

## SECTION 3. BOLTS

**7-34. GENERAL.** “Hardware” is the term used to describe the various types of fasteners and small items used to assemble and repair aircraft structures and components. Only hardware with traceability to an approved manufacturing process or source should be used. This traceability will ensure that the hardware is at least equal to the original or properly-altered condition. Hardware that is not traceable or is improperly altered, may be substandard or counterfeit, since their physical properties cannot be substantiated. Selection and use of fasteners are as varied as the types of aircraft; therefore, care should be taken to ensure fasteners are approved by the Federal Aviation Administration (FAA) for the intended installation, repair, or replacement. Threaded fasteners (bolts/screws) and rivets are the most commonly used fasteners because they are designed to carry shear and/or tensile loads.

**7-35. BOLTS.** Most bolts used in aircraft structures are either general-purpose, internal-wrenching, or close-tolerance AN, NAS, or MS bolts. In certain cases, fastener manufacturers produce 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.* Design specifications are available in MIL-HDBK-5 or USAF/Navy T.O. 1-1A-8/NAVAIR 01-1A-8. References should be made to military specifications and industry design standards such as NAS, the Society of Automotive Engineers (SAE), and Aerospace Material Standards (AMS). Typical bolt types are shown in table 7-12.

**7-36. IDENTIFICATION.** Aircraft bolts may be identified by code markings on the bolt heads. These markings generally denote the material of which the bolt is made, whether the

bolt is a standard AN-type or a special-purpose bolt, and sometimes include the manufacturer.

**a. AN standard steel bolts** are marked with either a raised dash or asterisk, corrosion-resistant steel is marked by a single dash, and AN aluminum-alloy bolts are marked with two raised dashes.

**b. Special-purpose bolts** include high-strength, low-strength, and close-tolerance types. These bolts are normally inspected by magnetic particle inspection methods. Typical markings include “SPEC” (usually heat-treated for strength and durability), and an aircraft manufacturer’s part number stamped on the head. Bolts with no markings are low strength. Close-tolerance NAS bolts are marked with either a raised or recessed triangle. The material markings for NAS bolts are the same as for AN bolts, except they may be either raised or recessed. Bolts requiring non-destructive inspection (NDI) by magnetic particle inspection are identified by means of colored lacquer, or head markings of a distinctive type. (See figure 7-1.)

**7-37. GRIP LENGTH.** In general, bolt grip lengths of a fastener is the thickness of the material the fastener is designed to hold when two or more parts are being assembled. Bolts of slightly greater grip length may be used, provided washers are placed under the nut or bolthead. The maximum combined height of washers that should be used is 1/8 inch. This limits the use of washers necessary to compensate for grip, up to the next standard grip size. Over the years, some fasteners specifications have been changed. For this reason, it is recommended when making repairs to an aircraft, whose original hardware is being replaced, that you must first measure the bolt before ordering, rather than relying on the parts manual for

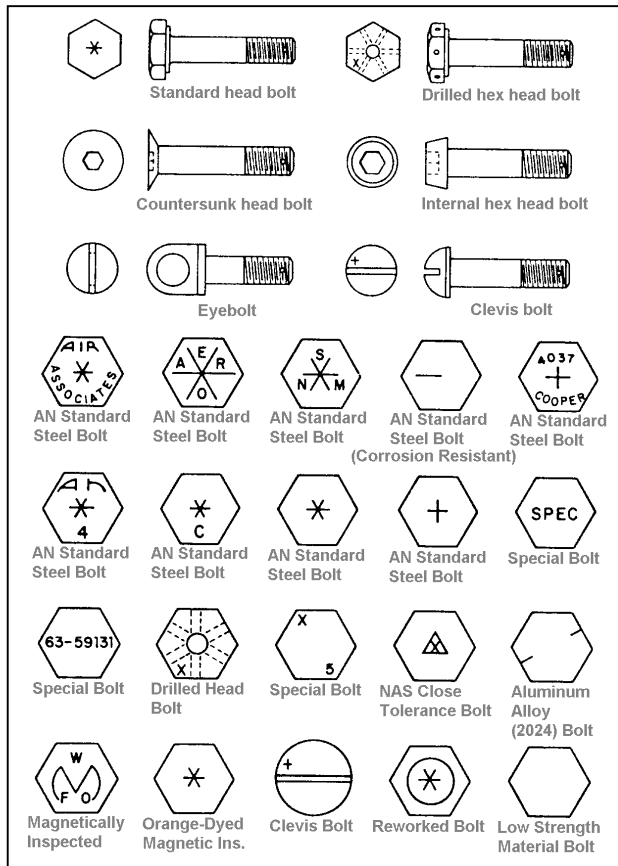


FIGURE 7-1. Typical aircraft bolt markings.

identification. In the case of plate nuts, if proper bolt grip length is not available, add shims under the plate. All bolt installations which involve self-locking or plain nuts should have at least one thread of the bolt protruding through the nut.

**7-38. LOCKING OR SAFETYING OF BOLTS.** Lock or safety all bolts and/or nuts, except self-locking nuts. Do not reuse cotter pins or safety wire.

**7-39. BOLT FIT.** Bolt holes, particularly those of primary connecting elements, have close tolerances. Generally, it is permissible to use the first-lettered drill size larger than the nominal bolt diameter, except when the AN hexagon bolts are used in light-drive fit (reamed) applications and where NAS close-tolerance bolts or AN clevis bolts are used. A light-drive fit can be defined as an interference

of 0.0006 inch for a 5/8 inch bolt. Bolt holes should be flush to the surface, and free of debris to provide full bearing surface for the bolt head and nut. In the event of over-sized or elongated holes in structural members, reaming or drilling the hole to accept the next larger bolt size may be permissible. Care should be taken to ensure items, such as edge distance, clearance, and structural integrity are maintained. Consult the manufacturer's structural repair manual, the manufacturer's engineering department, or the FAA before drilling or reaming any bolt hole in a critical structural member.

**7-40. TORQUES.** The importance of correct torque application cannot be overemphasized. Undertorque can result in unnecessary wear of nuts and bolts, as well as the parts they secure. Overtorque can cause failure of a bolt or nut from overstressing the threaded areas. Uneven or additional loads that are applied to the assembly may result in wear or premature failure. The following are a few simple, but important procedures, that should be followed to ensure that correct torque is applied.

**NOTE:** Be sure that the torque applied is for the size of the bolt shank not the wrench size.

a. **Calibrate the torque wrench** at least once a year, or immediately after it has been abused or dropped, to ensure continued accuracy.

b. **Be sure the bolt and nut threads are clean and dry**, unless otherwise specified by the manufacturer.

c. **Run the nut down to near contact** with the washer or bearing surface and check the friction drag torque required to turn the nut. Whenever possible, apply the torque to the nut and not the bolt. This will reduce rotation of the bolt in the hole and reduce wear.

**d. Add the friction drag torque** to the desired torque. This is referred to as “final torque,” which should register on the indicator or setting for a snap-over type torque wrench.

**e. Apply a smooth even pull** when applying torque pressure. If chattering or a jerking motion occurs during final torque, back off the nut and retorquer.

**NOTE: Many applications of bolts in aircraft/engines require stretch checks prior to reuse. This requirement is due primarily to bolt stretching caused by overtorquing.**

**f. When installing a castle nut**, start alignment with the cotter pin hole at the minimum recommended torque plus friction drag torque.

**NOTE: Do not exceed the maximum torque plus the friction drag. If the hole and nut castellation do not align, change washer or nut and try again. Exceeding the maximum recommended torque is not recommended.**

**g. When torque is applied** to bolt heads or capscrews, apply the recommended torque plus friction drag torque.

**h. If special adapters are used** which will change the effective length of the torque wrench, the final torque indication or wrench setting must be adjusted accordingly. Determine the torque wrench indication or setting with adapter installed as shown in figure 7-2.

**i. Table 7-1** shows the recommended torque to be used when specific torque is not supplied by the manufacturer. The table includes standard nut and bolt combinations, currently used in aviation maintenance. For further identification of hardware, see chapter 7, section 11.

**7-41. STANDARD AIRCRAFT HEX HEAD BOLTS (AN3 THROUGH AN20).** These are all-purpose structural bolts used for general applications that require tension or shear loads. Steel bolts smaller than No. 10-32, and aluminum alloy bolts smaller than 1/4 inch diameter, should not be used in primary structures. Do not use aluminum bolts or nuts in applications requiring frequent removal for inspection or maintenance.

**7-42. DRILLED HEAD BOLTS (AN73 THROUGH AN81).** The AN drilled head bolt is similar to the standard hex bolt, but has a deeper head which is drilled to receive safety wire. The physical differences preventing direct interchangeability are the slightly greater head height, and longer thread length of the AN73 through AN81 series. The AN73 through AN81 drilled head bolts have been superseded by MS20073, for fine thread bolts and MS20074 for coarse thread bolts. AN73, AN74, MS20073, and MS20074 bolts of like thread and grip lengths are universally, functionally, and dimensionally interchangeable.

**7-43. ENGINE BOLTS.** These are 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). They are similar to each other except for the holes in the head and shank. Hex head bolts (AN104601 through AN105500), drilled shank hex head bolts (AN105501 through AN106400), drilled hex head (one hole) bolts (AN106401 through AN107300), and drilled hex head (six holes) bolts (AN107301 through AN108200) are similar to the bolts described in paragraph 7-42, except that this series is manufactured from corrosion-resistant steel.

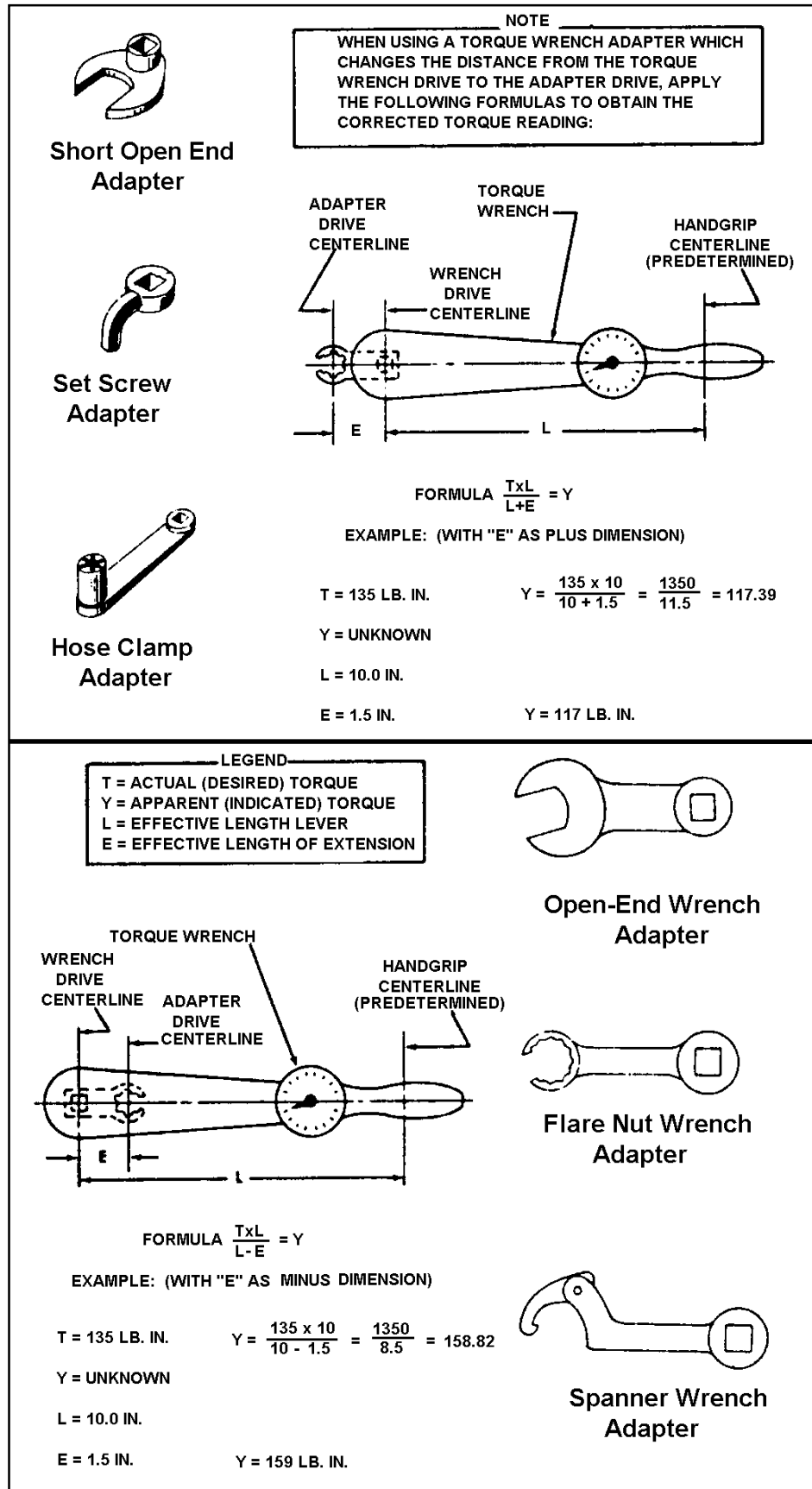


FIGURE 7-2. Torque wrench with various adapters.

**TABLE 7-1.** 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 TORQUE LIMITS	TIGHTENING
Thread 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
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.				

**7-44. CLOSE-TOLERANCE BOLTS.**

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, titanium alloy bolts (NAS653 through NAS658), 100-degree countersunk flathead, close-tolerance titanium alloy bolts (NAS663 through NAS668), and drilled hex head close-tolerance titanium alloy bolts (NAS673 through NAS678), are used in applications where two parts bolted together are subject to severe load reversals and vibration. Because of the interference fit, this type

of bolt may require light tapping with a mallet to set the bolt shank into the bolt hole.

**NOTE:** Elimination of friction in interference fit applications may sometimes be attained by placing the bolt in a freezer prior to installation. When this procedure is used, the bolt should be allowed to warm up to ambient temperature before torquing.

**CAUTION:** Caution must be exercised in the use of close-tolerance bolts for all critical applications, such as

**landing gear, control systems, and helicopter rotary controls. Do not substitute for close-tolerance fasteners without specific instructions from the aircraft manufacturer or the FAA.**

**7-45. INTERNAL WRENCHING BOLTS (NAS144 THROUGH NAS158 AND NAS172 THROUGH NAS176).** These are high-strength bolts used primarily in tension applications. Use a special heat-treated washer (NAS143C) under the head to prevent the large radius of the shank from contacting only the sharp edge of the hole. Use a special heat-treated washer (NAS143) under the nut.

**7-46. INTERNAL WRENCHING BOLTS (MS20004 THROUGH MS20024) AND SIX HOLE, DRILLED SOCKET HEAD BOLTS (AN148551 THROUGH AN149350).** These are very similar to the bolts in paragraph 7-45, except these bolts are made from different alloys. The NAS144 through NAS158 and NAS172 through NAS176 are interchangeable with MS20004 through MS20024 in the same thread configuration and grip lengths. The AN148551 through AN149350 have been superseded by MS9088 through MS9094 with the exception of AN149251 through 149350, which has no superseding MS standard.

**7-47. TWELVE POINT, EXTERNAL WRENCHING BOLTS, (NAS624 THROUGH NAS644).** These bolts are used primarily in high-tensile, high-fatigue strength applications. The twelve point head, heat-resistant machine bolts (MS9033 through

MS9039), and drilled twelve point head machine bolts (MS9088 through MS9094), are similar to the (NAS624 through NAS644); but are made from different steel alloys, and their shanks have larger tolerances.

**7-48. CLOSE-TOLERANCE SHEAR BOLTS (NAS464).** These bolts are designed for use where stresses normally are in shear only. These bolts have a shorter thread than bolts designed for torquing.

**7-49. NAS6200 SERIES BOLTS.** These are close tolerance bolts and are available in two oversized diameters to fit slightly elongated holes. These bolts can be ordered with an "X" or "Y" after the length, to designate the oversized grip portion of the bolt (i.e., NAS6204-6X for a 1/4 inch bolt with a 1/64 inch larger diameter). The elongated hole may have to be reamed to insure a good fit.

**7-50. CLEVIS BOLTS (AN21 THROUGH AN36).** These bolts are only used in applications subject to shear stress, and are often used as mechanical pins in control systems.

**7-51. EYEBOLTS (AN42 THROUGH AN49).** These bolts are used in applications where external tension loads are to be applied. The head of this bolt is specially designed for the attachment of a turnbuckle, a clevis, or a cable shackle. The threaded shank may or may not be drilled for safetying.

**7-52.—7-62. [RESERVED.]**

## SECTION 4. NUTS

**7-63. GENERAL.** Aircraft nuts are available in a variety of shapes, sizes, and material strengths. The types of nuts used in aircraft structures include castle nuts, shear nuts, plain nuts, light hex nuts, checknuts, wingnuts, and sheet spring nuts. Many are available in either self-locking or nonself-locking style. Typical nut types are shown in table 7-13. Refer to the aircraft manufacturer's structural repair manual, the manufacturer's engineering department, or the FAA, before replacing any nut with any other type.

**7-64. SELF-LOCKING NUTS.** These nuts are acceptable for use on certificated aircraft subject to the aircraft manufacturer's recommended practice sheets or specifications. Two types of self-locking nuts are currently in use, the all-metal type, and the fiber or nylon type.

**a. DO NOT** use self-locking nuts on parts subject to rotation.

**b. Self-locking castellated nuts** with cotter pins or lockwire may be used in any system.

**c. Self-locking nuts** should not be used with bolts or screws on turbine engine airplanes in locations where the loose nut, bolt, washer, or screw could fall or be drawn into the engine air intake scoop.

**d. Self-locking nuts** should not be used with bolts, screws, or studs to attach access panels or doors, or to assemble any parts that are routinely disassembled before, or after each flight. They may be used with anti-friction bearings and control pulleys, provided the inner race of the bearing is secured to the supporting structure by the nut and bolt.

**e. Metal locknuts** are constructed with either the threads in the locking insert, out-of-round with the load-carrying section, or with a saw-cut insert with a pinched-in thread in the locking section. The locking action of the all-metal nut depends upon the resiliency of the metal when the locking section and load-carrying section are engaged by screw threads. Metal locknuts are primarily used in high temperature areas.

**f. Fiber or nylon locknuts** are constructed with an unthreaded fiber or nylon locking insert held securely in place. The fiber or nylon insert provides the locking action because it has a smaller diameter than the nut. Fiber or nylon self-locking nuts are not installed in areas where temperatures exceed 250 °F. After the nut has been tightened, make sure the bolt or stud has at least one thread showing past the nut. **DO NOT** reuse a fiber or nylon locknut, if the nut cannot meet the minimum prevailing torque values. (See table 7-2.)

**g. Self-locking nut plates** are produced in a variety of forms and materials for riveting or welding to aircraft structures or parts. Certain applications require the installation of self-locking nuts in channel arrangement permitting the attachment of many nuts in a row with only a few rivets.

**7-65. NUT IDENTIFICATION FINISHES.** Several types of finishes are used on self-locking nuts. The particular type of finish is dependent on the application and temperature requirement. The most commonly used finishes are described briefly as follows.

**TABLE 7-2.** Minimum prevailing torque values for re-used self-locking nuts.

FINE THREAD SERIES	
THREAD SIZE	MINIMUM PREVAILING TORQUE
7/16 - 20	8 inch-pounds
1/2 - 20	10 inch-pounds
9/16 - 18	13 inch-pounds
5/8 - 18	18 inch-pounds
3/4 - 16	27 inch-pounds
7/8 - 14	40 inch-pounds
1 - 14	55 inch-pounds
1-1/8 - 12	73 inch-pounds
1-1/4 - 12	94 inch-pounds
COARSE THREAD SERIES	
THREAD SIZE	MINIMUM PREVAILING TORQUE
7/16 - 14	8 inch-pounds
1/2 - 13	10 inch-pounds
9/16 - 12	14 inch-pounds
5/8 - 11	20 inch-pounds
3/4 - 10	27 inch-pounds
7/8 - 9	40 inch-pounds
1 - 8	51 inch-pounds
1-1/8 - 8	68 inch-pounds
1-1/4 - 8	88 inch-pounds

**a. Cadmium-Plating.** This is an electrolytically deposited silver-gray plating which provides exceptionally good protection against corrosion, particularly in salty atmosphere, but is not recommended in applications where the temperature exceeds 450 °F. The following additional finishes or refinements to the basic cadmium can be applied.

**(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, and resists staining and finger marks.

**(2) Olive Drab Dichromate.** Cadmium-plated work is dipped in a solution of chromic acid, nitric acid, acetic acid, and a dye which produces corrosion resistance.

**(3) Iridescent Dichromate.** Cadmium-plated work is dipped in a solution of sodium dichromate and takes on a surface film of basic chromium chromate which resists corrosion. Finish is yellow to brown in color.

**NOTE: Cadmium-plated nuts are restricted for use in temperatures not to exceed 450 °F. When used in temperatures in excess of 450 °F, 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 locknuts for use at higher temperatures. Important advantages are its resistance to extreme heat (1,400 °F) and its excellent lubricating characteristics. Silver resists galling and seizing of mating parts when subjected to heat or heavy pressure.

**c. Anodizing for Aluminum.** An inorganic oxide coating is formed on the metal by connecting the metals and anodes in a suitable electrolyte. The coating offers excellent corrosion resistance and can be dyed in a number of colors.

**d. Solid Lubricant Coating.** Locknuts are also furnished with molybdenum disulfide for lubrication purposes. It provides a clean, dry, permanently-bonded coating to prevent seizing and galling of threads. Molybdenum disulfide is applied to both cadmium and silver-plated parts. Other types of finishes are available, but the finishes described in this chapter are the most widely used.

**7-66. CASTLE NUT (AN310).** The castle nut is used with drilled shank hex head bolts, clevis bolts, drilled head bolts, or studs that are subjected to tension loads. The nut has slots or castellations cut to accommodate a cotter pin or safety wire as a means of safetying.



**7-67. CASTELLATED SHEAR NUT (AN320).** The castellated shear nut is designed for use with hardware subjected to shear stress only.

**7-68. PLAIN NUT (AN315 AND AN335).** The plain nut is capable of withstanding large tension loads; however, it requires an auxiliary locking device, such as a checknut or safety wire. Use of this type on aircraft structures is limited.

**7-69. LIGHT HEX NUTS (AN340 AND AN345).** These nuts are used in nonstructural applications requiring light tension. Like the AN315 and AN335, they require a locking device to secure them.

**7-70. CHECKNUT (AN316).** The checknut is used as a locking device for plain nuts, screws, threaded rod ends, and other devices.

**7-71. WINGNUTS (AN350).** The wingnut is used where the desired torque is obtained by use of the fingers or handtools. Wingnuts are normally drilled to allow safetying with safety wire.

**7-72. SHEET SPRING NUTS (AN365).** Sheet spring nuts are commonly called speed nuts. They are used with standard and sheet metal self-tapping screws in nonstructural applications. They are used to support line and conduit clamps, access doors, etc. Their use should be limited to applications where they were originally used in assembly of the aircraft.

**7-73.—7-84. RESERVED.**

TABLE 7-11. (CONTINUED)




Screw MS, AN, or NAS Number	Description
NAS6100-6103 	Screw, hex head, tri-wing recess, full thr., titanium
NAS6500-6506 	Screw, 100° oval hd., tri-wing recess, full thr., cres.
NAS6900-6904 	Screw, panhead, tri-wing recess, full thr., cres.

TABLE 7-12. TABLE OF BOLTS.







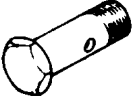
Bolt Number	Description
AN3-20 	Bolt, machine
AN21-36 	Bolt, clevis
AN42-49 	Bolt, eye
AN73-81 	Bolt, machine, drilled
AN173-186 	Bolt, aircraft Close tolerance
AN774 	Bolt, flared tube
AN775 	Bolt, universal fitting

TABLE 7-12. (CONTINUED)


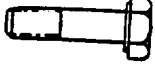
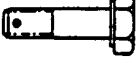
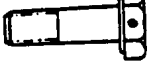

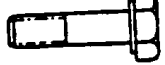
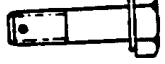
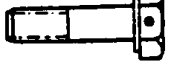
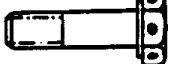


Bolt Number	Description
AN148551-149350 	Bolt, socket head, 6-hole drilled, .190-.625
AN101001-101900 	Bolt, hex, steel, head
AN101901-102800 	Bolt, hex., drilled shank, steel
AN102801-103700 	Bolt, Drilled hex. Head, (one hole), steel
AN103701-104600 	Bolt, drilled hex. Head, steel, (six holes)
AN104601-105500 	Bolt, hex. Head, corrosion-resistant steel
AN105501-106400 	Bolt, hex. Head, drilled shank, corrosion-resistant steel
AN106401-107300 	Bolt, hex., drilled head, (one holes), corrosion-resistant steel
AN107301-108200 	Bolt, hex., drilled head, (six holes), corrosion-resistant steel
MS9033-9039 	Bolt, machine 12pt. Head, 130,000 psi min. T.S.
MS9060-9066 	Bolt, machine 12pt. Double hex. 130,000 psi min. T.S. ext. washer head, drilled

TABLE 7-12. (CONTINUED)




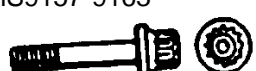
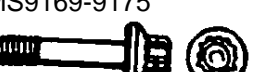

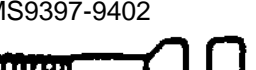
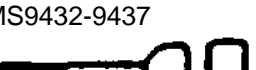
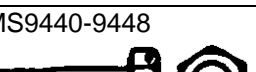
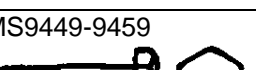
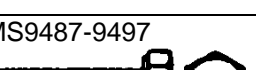
Bolt Number	Description
MS9088-9094 	Bolt, machine, steel, drilled 12 pt. head
MS9110-9113 	Bolt, machine, double hex., ext. washer head, close tolerance
MS9146-9152 	Bolt, steel, 12 pt. hd. black oxide 125,000 psi min. T.S.
MS9157-9163 	Bolt, steel, 12pt. hd. black oxide 125,000 psi min. T.S.
MS9169-9175 	Bolt, steel, 12 pt. drilled hd., black oxide 125,000 psi min. T.S.
MS9224 	Bolt, 12 pt. head, heat resistant
MS9397-9402 	Bolt, tee head, AMS 6322, chamfered cad. pl.
MS9432-9437 	Bolt, tee head AMS 5735 chamfered
MS9440-9448 	Bolt, mach. steel. AMS 6304 diffused nickel cad. hex. hd., 3 holes
MS9449-9459 	Bolt, mach. steel, AMS 6304 diffused nickel cad., hex. head
MS9487-9497 	Bolt, mach. hex. hd. full shank, AMS 5731

TABLE 7-12. (CONTINUED)



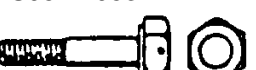
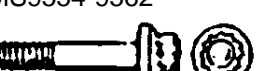
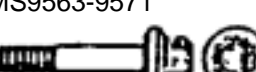
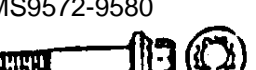

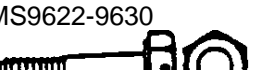
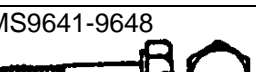
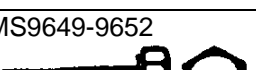
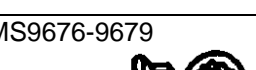
Bolt Number	Description
MS9498-9508 	Bolt, mach. hex. hd., 1 hole, full shank
MS9516-9526 	Bolt, mach., steel AMS 6322 cad. 1 hole hex. hd.
MS9527-9537 	Bolt, mach., steel AMS 6322 cad. 1 hole hex. hd.
MS9554-9562 	Bolt, mach., dbl. hex. ext. wash. hd., PD shank, AMS 5731
MS9563-9571 	Bolt, mach., dbl. hex. ext. wash. hd. drilled, AMS 5731
MS9572-9580 	Bolt, mach., dbl. hex. ext. wash. hd., drilled, PD shank AMS 5731 silver plated
MS9583-9591 	Bolt, mach., hex. hd. 6 holes full shank, AMS 5731
MS9622-9630 	Bolt, mach., hex. hd. 1 hole, PD shank, titanium AMS 4967
MS9641-9648 	Bolt, mach., hex. hd., 1 hole, full shank titanium AMS 4967
MS9649-9652 	Bolt, mach., hex. hd. full shank, titanium AMS 4967
MS9676-9679 	Bolt, mach., dbl. hex. ext. wash. hd., cup washer locked, cres. AMS 5731

TABLE 7-12. (CONTINUED)



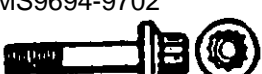

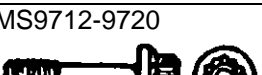
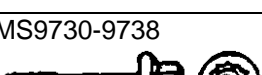
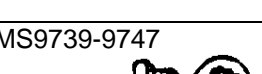
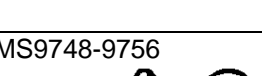
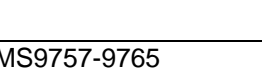
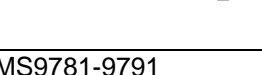

Bolt Number	Description
MS9680-9683 	Bolt, mach., dbl. hex. ext. wash. hd., cup washer locked, steel AMS 6322 cad.
MS9685-9693 	Bolt, mach., hex. hd. 1 hole, PD shank, steel AMS 6304 diffused nickel cad.
MS9694-9702 	Bolt mach. dbl. hex. ext. wash. hd. AMS 5708
MS9703-9711 	Bolt, mach., dbl. hex. ext. wash. hd., drilled, AMS 5708
MS9712-9720 	Bolt, mach. dbl. hex. ext. wash. hd. drilled, AMS 5708 silver plate
MS9730-9738 	Bolt, mach., dbl. hex. ext. wash. hd. PD shank, cres. AMS 5643
MS9739-9747 	Bolt, mach. dbl. hex. est. wash, hd. drilled, PD shank, cres. AMS 5643
MS9748-9756 	Bolt, mach. dbl. hex. ext. wash. hd. PD shank, titanium AMS 4967
MS9757-9765 	Bolt, mach., dbl. hex. ext. wash. hd., PD shank, drilled, titanium AMS 4967
MS9781-9791 	Bolt, hex. hd., mach. full shank, AMS 5643
MS9792-9802 	Bolt, mach., hex. hd. 1 hole, full shank, AMS 5643

TABLE 7-12. (CONTINUED)



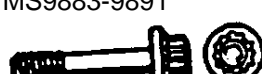
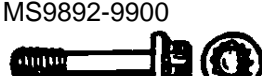
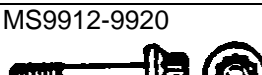
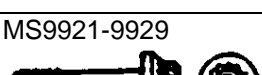
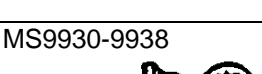
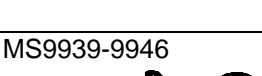
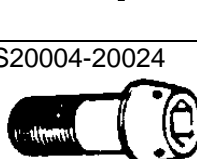
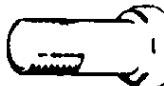
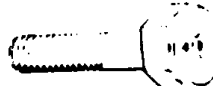
Bolt Number	Description
MS9803-9813 	Bolt, mach., hex. Hd. 1 hole, full shank, AMS 5643
MS9814-9824 	Bolt, mach., hex. Hd. 1 hole, PD shank, AMS 5643
MS9883-9891 	Bolt, mach., dbl. Hex. Ext. wash. Hd., AMS 5616
MS9892-9900 	Bolt mach., dbl. Hex. Ext. wash. Hd., AMS 5616 drilled
MS9912-9920 	Bolt, mach., dbl. Hex. Ext. wash. Hd., PD shank, steel AMS 6322 cad.
MS9921-9929 	Bolt, mach., dbl. Hex. Ext. wash hd. PD shank, steel AMS 6322 cad. Drilled
MS9930-9938 	Bolt, mach., dbl. Hex. Ext. wash. Hd., full shank, steel AMS 6322 cad.
MS9939-9946 	Bolt, mach., dbl. Hex. Ext. wash. Hd., drilled, full shank, steel AMS 6322 cad.
MS20004-20024 	Bolt, int. wrench, 160 KSI
MS20033-20046 	Bolt, machine, hex. Head, 1200 °F
MS20073-20074 	Bolt, machine, aircraft, drilled hd., fine & coarse thr.

TABLE 7-12. (CONTINUED)







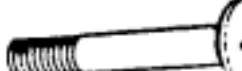

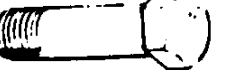


Bolt Number	Description
MS21091-21093 	Bolt, self-lock., 100° flush head, cross recessed
MS21094-21095 	Bolt, self-lock., hex. head
MS21096-21097 	Bolt, self-lock., pan-head, cross recessed
MS21098-21099 	Bolt, self-lock., 12 pt. ext. wrenching
MS21250 	Bolt, 12 pt., ext. wrenching
NAS144-158 	Bolt, internal wrenching, steel, 1/4-28 thru 1-1/8-12
NAS333-340 	Bolt, 100°, close tolerance, hi-strength
NAS428 	Bolt, adjusting, crowned hex. hd.
NAS464 	Bolt, shear, close tolerance
NAS501 	Bolt, hex. head, drilled & undrilled
NAS551 	Bolt, universal fitting

TABLE 7-12. (CONTINUED)

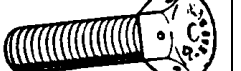










Bolt Number	Description
NAS563-572 	Bolt, full thread, fully identified head
NAS583-590 	Bolt, 100° head, hi-torque, close tol. 160,000 psi
NAS624-644 	Bolt, twelve point external wrench, 180,000 psi
NAS653-658 	Bolt, hex. head, close tolerance, ti. alloy
NAS663-668 	Bolt, full thread, fully identified head
NAS673-678 	Bolt, hex. head, close tolerance, ti. alloy
NAS1003-1020 	Bolt, machine, hex. head
NAS1053 	Eye Bolt Assembly, Shoulder nut
NAS1083 	Bolt, 100° flathead, titanium alloy
NAS1103-1120 	Bolt, machine, hex. head
NAS1202-1210 	Bolt, 100° phil. recessed, close tolerance, 16,000 psi

TABLE 7-12. (CONTINUED)











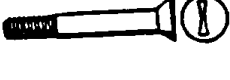
Bolt Number	Description
NAS1223-1235 	Bolt, self-locking, hex. head 250 °F
NAS1236 	Bolt, universal, Tube-end, flareless
NAS1243-1250 	Bolt, 100° head, hi-torq. 1600 psi
NAS1253-1260 	Bolt, 100° head, flush hd., .0312 O.S. hi-torque
NAS1261-1270 	Bolt, hex. head, short thread
NAS1271-1280 	Bolt, 12 point hd., external wrenching
NAS1297 	Bolt, shoulder, hex. head
NAS1303-1320 	Bolt, hex. head, close tolerance, 160,000 psi
NAS1414-1422 	Lock bolt, shear 100° head, all. steel
NAS1424-1432 	Lock bolt, shear protruding head, steel
NAS1503-1510 	Bolt, 100° flush head, hi-torq.

TABLE 7-12. (CONTINUED)












Bolt Number	Description
NAS1516-1522 	Lock Bolt, 100° head, pull type, al. Alloy
NAS1578 	Bolt, shear panhead, 1200 °F
NAS1580 	Bolt, tension, flush hd., 1200 °F
NAS1581 	Bolt, shear reduced 100 °F flush head, 1200 °F
NAS1586 	Bolt-tension, 1200 °F, 12 point, external wrenching
NAS1588 	Bolt, tension, flush hd., 1200 °F
NAS1703-1710 	Bolt, 100° head, .0156 O.S. shank,
NAS2005-2012 	Bolt lock, protruding head, ti. Alloy
NAS2105-2112 	Bolt, lock, 100° head, ti. Alloy
NAS2206-2210 	Bolt, lock, stump type, protruding head, ti. Alloy
NAS2306-2310 	Bolt, lock, stump type, 100° head, ti. Alloy

TABLE 7-12. (CONTINUED)


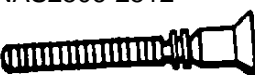
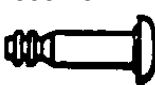
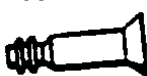







Bolt Number	Description
NAS2406-2412 	Bolt, lock, shear protruding head, ti. alloy
NAS2506-2512 	Bolt, lock, 100° head, ti. alloy
NAS2606-2612 	Bolt, lock, shear protruding head, ti. alloy
NAS2706-2712 	Bolt, lock, shear 100° head, ti. alloy
NAS2803-2810 	Bolt, lock, 100° hd., torq-set 180,000 psi
NAS2903-2920 	Bolt, hex. head, .0156 O.S. shank, 160,000 psi
NAS3003-3020 	Bolt, hex. head, .0312 O.S. shank, 160,000 psi
NAS3103-3110 	Bolt, U type
NAS3203-3210 	Bolt, hook
NAS3303-3305 	Bolt, U strap type
NAS4104-4116 	Bolt, 100° head, tri-wing recess, long thr., alloy stl.

TABLE 7-12. (CONTINUED)












Bolt Number	Description
NAS4204-4216 	Bolt, 100° head, tri-wing recess, long thr., cres.
NAS4304-4316 	Bolt, 100° head, tri-wing recess, long thr., titanium
NAS4400-4416 	Bolt, 100° head, tri-wing recess, short thr., alloy stl.
NAS4500-4516 	Bolt, 100° head, tri-wing recess, short thr., cres.
NAS4600-4616 	Bolt, 100° head, tri-wing recess, short thr., titanium
NAS4703-4716 	Bolt, 100° reduced, tri-wing recess, short thr., alloy stl.
NAS4803-4816 	Bolt, 100° reduced, tri-wing recess, short thr., cres.
NAS4903-4916 	Bolt, 100° reduced, tri-wing recess, short thr., titanium
NAS6203-6220 	Bolt, hex. head, short thread, alloy steel
NAS6303-6320 	Bolt, hex. head, short thread, cres.
NAS6403-6420 	Bolt, hex. head, short thread, titanium

TABLE 7-12. (CONTINUED)



Bolt Number	Description
NAS6604-6620 	Bolt, hex head, long thread, alloy steel
NAS6704-6720 	Bolt, hex. head, long thread, cres.

TABLE 7-13. TABLE OF NUTS.









Nut Part Number	Description
AN256 	Nut, self-lock right angle plate
AN310 	Nuts, castellated
AN315 	Nut, plain
AN316 	Nut, check
AN320 	Nut, castle shear
AN335 	Nut, plain, hex, nonstructural
AN340 	Nut, plain, hex., n-s, coarse thread
AN341 	Nut, plain, hex.

TABLE 7-13. (CONTINUED)












Nut Part Number	Description
AN345 	Nut, plain, hex., n-s, fine thread
AN350 	Nut, plain, wing
AN355 	Nut, engine, slotted
AN356 	Nut, stamped
AN360 	Nut, plain, engine
AN361 	Self-locking nut plate, countersunk 100°, 550 °F.
AN362 	Nut, plate, self-locking, noncounters., 550°F.
AN363 	Nut, self-locking, 550 °F.
AN364 	Nut, self-locking, thin, 250 °F.
AN365 	Nut, self-locking 250°F.
AN366 	Nut, plate, noncounters., 250°F.



TABLE 7-13. (CONTINUED)




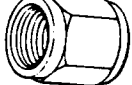
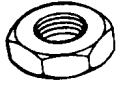






Nut Part Number	Description
AN373 	Countersunk nut, plate 100°, 250°F.
AN805 	Nut, union
AN817 	Nut, coupling
AN818 	Nut, coupling
AN924 	Nut, flared tube
AN3054 	Nut, coupling, elec. conduit
AN3066 	Nut, plain, hex. conduit coupling
AN6289 	Nut, flared tube universal fitting
AN121501-121550 	Nut, plain or cres. steel
AN121551-121600 	Nut, castel., hex.
MS9099-9100 	Nut, hex., boss connection, aluminum & cres.

TABLE 7-13. (CONTINUED)












Nut Part Number	Description
MS9197-9199 	Nut, tube coupling
MS9200-9201 	Nut, plain, hex., boss connection
MS9356-9357 	Nut, plain hex., A-286
MS9358-9359 	Nut, castellated hex., A-286
MS9360 	Nut, plain hex. Drilled, A-286
MS9361-9362 	Nut, plain hex. Check, A-286
MS9363-9364 	Nut, slotted hex. Shear hd., A-286
MS9553 	Nut, hex. Boss connection, cres.
MS9766-9767 	Nut, dbl. Hex. Cup washer locked, AMS 5737 cres. And AMS 6322 cad.
MS9881 	Nut, plain, hex. AMS 6322, cad. Plate
MS9882 	Nut, plain, hex., drilled, AMS 6322, cad. Plate

TABLE 7-13. (CONTINUED)












Nut Part Number	Description
MS9951 	Nut, spanner, end slots, cup washer locked, AMS 6322
MS16203 	Nut, plain, hex. Nonmagnetic
MS17825-17826 	Nut, self-locking, castle, hex. Regular and thin
MS17828 	Nut, self-locking, nylon insert, 250°, regular ht., monel
MS17829-17830 	Nut, self-locking, nylon insert, 250°, regular ht., cres. Steel, steel
MS19067-19068 	Nut, plain, round, retaining
MS20341 	Nut, electrical, plain, hex.
MS20364 	Nut, self-locking, 250 °F, thin
MS20365 	Nut, self-locking, 250° F, regular
MS20501 	Nut, plate, self-locking, two lug
MS21025 	Nut, castellated bearing, retaining

TABLE 7-13. (CONTINUED)












Nut Part Number	Description
MS21047-21048 	Nut, self-locking, plate, two lug, low ht.
MS21049-21050 	Nut, self-locking, plate, two lug, 100° csk., low ht.
MS21051-21052 	Nut, self-locking, plate, one lug, low ht.
MS21053-21054 	Nut, self-locking, plate, one lug, 100° csk.
MS21055-21056 	Nut, self-locking, plate, corner, low ht.
MS21057-21058 	Nut, self-locking, plate, corner, 100° csk.
MS21059-21060 	Nut, self-locking, plate, two lug, floating, low ht.
MS21061-21062 	Nut, self-locking, plate, floating low ht., one lug
MS21069-21070 	Nut, self-locking, plate, two lug, low ht., reduced rivet spacing
MS21071-21072 	Nut, self-locking, plate, one lug, low ht., reduced rivet spacing
MS21073-21074 	Nut, self-locking, plate, corner, reduced rivet spacing

TABLE 7-13. (CONTINUED)












Nut Part Number	Description
MS21078 	Nut, self-locking, plate, two lug, nylon insert
MS21080 	Nut, self-locking, plate, one lug, nylon insert
MS21081 	Nut, self-locking, plate, corner, nylon insert
MS21083 	Nut, self-locking, hex., nylon insert
MS21340 	Nut, plain, hex., electrical, thin, wire holes
MS21917 	Nut, sleeve coupling, flareless
MS21921 	Nut, sleeve coupling, flareless
MS24679-24680 	Nut, plain cap, low & high crown
MS25082 	Nut, plain, thin, hex., electrical
MS27040 	Nut, plain square
MS27128 	Nut, plain, welding

TABLE 7-13. (CONTINUED)












Nut Part Number	Description
MS27130-27131 	Nut, blind, rivet, flathead., open and closed end
MS27151 	Nut, stamped
MS27955 	Nut, spanner, plain, round
MS35425-35426 	Nut, wing, plain & drilled
MS35649-35650 	Nut, plain hex.
MS35690-35691 	Nut, plain hex.
MS35692 	Nut, slotted hex.
MS51967-51972 	Nut, plain, hex.
MS90415 	Nut, self-locking, 12 point captive washer
MS172236-172270 	Nut, spanner, bearing, retaining
MS172321-172370 	Nut, spanner

TABLE 7-13. (CONTINUED)












Nut Part Number	Description
NAS395-396 	Nut, U type
NAS443 	Nut, self-locking, int. wrenching
NAS444-445 	Nut, double lug, anchor type, offset
NAS446 	Nut, flat type
NAS447-448 	Nut, plate, self-locking
NAS449 	Nut, anchor type
NAS450 	Nut, plate, self-locking
NAS463 	Shim, plain anchor nut
NAS487 	Nut, instrument mount
NAS500 	Shim, anchor nut, csk.
NAS509 	Nut, drilled

TABLE 7-13. (CONTINUED)


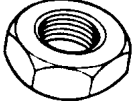
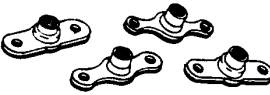

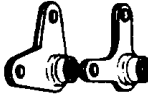



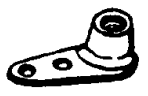


Nut Part Number	Description
NAS577-578 	Nut, self-locking floating barrel retainer
NAS671 	Nut, plain hex., small pattern
NAS680-681 	Nut, plate, self-locking, two lug
NAS682-683 	Nut, plate, self-locking, one lug
NAS684-685 	Nut, plate, corner, self-locking
NAS686 	Nut, plate, self-locking, two lug, floating
NAS687 	Nut, plate, self-locking, one lug
NAS688-695 	Nut Assembly, self-locking, gang channel
NAS696 	Nut, plate self-locking, one lug, miniature
NAS697 	Nut, plate, self-locking, two lug, miniature
NAS698 	Nut, plate, corner, self-locking, miniature

TABLE 7-13. (CONTINUED)















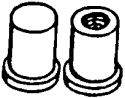
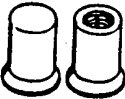




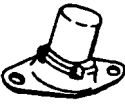

Nut Part Number	Description
NAS1021-1022 	Self-locking Nut, hex., regular and low ht.
NAS1023-1024 	Nut, plate, self-locking, two lug
NAS1025-1026 	Nut, plate, self-locking, one lug
NAS1027-1028 	Nut, plate, corner, self-locking
NAS1029-1030 	Nut, plate, self-locking, one lug, two lug
NAS1031 	Nut, plate, self-locking, two lug, floating
NAS1032 	Nut, plate, self-locking, one lug, floating
NAS1033 	Nut, plate, right angle, floating, self-locking
NAS1034-1041 	Nut Assembly, self-locking, gang channel
NAS1067 	Nut, plate, self-locking, one lug, miniature
NAS1068 	Nut, plate, floating, self-locking, two lug, miniature

TABLE 7-13. (CONTINUED)

Nut Part Number	Description
NAS1098 	Nut, tube fitting
NAS1287-1288 	Nut, hexagonal, self-locking, nut and washer shear pin
NAS1291 	Nut, hexagonal, self-locking, low height
NAS1329 	Nut, blind rivet, flathead, internal thread
NAS1330 	Nut, blind rivet, csk. Head, internal thread
NAS1408-1409 	Nut, hexagonal, self-locking, regular height, coarse and fine thr.
NAS1410 	Nut, tube fitting
NAS1423 	Nut, plain, thin hex., drilled jamnut
NAS1473 	Nut, plate, self-locking, two lug, cap floating
NAS1474 	Nut, plate, self-locking, two lug, cap floating, reduced rivet spacing
NAS1512-1513 	Nut, plate, self-locking gang channel