



## Buck Riveting Basics - Tools and Techniques

Prepared for Vintage Trailer Supply  
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### Overview

Bucked rivets, also referred to as driven or solid rivets, have been used as the primary fastener type in the construction of aluminum-framed recreational vehicles (RVs). These RVs employ a number of construction techniques (including bucked rivets) that have been borrowed from the aircraft industry. Airstream, Avion, Silver Streak, Spartan and a number of other brands have used bucked rivets. These solid rivets are light-weight, strong and inexpensive fasteners. That's why they were chosen for aluminum aircraft construction and the same advantages hold true for RVs.

### Basic Principles

A bucked rivet is a round fastener that attaches two or more pieces of metal together. The rivet is driven by a pneumatic rivet gun with an attached rivet set shaped according to the shape of the manufactured head of the rivet. The rivet's tail (blunt end) is backed up by a bucking bar that acts as an anvil while the rivet gun and set are acting as a hammer.

As rivets are driven the tail of the rivet is transformed (technically called "upset"):

1. The rivet shortens in length and the exposed tail bulges outward to morph into the shop head.
2. The shank diameter swells in the hole to fill it entirely.

A bucked rivet holds the metal pieces in compression (like your thumb and forefinger holding two pieces of paper together) and in shear (does not allow the pieces of metal to slide around in relationship to each other). Typically multiple rivets are used to hold objects together and the combined strength of all of the rivets have tremendous holding power. Although riveted construction is permanent in nature, it is easily repaired by drilling the existing rivets out, making any necessary repairs and re-riveting with the same or a slightly larger size of rivet.

It's important to note that in order to repair or alter an RV that uses bucked rivets, the interior walls in the vicinity of the bucked rivets under alteration must be removed in order to access the back side with a suitable bucking bar. Another category of rivets, blind rivets, may be used to repair riveted panels from one side only. Although, blind rivets have a number of advantages, they also have a number of limitations and generally the repair or alteration will not have the same appearance, strength or waterproof characteristics as the original bucked rivet approach.

### Types of Bucked Aluminum Rivets

A number of bucked rivet styles are available based on several of the following characteristics:

- Shape of the manufactured head – for example Airstream has used brazier head rivets and Spartan used universal head rivets in the manufacture of their respective trailers. Brazier head rivets were assigned an Army Navy standard designation of AN455. Modified brazier head

rivets carry a similar designation of AN456. The universal head rivets had their own designation in this system of AN470. These rivet head styles have been used by nearly all manufacturers of aluminum-framed trailers.

- Alloy used to manufacture the rivet – Most rivets used in the manufacture of aluminum-framed trailers are of a fairly soft variety and the aluminum alloy number is 1100. These rivets do not have any marking on the head and are the type sold by Vintage Trailer Supply (VTS). Some rivets used in travel trailers have a dimple marking in the head and are manufactured of a harder, heat-treated alloy that carries a number designation of 2117T.
- Rivet diameter and length - Rivet diameters increase in increments of 1/32 of an inch and the number of thirty-seconds is indicated as a dash number. So a 1/8" diameter rivet is 4/32" in diameter and is referred to as a -4 diameter rivet. A 5/32" rivet would likewise be a -5 rivet. The rivet length increases in 1/16" increments and the number of sixteenths is indicated as a second dash number. Therefore, a 4-4 rivet would be 1/8" in diameter and would have a 1/4 inch shank length.
- The rivets sold by VTS are either brazier head rivets in the 1/8" diameter (AN455-4) or modified brazier head rivets in the 5/32" diameter (AN456-5). Both have the same .312" diameter head but the modified brazier has a larger shank diameter. For repairs or re-work of a panel, the small increase in shank diameter of the -5 rivet will give the rivet a more solid fit in old holes that have been slightly enlarged by years of use.

## Introduction

Learning to install solid rivets is an important skill in maintaining or restoring aluminum framed recreational vehicles. Although it will take some time and practice to learn the necessary skills, it really isn't a terribly difficult skill. You will save a great deal of money over time by learning to use this skill in maintaining your trailer, aluminum boat, etc. versus hiring a professional to do the work for you and your sense of satisfaction in a job well done will reward you forever.

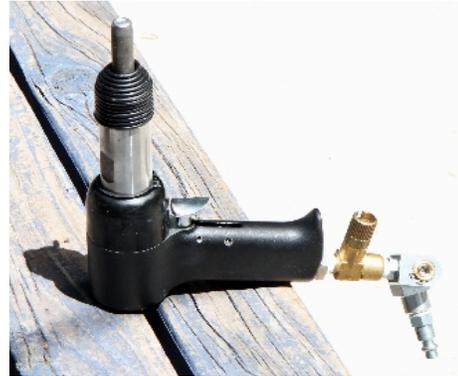
## Tool Descriptions

The ***rivet gun*** is like a hand held pneumatic jack hammer for driving rivets and could easily be confused with an air hammer. However, there is a significant difference between these tools as the rivet gun's impact can be controlled by varying the amount of squeeze on the trigger, whereas an air hammer is on full or off. *An air hammer should never be used for riveting!* The rivet gun incorporates a removable coil spring that both holds and retains the rivet set securely to the rivet gun and acts as a return spring each time the rivet gun drives the rivet set outward. The rivet gun should be connected to a supply of dry, clean air with the pressure regulator set to 90 PSI.



The rivet gun sold by VTS is a 3X type that has three times the impact force capacity of older standard rivet guns and is ideally suited to the riveting requirements used in the restoration and maintenance of riveted recreational vehicles. In order to further dial in the impact force of the rivet gun, an air inlet valve is included to fine tune the tool according to your needs. It is recommended that you turn the dial a couple of revolutions clockwise to reduce the force as a starting point (more about setting up the tool will follow in the upcoming Learning to Rivet section).

The **rivet set** is the business end of the rivet gun. You can have one rivet gun and any number of rivet sets to accommodate the shape required for the contour of the manufactured head of the rivets being used. The rivet set sold by VTS is designed to match both the 1/8" brazier head and 5/32" modified brazier head rivets. The face of the rivet set should be kept clean and corrosion free between uses. If you desire in the future, you can add other types of rivet sets to work with your rivet gun if you want to drive other types of rivets.



Rivet Set (left); installed in Rivet Gun (right) with addition of Air Hose Swivel purchased separately. Please note that the spring is placed over the rivet set. **It is unsafe to operate the gun without the spring.**

**Air tool oil** is an essential part of daily operation for any pneumatic tool, including your rivet gun. Two or three drops of this lubricant should be dripped into the inlet port of any rivet gun/impact wrench/drill or any other air operated tool prior to the first use of the day. This will keep the inner workings of the tool lubricated.



A **bucking bar** is a hand-held anvil as stated in the Basic Principles section. The bucking bar sold by VTS has three faces that can properly reach almost any rivet tail location encountered in bucking rivets in a recreational vehicle. It is important to keep the faces of the bucking bar clean and corrosion free. To store this tool, spray a little corrosion preventive to keep it in good shape for the future.

**Drill bit(s)** – The hole for any rivet should be slightly larger (perhaps 3% larger) than the shank of the rivet being driven prior to forming the shop head. This allows the rivet to move without binding or burring during the bucking process and the rivet will swell out in diameter to equal the drilled hole inside diameter when driven. Numbered drill bit sizes are recommended as follows: -4 (1/8") rivet requires #30 bit, -5 (5/32") rivet requires #20 or #21 bit, -6 (3/16") rivet requires #11 bit.



Drill bits sold by Vintage Trailer Supply have a split tip, which means that each flute or starting face is ground in such a way that there are two points of contact with the metal. This feature helps keep the bit centered

where you want it to be and minimizes the tendency of drill bit wander or walk around on the metal being drilled. When replacing a 1/8" rivet, it is important to use the next larger size or a 5/32" rivet and to drill the hole with a #20 or #21 bit. This practice ensures that you will have a clean cylindrical (as opposed to a jagged or oval) hole. Also, it's important to deburr each hole to ensure a smooth surface for the rivet to clamp against.

A **rivet cutter** is like a scissor or shear that can cut rivets of various sizes to specific lengths. The 1/4" length rivets cannot be cut any shorter with this tool as this the minimum length of cutting. However, the rivet cutter can cut longer rivets (like the 1/2" rivets) to 4/16" (AKA 1/4"), 5/16", 6/16" (or 3/8") and 7/16". The rivet cutter has a series of length setting spacers that can be rotated above the selected hole that is appropriate to the rivet diameter being cut. Then, tighten the knurled knob to keep the length setting you desire while cutting a number of rivets.



Advantages of a rivet cutter like this precision tool are:

- Ease of cutting
- Uniform cut length of rivets
- Square cut of tail for uniformity and ease of proper bucking of tail
- Ability to buy a quantity of rivet that are of sufficient length and cut them as necessary to the length required for a given area being riveted

### Tips for cutting and Sorting Rivets



*Cutting rivet to length using two 1/16" thick spacers + 1/4" thickness of cutter = 6/16" or 3/8" length*



*Cut rivet and butt*

Use a simple sorting device like an egg carton to cut a group of rivets to required lengths and keep them organized.



**Clecos and Cleco pliers** – Aluminum sheets tend to shift laterally during the drilling and alignment of panels and frames that are being riveted together. The solution to this dilemma is to use Clecos. Clecos are temporary fasteners that are installed with Cleco Pliers. The term Cleco was a trade name of the Cleveland Tool Company that originally made the tools. By using Clecos, the sheet metal can be pre-assembled and held in alignment to a significant degree while additional holes are being drilled or while rivets are being driven or bucked. Note: even when using Clecos properly, it will occasionally be necessary to re-drill/realign holes because some minor lateral shifting of the panels may occur. Since this lateral shifting is likely to occur, you might want to first drill the pilot holes for -5 rivets (5/32”) to a diameter of 1/8” initially and use 1/8” Clecos. Then, once you are ready to drive the rivets, drill out a couple of holes near the center of the pilot holes using a #21 bit. Next drive the rivets for those holes. Then drill out the next 1/8” holes on either side of the recently driven rivets with the #21 bit and drive the next rivets. This may be overkill, but it ensures round holes as the work progresses.

Clecos are color coded according to the rivet diameter that they are being used with:



Color	Diameter	Rivet
Copper	1/8”	-4
Black	5/32”	-5
Brass	3/16”	-6

In order to install the Cleco, special Cleco pliers (shown above, right) should be used to grasp the Cleco collar while depressing the spring-loaded plunger of the Cleco. This will thrust out the portion of the Cleco that is inserted into the pre-drilled rivet hole. Then the pressure on the plier is released allowing the portion of the Cleco that has been thrust into the holes to grasp the sheet metal in place.



*Using Cleco pliers to insert Clecos.*



## Learning to Rivet

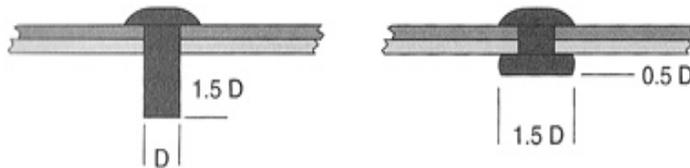
Even if you have never riveted before, it isn't very difficult to learn. However some intentional practice on scrap pieces of metal is definitely in order. A number of good resources (written material as well as videos) are available via an internet search. However, we'll cover the basics in this section.

Most of the major considerations related to bucked or driven solid rivets are listed below:

1. Solid rivets are superior to (strength/waterproofness) and less expensive than aluminum blind rivets.
2. Installation of solid rivets require access to the front and back sides of the parts being riveted.
3. Holes for solid rivets should be very slightly larger than the rivet's outside diameter prior to being driven.
4. Install Clecos to hold all parts to be joined with rivets as the holes are drilled to minimize any shift in position between parts. Note: as you rivet the parts together, some holes may need to be chased or cleaned-up with a drill bit again due to minor shifting of the parts.
5. A pneumatic rivet gun rather than an air hammer must be used to drive bucked solid rivets.
6. With small assemblies, a single operator can usually drive the rivet with the rivet gun and hold the bucking bar against the tail of the rivet during the bucking or upsetting process.
7. Larger panel assemblies require two operators, one to drive the rivet and the other who will buck the rivet.
8. The air pressure regulator on the rivet gun should be set such that about 6 or 8 impacts with the rivet gun will fully upset or drive the rivet.
9. The proper rivet set should be installed on the rivet gun according to the style of the rivet heads being driven.
10. The spring attaches the rivet set to the rivet gun and should be removed from the gun to allow the rivet set to be installed and then replaced over the base of the rivet set and screwed down securely.
11. The riveter (person operating the rivet gun) should:
  - a. Place the rivet set squarely over the rivet head.
  - b. Align the axis of the rivet gun so that it is perpendicular to the surface of the parts being riveted.
  - c. Apply several pounds of pressure against the rivet head.
  - d. Verify that the bucking partner (if one is involved) is ready to begin riveting – Call out "ready" and wait for an affirmative response.
  - e. Squeeze the trigger on the rivet gun for about one second and check the state of the shop-formed head or await the verbal report from partner doing the bucking.
  - f. Repeat as necessary.
12. The person bucking the rivets should:
  - a. Evaluate the length of the tail of the unformed rivet for length (should protrude about 1.5 to 2.0 rivet diameters from the back side of the surface being riveted).
  - b. Place the surface of the bucking bar against the tail of the unformed rivet so that the surface is perpendicular to the axis of the rivet and the mass of the bar is in line with the strike of the gun so that the force is absorbed and deadened most effectively.
  - c. Apply a slight pressure against the rivet (one or two pounds of pressure, but not enough to push the rivet back through the hole or lift the rivet head off the metal surface). The bucking bar pressure should be much less than what is applied to the rivet gun.
  - d. Communicate with your partner that you are on the correct rivet and ready to begin riveting.

- e. Evaluate the formed shop head (the tail should protrude about 1.5 diameters before forming and the shop head diameter should be approximately 1.5 times the rivet diameter after being driven – see illustration below).
- f. If the rivet has been driven too much (shop head is too thin and flat), the rivet will have to be drilled out and replaced.

Determining the length of the rivet for a properly formed shop head



## Practice Riveting

By practicing riveting using metal that will not be used in your trailer, you'll be a lot more satisfied with the results when you do start work on your pride and joy. Here is an example of progress learned over the course of eleven rivets (see below). Before actually riveting on his own trailer, this author actually practiced with about fifty rivets and started in an inconspicuous place on the trailer.



*Practice Rivets Front*



*Practice Rivets Back*

## Important Note for Repairs Using Bucked Rivets

When you have to drill out old rivets it is important to leave a properly sized round hole. If the hole is not sized and shaped correctly, the new rivet will not swell to fill the hole fully and the rivet may leak. Repairing an old hole usually requires enlarging it and installing the next size larger rivet. An old misshaped 1/8" rivet hole can be "saved" by using 5/32" replacement rivets. You may also want to install the new rivet in a "wet" fashion. That is, you should inject some type of sealer (caulking appropriate for aluminum such as TremPro, for example) to seal the hole. Also, consider installing additional rivets nearby to carry the structural load if that seems prudent due to multiple distorted holes.

## For More Information Visit:

[www.vintagetrailersupply.com](http://www.vintagetrailersupply.com)

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