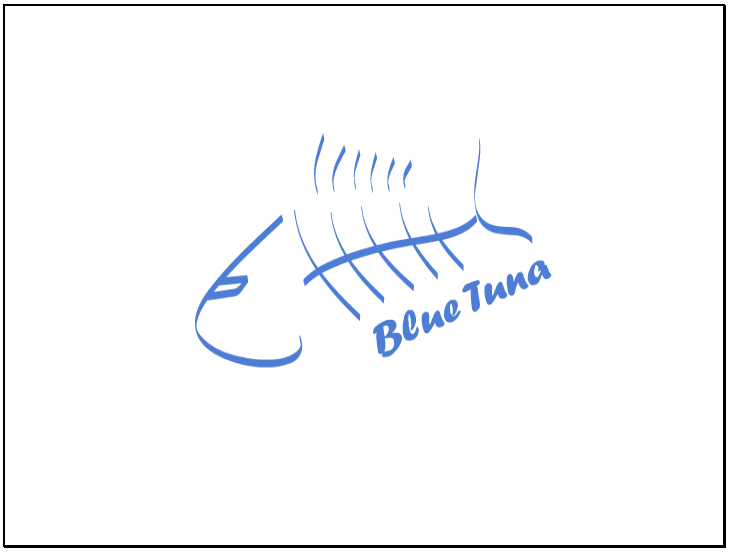

Blue Tuna

Slide 2

INSTALLATION OF BASIC AIRCRAFT FASTENERS

The prerequisite for this course would be "**Rivet Installation"** and it is assumed the employee has the practical skills in rivet installation before taking this Threaded Fastener course…

Slide 3

Introduction to Course

Personal Safety

Hand tools

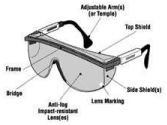
Installation Procedures

Inspection Procedures and Requirements

This introduction Course provides information concerning basic fundamentals of the installation of common threaded fasteners. One of the objectives of this basic course is to provide technicians with the education to effectively install these fasteners with emphasis placed on safe, efficient practices.
This course is part of a series that will cover a wide range of topics including:
Personal Safety
Hand tools
Installation Procedures
Inspection Procedures and Requirements

Slide 4

HOUSEKEEPING AND SAFETY

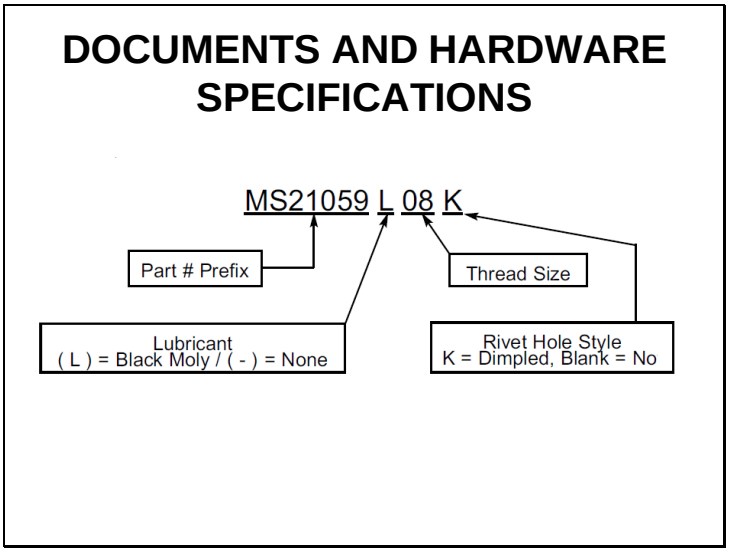


HOUSEKEEPING
Good housekeeping in Aircraft and shop is essential to safety and efficient manufacturing. The highest standards of orderly work arrangements and cleanliness should be observed during the manufacturing. Properly storing personal tools, rollaway boxes, all hoses, electrical cords and chemicals that are superfluous to the work to be accomplished. Keep your work area and equipment as clean as possible.
Store and use chemicals properly. Use vacuum cleaners instead of blowing dirt and dust from one area to the other. Sweep or vacuum, don't blow. Good housekeeping provides a safe working environment and is the responsibility of all employees.
Lets talk about PERSONAL PROTECTION EQUIPMENT or (PPE)
Always wear PPE Safety Glasses and Hearing Protection when:
Grinding
Drilling
Working with air or Working with chemicals
Or if you're near someone creating an eye, hearing, or breathing hazard

SAFETY EQUIPMENT
Personal safety equipment, i.e. goggles, chemical gloves, white cotton gloves, aprons, face shield, etc. Your company provides PPE that will handle chemicals, doing pressure checks and using cutting/grinding tools. This equipment must be worn when operating in these various working conditions. The safety equipment: hearing protection, eye protection, lungs and clothing/skin protection does not do a thing unless you put it on and wear the equipment. PPE protects you!

WORKING ENVIRONMENT AWARENESS
Stay alert to what you're doing; be aware of the other technicians around you.
COMPRESSED AIR SYSTEM
Compressed air and nitrogen are great tools when used correctly. Both can be very dangerous when not used correctly. Never use compressed air for horseplay. Unsafe airlines of various types should be replaced immediately. Look for Cracks, worn spots, and leaks.

Slide 5



The following are some DOCUMENTS AND HARDWARE SPECIFICATIONS
MS20426 Rivet, Solid Countersunk 100 degree Precision Head, Aluminum and Aluminum Alloy
MS20470 Rivet, Solid Universal Head, Aluminum and Aluminum Alloy
NAS 1097 Rivet, Solid 100 degree Flush Shear Head, Aluminum Alloy
AND 10387 Drill sizes and Drilled hole tolerances - Twist
NAS 618 Fastener -Recommended Shank, Hole and Head-To-Shank Fillet Radius Limits
NUTPLATE TYPES
On the upcoming Charts 1-6 Are The Most Common Type Fasteners // (.Selection To Be Per Eng. Drawing)
NUTPLATE CALLOUTS
The following nutplate callouts come in various sizes depending on screw selection
Basic screws would be NAS 514 or NAS 517 countersunk type
Or MS27039 Button head
Screws come in different threads most common is the 32 threads per inch
Sizes are in 1/32 diameters such as -04-06-08-10 the in sixteenths such as 3/16 or ¼ inch diameters
Typical nutplate callout - **MS21059-08** the - 08 is the screw diameter callout the MS21059 is the nutplate callout

Slide 6

TOOLS AND CHEMICALS

The following are a few CHEMICALS
483-660 epoxy primer mixed.
MPK or Alcohol for cleaning

Some trade HANDTOOLS are listed
Drill motor
Micro stop counter sink
100-degree countersink for deburring
Cleco (KLEECO)pliers and Clecos(KLEECOS)
Various Size Drill Bits
High lock Tools
Various size Reamers
Rivnut Puller
Various nutplate jigs
Allen Wrenches
Various Size Wrenches
50-degree countersink for chamfering

now are some of the EXPENDABLE ITEMS you may encounter
Pencil
Masking Tape
Paper towels
Artist Brushes
Paper cups

Slide 7

NUTPLATE PILOT HOLE SIZE

CHART 1 for drill hole sizes for center pin of nutplate jig

Nominal Fastener Size	Drill Size FOR Pilot pin	Hole Size Tolerance
No. 4	#33 (.113)	+.004 -.001
No. 6	#28 (.140)	
No. 8	#19 (.166)	+.005 -.001
No. 10	#11 (.191)	
1/4	1/4 (.250)	

A SELECTION OF NUTPLATE JIGs are as follows
Miniature, narrow, wide and/or Mickey mouse style, or domed Nutplates.
A 04 nutplate takes a 04 pilot pin; NOTE: make sure the **nutplate hole spacing** matches the **nutplate hole spacing**.
Pilot holes in nutplate jigs are #40 drill size

Lets look at NUTPLATE JIG PILOT SIZEHOLES
Round Holes are dimensioned in various ways, depending on the design requirement and manufacturing methods. For through holes (THRU) drilled the dimension if given, if drawing does not make this clear. note the hole tolerances given. The holes in the upper left corner has a very small variance.

Countersunk Holes have the diameter and include the angle of the countersink specified.

Slide 8

SCREW HOLE SIZE SELECTION

CHART 2

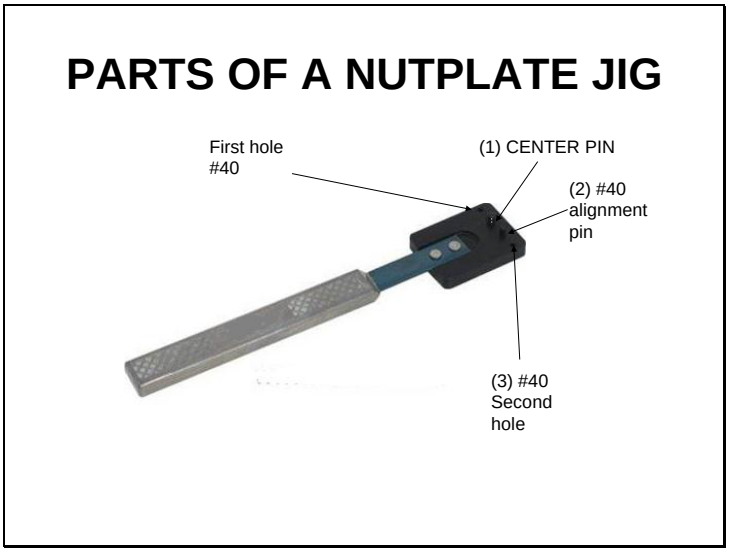
HOLES FOR USE WITH NUTPLATES						
	Clearance Hole *			Tight Hole		
Fastener Size	Hole Dia./Limits		Drill Dia.	Hole Dia./Limits		Drill Dia.
#4	.125	.130 .124	1/8	.116	.120 .115	#32
#6	.152	.157 .151	#24	.141	.145 .140	#28
#8	.203	.208 .202	13/64	.191	.196 .190	#11
#10	.228	.234 .227	#I	.218	.223 .217	7/32
1/4	.290	.296 .289	#L	.277	.283 .276	#J
5/16	.358	.363 .354	#T	.343	.349 .342	11/32

The first hole you will drill will be a pilot hole #40 drill at the specified location on the part or aircraft, the second hole you will drill will be the hole for the pilot pin on the nutplate jig.

A Nutplate can be used as the jig for tight areas of installation, you drill a pilot hole #40, drill then the screw hole size can be drilled, once the screw is installed into the nut plate and tightened then you can drill the nutplate holes, disassemble and deburr the shoot rivets

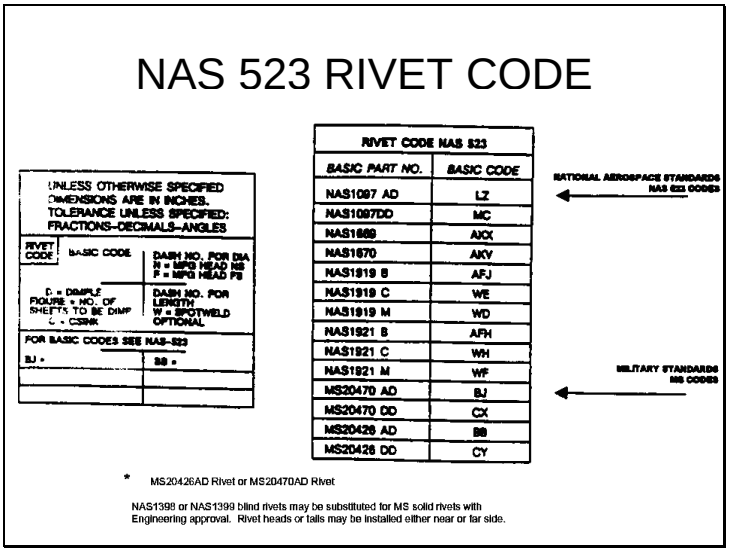
Always check and drill final hole size before installing nutplate.

Slide 9



See Chart One for the hole size for the - center pin – as an example: a #6 center pin would be drilled to a #28 or .140 drill size
The little pin is a #40 drill it aligns the nutplate jig so the First hole can be drilled then the nutplate jig is flipped over so the #40 alignment pin is dropped into the first hole and the second #40 hole is drilled

Slide 10

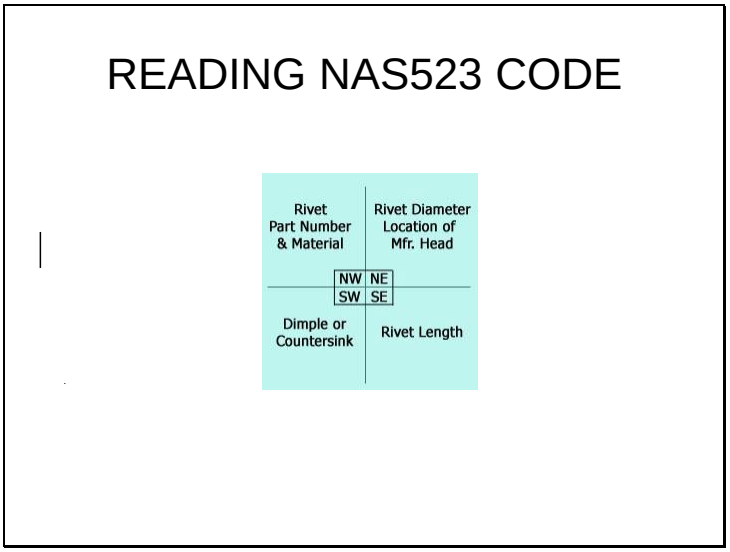


NAS523 CODES

The rivet code system has been standardized by the National Aerospace Standards Committee (NAS Standard) and has been adopted by most major companies in the aircraft industry. This system has been assigned the number NAS523 in the NAS Standard book

The NAS523 basic rivet symbol includes a single cross whose intersection is the locating point of the rivet. If required for clarity a cross symbol of adequate size to allow notation will be located to the side and a leader line will indicate the location of the rivet by pointing to a smaller cross at the proper point. The cross symbol may also by a hidden or phantom line to insure the shop of the rivets actual location.

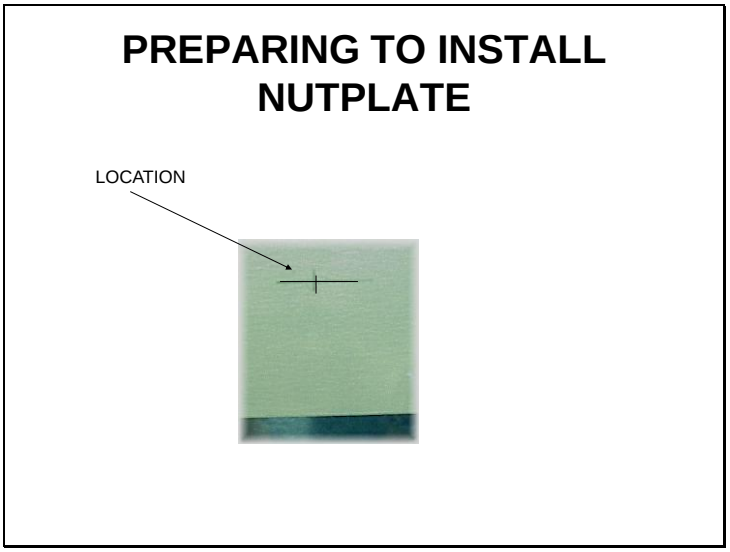
Slide 11



In certain aviation companies the use of the NAS523 rivet identification code is used on diagrams and drawings. The code embodies a number of details about the rivets to be used in a single 4-cornered symbol, with a "crosshair" at the center. Each quadrant is given a compass designation: NW for northwest, NE for northeast, SW for southwest and SE for southeast. These compass designations are not shown on the code, only the details.

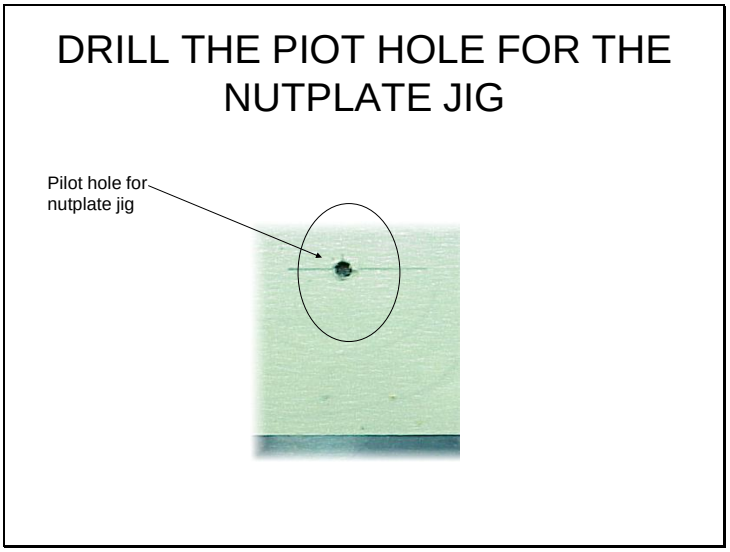
In the symbol, the upper left NW corner contains the rivet part number in either AN or MS part numbers, and a rivet material designation. For example, the letters **BJ** identify a standard MS20470AD rivet, which is made from 2117 alloy.
The NE quadrant indicates rivet diameter, and the location of the manufacturers head (**N**ear or **F**ar).
The SW quandrant indicates what special methods should be applied to the fasteners, such as dimpling or countersinking. For example, **D** stands for Dimpling, **D2** stands for Dimple both sheets, and **D2C** means Dimple two top sheets and countersink the third.
The lower right corner specifies fastener length in 1/16" increments. Example: a 3/8" rivet is shown as a -6.

Slide 12



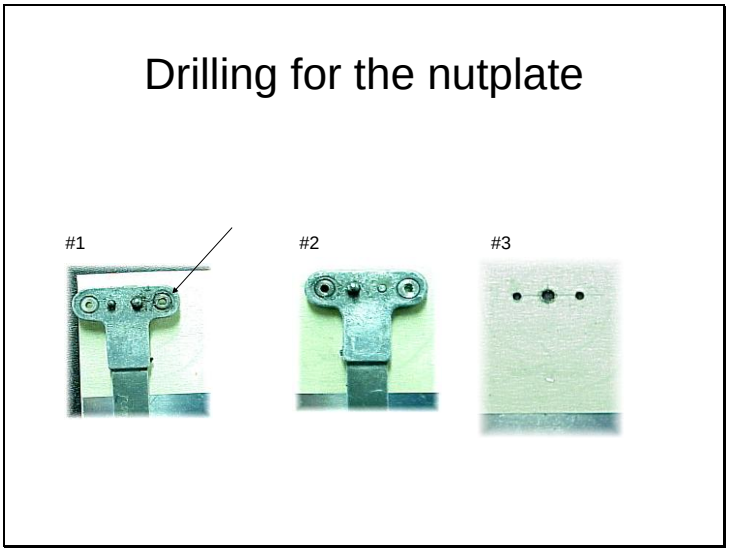
#1 Select Hardware outlined in the engineering drawing.
#2 Select tools required: nutplate jig, drill motor, drill bits ….
#3 In accordance with the engineering drawing or aircraft requirements, layout the location for the nut plate. (Use light marks not to damage part or finish) Pilot holes may exist in some parts.
#4 Lightly prick punch the metal at the center of cross. (do not damage metal no dents or dings) This prick punch will keep the tip of drill bit centered to the hole. These hole locations will become the screw hole for Nutplate. (See Table 2 and 3)
If the technician has never installed the nutplates practice on some scrap material to get the feeling for installing them

Slide 13



These hole locations will become the screw hole for Nutplate. (See Table 2 and 3)
#5 Look behind the area being drilled to ensure that nothing is going to be damaged when drilling the pilot hole through the material. A drill stop may be required at this time. A drill stop is a spring type or a solid piece collar both have allen set screwa to keep them on the drill, they control drill bit depth
#6 Drill the pilot hole and using the nutplate jig, drill one #40 hole. Turn the jig over and reinsert pilot pins into existing pre-drilled holes. Drill one more #40 hole

Slide 14

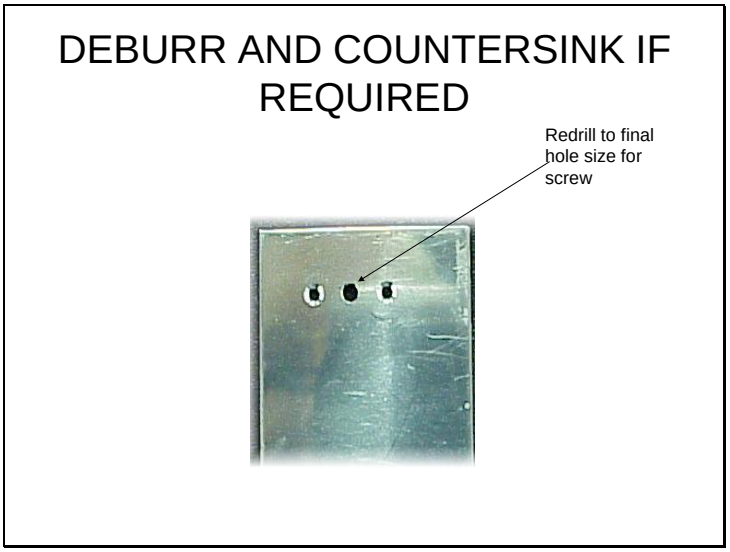


#1 put big pin in hole with a #40 drill ,drill the hole on the right first

#2 The little pin is a (2) #40 drill it aligns the nutplate jig so the First hole can be drilled then the nutplate jig is flipped over so the #40 alignment pin is dropped into the first hole hole and the (3)second #40 hole is drilled

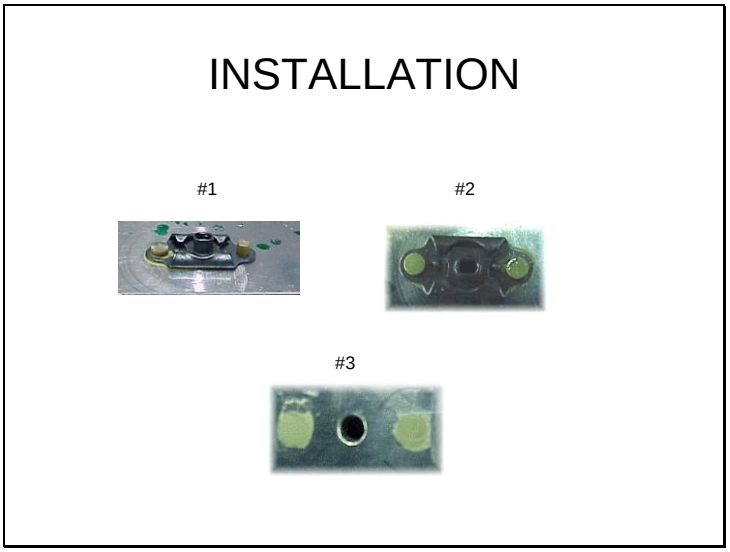
#3 part is drilled for the nutplate

Slide 15



#7 Deburr both sides of material.
#8 Countersink two #40 holes in material. (IAW Figure one Table 4) countersink opposite of the side nutplate is going to be installed on material. (Always check micro stop countersink on same thickness of material. before countersinking the existing holes on the part. The two holes that are to be countersunk are the holes that attach fastener to the material. (See Chart 2 for final screw hole size to drill if not depicted on the engineering drawing before installing nut plate.)

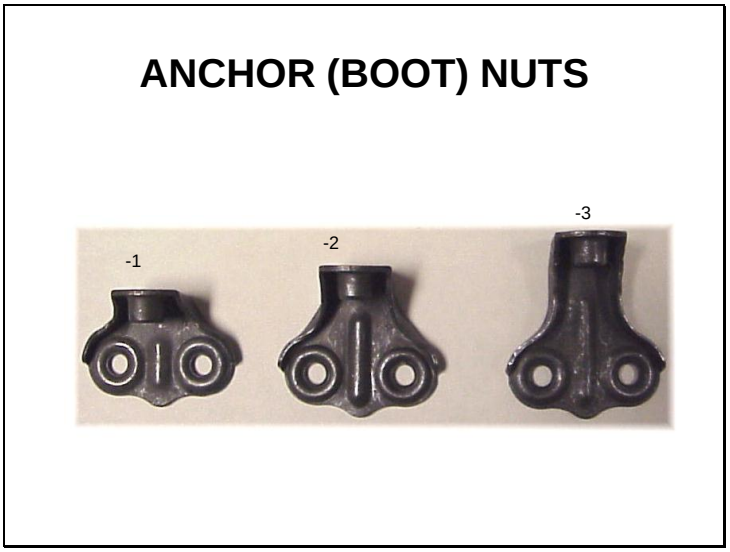
Slide 16



#1 See 1.5 time the diameter of the rivet - correct rivet length and dimension of bucktails. Using a rivet gun or hand C squeeze upset or squeeze rivet. (Nutplate is to be flat against part)

#2 If the rivet requires shaving, the Inspecting Quality Control department must verify rivets before shaving. Set rivet shaver up on a scrap piece of material. It should leave a very fine mark on rivet material, not cut, gouge the material or finish. (See Table 6)
#3 Touch up finish as required.
#4 All buck tails, heads of rivets and pilot hole should have epoxy primer applied after QC inspection.
#5 If damage to parts (dents or scratches) are caused by bucking bars or rivet sets, the damage shall be inspected, and reworked or repaired as required by your companies engineering policies .

Slide 17

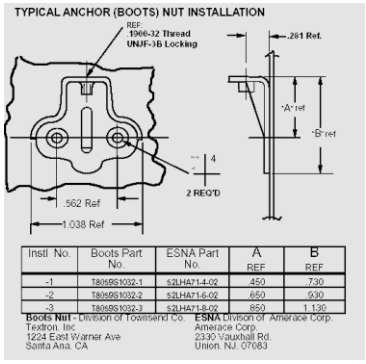


#1 Select Hardware outlined in the engineering drawing.

The part numbers are as follows: 1-3 Short thru long
T8059S1032-1
T8059S1032-2
T8059S1032-3

Slide 18

BOOT NUT DESCRIPTION



Instl No.	Boots Part No.	ESNA Part No.	A REF	B REF
-1	T8059S1032-1	52LHA71-4-02	.450	.730
-2	T8059S1032-2	52LHA71-6-02	.650	.930
-3	T8059S1032-3	52LHA71-8-02	.850	1.130

Boots Nut - Division of Townsend Co.
Textron, Inc.
1224 East Warner Ave
Santa Ana, CA

ESNA Division of Amerace Corp.
Amerace Corp.
2330 Vauxhall Rd.
Union, NJ. 07083

MS20426AD Rivet or MS20470AD Rivet

Alternate Fastener; (MS24693, Screw) & (MS21044, Self Locking Nut) ***may NOT be used in Primary Structure.***

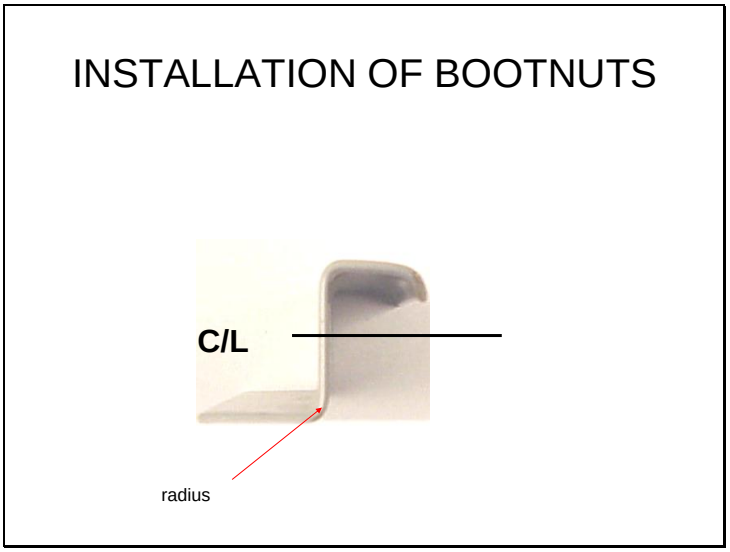
NAS1398 or NAS1399 blind rivets may be substituted for MS solid rivets with Engineering approval. Rivet heads or tails may be installed either near or far side.

Anchor boonut instaltion has multple steps

Slide 19

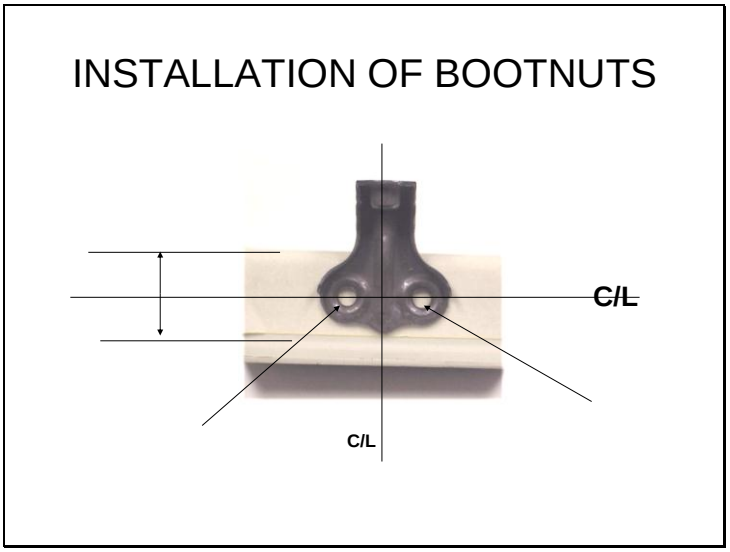
First you must Select the tools required: Cleco Pliers, #30 clecos, #30 drill bits, deburr tool, drill motor, c squeeze with sets …. (KLEEECO)

Slide 20



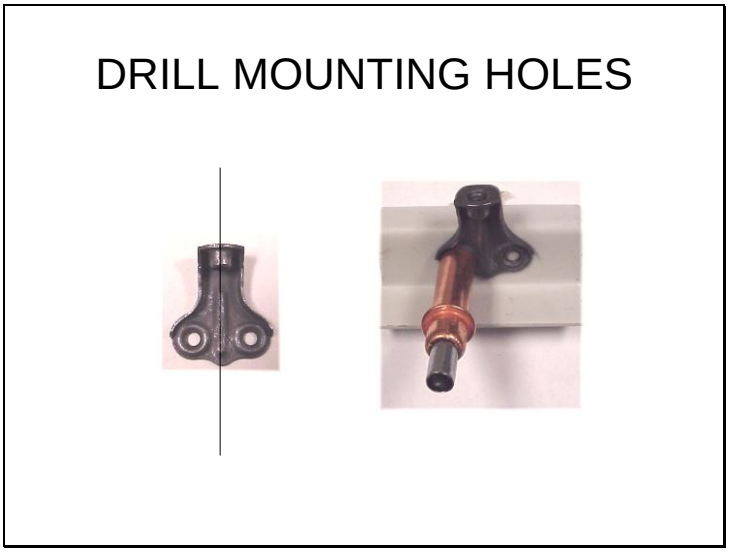
Second: Outlined by the engineering drawing or aircraft requirements, layout the location for anchor nut (Light pencil marks do not do damage to part or finish) Two faced tape maybe used to hold anchor nut in place at selected location. Centerline of stringer shown. Anchor nut must not ride or come down into a parts radius.
C/L = centerline of part or surface

Slide 21



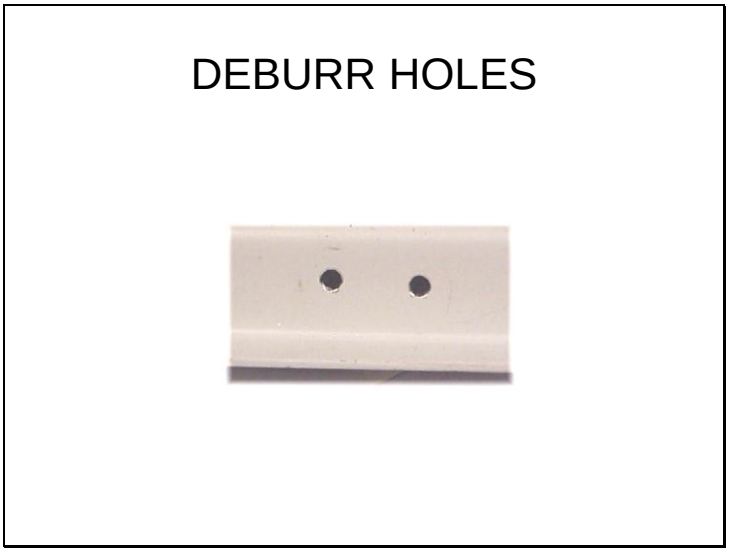
Third the The two mounting holes in the anchor nut will become the rivet holes for anchor nut Centerline of anchor nut shown If the technician has never installed the bootnuts, practice on some scrap material to get the feeling for installing them

Slide 22



In the fourth step you should Inspect behind area being drilled to ensure that nothing is going to be damaged when drilling the pilot hole through the material. A drill stop may be required at this time.
Fifth you should Drill holes using a #30 twist drill into existing holes in the anchor nut. Install a #30 cleco or rivet and drill the second mounting hole.

Slide 23



In the sixth step you should Deburr both sides of the material.

Slide 24

ATTACH FASTENER

Determine the rivet length and dimension of the bucktail.
In consideration of RIVET INSTALLATION and Before driving or setting rivets, all sheets are to be deburred on both sides. Remove burrs extending above the surface as well as burrs and chips.
Unless using a countersunk rivet, do not countersink the material. as this could materially affect the strength of the nutplate Installation.
Material thickness should include the thickness of the fastener leg material thickness.

The two rivet holes that are to be used to attach fasteners are to be shot epoxy wet.

When Using a rivet gun or hand C squeeze, upset or squeeze rivet. (Anchor nut is to be flat against part)

If parts are damaged due to (dents or scratches) that are caused by bucking bars or rivet sets, the damage shall be inspected, and reworked or repaired as outlined by engineering instructions.
NOTE
Do not crush stringer or damage parts when upsetting rivets

Slide 25

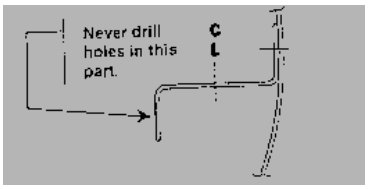
CORROSION PROTECTION

The following is important in consideration of corrosion protection

All bucktail and heads of rivets must have epoxy primer applied, touch up the finish as required.

Slide 26

NOTES,CAUTIONS

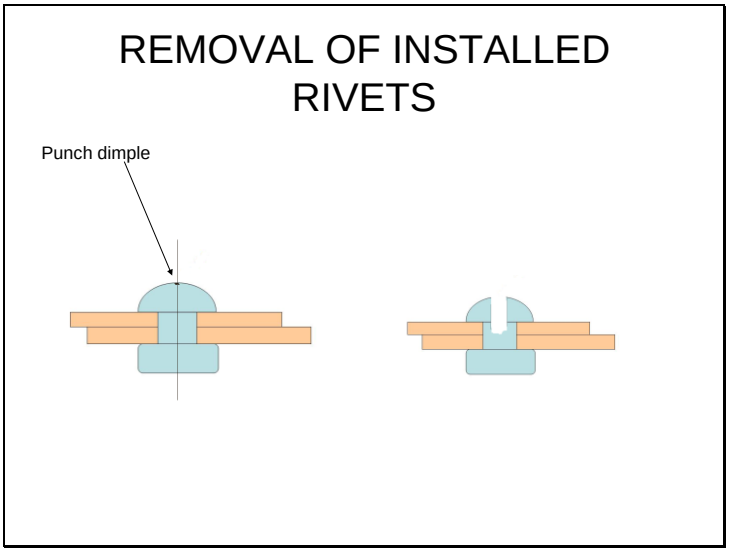


ANCHOR (BOOT) NUT LOCATION RESTRICTIONS
Unless otherwise specified on engineering drawing, the following restrictions apply to Anchor (Boots) Nut installations.

Do not install on skin panels.
Do not install in tensioned stiffeners.
Do not drill in the flanged edges. Install rivets close to the neutral axis in the web portion of frames or stringers.
Do not install on stringer or frame splices.

Avoid using blind rivets in areas close to passenger doors, windows, or emergency exits. NAS1398 or NAS1399 blind rivets may be substituted for MS solid rivets with Engineering approval. Rivet heads or tails may be installed either near or far side.
Do not attach on the "rotor burst" or bird impact protection deflectors (vertical stabilizer root and nose or Engine frames).
Do not install in **under-fuselage zones** where there is a risk of interference in normal usage and a risk of **tank perforation in the event of a crash.**

Slide 27



All MS20426 or MS20470 have a dimple in the center of the head

Make sure you have a Center Point in the center of the Manufactured Head to start drilling.
The factory “dimple” should work.
If you are not sure of your ability to drill accurately, use an automatic center punch.
If the head is damaged, file or grind a flat and then use the punch.

Drill undersize to the rivet installed
Drill down enough to penetrate into the shop head, but try not to drill through.
If you do drill through, it’s not disastrous, but go slow and take your time.

Next drill through the head the using the same size drill as the rivet hole.
Stop just short of the material as shown.

Use a small drift punch to knock out remaining rivet, remember not to forgot your trash or FOD (Foreign Object Debris)
You can put a piece of masking tape on the buck top to catch it,
If you drill the hole out big, see your engineer , they will recommend an over size rivet or next size bigger rivet if edge distance is no factor.

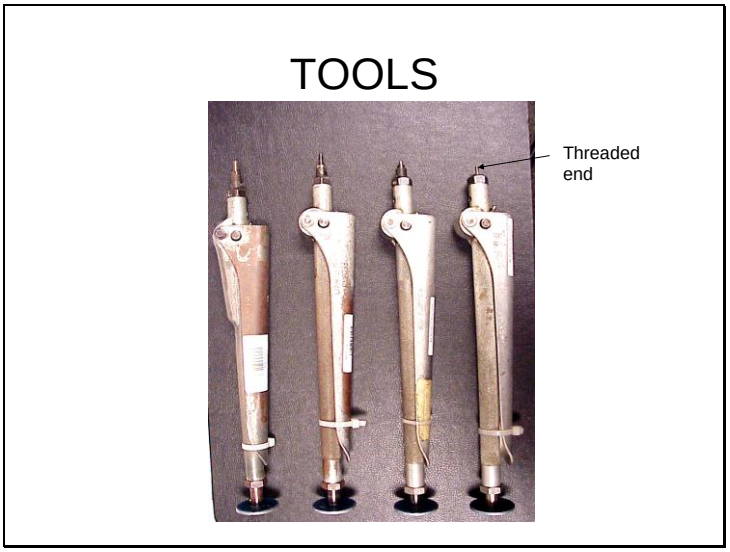
If the technician has never removed a rivet shot some in a scrap material and practice removing them to get the feeling for removing them them

Slide 28

HOW TO INSTALL RIVNUTS

In the image shown the Left Rivnut is countersunk and the right one is non countersunk
The Engineering drawing will show the size , part number and location of hole.

Slide 29

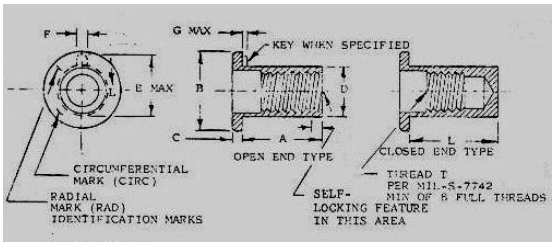


Rivnut pullers come in different thread sizes to match the thread size of the rivnut being pulled

These high quality threaded fastener installation tools are for installing aluminum fasteners for 4/40 - 6/32/- 8/32/ -10/32 1/4" and stainless steel fasteners up to 10-32. Small set of miniature files

Slide 30

NAS1329 RIVNUT



See Student Guide Fasteners Handout for key dimensions of thread size.

PART NUMBERS FOR RIVNUTS
Technicians should refer to Military spec NAS 1330 if engineering does not have drawings with all the details
This part number is for a Non- countersunk type rivnuts
Rivnuts come in flush or non flush type. (Locking and Non-Locking) Locking type have a protrusion on the head, this stops the rivnut from spinning when installing a screw.

Review the handout for the key to the displayed picture and take a moment to look at the typical part number.
F= most common Key dimension size of key width for thread size -04-06 08 -3 -4= .054 +.005 -.000
E MAX = -04=.198 -06=.240 -08=.271 -3=.302
G MAX= 04=..023 -06=..023 -08=.023 -3=.023
B= 04=.270 -06=.325 -08=.357 -3=.406
C= 04=.025 -06=.032 -08=.032 -3=..038
A= 04=. -06=.032 -08=.032 -3=..038

TYPICALL PART NUMBER (P/N) - NAS1330A3K130
P/N Breaks down like this:
NAS1330 > Nut, Blind Rivet, Countersunk (Slang = Rivnut)
A = Aluminum alloy
3=10/32 thread
K= Keyed
166= .116-.166 grip range

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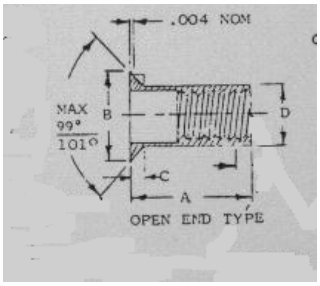
NAS1330 RIVNUT



See Fasteners Student Guide Handout for key dimensions for thread sizes.

Please, take a moment to review the code for the displayed picture using the courses student handout.

CODE for Picture
Countersunk 99-101 degrees
D= Drill bit size
F= most common Key dimension size of key width for thread size -04-06 08 -3 -4= .054 +.005 -.000
E MAX = -04=.198 -06=.240 -08=.271 -3=.302
G MAX= 04=..023 -06=..023 -08=.023 -3=.023
B= 04=.263 -06=.323 -08=.355 -3=.391
C= 04=.051 -06=.063-08=.063 -3=..065
A= 04=. -06=.032 -08=.032 -3=..038

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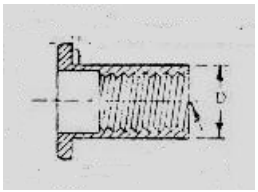
NAS 1330 OR NAS 1329 HOLE SIZE



Take a moment to Review the handout for Drill bit sizes

D= -04=..155-.157=5/32
-06=..189-.193=#12
-08=..221-.226=#2
-3=..250-.256=E

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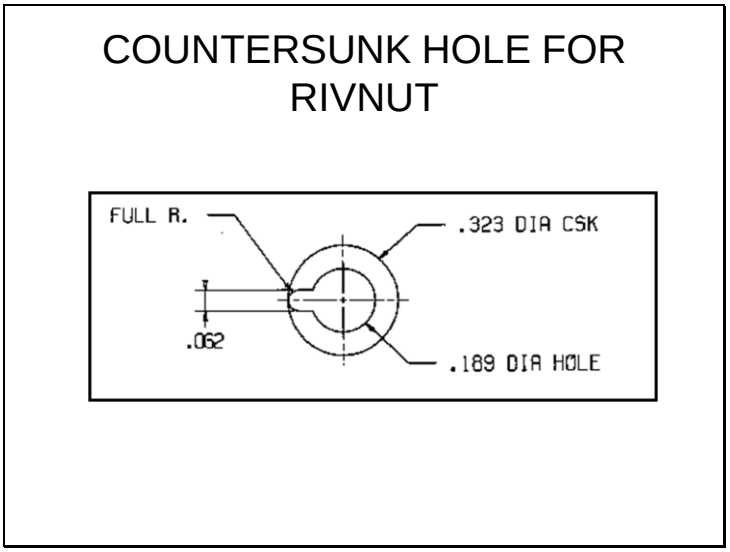

Considering HOLES FOR RIVNUTS
The Engineering drawing will show size and location of hole.
And is an Example of hole callout for a countersunk for locking rivnut.
All holes are deburred
The keyhole is filed or milled into countersink.
Locking type have a protrusion on the head, this stops the rivnut from spinning when installing a screw.

Look in the handout to review key deminsions.
Key dimensions for #04 is .062 wide x.046-.048 (tolerence+.003 -.000)

Key dimensions for 06 thru -3 size is .062 wide x.056-.058 (tolerence+.003 -.000)

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INSTALLING

Lets look at Installing the rivnut
The selected rivnut screws onto mandrel then it is inserted in a prepared hole
You squeeze the handles to set the rivnut which creates a bulb on the back of the part, this bulb has tolerances Its better to squeeze to little than to much
If the technician has never installed the rivnut, practice on some scrap material to get the feeling for installing them.

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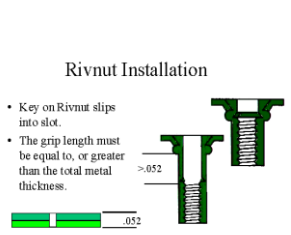
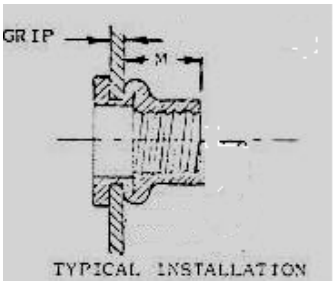
INSPECTION - INSTALLED





When inspecting rivnut installation the following is important:

First - the Key on the Rivnut slips into slot

Second - The grip length must be equal to, or greater than the total metal thickness

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INSPECTION - INSTALLED

G=GRIP RANGE=

- NAS1330 -04-81=.050-.081
- NAS1330 -04-106 =.081-..106
- NAS1330-06-106=.065-.106
- NAS1330-08-106=.065-.106
- NAS1330-3-116=.065-.116

- G=GRIP RANGE=
- NAS1329 -04-85=.060-.085
- NAS1330 -04-110 =.085-..110
- NAS1330-06-120=.075-.120
- NAS1330-08-120=.075-.120
- NAS1330-3-80=.010-..080

- M= - 04=.230 -06=.300 -08=..315 -3=..380

Lets take a moment to review these examples of installed dimensions:

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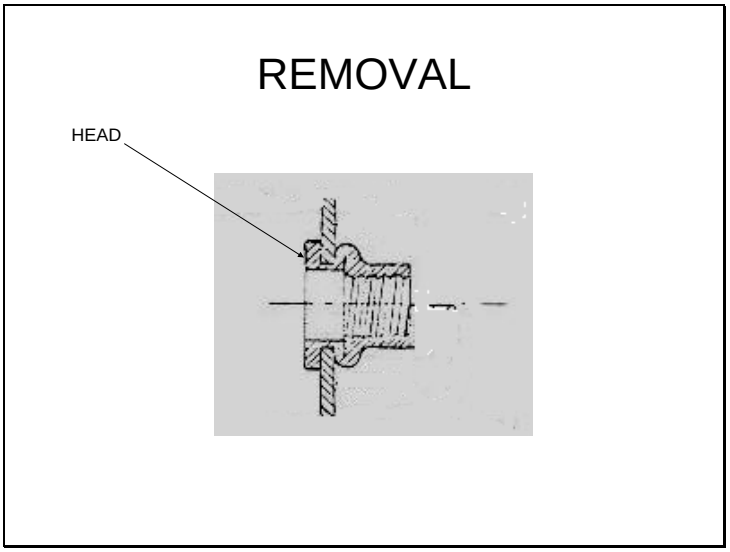

Lets look at REMOVAL
Drill out a rivnut with a drill bit with the diameter of the drill bit that installed the rivnut, drill through the head only. Break off the head with a drift pin, then drive out the remaining shank with a drift pin.
Look behind the area being drilled to be sure that nothing is going to be damaged when you drill the pilot hole through the Rivnut. A drill stop may be required at this time.