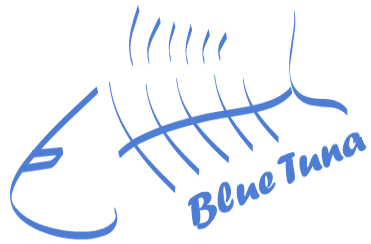
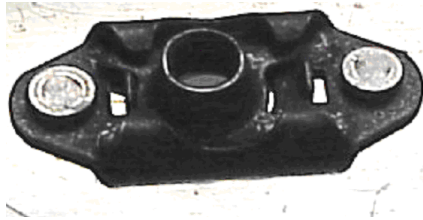


Slide 1



## WELCOME TO BASIC RIVET INSTALLATION



Welcome to Blue Tuna's Basic Rivet Installation course. You may pause or leave and come back at any time. However, it is best practice to continue through the course without interruption in order to accrue the maximum amount of information. You may navigate to the quiz at anytime once the course materials have been viewed.

## **COURSE OBJECTIVES**

- Establish Hand Tool Requirements
- Establish selection and installation requirements of Rivets
- Identify Rivet types
- Understand drill selections based on rivet diameter
- Identify Rivet callout symbols
- State common rivet diameters
- Identify correct hole preparation
- State installed rivet buck height and diameter
- State Basic Rivet Material Types

During the course we will explore the following objectives:

- Establish Hand Tool Requirements
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- Understand drill selections based on rivet diameter
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- State common rivet diameters
- Identify correct hole preparation
- State installed rivet, buck height, and diameter
- State Basic Rivet Material Types

## DOCUMENTS AND ENGINEERING SPECIFICATIONS

**AND 10387** Drill sizes and Drilled  
hole tolerances – Twist



**Lets talk about APPLICABLE DOCUMENTS and engineering specifications**

**AND 10387** Drill sizes and Drilled hole tolerances – Twist Specs

**MS20426** Rivet, Solid Countersunk 100 degree Precision Head, Aluminum and Aluminum Alloy

**MS20470** Rivet, Solid Universal Head, Aluminum and Aluminum Alloy

**NAS 1097** Reduced head Rivet, Solid 100 degree Flush Shear Head, Aluminum Alloy

Burrs shall be removed. **(ALL Holes will be deburred)**



The following are some chemical, hand tools, and expendable items

#### CHEMICALS

483-660 epoxy primer mixed.

MPK or Alcohol for cleaning

Drill bit Cleaner/Lubricator is designed to use with drill bits such as Boelube

#### HANDTOOLS as pictured :

##### Air Drill motor

#1. the 90 psi Specifications are as follows: 2000 RPM, ¼ inch Chuck, (point 2) .2 Horse Power can be Reversible.

#2 100-degree countersink for counter sinks and 50-degree countersink for chamfering the holes

250 Diameter 3 flute countersink., size varies from 3/16 inch to ¼ inch, and ½ inch. ¼ inch Shank.. High speed steel. Three flute design, and Made of High Speed Steel

#3 Cleco pliers and 3a Clecoc size #40 or #30 most popular

#4 are Various Size Drill Bits #40 or #30 are most popular

#5 is a 16 oz ball pen hammer

#6 is a .250 diameter punch

#7 is a rivet gun and

7a Flush with protection, straight Flush and various size sets

#8 are Bucking bars in various sizes

#9 is a air C squeeze with various sets

#10 is a hand c squeeze

#### EXPENDABLE ITEMS

Pencil

Masking Tape

Paper towels

Artist Brushes

and

Paper cups



Pictured is a Microstop counter sink

A tool for production countersinking. Ball thrust bearing for absolute depth control.

Adjusts in .001 inch increments, with positive adjustment lock. The Skirt accepts cutters up to 5/8 inch" diameter, and has 1/4-28 male threaded shaft for use with AT418 cutters and can be assembled and disassembled without special tools. Split shaft and taper locks pilot in place when cutter is tightened..

#2A - Uses #30 or #40, 21 Pilot, 1/2" inch Diameter. 1/4x28 Thread. 3 flute, 100 degrees. Integral (fixed) pilot for cutting accuracy. High Speed Steel

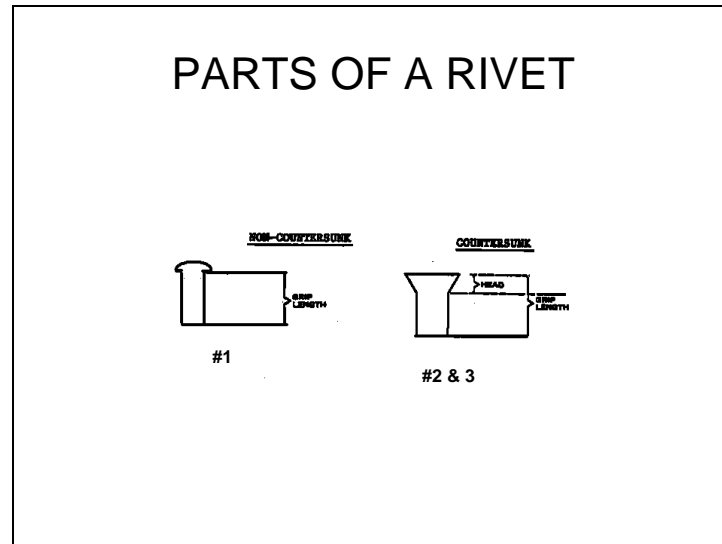
**PILOT (P =) A = 100 Degrees**

•#40 = 3/32 inch

•#30=1/8" inch

•#21= 5/32" inch

•#12 = 3/16" inch riveting



**The parts of a rivet are as follows:**

- 1. MS20426** Button head Rivet, Solid Countersunk 100 degree Precision Head, Aluminum and Aluminum Alloy
  - 2. MS20470** Countersunk Rivet, Solid Universal Head, Aluminum and Aluminum Alloy
  - 3. NAS 1097** Reduced head Rivet, Solid 100 degree Flush Shear Head, Aluminum Alloy
- Diameters x 1/32 inch increments.  
Length x 1/16 inch increments.

The two common head styles are Button Head and Flush Head  
Flush head rivet (is?) was mainly used for aerodynamics

EURO Rivet Code					
EURO SYMBOLS					
ISO rivet nominal dia.	2.4	3.2	4	4.8	5.6
Non-countersunk rivet symbol					
Countersunk rivet symbol					

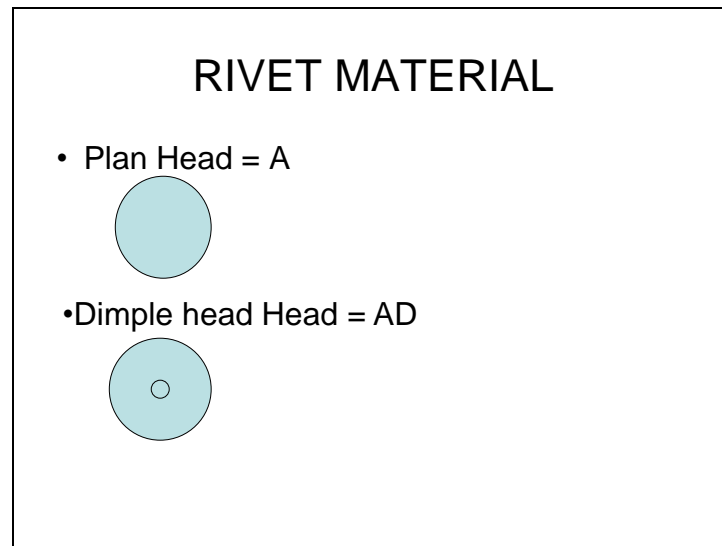
Pictured are various EURO SYMBOLS

The following are NON-COUNTERSUNK RIVET SYMBOLS

Euro - STD35050 =MS20470AD BUTTON HEAD

And some COUNTERSUNK RIVET SYMBOL Euro STD35071= MS20426AD  
COUNTERSUNK





Lets look at Rivet Material... One Rivet Material Type is 1100 with a Rivet callout of A and a Head Marking of Plain which is a very soft rivet with no structural value.

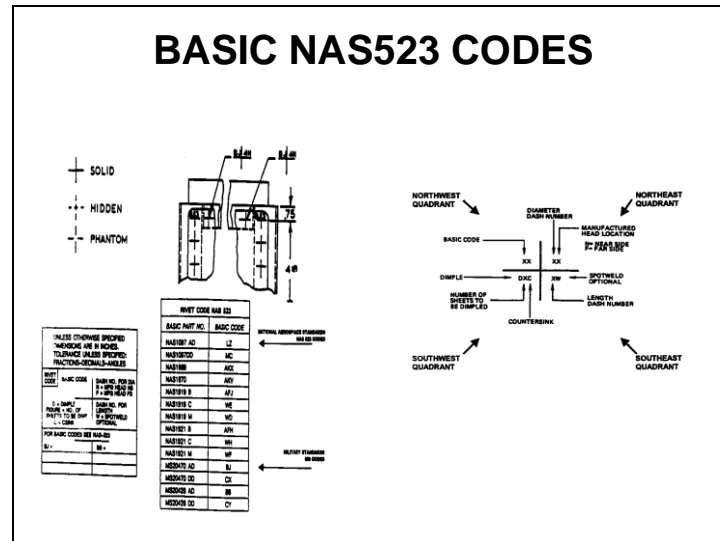
An Example of this type is MS20426A

Another example has a material type of 2117, with a callout of AD, and a Head Marking of Dimpled which is used for most non severe structural applications, nut-plates, boot-nuts, and small parts in brackets, and for attaching parts to the structure.

An Example is the MS20426AD

### **Heat Treated > Ice-Box Rivets.**

This is a term often used to describe 2117 (D) and 2024 (DD) rivets. It refers to the practice of storing these rivets refrigerated to delay the **natural age hardening** process that takes place after solution heat treatment. If rivets are used immediately following the heat treatment quench, they will remain soft enough to be driven for approx. 20-30 min. However, if after the quench they are immediately transferred to the freezer, the age hardening process is delayed up to 30 days. On removal from the freezer and returning to room temperature the aging process recommences and rivets should be driven without delay. An Example is MS20426DD which is used for high structural strength for skin to stringers and frame attachments, engine and wing attach points are another type of Area where these rivets would be used.



**Countersunk Holes** have the diameter and include the angle of the countersink specified drawings  
**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 be a hidden or phantom line to insure the shop of the rivets actual location.

Rivet Coding shows rivet identity, size installation requirements, etc. by letter and number coding within the four quadrants of the cross.

**BJ = MS20470AD**

**BB= MS20426AD**

**NW NE**

**SW SE**

**Northwest Quadrant** is used to show the identity of the rivet by a letter code. This code is comprised of non-significant letters and defines all the features for the fastener except diameter and grip length.

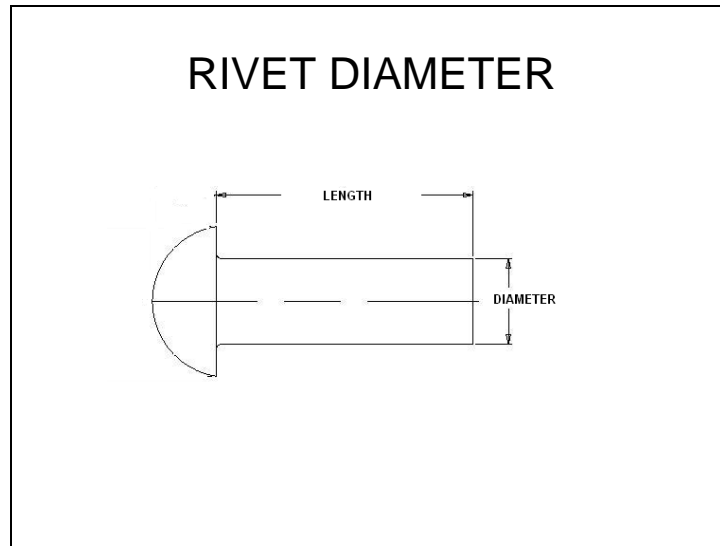
**Northeast Quadrant** indicates the diameter and location of the manufactured head by number and letter code. The number indicates the diameter and is representative of the diameter in the full part number. The location of the manufacturers head is represented by the letter code F (Far Side) and N (Near Side). If no indication of orientation is specified then it is not required.

**Southeast Quadrant** is used to indicate the length of the rivet or permission to SPOT WELD as an alternative method of assembly. The number indicates the length by use of the dash number that represents the length in the full part number of the rivet. If no number is given, the length required to form the head of the rivet is determined at assembly by Engineering specs. If a "W" is placed in the Southeast Quadrant this indicates permission to Spot Weld

**Southwest Quadrant** is used to show the parts or sheeting requiring or countersunk.

1. The letter "D" denotes dimpling requirement; if more than (1) sheet is dimpled, a number will follow

- the “D” to show the quantity of sheets to be dimpled.
2. The letter “C” is used to show a countersink requirement. No numbers are shown after the “C” to indicate the number sheet in joint. Countersinks depths are related to sheet thickness and are shown in FES 102.
  3. A “Flush Both Sides” condition can be shown by using separate lines in the Southwest Quadrant.
    - a. The first line indicates the operation for the manufactured side of the rivet.
    - b. The second line indicates the operation for the upset end (Pinned)
    - c. The third line indicates angle of the upset head if it is different from the manufactured head.
    - d. Rivet symbol applications to show where rows of similar rivets are used only the end rivets of the row will be shown. If two rows of dissimilar rivets intersect, the change in pattern will be noted.



**The following are some RIVETS followed with Rivet Diameter**

MS20426

MS20470

NAS 1097

D = Most popular size -  $\frac{3}{32}$  = #40 Drill

D = Most popular size -  $\frac{1}{8}$  = #30 drill

D =  $\frac{5}{32}$  = #21 drill

**RIVET DIAMETER**

MS20470AD3 -  $\frac{3}{32}$ " diameter

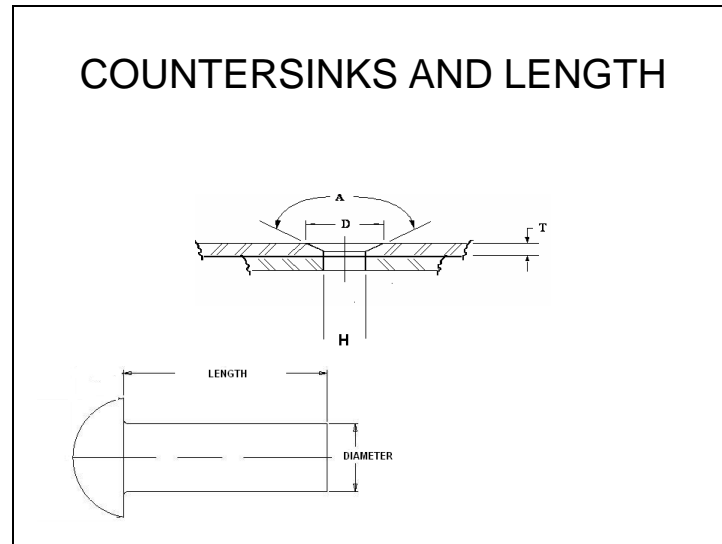
MS20426AD4 -  $\frac{1}{8}$ " diameter

NAS1097AD5-  $\frac{5}{32}$ " diameter

MS20470AD6-  $\frac{3}{16}$ " diameter

MS20426AD8 -  $\frac{1}{4}$ " diameter

**h**



**Lets talk about DRILL SIZE FOR DRIVEN RIVETS (NOT MECHANICALLY LOCKED)**

All countersinks are made with micro stop-countersinking tools. The diameter of the pilot pin of the countersinking tool shall be approximately .002 inches less than the drilled hole that is to be countersunk.

Suicide 100 degree countersinks should be used only as a last ditch method. – A good deburr tool is a 50 degree countersink – preferred

$L$  = Length of a rivet is material thickness + rivet body length to equal .5 times the diameter of the rivet Length is determined by the length it takes to make a correct rivet buck.

$A = 100^\circ$  Countersink

$D$  = Diameter of Countersink

$T$  = Thickness of material

$H$  = Diameter of rivet

Where the engineering drawing calls for an MS20426 rivet to be countersunk in material too thin for a standard countersink, the material will be countersunk for flush shear head rivet NAS 1097 and or a MS20426 rivet installed and shaved flush. As an alternate to driving a MS20426 rivet high in a countersink for flush shear head rivet and shaving, an NAS 1097 rivet may be installed in a countersink for flush shear head and driven flush.

Where the engineering drawing calls for an NAS 1097 rivet, an MS20426 rivet may be driven high in a countersink for flush shear head rivet and shaved flush. However, prior to shaving the head, Quality Assurance must verify the type of fastener.

All flush rivets must completely fill the countersink. The manufactured head of NAS 1097 flush rivets must seat tightly in the countersink. Gaps between the countersink and the NAS 1097 rivet head, which allow the insertion of a .002-inch feeler gage, are unacceptable.

Gaps between the countersink and the NAS 1097 rivet head which do not allow the insertion of a .002 inch feeler gage are acceptable, provided the gap does not extend for more than 40 % of the head circumference. Rivets driven below flush more than .002-inch maximum are not acceptable.

NAS 1097 and MS20426 rivets installed in a flat plane will be driven with flat sets. Rivets installed on a curved surface or plane will be driven with crown headsets. Note: Quality Assurance must verify fastener type prior to shaving.

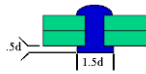
**NOTE**

NAS 1097 RIVETS WILL NOT BE SHAVED

## RIVET DIA and BUCK

(Dimensions in inches) Rivet Diameter	Minimum Head Diameter (Buck)	Max Head Diameter (Buck)	Head Thickness	
			Minimum (Buck)	Maximum (Buck)
1/16	.080	.11	.02	.040
3/32 #40	.12	.16	.03	.060
1/8 #30	.16	.21	.04	.080
5/32	.20	.27	.05	.10
3/16	.24	.32	.06	.12
1/4	.25	.43	.08	.17

Shop Head Dimensions



Buck diameter (d) is (1.5d) times the diameter of the rivet  
 Buck height is half (.5d) the diameter of the rivet  
 Deburr both sides of a hole before installing a rivet  
 50 degree preferred - lightly chamfered

## SHAVING RIVETS

	Nominal Rivet Diameter (inch)					
	1/8	5/32	3/16	1/4	5/16	3/8
"H" Maximum Head Protrusion prior to Shaving	.007	.009	.010	.012	.014	.016
"D" minimum Head Diameter after Shaving	.204	.262	.326	.442	.526	.650

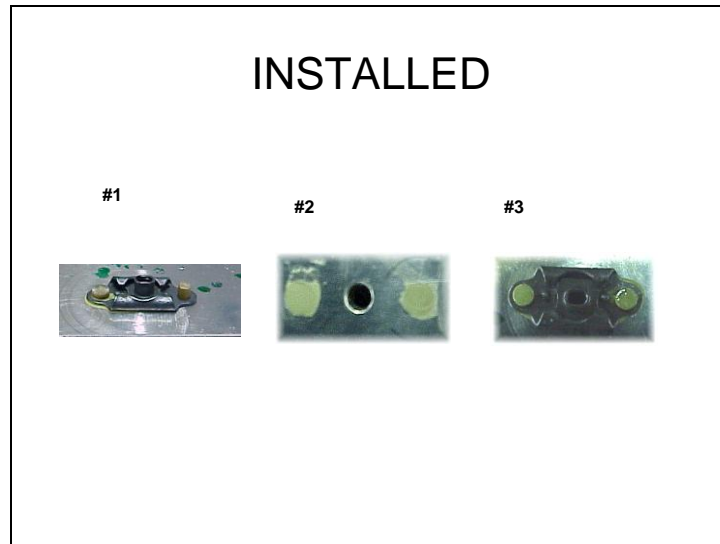
Shaving a MS20426 Countersunk rivet head must be kept to a minimum –usually from improper micro stop set up for depth of countersink.

**H** = how much of the rivet head is protruding

**D** = Diameter of head after shaving

**Note:** If the rivet requires shaving, the Inspecting Quality Control department will normally verify rivets before shaving. Set the rivet shaver up on a scrap piece of material. It should leave a very fine mark on rivet material, no cuts, gouge the material or finish as long as it does not damage to existing surrounding materials.





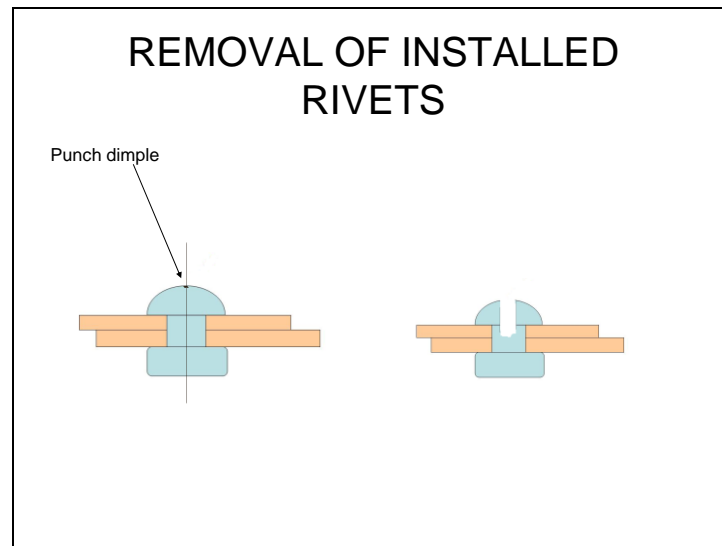
#1 Left rivet is correctly seated –Right Rivet to be seated

#2 rivet heads primed

#3 rivet bucks primed

Note: Always prime rivets after inspections are completed

No tooling marks (scratches, gouges ex) allowed on head or buck = No marring of head or buck allowed



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 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 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 forget your trash or FOD

You can put a piece of masking tape on buck top 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 shoot some in a scrap material and practice removing them to get the feeling for removing them.