4. Control Cable Wear Limit (Sheet 1 of 2)

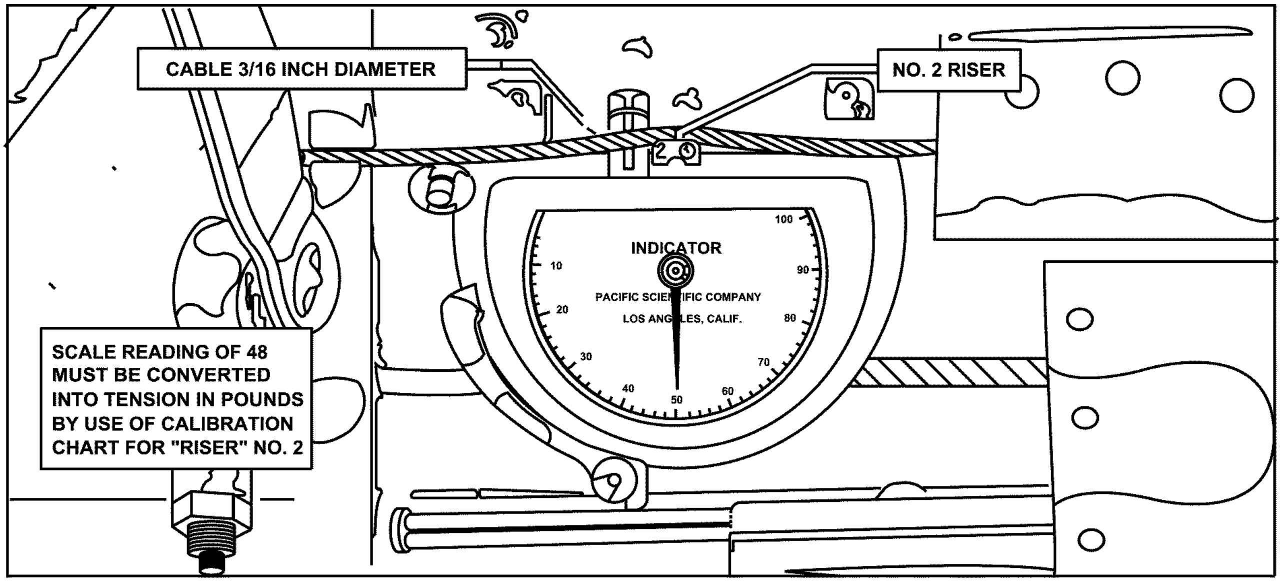


WEAR ON OUTER WIRES BEYOND 50%. NOTE HOURGLASS SHAPE OF WEAR PATTERN ON SOME WIRES PLUS BLENDED APPEARANCE ON OTHERS. NOTE ALSO THE BROKEN WIRES. CABLE SHOULD BE REPLACED IMMEDIATELY.

WEAR ON OUTER WIRES 40% TO 50%. NOTE BLENDED APPEARANCE OF WIRES. INDIVIDUAL WIRES SOMETIMES HARD TO DISTINGUISH. CABLE SHOULD BE REPLACED AT NEXT CONVENIENT OCCASION.

WEAR ON OUTER WIRES LESS THAN 30%. NOTE SHINY FLAT SPOTS. INDIVIDUAL WIRES EASILY DISTINGUISHABLE. CABLE DOES NOT REQUIRE REPLACEMENT.

Figure 11-4. Control Cable Wear Limit (Sheet 2)



NO.1				RISERS	No. 2		NO. 3	
DIA.	1/16	3/32	1/8	TENSION LBS.	5/32	3/16	7/32	1/4
	14	17	21	30	18	26		
	20	24	28	40	24	32		
	25	30	35	50	29	38		
	30	35	42	60	34	43		
	35	40	48	70	39	48		
	39	45	54	80	43	53		
	44	50	60	90	47	58		
	48	55	65	100	51	62		
	52	60	70	110	55	66		
	56	64	75	120	59	70		
		68	80	130	63	74		
		72	84	140	66	78		
			89	150	69	82		
			93	160	72	85		
				170	75	89		
				180	78	92		
				190	81	96		
				200	83	99		
				210				
				220				
				230				
				240				
				250				

TYPED FIGURES ARE INSTRUMENT SCALE READINGS CORRESPONDING TO TENSION

INSTRUMENT

NO. 1149

MODEL 401-1A-2

F11-005

Figure 11-5. Cable Tensiometer

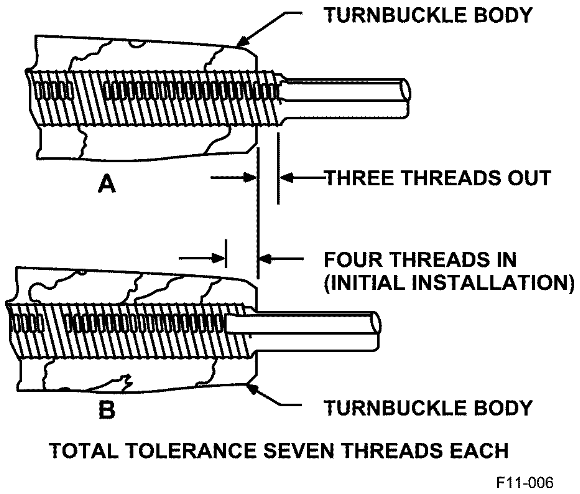
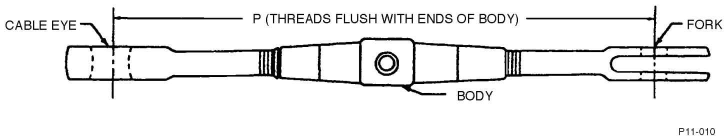


Figure 11-6. Turnbuckle Thread Tolerance

11.4.3 Fork, Eye, and Threaded End Cable Terminals, Bushings, Shackles, and Thimbles. Refer to Table 11-11 through Table 11-17 for information pertaining to fork, eye, and threaded end cable terminals, bushings, shackles, and thimbles.

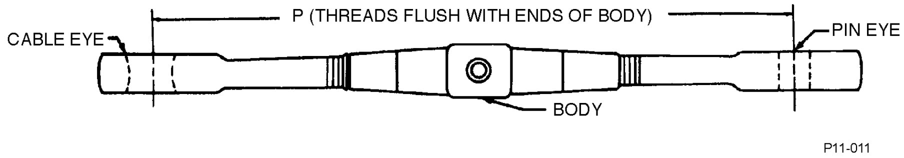
Table 11-3. Turnbuckle Assembly - Fork



Dash Number	Strength (Pounds)	Body	Fork	Cable Eye	P (Inches)	Takeup (Inches)
-2S	800	MS21251-2S	MS21252-2RS	MS21255-2LS	4.500	1-1/4
-2L		MS21251-2L	MS21252-2RL	MS21255-2LL	8.000	2-7/8
-3S	1,600	MS21251-3S	MS21252-3RS	MS21255-3LS	4.500	1-1/8
-3L		-3L	-3RL	-3LL	8.000	2-7/8
-5S	3,200	MS21251-5S	MS21252-5RS	MS21255-5LS	4.594	7/8
-5L		--5L	-5RL	-5LL	8.109	2-5/8
-6S	4,600	MS21251-6S	MS21252-6RS	MS21255-6LS	4.656	5/8
-6L		-6L	-6RL	-6LL	8.156	2-3/8
-8L	8,000	MS21251-8L	MS21252-8RL	MS21255-8LL	8.313	2-1/8
-9L	12,500	MS21251-9L	MS21252-9RL	MS21255-9LL	9.063	2-1/16
-10L	17,500	MS21251-10L	MS21252-10RL	MS21255-10LL	9.563	2-1/16

Groove on body indicates end with left-hand threads.

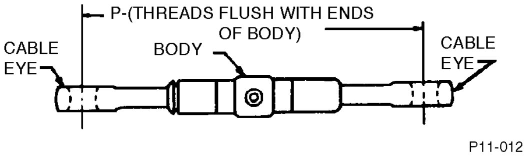
Table 11-4. Turnbuckle Assembly - Pin Eye



Dash Number	Strength (Pounds)	Body	Pin Eye	Cable Eye	P (Inches)	Takeup (Inches)
-2S	800	MS21251-2S	MS21254-2RS	MS21255-2LS	4.5	1-3/8
-2L		MS21251-2L	MS21254-2RL	MS21255-2LL	8.0	2-7/8
-3S	1,600	MS21251-3S	MS21254-3RS	MS21255-3LS	4.5	1-1/8
-3L		MS21251-3L	MS21254-3RL	MS21255-3LL	8.0	2-7/8
-5S	3,200	MS21251-5S	MS21254-5RS	MS21255-5LS	4.5	7/8
-5L		MS21251-5L	MS21254-5RL	MS21255-5LL	8.0	2-5/8
-6S	4,600	MS21251-6S	MS21254-6RS	MS21255-6LS	4.5	5/8
-6L		MS21251-6L	MS21254-6RL	MS21255-6LL	8.0	2-3/8
-8L	8,000	MS21251-8L	MS21254-8RL	MS21255-8LL	8.0	2-1/8
-9L	12,500	MS21251-9L	MS21254-9RL	MS21255-9LL	9.0	2-1/16
-10L	17,500	MS21251-10L	MS21254-10RL	MS21255-10LL	9.5	2-1/16

Groove on body indicates end with left-hand threads.

Table 11-5. Turnbuckle Assembly - Cable Eye

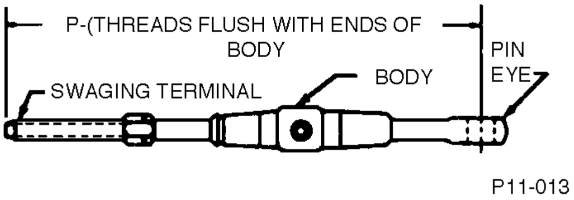


Dash Number	Strength (Pounds)	Body	Cable Eye	P (Inches)	Takeup (Inches)
-2S	800	MS21251-2S	MS21255-2RS -2LS	4.5	1-3/8
-2L		MS21251-2L	MS21255-2RL -2LL	8.0	2-7/8
-3S	1,600	MS21251-3S	MS21255-3RS -3LS	4.5	1-1/8
-3L		MS21251-3L	MS21255-3RL -3LL	8.0	2-7/8
-5S	3,200	MS21251-5S	MS21255-5RS -5LS	4.5	7/8
-5L		MS21251-5L	MS21255-5RL -5LL	8.0	2-5/8
-6S	4,600	MS21251-6S	MS21255-6RS	4.5	5/8

Table 11-5. Turnbuckle Assembly - Cable Eye - Continued

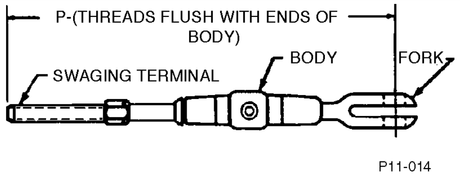
Dash Number	Strength (Pounds)	Body	Cable Eye	P (Inches)	Takeup (Inches)
			-6LS		
-6L		MS21251-6L	MS21255-6RL -6LL	8.0	2-3/8
-8L	8,000	MS21251-8L	MS21255-8RL -8LL	8.0	2-1/8
-9L	12,500	MS21251-9L	MS21255-9RL -9LL	9.0	2-1/16
-10L	17,500	MS21251-10L	MS21255-10RL -10LL	9.5	2-1/16
Groove on body end indicates left-hand threads.					

Table 11-6. Turnbuckle Assembly - Swaging Terminal, Pin Eye



Dash Number	Min Strength (Pounds)	Body	Pin Eye	Swaging Terminal	P (Inches)	Takeup (Inches)
-2S	800	MS21251-2S	MS21254-2S	MS21260-S2	1.042	1-3/8
		-2L	-2L	-L2		2-7/8
-3S	1,600	MS21251-3S	MS21254-3S	MS21260-S3		1-1/8
-3L		-3L	-3L	-L3	1.261	2-7/8
-5S	3,200	MS21251-5S	MS21254-5S	MS21260-S5		7/8
-5L		-5L	-5L	-L5	1.761	2-5/8
-6S	4,600	MS21251-6S	MS21254-6S	MS21260-S6		5/8
-6L		-6L	-6L	-L6	2.011	2-3/8
-8L	8,000	MS21251-8L	MS21254-8L	MS21260-8	2.511	2-1/8
-9L	12,500	MS21251-9L	MS21254-9L	MS21260-9	2.761	2-1/16
-10L	17,500	MS21251-10L	MS21254-10L	MS21260-10	3.011	2-1/16
Groove on body indicates end with left-hand threads.						

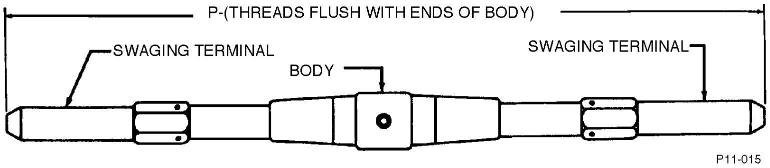
Table 11-7. Turnbuckle Assembly - Swaging Terminal, Fork



Dash Number	Min Strength (Pounds)	Body	Fork	Swaging Terminal	P (Inches)	Takeup (Inches)
-2S -2L	800	MS21251-2S -2L	MS21252-2RS -2RL	MS21260-S2LH -L2LH	1.042	1-3/8 2-7/8
-3S -3L	1,600	MS21251-3S -3L	MS21252-3R8 -3RL	MS21260-S3LH -L3LH	1.261	1-1/8 2-7/8
-5S -5L	3,200	MS21251-5S -5L	MS21252-5RS -5RL	MS21260-S5LH -L5LH	1.761	7/8 2-5/8
-6S -6L	4,600	MS21251-6S -6L	MS21252-6RS -6RL	MS21260-S6LH -L6LH	2.011	5/8 2-3/8
-8L	8,000	MS21251-8L	MS21252-8RL	MS21260-8LH	2.511	2-1/8
-9L	12,500	MS21251-9L	MS21252-9RL	MS21260-9LH	2.761	2-1/16
-10L	17,500	MS21251-10L	MS21252-10RL	MS21260-10LH	3.011	2-1/16

Groove on body indicates end with left-hand threads.

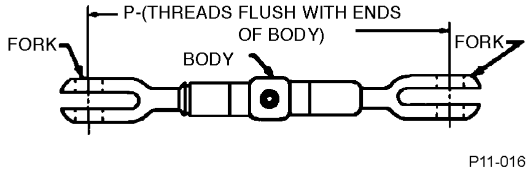
Table 11-8. Turnbuckle Assembly - Swaging Terminal



Dash Number	Min Break Strength (Pounds)	Body	Swaging Terminal	P (Inches)	Takeup (Inches)
-2S	800	MS21251-2S	MS21260-S2LH -S2RH	1.042	1-3/8
-2L		MS21251-2L	MS21260-L2LH -L2RH		3-1/8
-3S	1,600	MS21251-3S	MS21260-S3LH -S3RH	1.261	1-1/8
-3L		MS21251-3L	MS21260-L3LH -L3RH		2-7/8
-5S	3,200	MS21251-5S	MS21260-S5LH -S5RH	1.761	7/8
-5L		MS21251-5L	MS21260-L5LH -L5RH		2-5/8
-6S	4,600	MS21251-6S	MS21260-S6LH -S6RH	2.011	5/8
-6L		MS21251-6L	MS21260-L6LH -L6RH		2-3/8
-8L	8,000	MS21251-8L	MS21260-8LH -8RH	2.511	2-1/8
-9L	12,500	MS21251-9L	MS21260-9LH -9RH	2.761	2-1/16
-10L	17,500	MS21251-10L	MS21260-10LH -10RH	3.011	2-1/16

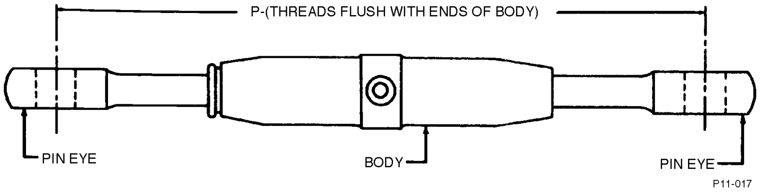
Groove on body indicates end with left-hand threads.

Table 11-9. Turnbuckle Assembly - Fork



Dash Number	Strength (Pounds)	Body	Fork	P (Inches)	Takeup (Inches)
-2S	800	MS21251-2S	MS21252-2LS - 2RS	4.5	1-3/8
-2L		MS212S1-2L	MS21252-2RL - 2LL	8.0	2-7/8
-3S	1,600	MS21251-3S	MS21252-3LS - 3RS	4.5	1-1/8
-3L		MS21251-3L	MS21252-3RL - 3LL	8.0	2-7/8
-5S	3,600	MS21251-5S	MS21252-5LS - 5RS	4.5	7/8
-5L		MS21251-5L	MS21252-5RL - 5LL	8.0	2-5/8
-6S	4,600	MS21251-6S	MS21252-6LS - 6RS	4.5	5/8
-6L		MS21251-6L	MS21252-6RL - 6LL	8.0	2-3/8
-8L	8,000	MS21251-8L	MS21252-8RL - 8LL	8.0	2-1/8
-9L	12,500	MS21251-9L	MS21252-9RL - 9LL	9.0	2-1/16
-10L	17,500	MS21251- 10L	MS21252-10RL - 10LL	9.5	2-1/16
Groove on body end indicates left-hand threads.					

Table 11-10. Turnbuckle Assembly - Pin Eye

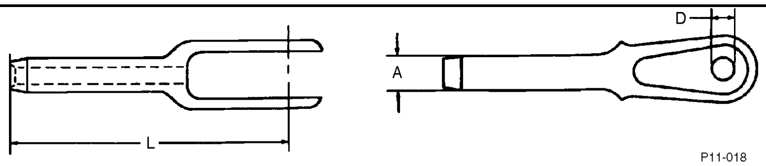


Dash Number	Strength (Pounds)	Body	Pin Eye	P (Inches)	Takeup (Inches)
-2S	800	MS21251-2S	MS21254-2LS -2RS	4.5	1-3/8
-2L		MS21251-2L	MS21254-2LL -2RL	8.0	2-7/8
-3S	1,600	MS21251-3S	MS21254-3LS	4.5	1-1/8

Table 11-10. Turnbuckle Assembly - Pin Eye - Continued

Dash Number	Strength (Pounds)	Body	Pin Eye	P (Inches)	Takeup (Inches)
			-3RS		
-3L		MS21251-3L	MS21254-3LL -3RL	8.0	2-7/8
-5S	3,200	MS21251-5S	MS21254-5LS -5RS	4.5	7/8
-5L		MS21251-5L	MS21254-5LL -5RL	8.0	2-5/8
-6S	4,600	MS21251-66	MS21254-6LS -6RS	4.5	5/8
-6L		MS21251-6L	MS21254-6LL -6RL	8.0	2-3/8
-8L	8,000	MS21251-8L	MS21254-8LL -8RL	8.0	2-1/8
-9L	12,500	MS21251-9L	MS21254-9LL -9RL	9.0	2-1/16
-10L	17,500	MS21251-10L	MS21254-10LL -10RL	9.5	2-1/16

Table 11-11. MS20658 Fork End Cable Terminal



Dash Number	Cable Diameter	A +0.000 -0.005	A_S +0.000 - 0.005	D + 0.002 -0.000	L + 0.020 -0.000	L_S (Approximately)
-3	3/32	0.218	0.190	0.190	2.531	2.656
-4	1/8	0.250	0.219	0.250	3.062	3.344
-5	5/32	0.297	0.250	0.250	3.313	3.656
-6	3/16	0.359	0.313	0.250	3.562	3.750
-7	3/16	0.359	0.313	0.313	3.687	3.875

A = Outside diameter of shank before swaging.

A_s = Outside diameter of shank after swaging.

D = Hole diameter.

L = Length before swaging.

L_s = Length after swaging.

All dimensions given in inches.

Code:

Dash numbers listed are for corrosion-resistant steel terminals.

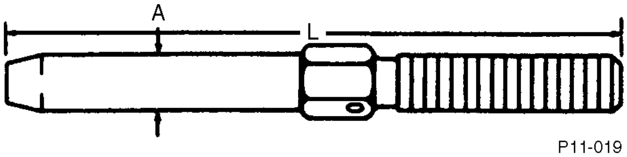
Example of part number:

MS20658-4 terminal, corrosion-resistant steel, 1/8-inch diameter cable, fork end.

Table 11-11. MS20658 Fork End Cable Terminal - Continued

Dash Number	Cable Diameter	A +0.000 -0.005	A_S +0.000 - 0.005	D + 0.002 -0.000	L + 0.020 -0.000	L_S (Approximately)
Material: Steel, corrosion-resistant, Specification MIL-T-781A.						

Table 11-12. MS21259 Threaded Cable Terminal



Dash Num-ber	Cable Diameter	Thread NF-3A UNF-3A	A		A_S		L + 0.016 - 0.000	L_S (Approximately)
-2	1/16	6-40	0.160	+0.000 -0.005	0.138	+0.000 -0.005	2.473	2.651
-3	3/32	10-32	0.218		0.190		2.879	2.996
-4	1/8	1/4-28	0.250		0.219		3.333	3.589
-5	5/32	1/4-28	0.297		0.250		3.627	3.972
-6	3/16	5/16-24	0.359		0.313		4.002	4.170
-7	7/32	3/8-24	0.427		0.375	+0.000 -0.007	4.516	4.812
-8	1/4	3/8-24	0.494		0.438		4.937	5.236
-9	9/32	7/16-20	0.563		0.500	+0.000 -0.008	5.391	5.750
-10	5/16	1/2-20	0.635		0.563		5.844	6.266
-12	3/8	9/16-18	0.703		0.625		6.656	7.093
-14	7/16	5/8-18	0.781		0.688		7.437	8.124
-16	1/2	5/8-18	0.844		0.750	+0.000 -0.009	8.187	8.683
-18	9/16	3/4-16	0.984		.0.875		9.125	9.937
-20	5/8	7/8-14	1.109		1.000	+0.000 -0.010	10.375	11.062
-24	3/4	1-14	1.359				12.063	12.750
-28	7/8	1-1/8-12	1.593	+0.000 -0.010	1.250 1.437	+0.000 -0.012	13.226	13.750
-32	1	1-1/4-12	1.812		1.625		14.969	15.750

A = Outside diameter of shank before swaging.

NOTE

These terminals are not to be used with turnbuckle barrels.

A_s = Outside diameter of shank after swaging.
L = Length of terminal before swaging.

Table 11-12. MS21259 Threaded Cable Terminal - Continued

Dash Number	Cable Diameter	Thread NF-3A UNF-3A	A	A_S	L + 0.016 - 0.000	L_S (Approximately)

L_s = Length of terminal after swaging.

All dimensions given in inches.

Code:

Dash numbers listed are for corrosion-resistant steel terminals.

RH or LH after dash numbers indicate right- or left-hand threaded terminals.

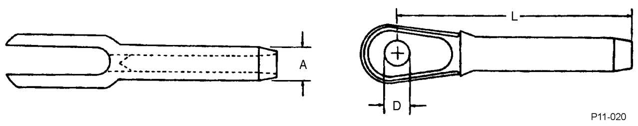
Example of part number:

MS21259-6RH terminal, corrosion-resistant steel, 3/16-inch diameter cable, right-hand threads.

Material:

Steel, corrosion-resistant, Specification MIL-T-781A.

Table 11-13. MS20667 Fork End Cable Terminal



Dash Number	Cable Diameter	A		A_S		D		L +0.020- 0.000	L_S (Approximately)
-2	1/16	0.160	+0.000 -0.005	0.138	+0.000 -0.005	0.190	0.002 0.000	1.572	1.750
-3	3/32	0.218		0.190		0.190		1.945	2.062
-4	1/8	0.250		0.219		0.190		2.352	2.608
-5	5/32	0.297		0.250		0.250		2.655	3.000
-6	3/16	0.359		0.313		0.313		3.071	3.239
-7	7/32	0.427		0.375	+0.000 -0.007	0.313		3.440	3.726
-8	1/4	0.494		0.438		0.375		3.806	4.105
-9	9/32	0.563		0.500	+0.000 -0.008	0.438		4.120	4.479
-10	5/16	0.635		0.563		0.438		4.438	4.860
-12	3/8	0.703		0.625		0.500	0.005 0.000	5.333	5.771
-14	7/16	0.781		0.688		0.562		6.102	6.781
-16	1/2	0.844		0.750	+0.000 -0.009	0.625		6.938	7.436
-18	9/16	0.984		0.875		0.750		7.750	8.562
-20	5/8	1.109		1.000	+0.000 -0.010	0.875		8.673	9.358
-24	3/4	1.359		1.250	+0.000 -0.012	0.875		9.740	10.436
-28	7/8	1.593	+0.000 -0.010	1.437		1.000		10.802	11.326
-32	1	1.812		1.625		1.125		12.312	13.089

A = Outside diameter of shank before swaging.

A_s = Outside diameter of shank after swaging.

D = Hole diameter.

Table 11-13. MS20667 Fork End Cable Terminal - Continued

Dash Number	Cable Diameter	A	A_S	D	L +0.020-0.000	L_S (Approximately)

L = Length before swaging.

L_s = Length after swaging.

All dimensions given in inches.

Code:

Dash numbers listed are for corrosion-resistant steel terminals.

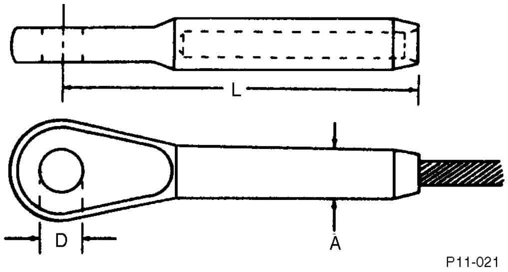
Example of part number:

MS20667-6 terminal, corrosion-resistant steel, 3/16-inch diameter cable.

Material:

Steel, corrosion-resistant, Specification MIL-T-781A.

Table 11-14. MS20668 Eye End Cable Terminal



Dash Number	Cable Diameter	A		A_S		D		L +0.020 -0.000	L_S (Approximately)
-2	1/16	0.160		0.138			0.190	1.631	1.809
-3	3/32	0.218		0.190	+0.000	0.190		2.043	2.160
-4	1/8	0.250		0.219	-0.005	0.190		2.337	2.593
-5	5/32	0.297	+0.000	0.250		0.250		2.684	3.029
-6	3/16	0.359	-0.005	0.313		0.313	+0.002	3.019	3.187
-7	7/32	0.427		0.375	+0.000	0.313	-0.000	3.382	3.678
-8	1/4	0.494		0.438	-0.007	0.375		3.763	4.062
-9	9/32	0.563		0.500		0.438		4.153	4.512
-10	5/16	0.635		0.563	+0.000	0.438		4.546	4.969
-12	3/8	0.703		0.625	-0.008	0.500		5.562	6.000
-14	7/16	0.781	+0.000	0.688		0.562		6.398	7.093
-16	1/2	0.844	-0.005	0.750	+0.000	0.625	+0.005	7.323	7.812
-18	9/16	0.984		0.875	-0.009	0.750	-0.000	8.185	9.000
-20	5/8	1.109		1.000	+0.000	0.875		9.167	9.853
-24	3/4	1.359		1.250	-0.010	0.875		10.328	11.031
-28	7/8	1.593	+0.000	1.437	+0.000	1.000		11.530	12.054
-32	1	1.812	-0.010	1.625	-0.012	1.125		13.156	13.937

A = Outside diameter of shank before swaging.

A_s = Outside diameter of shank after swaging.

Table 11-14. MS20668 Eye End Cable Terminal - Continued

Dash Number	Cable Diameter	A	A_S	D	L +0.020 -0.000	L_S (Approximately)

D = Hole diameter.

L = Length before swaging.

L_s = Length after swaging.

All dimensions given in inches.

Code:

Dash numbers listed are for corrosion-resistant steel terminals.

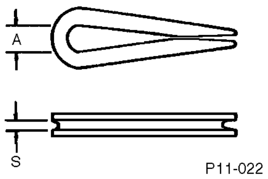
Example of part number:

MS20668-6 terminal, corrosion-resistant steel, 3/16-inch diameter cable.

Material:

Steel, corrosion-resistant, Specification MIL-T-781A.

Table 11-15. AN100 Cable Thimble



Dash Number	Cable Diameter	A (Inches)	S +1/64 -0 (Inch)
-3	1/16 5/64 3/32	.350	3/32
-4	7/64 1/8	.350	9/64
-5	5/32	.400	11/64
-6	3/16	.500	13/64
-7	7/32	.600	15/64
-8	1/4	.700	17/64
-9	9/32	.800	19/64
-10	5/16	.900	21/64
-12	3/8	1.000	25/64
-14	7/16	1.125	29/64
-16	1/2	1.250	33/64
-18	9/16	1.500 (Min)	37/64
-20	5/8	1.750 (Min)	41/64

AN100-18 and AN100-20 available only in commercial wrought steel.

Code:

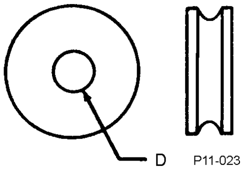
Dash numbers listed are for low carbon steel thimbles.

C before dash indicates corrosion-resistant steel thimbles.

Table 11-15. AN100 Cable Thimble - Continued

Dash Number	Cable Diameter	A (Inches)	S +1/64 -0 (Inch)
B before dash indicates phosphor bronze thimbles. Material: Carbon steel, Military Specification MIL-T-5677A. Corrosion-resistant steel, Military Specification MIL-S-5059, composition G. Phosphor bronze, Federal Specification QQ-P-330.			

Table 11-16. AN111 Cable Bushing



Dash Number	Cable Diameter	D Drill +.010 -.000 (Inch)
-3	1/16 5/64 3/32	.187
-4	1/8	.187
5	5/32	.250
-6	3/16	.312
-7	7/32	.375
-8	1/4	.375
-10	5/16	.437
-12	3/8	.500

Code:

Dash numbers listed are for low carbon steel.

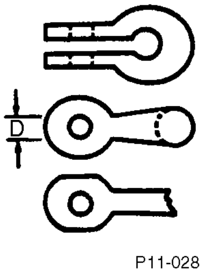
C before dash number indicates corrosion-resistant steel.

Material:

Corrosion-resistant steel, Military Specification MIL-S-7720.

11.4.4 Swaged Ball Terminals. (Refer to Table 11-18 and Table 11-19.) On some aircraft cables, swaged ball terminals are used. The MS20663 is a double-shank, ball end cable terminal and the MS20664 is a single-shank, ball end cable terminal. These terminals are used for attaching cables to quadrants and special connections where space is limited. The steel balls and shanks have a hole through the center and are slipped over the cable and then swaged in position. Dies are supplied with the standard, hand-swaging machines for attaching these terminals to cables. The terminal is placed at the correct location on the cable, then run through the dies in the standard swaging machine. The single-shank terminal is usually used at the end of cables, and the double-shank may be used at either the end or center of the cable. Cut or file flush all protruding or excess cable from ends of all fittings prior to testing.

Table 11-17. AH115 Cable Shackle



Dash Number	D Diameter +.010 -.000 (Inch)
-8	.188
-16	.188
-21	.188
-32	.250
-46	.313
-61	.375
-80	.375
-125	.438
-175	.500

Code:

Dash numbers listed are for cadmium- or zinc-plated steel.

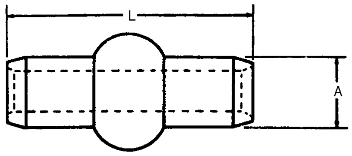
C before dash number indicates corrosion-resistant steel.

K before dash number indicates NI-CU-AL alloy.

Material:

Cadmium- or zinc-plated steel, corrosion-resistant steel, NI-CU-AL alloy.

Table 11-18. MS20663 Double Shank Ball End Cable Terminal



P11-029

Dash Number	Cable Diameter	A		A $_S$		L ±0.0075	L $_S$ (Approximately)
-2	1/16	0.127	+0.000 -0.004	0.112	+0.000 -0.003	0.362	0.390
-3	3/32	0.163		0.143		0.525	0.578
-4	1/8	0.218		0.190		0.688	0.765
-5	5/32	0.254		0.222	+0.000 -0.004	0.850	0.953
-6	3/16	0.293	+0.000 -0.005	0.255	+0.000 -0.005	1.012	1.140
-7	7/32	0.347		0.302		1.175	1.328
-8	1/4	0.401		0.348		1.337	1.515
-9	9/32	0.439	+0.000 -0.004	0.382	+0.000 -0.007	1.497	1.719
-10	5/16	0.475	+0.000 -0.005	0.413		1.664	1.875

A = Outside diameter of shank before swaging.

A_s = Outside diameter of shank after swaging.

L = Length of terminal before swaging.

L_s = Length of terminal after swaging.

All dimensions given in inches.

Code:

Dash numbers listed are for carbon steel terminals.

Example of part number:

MS20663-4 terminals, carbon steel, 1/8-inch diameter cable.

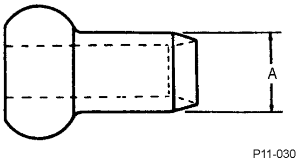
Material:

Steel, corrosion-resistant, Specification MIL-T-781A.

NOTE

Caution must be exercised to assure that AN663 or MS20663 carbon steel ball end terminals are not used with MIL-C-18375 or MIL-W-83420, Composition B, corrosion resistant steel cable. Only the AN663C or MS20663C stainless steel fitting will be used; however, either the carbon steel ball end or stainless steel ball end can be used on MIL-W-83420, Composition A carbon steel cable.

Table 11-19. MS20664 Single Shank Ball End Cable Terminal



Dash Number	Cable Diameter	A		A_S	
-2	1/16	0.132	+0.000 -0.004	0.112	+0.000 -0.003
-3	3/32	0.168		0.143	
-4	1/8	0.223		0.190	+0.000 -0.004
-5	5/32	0.259		0.222	
-6	3/16	0.298	+0.000 -0.005	0.255	+0.000 -0.005
-7	7/32	0.352		0.302	
-8	1/4	0.406		0.348	
-9	9/32	0.444		0.382	
-10	5/16	0.480		0.413	

A = Outside diameter of terminal before swaging.

A_s = Outside diameter of terminal after swaging.

All dimensions given in inches.

Code:

Dash numbers listed are for carbon steel terminals.

Example of part number:

MS20664-4 terminal, carbon steel, 1/8-inch diameter cable.

Material:

Steel, corrosion-resistant, Specification MIL-T-781A.

NOTE

Caution must be exercised to assure that AN664 or MS20664 carbon steel ball end terminals are not used with MIL-C-18375 or MIL-W-83420, Composition B, corrosion resistant steel cable. Only the AN664C or MS20664C stainless steel fitting will be used; however, either the carbon steel ball end or stainless steel ball end can be used on MIL-W-83420, Composition A, carbon steel cable.

11.5 PULLEYS.

Inspect pulleys for roughness, sharp edges, and presence of foreign material embedded in the grooves. Examine pulley bearings to assure proper lubrication, smooth rotation, freedom from flat spots, dirt, and paint spray. Periodically rotate pulleys, which turn through a small arc, to provide a new bearing surface for the cable. Maintain pulley alignment to prevent the cable from riding on the flanges and chafing against guards, covers, or adjacent structure. Check all pulley brackets and guards for damage, alignment, and security.

a. Pulley Wear patterns. Various cable system malfunctions maybe detected by analyzing pulley conditions. These include such discrepancies as too much tension, misalignment, pulley bearing problems, and size mismatches between cables and pulleys. Examples of these conditions are shown in Figure 11-7.

11.5.1 Cable Stops. (See Figure 11-8.) Cable stops, consisting of a tapered locking screw and a locking nut, are used on some aircraft trim tab system cables. When fabricating new cables for the trim tab system, the two units comprising the stop must be threaded onto the cable in the proper direction and sequence before swaging or soldering the last terminal. When this device is clamped onto a cable, the correct location should be found, the tapered locking screw held with an open-end wrench, and the locking nut screwed over the threads. The tapered locking screw should not be allowed to rotate on the cable, since the cable will be damaged as the wedging action of the locking nut increases.

11.5.2 Cable Fabrication.

WARNING

A suitable guard should be placed over the cable while it is being tested to prevent injury to personnel or damage to equipment should the cable break.

NOTE

All locally fabricated, reworked and repaired cable assemblies shall be tested for proper strength before installation. The desired method is to simulate the installation arrangement including pulleys where required, (if such simulation is not possible a straight pull test may be accomplished). Apply a test load of 60% of the minimum allowable breaking strength gradually to one end of the cable with the other end securely anchored. Hold for 3 minutes; release and examine the cable for damage in accordance with paragraph 11.2.1 and the fittings for any sign of failure of attachment.

11.5.3 Cable Replacement. If spare cables are not available, exact duplicates of the damaged cables should be prepared. However, if facilities and supplies are limited and immediate replacement is imperative, replacements may be prepared by using cable bushings and eye splices and proper combination of turnbuckles to match the original installation. Eye-type swaged terminals may be replaced by bushing in an eye splice. Clevis-type terminals may be replaced by a cable thimble in conjunction with an eye splice and a shackle. When this is done cables having a diameter of 3/32-inch and over may be woven-spliced by means of the five-tuck method, and cables of 1/16-inch diameter may be wrap-soldered. Table 11-20 gives the particular terminals recommended for use with an improvised woven-spliced or wrap-soldered cable.

11.5.4 Cutting Cables. Cables may be cut by any cutting method except a torch, depending upon the tools and machines available. If a cable tends to unravel or fray when being cut, the cut area should be sweat-soldered or wrapped with masking, cellulose, or friction tape so that half the soldered or taped width will remain on each end after cutting. Small diameter cables may be cut satisfactorily with a pair of heavy-duty diagonal cutters, side cutters, or with pair of wire nippers. (See Figure 11-9.) Best results are obtained if the cutting jaws are held perpendicular to the cable during the cutting operation. Cables up to 3/32-inch diameter may be cut in one cut by this method, while larger cables will require two or more cuts. When cutting large diameter cables in this manner, the end of the cutting blade should be used and a few strands cut at a time. A cold chisel, used in conjunction with a soft metal block, may also be used for cutting cables. The chisel should be held straight up and the cutting blade placed at right angles to the cable. (See Figure 11-10.) A heavy hammer should be used with a sharp blow to the chisel to effect a clean, square cut. The best method of cutting cables is with a cable-cutting machine having special jaws for cables of various diameters. (See Figure 11-11.) The cables should be positioned in the proper diameter groove and held firmly at right angles to the cutting blades while the operating handle is pulled down sharply. Large cables should be cut with a radiac (a thin, abrasive wheel which revolves at high speed).

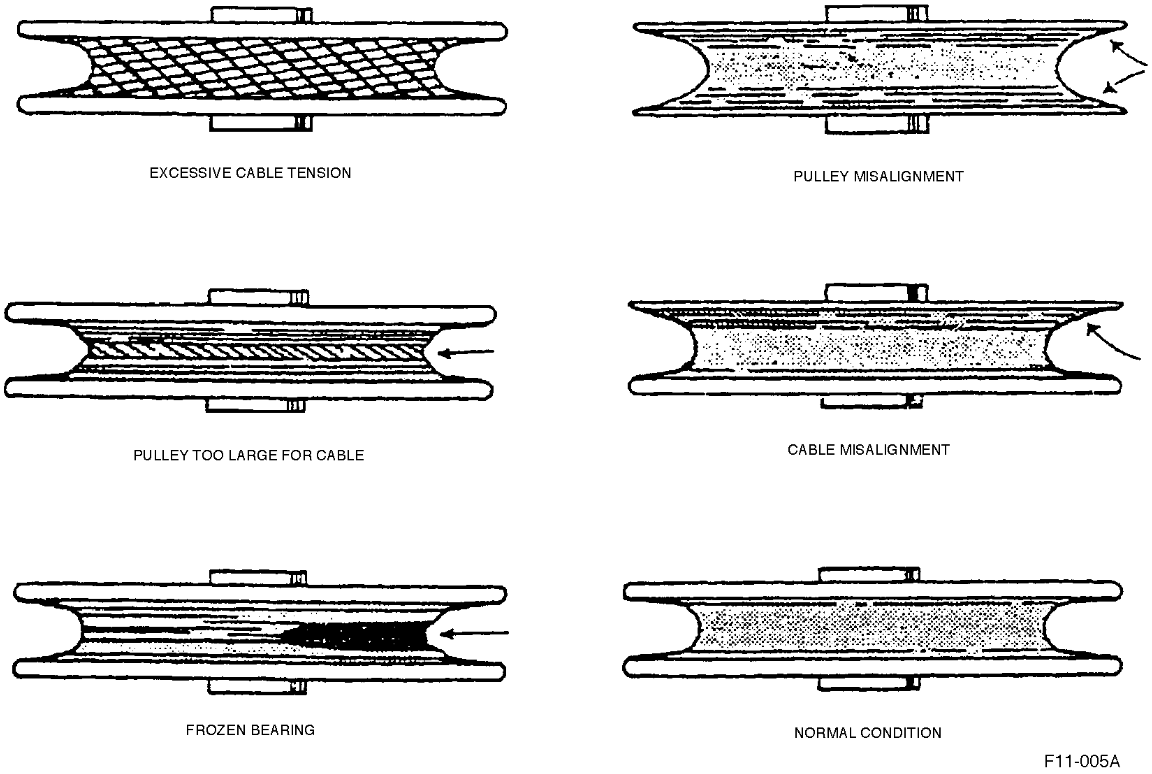


Figure 11-7. Pulley Wear Patterns

Table 11-20. Recommended Terminals for Use with Improvised Woven-Spliced or Wrap-Soldered Cable

Cable Size	Thimble	Bushing	Shackle	Turnbuckle Assembly (Including Forks)
1/16 inch	AN100-3	AN111-3	AN115-8	AN150-16S
3/32 inch	AN100-3	AN111-3	AN115-8	AN150-16S
1/8 inch	AN100-4	AN111-4	AN115-16	AN150-21S
5/32 inch	AN100- 5	AN111-5	AN115-21	AN150-32S

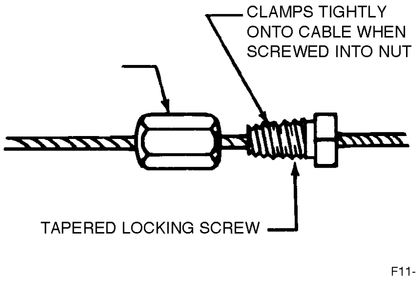


Figure 11-8. Trim Tab Cable Stop

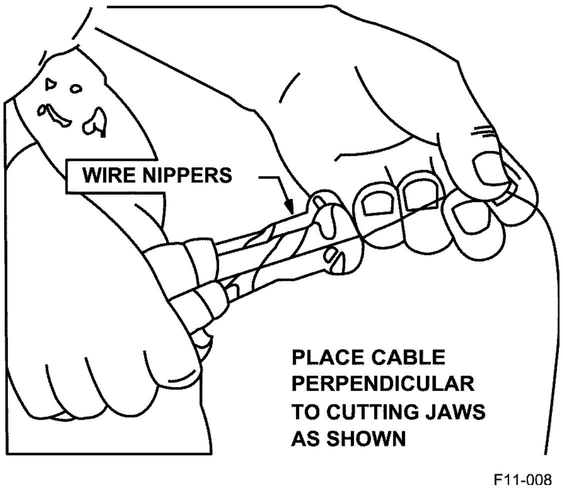


Figure 11-9. Cutting Small Diameter Cable

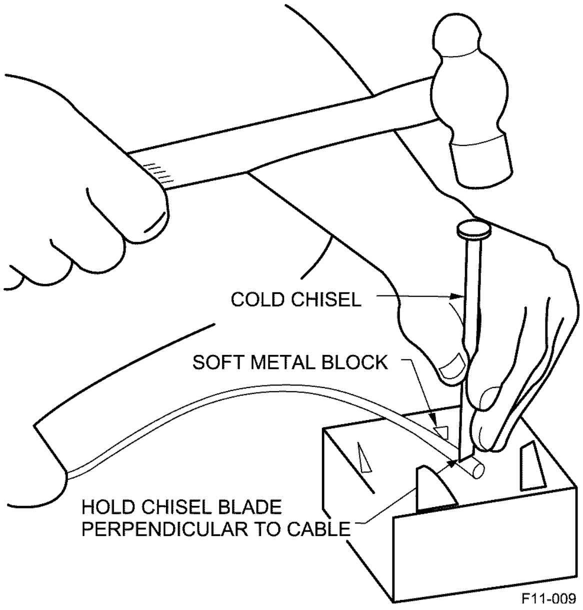


Figure 11-10. Cutting Cable With Cold Chisel

11.5.5 Cable Lubrication and Corrosion Preventative Treatment. Lubrication and corrosion preventative treatment of cables may be effected simultaneously by application of compound MIL-C-16173 grade 4, or MIL-C-11796, class I. MIL-C-16173 compound should be brushed, sprayed or wiped on the cable to the extent it penetrates into the strands and adequately covers the cable surfaces. It will dry ‘‘tack free’’ in 24 hours at 77°F. MIL-C-11796 compound is applied by dipping the cable in a tank of compound heated to 77 ±5°C (170 ± 9°F) for 1/2 minute then removing it and wiping off the excess oil.

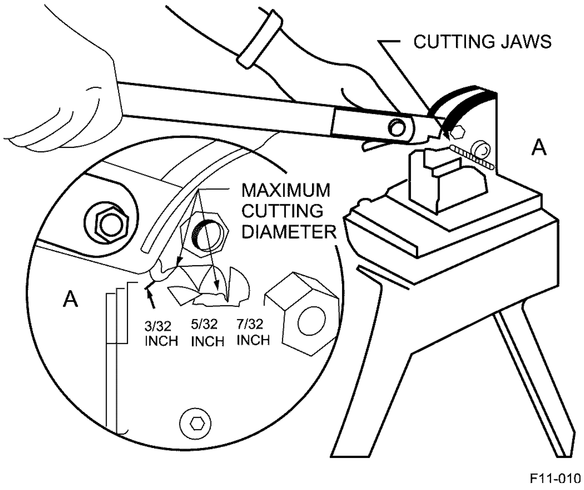


Figure 11-11. Cable Cutting Machine

11.5.6 Swaging Cable Terminals. Swaged terminals should be used in fabrication if available. After preparing the necessary cable length, allowing for the fitting elongation under swaging and proof loading, the end of the cable should be coated with lubricating oil, Military Specification MIL-L-15016. To swag the terminals onto the cable end, proceed as follows:

a. Check that end of cable is square cut so that entire cable end will go inside terminal barrel. (See Figure 11-13.)

b. Insert cable into terminal approximately 1-inch. Bend cable toward terminal, straighten back to normal, and then push cable end entirely into terminal barrel.

c. Check that proper size swaging dies are in swaging machine. (See Figure 11-14, Figure 11-15, and Figure 11-16.)

d. With a micrometer, check terminal barrel diameter after swaging. If, after swaging, the terminal has more than allowable 1/2-degree bend, secure it in a vise and straighten it with as few applications of pressure as possible.

e. Accurately measure the overall cable length and trim the cable as required.

f. Check that all additional fittings are slipped on the cable in proper sequence.

g. Swage the other terminal as directed in steps a through d above.

h. Using red paint, paint the junction of the swaged fitting and cable.

i. At all subsequent service inspections of the swaged fitting, check for gap in the painted section which would indicate cable slippage.

11.5.7 Sweat-Soldering Cable Terminals. As sweat-soldered terminals are employed only on lightly loaded cables, they should be used only when replacing cables where they were originally used. Sweat-soldered terminals can be distinguished from swaged-type terminals by the air holes in the barrel of the terminal, which allow the molten solder to fill the barrel without air bubbles. (See Figure 11-17.) To attach sweat-soldered terminals to cables proceed as follows:

a. Select proper size and type terminal and place it, barrel up, in a suitable clamping device. The clamping device should have jaws of fiber or some other nonconductive material that will not lose heat readily.

b. Apply heat to terminal barrel with a soldering torch or a high-wattage soldering iron.

c. After terminal is thoroughly heated, insert a small amount of soldering flux into barrel. Stearic acid, a suitable mixture of stearic acid and resin, or resin dissolved in alcohol may be used as the soldering flux. Muriatic acid should not be used as a flux.

d. Apply soldering flux to end of the cable and insert it into barrel of terminal. On clevis-type terminals, allow cable to extend through barrel a short distance and free end strands of cable; allow them to fray. Pull cable back into barrel until end is flush with clevis.

e. Apply tin-lead solder, Federal Specification QQ-S-571, around cable at terminal opening and thoroughly sweat-solder into terminal barrel until solder appears at opposite end of barrel and fills each breather hole. Avoid overheating solder.

f. Leave a solder bead around cable at terminal opening and allow terminal to air-cool. Do not quench.

11.5.8 Wrap-Soldering Cable Terminals. (See Figure 11-18.)

The wrap-soldered splice may be employed to fabricate end fittings on cables of 1/16-inch diameter only. To replace an eye-type fitting, the AN111-3 cable bushing is used; to replace a clevis-type fitting, the AN100-3 cable thimble and an AN115-8 cable shackle is used. Proceed as follows:

a. Arrange cable and fittings, allowing approximately 2-1/4 inches of free end. Before wrapping cable around a thimble, place cable shackle in position, as this cannot be done after splice is completed.

b. Clamp assembly in a splicing clamp or similar holding device and secure in a vise.

c. Starting as close as practicable to end fitting, press free end of standing length of cable together tightly and wrap with a single layer of number 20 zinc-coated soft steel wire, Federal Specification QQ-W-461, leaving a space of approximately 1/8 inch between every 1/2 inch of wrapping. Allow wrapping to extend approximately 1/4 inch beyond free end.

NOTE

Be careful to prevent standing length from twisting during this operation.

d. Thoroughly flux entire splice with stearic acid, a suitable mixture of stearic acid and resin, or resin dissolved in alcohol. Muriatic acid should not be used as a flux.

e. Remove splice from cable clamp and dip wrapping in tin-lead solder, Federal Specification QQ-S-571. Carefully sweat-solder into cable about wrapping and apply solder until wrapping wire is barely discernible, making certain that open spaces between wrapped sections are thoroughly impregnated with molten solder. If a solder pot is not available, a soldering torch may be used; in that case, be careful to thoroughly impregnate entire splice with solder.

f. Remove splice from solder pot and allow to cool. Do not quench.

g. After splice has cooled, thoroughly wipe clean and wash away all soldering flux from splice and adjacent cable with hot water.

h. Dry splice and impregnate spliced section with a rust or corrosion preventive conforming to Military Specifications MIL-C-11796, class I, MIL-C-16173, Grade 4.

i. Carefully inspect splice. A wrap-soldered splice easily bent with the fingers is unsatisfactory because of poor solder penetration. Cracks in solder, between wrapping wire and short space provided between wraps, are a positive indication of slippage in a wrap-soldered splice.

NOTE

Before replacing clevis-type terminal with a cable thimble and cable shackle, see that there will be sufficient room and clearance for this setup. If not, make an eye splice with an AN111 bushing and use in conjunction with a turnbuckle assembly. (See Figure 11-19.)

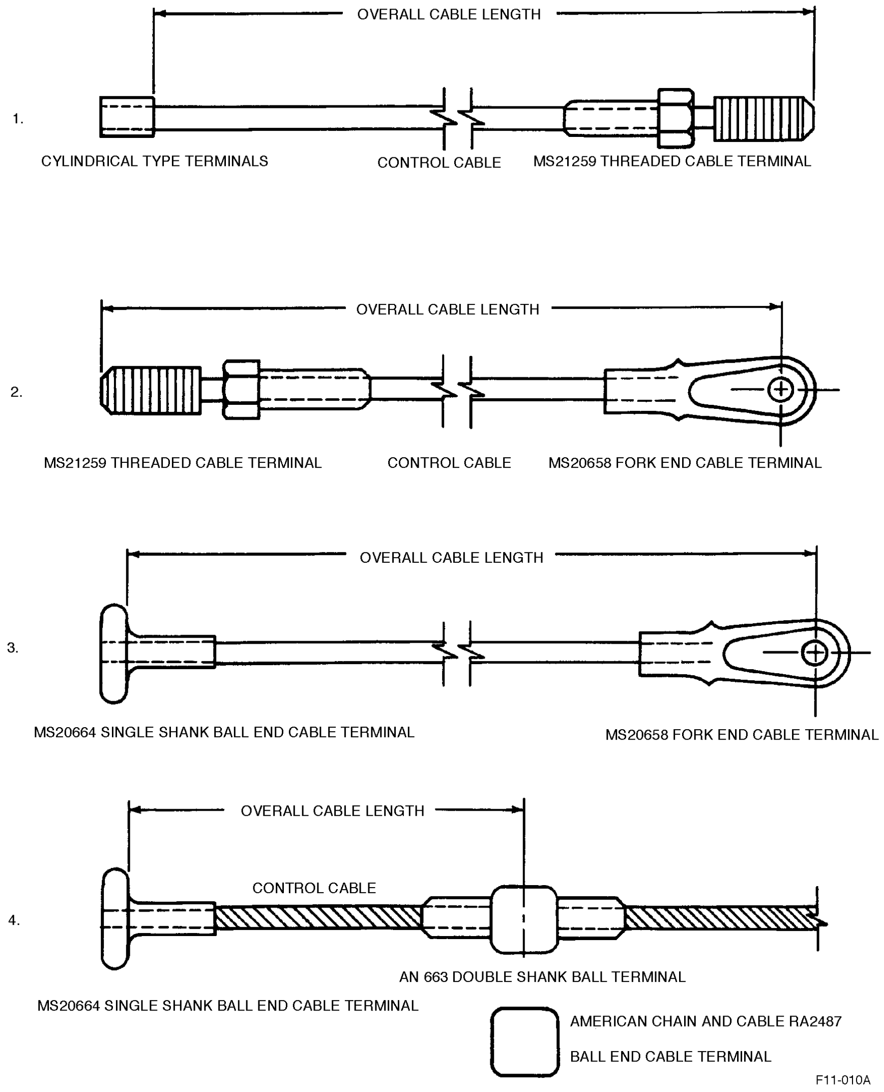


Figure 11-12. General Cable Measurements

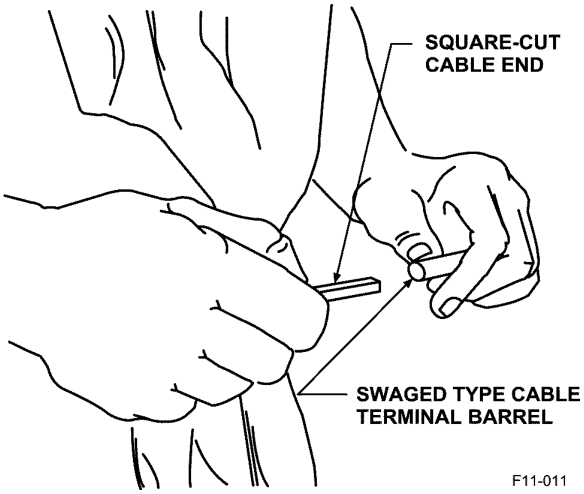


Figure 11-13. Inserting Cable in Swaging Terminal

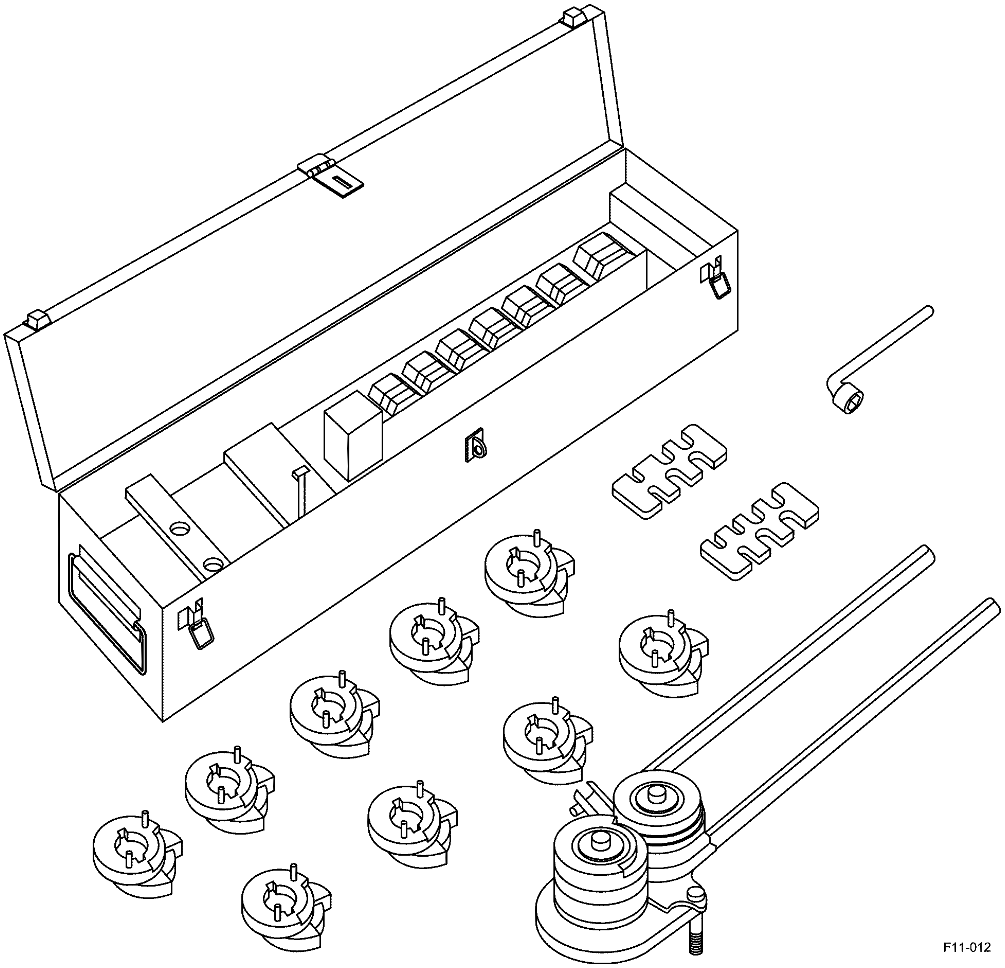


Figure 11-14. Standard Hand Swaging Machine Set With Dies

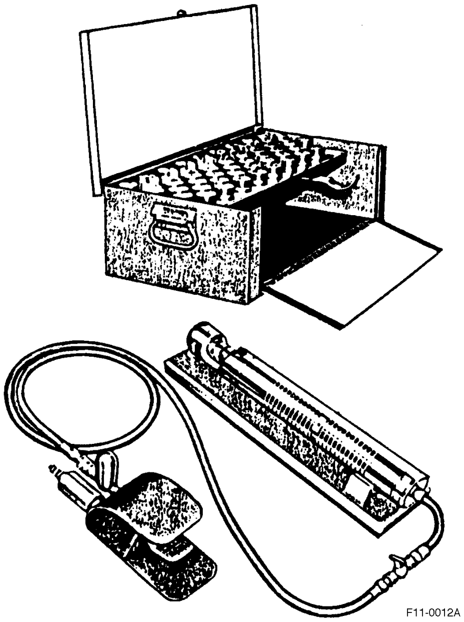


Figure 11-15. Portable Aircraft Cable Swaging Machine

11.5.9 Woven-Spliced Cable Terminals. Where facilities are limited and immediate replacement of cables is imperative, five-tuck woven-spliced terminals may be used in conjunction with AM111 bushing, or with AN100 cable thimbles and AN115 shackles, in place of swaged terminals. Because of restrictions such as fairleads, cutouts, and pulleys, it may be necessary to splice one end of the cable in the aircraft. Therefore, the original installation should be checked for any restrictions on the passage of the splice. Prior to splicing a cable by this method, the cable should be annealed with a welding torch for a distance of one inch from the tip. (See Figure 11-20.) Each of the strands should be trimmed after annealing. (See Figure 11-22 for the designation of numbers and letters referred to in the following sequence of operations.) The procedure for the fabrication of the five-tuck woven splice is as follows:

a. Secure cable around a bushing or thimble by means of a splicing clamp, leaving eight inches or more of free end. Secure splicing clamp in a vise with free end left of standing wire and away from operator. (See Figure 11-21.) If a thimble is used as the end fitting, turn points outward approximately 45-degrees.

b. Select free strand (1, Figure 11-22) nearest standing length at end of fitting and free this strand from the rest of free ends. Insert a marlinspike under first three strands (A, B, and C) of standing length nearest separated strand of free end and separate them momentarily by twisting marlinspike. Insert free strand (1) under the three separate strands through opening created by marlinspike. Pull free end taut by means of pliers.

c. Untwist a second strand (2), located to left of first strand tucked, and insert it under first two standing strands (A, B). Loosen third free length strand (3) located to left of first two, and insert it under first standing strand (A) of original three.

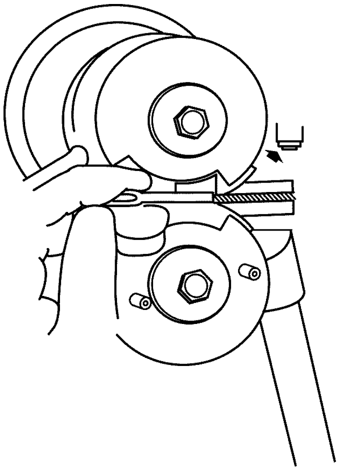


Figure 11-16. Locating the Terminal in the Swaging Jaws

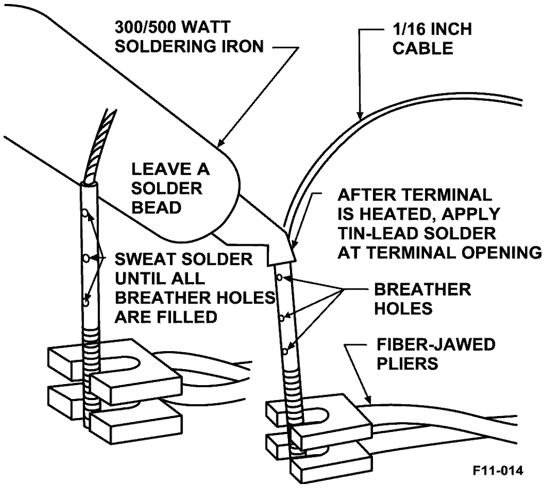


Figure 11-17. Sweat Soldering Cable Terminal

d. Remove center or core strand (7) from free end and insert it under same standing strands (A, B). Temporarily secure core strand to body of standing cable. Loosen last free strand (6), located just to right of first (1), and tuck it under last two strands (E, F) of standing cable. Tuck fifth free end (5) around fifth standing strand (E). Tuck fourth free end (4) around sixth standing strand (F). Pull all strands snug toward end fitting with pliers. This completes first tuck.

e. Begin with first free strand (1) and work in a counterclockwise direction tucking free strands under every other standing strand. After completion of every tuck pull strands tight with pliers. Pull toward end fitting. After completion of the third complete tuck, divide in half the number of wires in each free strand. Make another complete tuck with wires remaining at the completion of fourth tuck; again halve wires in the free strands and make one final tuck with wires remaining. Cut off all protruding strands and pound splice with a wooden or rawhide mallet to relieve strain in wires. Serve splice with waxed-linen cord, Federal Specification V-T-291. Start 1/4 inch from end of splice and carry wrapping over loose end of the cord and along tapered splice to a point between second and third tucks. Insert end of cord back through last five wrappings and pull snug. Cut off ends. If a thimble is used as an end fitting, bend down points. Apply two coats of shellac to cord, allowing two hours between applications. Carefully inspect cable strands and splices for local failure. Weakness in a woven splice is made evident by a separation of strands of serving cord.

NOTE

Nonpreformed and stainless steel cables can be spliced, but not as easily as preformed cables, due to the fact that strands of the cable have a tendency to flare or spread out when cut. To avoid strand flaring, the electric cable cutter should be used. If this tool is not available, flaring may be prevented by placing solder on cable at cutoff position.

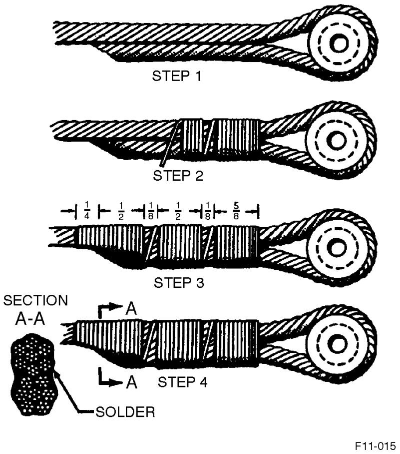


Figure 11-18. Wrap-Soldered Splice

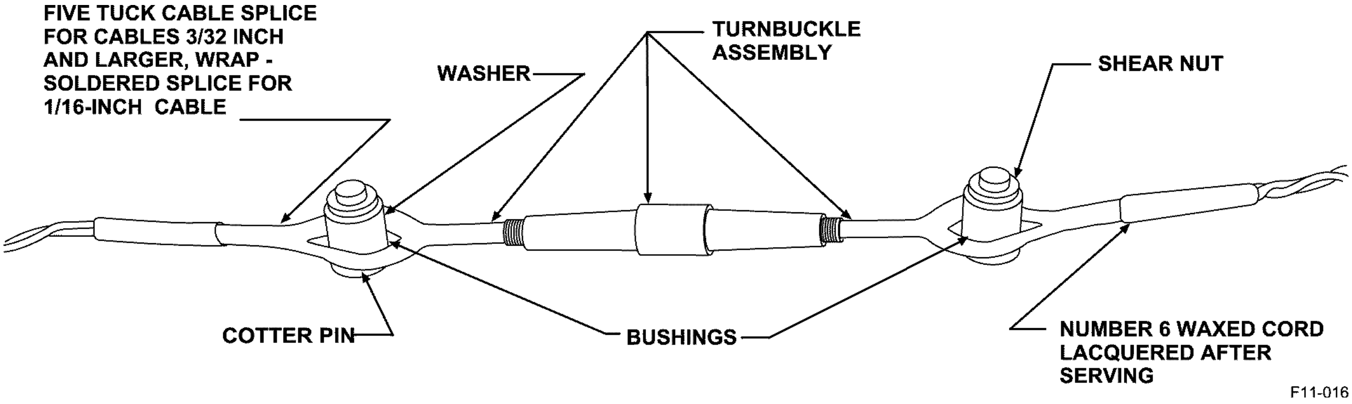


Figure 11-19. Turnbuckle and Splices

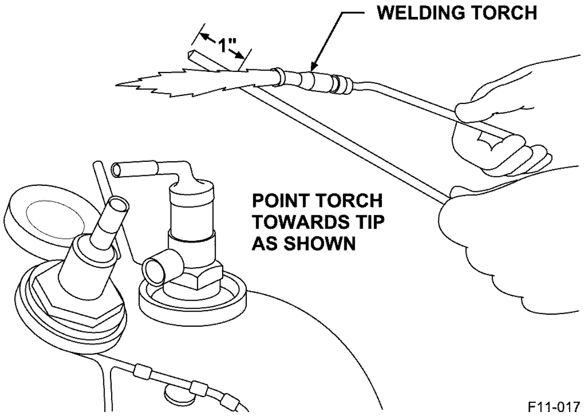


Figure 11-20. Annealing Cable End

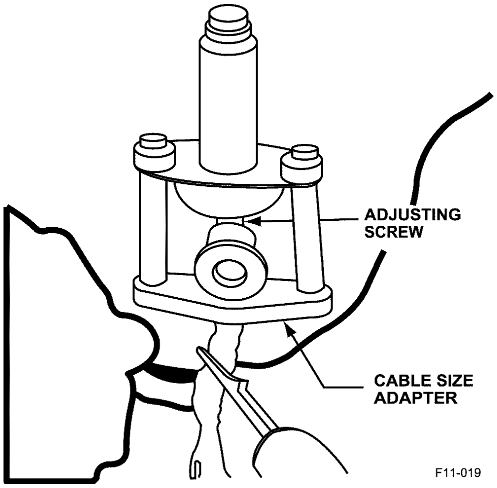


Figure 11-21. Cable Clamp for Woven Splice

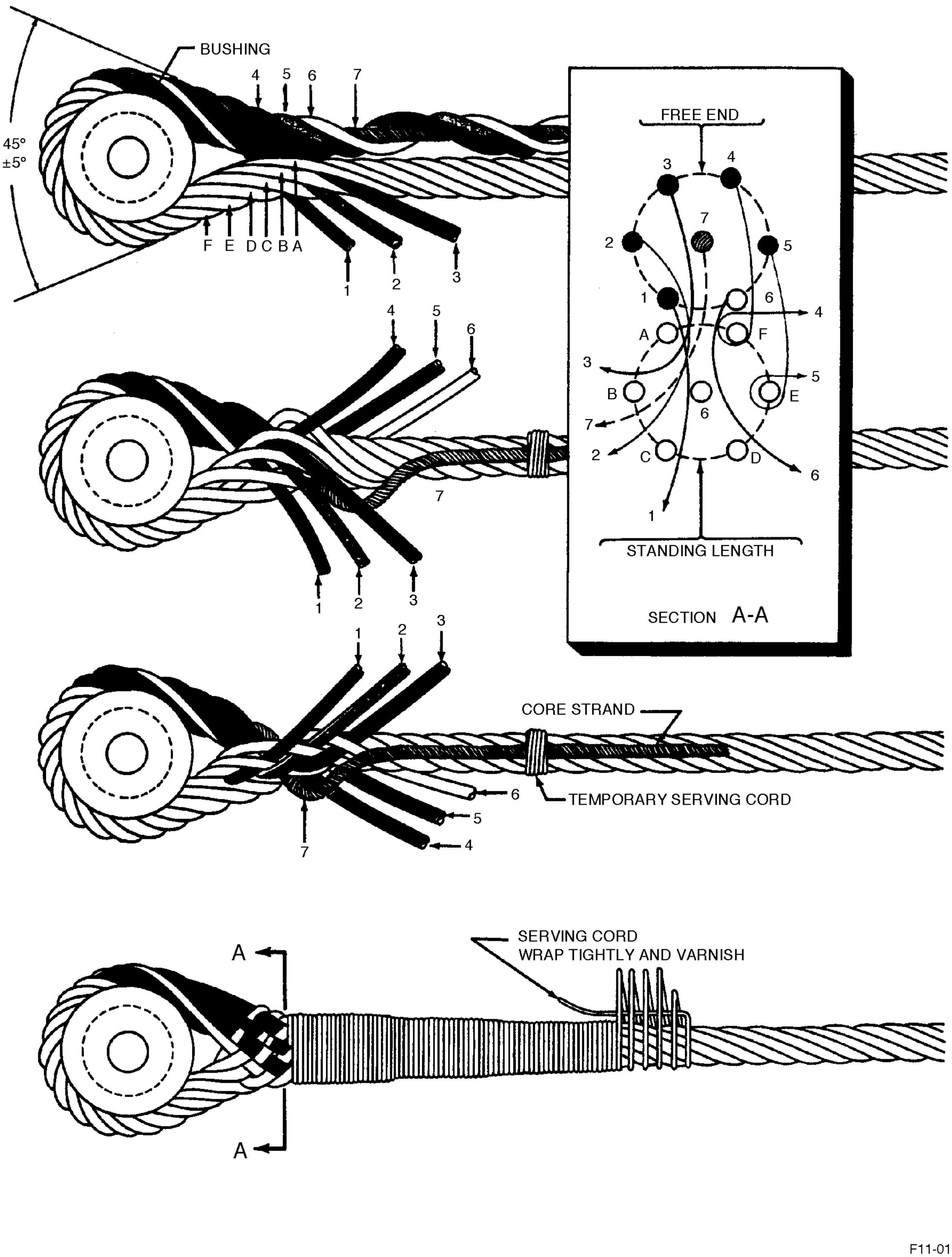


Figure 11-22. Woven Cable Splice

CHAPTER 12
TIE RODS AND CONTROL RODS

12.1 TIE RODS AND CONTROL RODS.

Tie rods and control rods of several different sizes and types are used in the makeup of tie rod and control rod assemblies. Tie rod assemblies are used as tension carrying structural members which have a high strength and will affect the alignment of adjacent structural elements. Control rod assemblies are used as links in mechanical systems to allow remote operation for adjustment of engine accessories, main flight controls, and miscellaneous units of fixed equipment.

12.1.1 Tie Rods. (Refer to Table 12-1 and Table 12-2.)

12.1.2 Tie Rod Assemblies. A tie rod assembly consists of a tie rod, two checknuts, and two tie rod terminal fittings. The tie rod is made of high strength steel, and is threaded with right-hand and left-hand threads at opposite ends. A portion of the shank is flat, which allows a wrench to be used for turning the tie rod during installation and adjustment. A checknut and fitting are installed on each end of the tie rod. The checknuts are tightened against the fittings to prevent loosening caused by vibration. A typical tie rod assembly is shown in Figure 12-1.

12.1.3 Types of Tie Rods. There are several types of tie rods available including streamlined, round, and square tie rods. The streamlined tie rods (AN671 through AN686) are elliptical in shape and are designed for external use where it is important to reduce air resistance. The round and square tie rods (AN701 through AN708) are used internally for various bracing purposes where a light, strong, adjustable member is required.

12.1.4 Types of Tie Rod Terminal Fittings. There are several different types of tie rod terminal fittings. The most common type used is the AN665 tie rod end terminal. This fitting has a clevis end and is threaded for attachment to the threaded end of the tie rod shank.

12.1.5 Control Rods. (Refer to Table 12-3.)

12.1.6 Control Rod Assembly. (Refer to Table 12-4 through Table 12-23.) Most control rod assemblies consist of a tube assembly, two checknuts and two rod ends or a tube assembly, one checknut and one rod end. Others consist of a control rod, two checknuts and two rod ends. The control rod is made of steel and the tubing for the tube assembly is made of stainless steel or aluminum alloy. Control rod assemblies can be made from standard AN or NAS parts, using any combination that is required. Length adjustment is accomplished by the use of screw-type fittings which may be capable of self-alignment to avoid rod distortion under certain types of motion. Control rod assemblies with ball-bearing rod ends are used for mechanical systems where low friction loads are desired and where motion tends to twist or bend the control rod. The checknut is first installed on the threaded end of the rod or tubing assembly, and then the rod end is attached. When the correct length of the control rod assembly has been determined, the checknut is tightened against the rod end to prevent the rod end from becoming loose. Typical control rod assemblies are shown in Figure 12-2.

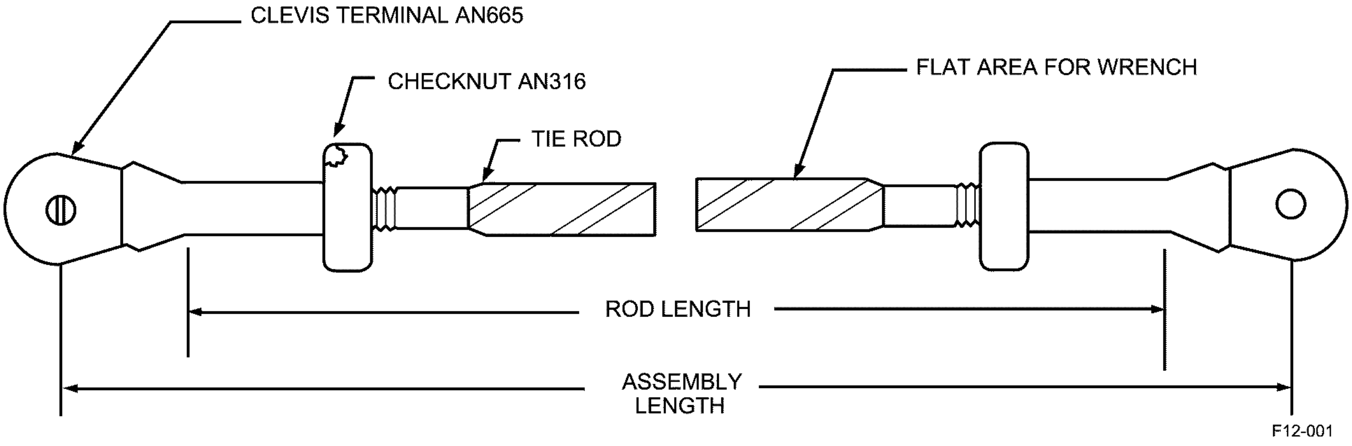


Figure 12-1. Typical Tie Rod Assembly

NOTE

When connecting a ball bearing control rod, a plain or countersunk washer of appropriate size, NAS143 (reference Table 6-2), MS20002 (reference Table 6-9, or AN970 (reference Table 6-7) will be installed under the attaching nut and bolt head to prevent any possibility of control rod slipping off over the bearing retaining nut or bolt head. The attaching nut and bolt must tightly clamp the inner race of the bearing to face of the washer and supporting structure. A nut and bolt that is only finger tight does not utilize the bearing for the purpose it was intended. Control rods utilizing clevis rod ends may have washers, if required, installed under the bolt and nut heads on the outside of the fork or between the fork and bearing if space permits. Nuts should be tightened to the recommended torque values listed in Table 5-9.

12.1.7 Control Tube Assemblies. (Refer to Table 12-24 through Table 12-29.) The control tube assembly consists of a metal tube and two rod ends. One rod end is attached to each end of the metal tube. The metal tube may be swaged, expanded, or reamed at the ends to engage the rod ends. The rod ends are welded or riveted to the tube.

12.1.8 Types of Rod Ends. (Refer to Table 12-30 through Table 12-42.) There are several different types of rod ends. Rod ends are available with threaded, clevis, and bearing ends. Rod ends that have internally threaded shanks are used on threaded control rods or control tube assemblies which have threaded rod ends. Other rod ends are used to make up control tube assemblies.

NOTE

Thread engagement criteria. Inspect all internally threaded rod ends equipped with inspection holes to insure proper thread engagement. Proper thread engagement is insured when the threads of the externally threaded rod protrude past the inspection hole. If the installation is difficult to check visually, a piece of wire shall be inserted in the inspection hole to determine if the rod end has sufficient thread engagement to block the hole.

12.1.9 Types of Control Tubes. (Refer to Table 12-43 and Table 12-44.)

12.1.10 Torque Rod Assemblies. (Refer to Table 12-45 and Table 12-46.) The manual operation or adjustment of various accessories or flight controls requires a rotating motion which is often accomplished by means of torque tubes. To effect changes in direction of the torque tube, universal joints are required. The most commonly used universal joints are the MS20270 and MS20271, which are attached to the tube by bolts or rivets.

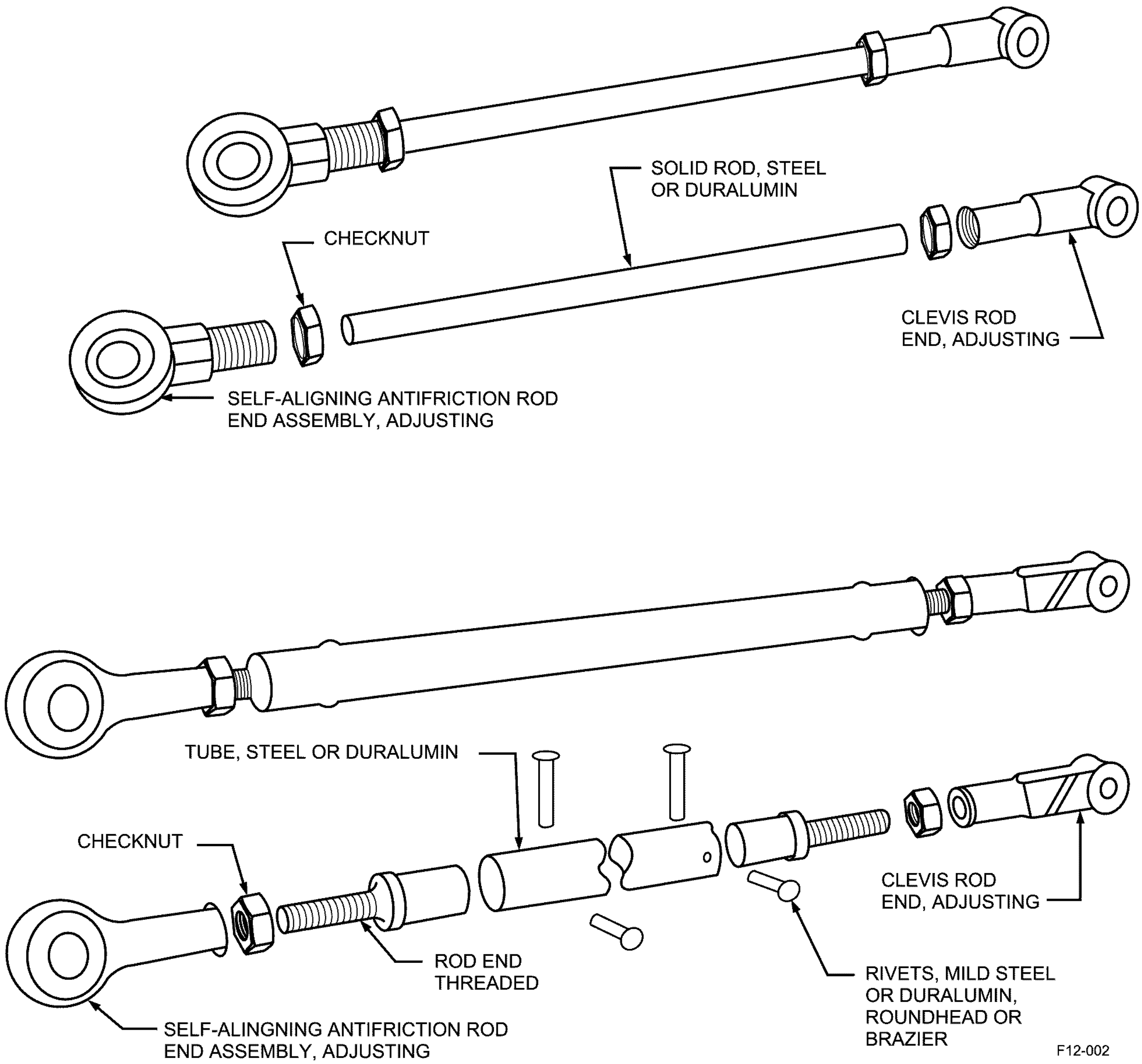
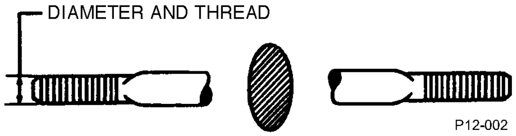


Figure 12-2. Typical Control Rod Assembly

Table 12-1. AN671 through AN686, Tie Rods



AN Number	671	673	674	675	676	677	678	679	680	682	684	686
Diameter and Thread (NF-3)	6-40	10-32	1/4-28	5/16-24	3/8-24	7/16-20	1/2-20	9/16-18	5/8-18	3/4-16	7/8-14	1-14
Tensile Strength (Pounds)	1200	2400	4200	6900	10,000	13,700	18,500	24,000	29,500	42,000	58,000	76,000
A	1-1/4	1-1/2	1-7/8	2-1/8	2-1/4	2-1/2	2-7/8	3-1/4	3-1/2	4-3/8	5	6

Code:

Dash number is rod length in inches and hundredths of an inch.

C before dash number indicates corrosion-resistant steel rod.

Example of part number:

AN671-3050 = 6-40 rod, 30.50 inches long, carbon steel.

AN671C3050 = 6-40 rod, 30.50 inches long, corrosion-resistant steel.

Material:

Carbon steel, corrosion-resistant steel, Military Specification MIL-T-5684.

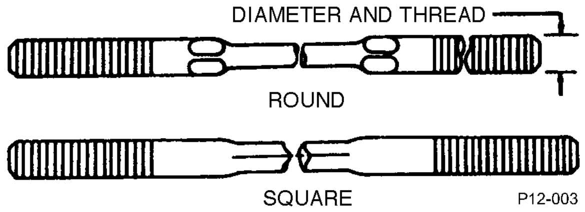
Finish:

Cadmium plating, Federal Specification QQ-P-416.

Zinc plating, Federal Specification QQ-Z-325.

A plus rod length is assembly length.

Table 12-2. AN701 through AN708, Tie Rods



AN Number	701	703	704	705	706	707	708
Diameter And Thread (NF-3)	6-40	10-32	1/4-28	5/16-24	3/8-24	7/16-20	1/2-20
Tensile Strength (Pounds)	1000	2100	3400	6100	8000	11,500	15,500
A	1-1/4	1-1/2	1-7/8	2-1/8	2-1/2	2-1/2	2-7/8

Code:

Dash number is rod length in inches and hundredths of an inch.

C before dash number indicates corrosion-resistant steel rod.

Example of part number:

An701-3050 = 6-40 rod, 30.30 inches long, carbon steel.

An701c3050 = 6-40 rod, 30.50 inches long, corrosion-resistant steel.

Material:

Carbon steel, corrosion-resistant steel, Federal Specification QQ-M-151.

Finish:

Cadmium plating, Federal Specification QQ-P-416.

Zinc plating, Federal Specification QQ-Z-325.

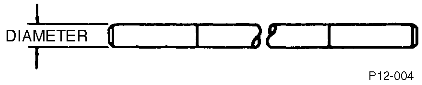
A plus rod length is assembly length.

12.1.11 Repair of Control Tubes. Control tubes can be repaired by methods similar to those used on structural members. When repairing a control tube, a perfect straightness must be obtained to develop the full strength of the tube. Sleeve reinforcements may be added to steel tubes with a scarfed or fishmouth cut and then welded in place. Duralumin tubes can be repaired in the same manner using rivets for attachments. If at all possible, the tube should be replaced and the terminals salvaged. AN490 threaded rod ends should be replaced because of the difficulty in picking up the original rivet holes.

NOTE

Tube repair should not be attempted if damage occurs in the center one-third of the assembly.

Table 12-3. NAS354 Control Rod



First Dash Number	Diameter	Thread NF-3
-4	1/4	1/4-28
-5	5/16	5/16-24

Code:

Second dash number is rod length in inches and hundredths of an inch.

Example of part number:

NAS354-4-5.90 = control rod, 5.90 inches long.

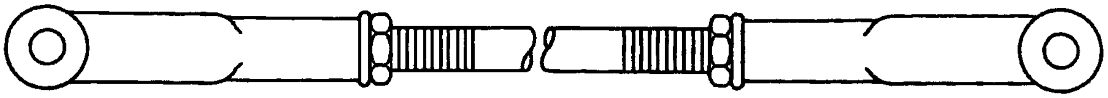
Material:

Steel, Military Specification MIL-S-18732.

Finish:

Cadmium plating, Federal Specification QQ-P-416.

Table 12-4. NAS91 Control Rod Assembly (1/4 Adjustable Clevis Ends)



First Dash Number	Control Rod Number	Left Rod End	Right Rod End	Checknuts
-1	NAS354-4	AN486-1	AN486-1	AN316-4R (2 Required)
-2		AN486-1	AN486-2	
-3		AN486-1	AN486-3	
-4		AN486-1	AN486-4	
-5		AN486-2	AN486-2	
-6		AN486-2	AN486-3	
-7		AN486-2	AN486-4	
-8	NAS354-4	AN486-3	AN486-3	AN316-4R (2 Required)
-9		AN486-3	AN486-4	
-10		AN486-4	AN486-4	

Code:

Second dash number is rod length in inches.

Example of part number:

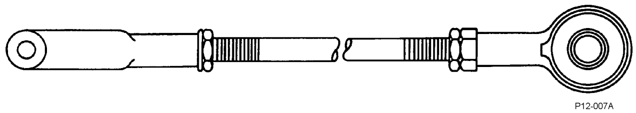
NAS91-1-5.875 = control rod assembly, 5.875 inches long.

Tensile Strength:

Table 12-4. NAS91 Control Rod Assembly (1/4 Adjustable Clevis Ends) - Continued

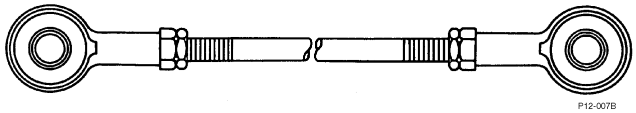
First Dash Number	Control Rod Number	Left Rod End	Right Rod End	Checknuts
Ultimate 1700 pounds.				

Table 12-5. NAS92 Control Rod Assembly (1/4 Adjustable Clevis and Bearing Ends)



First Dash Number	Control Rod Number	Left Rod End	Right Rod End	Checknuts
-1	NAS354-4	AN951-RE3F4	AN486-1	AN316-4R (2 Required)
-2			AN486-2	
-3			AN486-3	
-4			AN486-4	
Code: Second dash number is rod length in inches. Example of part number: NAS92-1-5.875 = control rod assembly, 5.875 inches long. Tensile strength: Ultimate 1700 pounds.				

Table 12-6. NAS93 Control Rod Assembly (1/4 Adjustable Bearing Ends)



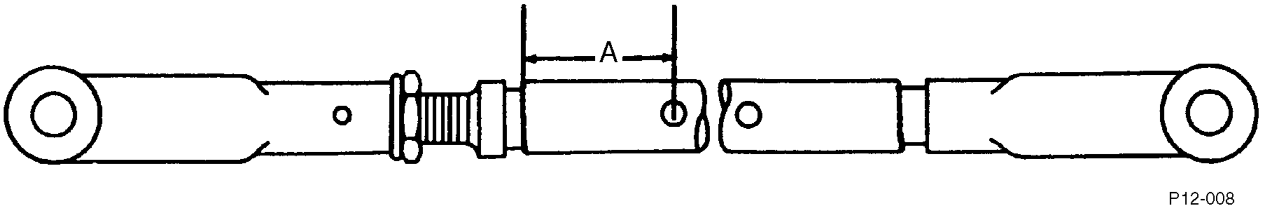
Rod Assembly Number	Control Rod Number	Left Rod End	Right Rod End	Checknuts
NAS93	NAS354-4	AN951-RE3F4	AN951-RE3F4	AN316-4R (2 Required)
Code: Second dash number is rod length in inches.				

Table 12-6. NAS93 Control Rod Assembly (1/4 Adjustable Bearing Ends) - Continued

Rod Assembly Number	Control Rod Number	Left Rod End	Right Rod End	Checknuts

Example of part number:
NAS93-5.875 = control rod assembly, 5.875 inches long.
Tensile strength:
Ultimate 1700 pounds.

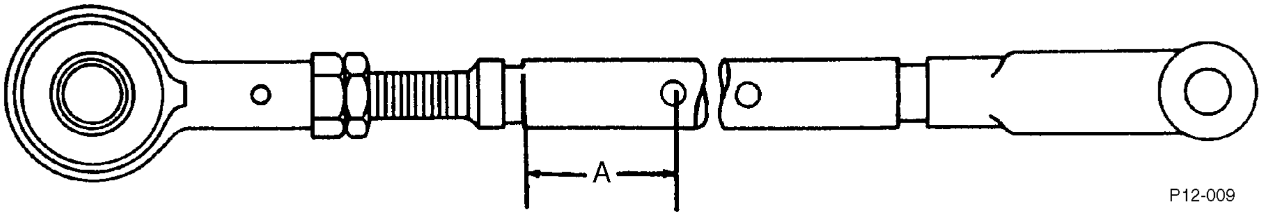
Table 12-7. NAS95 Control Rod Assembly (Welded Tube, 3/8-inch Outside Diameter, Fixed and Adjustable Clevis Ends)



First Dash Number	Left Rod End	Checknut	Tube Assembly Number
-1	AN486-1		NAS359-61
-2	AN486-1		NAS359-62
-3	AN486-1		NAS359-63
-4	AN486-1		NAS359-64
-5	AN486-2		NAS359-61
-6	AN486-2		NAS359-62
-7	AN486-2	AN316-4R	NAS359-63
-8	AN486-2		NAS359-64
-9	AN486-3		NAS359-61
-10	AN486-3		NAS359-62
-11	AN486-3	AN316-4R	NAS359-63
-12	AN486-3		NAS359-64
-13	AN486-4		NAS359-61
-14	AN486-4		NAS359-62
-15	AN486-4		NAS359-63
-16	AN486-4		NAS359-64

Code:
Second dash number is rod assembly length in inches.
Third dash number is length of A in inches.
No third dash number indicates A length of one inch.
Example of part number:
NAS95-1-8.75 = control rod assembly, 8.75 inches long, A equal to 1 inch.
NAS95-1-8.75-3 = control rod assembly, 8.75 inches long, A equal to 3 inches.
Tensile strength:
Ultimate 1700 pounds.

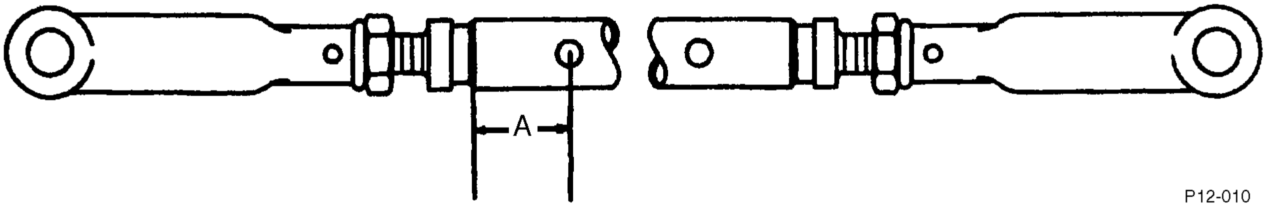
Table 12-8. NAS96 Control Rod Assembly (Welded Tube, 3/8-inch Outside Diameter, Fixed Clevis and Adjustable Bearing Ends)



First Dash Number	Left Rod End	Tube Assembly Number	Checknut
-1	AN951-RE3F4	NAS359-1	AN316-4R
-2			
-3			
-4			

Code:
Second dash number is rod assembly length in inches.
Third dash number is length of A in inches.
No third dash number indicates A length of one inch.
Example of part number:
NAS104-8.75 = control rod assembly, 8.75 inches long, A equal to 1 inch.
NAS104-9.25-3 = control rod assembly, 9.25 inches long, A equal to 3 inches.
Tensile strength:
Ultimate 1700 pounds.

Table 12-9. NAS98 Control Rod Assembly (Welded Tube, 3/8-inch Outside Diameter, 1/4 Adjustable Clevis Ends)



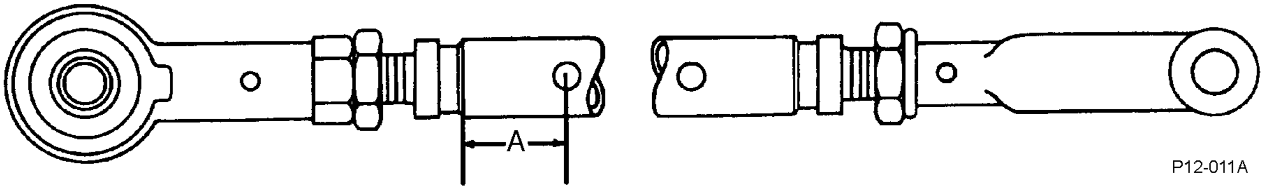
First Dash Number	Left Rod End	Right Rod End	Tube Assembly Number	Checknuts
-1	AN486-1	AN486-1	NAS358	AN316-4R (2 Required)
-2	AN486-1	AN486-2		
-3	AN486-1	AN486-3		
-4	AN486-1	AN486-4		
-5	AN486-2	AN486-2		
-6	AN486-2	AN486-3		
-7	AN486-2	AN486-4		

Table 12-9. NAS98 Control Rod Assembly (Welded Tube, 3/8-inch Outside Diameter, 1/4 Adjustable Clevis Ends) - Continued

First Dash Number	Left Rod End	Right Rod End	Tube Assembly Number	Checknuts
-8	AN486-3	AN486-3		
-9	AN486-3	AN486-4		
-10	AN486-4	AN486-4		

Code:
Second dash number is rod assembly length in inches.
Third dash number is length of A in inches.
No third dash number indicates A length of one inch.
Example of part number:
NAS98-1-8.75 = control rod assembly, 8.75 inches long, A equal to 1 inch.
NAS98-1-9.25-3 = control rod assembly, 9.25 inches long, A equal to 3 inches.
Tensile strength:
Ultimate 1700 pounds.

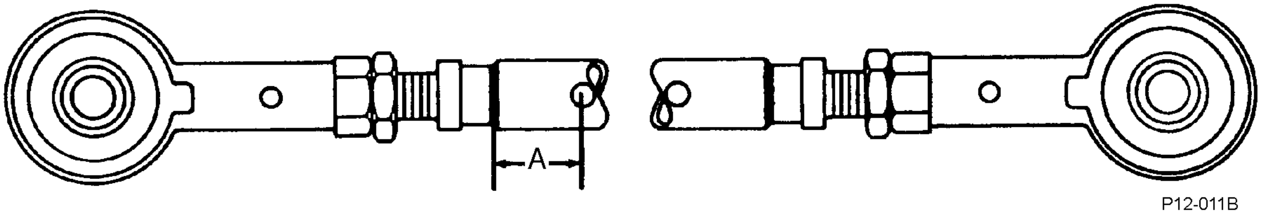
Table 12-10. NAS99 Control Rod Assembly (Welded Tube, 3/8-inch Outside Diameter, 1/4 Adjustable Clevis and Bearing Ends)



First Dash Number	Left Rod End	Right Rod End	Tube Assembly Number	Checknuts
-1	AN951-RE3F4	AN486-1	NAS358	AN316-4R (2 Required)
-2		AN486-2		
-3		AN486-3		
-4		AN486-4		

Code:
Second dash number is cod assembly length in inches.
Third dash number is length of A in inches.
No third dash number indicates A length of one inch.
Example of part number:
NAS99-1-8.75 = control rod assembly, 8.75 inches long, A equal to 1 inch.
NAS99-1-9. 25-3 = control rod assembly, 9.25 inches long, A equal to 3 inches.
Tensile strength:
Ultimate 1700 pounds.

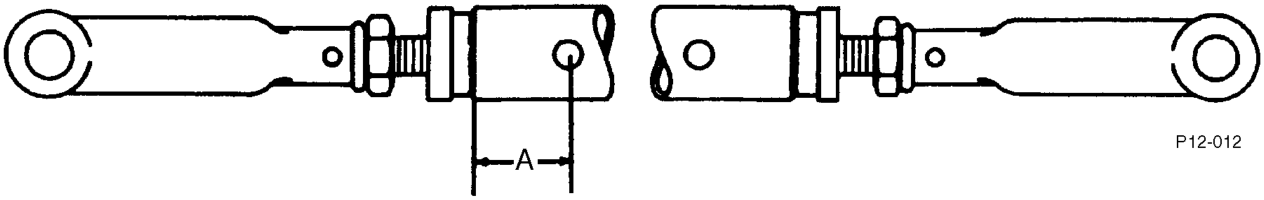
Table 12-11. NAS100 Control Rod Assembly (Welded Tube, 3/8-inch Outside Diameter, 1/4 Adjustable Bearing Ends)



Rod Assembly Number	Left Rod End	Right Rod End	Tube Assembly Number	Checknuts
NAS100	AN951-RE3F4	AN951-RE3F4	NAS358	AN316-4R (2 Required)

Code:
Second dash number is rod length in inches.
Third dash number is length of A in inches.
No dash number indicates A length of one inch.
Example of part number:
NAS100-8.75 = control rod assembly, 8.75 inches long, A equal to 1 inch.
NAS100-9.25-3 = control rod assembly, 9.25 inches long, A equal to 3 inches.
Tensile strength:
Ultimate 1700 pounds.

Table 12-12. NAS103 Control Rod Assembly (Welded Tube, 1/2-inch Outside Diameter, 1/4 Adjustable Clevis Ends)



First Dash Number	Left Rod End	Right Rod End	Tube Assembly Number	Checknuts
-1	AN486-1	AN486-1		
-2	AN486-1	AN486-2		
-3	AN486-1	AN486-3		
-4	AN486-1	AN486-4		
-5	AN486-2	AN486-2	NAS358	AN3164R (2 Required)
-6	AN486-2	AN486-3		
-7	AN486-2	AN486-4		
-8	AN486-3	AN486-3		
-9	AN486-3	AN486-4	NAS358	AN3164R (2 Required)
-10	AN486-4	AN486-4		

Table 12-12. NAS103 Control Rod Assembly (Welded Tube, 1/2-inch Outside Diameter, 1/4 Adjustable Clevis Ends) - Continued

First Dash Number	Left Rod End	Right Rod End	Tube Assembly Number	Checknuts

Code:

Second dash number is rod length in inches.

Third dash number is length A in inches.

No dash number indicates A length of one inch.

Example of part number:

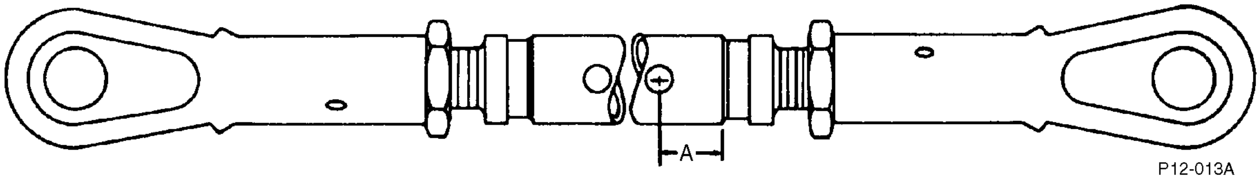
NAS103-1-8.75 = control rod assembly, 8.75 inches long, A equal to 1 inch.

NAS103-1-9.25-3 = control rod assembly, 9.25 inches long, A equal to 3 inches.

Tensile strength:

Ultimate 1700 pounds.

Table 12-13. NAS104 Control Rod Assembly (Welded Tube, 1/2-inch Outside Diameter, 5/16 Adjustable Clevis Ends)



Rod Assembly Number	Left Rod End	Right Rod End	Tube Assembly Number	Checknuts
NAS104	AN665-46R	AN665-46R	NAS358	AN316-5R (2 Required)

Code:

Second dash number is rod length in inches.

Third dash number is length A in inches.

No dash number indicates A length of one inch.

Example of part number:

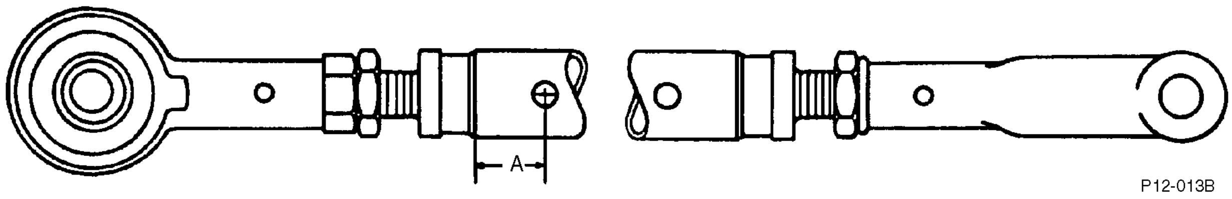
NAS104-8.75 control rod assembly, 8.75 inches long, A equal to 1 inch.

NAS104-9.25-3 - control rod assembly, 9.25 inches long, A equal to 3 inches.

Tensile strength:

Ultimate 2300 pounds.

Table 12-14. NAS105 Control Rod Assembly (Welded Tube, 1/2-inch Outside Diameter, 1/4 Adjustable Clevis and Bearing Ends)



First Dash Number	Left Rod End	Right Rod End	Tube Assembly Number	Checknuts
-1	AN951-RE3F4	AN486-1	NAS358	AN316-4R (2 Required)
-2		AN486-2		
-3		AN486-3		
-4		AN486-4		

Code:

Second dash number is rod length in inches.

Third dash number is length A in inches.

No dash number indicates A length of one inch.

Example of part number:

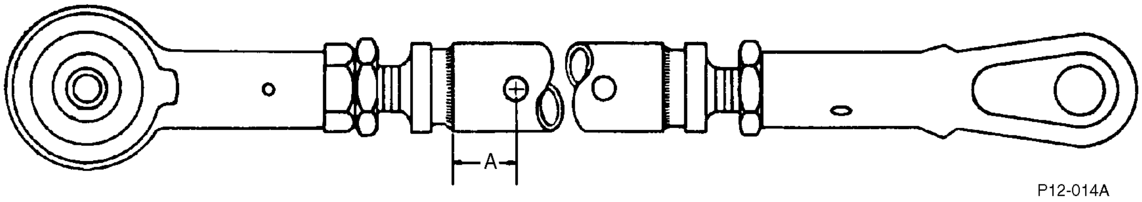
NAS105-1-8.75 = control rod assembly, 8.75 inches long, A equal to 1 inch.

NAS105-1-9.25-3 = control rod assembly, 9.25 inches long, A equal to 3 inches.

Tensile strength:

Ultimate 1700 pounds.

Table 12-15. NAS106 Control Rod Assembly (Welded Tube, 1/2-inch Outside Diameter, 5/16 Adjustable Clevis and Bearing Ends)



Rod Assembly Number	Left Rod End	Right Rod End	Tube Assembly Number	Checknuts
NAS106	AN951-RE4F5	AN665-46R	NAS358	AN316-5R (2 Required)

Code:

Second dash number is rod assembly length in inches.

Third dash number is length of A in inches.

No dash number indicates A length of one inch.

Example of part number:

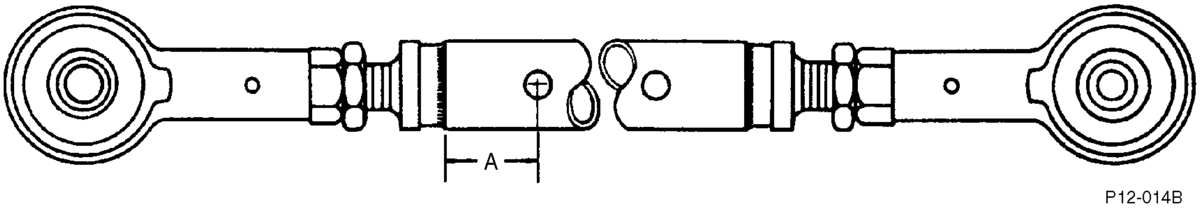
NAS106-8.75 = control rod assembly, 8.75 inches long, A equal to 1 inch.

NAS103-1-9.25-3 = control rod assembly, 9.25 inches long, A equal to 3 inches.

Tensile strength:

Ultimate 23 pounds.

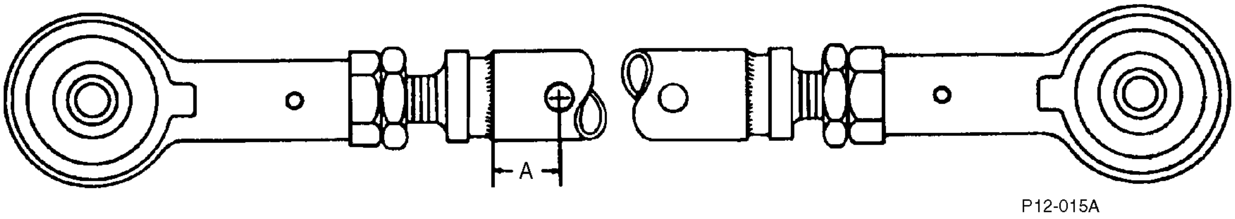
Table 12-16. NAS107 Control Rod Assembly (Welded Tube, 1/2-inch Outside Diameter, 1/4 Adjustable Bearing Ends)



Rod Assembly Number	Left Rod End	Right Rod End	Tube Assembly Number	Checknuts
NAS107	AN951-RE3F4	AN951-RE3F4	NAS358	AN316-4R (2 Required)

Code:
Second dash number is rod assembly length in inches.
Third dash number is length of A in inches.
No dash number indicates A length of one inch.
Example of part number:
NAS107-8.75 = control rod assembly, 8.75 inches long, A equal to 1 inch.
NAS107-9.25-3 = control rod assembly, 9.25 inches long, A equal to 3 inches.
Tensile strength:
Ultimate 1700 pounds.

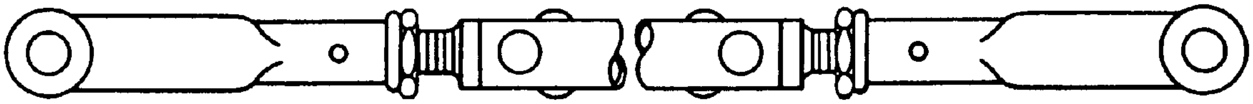
Table 12-17. NAS108 Control Rod Assembly (Welded Tube, 1/2-inch Outside Diameter, 5/16 Adjustable Bearing Ends)



Rod Assembly Number	Left Rod End	Right Rod End	Tube Assembly Number	Checknuts
NAS108	AN951-RE4F5	AN951-RE4F5	NAS358	AN316-5R (2 Required)

Code:
Second dash number is rod assembly length in inches.
Third dash number is length of A in inches.
No dash number indicates A length of one inch.
Example of part number:
NAS108-8.75 = control rod assembly, 8.75 inches long, A equal to 1 inch.
NAS108-9.25-3 = control rod assembly, 9.25 inches long, A equal to 3 inches.
Tensile strength:
Ultimate 2300 pounds.

Table 12-18. NAS111 Control Rod Assembly (Riveted Tube, 3/8-inch Outside Diameter, 1/4 Adjustable Clevis Ends)


P12-015B

First Dash Number	Left Rod End	Right Rod End	Tube Assembly Number	Checknuts
-1	AN486-1	AN486-1	NAS355	AN316-4R (2 Required)
-2	AN486-1	AN486-2		
-3	AN486-1	AN486-3		
-4	AN486-1	AN486-4		
-5	AN486-2	AN486-2		
-6	AN486-2	AN486-3		
-7	AN486-2	AN486-4		
-8	AN486-3	AN486-3		
-9	AN486-3	AN486-4		
-10	AN486-4	AN486-4		

Code:

Second dash number is rod assembly length in inches.

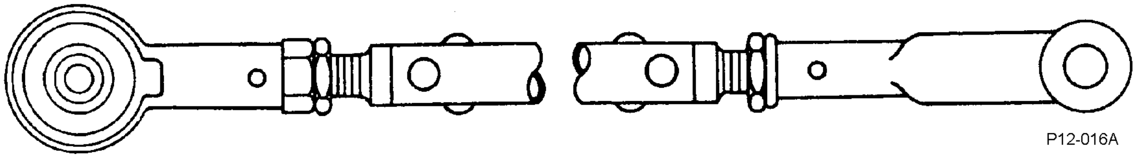
Example of part number:

NAS116-1-8.75 = control rod assembly, 8.75 inches long.

Tensile strength:

Ultimate 1300 pounds.

Table 12-19. NAS112 Control Rod Assembly (Riveted Tube 3/8-inch Outside Diameter, 1/4 Adjustable Clevis and Bearing Ends)


P12-016A

Dash Number	Left Rod End	Right Rod End	Tube Assembly Number	Checknuts
-1		AN486-1	NAS355	AN316-4R (2 Required)
-2	AN951-RE3F4	AN486-2		
-3		AN486-3		
-4		AN486-4		

Code:

Second dash number is rod assembly length in inches.

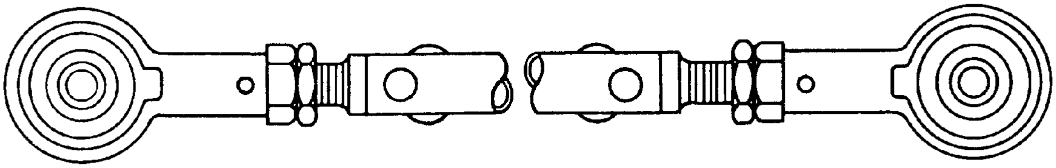
Example of part number:

NAS112-1-8.75 = control rod assembly, 8.75 inches long.

Tensile strength:

Ultimate 1300 pounds.

Table 12-20. NAS113 Control Rod Assembly (Riveted Tube, 3/8-inch Outside Diameter, 1/4 Adjustable Bearing Ends)


P12-016B

Rod Assembly Number	Left Rod End	Right Rod End	Tube Assembly Number	Checknuts
NAS113	AN951-RE3F4	AN951-RE3F4	NAS355	AN316-4R (2 Required)

Code:

Second dash number is rod assembly length in inches.

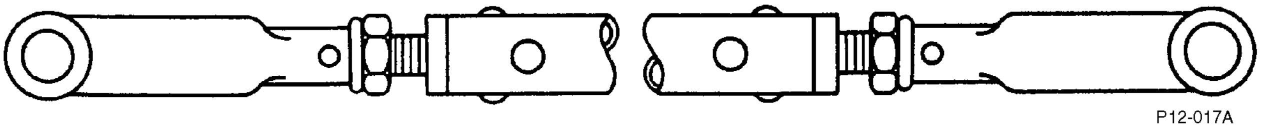
Example of part number:

NAS113-8.75 = control rod assembly, 8.75 inches long.

Tensile strength:

Ultimate 1300 pounds.

Table 12-21. NAS116 Control Rod Assembly (Riveted Tube, 1/2-inch Outside Diameter, 1/4 Adjustable Clevis Ends)



Dash Number	Left Rod End	Right Rod End	Tube Assembly Number	Checknuts
-1	AN486-1	AN486-1	NAS355	AN316-4R (2 Required)
-2	AN486-1	AN486-2		
-3	AN486-1	AN486-3		
-4	AN486-1	AN486-4		
-5	AN486-2	AN486-2		
-6	AN486-2	AN486-3		
-7	AN486-2	AN486-4		
-8	AN486-3	AN486-3		
-9	AN486-3	AN486-4		
-10	AN486-4	AN486-4		

Code:

Second dash number is rod assembly length in inches.

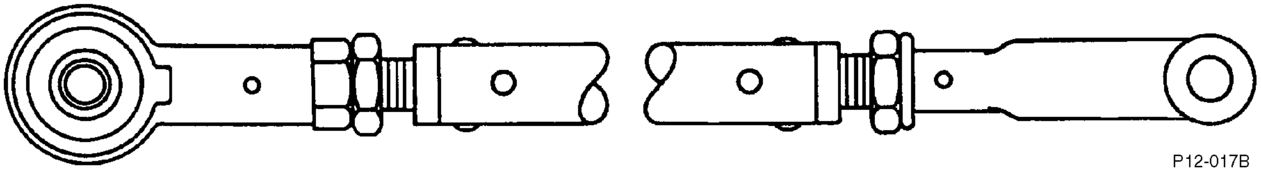
Example of part number:

NAS116-1-8.75 = control rod assembly, 8.75 inches long.

Tensile strength:

Ultimate 1300 pounds.

Table 12-22. NAS117 Control Rod Assembly (Riveted Tube, 1/2-inch Outside Diameter, 1/4 Adjustable Clevis and Bearing Ends)



Dash Number	Left Rod End	Right Rod End	Tube Assembly Number	Checknuts
-1	AN951-RE3F4	AN486-1	NAS355	AN316-4R (2 Required)
-2		AN486-2		
-3		AN486-3		
-4		AN486-4		

Code:

Second dash number is rod assembly in inches.

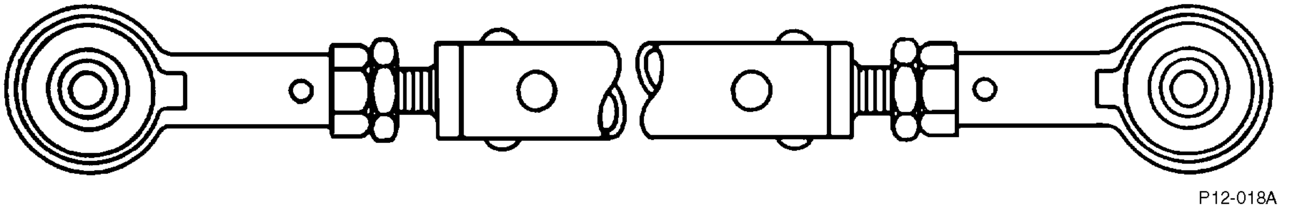
Example of part number:

NAS117-1-8.75 = control rod assembly, 8.75 inches long.

Table 12-22. NAS117 Control Rod Assembly (Riveted Tube, 1/2-inch Outside Diameter, 1/4 Adjustable Clevis and Bearing Ends) - Continued

Dash Number	Left Rod End	Right Rod End	Tube Assembly Number	Checknuts
Tensile strength: Ultimate 1300 pounds.				

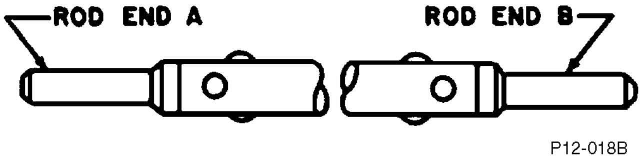
Table 12-23. NAS118 Control Rod Assembly (Riveted Tube, 1/2-inch Outside Diameter, 1/4 Adjustable Bearing Ends)



P12-018A

Rod Assembly Number	Left Rod End	Right Rod End	Tube Assembly Number	Checknuts
NAS118	AN951-RE3F4	AN951-RE3F4	NAS355	AN316-4R (2 Required)
Code: First dash number is rod assembly length in inches. Example of part number: NAS118-8.75 = control rod assembly, 8.75 inches long. Tensile strength: Ultimate 1300 pounds.				

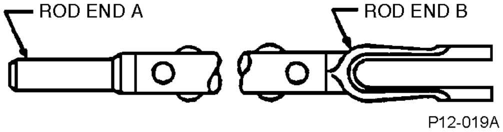
Table 12-24. NAS355 Control Tube Assembly (With Riveted Threaded Rod Ends)



P12-018B

First Dash Number	Tube Number	Rod Ends		Rivets
		A	B	
-60	NAS357-60	AN490HT6P	AN490HT6P	AN470AD4-10
-80	NAS357-80	AN490HT8P	AN490HT8P	AN470AD4-12
Code: Second dash number is tube assembly length in inches and hundredths of an inch. Example of part number: NAS355-6-880 = control tube assembly, 8.80 inches long.				

Table 12-25. NAS356 Control Tube Assembly (With Riveted Clevis and Threaded Rod Ends)



First Dash Number	Tube Number	Rod Ends		Rivets
		A	B	
61	NAS357-60	AN490HT6P	AN481-1P	AN470AD4-10
62			AN481-2P	
-63			AN481-3P	
64			AN481-4P	
-81	NAS357-80	AN490HT8P	AN481-9P	AN470AD4-12
-82			AN481-10P	
-83			AN481-11P	
-84			AN481-12P	

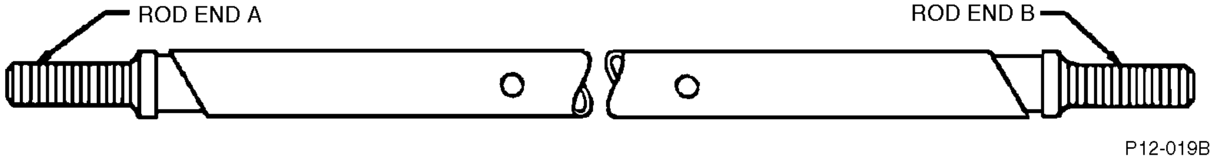
Code:

Second dash number is tube assembly length in inches and hundredths of an inch.

Example of part number:

NAS356-61-880 = control tube assembly, 8.80 inches long.

Table 12-26. NAS358 Control Tube Assembly (With Welded Threaded Rod Ends)



First Dash Number	Tube Number	Rod Ends	
		A	B
-60	NAS360-60	AN490HT6	AN490HT6
-80	NAS360-80	AN490HT8	AN490HT8
-82	NAS360-82	AN490HT9	AN490HT9

Code:

Second dash number is tube assembly length in inches and hundredths of an inch.

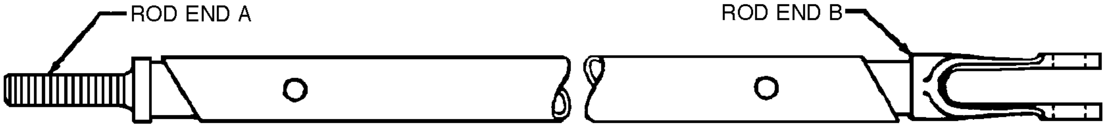
Example of part number:

NAS358-60-880 = control tube assembly, 8.80 inches long.

Finish:

Cadmium plating, Federal Specification QQ-P-416; apply one coat of epoxy primer, Military Specification MIL-P-23377.

Table 12-27. NAS359 Control Tube Assembly (With Welded Clevis and Threaded Rod Ends)



P12-020

First Dash Number	Tube Number	Rod Ends	
		A	B
-61	NAS360-60	AN489HT6	AN481-1
-62			AN481-2
-63			AN481-3
-64			AN481-4
-81	NAS360-80	AN490HT6	AN481-9
-82			AN481-10
-83			AN481-11
-84			AN481-12

Code:

Second dash number is tube assembly length in inches and hundredths of an inch.

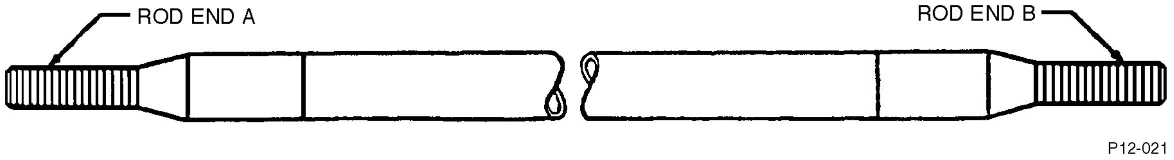
Example of part number:

NAS359-61-880 = control tube assembly, 8.80 inches long.

Finish:

Cadmium plating, Federal Specification QQ-P-416; apply one coat of epoxy primer, Military Specification MIL-P-23377.

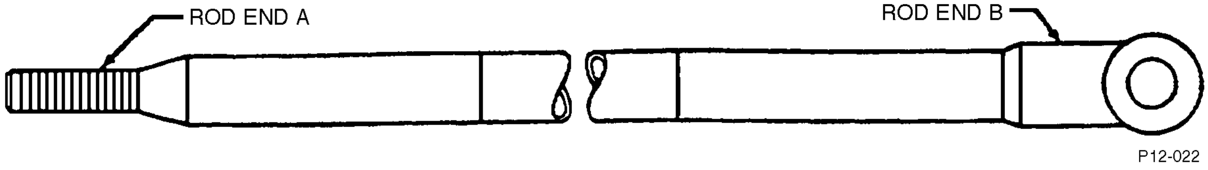
Table 12-28. NAS361 Control Tube Assembly (With Flash-Welded Clevis and Threaded Rod Ends)



First Dash Number	Tube Size	Rod Ends	
		A	B
-62	3/8-.035	NAS5-12	NAS5-12
-62L		NAS5-12	NAS5-12L
-63		NAS5-13	NAS5-13
-63L		NAS5-13	NAS5-13L
-84	1/2-.035	NAS5-14	NAS5-14
-84L		NAS5-14	NAS5-14L
-85		NAS5-15	NAS5-15
-85L		NAS5-15	NAS5-15L
-96	9/16-.035	NAS5-16	NAS5-16
-96L		NAS5-16	NAS5-16L
-97		NAS5-17	NAS5-17
-97L		NAS5-17	NAS5-17L

Code:
L after first dash number indicates left-hand threads at rod end B.
Second dash number is tube assembly length in inches and hundredths of an inch.
Example of part number:
NAS361-62-880 = control tube assembly, 8.80 inches long.
Material:
Steel tubing, Military Specifications MIL-T-6731 and MIL-T-6736.
Finish:
Cadmium plate, Federal Specification QQ-P-416; apply one coat of epoxy primer, Military Specification MIL-P-23377.

Table 12-29. NAS362 Control Tube Assembly (With Flash-Welded Clevis and Threaded Rod Ends)



First Dash Number	Tube Number	Rod Ends	
		A	B
-61		NAS5-12	NAS171-1L
-62			NAS171-2L
-63			NAS171-3L

Table 12-29. NAS362 Control Tube Assembly (With Flash-Welded Clevis and Threaded Rod Ends) - Continued

First Dash Number	Tube Number	Rod Ends	
		A	B
-64			NAS171-4L
-61L	NAS360-60	NAS5-12L	NAS171-1L
-62L			NAS171-2L
-63L			NAS171-3L
-64L			NAS171-4L
-65		NAS5-13	NAS171-1L
-66			NAS171-2L
-67			KAS171-3L
-68			NAS171-4L
-65L		NAS5-13L	NAS171-1L
-66L			NAS171-2L
-67L			NAS171-3L
-68L			NAS171-4L
-81	NAS360-80	NAS5-14	NAS171-5L
-82			NAS171-6L
-83			NAS171-7L
-84			NAS171-8L
-81L	NAS360-80	NAS5-14L	NAS171-5L
-82L			NAS171-6L
-83L			NAS161-7L
-84L			NASI71-8L
-85		NAS5-15	NAS171-5L
-86			NAS171-6L
-87			NAS171-7L
-88			NAS171-8L
-85L		NAS5-15L	NAS171-5L
-86L			NAS171-6L
-87L			NAS171-7L
-88L			NAS171-8L

Code:

L after first dash number indicates left-hand threads.

Second dash number is tube assembly length in inches and hundredths of an inch.

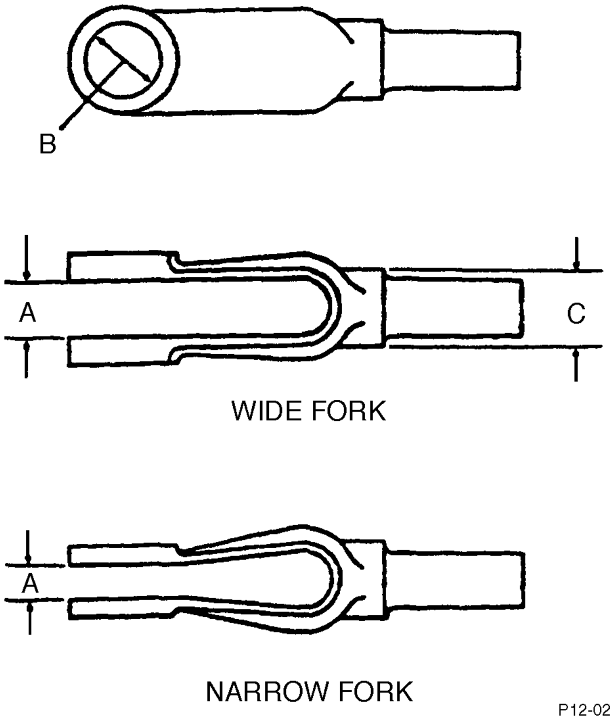
Example of part number:

NAS362-61-880 = control tube assembly, 8.80 inches long.

Finish:

Cadmium plating, Federal Specification QQ-P-416; apply one coat of epoxy primer, Military Specification MIL-P-23377.

Table 12-30. AN481 Rod End Clevis



Dash Number	A	B	C	Type of Fork
-1	.266	1/4	.375	Wide
-2	.141			Narrow
-3	.266	3/16		Wide
-4	.141			Narrow
-5	.266	1/4	.375	Wide
-6	.141			Narrow
-7	.266	3/16		Wide
-8	.141			Narrow
-9	.266	1/4	.500	Wide
-10	.141			Narrow
-11	.266	3/16		Wide
-12	.141			Narrow

Code:

P after dash number indicates plated rod end clevis.

Example of part number:

AN481-6 = rod end clevis, unplated.

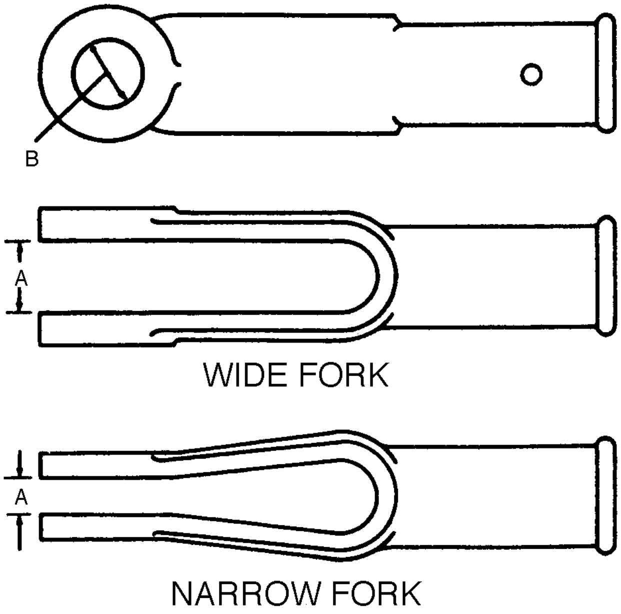
Material:

Steel, Military Specification MIL-S-8617.

Finish:

Cadmium plating, Federal Specification QQ-P-416.

Table 12-31. AN486 Rod End Adjusting Clevis



P12-025

Dash Number	A	B	Type of Fork
-1	.266	1/4	Wide
-2	.141		Narrow
-3	.266	3/16	Wide
-4	.141		Narrow

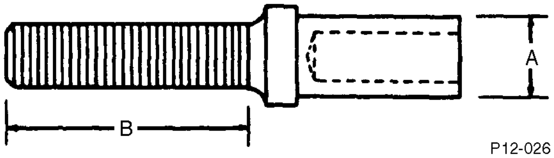
Material:

Steel, Military Specification MIL-S-8617.

Finish:

Cadmium plating, Federal Specification QQ-P-416.

Table 12-32. AN490 Threaded Rod End



P12-026

Dash Number	A Diameter +.000 -.002	B	Tube Size	Thread UNF-3A
-HT5	.242	.937	5/16 x.035	1/4-28
-HT6	.305	.937	3/8 x.035	1/4-28
-HT8	.430	.937	1/2 x.035	1/4-28
-HT10	.555	1.000	5/8 x.035	5/16-24
-HT11	.680	1.000	3/4 x.035	5/16-24
-HT13	.555	1.000	5/8 x.035	3/8-24

Table 12-32. AN490 Threaded Rod End - Continued

Dash Number	A Diameter +.000 -.002	B	Tube Size	Thread UNF-3A
-HT14	.680	1.000	3/4 x.035	3/8-24
-HT15	.372	1.000	1/2 x.058	5/16-24
-HT16	.372	1.000	1/2 x.058	3/8-24

Code:

P after dash Dumber indicates plated rod end.

Example of part number:

AN490HT5 = rod end, threaded, unplated steel.

AN490HT5P = rod end, threaded, cadmium plated.

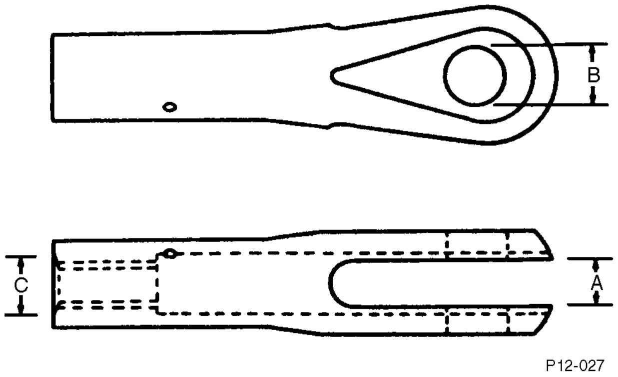
Material:

Steel, Military Specification MIL-S-6758.

Finish:

Cadmium plating, Federal Specification QQ-P-416.

Table 12-33. AN665 Tie Rod End Terminal



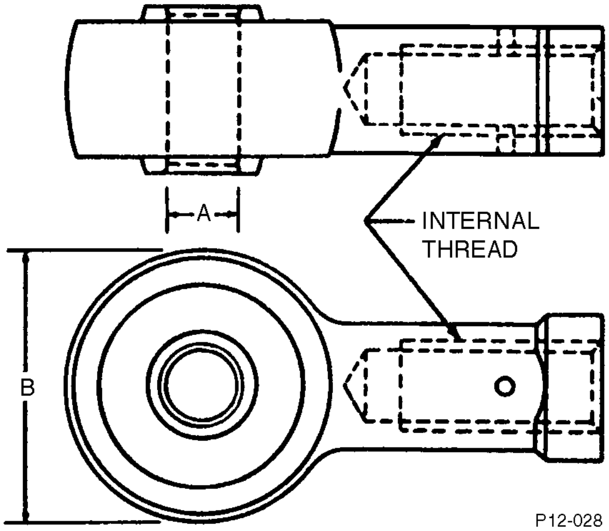
Dash Number	A	B	Thread NF-3
-10L -10R	.109	.190	6-40
-21L -21R	.150	.190	10-32
-34L -34R	.203	1/4	1/4-28
-46L -46R	.203	5/16	5/16-24
-61L -61R	.203	3/8	5/16-24

Table 12-33. AN665 Tie Rod End Terminal - Continued

Dash Number	A	B	Thread NF-3
-80L -80R	.266	3/8	3/8-24
-80LA -80RA	.266	3/8	3/8-24
-115L -115R	.344	7/16	7/16-20
-155L -155R	.406	1/2	1/2-20
-202L -202R	.453	9/16	9/16-18
-247L -247R	.516	5/8	5/8-18
-430L -430R	.656	3/4	3/4-16
-580L -580R	.781	7/8	7/8-14
-760L -760R	.906	1	1-14

Code:
L after dash number indicates left-hand threads.
R after dash number indicates right-hand threads.
Example of part number:
AN665-10L = rod end terminal, left-hand threads.
AN665-10R = rod end terminal, right-hand threads.
Material:
Steel, Military Specification MIL-S-6050, MIL-S-6758, MIL-S-18732, or MIL-S-8503.
Finish:
Cadmium plating, Federal Specification QQ-P-416.
Zinc plating, Federal Specification QQ-Z-325.

Table 12-34. AN943 Plain, Self-Aligning, Internal Thread, Rod End Bearing



Dash Number	A	B	Bore Size	Thread NF-3	Engineering Data Radial Test Load Pounds	Engineering Data Axial Test Load Pounds
-3	.1895	.781	No. 10	1/4-28	1300	920
-4	.2495	.938	1/4	5/16-24	2200	1520
-5	.3120	1.250	5/16	5/16-24	4200	2960
-6	.3745	1.500	3/8	3/8-24	6400	4430
-8	.4995	1.750	1/2	1/2-20	9000	6320
-10	.6245	2.000	5/8	5/8-18	11,400	8000

Code:

Dash number is bore size in 1/16 inch.

Example of part number:

AN947-4 = plain, self-aligning, external thread, rod end bearing with 1/4 bore size.

Material:

Steel, Military Specification MIL-S-6758.

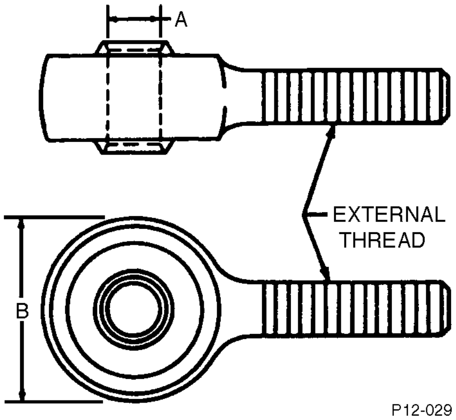
Corrosion-resistant steel, Military Specification MIL-S-7720.

Finish:

Cadmium plating, Federal Specification QQ-P-416.

Zinc plating, Federal Specification QQ-Z-325.

Table 12-35. AN946 Antifriction, Self-Aligning, External Thread, Rod End Ball Bearing



Dash Number	A	B	Bore Size	Thread NS-3	Engineering Data	
					Radial Test Load Pounds	Axial Test Load Pounds
-RE3ML3	.1900	.781	No. 10	10-32LH	1000	200
-RE3MR3				10-32RH		
-RE3M6A		.969		3/8-24RH	1200	240
-RE3M6-2N		.781			1000	200
-RE3ML6-2N				3/8-24LH		
-RA3M4-2				1/4-28RH		
-RE4M6	.2500	.938	1/4	3/8-24RH	1720	345
-RE4ML6				3/8-24LH		
-RE5M6	.3125	1.250	5/16	3/8-24RH	2920	585
-RE5M7				7/16-20RH		
-RE5M10				5/8-18RH		
-RA10M10	.6250	2.000	5/8	5/8-18RH	7090	1420

Example of part number:

AN946-RE3ML3 = antifriction, self-aligning, rod end ball bearing, external left-hand thread, metal shield, size 3 bearing.

Material:

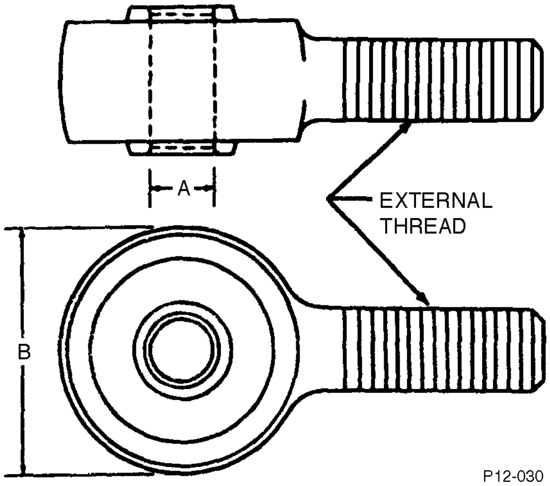
Steel, Military Specification MIL-B-6039.

Finish:

Cadmium plating, Federal Specification QQ-P-416.

Zinc plating, Federal Specification QQ-Z-325.

Table 12-36. AN947 Plain, Self-Aligning, External Thread, Rod End Bearing



Dash Number	A	B	Bore Size	Thread NF-3	Engineering Data	
					Radial Test Load Pounds	Axial Test Load Pounds
-3	.1895	.781	No. 10	1/4-28	1300	920
-4	.2495	.938	1/4	5/16-24	2200	1520
-5	.3120	1.250	5/16	5/16-24	4200	2960
-6	.3745	1.500	3/8	3/8-24	6400	4430
-8	.4995	1.750	1/2	1/2-20	9000	6320
-10	.6245	2.000	5/8	5/8-18	11,400	8000

Code:

Dash number is bore size in 1/16 inch.

Example of part number:

AN947-4 = plain, self-aligning, external thread, rod end bearing with 1/4 bore size.

Material:

Steel, Military Specification MIL-S-6758.

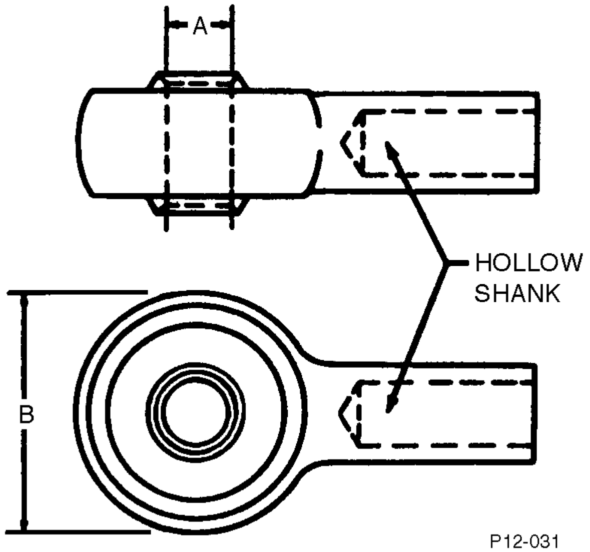
Corrosion-resistant steel, Military Specification MIL-S-7720.

Finish:

Cadmium plating, Federal Specification QQ-P-416.

Zinc plating, Federal Specification QQ-Z-325.

Table 12-37. AN948 Antifriction, Self-Aligning, Hollow Shank, Rod End Ball Bearing



Dash Number	A	B	Bore Size	Engineering Data	
				Radial Test Load Pounds	Axial Test Load Pounds
-RE3H5	.1900	.781	No. 10	1000	200
-RE4H6	.2500	.938	1/4	1720	345
-RE4H8			1/4		

Example of part number:

AN948-RE3H5 = antifriction, self-aligning, hollow shank, rod end ball bearing, size 3 bearing.

Material:

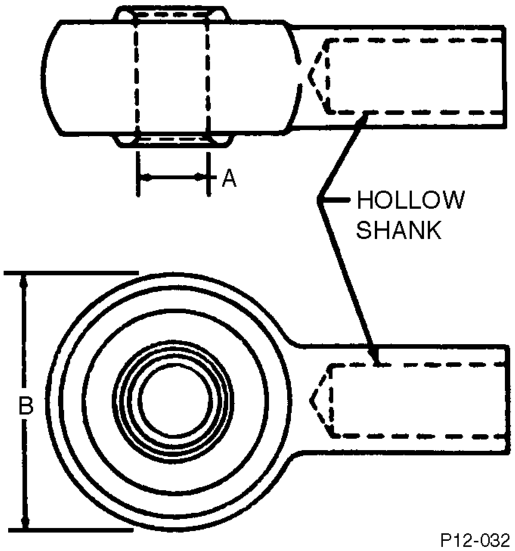
Steel, Military Specification MIL-B-6039.

Finish:

Cadmium plating, Federal Specification QQ-P-416.

Zinc plating, Federal Specification QQ-Z-325.

Table 12-38. AN949 Plain, Self-Aligning, Hollow Shank, Rod End Bearing



Dash Number	A	B	Bore Size	Engineering Data	
				Radial Test Load Pounds	Axial Test Load Pounds
-3	.1895	.781	No. 10	1300	920
-4	.2495	.938	1/4	2200	1520
-5	.3120	1.250	5/16	4200	2960
-6	.3745	1.500	3/8	6400	4430
-8	.4995	1.250	1/2	9000	6320
-10	.6245	2.000	5/8	11,400	8000

Code:

Dash number is bore size in 1/16 inch.

Example of part number:

AN949-3 = plain, self-aligning, hollow shank, rod end bearing with number 10 or 3/16-inch bore size.

Material:

Steel, Military Specification MIL-S-6758.

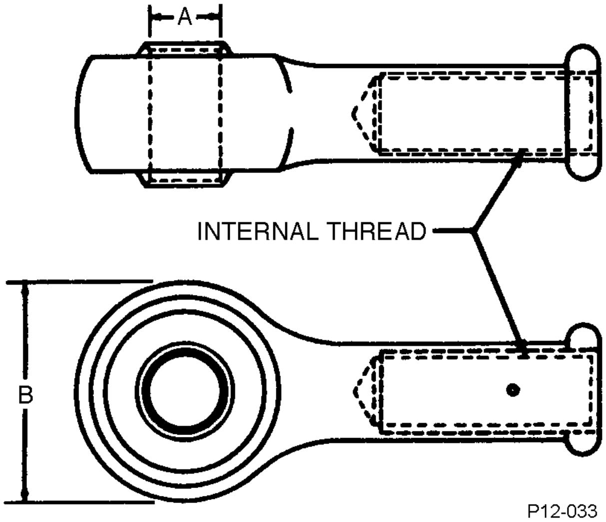
Corrosion-resistant steel, Military Specification MIL-S-7720.

Finish:

Cadmium plating, Federal Specification QQ-P-416.

Zinc plating, Federal Specification QQ-Z-325.

Table 12-39. AN951 Antifriction, Self-Aligning, Internal Thread, Rod End Ball Bearing



P12-033

					Engineering Data	
Dash Number	**A**	**B**	**Drill Size**	**Thread**	**Radial Test Load Pounds**	**Axial Test Load Pounds**
-REB3N	.1900	.781	No. 10	1/4-28RH	1000	200
-REB3N2				5/16-24RH		
-RE3F4				1/4-28RH		
-RE3FL4				1/4-28LH		
-RE3FL4-3				1/4-28LH		
-RE4F5	.2500	.938	1/4	5/16-24RH	1700	345
-RE4FL5				5/16-24LH		
-RE4F7				7/16-20RH		
-RE4FL7				7/16-20LH		
-RE5F5	.3125	1.250	5/16	5/16-24RH	2920	585
-RE5FL5				5/16-24LH		

Example of part number:

AN951-RE3FL4 = antifriction, self-aligning, internal left-hand thread, rod end ball bearing, size 3 bearing.

Material:

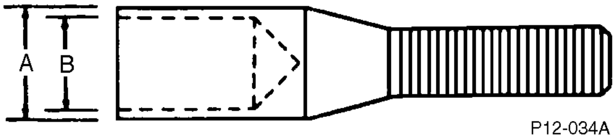
Steel, Military Specification MIL-B-6039.

Finish:

Cadmium plating, Federal Specification QQ-P-416.

Zinc plating, Federal Specification QQ-Z-325.

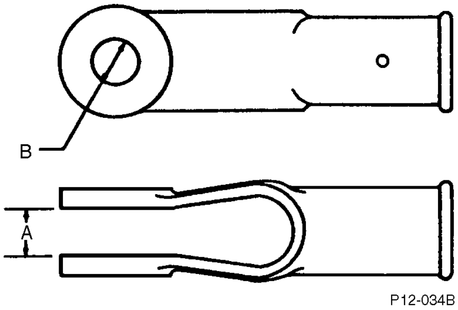
Table 12-40. NAS5 Threaded Rod End (For Resistance Welding)



Dash Number	Stock Diameter A	Drill Size B	Thread NF-3
-12	.375	.297	1/4-28
-13	.375	.297	5/16-24
-14	.500	.422	1/4-28
-15	.500	.422	5/16-24
-16	.563	.484	1/4-28
-17	.563	.484	5/16-24

Code:
L after dash number indicates left-hand threads.
Example of part number.
NAS5-12L = rod end, left-hand threads.
Material:
Steel, Military Specification MIL-S-6050
Finish:
Coat with corrosion preventive, Military Specification MIL-C-16173 or MIL-C-11796.

Table 12-41. NAS170 Engine Control Rod End, Adjustable Clevis

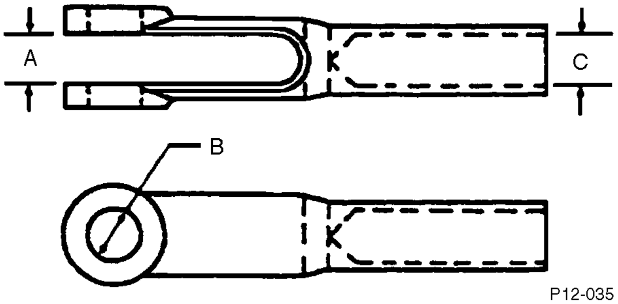


Dash Number	A	B	Thread NF-3	Type of Fork
-1	.266	1/4	5/16-24	Wide
-2	.141	1/4	5/16-24	Narrow
-3	.266	3/16	5/16-24	Wide
-4	.141	3/16	5/16-24	Narrow
-5	.266	1/4	3/8-24	Wide
-6	.141	1/4	3/8-24	Narrow
-7	.266	3/16	3/8-24	Wide
-8	.141	3/16	3/8-24	Narrow

Table 12-41. NAS170 Engine Control Rod End, Adjustable Clevis - Continued

Dash Number	A	B	Thread NF-3	Type of Fork
Material: Steel, Military Specification MIL-S-8617. Finish: Cadmium plating, Federal Specification QQ-P-416.				

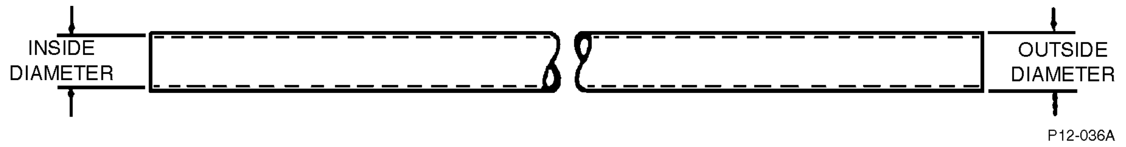
Table 12-42. NAS171 Rod End Clevis (For Resistance Welding)



Dash Number	A	B	Drill Size C	Type of Fork
-1	.266	1/4	.375	Wide
-2	.141	1/4	.375	Narrow
-3	.266	3/16	.375	Wide
-4	.141	3/16	.375	Narrow
-5	.266	1/4	.500	Wide
-6	.141	1/4	.500	Narrow
-7	.266	3/16	.500	Wide
-8	.141	3/16	.500	Narrow

Code:
S after dash number indicates short type rod end clevis.
L after dash number indicates long type rod end clevis.
Example of part number:
NAS171-1-S = rod end clevis, short type, drill size 0.375.
Material:
Steel, Military Specification MIL-S-8617.
Finish:
Coat with corrosion preventive, Military Specification MIL-C-16173 or MIL-C-11796.

Table 12-43. NAS357 Control Tube



First Dash Number	Outside Diameter	Wall Thickness	Ream or Expanded Section	
			Inside Diameter +.000 -.003	A (Min)
-60	3/8	.035	.310	1.00
-80	1/2	.035	.435	1.00

Code:

Second dash number is tube length in inches and hundredths of an inch.

Example of part number:

NAS357-60-650 = control tube, 6.50 inches long.

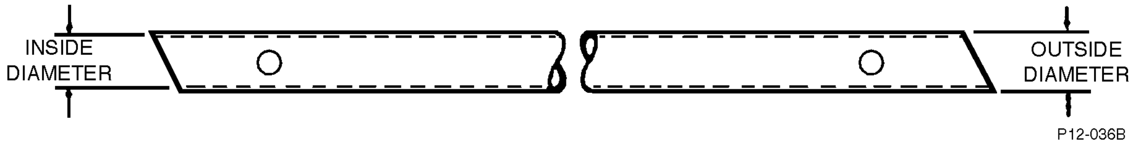
Material:

Aluminum alloy tubing, Federal Specification WW-T-785.

Finish:

Anodize, Military Specification MIL-A-8625; apply two coats of epoxy primer, Military Specification MIL-P-23377.

Table 12-44. NAS360 Control Tube



First Dash Number	Outside Diameter	Wall Thickness	Ream or Expanded Section	
			Inside Diameter ±.001	A (Min)
-60	3/8	.035	.306	1.00
-80	1/2	.035	.431	1.00
-82	1/2	.058	.385	1.00

Code:

Second dash number is tube length in inches and hundredths of an inch.

Example of part number:

NAS360-60-625 = control tube, 6.25 inches long.

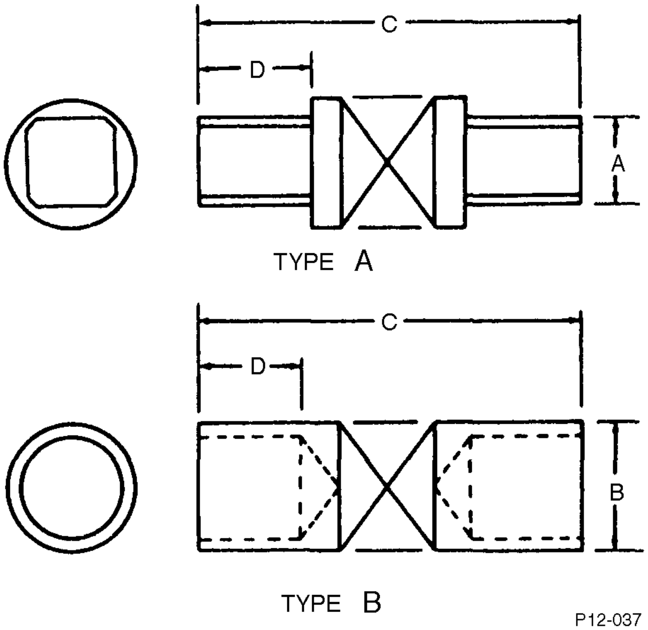
Material:

Steel tubing, Military Specifications MIL-T-6731 and MIL-T-6736.

Finish:

Apply corrosion preventive.

Table 12-45. MS20270 Light Duty Universal Joint



Dash Number	Nominal Size	A	B	C	D
-6*	3/8		.372	1-3/4	5/8
-8	1/2	.373	.495	1-7/8	5/8
-10	5/8	.436	.620	2-3/16	3/4
-12	3/4	.560	.745	2-1/2	7/8
-14*	7/8		.870	3	1-1/32
-16	1	.686	.995	3-3/8	1-1/8
-20	1-1/4	.873	1.245	3-3/4	1-3/16
-24	1-1/2	.998	1.495	4-1/2	1-3/8

*Available in Type B universal joint only.

Code:

A before dash number indicates Type A universal joint.

B before dash number indicates Type B universal joint.

Example of part number:

MS20270A8 = Type A, 1/2-inch universal joint.

Material:

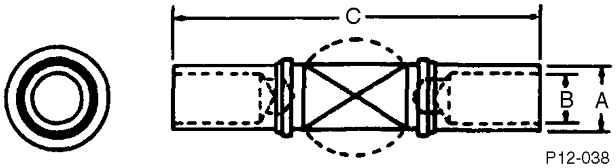
Steel, Military Specification MIL-J-6193A.

Finish:

Cadmium plating, Federal Specification QQ-P-416.

Zinc plating, Federal Specification QQ-Z-325.

Table 12-46. MS20271 Heavy Duty Universal Joint



Dash Number	Nominal Size	A	B	C
-B6	3/8	.372	.250	2
-B8	1/2	.495	.375	2-5/16
-B10	5/8	.620	.500	2-3/4
-B12	3/4	.745	.625	3-3/16
-B14	7/8	.870	.750	3-5/8
-B16	1	.995	.812	4-1/16
-B20	1-1/4	1.245	1.062	4-5/8
-B24	1-1/2	1.495	1.250	5-1/4

Material:
Steel, Military Specification MIL-J-6193A.
Finish:
Cadmium plating, Federal Specification QQ-P-416.
Zinc plating, Federal Specification QQ-Z-325.

CHAPTER 13

TUBING SYSTEMS AND TUBING REPAIRS

13.1 TUBING SYSTEMS AND TUBING REPAIRS.

Tubing Systems and Tubing Repair Section of T.O. 1-1A-8 was removed from T.O. 1-1A-8. This information was incorporated into a Joint Services book with the Navy. For technical instructions on Tubing Systems and Tubing Repairs, use the following technical manuals:

Air Force	TO 42E1-1-1
Navy	NAVAIR 01-1A-20

CHAPTER 14

FLEXIBLE HOSE AND FITTINGS

14.1 FLEXIBLE HOSE AND FITTINGS.

For technical instructions on flexible hose and fittings use the following technical manuals:

Air Force	TO 42E1-1-1
Navy	NAVAIR 01-1A-20
AVCOM	TM55-1500-204-25/1 (Rubber) TB750-125 (Teflon)

CHAPTER 15
SELECTION AND INSTALLATION OF ACRES FASTENER SLEEVES
MIL-S-85069

15.1 ACRES FASTENER SLEEVES.

15.1.1 Introduction. Acres Fastener Sleeves are precision formed, thin wall, tubular elements with a flared end. These sleeves were developed to meet several specific needs such as bushing oversize holes, protecting from corrosion, and to aid sealing.

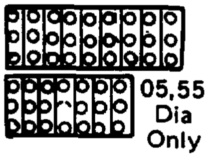
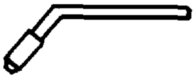
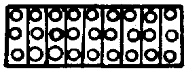
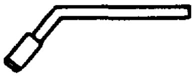
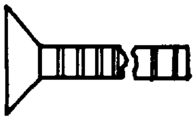
15.1.2 Purpose. The primary purpose for Acres Fastener Sleeves is to repair enlarged holes, The sleeves come in standard fastener diameters with standard fastener heads. The sleeves are generally 1 inch long and are adjusted to the length of fastener being used. Acres Sleeves may be bonded into areas where holes need protection such as vent holes, drain holes, or through composite structure.

15.1.3 Description. Acres Fastener Sleeves are manufactured from A286 stainless steel. There are in general four head styles; three flush and one protruding. (See Figure 15-2.) The sleeves have grooves on the shank spaced 1/16 of an inch apart for two reasons. The first reason is to trap sealant in between the sleeve and the wall of the hole to afford better seals. The second reason being to aid in adjusting the sleeve to length. MIL-S-85069 and associated slash pages cover the fastener sleeves as shown in Figure 15-1.

1/64	MIL-S-85069/2	Sleeves, fastener, grooved, protruding head (shear and tension), 1/64 oversize.
	MIL-S-85069/3	Sleeves, fastener, grooved, 100° flush reduced head (shear), 1/64 oversize.
	MIL-S-85069/4	Sleeves, fastener, grooved, 100° flush head (i.e. MS20426), 1/64 oversize.
	MIL-S-85069/5	Sleeves, fastener, grooved, 100° flush full head (tension, i.e. AN509), 1/64 oversize
1/32	MIL-S-85069/6	Sleeves, fastener, grooved, protruding head, (shear and tension) 1/32 oversize.
	MIL-S-85069/7	Sleeves, fastener, grooved, 100° flush reduced head (shear), 1/32 oversize.
	MIL-S-85069/8	Sleeves, fastener, grooved, 100° flush head (i.e. MS20426), 1/32 oversize.
	MIL-S-85069/9	Sleeves, fastener, grooved, 100° flush full head (tension, i.e. AN509), 1/32 oversize

F15-099

Figure 15-1. MS Numbers for Acres Fastener Sleeves

	MIL-S-85069 Configuration	For Fast. With These Head Styles	Sleeve Vendor Part Number	Tooling	Description	Tool Part Number
FIRST INCREMENT OVERSIZE 1/64	 MIL-S-85069/2	Prot. Hd. Fasteners Shear and Tension	JK5517CXX		Step Plate Step Plate	JK6555-XX JK6557-05 JK6557-55
	 MIL-S-85069/3	Reduced Shear Flush Hd. (NAS1097)	JK5512CXX		Break Off Handle	JK6548-XX
	 MIL-S-85069/4	Shear Flush Head (MS20426)	JK5514CXX		Inserting Tool Interference Only	JK6536-XX
	 MIL-S-85069/5	Tension Flush Head (AN509)	JK5516CXX		Removing Tool	JK6526-XX
SECOND INCREMENT OVERSIZE 1/32	 MIL-S-85069/6	Prot. Hd. Fasteners Shear and Tension	JK5577C XX		Step Plate	JK6556-XX
	 MIL-S-85069/7	Reduced Shear Flush Head (NAS1097)	JK5572C XX		Break Off Handle	JK6546-XX
	 MIL-S-85069/8	Shear Flush Head (MS20426)	JK5574C XX		Inserting Tool	JK6536-XX
	 MIL-S-85069/9	Tension Flush Head (AN509)	JK5576C XX		Removing Tool	JK6524-XX

F15-098

Figure 15-2. Acres Fastener Sleeves Styles

15.2 OVERSIZE FASTENER SLEEVES, TYPE I.

- Type I, Class 1, First Oversize, 1/64 MIL-S-85069/(2-5)
- Type I, Class 2, Second Oversize, 1/32, MIL-S-85069/(6-9)

15.2.1 Drill or ream the hole for the application fastener and sleeve in accordance with applicable slash sheet. If flush head fasteners are to be installed, the countersink in the material will have to be deepened 0.005 for 1/64 and 0.010 for 1/32 oversize to accommodate the countersunk portion of the sleeve. The installed sleeve and fastener shall meet the applicable aerodynamics smoothness requirements on exterior surfaces. Except where a smoother finish is specified on the engineering drawing or in the fastener installation document, the surface finish of the hole shall not exceed 125 RHR as defined in ANSI-B-46.1.

15.2.2 Sleeve shall correspond to the fastener configuration (flush or protruding head), fastener application (tension or shear), and fastener diameter. See slash sheet. Each type of sleeve is stocked in only one length. Diameters #10 through 3/8 inch have a 1 inch grip length. All sleeves have external circumferential grooves spaced 1/16 inch apart over the straight portion of their grip length.

15.2.3 Sleeves shall be prepared for installation by breaking or grinding them off at a groove so that the grip length will be the same as the fastener grip length. If the grip length or the fastener is longer than the maximum length of the sleeves as listed in paragraph 15.2.2, an additional cylindrical section broken from a second sleeve may be used to make up the required fastener grip length. Do not use a section of sleeve less than 1/4 of an inch long. Break off tools listed in Figure 15-2 must be used.

15.3 ADJUSTING TO LENGTH.

Using step plate (see Figure 15-2) and breakoff handle (see Figure 15-2), break sleeve to length per Figure 15-3 through Figure 15-6.

15.4 ALTERNATE METHOD OF ADJUSTING SLEEVE TO LENGTH IN STRUCTURE.

To adjust sleeve to length in a structure, be sure the structure sheets are firmly held together. Insert the sleeve into the hole until the head is fully seated. Examine the rear protrusion of the sleeve. If a groove is barely visible on the sleeve next to the sheet, use the break off handle to break off the protruding section of sleeve. If the back surface of the sheet falls in between grooves, use a standard washer, 1/32 inch thick, with the hole enlarged with the same drill or reamer used to manufacture the hole to accept the sleeve. Place this washer on the sleeve and push securely against the back sheet. Then using the break off handle, break off the portion of the sleeve standing above the washer. This will always leave the sleeve protruding slightly from the back sheet. The washer may be left on or may be removed and a nut or collar with the proper counterbore used on the bolt.

15.5 PROCEDURE FOR GRINDING SLEEVE TO PROPER LENGTH(FIGURE 15-4).

15.6 INSTALLATION.

Fastener sleeves must be installed with reasonable care to insure that they function properly in inhibiting corrosion, sealing, and in serving to restore the structural integrity of joints in modification, repair or in the original manufacture of aerospace or military hardware. The installation information available and the processing specification should be followed. Various tools are available which facilitate and insure that the sleeve installations may be properly performed.

15.6.1 Fasteners and sleeves shall be installed wet with sealing compounds as required. A thin coat of material shall be applied to the exterior of the sleeve and the sleeve inserted into the hole. If there is an interference fit between the sleeve and the hole, inserting tool JK6536-XX shall be used to install the sleeve into the hole. The same material shall be applied to the shank of the fastener and the fastener inserted or driven into the sleeve. Do not allow the compound to cure before completing the installation. (See Figure 15-5.)

15.7 FLUSHING BACK SIDE WHEN NECESSARY.

Normally the sleeve does not need to be flush on the back side. The sleeve protrusion will fit into the same counterbore in the attaching nut or collar as an oversize bolt. A washer may be used when necessary.

15.7.1 When the sleeve must be flush on the back side it may be trimmed by using a counterbore or countersink in a cage. Adjust the cage to cut flush. A pilot on the cutting tool to fit the sleeve hole must be used. Cut slowly.

15.7.2 To keep the sleeve from turning it is helpful to have it in an interference fit. It may be bonded into the material and held by tools as shown in Figure 15-6.

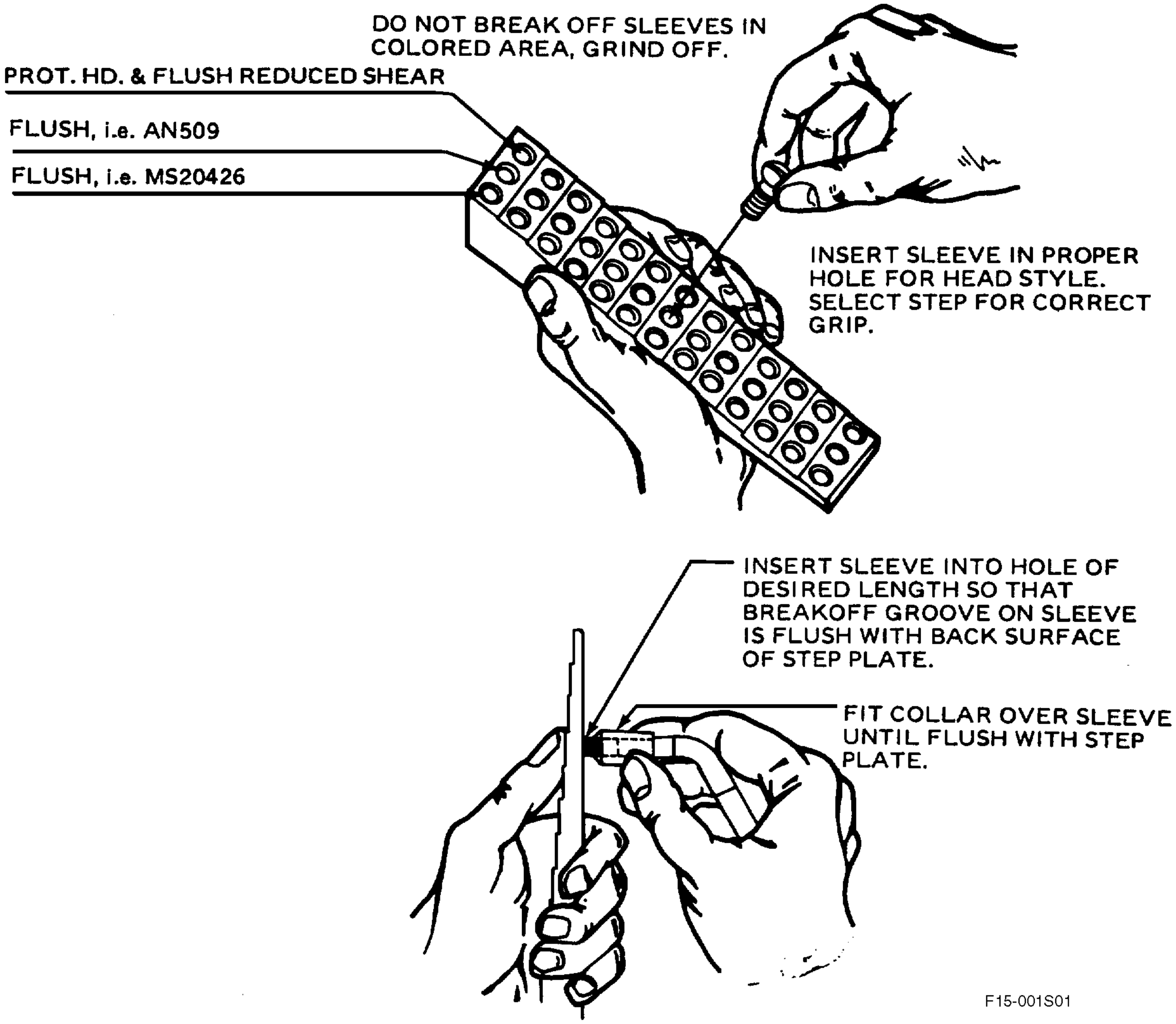


Figure 15-3. Adjusting Sleeve to Length (Sheet 1 of 2)

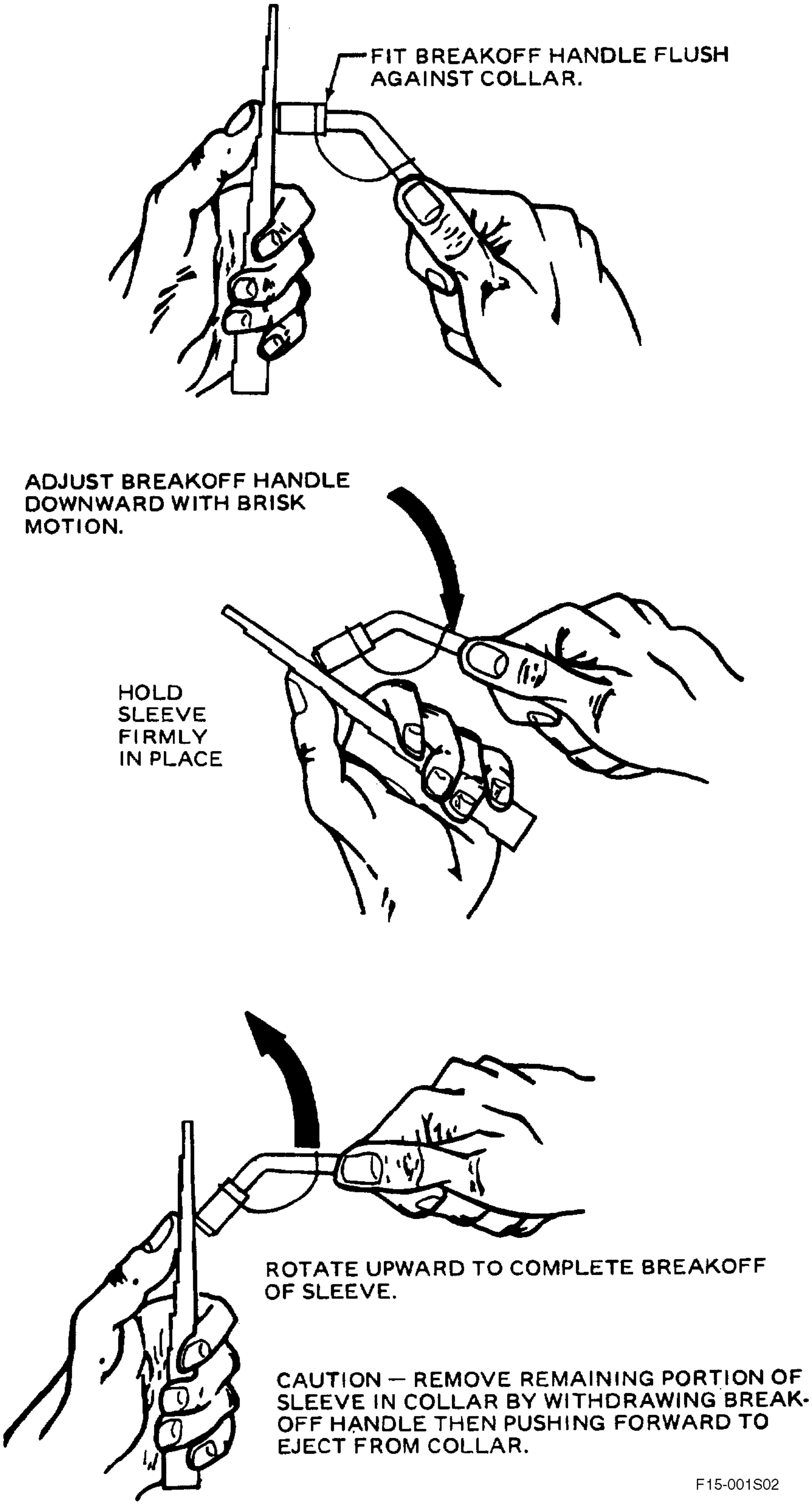
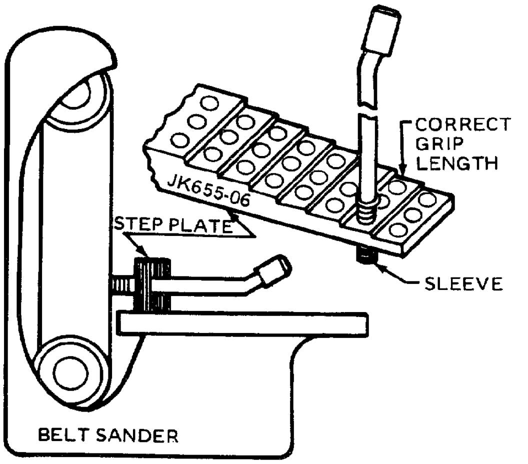


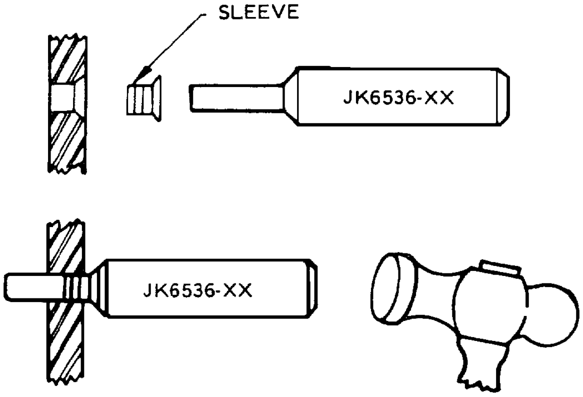
Figure 15-3. Adjusting Sleeve to Length (Sheet 2)



NOTES:
1. MAY ALSO BE GROUND ON DISC SANDER.
2. DEBURR INSIDE AND OUT.
3. DO NOT GRIND THE BOTTOM OF THE STEP PLATE.

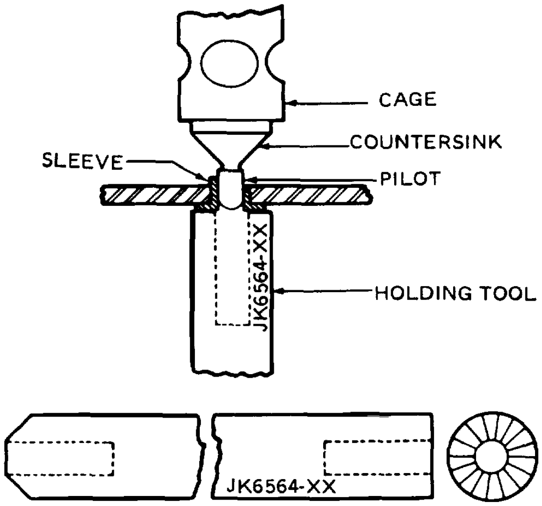
F15-002

Figure 15-4. Grinding Sleeve to Proper Length



F15-003

Figure 15-5. Installing Fasteners and Sleeves



F15-004

Figure 15-6. Bonding Sleeve

15.8 SLEEVES, FASTENERS, DESIGN AND USAGE LIMITATIONS.

Fastener sleeves replace oversize shank fasteners. Use the sleeves with standard diameter straight fasteners. Use fastener sleeves under the same restrictions as oversize fasteners and in compliance with the specific users repair procedures and restrictions.

15.9 RESTRICTED APPLICATIONS.

a. Fastener sleeves shall not be used in those applications utilizing tapered shank fasteners.

b. Fastener sleeves shall not be used in interference that exceeds 0.003 (hole to sleeve).

c. These repair sleeves will not be used with blind fasteners.

d. The fastener or attaching element (nut or collar) must contain a counterbore to accept the protrusion of the sleeve or a washer must be used or the sleeve may be flushed on the back side.

15.9.1 Procuring activity or the appropriate engineering organization (i.e. stress, strength, fatigue/fracture) approval is required for the following applications:

a. In fluid applications.

b. Fatigue and fracture critical locations.

c. Edge distance, measured from the center of the hole, is less than 1 1/2 diameter.

d. The number of discrepant holes being repaired in the pattern is greater than 10 percent of the total number of holes in the pattern.

e. More than three (3) adjacent holes are discrepant.

15.9.2 Deviation from any of the above requirements must be approved by the procuring agency.

15.10 APPLICATION.

a. When the edge distance measured from the center of the holes is 2D or greater, there is no restriction on the number or location of fasteners installed with sleeves.

b. Sleeves are to be used only on/with fasteners ranging from 5/32 through 3/8 inch nominal diameter and up to 2 inches thick stack up.

CHAPTER 16
SAFETY METHODS

16.1 SAFETY METHODS.

(See WARNING listed before paragraph 16.1.2 prior to use.) This section presents instructions for securing screws, nuts, bolts, snap rings, oil caps, drain cocks, valves, and pins with lockwire (safety wire), Safety Cable and cotter pins.

CAUTION

Electrical connectors shall not be lock-wired to any part of fuel, oil, hydraulic, or oxygen system (lines, tubes, elbows, flanges, jam nut, etc).

NOTE

Safetywire or Safety Cable shall not be used to secure nor shall it be dependent upon fracture as the basis for operation of emergency devices such as handles, switches, guards covering handles etc., that operate emergency mechanisms such as emergency exits, fire extinguishers, ejection seats, emergency cabin pressure releases, emergency bomb releases, emergency landing gear door releases, and the like. However, where existing structural equipment or safety of flight emergency devices require shear, single-strand copper safetywire (.020-inch diameter lockwire only), or as identified in specific technical orders to secure equipment while not in use, but which are dependent upon shearing or breaking of the safetywire for successful emergency operation of equipment, particular care shall be exercised to assure that safetying under these circumstances shall not prevent emergency operation of these devices. Safety Cable shall not be used for emergency ‘‘Shear’’ or ‘‘Breakaway’’ applications.

16.1.1 Securing Aircraft Hardware with Lockwire. (See Figure 16-1.)

a. Figure 16-1 and Figure 16-2 illustrate a typical lockwire procedure. Although there are numerous lockwiring operations performed on aircraft hardware, practically all are derived from the basic examples shown in Figure 16-1 and Figure 16-2.

b. Aircraft hardware that requires lockwiring for security is secured with zinc coated soft steel wire, Federal Specification QQ-W-461. Annealed corrosion-resisting wire, Federal Specification QQ-W-423, condition A, should be used where non-magnetic qualities and heat resisting properties are desired. There are two methods of lockwiring, the double twist method that is most commonly used, and the single wire method used on screws, bolts, and/or nuts in a closely spaced or closed geometrical pattern such as a triangle, square, rectangle, or circle. The single wire method may also be used on parts in electrical systems and in places that are difficult to reach.

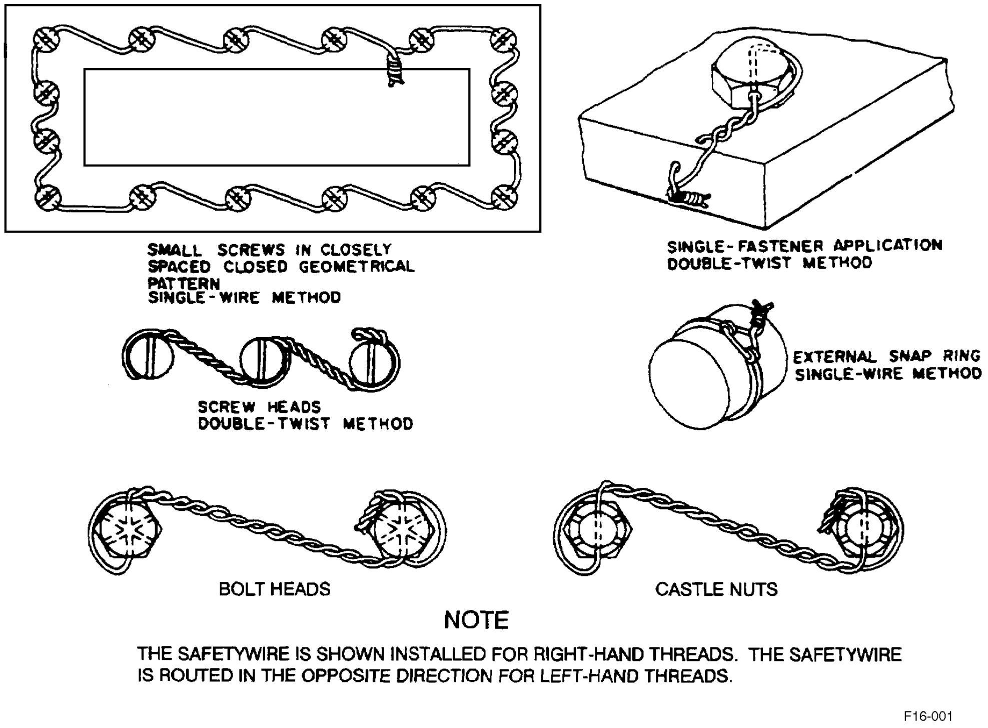
16.1.2 Securing Aircraft Hardware with Safety Cable.

WARNING

Eye protection shall be worn while installing or removing safety wire/safety cable. Keep fingers away from jaws and cutting edge.

a. Safety cable may be used to secure aircraft hardware. When used, safety cable size, construction, and application procedures shall be in accordance with the guidelines specified in this manual.

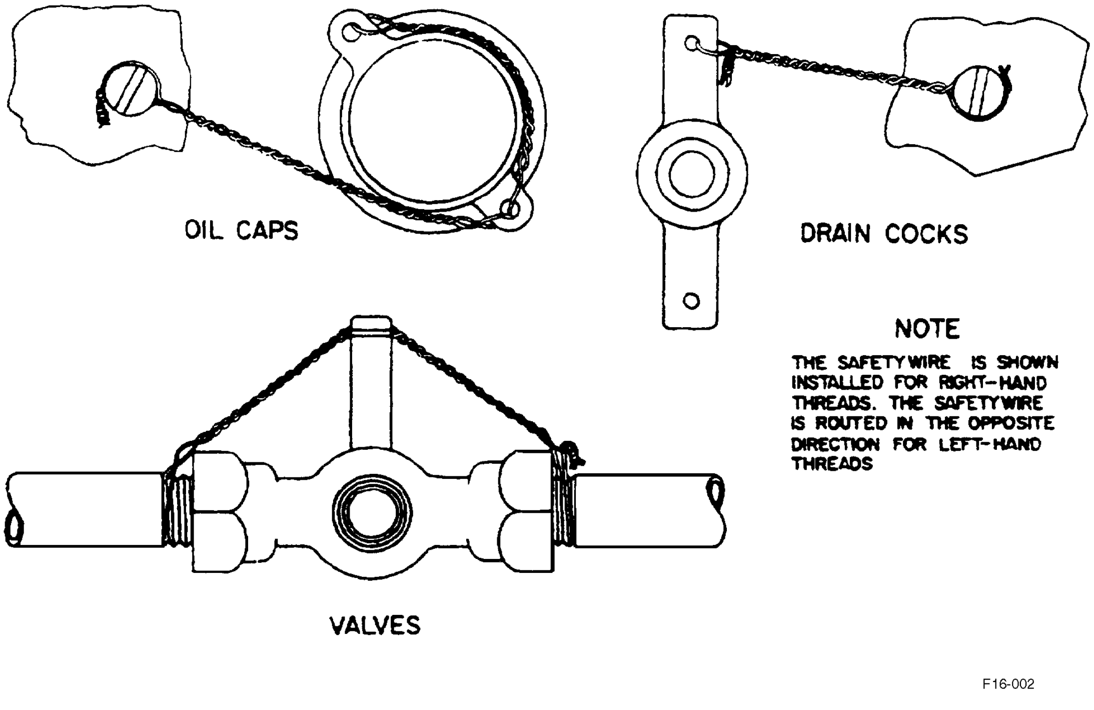
b. The selection of materials shall be in accordance with AS4536 (SAE), available from SAE International, 400 Commonwealth Avenue, Warrendale, PA 15096-0001, and shall be in accordance with the service limitation outlined herein.



NOTE

THE SAFETYWIRE IS SHOWN INSTALLED FOR RIGHT-HAND THREADS. THE SAFETYWIRE IS ROUTED IN THE OPPOSITE DIRECTION FOR LEFT-HAND THREADS.

Figure 16-1. Securing Screws, Nuts, Bolts, and Snap Rings



NOTE

THE SAFETYWIRE IS SHOWN INSTALLED FOR RIGHT-HAND THREADS. THE SAFETYWIRE IS ROUTED IN THE OPPOSITE DIRECTION FOR LEFT-HAND THREADS

Figure 16-2. Securing Oil Caps, Drain Cocks, and Valves

16.1.3 Lockwiring and Safety Cabling Procedures. There are many combinations of lockwiring and safety cabling with certain basic rules common to all applications. These rules are as follows:

16.1.4 Lockwiring Procedures.

WARNING

Lockwire ends must be bent under to prevent injury.

CAUTION

- Use only new wire when replacing wired electrical connectors or emergency devices. Do not re-use the old wire.
- Make sure wire does not become kinked or nicked during twisting operation. If wire is damaged, replace with new wire.

a. When drilled head bolts, screws, or other parts are closely grouped it is more convenient to safetywire them in series or to each other. The number of bolts, nuts, screws, etc., that may be wired together depends on the application. When securing widely spaced bolts by the double-twist method, the maximum number of bolts that can be wired in a series is three. When securing closely spaced bolts, the number that can be secured by a 24-inch length of wire is the maximum number in a series. Widely spaced multiple groups shall not be safetied together when the fasteners are from 4 to 6 inches apart. Lockwiring shall not be used to secure fastenings or fittings which are spaced more than 6 inches apart, unless tie points are provided on adjacent parts to shorten the span of the lockwire to less than six inches.

b. Drilled head bolts and screws need not be safetywired if installed with self-locking nuts or lockwashers in accordance with Chapter 5 and Chapter 6, respectively.

c. Lockwire must be tight when installed.

(1) To prevent failure due to rubbing or vibration, lockwire must be tight after installation.

d. Lockwire must tend to tighten.

(1) By installing lockwire in a manner that tends to tighten and keep a part locked in place, the natural tendency of the part to loosen is counteracted.

e. Lockwire must never be overstressed.

(1) Lockwire will break under vibrations if twisted too tightly. Lockwire shall be pulled taut when being twisted, but shall have a minimum of tension, if any, when secured.

f. Lockwire ends must be bent under to prevent injury.

(1) The remaining lockwire ends shall be bent into the part to avoid sharp or projecting ends which might present a safety hazard.

g. Internal wiring must not cross over or obstruct a flow passage when an alternate method can be used.

h. Check the units to be lockwired to make sure that they have been correctly torqued and that the wiring holes are properly positioned in relation to each other. When there are two or more units, it is desirable that the holes in the units be in the same relationship to each other. Never over torque or loosen units to obtain proper alignment of the holes. It should be possible to align the wiring holes when the units are torqued within the specified limits. However, if it is impossible to obtain a proper alignment of the holes without either over or under torquing, select another unit which will permit proper alignment within the specified torque limits.

i. To prevent mutilation of the twisted section of wire when using pliers, grasp the wires at the ends. Lockwire must not be nicked, kinked or mutilated. Never twist the wire ends off with pliers and, when cutting off ends, leave at least four to six complete turns (1/2 to 5/8 inches long) after the loop. The strength of the lockwire hole are marginal. When removing a lockwire, never twist the wire off with pliers. Cut the lockwire close to hole, exercising caution.

j. Turns per inch requirements are listed as follows:

(1) .020 gauge wire to 9 - 12 turns.

(2) .032 gauge wire to 7 - 12 turns.

(3) .041 gauge wire to 7 - 10 turns.

k. Lockwire should, where practicable, be installed with the wire positioned around the head of the bolt, screw, or nut and twisted in such a manner that the loop of the wire fits closely to the contour of the unit being lockwired.

16.1.5 Twisting with Special Tools. Twist wire with a wire twister as follows. (Refer to Figure 16-3):

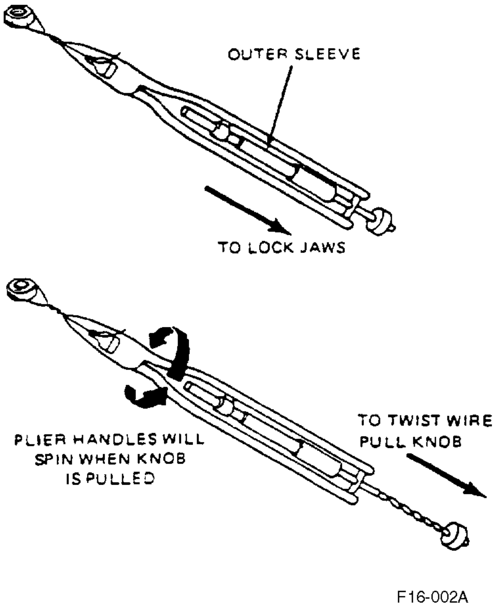


Figure 16-3. Use of Wire Twister

WARNING

When using wire twisters and wire extends 3 inches beyond jaws of twisters, loosely wrap wire around pliers to prevent whipping and possible personnel injury.

a. Grip wire in jaws of wire twister and slide outer sleeve down with thumb to lock handles.

b. Pull knob; spiral rod spins and twists the wire.

c. Squeeze handles together to release wire.

16.1.6 Safety Cable Procedures. The selection of materials shall be in accordance with AS4536 (SAE), available from SAE International, 400 Commonwealth Avenue, Warrendale, PA 15096-0001, and shall be in accordance with the service limitations outlined herein.

NOTE

Minimize mixing of safety wire and safety cable.

a. AS3510 series (UNS S32100 CRES) safety cable shall be selected for general purpose use on all applications up to 649°C (1200°F).

b. AS3509 series (UNS N6600 Nickel Alloy) safety cable shall be selected for applications up to 982°C (1800°F).

c. Only safety cables and ferrules supplied by a manufacturer that meets all the requirements of AS4536 shall be allowed.

d. Safety cable shall not be used for any shear, or break away applications.

e. Safety cable shall be installed with a calibrated tool which is supplied by the safety cable manufacturer for the purpose of applying tension to the cable, crimping the ferrule, and cutting the excess cable without allowing tension to be lost.

16.1.7 **The size of safety cable shall be in accordance with the following requirements:**

a. 0.020 inch diameter safety cable is intended for use on parts having a nominal hole diameter of 0.045 inch (1.14 mm) or smaller.

b. 0.032 inch diameter safety cable is intended for use on parts having a nominal hole diameter of 0.075 inch (1.91 mm) or smaller.

c. 0.040 inch diameter safety cable is intended for use on parts having a nominal hole diameter of 0.095 inch (2.41 mm) or smaller. For larger diameters see paragraph 16.5, step (5).

d. The specified length of the cable shall be selected to accommodate the span between fasteners added to the length of cable required to correctly engage the application tool.

16.2 SECURING OIL CAPS, DRAIN COCKS, AND VALVES.

(See Figure 16-2 and Figure 16-4). When securing oil caps and drain cocks, the safetywire should be anchored to an adjacent fillister head screw. This method of safetywiring is applied to wing nuts, filler plugs, single drilled head bolts, fillister head screws, etc., which are safetywired or safety cabled individually. Safety cable may be substituted, where practical, as shown in Figure 16-4. When securing valve handles in the vertical position the wire is looped around the threads of the pipe leading into one side of the valve, double-twisted around the valve handle, and anchored around the threads of the pipe leading into the opposite side of the valve. When castellated nuts are to be secured with safetywire, tighten the nut to the low side of the selected torque range, unless otherwise specified, and if necessary continue tightening until a slot aligns with the hole. In blind tapped hole applications of bolts or castellated nuts on studs, the safetywiring or safety cabling shall be in accordance with the general instruction contained herein. Hollow head bolts are safetied in the manner prescribed for regular bolts.

16.2.1 Securing Snap Rings.

CAUTION

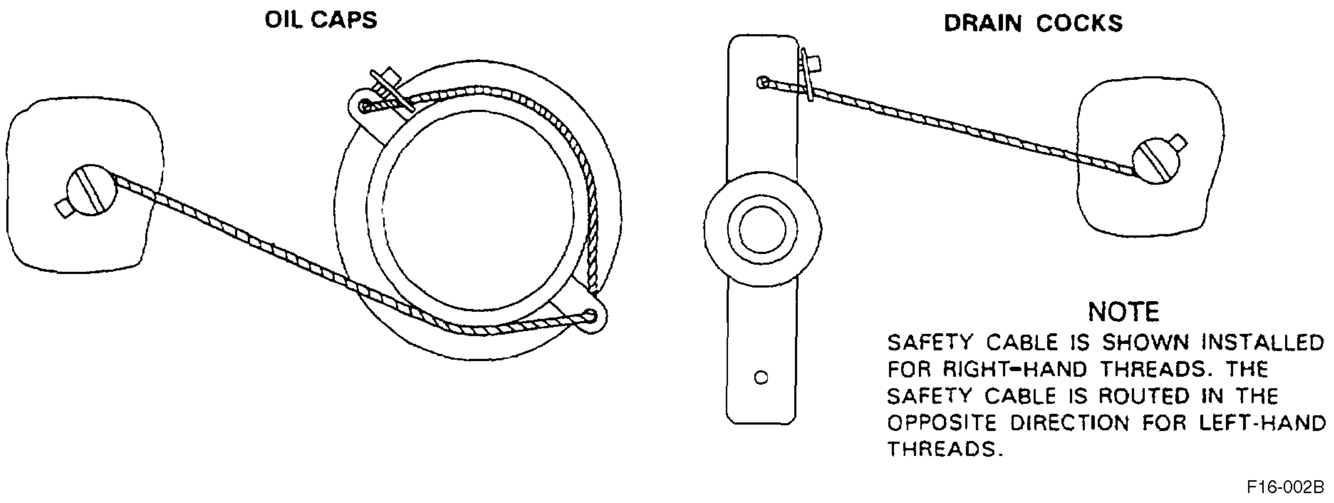
Do not loosen or tighten properly tightened nuts to align safetywire holes.

External snap rings shall be safetied in accordance with the applicable A/C publications. Where safety cable is used it shall be installed as illustrated in Figure 16-5.

a. Safety Cable may be substituted for lockwire on external snap ring applications only.

b. Internal snap rings shall not be safety wired or safety cabled.

c. Correct Safety Cable diameter shall be selected using criteria specified in paragraph 16.5, step (1) and 16.5, (5).



NOTE

SAFETY CABLE IS SHOWN INSTALLED FOR RIGHT-HAND THREADS. THE SAFETY CABLE IS ROUTED IN THE OPPOSITE DIRECTION FOR LEFT-HAND THREADS.

Figure 16-4. Self Looping Safety Cable used on Oil Caps and Drain Cocks

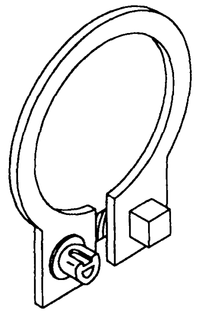


Figure 16-5. External Snap Ring Installation with Safety Cable

16.3 SECURING TURNBUCKLES.

16.3.1 Securing Turnbuckles with Safety Wire.

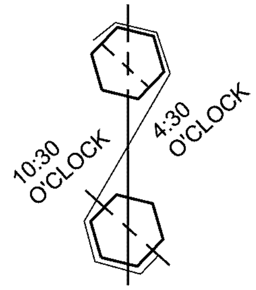
(See Figure 16-9.) (Prior to securing turnbuckles, threaded terminals should be screwed into the turnbuckle barrel until no more than three threads of either terminal are outside the barrel. After the turnbuckle has been adjusted for proper cable tension, two pieces of safetywire are inserted one-half the wire length into the hole in the center of the turnbuckle barrel. The safetywires are bent so that each wire extends one-half the length of the turnbuckle on top and one-half on bottom. The ends of the wires are passed through the hole in the turnbuckle eyes or between the jaws of the turnbuckle fork, as applicable. The wires are then bent toward the center of the turnbuckle and each wire is wrapped around the shank four times, binding the wrapping wires in place as shown in Figure 16-9. When a swaged terminal is being secured, one wire is passed through the hole in the terminal and is looped over the free end of the other wire and both ends wrapped around the shank. All lockwire used in the safetying of turnbuckles shall be carbon steel, corrosion-resistant steel, nickel-chromium iron alloy (inconel), nickel-copper alloy (monel) or aluminum alloy. The minimum lockwire diameter shall be in accordance with Table 16-1. On aircraft where the present standard sizes have not been installed, no change is required to comply with Air Force-Navy Aeronautical Standard 669. If hole sizes are not large enough to accommodate specified wire a substitute size wire is authorized. On turnbuckles having 3/32-inch or 1/8-inch diameter cables that would normally use 0.041-inch diameter safetywire, a 0.032-inch diameter safetywire may be substituted. On turnbuckles having cables greater than 1/8-inch diameter that would normally use 0.047-inch diameter safetywire, a 0.041-inch diameter safetywire is authorized. Care should be exercised when safetywiring, particularly where corrosion will present a problem because smaller wire sizes tend to crack when bent. Federal Specification QQ-W-461, is the standard turnbuckle safetywire. Annealed, corrosion-resisting wire, Federal Specification QQ-W-423, should be used where nonmagnetic or heat resisting qualities are desired.

16.3.2 Securing Turnbuckles with Safety Cable. (See Figure 16-10 and Figure 16-11.)

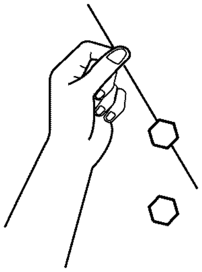
a. Safety Cable may be substituted on turnbuckles. The standard procedure for securing turnbuckles with safety cable is shown in Figure 16-10 and Figure 16-11.

   (1) A self-looping safety cable is threaded through the turnbuckle. The free end shall be wrapped in one direction around the turnbuckle. The safety cable is then threaded through the hole in the self looping jumper, and terminated with the appropriate application tool (See Figure 16-11).

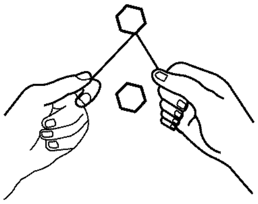
   (2) 0.032 inch diameter Safety Cable selection for turnbuckle applications, shall be used on assemblies where cable diameter is 1/16 inch or smaller, and 0.040 inch diameter safety cable or greater shall be used on turnbuckle cable diameters greater than 1/16 inch.



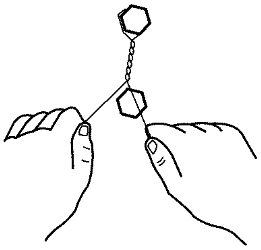
Position the holes



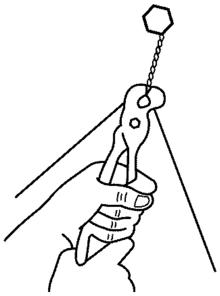
Insert proper gage wire. To determine the proper wire to be used in conjunction with a particular tightening operation refer to the correspondingly designated engine parts catalog or illustrated parts breakdown. Lockwire which is specially treated for 982°C (1800°F) application has a dark gray to black color.



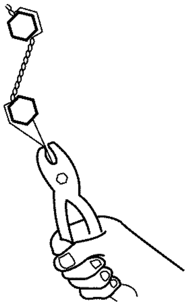
Grasp under end of the wire and bend it around the head of the bolt; then under the other end of the wire. Be sure wire is tight around head.



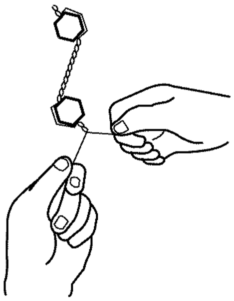
Twist wire until wire is just short of hole in the second bolt.



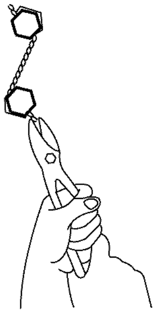
Keeping wire under tension twist in a clockwise direction until the wire is tight. When tightened the wire shall have approximately 8-10 turns per inch.



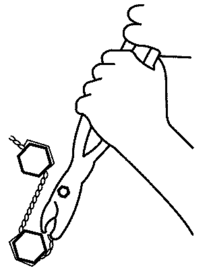
Insert the uppermost wire, which points towards the second bolt, through the hole which lies between the nine and twelve o'clock position. Grasp the end of the wire with a pair pf pliers and pull the wire tight.



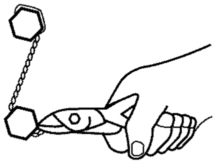
Bring the free end of the wire around the bolt head in a counterclockwise direction and under the end protruding from the bolt hole. Twist the wire in a counterclockwise direction.



Grasp the wire beyond the twisted portion and twist the wire ends counterclockwise until tight.



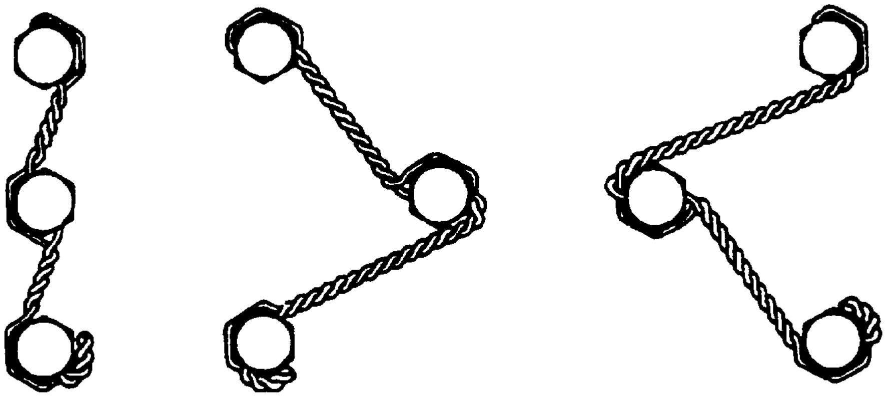
During the final twisting motion of the pliers, bend the wire down and under the head of the bolt.



Cut off excess wire with diagonal cutters.

F16-003S01

Figure 16-6. Safetywiring Procedures (Sheet 1 of 4)

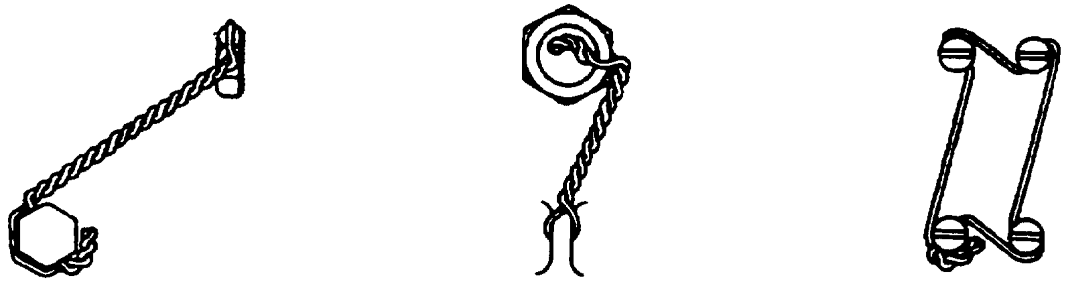


EXAMPLE 1 EXAMPLE 2 EXAMPLE 3 EXAMPLE 4

Examples 1, 2, 3, and 4 apply to all types of bolts, fillister head screws, square head plugs, and other similar parts which are wired so that the loosening tendency of either part is counteracted by tightening of the other part. The direction of twist from the second to the third unit is counterclockwise in examples 1, 3 and 4 to keep the loop in position against the head of the bolt. The direction of twist from the second to the third unit in example 2 is clockwise to keep the wire in position around the second unit. The wire entering the hole in the third unit will be the lower wire except example 2 and by making a counterclockwise twist after it leaves the hole, the loop will be secured in place around the head of that bolt.

EXAMPLE 6 EXAMPLE 5 EXAMPLE 7 EXAMPLE 8

Examples 5, 6, 7, & 8 show methods for wiring various standard items. Note: Wire may be wrapped over the unit rather than around it when wiring castellated nuts or on other items when there is a clearance problem.



EXAMPLE 9

Example 9 shows the method for wiring bolts in different planes. Note that wire should always be applied so that tension is in the tightening direction.

EXAMPLE 10

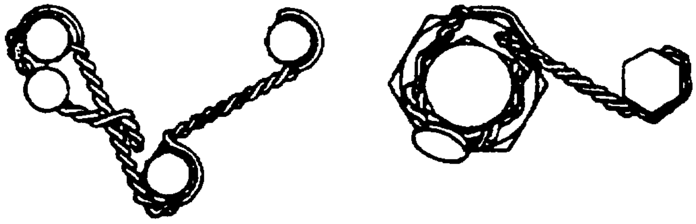
Hollow head plugs shall be wired as shown with the tab bent inside the hole to avoid snags and possible injury to personnel working on the engine.

EXAMPLE 11

Correct application of single wire to closely spaced multiple group.

F16-003S02

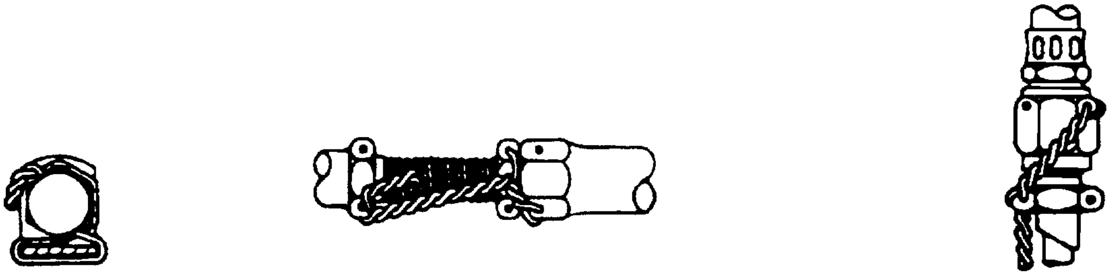
Figure 16-6. Safetywiring Procedures (Sheet 2)



EXAMPLE 12

EXAMPLE 13

Examples 12 & 13 show methods for attaching lead seal to protect critical adjustments.



EXAMPLE 14

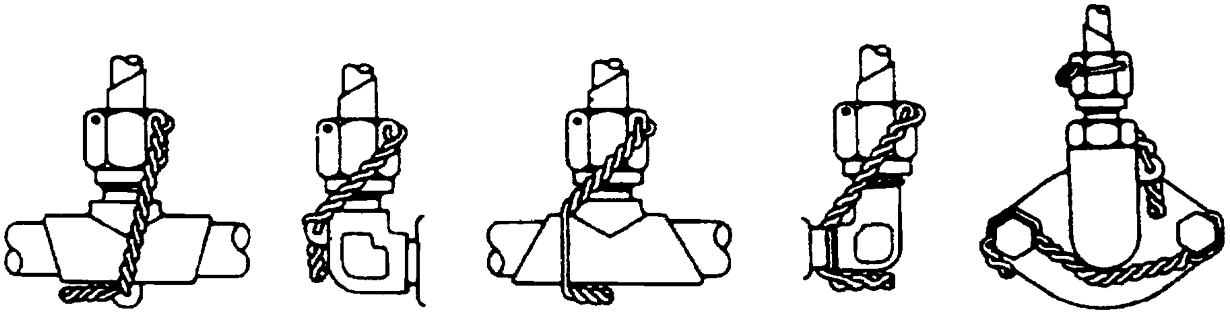
EXAMPLE 15

EXAMPLE 16

Example 14 shows bolt wired to a right angle bracket with the wire wrapped around the bracket.

Example 15 shows correct method for wiring adjustable connecting rod.

Example 16 shows correct method for wiring the coupling nut on flexible line to the straight connector brazed on rigid tube.



EXAMPLE 17

EXAMPLE 18

EXAMPLE 19

EXAMPLE 20

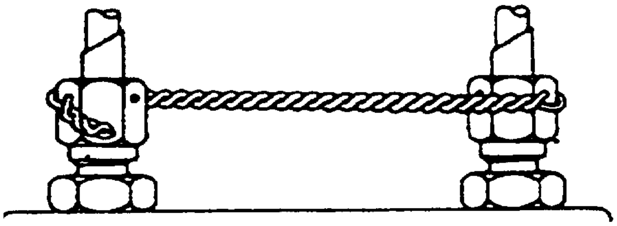
EXAMPLE 21

Fittings incorporating wire lugs shall be wired as shown in Examples 17 & 18. Where no lockwire lug is provided, wire should be applied as shown in Examples 19 & 20 with caution being exerted to ensure that wire is wrapped tightly around the fitting.

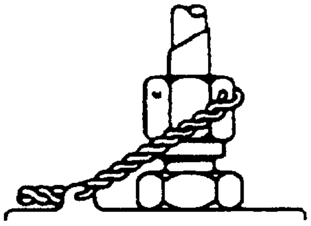
Small size coupling nuts shall be wired by wrapping the wire around the nut and inserting it through the holes as shown.

F16-003S03

Figure 16-6. Safetywiring Procedures (Sheet 3)

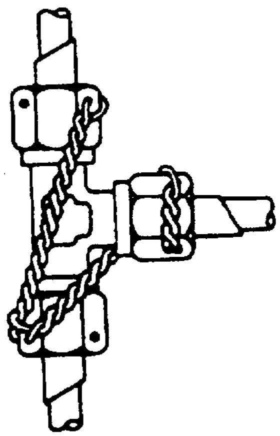


EXAMPLE 22



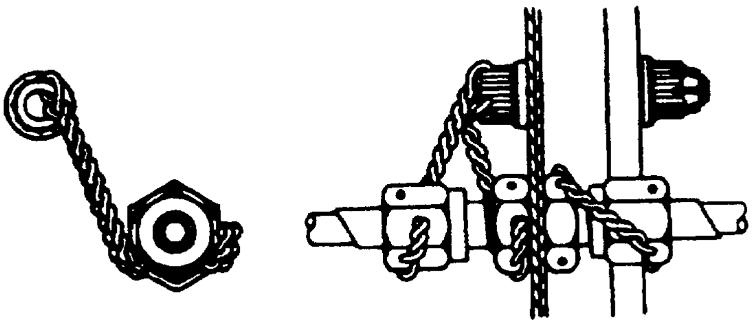
EXAMPLE 23

Coupling nuts attached to straight connectors shall be wired as shown when hex is an integral part of the connector.



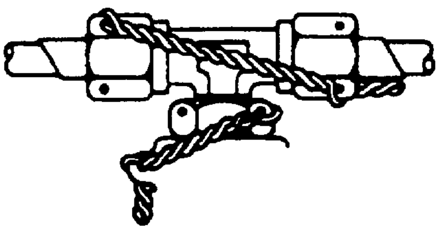
EXAMPLE 24

Coupling nuts on a tee shall be wired as shown above so that tension is always in the tightening direction.

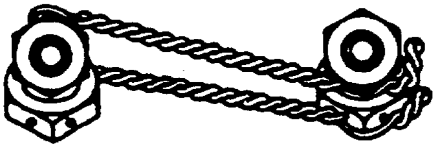


EXAMPLE 25

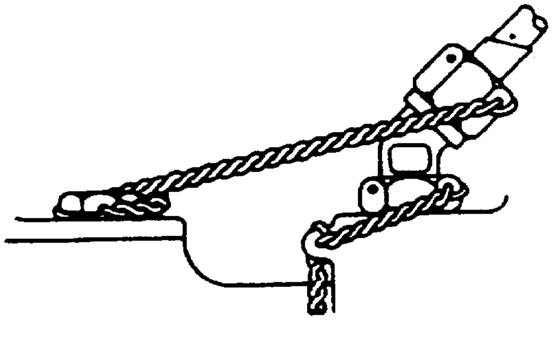
Straight Connector
(Bulkhead Type)



EXAMPLE 26



EXAMPLE 27



EXAMPLE 28

Examples 26, 27, & 28 show the proper method for wiring various standard fittings with check nut wired independently so that it need not be disturbed when removing the coupling nut.

F16-003S04

Figure 16-6. Safetywiring Procedures (Sheet 4)

16.3.3 Addition to Safety Wire.

a. Hollow Headed Bolts with Four Tapped Holes.

(1) Install safety wire on hollow headed bolts with four tapped holes or other similar types of bolts, so that tightening of the other part counteracts loosening tendency of either part.

(2) Starting on an outside bolt, insert wire through two holes crossing in the middle and extend out through opposite set of holes.

(3) Twist wire clockwise for number of twists prescribed by wire gauge used. Repeat for next two bolts.

(4) After the final twist, cut off excess wire and bend the end into hollow bolt.

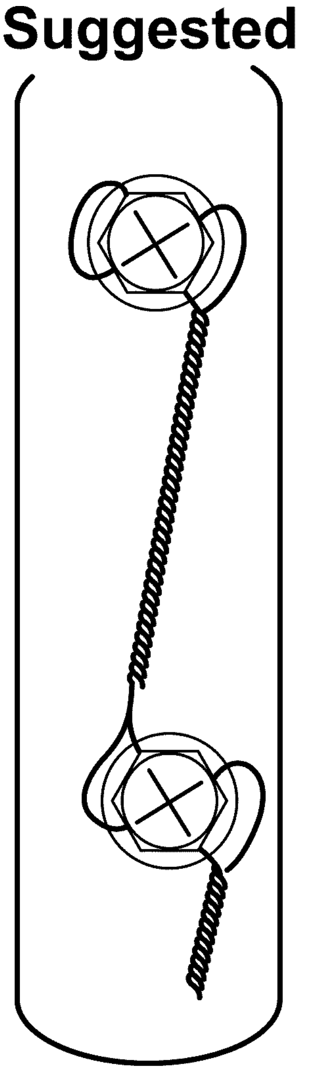
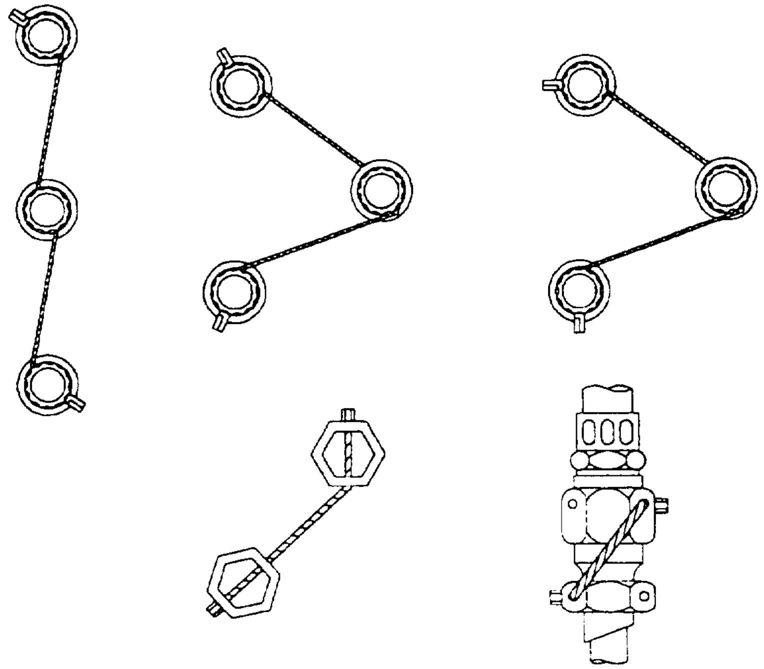
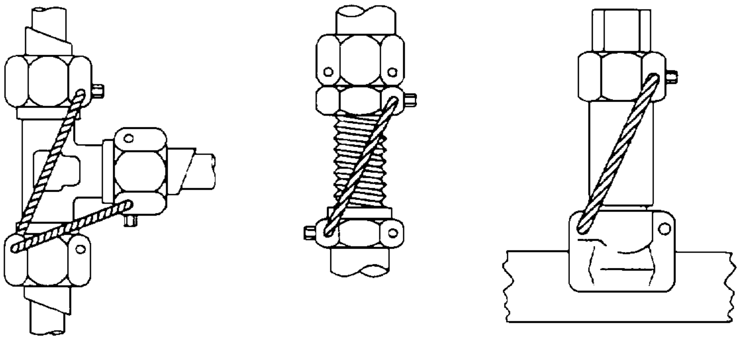


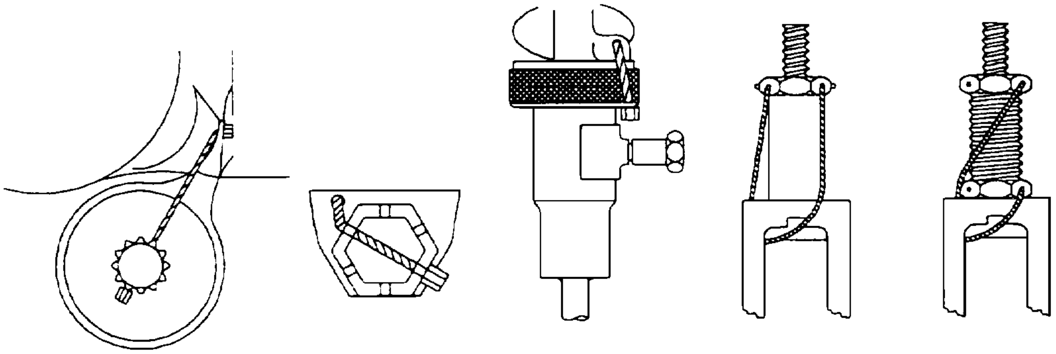
Figure 16-7. Hollow Headed Bolts



STANDARD HARDWARE



TUBE COUPLING



OTHER APPLICATIONS

Figure 16-8. Examples of Installed Safety Cable

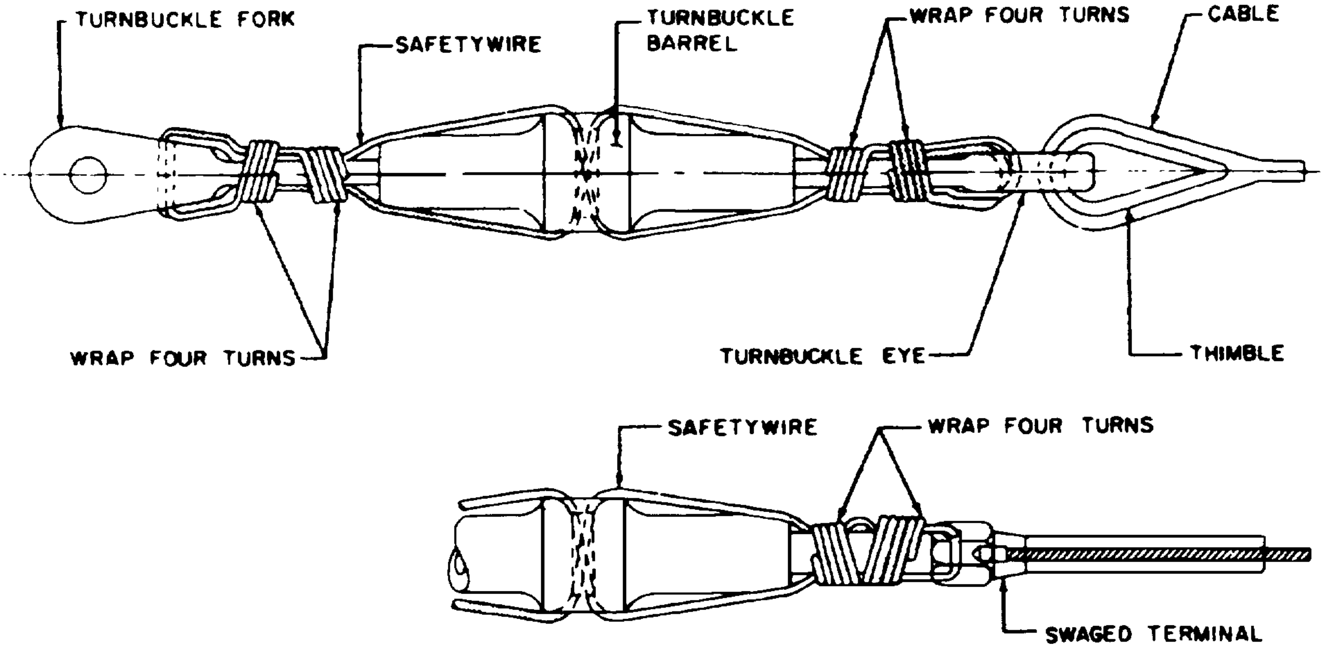


Figure 16-9. Securing Turnbuckles

Table 16-1. Safetywire, Type and Size for Various Turnbuckle Cable Diameters

Cable Diameter	1/16	3/32 or 1/8	5/32, 3/16, 7/32, 1/4, 9/32, 5/16
Turnbuckle, AN155 Dash No.	-5S, 8-S, or-8L	-16S, -16L, -32S or -32L	-32S, -32L, -46L, -80L, -125L or-175L
Carbon Steel	0.032	.041	0.047
Monel			0.040
Inconel	0.020	0.032	
Corrosion-Resistant Steel			0.041
Aluminum Alloy	0.023	0.041	0.047

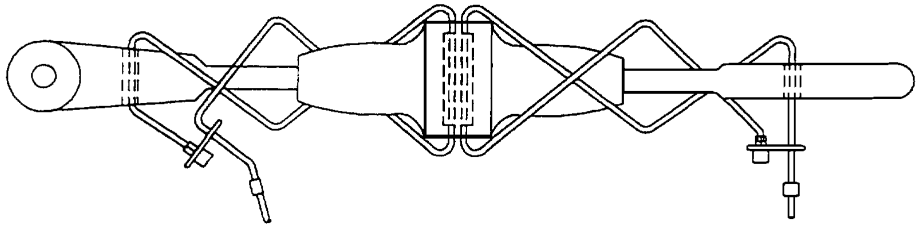


Figure 16-10. Routing of Safety Cable on Turnbuckles

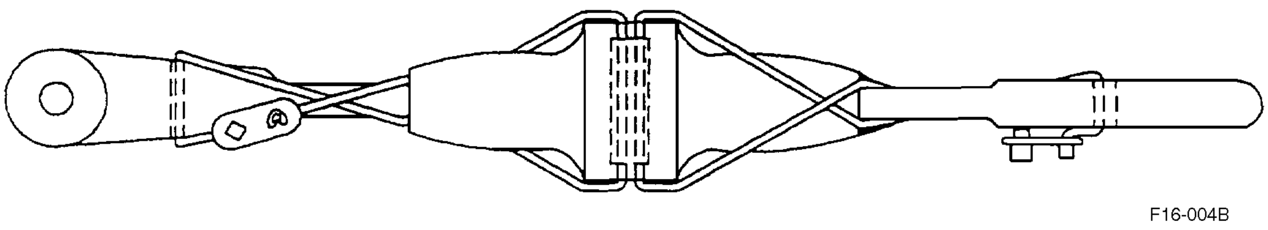


Figure 16-11. Example of Final Safety Cable Turnbuckle Installation

Table 16-2. Safetywire, Number of Turns for Various Turnbuckle Cable Diameters

Turnbuckle	No. of Turns
Short for 1/16 Cable	5 to 7
Short for 1/8 Cable	2 to 3
Long for 3/32 Cable	10
Long for 5/32 Cable	
Long for 3/16 Cable	6 to 8
Long for 1/8 Cable	10

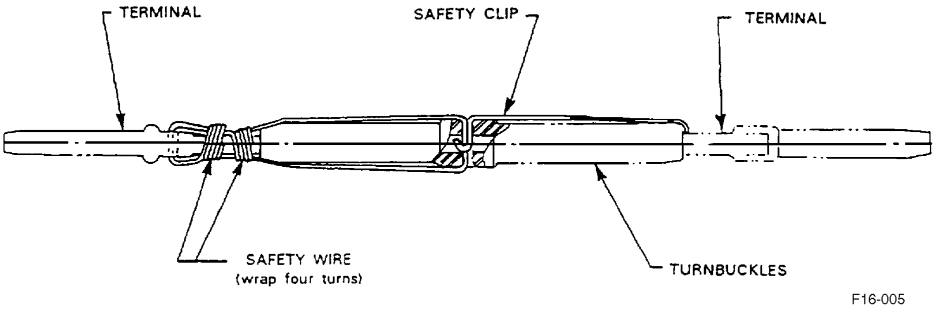


Figure 16-12. Securing Turnbuckle with Safety Clips

Table 16-3. Maximum Thread Extension for Various Cable Sizes and Threads

Cable Dia	Thread	Maximum Thread Extension
1/16	6-40	0.75
3/32	10-32	
1/8		0.85
5/32	1/4-28	
3/16	5/16-24	
7/32	3/8-24	
1/4		
9/32	7/16-20	1.00

Table 16-3. Maximum Thread Extension for Various Cable Sizes and Threads - Continued

Cable Dia	Thread	Maximum Thread Extension
5/16	1/2-20	1.10

16.3.4 Safetywire Sizes.

WARNING

Care should be taken not to confuse steel with aluminum wire.

When using the double-twist method of safety-wiring, 0.032-inch minimum diameter wire should be used on parts that have a hole diameter larger than 0.045 inch. Safetywire of 0.020-inch diameter (double strand) may be used as applicable on parts that have a hole diameter of 0.045 inch or less; or, on parts having a nominal hole diameter between 0.045 and 0.062 inches with a spacing between parts of less than 2 inches. When using the singlewire method, the largest size wire that the hole will accommodate should be used. Copper wire, 0.020-inch diameter, aluminum wire, 0.031-inch diameter, or other similar wire called for in specific technical orders should be used as seals on equipment such as first aid kits, portable fire extinguishers, emergency valves, or oxygen regulators.

A secure seal indicates that the component has not been opened. Some emergency devices require installation of safety or shear wire. Particular care should be exercised to assure that the use of safetywire will not prevent emergency operation of the devices.

16.4 ASSEMBLING AND SECURING CLIP LOCKING TURNBUCKLES.

(See Figure 16-13 and Table 16-4.) Clip locking turnbuckles are assembled and secured as follows:

a. Engage threads of turnbuckle barrel with threads of cable terminal and turn barrel until proper cable tension is reached.

b. Align slot in barrel with slot in cable terminal.

c. Hold lock clip between thumb and forefinger at loop end and insert straight end of clip into opening formed by aligned slots.

d. Bring hook end of lock clip over hole in center of turnbuckle barrel and seat hook loop into hole.

e. Apply pressure to hook shoulder to engage hook lip in turnbuckle barrel and to complete safety locking of one end of turnbuckle.

NOTE

Repeat the above steps to safety lock the opposite end of turnbuckle. Both lock clips may be inserted in the same turnbuckle barrel hole or they may be inserted in opposite holes.

f. After assembly, examine both lock clips to insure that hook lip is properly engaged in turnbuckle barrel hole by applying a slight amount of pressure in the disengaging direction.

NOTE

The turnbuckle assemblies on one or both ends shall be secured by clip locking wherever feasible. The clips shall be installed when the AN part is replaced by an MS turnbuckle on a repair/replacement basis. It is permissible to use a clip locking device on one end and safety wire on the opposite end. (See Figure 16-10, Figure 16-11, and Figure 16-12).

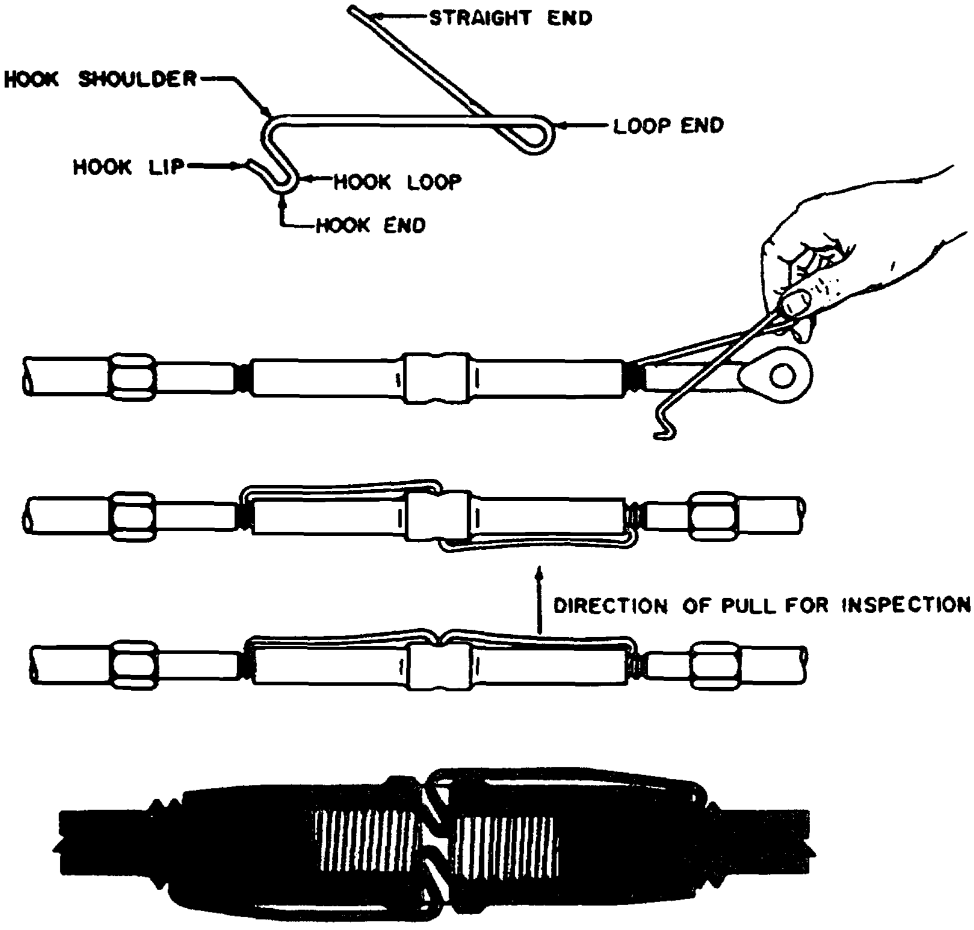


Figure 16-13. Assembling and Securing Clip Locking Turnbuckles

Table 16-4. Locking Clip Application

Nominal Cable Dia.	Thread UNF-3	Locking Clip MS21256	Turnbuckle Body MS21251
1/16	No. 6-40	-1	-2S
3/32	No. 10-32		-3S
		-2	-3L
1/8	1/4-28	-1	-4S
		-2	-4L
5/32		-1	-5S
		-2	-5L
3/16	5/16-24	-1	-6S
		-2	-6L
7/32	3/8-24		-7L
1/4			-8L
9/32	7/16-20	-3	-9L

Table 16-4. Locking Clip Application - Continued

Nominal Cable Dia.	Thread UNF-3	Locking Clip MS21256	Turnbuckle Body MS21251
5/16	1/2-20		-10L

16.5 SAFETY CABLE.

a. Safety Cable Installation. Safety cable may be used as a substitute for lockwire to prevent loosening during service. Threaded parts, such as drilled-head bolts, fillister head screws, turnbuckles, thumbscrews, hose fittings and electrical connectors, plugs, caps, and similar items are within the scope of the safety cable application. The following rules shall apply when using safety cable.

NOTE

Routing of safety cable may vary from that of lockwire in order to achieve a proper installation.

(1) When safety cable is being substituted for lockwire in an existing installation (maintenance, rework, etc.), equivalent diameter safety cable to that of the lockwire shall be selected for use, providing that selection criteria for safety cable as defined in the safety cable procedures, paragraphs 16.1.6 and 16.3.2 and 16.5 are met.

(2) Adjacent Units: Safety cable shall be installed in such a manner that any tendency for a fastener to loosen will be counteracted by an additional tension on the cable. Safety cable shall be threaded through the fasteners in such a way as to produce installed safety cable with either positive or neutral pull.

(3) Maximum Span: The maximum span of safety cable between two termination points shall be 6 inches (152.4 mm) unless otherwise specified.

(4) Installing Defects: Any cable defect (nick, fray, kink, or any other mutilation of the safety cable) found prior to, during, or subsequent to installation, is not acceptable.

NOTE

Avoid kinks or sharp bends while handling and threading safety cable.

(5) Applications where safety cable is to be installed through a hole having a nominal diameter of greater than 0.095 inch (2.41 mm), but less than 0.200 inch (5.08 mm) shall require a flat washer (same material composition as the safety cable) which is supplied by the safety cable manufacturer for this purpose, and shall be used as shown in Figure 16-14.

(6) Safety cable shall be installed with an application tool which has been calibrated to meet the performance requirements of AS4536 (SAE) and this manual.

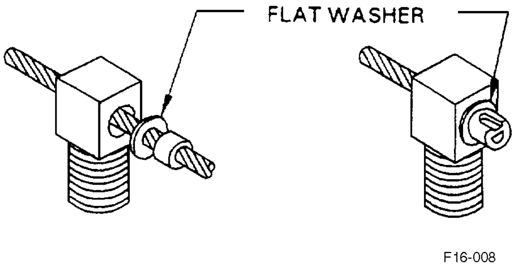


Figure 16-14. Flat Washer Safety Cable Installation

(7) Installing Holes: Safety cable must be installed through the holes intended for this purpose in the part being secured, or through the holes provided in a self looping device secured to the safety cable by the safety cable manufacturer (Refer to Figure 16-15). In applications where holes are not provided for safety cable in the component to which it is attached, the self looping safety cable may be used in a manner like, or similar to Figure 16-16.

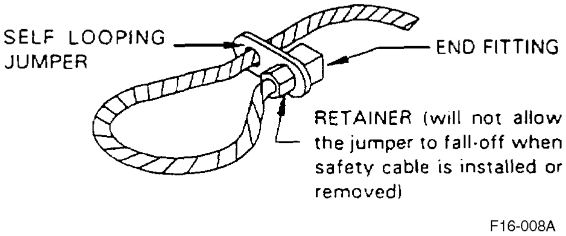


Figure 16-15. Self-Looping Safety Cable

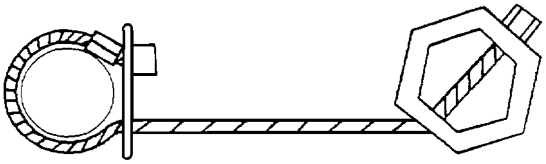


Figure 16-16. Self-Looping Safety Cable Anchored to a Pin Assembly

(8) Safety Cable/Ferrule Reuse: Safety cable and ferrule shall be new upon each application. Reuse is not allowed.

(9) Installation: Various examples of safety cable installation are shown in Figure 16-7. All possible combinations and applications are not shown. Unless otherwise specified, safety cable shall be installed in two or three bolt patterns with two bolt patterns being the preferred method where an even number of fasteners are to be secured. The installer must adhere to the basic rules outlined in this manual.

(10) Hose fittings and Electrical Connector Requirements: Hose Fittings and electrical coupling nuts shall have safety cable installed in the same manner as tube coupling nuts.

(11) Excess Cable: After installing safety cable, excess cable from the crimped ferrule shall be cut by the installation tool. The maximum allowable length of cable extending beyond the ferrule shall be 0.031 inch (0.79 mm).

(12) Crimping Requirements (Pull-Off Load Refer to Table 16-5): Safety Cable shall be installed with the Safety Cable manufacturers recommended tool, which has been tested and calibrated in accordance with procedures specified in paragraph 16.6.2 of this manual.

Table 16-5. Safety Cable Minimum Crimp Requirements (Pull-Off Load)

Nominal Cable Diameter inch (mm)	Safety Cable Construction	Minimum Pull-Off Load lbf (N)
.020 (0.51)	1 x 7	30 (133.4)
.032 (0.81)	3 x 7	70 (311.4)
.040 (1.02)	7 x 7	110 (489.3)

(13) Hole Alignment: Undertorquing or overtorquing to obtain proper alignment of the holes is not permitted. Apply recommended torque values to parts to be secured, and alignment of holes shall be evaluated before attempting to proceed with safety cable installation.

WARNING

The maximum bend exit limit of safety cable, when applied to a threaded fastener head, shall be 145°. This does not apply to hose fittings, electrical connector coupling mechanisms, turnbuckles, and similar applications where the safety cable is constrained by the shape of the component being secured.

(14) In applications where safety cable shall be required to exceed the 145° maximum bend exit limit in order to achieve neutral to positive pull on a threaded fastener head, a self looping device which is secured to the safety cable by the safety cable manufacturer may be used to obtain a secured installation as shown. (Refer to Figure 16-15 and Figure 16-17).

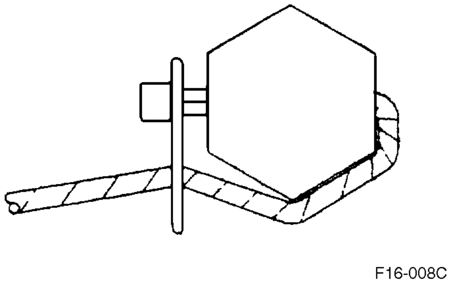


Figure 16-17. Self-Looping Safety Cable in High Bend Exit Application

WARNING

This method should only be used in applications where the safety cable can not ‘‘flip’’ over the corner or over the head of the fastener being secured.

(15) Cable Flex Limits: After installing safety cable, the maximum flex between termination points shall be no greater than the specified in the Cable Flex Limit Table. (Refer to Table 16-6).

NOTE

Light finger pressure of approximately 2 pounds shall be applied at mid-span when inspecting total flex limit of installed safety cable.

Table 16-6. Flex Limits, Inch (mm)

A	B	C
0.5 (12.7)	0.125 (3.18)	0.062 (1.59)
1.0 (25.4)	0.250 (6.35)	0.125 (3.18)
2.0 (50.8)	0.375 (9.52)	0.188 (4.76)
3.0 (76.2)	0.375 (9.52)	0.188 (4.76)
4.0 (101.6)	0.500 (12.70)	0.250 (6.35)
5.0 (127.0)	0.500 (12.70)	0.250 (6.35)
6.0 (152.4)	0.625 (15.88)	0.312 (7.94)

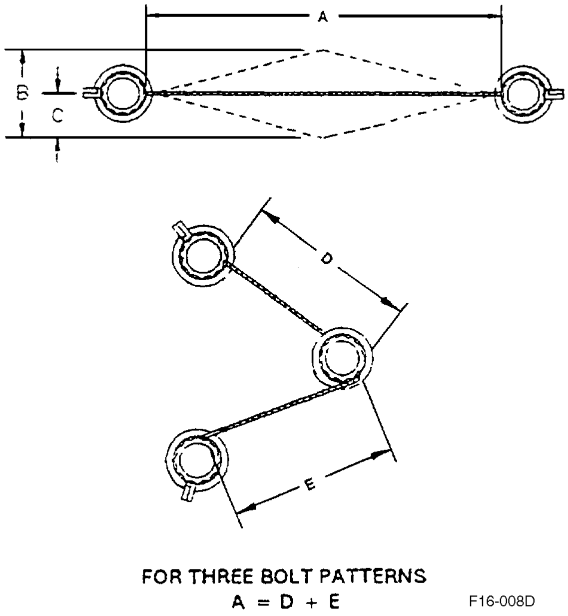


Figure 16-18. Safety Cable Flex Limits

NOTE

It is important to hold the tool as steady and perpendicular to the fastener as possible during the crimp/cut cycle in order to maintain consistent tensioning of the cable after the tool is removed.

b. Elongated Ferrules: Ferrules of extra length, having a radius at one end and a straight surface at the other end, may be used in applications which restrict the clearance for the installation tool nose to be placed in correct alignment with the fastener (such as low profile fastener heads, recess locations, or obstructions by structures or installed components) Refer to Figure 16-19.

NOTE

- Always install elongated ferrules with the radius end toward the fastener, and the straight end in the tool crimp cavity. Double check cable tension between fasteners after removal of application tool.
- Radius required on 0.032 inch diameter and larger elongated ferrules. Radius optional on 0.020 inch diameter elongated ferrules.

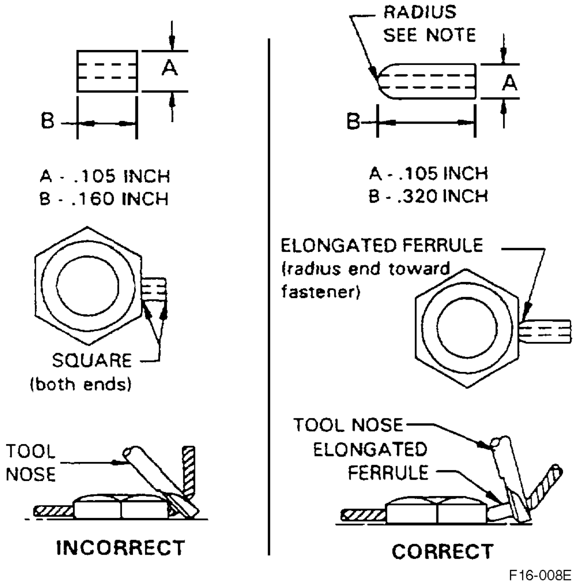


Figure 16-19. Low Profile Application for 0.032 and 0.040 Inch Safety Cable

c. Safety cable identification stamp. In applications where the user requires a logo or ID code to be a permanent part of the safety cable installation (for warranty or traceability), it shall be applied by the safety cable manufacturer to one or more surfaces of the square end fitting of the safety cable. Only impression stamping is permitted, no paint, ink, or labels are acceptable (Refer to Figure 16-20).

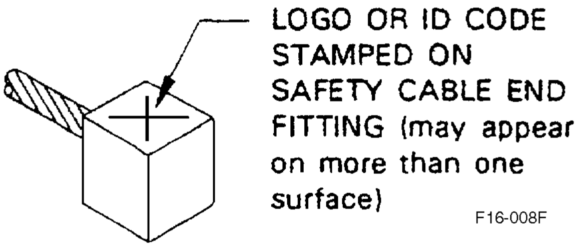


Figure 16-20. Safety Cable Identification Stamp

d. Safety Cable Jacketing for Protection. It is recommended to use a tubular jacket over safety cable when it is installed in a location where it is in contact with (or may contact) surfaces which may damage the safety cable. A tubular jacket material shall be capable of meeting the temperature range of the application, and shall be resistant to oil and chemical environments (Refer to Figure 16-21).

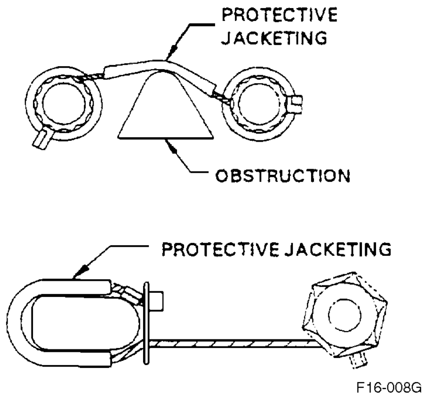


Figure 16-21. Safety Cable Jacketing for Protection

e. A self-looping safety cable is used to secure threaded tube fittings as shown in Figure 16-22. After torquing, the cable is threaded through the safety holes in the fitting, and terminated at the self looping jumper.

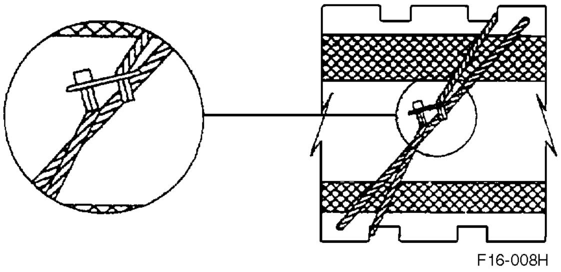


Figure 16-22. Safety Cable on Tube Couplings

16.6 SAFETY CABLE APPLICATION TOOLS.

a. Procedures. When safety cable is used, the following basics apply for the application tools and calibration equipment.

(1) Minimize mixing of safety wire and safety cable.

(2) Install the ferrule cartridge into the tool body under the handle grip.

NOTE

When loading and using the safety cable application tools, be certain that the correct size safety cable and ferrules are being used with the tools.

(3) Install the Safety Cable through the fasteners to be secured.

(4) The nose can index to four positions at 90° increments. To select the position, push the nose in towards the tool and rotate to the desired position. Release the nose, if the nose does not lock into the indexed position, turn it slightly until it locks (Refer to Figure 16-23).

(5) Insert the free end of the cable through the ferrule in the cartridge, and remove the ferrule by pulling the cable away from the end of the cartridge (Refer to Figure 16-23).

NOTE

Do not release the free end of the cable until it has been inserted through the tool nose (Refer to Figure 16-24).

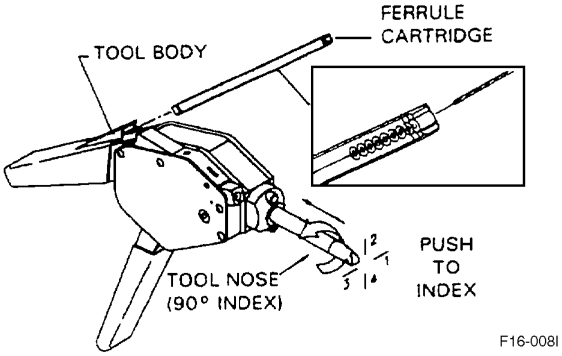


Figure 16-23. Pre-Set Tension Safety Cable Tool

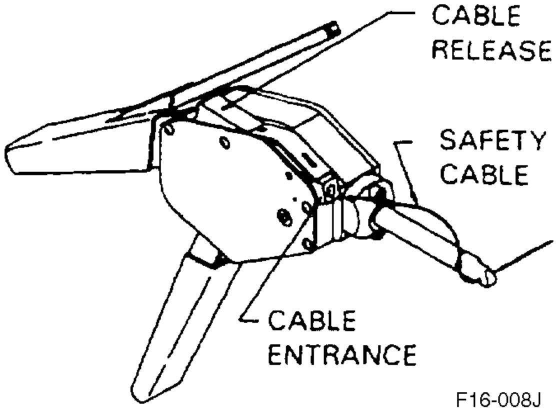


Figure 16-24. Safety Cable Tools

(6) Insert the free end of the cable through the tool nose and slide the tool along the cable to the fastener being secured (Refer to Figure 16-25).

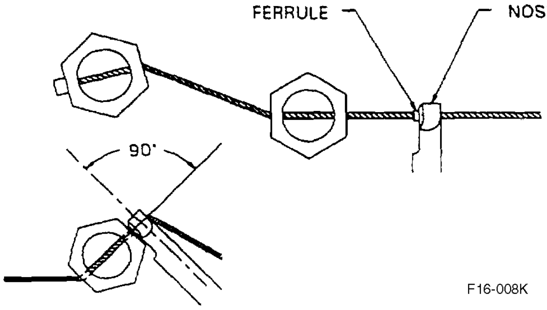


Figure 16-25. Position of Safety Cable Tool

16.6.1 Types of Safety Cable Tools.

a. The pre-set tension tool. (Refer to Figure 16-23 and Figure 16-24). Insert the free end of the cable into the cable entrance and continue to push the cable into the cavity. When the free end of the cable appears at the bottom of the tool, grip the cable and pull the slack from the cable until resistance is felt. Begin removing slack from the cable by repeatedly closing the tool handle allowing the handle to open fully before closing again. When all slack is removed from the cable, snug the tool against the fastener by using several short strokes of the handle. Release the handle to the full open position and fully close the handle to crimp securely and cut flush.

NOTE

It is important on this final stroke to hold the tool as steady and perpendicular to the cable as possible while completing a full stroke. This assures consistent tensioning of the cable (Refer to Figure 16-25).

b. Adjustable tension tool. (Refer to Figure 16-26). Thread the safety cable through the fastener, ferrule, and tool nose in the same way as with other models. Wrap the cable one full revolution (clockwise) around the tension wheel, and with slight pressure applied by pulling the cable, secure the cable into the slot. Rotate the tension knob until several clicks are heard and felt. If additional tension is required, adjustment can be made with the tension adjuster on the opposite side of the tool.

WARNING

Do not overtighten safety cable. It is a good practice to find a tension setting which removes the slack from the cable, (in order to meet the flex limit requirement) without over stressing the safety cable components.

(1) Completely close the handle to crimp and cut the cable. Hold the tool steady and perpendicular to the cable to maintain consistent cable tension. Release the handle and remove the tool from the crimped ferrule. Remove the excess cable segment from the tool prior to the next application.

(2) If it is more convenient to use the adjustable tension tool with the knob located on the opposite side, you may remove the retaining ring located below the tension adjuster, slide the knob assembly out of the tool body, and reinsert it on the opposite side. Re-install the retaining ring. (Refer to Figure 16-26)

NOTE

When using a hand tool, the tool handle is to remain fully open during the cable entry process (in both tool models). The handle is to be actuated in the pre-set tension model after the tension pawl is engaged with the cable, and in the adjustable tension model only after the desired tension is achieved.

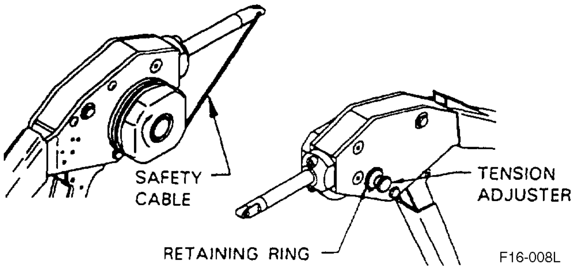


Figure 16-26. Adjustable Tension Safety Cable Tool

c. The pneumatic safety cable application tool. (Refer to Figure 16-27). Connect the Pneumatic Safety Cable Tool to a clean, dry air supply of 80 to 100 psi.

(1) Install the safety cable through the fasteners which are to be secured.

(2) The nose can be indexed to four positions in 90° increments. To select the position, push the nose in towards the tool and rotate to the desired position. Release the nose. If the nose does not lock into the indexed position, turn it slightly until it snaps into position and locks.

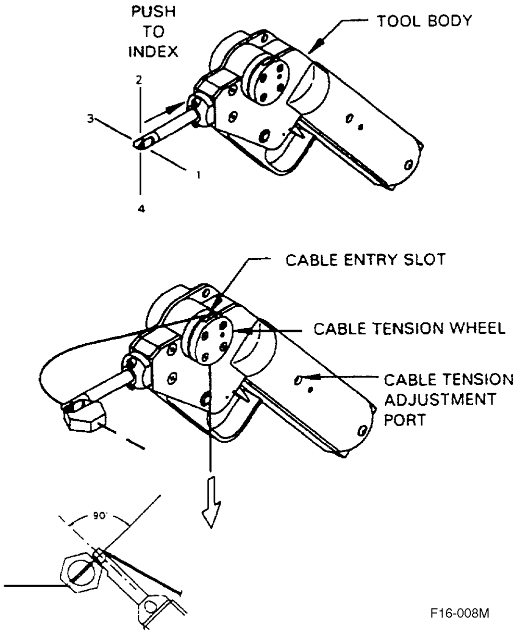


Figure 16-27. Pneumatic Safety Cable Application Tool

WARNING

Do not actuate the pneumatic tool unless the nose is locked into position. Actuation of the tool without the nose being locked will severely damage the nose or other tool components.

(3) Insert the free end of the cable through the ferrule in the cartridge and remove the ferrule by pulling the cable away from the end of the cartridge. Insert the free end of the cable through the nose of the tool and slide the tool along the cable to the desired position.

(4) Rotate the cable tensioning wheel clockwise if necessary to move the cable entry slot to an accessible position. Align the nose such that the ferrule is pressed squarely against the fastener. Make certain that the ferrule is fully seated into the nose. Insert the free end of the cable into the cable entry slot of the cable tensioning wheel. When the end of the cable exits the wheel, grip the cable and pull the slack from the cable. Do not leave more than 1 1/2 inch of total slack in the cable.

(5) Press the trigger and hold. The tool will apply tension to the cable, crimp and cut. When the trigger is released, the crimp mechanism will retract (after the cycle is complete), and the tool nose can be removed from the ferrule. The excess cable shall be discarded.

(6) The tension is adjustable by inserting the adjustment key (to be supplied by the manufacturer) into the adjustment port located on the tool handle. Clockwise rotation increases tension, and counter clockwise rotation decreases tension.

16.6.2 Safety Cable Application Tool Maintenance and Calibration. The safety cable tools should be stored in a clean, dry place when not in use. Clean any debris (especially in the crimp cavity in the tool nose) from the tool with a small brush and solvent if necessary. Lubricate the tool nose (into the crimp cavity) with a drop of oil on a regular basis.

a. Tool calibration verification with the safety cable test fixture or electronic pull tester.

NOTE

Indenter Calibration should be verified periodically and must always be checked if the nose assembly has been removed or changed.

(1) Use of the calibration test fixture and torque wrench to verify safety cable tool indenter adjustment. (Refer to Figure 16-28). Thread the safety cable into the 12 pt. screw and through the swivel, holding the lever against the built-in-stop. If the lever is not kept against the stop, the results may be adversely affected. Terminate the safety cable with the tool being tested.

(2) Apply approximately 2 lbs force to the cable with your finger at the line marked ‘‘test area.’’ The cable shall not touch either the side or bottom surface of the test fixture.

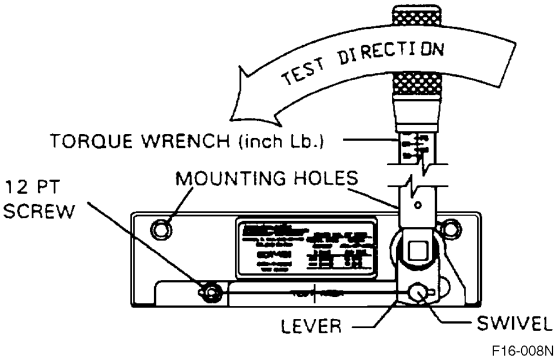


Figure 16-28. Calibration Test Fixture and Torque Wrench

(3) Place a calibrated 3/8 inch drive torque wrench (capable of indicating 30 inch. lb. for 0.020 inch safety cable, 70 inch. lb. for 0.032 inch safety cable and 110 inch. lb. for 0.040 inch safety cable) into the square drive hole, as shown in Figure 16-28, orienting the test block and torque wrench on a stable surface. Slowly and steadily apply the required torque for the cable size being tested, do not over torque the cable.

Table 16-7. Torque Wrench Pull-off Loads for Safety Cable

Safety Cable Diameter Inch	Torque Wrench Minimum Pull-Off-Load Inch-Pounds
.020	30 IN/LB
.032	70 IN/LB
.040	110 IN/LB

(4) The safety cable should remain in place during application of the measured torque (specified in Table 16-7). Apply approximately 2 lbs. force to the safety cable with your finger at the line marked ‘‘test area.’’ If the safety cable touches either the side (or bottom) surface of the test fixture, the tool indenter should be adjusted.

(5) Use of an electronic pull tester to verify Safety Cable tool indenter adjustment. (Refer to Figure 16-29). It may be required in some applications to pull test safety cable to destruction. If this is required, an electronic pull tester may be used in place of the calibration test fixture/torque wrench method.

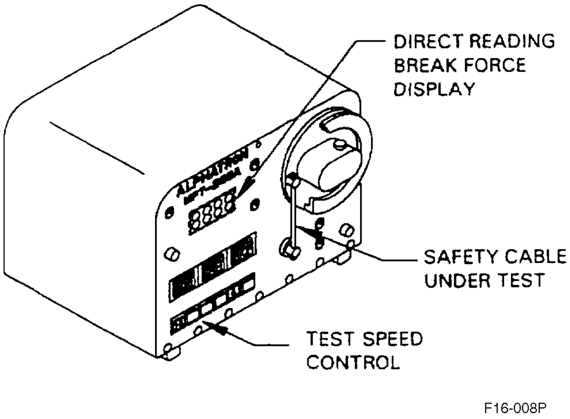


Figure 16-29. Electronic Safety Cable Pull Tester

b. Indenter adjustment for all safety cable application tools.

NOTE

Calibration should be checked frequently by the use of the calibration test fixture, or the electronic pull tester.

(1) Remove the nose assembly by removing the two 8-32 socket head cap screws with a 9/64 inch hex wrench. (Refer to Figure 16-30.)

(2) Adjust the pushrod adjustment screw with a flat blade screw driver, or the adjustment key (to be supplied by the manufacturer). (Refer to Figure 16-31.) Turn the pushrod adjustment screw clockwise to loosen the crimp (enlarge the gaging dimension), or counterclockwise to tighten the crimp (reduce the gaging dimension). Replace the nose assembly and the two 8-32 socket head cap screws, being sure that they are firmly tightened. Check calibration as previously described.

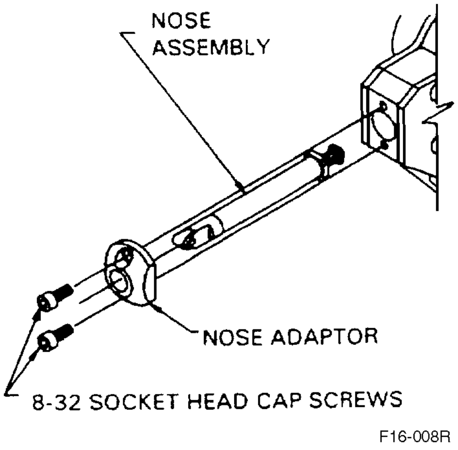


Figure 16-30. Removal of Safety Cable Tool Nose Assembly

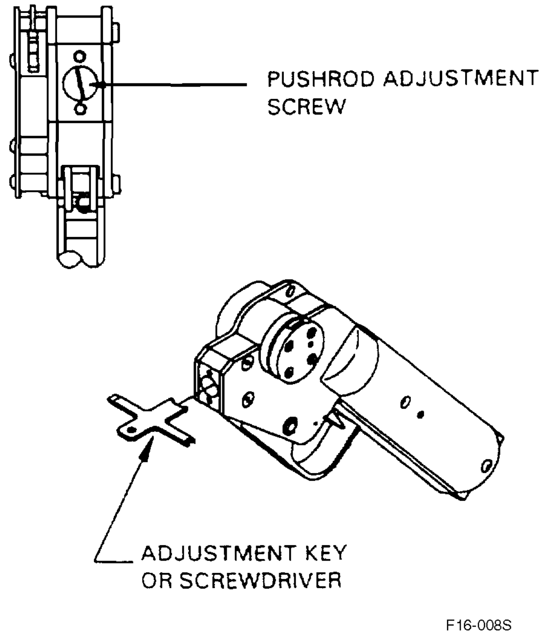


Figure 16-31. Adjustment of Safety Cable Indenter (Same for Hand or Pneumatic Tool Models)

16.7 SECURING WITH COTTER PINS.

WARNING

Do not adjust the pushrod more than a quarter of a turn at a time, severe adjustment may damage the tool.

NOTE

Some tool models utilize a pushrod lock nut. This must be loosened prior to adjustment, and tightened after adjustment with the adjustment key provided by the manufacturer.

(See Figure 16-32 and Figure 16-33.) MS24665 reflects a variety of cotter pins for selection.

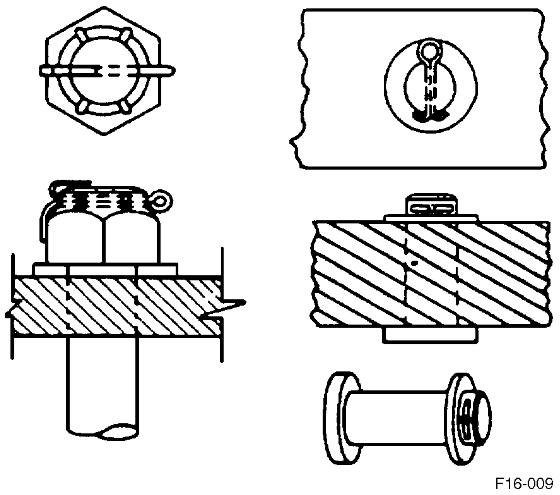


Figure 16-32. Securing with Cotter Pins

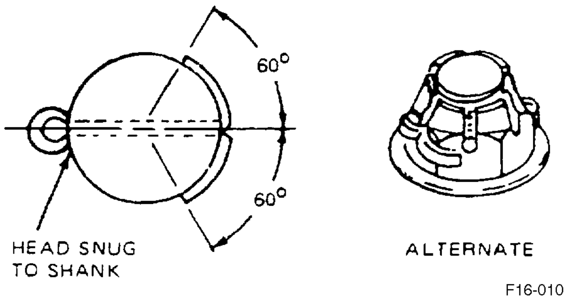


Figure 16-33. Alternate Method

WARNING

Installation of cotter pins should be in accordance with NASM33540. To prevent injury during and after pin installation, the end of the cotter-pin, upper prong, can be rolled and tucked.

CAUTION

In using the method of cotter pin safetying, as shown in Figure 16-32, insure the prong bent over the bolt is seated firmly against the bolt shank, not to exceed bolt diameter, and the prong bent down and firmly against the nut flat does not contact the surface of the washer.

16.7.1 Cotter pins are used to secure such items as bolts, screws, pins, and shafts. Their use is favorable because they can be removed and installed quickly. The diameter of cotter pins selected for any application should be the largest size that will fit consistent with the diameter of the cotter pin hole and/or the slots in the nut, unless otherwise specified in the applicable maintenance or overhaul technical manual for the item or assembly in question. Cotter pins will not be re-used on aircraft and missiles.

16.7.2 Using the lowest specified torque value, tighten nut until shank aligns with the slot in nut (Figure 16-34). If alignment is not proper for insertion of pin, tighten nut (without exceeding torque specification) until hole appears in slot.

NOTE

When properly installed, the cotter pin hole is aligned so that no more than one-half the diameter of the cotter pin protrudes above the nut castellation. If necessary, a maximum of two washers may be installed under the nut to properly locate the cotter pin.

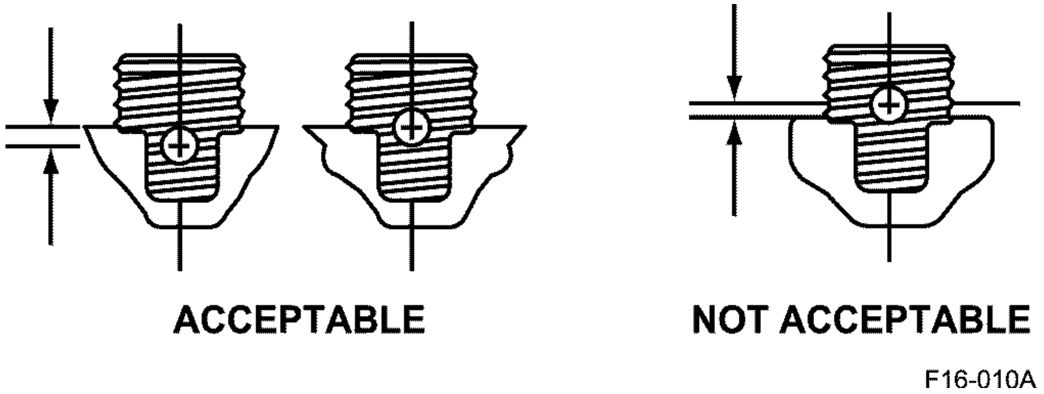
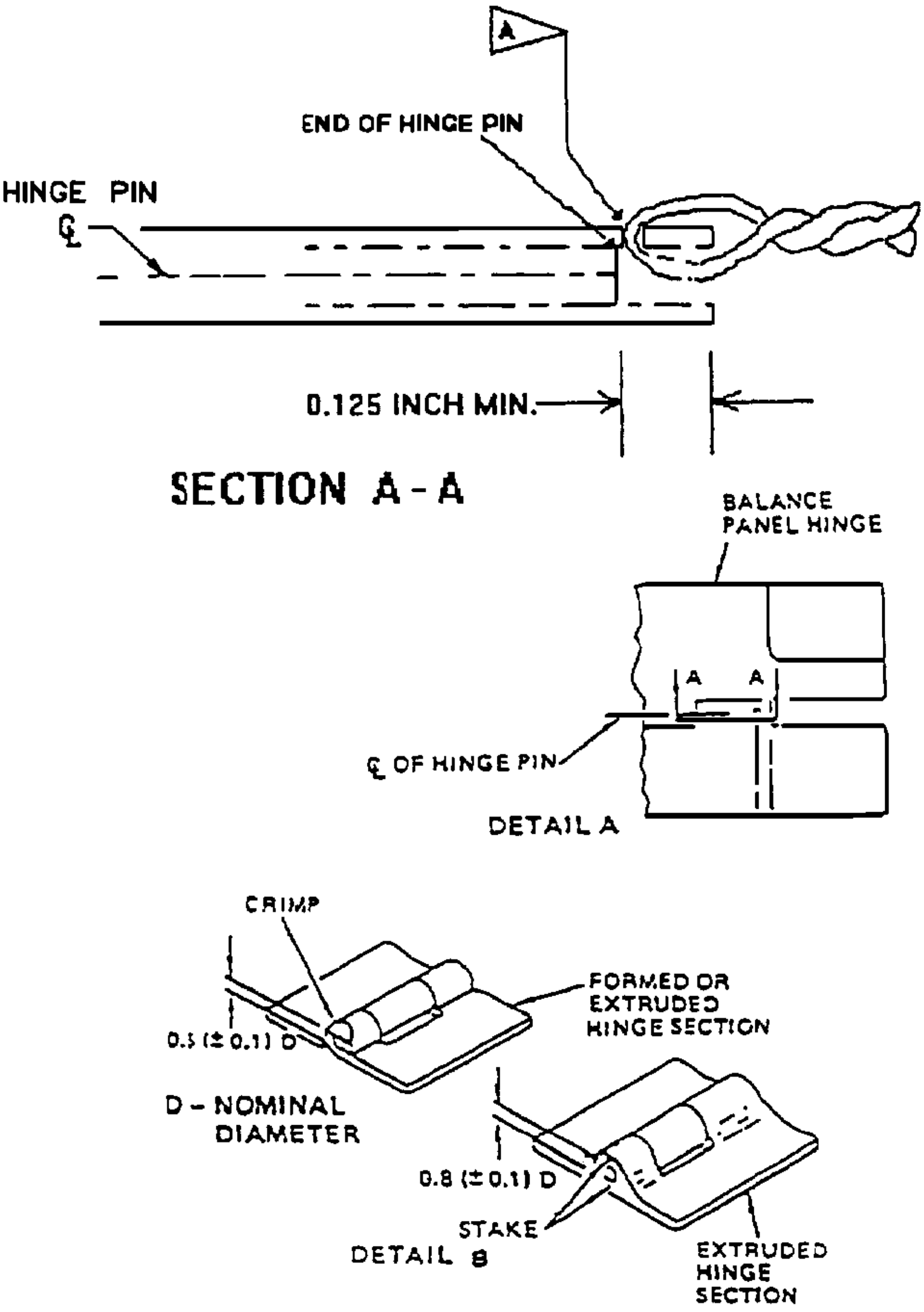


Figure 16-34. Castellated Nut Installation

16.8 SAFETYING HINGE PINS.

Balance hinge pins shall be secured with safety wire wherever possible per Detail A of Figure 16-35. Other hinge pins not retained by mechanical means are crimped or staked as shown in Detail B. The hinge pin is cut to leave an 1/8 inch recess before crimping or staking.



NOTE

A Drill 0.04 (+0.01/-0.03) inch diameter hole 0.125 inch minimum from inboard end of hinge, through half of hinge loop only, and safety as shown with 0.032 inch corrosion resistant safety wire.

F16-011

Figure 16-35. Safetying Hinge Pins

CHAPTER 17

QUICK CONNECT/DISCONNECT COUPLINGS, SELF-SEALING, MANUAL OPERATING TYPE

17.1 HISTORY AND ADVANTAGES.

Development of these type couplings is directly related to the advent of compact high performance aircraft and aerospace ground equipment. Advantages include ease and speed of connecting and disconnecting plumbing systems, particularly in congested areas. Other advantages fostered by incorporation of self-sealing valves are elimination of system fluid or gas loss, hazards related thereto and clean-up time in addition to eliminating or lessening introduction of air into system. These advantages are afforded without compromise of system reliability if certain basic principles of coupling operation are understood and coupling is given normal care and proper maintenance.

17.2 TYPES OF QUICK DISCONNECT COUPLINGS.

The more common type quick disconnect couplings, their principles of operation and other related information are outlined as follows:

17.2.1 Screw Type.

17.2.1.1 Connecting Coupling Halves. (See Figure 17-1.) Join coupling halves by rotating the union nut in direction (X). Tighten until the teeth (A) of the union nut, fully engage the teeth (B) of the lock spring. There is a distinct clicking noise as the teeth engage.

17.2.1.2 Proper tightening may be determined by visual inspection of the lock spring or by feel. The legs of the lock spring will extend gap (C) beyond the main-plate. The inner ring and outer sleeve of the union nut will be flush as indicated (D). Note that the outer sleeve (E) remains loose. Its only function is to release the teeth of the union nut from the lock spring when disconnecting the coupling.

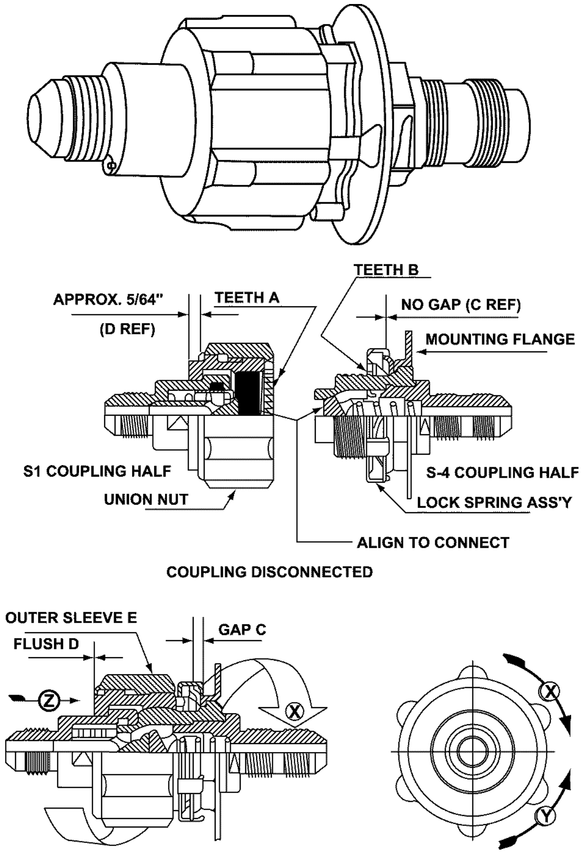
17.2.1.3 The union nut may be tightened easily by hand. However, in inaccessible locations, a wrench may be used. Excessive torque may damage the union nut and cause malfunctioning of the lock spring releasing mechanism. A crowfoot type wrench is highly recommended. Never use a striking block, pipe wrench, or water pump pliers on the union nut.

17.2.1.4 The lock spring is provided for safety and in no case should the coupling be connected without the lock spring.

17.2.1.5 When these coupling halves are properly connected the valve assembly in the S1 half and the valve in the S4 half will force each other to the full open position. In this position, the valve springs will be depressed and under sufficient tension to immediately return the valves to the closed position and seal off system fluid or gas flow when coupling halves are separated. Refer to Figure 17-1 for basic instructions and torque values.

17.2.2 Quick Threading - Indicating Type. This type coupling (Figure 17-2) is readily connected by twisting the socket in a clockwise direction onto the threaded nipple portion. The 3 equally spaced indicating pins on the socket half will assume an extended position when these coupling halves are properly connected and will assume a retracted position when coupling halves are separated (see Figure 17-2). Their only function is to provide a see or feel means of determining whether or not the coupling is fully connected. The 3 indicating pins have no effect whatever on locking the coupling in the connected position.

17.2.2.1 Disconnect is accomplished by pulling back the knurled socket outer shell and turning counterclockwise. This type coupling employs spring loaded valves which open each other when coupling is connected and immediately return to the closed position when disconnected. Do not employ gripping tools to connect or disconnect these type couplings as these actions can be readily accomplished by hand.



TORQUE VALUES TO
PROPERLY CONNECT

SIZE	TORQUE
4 & 5	10 ft. lbs.
6 & 8	15 ft. lbs.
10 & 12	20 ft. lbs.
16, 20, & 24	30 ft. lbs.

F17-001

Figure 17-1. Screw Type Couplings

17.2.3 Inst-o-Matic Push-Pull Type.

CAUTION

The socket half of this type coupling is permanently assembled by a wire lock ring. Excessive wear on this ring and the pressure flank of the Acme thread will allow the poppets to move from a stationary open position and restrict flow through the coupling. Refer to paragraph 17.7 for inspection procedures and acceptable wear limits.

This type coupling (Figure 17-3) is readily connected by pulling back the spring loaded outer shell of the socket, and while in this condition, push socket firmly onto the nipple and release the socket shell. In the connected condition, the socket locking dogs will engage in the nipple lock collar and prevent separation. The socket and nipple spring loaded valves will force each other to the FULL OPEN position.

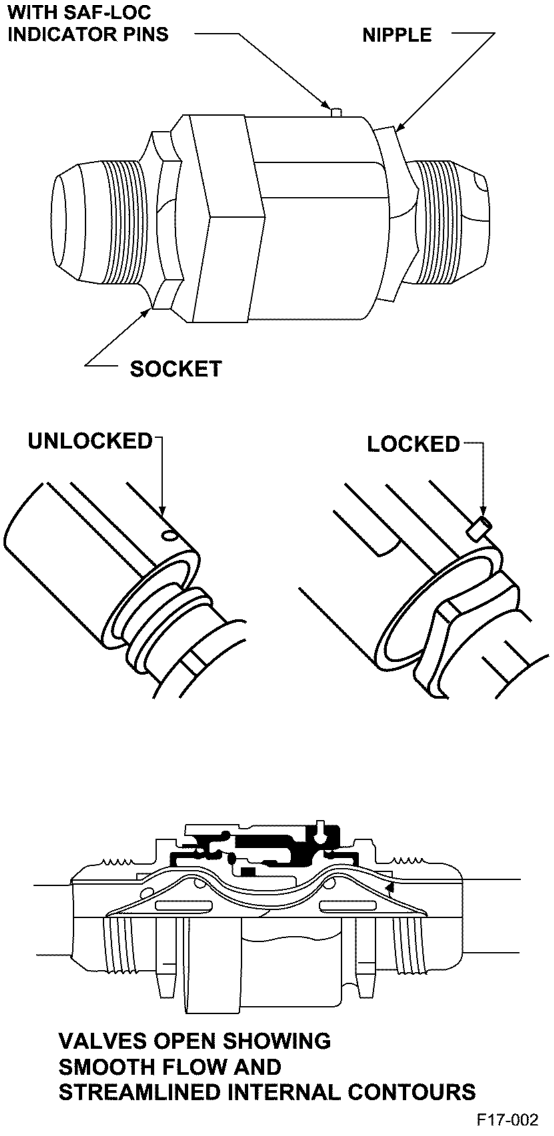


Figure 17-2. Quick Thread-Indicating Type

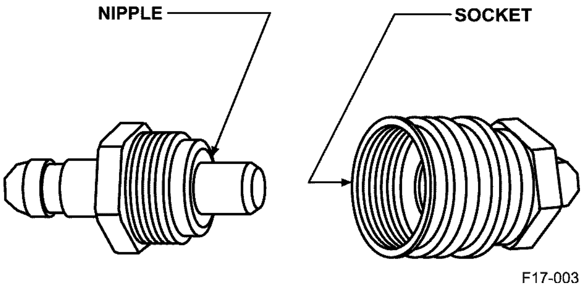


Figure 17-3. Inst-o-Matic Push-Pull Type

17.2.3.1 Disconnect is readily accomplished by pulling in a backward motion on the socket outer shell. In the disconnected condition, the nipple and socket spring loaded valves will assume a closed attitude and prevent system leakage.

17.2.3.2 The number of locking dogs incorporated in the socket portion will vary with the size of the coupling and will increase in number in the larger coupling sizes. The principle of operation, however, will remain the same regardless of the size.

17.2.4 Full Grip - Push-Pull Type. This type coupling (Figure 17-4) is similar in operation to the coupling shown in Figure 17-3. Connection is accomplished by pushing the mating halves together. Disconnect is easily accomplished by pulling back on the nipple outer shell. The coupling spring loaded valves will force each other to the FULL OPEN position when connected and will automatically close and seal off the system when the coupling is disconnected.

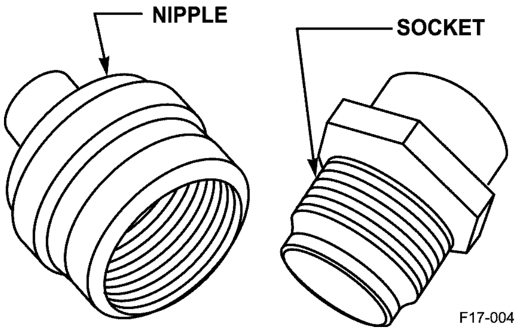


Figure 17-4. Push-Pull Type

17.2.5 Straight-Flow Ball Valve Type. This type coupling (Figure 17-5) employs a drilled ball valve in each coupling half to effect open and closed valve condition.

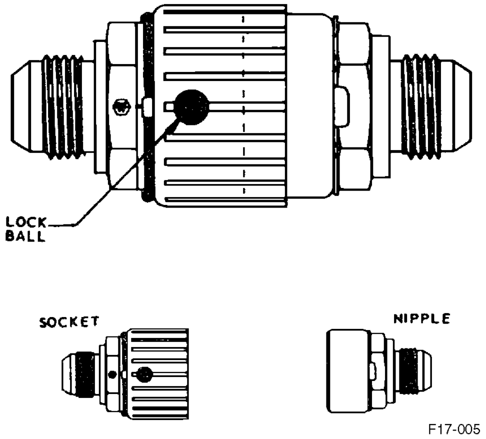


Figure 17-5. Straight-Flow Ball Valve Type

17.2.5.1 To connect, mate the socket to the nipple portion and turn socket in a clockwise direction. In the coupling connected condition the lock ball on the socket half will protrude through the socket outer shell. To disconnect, push down the lock ball and simultaneously rotate the socket in a counterclockwise direction. In the disconnected condition the lock ball will disappear under the socket shell.

17.2.5.2 The drilled ball valves (not visible in Figure 17-5) are gear driven and when coupling halves are connected will rotate and match their drilled passages allowing system media to free flow. When uncoupled the drilled ball valves will rotate and match their undrilled portions and seal off the system flow.

17.2.5.3 Avoid side loading of this type coupling as severe damage to the coupling locking lugs and locking ears may occur. Dirt contamination must also be avoided as an abrasive action will occur between the polished ball valves and their upper and lower teflon seals when the ball valves are caused to rotate. This abrasive action will produce scratching of these components and cause the coupling to leak at the ball valve when the coupling is disconnected and system is under pressure.

17.2.6 Ball-Lock Type. This type coupling (Figure 17-6) employs a cam ring and a ball cage in the socket to effect connection and locking action onto the nipple portion. Valve action is same as couplings in Figure 17-2 and Figure 17-3.

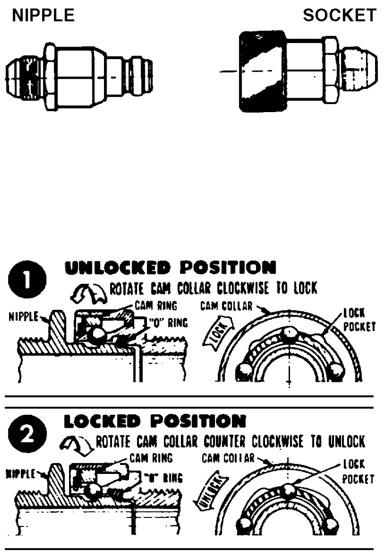


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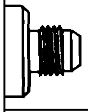
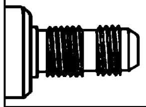
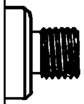
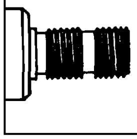
Figure 17-6. Ball Lock Type

STYLE OF END FITTING	MIL SPEC
	MS 33656 FLARED TUBE
	MS 33657 FLARED TUBE BULKHEAD
	MS 33514 FLARELESS TUBE
	MS 33515 FLARELESS TUBE BULKHEAD

F17-007

Figure 17-7. End Fitting Style

17.2.6.1 To connect, push socket onto nipple assembly and rotate socket cam collar clockwise. A distinct ‘‘snap’’ will be heard and felt when the lock balls reach the end of the cam travel and they drop into a lock pocket. To disconnect the coupling, rotate the socket cam collar counterclockwise. This releases the balls from the lock pocket and permits them to travel along the cam until they clear the outside diameter of the nipple.

17.2.7 End Fitting Styles (Common Types). The more common coupling end fitting styles are shown in Figure 17-7. Other variations of end fittings are also employed on quick disconnect couplings.

17.2.7.1 It should be remembered that the type of end fitting employed has no effect upon the operating principles of a coupling.

17.2.7.2 Refer to AF Technical Order 42E1-1-1 for information that outlines and illustrates fitting repairs that are authorized. These repair procedures should be employed where practical and when required, on quick disconnect coupling end fittings.

17.3 CARE AND HANDLING PRACTICES.

Proper care and handling of quick disconnect couplings must be exercised to prolong coupling life and insure the integrity of the system in which they are employed.

17.3.1 Do not use gripping tools to connect or disconnect coupling halves as these actions can normally be readily accomplished by hand.

17.3.2 Couplings of the types listed have undergone extensive engineering prior to production. All have been subjected to extensive vibrational and other testing. They will perform satisfactorily and will not separate during use if they have been properly connected and are otherwise in serviceable condition.

17.3.3 Avoid dirt or other foreign matter contamination when couplings are in the disconnected condition. Contamination can inflict coupling damage and will when coupling halves are connected cause system contamination. Should contamination occur, wipe with a clean, dry lint-free cloth or use a clean brush. If a brush is used, assure no bristles remain in the coupling connecting areas after brushing.

17.3.4 Handle quick disconnects as you would any other fine piece of equipment. Although they are not delicately designed, do not abuse them by dropping or inflicting other types of abuse.

17.4 TECHNICAL MANUAL COVERAGE.

Technical manual coverage (Repair Instructions/Parts Breakdown and Test) was procured for some couplings where warranted. The following Technical Order series should be consulted to ascertain Technical Order assignment:

- 9H8
- 9H11
- 9P8
- 35DA3

17.5 TROUBLESHOOTING HINTS.

The following is offered to assist in determining cause of coupling leakage and to spot signs of impending failure.

17.5.1 If leakage occurs between the connected halves, the most probable cause is wear or damage to the seal that encircles the nipple and/or damage to the sealing portion of the nipple.

17.5.2 Leakage at the point where the end fitting engages the coupling body seldom occurs. In the event it does occur the end fitting seal is the most probable cause.

17.5.3 Leakage that occurs at the coupling end fitting and hose or tube connection point may be attributed to such causes as follows:

17.5.3.1 Insufficient coupling nut torque.

17.5.3.2 Over-torque which may have damaged the sealing surfaces of component parts.

17.5.3.3 Dirt or other foreign material on the sealing surfaces, when leakage occurs to a flared end connection.

17.5.4 Leakage that occurs at the valve end of either the nipple or socket half when coupling is disconnected can be attributed to worn or damaged valve seal or to the metal to metal sealing surfaces if coupling does not employ a valve seal.

17.5.5 Refer to Figure 17-1 ‘‘Screw Type’’ coupling. Signs of impending failure are:

17.5.5.1 Major thread damage on either coupling half.

17.5.5.2 Major thread damage on the union nut.

17.5.5.3 Damaged or badly worn union nut teeth.

17.5.5.4 Damaged or badly worn locking spring assembly.

17.5.6 Refer to Figure 17-2, ‘‘Quick Thread Type’’ coupling. Signs of impending failure are:

17.5.6.1 Major thread damage on either coupling half end fitting.

17.5.6.2 Major damage to the quick lead acme threaded portion of either coupling half.

17.5.6.3 Damage to the spring loaded valve stems of either coupling half.

17.5.6.4 Loss of spring tension on the socket outer shell.

17.5.7 Refer to Figure 17-3, ‘‘Push-Pull Type’’ coupling. Signs of impending failure are:

17.5.7.1 Major thread damage on either coupling half.

17.5.7.2 Damaged or broken locking dogs on socket half.

17.5.7.3 Loss of spring tension on the socket outer shell.

17.5.7.4 Damage to the nipple sealing surface and/or to the lock collar of the nipple half.

17.5.7.5 Damage to the spring loaded valve stems of either coupling half.

17.5.8 Refer to Figure 17-4, Full Grip ‘‘Push-Pull Type’’ coupling. Signs of impending failure are same as outlined in paragraph 17.5.7 for type shown in Figure 17-3.

17.5.9 Refer to Figure 17-5, ‘‘Ball Valve Type’’ coupling. Signs of impending failure are:

17.5.9.1 Major thread damage on either coupling half.

17.5.9.2 Damaged or badly worn locking lugs on the socket half.

17.5.9.3 Damaged or badly worn locking ears on the nipple half.

17.5.9.4 Scratched ball valves. The ball valves can be examined when the coupling halves are disconnected.

17.5.10 Refer to Figure 17-6, ‘‘Ball-Lock Type’’ coupling. Signs of impending failure are:

17.5.10.1 Major thread damage on either coupling half.

17.5.10.2 Major damage or brinelling of the nipple locking collar area.

17.5.10.3 Damage to the extreme end portion of the nipple that enters the socket. Leakage in the coupling connected condition can occur if nipple sealing end is damaged.

17.5.10.4 Damage to the spring loaded valve stems of either coupling half.

17.5.10.5 Binding of the socket knurled cam collar.

17.5.11 The foregoing is offered to familiarize using personnel with quick disconnect type couplings. Proper care, handling, and understanding of quick disconnect couplings will greatly enhance the integrity of the many systems in which they are employed.

17.6 SEAL REPLACEMENT.

As previously stated in paragraph 17.5, Leakage which may occur between the connected halves is most probably caused by a defective seal and/or a damaged nipple. Seal replacement can be readily accomplished without tear down on the following type couplings. When leakage is evident in these type couplings replace the seal and inspect the nipple sealing surface for damage. All reference to socket or nipple will be as shown in the foregoing illustrations.

17.6.1 Quick Thread-Indicating Type, Figure 17-2. One O-ring type seal is employed and located at the extreme inner end of nipple at the acme threaded area.

17.6.2 Inst-o-Matic, “Push Pull Type,” Figure 17-3. This type employs one flat round seal and one O-ring type seal in the inner open area of the socket.

17.6.3 Full Grip “Push-Pull Type,” Figure 17-4. This type employs one O-ring type seal in the socket to effect both coupled and uncoupled attitude sealing. Depress the socket valve; seal will be visible at the outer end of the socket inner portion.

17.6.4 Straight-Flow “Ball Valve Type,” Figure 17-5. One O-ring type seal is employed and is located in the nipple at the outer end of the nipple inner portion.

17.6.5 Ball-Lock Type, Figure 17-6. One O-ring type seal is employed and is located in the socket inner portion slightly below the lock balls.

To ascertain part number assignment for seals, consult applicable coupling technical orders, system -4 technical manual and/or vendor drawings. Federal Stock Number assignment can be ascertained by use of USAF Master Cross Reference Index S-00-1-1.

Test after seal replacement as per applicable technical order, vendor drawing or local engineering instructions.

17.7 INSPECTION OF AEROQUIP CORP SERIES 3700 AND 3750 QUICK THREAD COUPLINGS.

(Figure 17-2) Installation side load and vibration will impose wear upon the internal lock ring and flank of the Acme thread of this type coupling that can disrupt the flow characteristics and adversely affect system operation. As wear occurs in the coupling assembly internal springs force the poppet guides apart, allowing movement of the poppet valves. As the wear progresses, movement of the poppets increases, reducing volume of the flow cavity or allowing fluid to push the valves downstream to restrict the flow by closing the poppet in the upstream coupling half.

17.7.1 Installed couplings can be inspected for excessive wear by measuring the length variation of the coupling assembly which is accomplished as follows:

17.7.1.1 With system pressure at zero and the coupling connected, compress the coupling lengthwise and measure from the back of the nipple half adapter hex to the back of the socket half adapter hex.

17.7.1.2 Record the measurement as value ‘‘A.’’

17.7.1.3 Extend the coupling by pulling lengthwise and repeat the measurement.

17.7.1.4 Record this measurement as value ‘‘B.’’

17.7.1.5 Compare values ‘‘A’’ and ‘‘B’’ to determine amount of length variation.

17.7.2 Refer to Table 17-1 if length variation exceeds the given value for the particular dash size early failure is indicated. Replace the coupling assembly.

Table 17-1. Values for Inspection of Series 3700 and 3750 Quick Disconnects

Coupling Dash Size	Maximum Allowable Length Variation
-4	0.050
-6	0.050
-8	0.050
-10	0.068
-12	0.068
-16	0.081
-20	0.099
-24	0.099

CHAPTER 18

INSPECTION AND INSTALLATION OF V-BAND COUPLINGS

18.1 V-BAND COUPLINGS.

The instruction given is a brief outline of precautionary procedures and installation techniques to improve the reliability of V-couplings used in aircraft and missiles.

NOTE

The instructions are general and are applicable except when otherwise specified in the manuals for the specific aerospace vehicle. If there is a conflict between this manual and the manuals for a particular aerospace vehicle, subsequent technical orders, technical notes, or change orders, the latter will govern in all cases.

18.2 PRE-INSTALLATION CHECKS.

Exercise particular care during handling and installation of ducts and tubes to ensure that flange faces are not scratched, distorted or deformed.

a. Clean flange faces free of dirt, grease and corrosion.

b. Use protective flange caps on the ends of all ducts until the installation progresses to the point where removal of the cap is essential to continuing with the installation.

c. Use care during the installation of ducts and tubes to ensure mating and alignment of flanges. A poorly-fitted joint requires excessive torque on the T-bolt to close the joint and imposes structural loads on the V-Band Clamp. Adjacent support clamps or brackets should remain loose until installation of the coupling has been completed. When connections are by V-Band Couplings, the weight of the components should be fully supported during the fit-up and installation of the coupling. Refer to the applicable maintenance, overhaul or service instructions for joint and clearances.

d. Clean the flange faces and inspect every time a clamp is removed. Clean the flange faces by wiping with a clean cloth. Do not use a wire brush to remove dirt.

18.3 INSTALLATION.

Check the part number to ensure that the proper coupling is being installed.

a. When re-installing a used coupling, check it for twist or distortion. Visually check the V-section for spreading at the open ends or other signs of distortion. Check spot weld or rivets for condition and security. The corner radii should be carefully checked for tool marks and cracks. Couplings in poor condition should be replaced.

b. Check the threads on the T-bolt for wear and condition. If there is any sign of wear, galling or deformation, install a new T-bolt or coupling.

c. Check the T-bolt for straightness; however, if it is bent it will be necessary to determine if the bend is intentional. Some small diameter couplings have curved T-bolts. Check the applicable illustrated parts breakdown for part identification. If in doubt, install a new T-bolt or coupling.

d. The trunnion and latch should be checked for freedom of movement or other evidence of overloading.

e. Avoid twisting, spreading or bending of the coupling when positioning the coupling on the joint.

18.3.1 Gaskets. When gaskets are used in the joint, exercise particular care in handing to avoid nicks and burrs on the gasket surfaces. Whenever a joint is disassembled after service operations, a new gasket should be used when reassembling to ensure maximum sealing efficiency. Exercise care to ensure that the gasket is properly seated.

18.3.2 Torque. Before installing the coupling, determine the correct torque for tightening the T-bolt nut by referring to the applicable Maintenance, Overhaul, or Service Instructions. Correct torque is vital in assuring reliability of the coupling.

18.3.3 Nuts. Several different types of nuts are used on the T-bolts. If a nut is lost or damaged, replace it with a clean and undamaged identical type nut. Be careful to match the T-bolt threads.

WARNING

- V-Band coupling for bleed airlines will not use fiber lock retaining nuts. Non-metallic inserts, self-locking nuts shall not be subjected to temperatures in excess of 250°F in accordance with Military Specification MIL-N-25027.
- Do not use cadmium plated nuts on V-Band couplings for any engine applications. Catastrophic failure of the clamp may occur during operation.

a. To install the coupling on the joint, place the coupling over one of the tube ends far enough to clear the flange. Install the gasket and mate the flanges. Relocate the coupling over both flanges and press the coupling closed. Engage the quick coupler latch or install the nut. Be sure the T-bolt is correctly seated. Tighten the nut to about two-thirds of the specified torque and tap the coupling lightly around the circumference of the band with a plastic or other non-metallic mallet. On multibolt assemblies, nuts should be drawn up equally. Continue, alternately tightening and tapping where possible until the torque indicated on the torque wrench stabilizes at the specified value. Exercise caution to avoid overtorquing.

WARNING

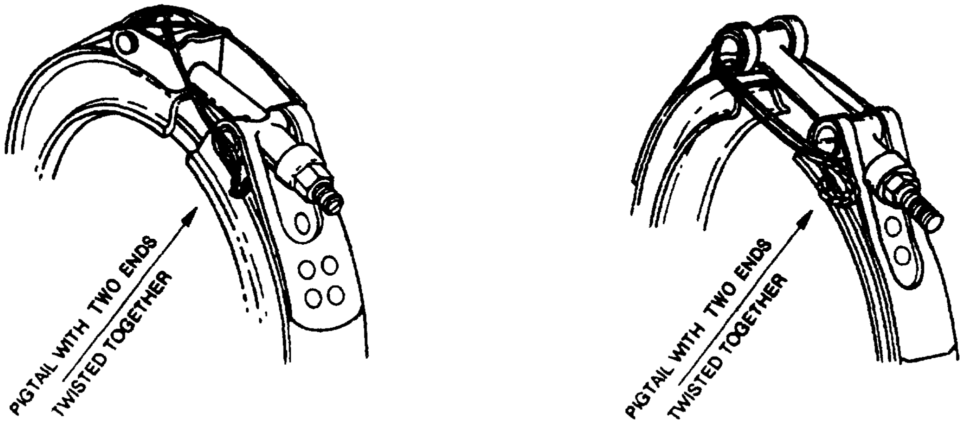
Use of improper size clamp, overtightening T-Bolt or missing, defective gasket could cause separation of the coupling and injury may result.

b. Do not attempt to seal a leaking joint by overtightening the T-bolt. Check for a wrong coupling, a damaged flange, or a defective gasket.

c. To prevent complete separation of the joint in the event of T-bolt failure, lock wire the coupling. Lockwire shall be Federal Specification QQ-W-423 type and diameter shall be 0.032 to 0.041 inch steel safety wire. Quick Disconnect V-Band couplings are required to be lock wired by the X method as per Figure 18-1, view A. Unless specifically directed by an aerospace vehicle maintenance manual, the captive T-bolt type coupling is not required to be safetied.

NOTE

When safety wire is required, Captive T-Bolt V-band maybe lock wire using either method in Figure 18-1. Lock wire will be installed through band loops which retain the T-bolt and T-bolt trunnion or quick-disconnect coupler, see Figure 18-1. A double loop of single strain wire is required. Install first loop firmly in place, second loop should not be over stressed by twisting end of wires.



T-BOLT QUICK DISCONNECT
A

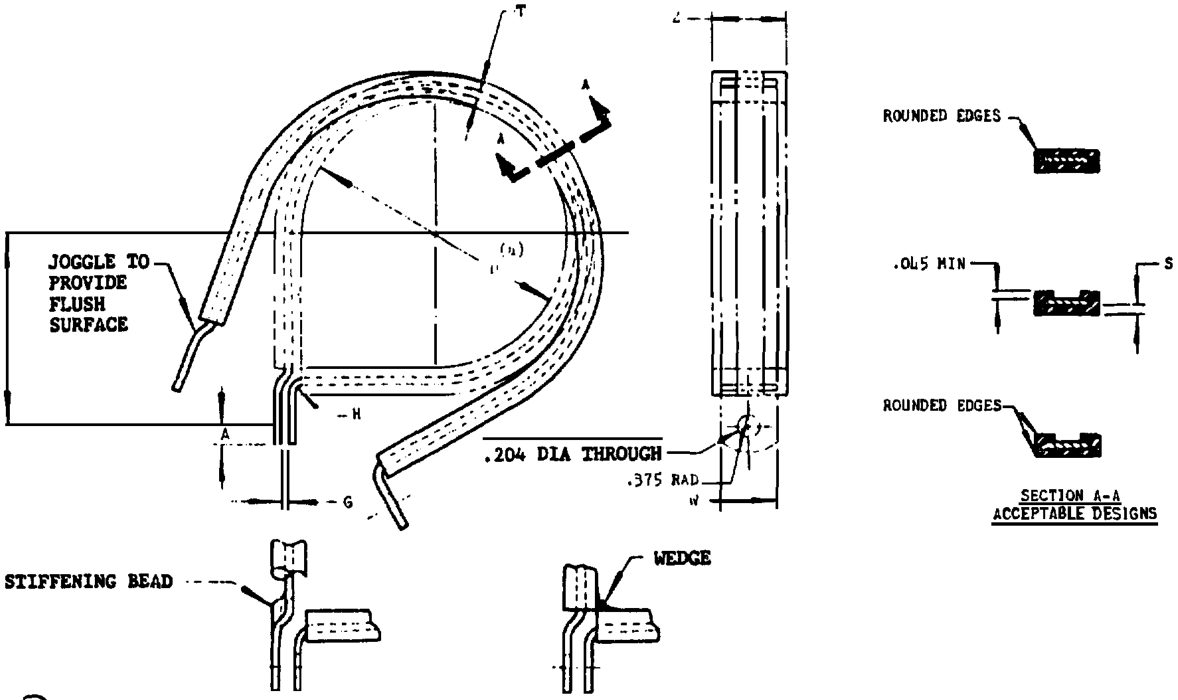
CAPITIVE T-BOLT AND JANITROL
B

Figure 18-1. V-Band Coupling Safety Wiring Techniques

CHAPTER 19

CLAMP LOOP GENERAL DATA

19.1 The information given is general, its primary purpose is to aide the technician in selecting the proper clamp or a suitable replacement, except when otherwise specified in the manuals for the specific aerospace vehicle. If there is a conflict between this manual and the manuals for a particular aerospace vehicle subsequent technical orders, technical notes, or change orders, the latter will govern in all cases.



ⒹMATERIAL: CLAMP BAND: SEE PROCUREMENT SPECIFICATION
CUSHION: SEE PROCUREMENT SPECIFICATION

FINISH: **SEE PROCUREMENT SPECIFICATION**

ⒹHAND:
ADD B BEFORE DASH NUMBER FOR CARBON STEEL CLAMP BAND.
ADD C BEFORE DASH NUMBER FOR CORROSION RESISTANT STEEL CLAMP BAND.
ADD D BEFORE DASH NUMBER FOR ALUMINUM ALLOY CLAMP BAND.

CUSHION:
ADD F BEFORE DASH NUMBER FOR FUEL-RESISTANT CUSHION
ADD G BEFORE DASH NUMBER FOR NON-FUEL RESISTANT CUSHION
ADD H BEFORE DASH NUMBER FOR HIGH TEMPERATURE (500°F) CUSHION
ADD W BEFORE DASH NUMBER AND ANY OTHER CODE LETTER FOR WEDGE-TYPE CUSHION CONSTRUCTION.

ⒹEXAMPLES OF PART NUMBERS:
MS21919BF8 - CUSHION CLAMP, CARBON STEEL, .500 (8/16) ID, FUEL-RESISTANT.
MS21919DF8 - CUSHION CLAMP, ALUMINUM-ALLOY, .500 (8/16) ID, FUEL-RESISTANT.
MS21919BH8 - CUSHION CLAMP, CARBON STEEL, .500 (8/16) ID, HIGH TEMPERATURE.
MS21919BG8 - CUSHION CLAMP, CARBON STEEL, .500 (8/16) ID, GENERAL PURPOSE, NON-FUEL-RESISTANT.
MS21919DG8 - CUSHION CLAMP, ALUMINUM-ALLOY, .500 (8/16) ID, GENERAL PURPOSE, NON-FUEL-RESISTANT.
MS21919WDG8 - CUSHION CLAMP, ALUMINUM-ALLOY, .500 (8/16) ID, GENERAL PURPOSE, NON-FUEL-RESISTANT, WEDGE-TYPE, CUSHION CONSTRUCTION.
MS21919CH8 - CUSHION CLAMP STEEL, CORROSION RESISTANT, .500 (8/16) ID, HIGH TEMPERATURE.

REMOVE ALL BURRS AND SHARP EDGES.

DIMENSIONS IN INCHES. UNLESS OTHERWISE SPECIFIED, TOLERANCES: DECIMALS ±.015.

THE MS PART NUMBER, INCLUDING DASH NUMBER, AND MANUFACTURER'S IDENTIFICATION, SHALL BE MARKED ON EACH CLAMP.

THE ENDS OF THE CUSHION SHALL MEET WHEN CLAMP IS IN THE INSTALLED POSITION.

CLAMPS SHALL BE FURNISHED IN THE OPEN POSITION AS SHOWN BY THE SOLID LINES.

FUEL-RESISTANT CLAMPS EMPLOYING RUBBER CUSHION MATERIAL ARE TO BE USED ONLY IN APPLICATIONS WHERE CLAMPS ARE EXPOSED TO FUEL OR FUEL VAPORS UNDER NORMAL CONDITIONS. THIS TYPE OF RUBBER WILL DETERIORATE EXCESSIVELY WHEN EXPOSED TO AIR.

INACTIVE FOR DESIGN AFTER 1 JULY 1967. SEE MS21105 AND MS21122
REINSTATED AFTER 17 DECEMBER 1968

THIS STANDARD TAKES PRECEDENCE OVER DOCUMENTS REFERRED HEREIN. REFERENCED DOCUMENTS SHALL BE OF THE ISSUE IN EFFECT ON DATE OF INVITATIONS FOR BID.
THIS DOCUMENT HAS BEEN PROMULGATED BY THE DEPARTMENT OF DEFENSE AS THE MILITARY STANDARD TO LIMIT THE SELECTION OF THE ITEM, PRODUCT, OR DESIGN COVERED HEREIN IN ENGINEERING, DESIGN, AND PROCUREMENT. THIS STANDARD SHALL BECOME EFFECTIVE NOT LATER THAN 90 DAYS AFTER THE LATEST DATE OF APPROVAL SHOWN.

F19-001S01

Figure 19-1. Drawing MS21919 (ASG) (Sheet 1 of 2)

MS PART NUMBERS	FIIN	RIGID TUBE NOMINAL OD (REF)	DIMENSIONS												
			D ±.015 DIA	E		G	R ±.016 RAD	S ±.016 -.000	T		W		X	Z MAX	
				ALUMINUM ALLOY	CARBON STEEL				ALUMINUM ALLOY	CARBON STEEL	ALUMINUM ALLOY	CARBON STEEL		ALUMINUM ALLOY	CARBON STEEL
MS21919-2		1/8	.125	.457	.457	.062 + .016 - .000	.062	.045	.0320 ± .0025	.0320 ± .0035	.500	.375	.188	.622	.497
MS21919-3		3/16	.188	.498	.498										
MS21919-4		1/4	.250	.529	.529										
MS21919-5		5/16	.313	.560	.560										
MS21919-6		3/8	.375	.592	.592										
MS21919-7		7/16	.438	.623	.623										
MS21919-8		1/2	.500	.654	.654										
MS21919-9		9/16	.563	.752	.749		.109		.050 ± .004			.500	.218		.622
MS21919-10		5/8	.625	.783	.780										
MS21919-11		11/16	.688	.814	.811										
MS21919-12		3/4	.750	.845	.842										
MS21919-13		13/16	.813	.877	.858										
MS21919-14		7/8	.875	.908	.889										
MS21919-15		15/16	.983	.939	.920										
MS21919-16		1	1.000	.970	.951										
MS21919-17		1-1/16	1.063	1.002	.983										
MS21919-18		1-1/8	1.125	1.062	1.030	.094 + .031 - .000	.125	.062	.063 ± .005					.656	.656
MS21919-19		1-3/16	1.188	1.093	1.061										
MS21919-20		1-1/4	1.250	1.124	1.092										
MS21919-21		1-5/16	1.313	1.156	1.124										
MS21919-22		1-3/8	1.375	1.187	1.155										
MS21919-23		1-7/16	1.438	1.218	1.186										
MS21919-24		1-1/2	1.500	1.249	1.217										
MS21919-25		1-9/16	1.563	1.281	1.259										
MS21919-26		1-5/8	1.625	1.312	1.280										
MS21919-27			1.688	1.344	1.312										
MS21919-28		1-3/4	1.750	1.374	1.342										
MS21919-29			1.813	1.406	1.374										
MS21919-30		1-7/8	1.875	1.437	1.405										
MS21919-31			1.938	1.468	1.414	.125 + .031 - .000				.040 ± .004					
MS21919-32		2	2.000	1.499	1.475										
MS21919-33			2.062	1.531	1.507										
MS21919-34		2-1/8	2.125	1.562	1.539										
MS21919-35			2.188	1.594	1.570										
MS21919-36		2-1/4	2.250	1.624	1.600										
MS21919-37			2.312	1.655	1.631										
MS21919-38		2-3/8	2.375	1.687	1.663										
MS21919-40		2-1/2	2.500	1.752	1.728										
MS21919-42			2.625	1.812	1.788										
MS21919-43			2.688	1.844	1.820										
MS21919-44		2-3/4	2.750	1.875	1.851										
MS21919-45			2.812	1.906	1.882										
MS21919-46			2.875	1.937	1.913										
MS21919-48		3	3.000	2.000	1.976										
MS21919-50			3.125	2.062	2.038										
MS21919-52		3-1/4	3.250	2.125	2.101										
MS21919-54			3.375	2.187	2.163										
MS21919-56		3-1/2	3.500	2.250	2.226										
MS21919-58			3.625	2.312	2.288										
MS21919-64		4	4.000	2.500	2.476										
MS21919-66			4.125	2.562	2.538										

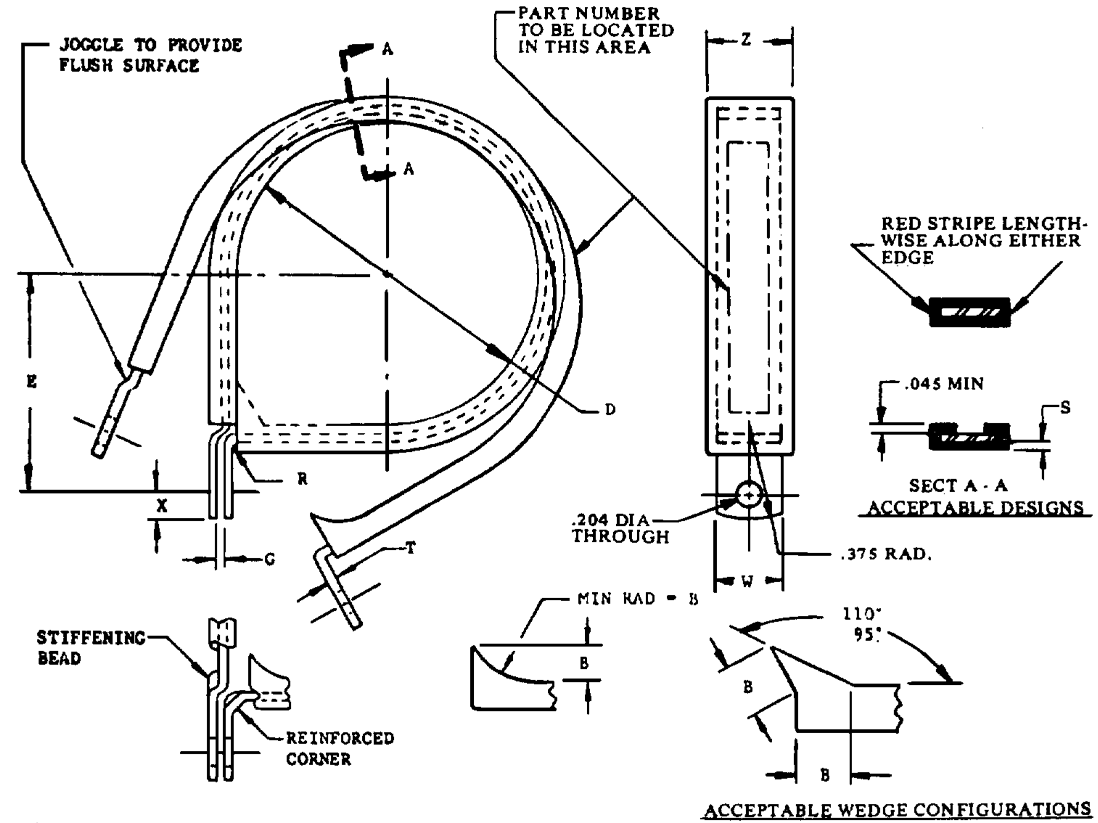
THIS STANDARD TAKES PRECEDENCE OVER DOCUMENTS REFERENCED HEREIN.

REFERENCED DOCUMENTS SHALL BE OF THE ISSUE IN EFFECT ON DATE OF INVITATIONS FOR BID.

THIS DOCUMENT HAS BEEN PROMULGATED BY THE DEPARTMENT OF DEFENSE AS THE MILITARY STANDARD TO LIMIT THE SELECTION OF THE ITEM, PRODUCT, OR DESIGN COVERED HEREIN IN ENGINEERING, DESIGN, AND PROCUREMENT. THIS STANDARD SHALL BECOME EFFECTIVE NOT LATER THAN 90 DAYS AFTER THE LATEST DATE OF APPROVAL SHOWN.

F19-001S02

Figure 19-1. Drawing MS21919 (ASG) (Sheet 2)



NOTES:

1. CLAMP BAND: ALUMINUM ALLOY 2024-0 CLAD PER QQ-A-250/5.
   CORROSION RESISTANT STEEL, COMPOSITION TYPES Ti OR Cb PER MIL-S-6721, ANNEALED.
   CUSHION: MOLDED OR EXTRUDED ELASTOMER THAT MEETS REQUIREMENTS OF PROCUREMENT SPECIFICATION. MATERIAL SHALL BE COLORED BLACK WITH A RED STRIPE LENGTHWISE ALONG ONE EDGE.
2. PROTECTIVE TREATMENT: ALUMINUM ALLOY - NONE.
   CORROSION RESISTANT STEEL - PASSIVATE PER QQ-P-35.
3. Ⓐ HEAT TREATMENT: ALUMINUM ALLOY, T4 TEMPER PER MIL-H-6088, AFTER FORMING.
   CORROSION RESISTANT STEEL - NONE.
4. REMOVE ALL BURRS AND SHARP EDGES.
5. DIMENSIONS IN INCHES. UNLESS OTHERWISE SPECIFIED, TOLERANCES: DECIMALS ± .015. DIMENSION D IS APPLICABLE IN CLOSED POSITION ONLY.
6. ADD D BEFORE DASH NUMBER FOR ALUMINUM ALLOY CLAMP.
7. ADD C BEFORE DASH NUMBER FOR CORROSION RESISTANT STEEL CLAMP.
8. Ⓐ ADD W BEFORE DASH NUMBER FOR WEDGE-TYPE CUSHION CONSTRUCTION. FOR THE -2 AND -3 SIZES ONLY.
9. EXAMPLES OF PART NUMBERS: MS21104D8 - CUSHION CLAMP, ALUMINUM, .500 ID, FUEL-WEATHER RESISTANT.
   MS21104C8 - CUSHION CLAMP, CRES, .500 ID, FUEL-WEATHER RESISTANT.
10. THE MS PART NUMBER, INCLUDING DASH NUMBER, AND MANUFACTURER'S IDENTIFICATION, SHALL BE MARKED ON EACH CLAMP.
11. THE ENDS OF THE CUSHION SHALL MEET WHEN THE CLAMP IS IN THE INSTALLED POSITION.
12. CLAMPS SHALL BE FURNISHED IN THE OPEN POSITION. (SEE PROC. SPEC.)
13. WEDGE IS INTEGRAL PART OF CUSHION.
14. WEDGE IS MANDATORY ON ALL CLAMPS ABOVE -3 SIZE.
15. REINFORCED CORNER AND STIFFENING BEAD ARE MANDATORY.
16. INTERCHANGEABILITY RELATIONSHIP: MS21104 CLAMPS CAN UNIVERSALLY REPLACE THE MS21919DF, MS21919DG, MS21919WDF, AND MS21919WDG CLAMPS OF THE SAME DASH NUMBER. MS21104C CLAMPS CAN UNIVERSALLY REPLACE THE MS21919G CLAMPS OF THE SAME DASH NUMBER. STOCKS OF THE MS21919 CLAMPS MAY BE USED UNTIL THE SUPPLY IS DEPLETED.

FOR DESIGN FEATURE PURPOSES, THIS STANDARD TAKES PRECEDENCE OVER PROCUREMENT DOCUMENTS REFERENCED HEREIN. REFERENCED DOCUMENTS SHALL BE OF THE ISSUE IN EFFECT ON DATE OF INVITATIONS FOR BID.

(A) FOR CHANGES SEE SHEETS 1 AND 2.

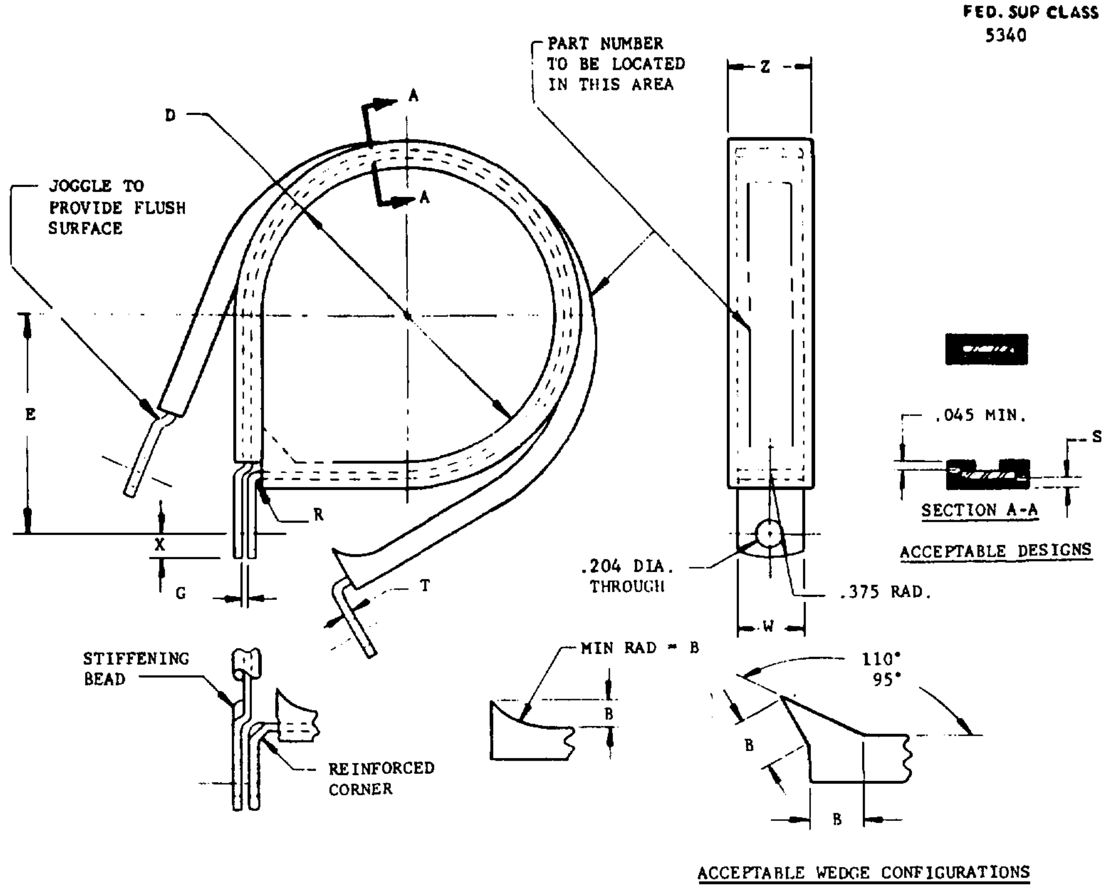
F19-002S01

Figure 19-2. Drawing MS21104 (Sheet 1 of 2)

DASH NOS.	RIGID TUBE NOMINAL OD (REF)	DIMENSIONS													
		B ±.032	D ±.015 DIA.	E		G	R ±.016 RAD	S +.016 -.000	T		W		X ±.015	Z MAX	
				ALUM.	CRES				ALUM.	CRES	ALUM.	CRES		ALUM.	CRES
-2	1/8	.078	.125	.457	.457	.062 +.016 -.000	.062	.045		.0320 ±.0035	.500	.375	.188	.622	.497
-3	3/16		.188	.498	.498										
-4	1/4	.094	.250	.529	.529				.0320 ±.0025						
-5	5/16	.109	.313	.560	.560										
-6	3/8		.375	.592	.592										
-7	7/16	.125	.438	.623	.623										
-8	1/2		.500	.654	.654										
-9	9/16		.563	.752	.749		.109					.500	.218		.622
-10	5/8		.625	.783	.780										
-11	11/16	Ⓐ .187	.688	.814	.811										
-12	3/4		.750	.845	.842				.050 ±.004						
-13	13/16		.813	.877	.858										
-14	7/8		.875	.908	.889										
-15	15/16		.938	.939	.920										
-16	1		1.000	.970	.951										
-17	1- 1/16		1.063	1.002	.983										
-18	1- 1/8		1.125	1.062	1.030	.094 +.031 -.000	.125	.062	.063 ±.005					.656	.656
-19	1- 3/16		1.188	1.093	1.061										
-20	1- 1/4		1.250	1.124	1.092										
-21	1- 5/16		1.313	1.156	1.124										
-22	1- 3/8		1.375	1.187	1.155										
-23	1- 7/16		1.438	1.218	1.186										
-24	1- 1/2		1.500	1.249	1.217										
-25	1- 9/16		1.563	1.281	1.259										
-26	1- 5/8		1.625	1.312	1.280										
-27			1.688	1.344	1.312										
-28	1- 3/4		1.750	1.374	1.342										
-29			1.813	1.406	1.374										
-30	1- 7/8		1.875	1.437	1.405										
-31			1.938	1.468	1.444	.125 +.031 -.000				.040 ±.004					
-32	2		2.000	1.499	1.475										
-33			2.062	1.531	1.507										
-34	2- 1/8		2.125	1.562	1.538										
-35			2.188	1.594	1.570										
-36	2- 1/4		2.250	1.624	1.600										
-37			2.312	1.655	1.631										
-38	2- 3/8		2.375	1.687	1.663										
-40	2- 1/2		2.500	1.752	1.728										
-42			2.625	1.812	1.788										
-43			2.688	1.844	1.820										
-44	2-3/4		2.750	1.875	1.851										
-45			2.812	1.906	1.882										
-46			2.875	1.937	1.913										
-48	3		3.000	2.000	1.976										
-50			3.125	2.062	2.038										
-52	3- 1/4		3.250	2.125	2.101										
-54			3.375	2.187	2.163										
-56	3- 1/2		3.500	2.250	2.226										
-58			3.625	2.312	2.288										
-64	4		4.000	2.500	2.476										
-66			4.125	2.562	2.538										

F19-002S02

Figure 19-2. Drawing MS21104 (Sheet 2)



NOTES:

1. CLAMP BAND: CORROSION RESISTANT STEEL, COMPOSITION TYPES Ti OR Cb, PER MIL-S-6721, ANNEALED.
   CUSHION: MOLDEDOR EXTRUDED HIGH POLYMER OR OTHER NON-METALLIC MATERIAL THAT MEETS REQUIREMENTS OF PROCUREMENT SPECIFICATION. MATIERIAL SHALL BE COLORED RED.
2. PROTECTIVE TREATMENT: CORROSION RESISTANT STEEL - PASSIVATE PER QQ-P-35.
3. REMOVE ALL BURRS AND SHARP EDGES.
4. DIMENSIONS IN INCHES. UNLESS OTHERWISE SPECIFIED, TOLERANCIES: DECIMALS ±.015.
5. Ⓐ DIMENSION D IS APPLICABLE IN CLOSED POSITION ONLY.
6. ADD W BEFORE DASH NUMBER FOR WEDGE-TYPE CUSHION CONSTRUCTION FOR THE -2 AND -3 SIZES ONLY.
7. EXAMPLES OF PART NUMBERS: MS21105-8 = CUSHION CLAMP, CRES, .500 ID, FLUID RESISTANT, 500°F.
8. THE MS PART NUMBER, INCLUDING DASH NUMBER, AND MANUFACTURER'S IDENTIFICATION, SHALL BE MARKED ON EACH CLAMP.
9. THE ENDS OF THE CUSHION SHALL MEET WHEN THE CLAMP IS IN THE CLOSED POSITION.
10. CLAMPS SHALL BE FURNISHED IN THE OPEN POSITION. SEE PROCUREMENT SPECIFICATION.
11. FLUID RESISTANCE: TESTS IN MIL-L-7808 AND MIL-H-5606 OILS ARE CONDUCTED AT 275°F TEMPERATURE AND DO NOT NECESSARILY INDICATE FLUID RESISTANCE TO 500°F. SEE PROCUREMENT SPECIFICATION.

12. WEDGE IS INTEGRAL PART OF CUSHION.
13. WEDGE IS MANDATORY ON ALL CLAMPS ABOVE -3 SIZE.
14. REINFORCED CORNER AND STIFFENING BEAD ARE MANDATORY.

15. INTERCHANGEABILITY RELATIONSHIP: MS21105 CLAMPS CAN UNIVERSALLY REPLACE THE MS21919H CLAMPS OF THE SAME DASH NUMBER, STOCKS OF THE MS21919H CLAMPS MAY BE USED UNTIL SUPPLY IS DEPLETED.

FOR DESIGN FEATURE, PURPOSES THIS STANDARD TAKES PRECEDENCE OVER PROCUREMENT DOCUMENTS REFERENCED HEREIN. *REFERENCED DOCUMENTS SHALL BE OF THE ISSUE IN EFFECT ON DATE OF INVITATIONS FOR BID.*

Ⓐ FOR CHANGES SEE SHEETS 1 AND 2

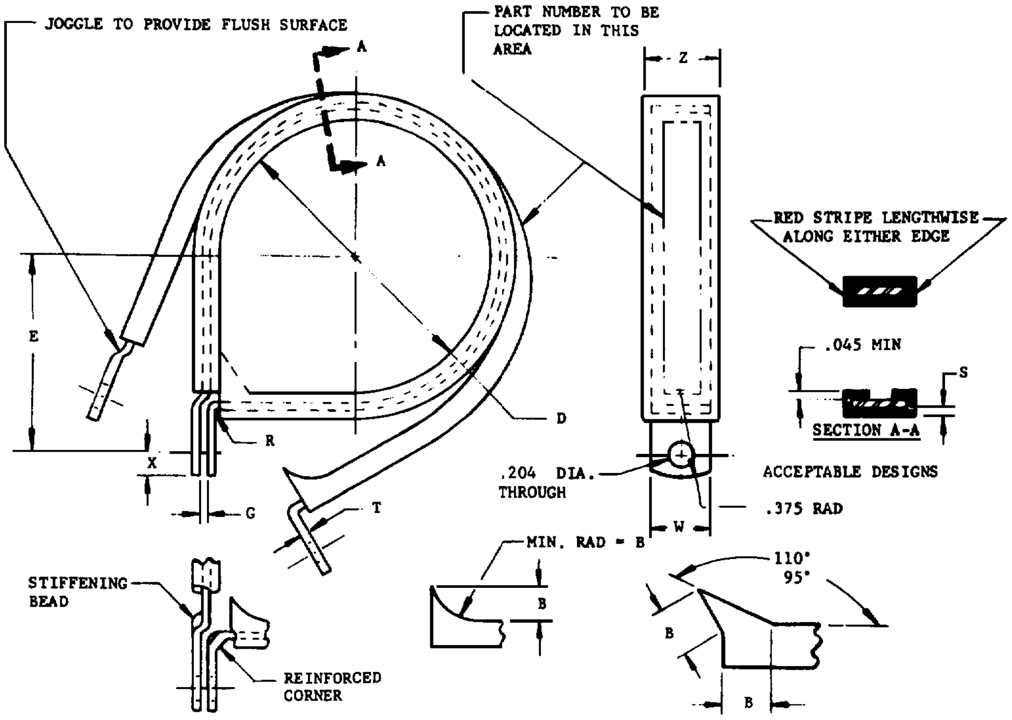
F19-003S01

Figure 19-3. Drawing MS21105 (Sheet 1 of 2)

DASH NUMBERS	RIGID TUBE NOMINAL OD (REF)	DIMENSIONS									
		B ±.032	D ±.015 DIA	E ±.015	G	R ±.016 RAD	S +.016 -.000	T	W ±.015	X ±.015	Z MAX
-2	1/8		.125	.457	.062 +.016 -.000	.062	.045	.0320 ±.0035	.375	.188	.497
-3	3/16		.188	.498							
-4	1/4	.094	.250	.529							
-5	5/16	.109	.313	.560							
-6	3/8		.375	.592							
-7	7/16	.125	.438	.623							
-8	1/2		.500	.654							
-9	9/16		.563	.749		.109			.500	.218	.622
-10	5/8		.625	.780							
-11	11/16	Ⓐ .187	.688	.811							
-12	3/4		.750	.842							
-13	13/16		.813	.858							
-14	7/8		.875	.889							
-15	15/16		.938	.920							
-16	1		1.000	.951							
-17	1- 1/16		1.063	.983							
-18	1- 1/8		1.125	1.030	.094 +.031 -.000	.125	.062				.656
-19	1- 3/16		1.188	1.061							
-20	1- 1/4		1.250	1.092							
-21	1- 5/16		1.313	1.124							
-22	1- 3/8		1.375	1.155							
-23	1- 7/16		1.438	1.186							
-24	1- 1/2		1.500	1.217							
-25	1- 9/16		1.563	1.259							
-26	1- 5/8		1.625	1.280							
-27			1.688	1.312							
-28	1- 3/4		1.750	1.342							
-29			1.813	1.374							
-30	1- 7/8		1.875	1.405							
-31			1.938	1.444	.125 +.031 -.000			.040 ±.004			
-32	2		2.000	1.475							
-33			2.062	1.507							
-34	2- 1/8		2.125	1.538							
-35			2.188	1.570							
-36	2- 1/4		2.250	1.600							
-37			2.312	1.631							
-38	2- 3/8		2.375	1.663							
-40	2- 1/2		2.500	1.728							
-42			2.625	1.788							
-43			2.688	1.820							
-44	2- 3/4		2.750	1.851							
-45			2.812	1.882							
-46			2.875	1.913							
-48	3		3.000	1.976							
-50			3.125	2.038							
-52	3- 1/4		3.250	2.101							
-54			3.375	2.163							
-56	3- 1/2		3.500	2.226							
-58			3.625	2.288							
-64	4		4.000	2.476							
-66			4.125	2.538							

F19-003S02

Figure 19-3. Drawing MS21105 (Sheet 2)



ACCEPTABLE WEDGE CONFIGURATIONS

NOTES:

1. CLAMP BAND: ALUMINUM ALLOY 2024-0 CLAD PER QQ-A-250/5.
   CORROSION RESISTANT STEEL, COMPOSTION TYPE Ti OR Cb PER MIL-S-6721, ANNEALED.
   CUSHION: EXTRUDED POLYTETRAFLUOROETHYLENE PER L-P-403, NATURAL COLOR WITH RED STRIPE LENGTHWISE ALONG EITHER EDGE.

2. PROTECTIVE TREATMENT: ALUMINUM ALLOY - NONE.
   CORROSION RESISTANT STEEL - PASSIVATE PER QQ-P-35.

Ⓐ 3. HEAT TREATMENT: ALUMINUM ALLOY, TEMPER T-4 PER MIL-H-6088, AFTER FORMING
   CORROSION RESISTANT STEEL NONE.

4. REMOVE ALL BURRS AND SHARP EDGES.

5. DIMENSIONS IN INCHES. UNLESS OTHERWISE SPECIFIED, TOLERANCES: DECIMALS ±.015

6. ADD C BEFORE DASH NUMBER FOR CORROSION RESISTANT STEEL CLAMP.

Ⓐ 7. ADD W BEFORE DASH NUMBER FOR WEDGE TYPE CUSHION CONSTRUCTION FOR THE -2 AND -3 SIZES ONLY

8. EXAMPLES OF PART NUMBERS: MS21122-8 = CUSHION CLAMP, ALUMINUM, .500 ID.
   MS21122C8 = CUSHION CLAMP, CRES, .500 ID.

9. THE MS PART NUMBER, INCLUDING DASH NUMBER, AND MANUFACTURER'S IDENTIFICATION SHALL BE MARKED ON EACH CLAMP.

10. THE ENDS OF THE CUSHION SHALL MEET WHEN THE CLAMP IS IN THE INSTALLED POSITION.

11. CLAMPS SHALL BE FURNISHED IN THE OPEN POSITION. SEE PROCUREMENT SPECIFICATION.

12. DIMENSION D IS APPLICABLE IN CLOSED POSITION ONLY.

13. WEDGE IS MANDATORY ON ALL CLAMPS ABOVE -3 SIZE.

14. WEDGE IS INTEGRAL PART OF CUSHION.

15. REINFORCED CORNER AND STIFFENING BEAD ARE MANDATORY.

Ⓐ FOR CHANGES SEE SHEETS 1 AND 2

F19-004S01

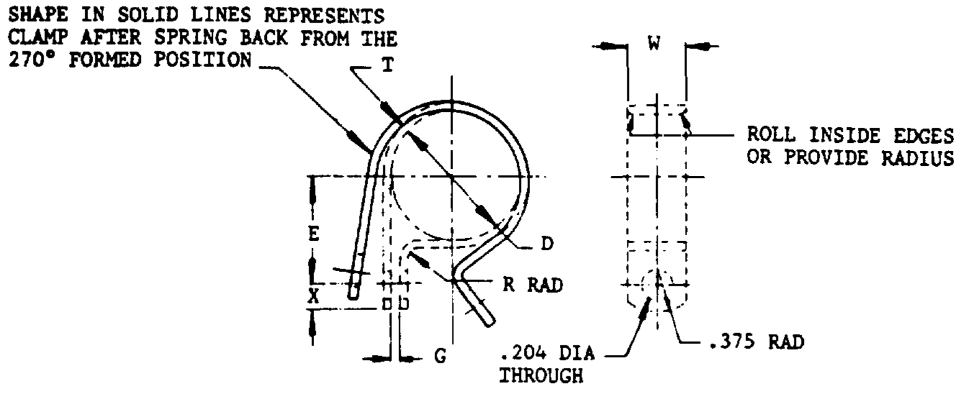
Figure 19-4. Drawing MS21122 (Sheet 1 of 2)

DASH NOS.	RIGID TUBE NOMINAL OD (REF)	DIMENSIONS													
		B ±.032	D ±.015 DIA	E		G	R ±.016 RAD	S +.016 -.000	T		W		X ±.015	Z MAX.	
				ALUM.	CRES				ALUM.	CRES	ALUM.	CRES		ALUM.	CRES
-2	1/8		.125	.457	.457	.062 +.016 -.000	.062	.025	.0320 ±.0025	.0320 ±.0035	.500	.375	.188	.622	.497
-3	3/16		.188	.498	.498										
-4	1/4	.094	.250	.529	.529										
-5	5/16	.109	.313	.560	.560										
-6	3/8		.375	.592	.592										
-7	7/16	.125	.438	.623	.623										
-8	1/2		.500	.654	.654										
-9	9/16		.563	.752	.749		.109		.050 ±.004			.500	.218		.622
-10	5/8		.625	.783	.780										
-11	11/16	Ⓐ .187	.688	.814	.811										
-12	3/4		.750	.845	.842										
-13	13/16		.813	.877	.858										
-14	7/8		.875	.908	.889										
-15	15/16		.938	.939	.920										
-16	1		1.000	.970	.951										
-17	1-1/16		1.063	1.002	.983										
-18	1-1/8		1.125	1.062	1.030	.094 +.031 -.000	.125		.063 ±.005					.656	.658
-19	1-3/16		1.188	1.093	1.061										
-20	1-1/4		1.250	1.124	1.092										
-21	1-5/16		1.313	1.156	1.124										
-22	1-3/8		1.375	1.187	1.155										
-23	1-7/16		1.438	1.218	1.186										
-24	1-1/2		1.500	1.249	1.217										
-25	1-9/16		1.563	1.281	1.259										
-26	1-5/8		1.625	1.312	1.280										
-27			1.688	1.344	1.312										
-28	1-3/4		1.750	1.374	1.342										
-29			1.813	1.406	1.374										
-30	1-7/8		1.875	1.437	1.405										
-31			1.938	1.468	1.444	.125 +.031 -.000				.040 ±.004					
-32	2		2.000	1.499	1.475										
-33			2.062	1.531	1.507										
-34	2-1/8		2.155	1.562	1.538										
-35			2.188	1.594	1.570										
-36	2-1/4		2.250	1.624	1.600										
-37			2.312	1.655	1.631										
-38	2-3/8		2.375	1.387	1.663										
-40	2-1/2		2.500	1.752	1.728										
-42			2.625	1.812	1.788										
-43			2.688	1.844	1.820										
-44	2-3/4		2.750	1.875	1.851										
Ⓐ -45			2.812	1.906	1.882										
-46			2.875	1.937	1.913										
-48	3		3.000	2.000	1.976										
-50			3.125	2.062	2.038										
-52	3-1/4		3.250	2.125	2.101										
-54			3.375	2.187	2.163										
-56	3-1/2		3.500	2.250	2.226										
-58			3.625	2.312	2.288										
-64	4		4.000	2.500	2.476										
-66			4.125	2.562	2.538										

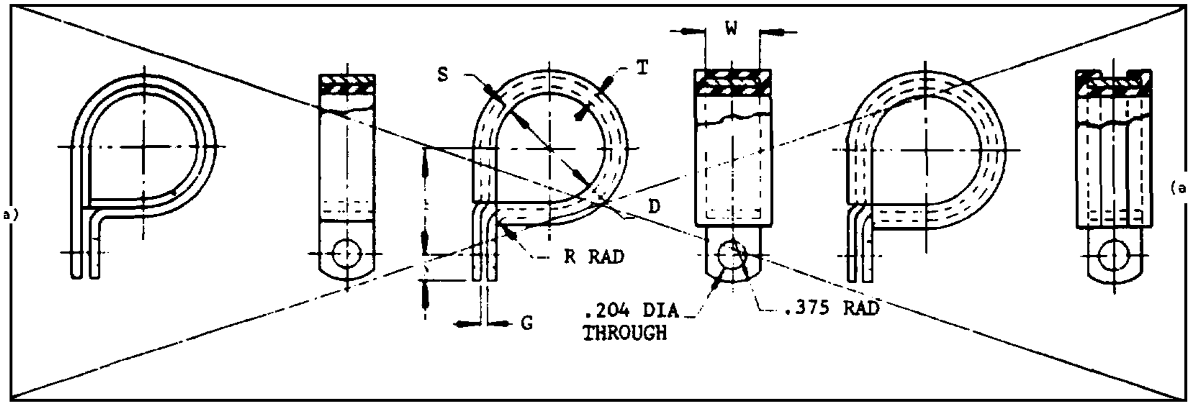
— FOR DESIGN FEATURE PURPOSES, THIS STANDARD TAKES PRECEDENCE OVER PROCUREMENT DOCUMENTS REFERENCED HEREIN. REFERENCED DOCUMENTS SHALL BE OF THE ISSUE IN EFFECT ON DATE OF INVITATIONS FOR BID.

F19-004S02

Figure 19-4. Drawing MS21122 (Sheet 2)



PLAIN CLAMPS



CUSHION CLAMPS

FOR DEFINITION AND APPLICATION OF DRAFTING STATUS NOTES, SEE MIL-STD-32.

MATERIAL: STEEL, ALUMINUM ALLOY, CORROSION-RESISTANT STEEL, HIGH-TEMPERATURE STEEL: SEE PROCUREMENT SPECIFICATION.

FINISH: STEEL, CADMIUM PLATE, QQ-P-416, TYPE II, CLASS 3.
~~[illegible]~~
ADD F BEFORE DASH NO. FOR CORROSION-RESISTANT STEEL CLAMP.
ADD D BEFORE DASH NO. FOR ALUMINUM-ALLOY CLAMP.
ADD H BEFORE DASH NO. FOR HIGH-TEMPERATURE STEEL CLAMP.
~~[illegible]~~
EXAMPLES OF PART NUMBERS: AN742-8 = CLAMP, STEEL, .500 (8/16) ID.
~~[illegible]~~
AN742F8 = CLAMP, CORROSION-RESISTANT STEEL, 500 (8/16) ID.
AN742D8 = CLAMP, ALUMINUM-ALLOY, .500 (8/16) ID.
AN742H8 = CLAMP, HIGH-TEMPERATURE STEEL, .500 (8/16) ID.
~~[illegible] CUSHION CLAMP, STEEL, .50 [illegible] ID.~~
~~AN742D10C - CUSHION [illegible] -1/8) ID.~~
~~[illegible] CUSHION CLAMP, ALUMINUM-ALLOY, [illegible]~~

THE AN PART NUMBER, INCLUDING THE DASH NUMBER, AND THE MANUFACTURER'S IDENTIFICATION SHALL BE MARKED ON EACH CLAMP.

REMOVE ALL BURNS AND SHARP EDGES.

DIMENSIONS IN INCHES. UNLESS OTHERWISE SPECIFIED, TOLERANCES: DECIMALS = ±.015.

CLAMPS SHALL BE FURNISHED IN OPEN POSITION.

INACTIVE FOR DESIGN AFTER 1 JULY 1967. SEE MS21103, MS21104, MS21105, MS21106 AND MS21122.

⑦ REINSTATED AFTER 17 DECEMBER 1968.

F19-005S01

Figure 19-5. Drawing AN742 (Sheet 1 of 2)

	FOR USE WITH			DIMENSIONS										
AN PART NUMBERS PLAIN CLAMPS	RIGID TUBE NOMINAL OD (REF)	UNCOATED FLEXIBLE CONDUIT ID	COATED FLEXIBLE CONDUIT ID	D ±.015 DIA	E		G	R ±.016 RAD	T			W		X
					ALUMINUM ALLOY	ALL STEELS			ALUMINUM ALLOY	CARBON STEEL	HIGH TEMP AND ORE STEEL	ALUMINUM ALLOY	ALL STEELS	
2	1/8			.125	.360	.360	.062 +.016 -.000	.062	.0320 ±.0025	.0320 ±.0035	.020 ±.003	.500	.375	.188
3	3/16			.188	.423	.423								
4	1/4			.250	.457	.457								
5	5/16	3/16		.313	.498	.498								
6	3/8	1/4	3/16	.375	.529	.529								
7	7/16		1/4	.438	.560	.560								
8	1/2	3/8		.500	.592	.592								
9	9/16		3/8	.563	.623	.623								
10	5/8	1/2		.625	.654	.654								
11	11/16		1/2	.680	.752	.749		.109	.050 ±.004		.032 ±.004		.500	.218
12	3/4	5/8		.750	.783	.780								
13	13/16		5/8	.813	.814	.811								
14	7/8	3/4		.875	.845	.842								
15	15/16		3/4	.938	.877	.858								
16	1			1.000	.908	.889								
17	1-1/16			1.063	.939	.920								
18	1-1/8			1.125	.970	.951								
19	1-3/16	1		1.188	1.002	.983								
20	1-1/4		1	1.250	1.062	1.030	.094 +.031 -.000	.125	.063 ±.005					
21	1-5/16			1.313	1.093	1.061								
22	1-3/8			1.375	1.124	1.092								
23	1-7/16	1-1/4		1.438	1.156	1.124								
24	1-1/2		1-1/4	1.500	1.187	1.155								
25	1-9/16			1.563	1.218	1.186								
26	1-5/8			1.625	1.249	1.217								
27		1-1/2		1.688	1.281	1.259								
28	1-3/4		1-1/2	1.750	1.312	1.280								
29				1.812	1.344	1.312								
30	1-7/8			1.875	1.374	1.342								
31		1-3/4		1.938	1.406	1.374								
32	2		1-3/4	2.000	1.437	1.405								
33				2.062	1.468	1.444	.125 +.031 -.000			.040 ±.004	.040 ±.004			
34	2-1/8			2.125	1.499	1.475								
35		2		2.188	1.531	1.507								
36	2-1/4		2	2.250	1.562	1.538								
37				2.312	1.594	1.570								
38	2-3/8			2.375	1.624	1.600								
40	2-1/2			2.500	1.687	1.663								
42				2.625	1.752	1.728								
43		2-1/2		2.688	1.778	1.754								
44	2-3/4		2-1/2	2.750	1.812	1.788								
45				2.812	1.844	1.820								
46				2.875	1.875	1.851								
48	3			3.000	1.937	1.913								
50				3.125	2.000	1.976								
52	3-1/4			3.250	2.062	2.038								
54				3.375	2.125	2.101								
56	3-1/2			3.500	2.187	2.163								
58				3.625	2.250	2.226								
64	4			4.000	2.437	2.413								
66				4.125	2.500	2.476								

SEE SHEET 3 FOR DIMENSIONS OF CUSHION CLAMPS.

F19-005S02

Figure 19-5. Drawing AN742 (Sheet 2)

CHAPTER 20
PULLEYS

20.1 PULLEYS.

This chapter presents information about Pulleys, pulley wear and damage criteria. (See Figure 20-1)

20.2 PULLEY DEFINITION.

A wheel for supporting, guiding, or transmitting force or direction to or from a moving rope, chain, belt, or cable passing over its edge.

20.3 PULLEY MATERIAL.

Only material approved by the qualifying agency shall be used, typically a molded or machined phenolic of light alloy metal such as aluminum. The phenolic type pulleys have a metal housing case formed into the phenolic for a bearing housing.

20.4 PULLEY INSPECTION.

20.4.1 Flange Area. The flange is the protruding rim of the pulley. The flange is subject to failure in the form of breaking, chipping, and cracking. Any crack shall be considered a failure of the pulley, and is cause for rejection. A chip whose depth exceeds half the difference between the pulley outside radius and the pulley groove radius shall be considered a failure of the pulley, and is cause for rejection.

20.4.2 Sheave Area. The sheave is the body of the pulley, where the moving cable, wire, belt etc. contacts the pulley. The sheave area is susceptible to excessive wear should the pulley bind or the bearings fail. The effects of such wear are flat spots, detectable by a rise and fall of the cable as the pulley rotates. Should the groove diameter of the pulley be reduced by more that 1/32 inch, the pulley shall be considered to have failed.

20.4.3 Depressions or pitting of the sheave groove are additional effects of wear. To determine the existence of a defect, a 0.030-inch radius ball point scribe or a 0.032-inch lock-wire is to be held perpendicular and at right angles to the surface being examined, and then pulled slowly across the sheath groove. Only light pressure should be applied to the scribe. If the inspector is able to feel a slight but definite pull on the 0.030-inch radius scribe or a 0.032-inch lock-wire when it is passed over the defect, it is an indication that the defect has considerable depth or rough sides or lock-wire. Such a defect may cause a cable to separate and allow foreign objects to penetrate the cable, initiating corrosion. Such defects shall be considered a failure of the pulley, and is cause for rejection.

20.4.4 Pulley Bearings. The bearings are considered part of the pulley sheave. Bearing failure requires replacement. Refer to T.O. 44B-1-2 for inspection of pulley bearing and lubrication.

20.4.5 Cables. Condition of cables shall be checked any time a defect is found with a pulley. Cable inspections should be made in accordance with T.O. 1-1A-8.

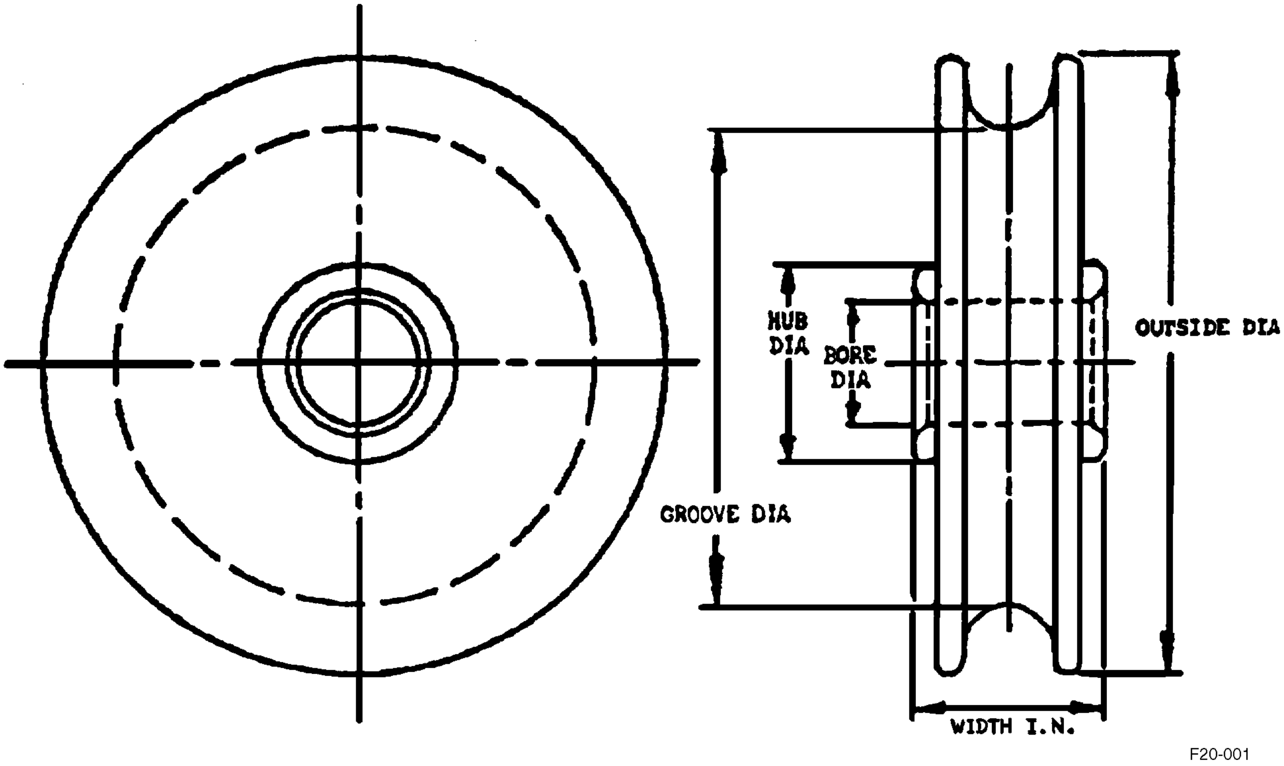
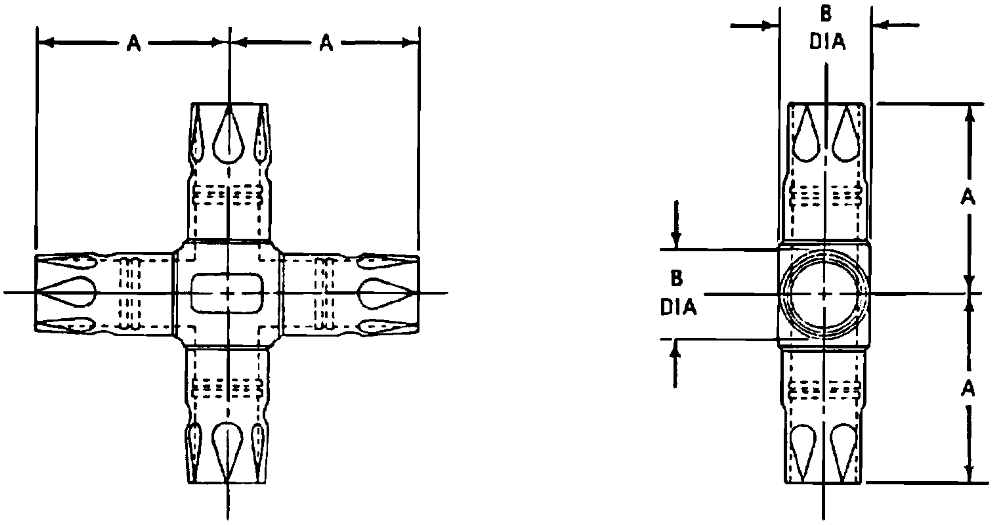


Figure 20-1. Pulley Inspection

APPENDIX A
PERMASWAGE FITTINGS

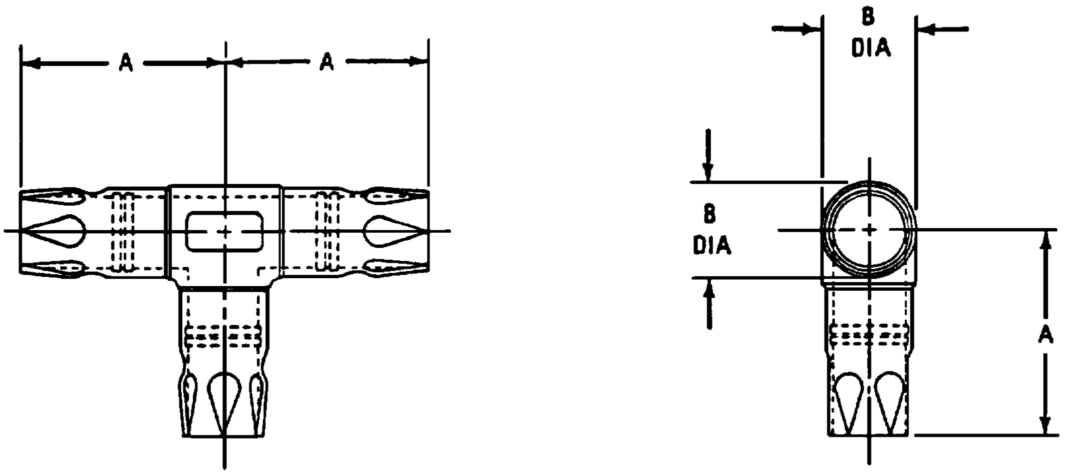
A.1 The Permaswage fittings are formed of corrosion-resistant steel, Type 21-6-9, passivated per MIL-S-5002. These fittings are Teflon coated on internal surfaces only, to a short distance into each end of the fitting bore. Dimensional data of these fittings are shown in this Appendix.



PART NO.	TUBE SIZE	A	B DIA.
APPLICABLE TO D10000 SERIES AND D12300 SERIES TOOL KITS:			
D9854-3	3/16	.860	.325 .310
D9854-4	1/4	1.050	.390 .375
D9854-5	5/16	1.120	.465 .450
D9854-6	3/8	1.190	.550 .530
D9854-8	1/2	1.755	.705 .690
D9854-10	5/8	1.860	.866 .846
D9854-12	3/4	1.990	1.041 1.021
D9854-16	1	2.344	1.385 1.365
APPLICABLE TO D10000 SERIES TOOL KITS ONLY:			
D9854-20	1-1/4	2.468	1.697 1.677
D9854-24	1-1/2	2.593	1.885 1.865
APPLICABLE TO D12300 SERIES TOOL KITS ONLY:			
D10254-20	1-1/4	2.535	1.697 1.677
DNR9854-24	1-1/2	2.683	1.885 1.865

F0A-001

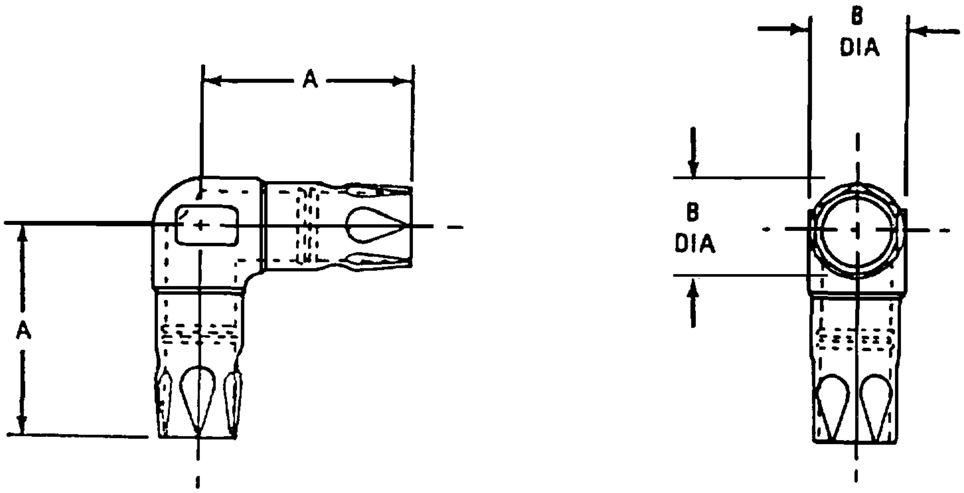
Figure A-1. Permaswage Cross



PART NO.	TUBE SIZE	A	B DIA.
APPLICABLE TO D10000 SERIES AND D12300 SERIES TOOL KITS:			
D9855-3	3/16	.860	.325 .310
D9855-4	1/4	1.050	.390 .375
D9855-5	5/16	1.120	.465 .450
D9855-6	3/8	1.190	.550 .530
D9855-8	1/2	1.755	.705 .690
D9855-10	5/8	1.860	.866 .846
D9855-12	3/4	1.990	1.041 1.021
D9855-16	1	2.344	1.385 1.365
APPLICABLE TO D10000 SERIES TOOL KITS ONLY:			
D9855-20	1-1/4	2.468	1.697 1.677
D9855-24	1-1/2	2.593	1.885 1.865
APPLICABLE TO D12300 SERIES TOOL KITS ONLY:			
D10255-20	1-1/4	2.535	1.697 1.677
DNR9855-24	1-1/2	2.683	1.865

F0A-002

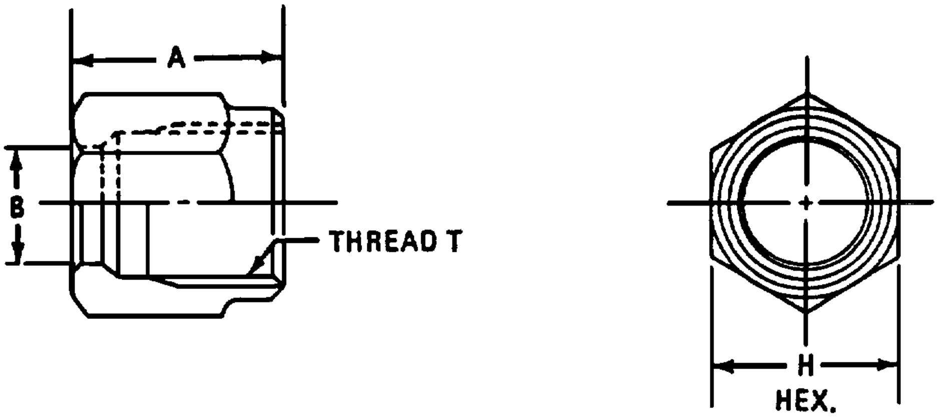
Figure A-2. Permaswage Tee



PART NO.	TUBE SIZE	A	B DIA.
	APPLICABLE TO D10000 SERIES AND D12300 SERIES TOOL KITS:		
D9856-3	3/16	.860	.325 .310
D9856-4	1/4	1.050	.390 .375
D9856-5	5/16	1.120	.465 .450
D9856-6	3/8	1.190	.550 .530
D9856-8	1/2	1.755	.705 .690
D9856-10	5/8	1.860	.866 .846
D9856-12	3/4	1.990	1.041 1.021
D9856-16	1	2.344	1.385 1.365
	APPLICABLE TO D10000 SERIES TOOL KITS ONLY:		
D9856-20	1-1/4	2.468	1.697 1.677
D9856-24	1-1/2	2.593	1.885 1.865
	APPLICABLE TO D12300 SERIES TOOL KITS ONLY:		
D10256-20	1-1/4	2.535	1.697 1.677
DNR9856-24	1-1/2	2.683	1.885 1.865

F0A-003

Figure A-3. Permaswage Elbow

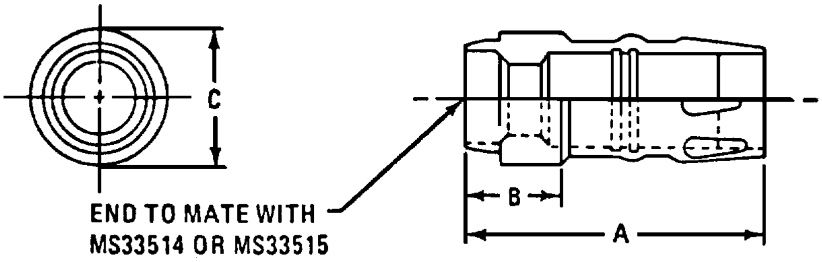


PART NO.	TUBE SIZE	A	B	H HEX
D10006-3	3/16	.609	.2770	.438
D10006-4	1/4	.660	.3175	.562
D10006-5	5/16	.700	.3845	.625
D10006-6	3/8	.736	.4505	.687
D10006-8	1/2	.870	.6140	.875
D10006-10	5/8	.970	.7370	1.000
D10006-12	3/4	1.060	.8670	1.250

Note: For sizes -16, -20 and -24, refer to D10059 and D10060 assemblies. D10006 nuts may not be used with MS20819 flared and MS21922 flareless sleeves.

F0A-004

Figure A-4. Nut Permaswage Flared and Flareless

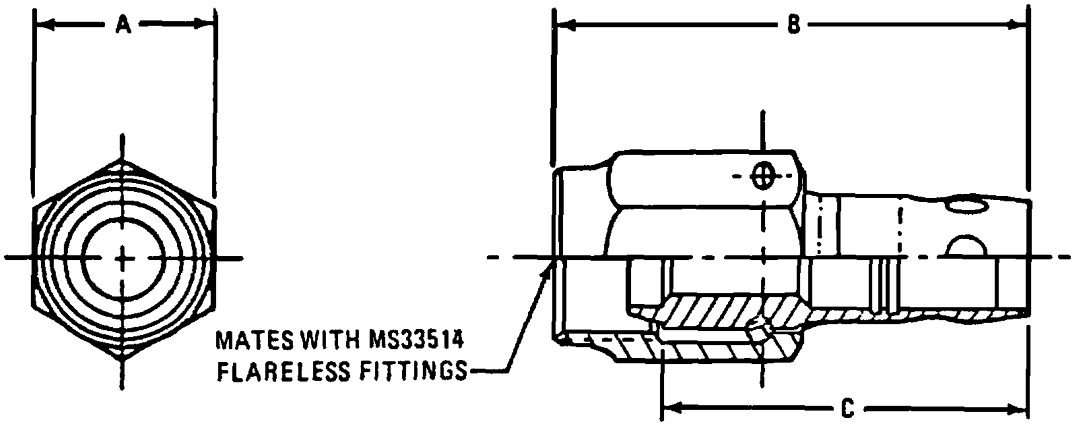


PART NO.	TUBE SIZE	A	B	C
D10007-3	3/16	1.040	.296	.330
D10007-4	1/4	1.175	.322	.385
D10007-5	5/16	1.215	.333	.446
D10007-6	3/8	1.198	.370	.506
D10007-8	1/2	1.770	.410	.684
D10007-10	5/8	1.777	.440	.801
D10007-12	3/4	1.877	.440	.976
D10007-16	SEE D10059			
D10007-20	SEE D10059			
D10007-24	SEE D10059			

Note: Sizes -3 thru -16 applicable to both D10000 series and D12300 series tool kits. D10006 nuts must be used with D10007 permaswage flareless sleeves. MS21921 nuts are not compatible with permaswage sleeves.

F0A-005

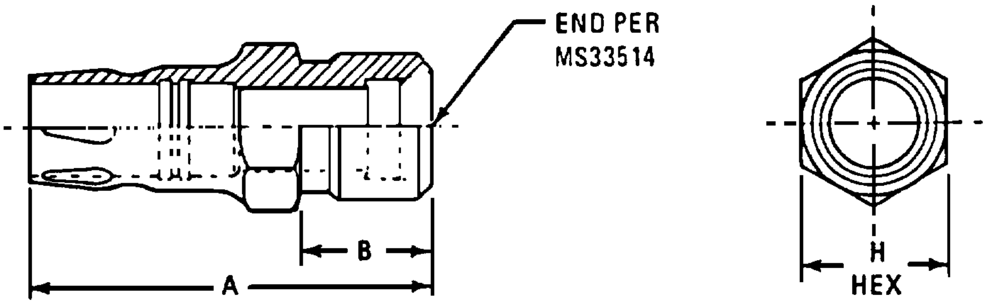
Figure A-5. Sleeve Permaswage Flareless



PART NO.	TUBE SIZE	A	B	C
	APPLICABLE TO D10000 SERIES AND D12300 SERIES TOOL KITS:			
D10059-16	1	1.625	3.718	3.153
	APPLICABLE TO D12300 SERIE S TOOL KITS ONLY:			
D10059-20	1-1/4	1.875	3.185	2.660
D10059-24	1-1/2	2.125	3.291	2.736

F0A-006

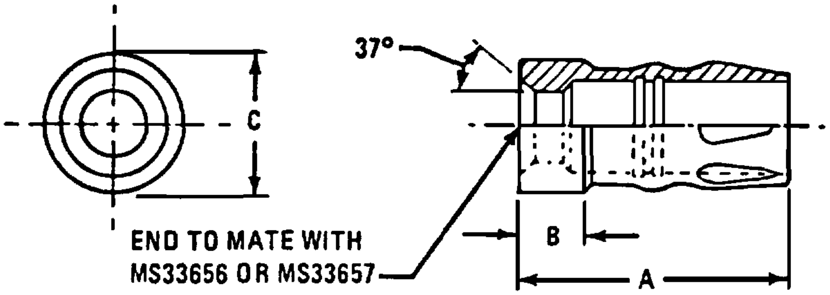
Figure A-6. Permaswage Separable Flareless Sleeve Assembly



PART NO.	TUBE SIZE	A	B	HEX H
	APPLICABLE TO D10000 SERIES AND D12300 SERIES TOOL KITS:			
D10008-3	3/16	1.318	.422	.375
D10008-4	1/4	1.484	.453	.437
D10008-5	5/16	1.528	.453	.500
D10008-6	3/8	1.530	.469	.562
D10008-8	1/2	2.332	.562	.750
D10008-10	5/8	2.357	.625	.875
D10008-12	3/4	2.460	.688	1.062
D10008-16	1	2.858	.688	1.500
	APPLICABLE TO D12300 SERIES TOOL KITS ONLY:			
D10008-20	1-1/4	3.050	.688	1.812
D10008-24	1-1/2	2.905	.688	2.125

F0A-007

Figure A-7. Union Permaswage Flareless

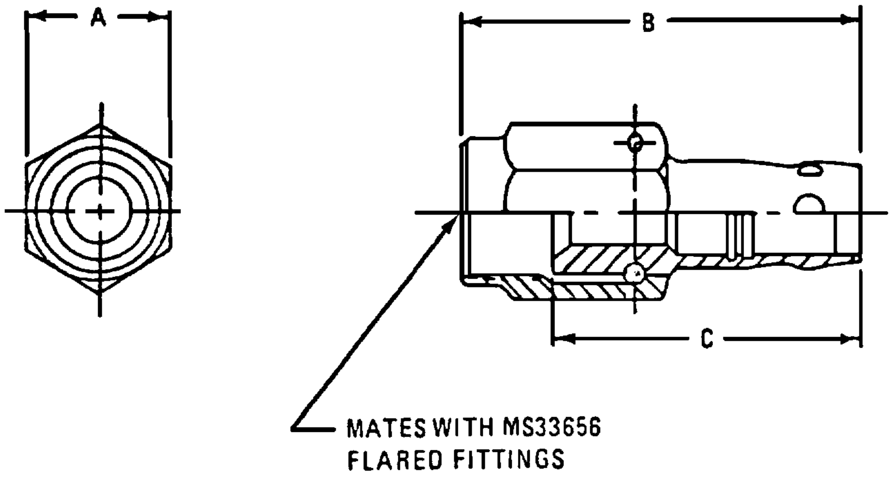


PART NO.	TUBE SIZE	A	B	C
D10010-3	3/16	.900	.156	.330
D10010-4	1/4	1.035	.182	.385
D10010-5	5/16	1.075	.194	.446
D10010-6	3/8	1.061	.233	.506
D10010-8	1/2	1.580	.220	.684
D10010-10	5/8	1.582	.245	.967
D10010-16	SEE D10060			
D10010-20	SEE D10060			
D10010-24	SEE D10060			

Note: Sizes -3 thru -16 applicable to both D10000 series and D12300 series tool kits. D10006 nuts must be used with D10010 permaswage flared sleeves. AN818 nuts are not compatible with permaswage sleeves.

F0A-008

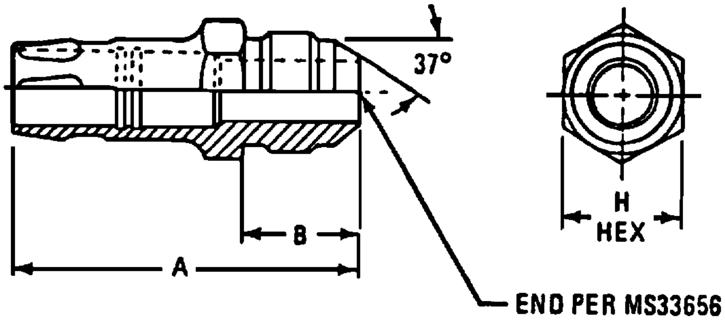
Figure A-8. Sleeve Permaswage Flared - Female



PART NO.	TUBE SIZE	A	B	C
	APPLICABLE TO D10000 SERIES AND D12300 SERIES TOOL KITS:			
D10060-16	1	1.625	3.870	3.240
	APPLICABLE TO D12300 SERIES TOOL KITS ONLY:			
D10060-20	1-1/4	1.875	3.355	2.730
D10060-24	1-1/2	2.125	3.570	2.865

F0A-009

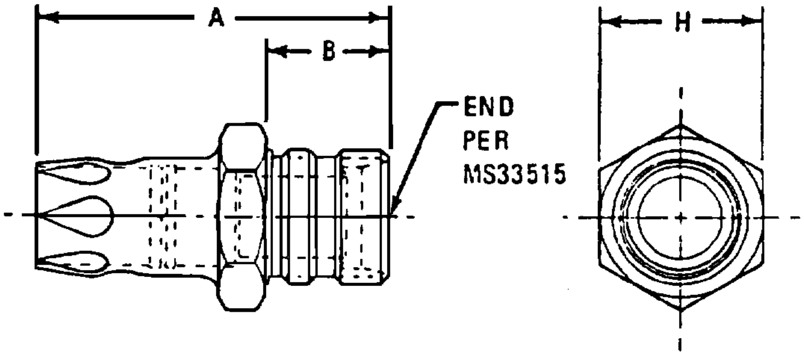
Figure A-9. Permaswage Separable Flared Sleeve Assembly



PART NO.	TUBE SIZE	A	B	HEX H
	APPLICABLE TO D10000 SERIES AND D12300 SERIES TOOL KITS:			
D10011-3	3/16	1.375	.479	.375
D10011-4	1/4	1.581	.550	.437
D10011-5	5/16	1.625	.550	.500
D10011-6	3/8	1.617	.556	.562
D10011-8	1/2	2.427	.657	.750
D10011-10	5/8	2.480	.758	.875
D10011-12	3/4	2.636	.864	1.062
D10011-16	1	3.081	.911	1.500
	APPLICABLE TO D12300 SERIES TOOL KITS ONLY:			
D10011-20	1-1/4	3.320	.958	1.812
D10011-24	1-1/2	3.300	1.083	2.125

F0A-010

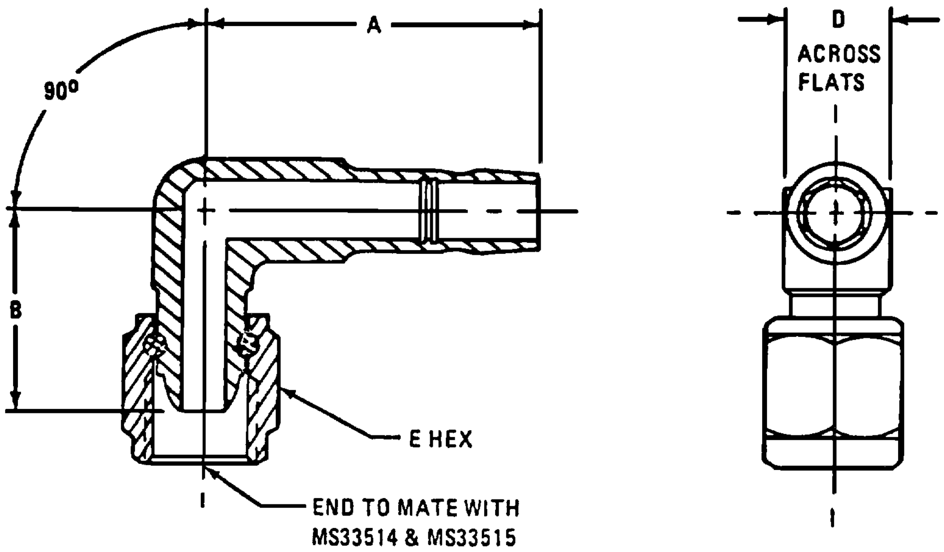
Figure A-10. Union Permaswage Flared - Male



PART NO.	TUBE SIZE	A	B	H HEX
	APPLICABLE TO D10000 SERIES AND D12300 SERIES TOOL KITS:			
D10019-3	3/16	1.853	.906	.625
D10019-4	1/4	2.046	.969	.688
D10019-5	5/16	2.096	.969	.750
D10019-6	3/8	2.174	1.015	.813
D10019-8	1/2	2.853	1.156	1.000
D10019-10	5/8	2.994	1.297	1.125
D10019-12	3/4	3.153	1.406	1.375
D10019-16	1	3.490	1.406	1.625
	APPLICABLE TO D12300 SERIES TOOL KITS ONLY:			
D10019-20	1-1/4	3.490	1.406	1.875
D10019-24	1-1/2	3.490	1.406	2.125

F0A-011

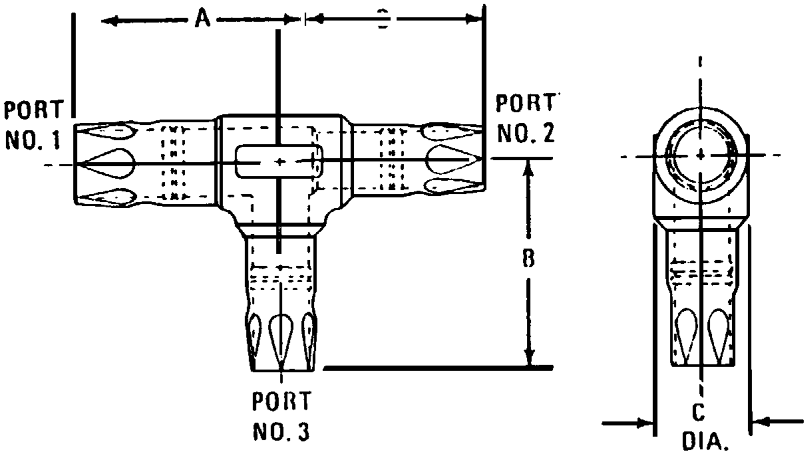
Figure A-11. Union Permaswage to Flareless Bulkhead



PART NO.	TUBE SIZE	A	B	D	E HEX
	APPLICABLE TO D10000 SERIES AND D12300 SERIES TOOL KITS:				
D10021A-3	3/16	1.276	.966	.325/.310	.500
D10021A-4	1/4	1.423	.870	.390/.375	.562
D10021A-5	5/16	1.529	1.002	.465/.450	.625
D10021A-6	3/8	1.625	1.112	.550/.530	.688
D10021A-8	1/2	2.150	1.156	.705/.690	.875
D10021A-10	5/8	2.275	1.391	.866/.846	1.000
D10021A-12	3/4	2.672	1.625	1.041/1.021	1.250
D10021A-16	1	2.750	1.781	1.385/1.365	1.500

F0A-012

Figure A-12. Adapter 90° Permaswage Flareless



.390/ .375	.465/ .450	.550/ .530	.705/ .690	.866/ .846	1.041/ 1.021	1.385/ 1.365	1.697/ 1.677	1.885/ 1.865	C DIAMETER	
1.050	1.120	1.190	1.755	1.860	1.990	2.344	2.468	2.593	A DIMENSION	
4	5	6	8	10	12	16	20	24	FORGING SIZE (LARGEST END)	
.895	.930	.962	1.050	1.116	1.187	1.351	1.419	1.546	3	“B” DIMENSION FOR PORTS 2 AND 3
	1.088	1.121	1.209	1.275	1.347	1.510	1.585	1.705	4	
		1.153	1.241	1.307	1.379	1.542	1.609	1.737	5	
			1.278	1.344	1.416	1.579	1.646	1.775	6	
				1.821	1.893	2.056	2.146	2.275	8	
					1.932	2.095	2.187	2.313	10	
						2.157	2.255	2.383	12	
							2.448	2.576	16	
								2.576	20	

NOTES:

1. Determine leg length as follows:

   Dimension A (largest port reads directly above size required;
   Dimension B (Reducer Port) reds from right to left port size required to forging size required.

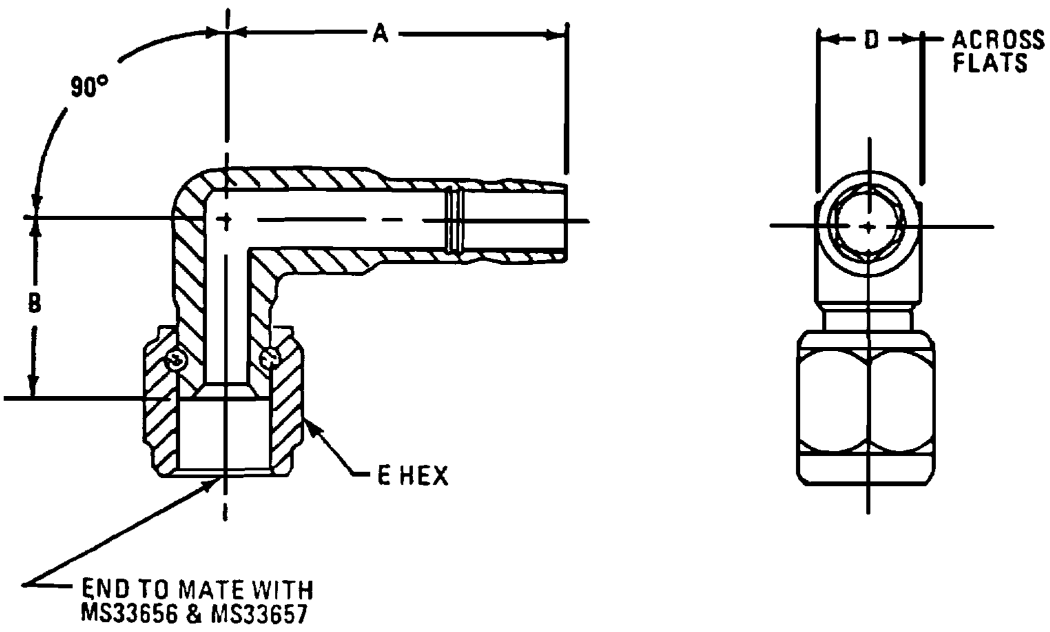
2. End sizes specified as follows:
   D10023 - 10 06 08

   Port No. 3 side port (1/2 O.D.)
   Port No. 2 opposite port on run (3/8 O.D.)
   Port No. 1 largest port on run (5/8 O.D.)
   Material (corrosion resistant steel)
   MFRS basic part number

Leg sizes -3 thru -16 swageable with D10000 series and D12300 series tool kits. Leg sizes -20 and -24 swageable with D10000 series tool kits only.

F0A-013

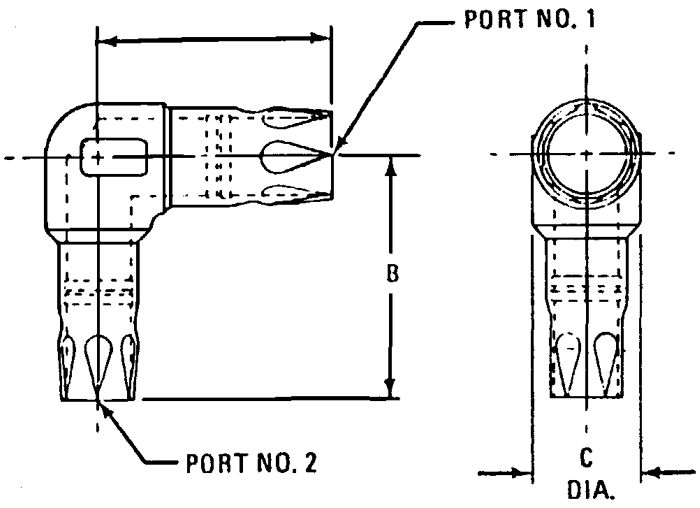
Figure A-13. D10023 Tee Permaswage Reducer



PART NO.	TUBE SIZE	A	B	D	E HEX
	APPLICABLE TO D10000 SERIES AND D12300 SERIES TOOL KITS:				
D10027A-3	3/16	1.276	.750	.325/.310	.500
D10027A-4	1/4	1.423	.719	.390/.375	.562
D10027A-5	5/16	1.529	.844	.465/.450	.562
D10027A-6	3/8	1.625	.922	.550/530	.688
D10027A-8	1/2	2.150	.938	.705/.690	.875
D10027A-10	5/8	2.275	1.125	.866/.846	1.000
D10027A-12	3/4	2.672	1.375	1.041/1.021	1.250
D10027A-16	1	2.750	1.500	1.385/1.365	1.500

F0A-014

Figure A-14. Adapter 90° Permaswage Flared



.390/ .375	.465/ .450	.550/ .530	.705/ .690	.866/ .846	1.041/ 1.021	1.385/ 1.365	1.697/ 1.677	1.885/ 1.865	C DIAMETER	
1.050	1.120	1.190	1.755	1.860	1.990	2.344	2.468	2.593	A DIMENSION	
4	5	6	8	10	12	16	20	24	FORGING SIZE	
.895	.930	.962	1.050	1.116	1.187	1.351	1.419	1.546	3	“B” DIMENSION (PORT 2)
	1.088	1.121	1.209	1.275	1.347	1.510	1.510	1.705	4	
		1.153	1.241	1.307	1.379	1.542	1.609	1.737	5	
		1.153	1.278	1.344	1.416	1.579	1.646	1.775	6	
				1.821	1.893	2.056	2.146	2.275	8	
					1.932	2.095	2.187	2.313	10	
						2.157	2.255	2.383	12	
							2.448	2.576	16	
								2.576	20	

NOTES:

1. Determine leg length as follows:

   Dimension “A” (largest port) reads directly above forging size required.
   Dimension “B” (reducer port) reads from right to left port size required to forging size required.

2. End sizes specified as follows:

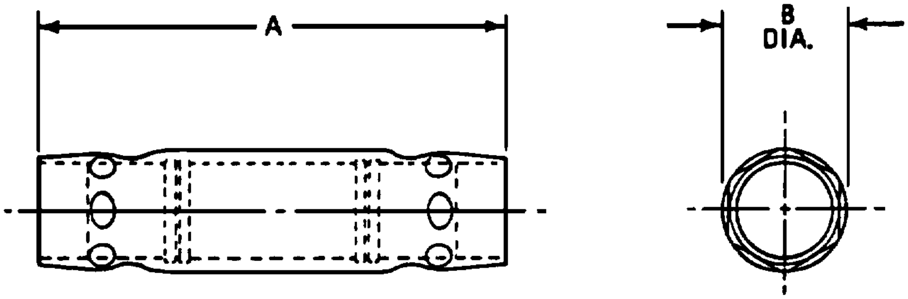
   D10035 - 10 06

   Port No. 2 small port (3/8 O.D.)
   Port No. 1 large port (5/8 O.D.)
   Material (corrosion resistant steel)
   MFRS basic part number

Leg sizes -3 thru -16 swageable with D10000 series and D12300 series tool kits. Leg sizes -20 and -24 swageable with D10000 series tool kits only.

F0A-015

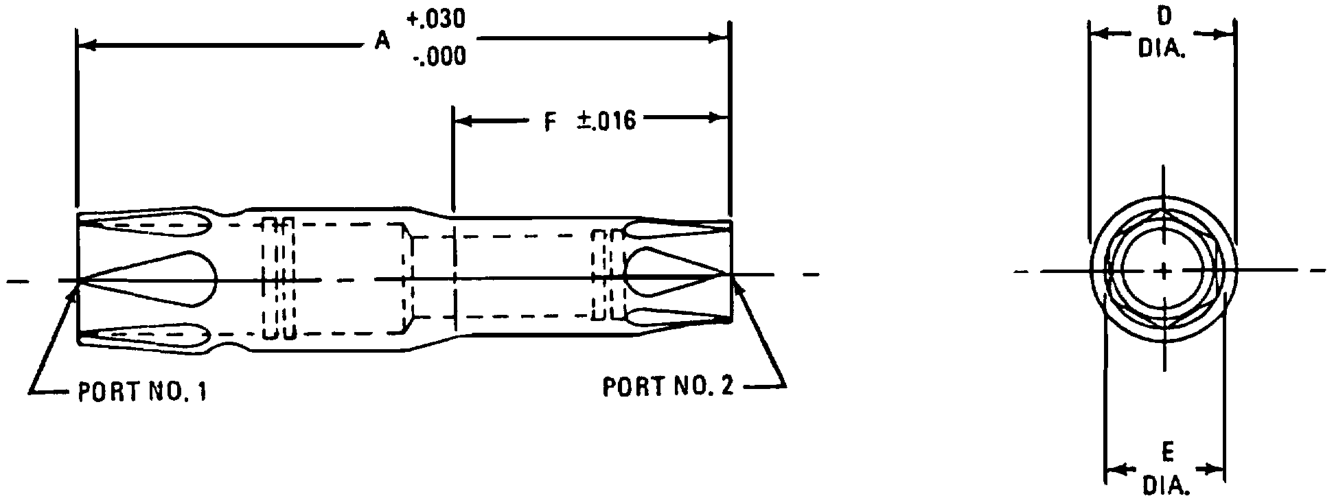
Figure A-15. D10035 Elbow 90° Permaswage Reducer



PART NO.	TUBE SIZE	A	B DIA.
APPLICABLE TO D10000 SERIES AND D12300 SERIES TOOL KITS:			
D10036-3	3/16	1.255/1.245	.275/.272
D10036-4	1/4	1.540/1.530	.338/.335
D10036-5	5/16	1.620/1.610	.413/.410
D10036-6	3/8	1.690/1.680	.480/.477
D10036-8	1/2	2.700/2.686	.655/.652
D10036-10	5/8	2.780/2.766	.787/.784
D10036-12	3/4	2.920/2.906	.929/.926
D10036-16	1	3.209/3.195	1.257/1.253
APPLICABLE TO D10000 SERIES TOOL KITS ONLY:			
D10036-20	1-1/4	3.414/3.400	1.393/1.390
D10036-24	1-1/2	3.664/3.650	1.648/1.645
APPLICABLE TO D12300 SERIES TOOL KITS ONLY:			
D10136-20	1-1/4	3.414/3.400	1.489/1.486
D10136-24	1-1/2	3.664/3.650	1.786/1.783

F0A-016

Figure A-16. Permaswage Union



A (OVERALL LENGTH)												
.275 3	.338 4	.413 5	.480 6	.655 8	.787 10	.929 12	1.257 16	1.489 20	1.786 24	"D" DIA. (REF.) PORT NO. 1		"E" DIA. (REF.)
—	—	—	—	—	—	—	—	—	—	2	PORT NO. 2 (REDUCER PORT)	—
	1.640	1.688	1.790	2.375	2.500	2.570	2.985	—	—	3		.275
		1.765	1.850	2.415	2.550	2.620	3.070	3.425	—	4		.338
			1.875	2.425	2.575	2.630	3.150	3.475	3.710	5		.413
				2.425	2.590	2.640	3.340	3.688	3.915	6		.480
					2.953	3.030	3.420	3.796	3.984	8		.655
						3.030	3.375	3.770	3.955	10		.787
							3.375	3.770	3.955	12		.929
								3.850	4.040	16		1.257
									4.140	20		1.489

3	4	5	6	8	10	12	16	20	24	PORT NO. 1	
—	—	—	—	—	—	—	—	—	—	2	PORT NO. 2 (REDUCER PORT)
	.775	.775	.775	.775	.775	.775	.850	—	—	3	
		.875	.875	.875	.875	.875	.975	.975	—	4	
			.925	.925	.925	.925	1.075	1.075	1.075	5	
				.940	.940	.940	1.240	1.240	1.240	6	
					1.420	1.420	1.420	1.420	1.420	8	
						1.460	1.460	1.460	1.460	10	
							1.520	1.520	1.520	12	
								1.780	1.780	16	
									2.075	20	

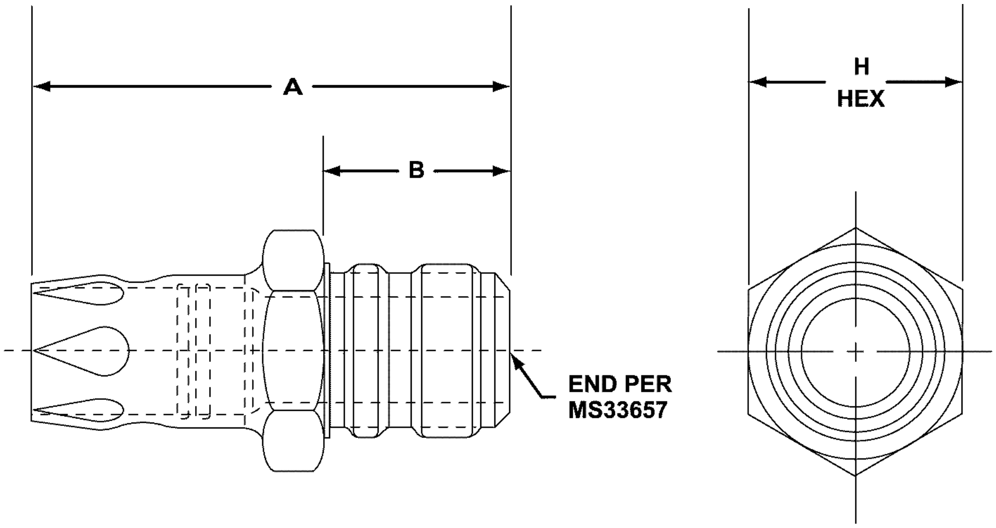
NOTE:
End sizes specified as follows:
D10045 - 10 08

Port No. 2 Reducer port (1/2 O.D.)
Port No. 1 Largest port (5/8 O.D.)
Material
MFRS Basic Part Number

NOTE: Leg sizes -3 thru -16 swageable with D10000 series and D12300 series tool kits. Leg sizes -20 and -24 swageable with D12300 series tool kits only.

F0A-017

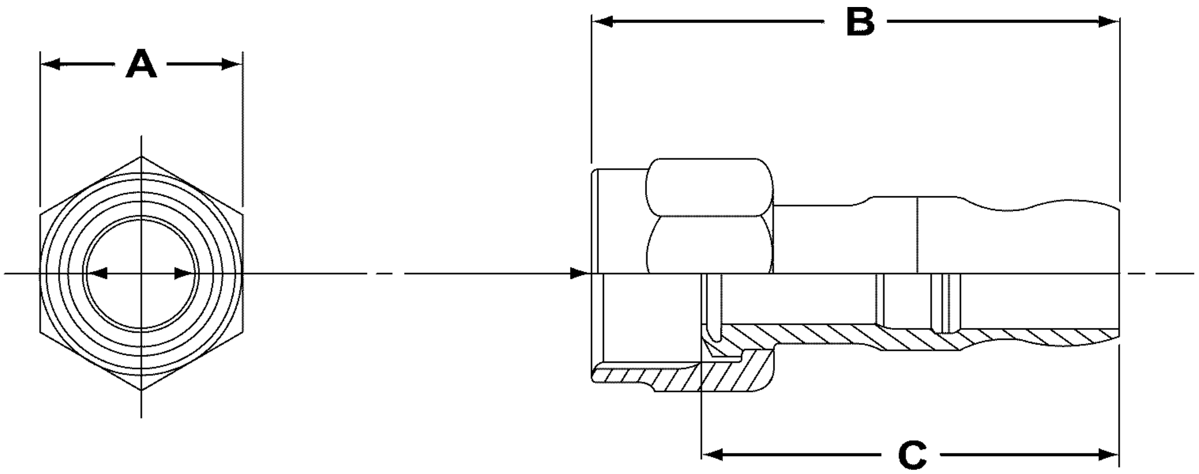
Figure A-17. Permaswage Reducer Union



PART NO.	TUBE SIZE	A	B	H HEX
	APPLICABLE TO D10000 SERIES AND D12300 SERIES TOOL KITS:			
D10046-3	3/16	2.047	.953	.625
D10046-4	1/4	2.275	1.047	.688
D10046-5	5/16	2.325	1.047	.750
D10046-6	3/8	2.437	1.125	.813
D10046-8	1/2	3.140	1.281	1.000
D10046-10	5/8	3.280	1.422	1.125
D10046-12	3/4	3.470	1.593	1.375
D10046-16	1	3.888	1.593	1.625

F0A-018

Figure A-18. Union Permaswage to Flared Bulkhead



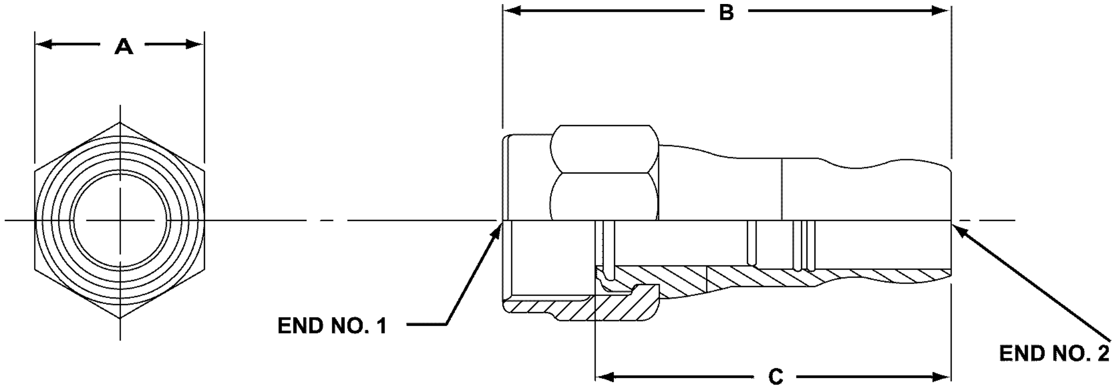
PART NO.	TUBE SIZE	A HEX. (REF.)	B (REF.)	C (REF.)
APPLICABLE TO D10000 SERIES AND D12300 SERIES TOOL KITS:				
DD00200AP-3	3/16	.500	1.610	1.455
DD00200AP-4	1/4	.562	1.801	1.620
DD00200AP-5	5/16	.625	1.836	1.640
DD00200AP-6	3/8	.687	1.925	1.715
DD00200AP-8	1/2	.875	2.502	2.275
DD00200AP-10	5/8	1.000	2.645	2.360
DD00200AP-12	3/4	1.125	2.713	2.295
DD00200AP-16	1	1.500	3.038	2.720
APPLICABLE TO D12300 SERIES TOOL KITS ONLY:				
D11200P-20	1-1/4	1.875	2.927	2.562
SPECIAL FITTING FOR F-14 ONLY, INSTALLED WITH D12300 SERIES KIT:				
DD00200AP-24	1-1/2	2.125	3.322	2.895

EXAMPLE OF CODE: DD00200AP - 8 W

W — 2 Safety Wire Holes (optional)
8 — Tube size (1/2")
\- — Material - corrosion resistant steel
DD00200AP — Basic Part Number

F0A-019

Figure A-19. Female Adapter Permaswage Lipseal Assembly



PART NO.	TUBE SIZE	A HEX. (REF.)	B (REF.)	C (REF.)
DD00300AP-0403	1/4	.562	1.656	1.475
DD00300AP-0504	5/16 - 1/4	.625	1.764	1.550
DD00300AP-0604	3/8 - 1/4	.687	1.835	1.625
DD00300AP-0804	1/2 - 1/4	.875	1.852	1.625
DD00300AP-0806	1/2 - 3/8	.875	1.952	1.715
DD00300AP-1006	5/8 - 3/8	1.000	2.015	1.730
DD00300AP-1008	5/8 - 1/2	1.000	2.575	2.290
DD00300AP-1206	3/4 - 3/8	1.125	2.168	1.850
DD00300AP-1208	3/8 - 1/2	1.125	2.643	2.325
DD00300AP-1210	3/4 - 5/8	1.125	2.713	2.395
DD00300AP-1608	1-1/2	1.500	2.738	2.420
DD00300AP-1610	1-5/8	1.500	2.808	2.490
DD00300AP-1612	1-3/4	1.500	2.878	2.490
DD00300AP-2016	1-1/4-1	1.812	3.077	2.735

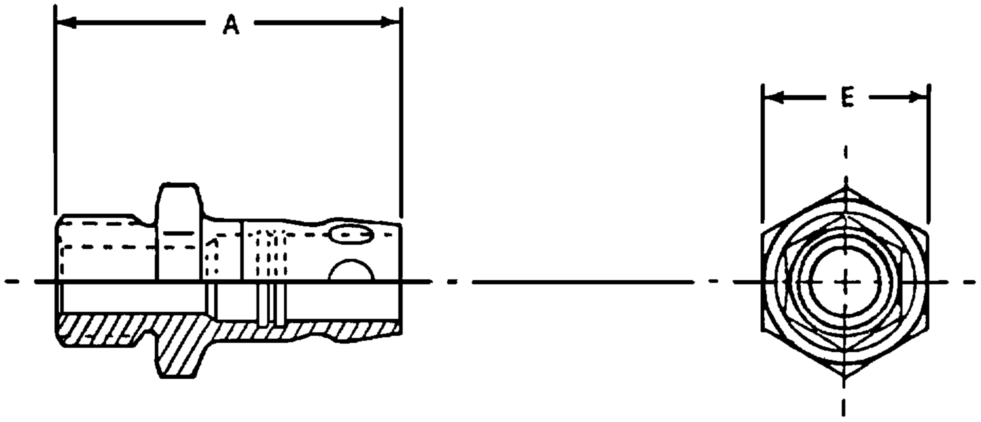
Note: All of the above configurations may be swaged with either D10000 series or D12300 series tool kits.
The - 2016 configuration uses an obsolete thread size applicable to the F-14 aircraft only.

EXAMPLE OF CODE: DD00300 AP - 10 08 W

2 Safety Wire Holes (optional)
End No. 2 (tube end - 1/2")
End No. 1 (threaded end - 5/8")
Material - corrosion resistant steel
Basic Part Number

F0A-020

Figure A-20. Reducer, Female Adapter Permaswage Lipseal Assembly



PART NO.	A	D HEX
APPLICABLE TO D10000 SERIES AND D12300 SERIES TOOL KITS:		
D11007-3	1.129	.375
D11007-4	1.306	.438
D11007-5	1.349	.500
D11007-6	1.356	.562
D11007-8	2.078	.750
D11007-10	2.104	.875
D11007-12	2.184	1.062
D11007-16	2.630	1.500
APPLICABLE TO D12300 SERIES TOOL KITS ONLY:		
D11007-20	2.819	1.625
D11007-24	2.759	2.125

EXAMPLE OF CODE: D11007 - 8 W

2 Safety Wire Holes (optional)
Tube size (1/2")
Material — corrosion resistant steel
Basic Part Number

F0A-021

Figure A-21. Male Adapter Permaswage Lipseal

INDEX