

***REVISION DESCRIPTION:***

**Page 03-03 REV 4:** 120° Machine Countersink Cutter with #30 Pilot, Economy 90° Drilling Attachment, and Threaded Shank Drill Set 76 pc. now required for RV-14.

Flush Head Rivet Set (Tall, 1/2" Thick - Squeezer) and Rivet Cutter, no longer optional.

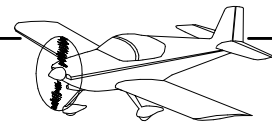
Angle Drill Kit (Alternately use the Economy 90° Attachment Listed Below), Flush Swivel Rivet Set - Rivet Gun and Bucking Bar - Tungsten now optional.

**Page 03-04 REV 3:** Drill Press, Wiss Snips - Offset - Right, and Digital Level no longer optional.

Rubber Mallet or Heavy Soft Faced Hammer now required for RV-14.

Dimpling Mallet now optional.

Added 3/8 dia. Drift Pin.



# SECTION 3: TOOLS AND WORKSPACE

While building an RV requires some investment in special tools, most builders with home workshops already own many of the basics. In addition, there are a number of tools which are nice to have, but not essential. See the *Builder's Tool Requirements* list in this section for specific tool types and sizes required.

Unless you live in a major metropolitan area, you probably have to order specialized tools by mail or online. Several mail order tool houses offer excellent quality and service. Van's surveyed RV builders about the quality and service provided by the various mail order tool houses. The results generally agreed with the old adage: "you get what you pay for." Inexpensive tools often proved to be of inferior quality, resulting in frustration and poor results. We have supplied a list of tool suppliers in our printed and online catalogs.

## STATIONARY TOOLS

**Bench Grinder:** A bench grinder with a Scotchbrite polishing wheel is extremely useful. While the edges of sheet metal parts can be deburred and/or sanded smooth, the grinder will save many hours. Grinders with totally enclosed motors will endure the abrasive dust better.

**Belt sander:** Many builders report that a benchtop 1" belt sander is one of their most used tools. Most of the jobs it does could be accomplished with a file and sandpaper, so it is not essential, but it will save a lot of time.

**Air Compressor:** Output and tank volume are not critical, but it should be capable of 75 psi. If you plan to use rotary air tools like air drills or die grinders, a larger tank (20 gallons or more) will keep the compressor from running continuously. Any 1 1/2 to 2 hp home shop compressor with enough volume to power a spray gun will be adequate. If lower noise level is desired, a compressor that uses a belt and speed reduction pulleys is preferable.

**Band Saw:** Another non-essential but handy tool.

**Drill Press:** One of the most useful auxiliary tools. Kit builders can manage without, but will find many uses if they have one.

## HAND TOOLS

**Hand Held Drill Motor:** A 1/4 or 3/8 inch electric hand drill will do. A variable speed reversible drill is better. Battery drills can be convenient, and some of the high power, high rpm models do an excellent job. A minimum of 1100 to 1200 rpm are necessary. Two or more electric drill motors is a good idea. For instance, you might have a drill bit in one, and a machine counter-sink in another. They are cheap enough to make this convenience affordable. Air drills are preferred by many builders because of their small size, high speed, and variable speed feature. They do use a lot of air, however, so plan on having a compressor with a larger tank.

**Drill Bits:** The basic tool of RV building. We have found that High Speed Steel bits work well for small holes. "Split point" drill bits, either the 118 deg or the 135 deg, work especially well, giving a clean start and a round hole. Split points almost eliminate the ugly "worm track" left when a bit does not start cleanly and spins off across the work-piece. Plexi or plastic drilling bits are designed to minimize the risk of chipping or cracking.

**Unibits:** Also known as step drills. Drilling holes larger than 1/4 inch in thin sheet metal with a twist drill often results in distorted holes or parts. The Unibit cuts these larger holes in sheet aluminum cleanly and quickly, and also work very well in plexiglass. They are stepped in 32nds and 16ths of an inch.

**Deburring bits:** Several styles are available. A hand swiveling type is inexpensive and works well. Adapters that fit deburring bits to slow turning electric screwdrivers and hand drills have become popular for large jobs, such as deburring big skins. Three flute deburring cutters are widely available and generally work well, but they do have a tendency to chatter. Single flute deburring bits work beautifully.

**Rivet Gun:** The 3X size is preferred by most builders, although good results are possible with the lighter duty 2X. Better guns are distinguished by a progressive or variable "hit" rate controlled by trigger squeeze. With a good gun, it is possible to drive various size rivets without changing the air pressure or flow rate. Lower quality guns tend to be single speed tools, which means that once you pull the trigger, you get all of the speed and force that the line pressure will produce. The only control you then have is the duration (how long you hold the trigger down) or the line pressure. An inexpensive air flow regulator installed at the air inlet of the gun is essential on these lower quality guns and is a useful accessory on the better guns as well. Many "air chisel" pneumatic tools are now available for prices far below the cost of a rivet gun. They look similar to aircraft rivet guns, but they won't do the job very well. Saving \$150 on a rivet gun but ending up with several thousand bad looking rivets is not a good trade.

**Rivet Cutter:** Needed for shortening rivets when the exact length rivet is not available. Not used too often, a good pair of wire snips can be used instead.

**Rivet Sets:** Several are required. Some builders prefer a flush set with a rubber guard around the edge to help eliminate "smiles" in the metal. Others don't. A flush rivet set with a swivel joint between the face and the shaft is available. This will help eliminate "smiles" by keeping the face of the set square to the work, even if the gun is held at a slight angle. These come with a rubber guard that must be sanded back flush with the face of the set.

**Dimple Dies:** Many of the skins are too thin to machine away metal for the countersunk rivets and screws, and dimpling is required. Dimple dies, made from high quality tool steel, come in male/female pairs. Used in a squeezer, they form rivet shaped depressions in sheet metal.

**Pop-rivet Dimple Dies:** A special version of the dies above works with a pop rivet tool. Not used often, but goes where no other tool can go. They use a common nail as a mandrel.

**Bucking Bars:** It seems that one never has enough sizes and shape bucking bars. Fortunately, any smooth piece of steel with a sufficient mass can be used for a bucking bar. Get two or three good all-around bars, and improvise with anything you have laying around the shop when you encounter a riveting situation where these won't fit.

**Hand Seamer:** Required for bending small tabs and flanges, and for straightening or re-aligning major flanges.

**MicroStop Countersink:** or "machine countersink cage". This tool holds a piloted cutter and has a micro-adjustable sliding sleeve to set the depth of cut. Only one is necessary, but two, set up with different cutters, are a nice convenience.

**Cleco Fasteners:** Cleco is a trade name which has come into common use to mean Temporary Sheet Metal Fastener. This is a little cylindrical shaped device about the size of a 45 caliber bullet. It has a spring loaded barbed pin in the end which fits into a drilled hole in two or more thicknesses of sheet and locks them together. More is better....many builders measure them by the quart.

**Cleco Pliers:** As the name implies, this is a pliers-like tool used for installing and removing temporary sheet metal fasteners.

**C-Clamps:** About 2 inch size.

**Other Clamps:** You can never have too many spring clamps. They are a quick and inexpensive way of setting up and holding assemblies together. Do not trust them to hold parts in alignment when drilling -- the springs do not provide enough clamping pressure to resist power tools. There are many types of cam clamps, almost like mini-vice grips available from different manufacturers. They hold much better than spring clamps and are usually a worthwhile investment.

**Metal Cutting Snips:** 3 types required. Right hand, left hand, and straight cutting. WISS brand cutters are widely used. The right and left hand cutters usually have serrated edges which help in cutting curves, but leave small marks on the edge of the aluminum. Choose a straight snips with smooth jaws for the neatest possible cuts.

**Pop-Rivet Puller:** Used to set blind or pop-rivets. Most commonly available flush head Blind Rivets (often referred to as Pop-rivets, a trade name) have 120 deg. head angles rather than the 100 deg. for flush head AN rivets. Thus, special dimple die sets are needed for a perfect fit, although almost all builders we know use regular dimple dies and report acceptable results. We recommend using the "Pop" Riveter PRP-26A, USM Corp., which will fit into the tighter spaces better than other rivet pullers. Although not required, a pneumatic puller is useful and can be run with a small air-compressor.

**Body File:** Also known as a Vixen file or a SuperShear (Nicholson brand name.) Distinguished by the crescent shaped cutters across the width of the file. Not an absolutely essential tool, but is very useful for smoothing the edges of thicker gauges of aluminum.

**Files:** A minimum of 3 or 4 will do. Small round, flat, and flat-face/round back.



**Protractor/Carpenters Level:** A bubble protractor can measure the angle of any surface from a horizontal or vertical reference plane. The carpenters level (2-3 ft. in length) is useful in measuring the horizontal and vertical alignment of RV parts and structural components. A bubble protractor mounted on a straight edge of comparable length will serve the same purpose. Either the bubble protractor or the level should be checked for accuracy before use. This can be done by finding a level (or nearly level) surface and laying the level on it. Note the position of the bubble, and then reverse the level end for end. Now check the bubble position again. If not the same, loosen the adjustment screw on the bubble and re-position. Then switch ends again and re-check. Repeat until the reading is the same regardless of the orientation of the level. Use digital protractors and levels or "smart" levels whenever possible.

**Circle Cutter:** Also known as a fly-cutter. Used for cutting lightening holes in ribs and other thin webs, plus instrument panel holes. A wicked little tool that can cause nasty damage to hands and unguarded body parts. Should be used in drill press only, never on a hand-held drill.

**Fluting Pliers:** Used for crimping rib flanges, etc. to effectively shrink them and straighten the part. Several styles are available. We prefer pliers that leave a crisp indentation, and avoid the type with the large rubber tips. These make a wide shallow flute which gives less flat area for rivets.

**Edge Deburring Tools:** A selection of tools as listed in the required parts list. Deburring tools are used for rounding and smoothing the edges of sheet metal parts.

**Hand Rivet Squeezer:** Used for dimpling and setting rivets near material edges. There are cheap ones on the market, but they give poor results. Spend the money.

**Pneumatic Rivet Squeezer:** Used for dimpling and setting rivets near material edges. More expensive than the hand rivet squeezer, but much easier on the arms.

**Paint Spray Gun/Respirator:** Priming of internal parts of an RV requires a spray gun. Almost any quality gun will do because primer finishes are not as critical as exterior painting. One of the biggest problems involved in priming is cleaning up. Often only a small amount of priming is needed. Small spray guns with disposable cup reservoirs are adequate for priming. Clean up of the spray nozzle is very simple, and the spray pattern quality is more than adequate for priming.

Respiratory protection from primers and paints should not be taken lightly. Those warnings are on paint cans for a reason! A good respirator (not a dust mask) is essential. In the last year or two, "fresh air" spray systems, using an oil-less compressor to supply fresh air from a remote source to a respirator or spray helmet, have become affordable.

**Hand Riveting and Dimpling Tool:** This hand operated, bench mounted riveting and dimpling tool is one of the most useful tools a builder could have. It consists of a large "C" shaped frame with a driver and anvil at the open end. The driver shaft and anvil have guides and holders for the rivet sets and dimple dies. It uses the same dies as do the rivet guns and hand rivet squeezers previously discussed. The force for doing the riveting or dimpling is provided by hitting the guided tool holder with a hammer. Because the dies and sets are held accurately in place, good quality dimpling and setting is simple. The depth of the "C" frame is sufficient to dimple almost all the skins on RVs. It is rigid enough to permit setting rivets up to 3/16 inch dia., so some builders use it even for the heavy riveting on the main wing spar (older model kits).



**Torque wrench:** This is a must have tool. Get one calibrated in inch-pounds, a foot pound wrench will do you no good. Aircraft nuts and bolts have specific torque values (see the Standard Aircraft Handbook or the table reprinted in Section 5V of this manual) that can only be set accurately with this tool. It is very easy to over torque the small AN3 (10-32) bolts without one.

**Taps:** Used to add internal threads to drilled holes. See required tool list for specific sizes.

**Tubing bender:** Although there are not a lot of aluminum tubes in the RVs, those that are there need to be bent properly. Fuel lines, pitot lines etc. need to be kink free.

**Tubing Flaring Tool:** Fuel lines need to have the proper 37° flare on the end in order to seal properly. Buy one or borrow one, but don't try to use an automotive 45° tool.

**Heavy soft faced hammer:** Select one between 12 and 24oz.

**Hollow Ground Planer Blade (Older Model Kits):** Used in a table saw for cutting any aluminum sheet too thick for a hand shear. This results in a relatively smooth cut edge which needs little clean up afterwards. Just knock off the edges with a file and smooth the cut surface either with a fine file or a polishing wheel.

All required riveting equipment can be purchased from one of the suppliers listed in our accessories catalog. While other suppliers are available, these have catalogs available which make shopping easier. These catalogs are also useful as a general information source about sheet metal tools.

Studying any one or more of the tool catalogs will introduce you to many more metal working tools, some of which can also be used to advantage in aluminum aircraft construction. Several of the larger general parts suppliers such as Aircraft Spruce and Wicks publish extensive catalogs which are very valuable not only introducing the builder to the wide variety of hardware, tools, and parts available, but also including useful charts and table of aircraft standards.

While we feel that those tools we have listed are sufficient, some builders (or groups of builders) might have the resources and desire to have a super well equipped shop and should be aware that there is practically no limit to the variety of tools available. Within reason, money spent on good tools is seldom regretted.

Following is a list of tools compiled specifically for building the RV.

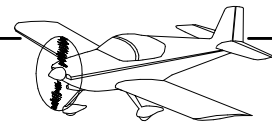
### BUILDER'S TOOL REQUIREMENTS

**NOTE: Tools listed as "Optional" in the following tools and materials lists make the build process easier, but are not required to complete construction. Tools required for a specific model but optional for others will be indicated with that aircraft model number (i.e. "REQ RV-14").**

CATEGORY	QTY	ITEM	Required/Optional
<b>Clecos</b>	125	Clecos 1/8"	
	350	Clecos 3/32"	
	10	Clecos 3/16"	
	10	Clecos 5/32"	
	4	Cleco Clamps -1" Jaw s - Side Grip	
4	Cleco Clamps -1/2" Jaw s - Side Grip		
1	Pliers - Cleco		

CATEGORY	QTY	ITEM	Required/Optional
<b>Cutting/Deburring Tools</b>	1	Abrasive Cutting Disk	
	1	Hacksaw (Fine Tooth 32 Teeth per Inch Blade) or Bandsaw	
	1	Scotch Brite Wheel	
	3	Scotch Brite Pads - Maroon	
	1	Speed Deburring Tool	
	1	Emery Cloth	
	1	Files - Assorted (Vixen, Bastard, Rat Tail, Rasp, Etc)	
	1	File Card / Brush	
	1	Multi-Burr Deburring Tool (Royal Style)	

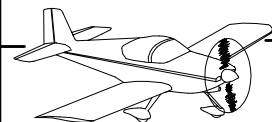
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CATEGORY	QTY	ITEM	Required/Optional
Drills/Countersink/Taps	1	#3 Drill Bit	
	1	#10 Drill Bit	
	1	#11 Drill Bit	
	2	#12 Drill Bit	
	1	#16 Drill Bit	
	2	#19 Drill Bit	
	1	#21 Drill Bit	
	1	#27 Drill Bit	
	1	#29 Drill Bit	
	3	#30 Drill Bit	
	1	#30 Drill Bit 12" Long	
	1	#33 Drill Bit 6" Long	
	1	#36 Drill Bit	
	5	#40 Drill Bit	
	1	#40 Drill Bit, 12" Long	
	1	#43 Drill Bit	
	1	#52 Drill Bit	
	1	1/4" Drill Bit	
	1	5/16" Drill Bit	
	1	Q (or 11/32nd) Drill Bit	
	1	Ream .311"	
	1	Ream 3/8"	
	1	Step Drill (Uni-bit) Preferably 1/4 to 7/8" X 1/16 Step Increment	
	1	Countersink #8 Screw	
	1	Countersink #10 Screw	
	1	100° Machine Countersink Cutter with #12 Pilot	
	1	100° Machine Countersink Cutter with #19 Pilot	
	1	100° Machine Countersink Cutter with #27 Pilot	
	1	100° Machine Countersink Cutter with #30 Pilot	
	1	120° Machine Countersink Cutter with #30 Pilot	REQ RV-14
	1	100° Machine Countersink Cutter with #40 Pilot	
	1	Countersink Micro Stop Cage	
	1	Drill Stops - #30 #40 #12	Optional
	1	Angle Drill Kit (Alternately use the Economy 90° Attachment Listed Below)	Optional
	1	Economy 90° Drilling Attachment	REQ RV-14
	1	Threaded Shank Drill Set 6 pc. (or min. 1 ea. #40, #30, #12 bits) for 90° Drill	REQ RV-14
	1	1/4-28 Tap	
	1	5/16-24 Tap	
	1	3/8-16 Tap	
	1	3/8-24 Tap	
	1	4-40 Tap	
	2	6-32 Tap	
	1	8-32 Tap	
	1	10-24 Tap	

CATEGORY	QTY	ITEM	Required/Optional
Dimpling/Riveting	1	Dimple Die-Reduced diam. (3/8" diam.) 3/32" Female Dimple Die	
	1	Dimple Die-Reduced diam. 1/8" diam Female Dimple Die	REQ FOR RV-14
	1	Dimple Die Set 1/8" (100°)	
	1	Dimple Die Set 3/32" (100°)	
	1	Dimple Die Set #6 Screw	
	1	Dimple Die Set #8 Screw	
	1	Dimple Die Set #10 Screw	
	1	Dimpler 3/32" Pop Rivet	
	1	Dimpler 3/32" Vice Grip	
	1	Flush Head Rivet Set (Tall, 1/2" Thick - Squeezer)	
	2	Flush Head Rivet Set (Short, 1/8" Thick - Squeezer)	
	1	Flush Swivel Rivet Set - Rivet gun	Optional
	1	Rivet Set - Offset 1/8" (With a Flat Ground on One Edge) - Rivet Gun	
	1	Rivet Set - 1/8" Cupped Set 3.5" - Rivet Gun	
	1	1/8 Protuding Head Rivet Set (Tall, 1/2" Thick - Squeezer)	
	1	Rivet Set - 3/32" (Cupped Set 3.5" - Squeezer)	
	1	Beehive Retainer Spring (Often Supplied w ith Rivet Gun)	
	1	Quick Change Spring (For Flush Rivet Sets, maybe Supplied w ith Rivet Gun)	
	1	Back Rivet Set	
	1	Hand Squeezer w ith 3" Deep Yoke	
	1	C Frame Riveting/Dimpling Tool	
	1	Back-Riveting Plate, .375[9.5mm] X 6[152mm] X 12[305mm]	
	1	Dimple Die Organizer	
	1	3M F9460PC VHB Tape (or Fuel Tank Sealant)	
	1	Rivet Tape	
	1	Rivet Cutter	
	1	Rivet Gauge Set	
	1	Hand Blind Rivet Puller "POP" Riveter PRP-26A, USM Corp./ or Equivelant	
	1	Bucking Bar - Anvil 1.9 lb.	
	1	Bucking Bar - Tungsten	Optional
	1	Bucking Bar - Mini 1 lb.	

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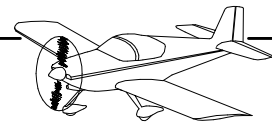


**RV-14 BUILDER'S SUPPLIES REQUIREMENTS**

CATEGORY	QTY	ITEM	Required/Optional
<b>Power/Air/Shop Tools</b>	1	Drill Motor 1/4" - Air - 2500-4000 RPM	
	1	Drill Motor - Battery Powered	
	1	Air Tool Oil	
	1	Air Tool Regulator	
	1	Air Swivel	
	1	Die Grinder	
	1	Drill Press	
	1	Rivet Gun , 2X and 3X or 3X Rivet Gun Only	
	1	6" Bench Vise	

CATEGORY	QTY	ITEM	Required/Optional
<b>Hand Tools</b>	1	Pliers - Duck Bill	
	1	Pliers - Fluting	
	1	Pliers - Needlenose	
	1	Diagonal Cutter	
	1	Tape Measure - Combination Fractional/Decimal Rule	
	1	12" Steel Rule	
	1	Punch - Assorted Sizes	
	1	Wiss Snips - Offset - Left	
	1	Wiss Snips - Offset - Right	
	1	Hammer - 12 oz. Dead Blow	
	1	Dimpling Mallet	Optional
	1	Rubber Mallet or Heavy Soft Faced Hammer	REQ RV-14
	1	Hearing Protector	
	1	Safety Glasses	
	1	Caliper (6") Dial or Digital	
	1	Edge Rolling Tool	
	1	Hand Seamer	
	2	Screw driver Bits - Size #2	
	10	Small (2") "C" Clamps	
	4	Large (3") Spring or "Pony" Clamps	
	1	Combination Wrench Set (1/4"-3/4")	
	1	Fish Scale (0-50lbs)	
	1	Torque Wrench (Inch/Pounds & Foot/Pounds Scale)	
	1	Aviation Flaring Tool (Tube) 37°	
	1	Tubing Cutter	
	1	Tubing Bender, 1 inch centerline radius	
	1	Wire Crimper/Stripper	
	1	OLFA RTY-2/G 45mm Rotary Cutter (or Equivalent)	
	1	Multimeter (with Continuity Check Capability)	
	1	Digital Level	
	1	0-2lb Scale (for Measuring Tank Sealant)	Optional
	1	Socket Set 1/4-3/8 Drive	
	4	3/8" dia. Drift Pin (Fabricate from hardware store bolts by tapering the end)	

CATEGORY	QTY	ITEM	Required/Optional
<b>Ref. Mat'ls/Supplies</b>	1	A/C STRUCTURAL TECHNICIAN BOOK	
	1	STANDARD AIRCRAFT HANDBOOK	
	1	Tape Dispenser	
	1 Box	Permanent Markers ("Sharpie" Xtra or Ultra Fine Point)	
	1 Roll	String	
	1 Tube	Super Glue	
	1 Tube	Boelube	
	1 Can	LPS#1, 2 3, or a light motor oil.	
	1 Can	Pipe Thread Sealant	
	1-2 Qt	Fuel Tank Sealant	
	1 Tube	RTV Sealant - Red	
	1 Tube	Clear Silicone	
	1 Tube	Threadlocker - Loctite or Permatex - Red	
	1 Tube	Threadlocker - Loctite or Permatex - Blue	
	1 Tube	Anti-Seize Paste (High temp)	
	3 Yds	9oz/sq yd Plain Weave "E-glass" Fabric	
	1 Yd	Peel Ply (optional)	
	1 Qt	Kit of Epoxy Resin & Hardener	
	1 Qt	Acetone (for Clean-Up)	
	25	Mixing Cups (Solo™ Clear Plastic Cups Recycle Code #1 or #5)	
	100	Craft Sticks (a.k.a. Popsicle Sticks)	
	1/4 lb	Flocked Cotton Fiber (a.k.a. "Flox")	
	1/4 lb	Glass Spheres (a.k.a. "Micro-Balloons")	
	1 Roll	Low-Tack "Painters" Masking Tape	
	1 Roll	Mylar Packing Tape	
	1 Roll	Duct Tape	
	1 Kit	Fuel Tank Test Kit - See Van's Aircraft Catalog	
	1 Roll	Masking Paper - 24"	
	1 Sheet	Sandpaper - 60 Grit - 8.5X11 Sheet	
	2 Sheet	Sandpaper - 80 Grit - 8.5X11 Sheet	
	2 Sheet	Sandpaper - 100 Grit - 8.5X11 Sheet	
	1 Sheet	Sandpaper - 150 Grit - 8.5X11 Sheet	
	2 Sheet	Sandpaper - 220 Grit - 8.5X11 Sheet	
	2 Sheet	Sandpaper - 320 Grit - 8.5X11 Sheet	
	5	Sanding Blocks - Various Sizes/Shapes	
	3	Paint Brush - 1" Wide (Cheap, Natural Bristle Type)	
	2	Paint Brush - 2" Wide (Cheap, Natural Bristle Type)	
	2	Paint Brush - 3" Wide (Cheap, Natural Bristle Type)	



## PARTS DESIGNATION SYSTEM

All parts in an RV structure (other than standard aircraft hardware items or common vendor items) have a part number assigned to them. Here is a typical part number, followed by an explanation of the numbering system: W-00006

1. The first letter designates the major portion of the airframe in which the part is used. In this instance, "W" denotes "WING". Other prefix examples are: W - Wing, F - Fuselage, HS - Horizontal Stabilizer or Stabilator, VS - Vertical Stabilizer, R - Rudder, A - Aileron or Flaperon, FF - Firewall Forward, T - Tank, U - Undercarriage, WD - Weldment, C - Canopy.

2. The first numbers (in RV models 3, 4, 6 and 6A, 7 and 7A, 8 and 8A, 9 and 9A and 10) were allocated in blocks of 100 for our various models. Thus, most 800 series numbers are for the RV-8, 1000 series numbers are for the RV-10, 1200 series numbers for the RV-12, etc. The RV-14 and later series aircraft parts are numbered using a more generic numbering system that is not aircraft specific. For example: The W-00006 does not specify a specific aircraft model, but pertains only to a wing part number 00006.

In some cases, the construction manual calls out parts from lower model number aircraft. For instance, the RV-14 ailerons use parts that were previously used in the RV-10 aileron. In these cases, the part is common to more than one aircraft and to avoid the confusion of having one part with two possible part numbers, only one part number is used.

3. The suffix letter is used when a part, such as the wing spar in this instance, consists of two or more assembled parts. For example: the W-1026 Torque Tube Support Assembly consists of the parts W-1026A, W-1026B, W-1026C, W-1026D.

4. Parts which are specific to a left or right configuration will be followed by "-L" or "-R". For example FL-1005-R is a flap rib with flanges that are bent towards the right when the part is installed in the aircraft. This is a "-R" part regardless of which side of the aircraft the part is installed on.

Raw materials use a different numbering system.

AA Aluminum Angle  
 AB Aluminum Bar  
 AS Aluminum Sheet  
 AT Aluminum Tube  
 PS Plastic Sheet/Strip  
 PT Plastic Tube  
 SS Steel Sheet  
 SSP Stainless Steel Pin  
 ST Steel Tube

The next number denotes the temper, condition or alloy:

0 Soft Aluminum  
 3 T-3 (aluminum)  
 6 T-6 (aluminum)  
 4130 Steel alloy

The number following the dash shows the thickness of the material

-025 0.025"  
 -032 0.032"

Next the size is specified: An example: AS3-032x15x20 shows a part of Aluminum Sheet, temper T-3, 0.032" thick, 15"x20"

When referring to parts for re-ordering or technical assistance purposes, please use the full number so that confusion can be avoided.

Standard aircraft hardware is listed by the most common designation, usually numbers with either AN, MS, or NAS prefixes. "AN" is for Army/Navy, "MS" is for Military Standard, and "NAS" is for National Aerospace Standard. The numbers and letter in an aircraft hardware designation all tell something about the part. For example, one of the most basic is that of aircraft bolts. One example would be an AN3-4A, which means that it is a 3/16" diameter bolt (first number) which is 4/8 (1/2) inch long, has fine threads (std. for aircraft hardware), and has an undrilled shank (A suffix).

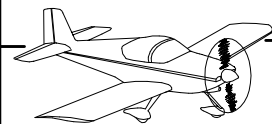
It is not our purpose here to list information about all types of aircraft hardware used in an RV. We hope that one or more of the reference texts you purchase as construction aids will provide such listings. Catalogs from aircraft hardware suppliers listed in our accessories catalog usually have a wealth of general information of this nature, and are a valuable reference source even if they are old and prices are out of date.

## WORKSPACE REQUIRED

We rarely encounter builders who feel that they have too much workspace; it's about like having too large a bank account -- there is no such thing! The derivation of the word "Homebuilt" is obvious, and most of us have heard stories of airplanes being built in basements or attics where the walls had to be knocked down to get them out when finished. We expect that some RVs will also be built, or partially built, in some rather strained quarters. However, we suggest that the desired building space be about that of a two-car garage (about 20 x 20 ft). While this is more than enough for building individual airframe components, it will come in handy for storing completed components while others are being built, and for final assembly, etc.

One of the tougher problems is finding a place to spray paint. Some builders choose to corrosion proof their airplanes, and the two part epoxy primers usually used can be toxic, or, at best, unpleasant. A well ventilated spray area, partitioned or in a separate building from the work area is necessary. A corner of the shop cordoned off with plastic sheet and equipped with an exhaust fan is a common solution.

A firm table with a smooth, level surface of about 3' x 6' is needed for RV construction. You will probably want a larger table or tables than this to hold tools, hardware, and other completed or semi-completed surfaces. Did you ever see anything even vaguely resembling a table top which wasn't immediately cluttered beyond the point of use? Like shop space, you never seem to have enough table space either.



### MECHANICAL DRAWINGS AND MECHANICAL DRAWING READING

While mechanical drawings are not a tool in the same sense of a hammer and saws, they indeed are tools in the contribution they make to completion of a homebuilt airplane. They are drawings which present a picture of parts and assemblies from one or more viewpoints. Like a written language, mechanical drawings are only useful if the viewer can read them. RV drawings have been prepared using a blend of accepted mechanical drawing practices and presentations which we feel can be most easily understood by the average homebuilder. The individual drawings of the respective views show what can be seen from that viewpoint plus, at times, all hidden lines and features. Looking at the front view shows the presence of hidden lines which can only be clarified by the addition of one or more views. The side view provides enough information to fully understand the shape of the part. The top view provides yet more clarification.

Since a mechanical drawing is composed mostly of lines of one form or another, we must define them. Following is a description of some symbols and lines used.

**Solid Line:** Represents a surface or an edge which is visible to the viewer.

**Hidden Line:** Is a uniform line of short dashes representing an edge or surface which cannot be seen by the viewer but is important to present in the drawing.

**Phantom Line:** A line of interspaced long and short dashes shows the position that another part will occupy at another state of construction or assembly. It is used to make the builder aware of the relationship of other parts of the structure, without the clutter of an assembly drawing.

**Bend Line:** Indicates the line about which a bend is to be made.

**Section Line:** This is used to indicate a view of a part which could be seen if the part were cut in two and viewed from the direction of arrows at end of the line. The letters correspond to the view located elsewhere on the drawing.

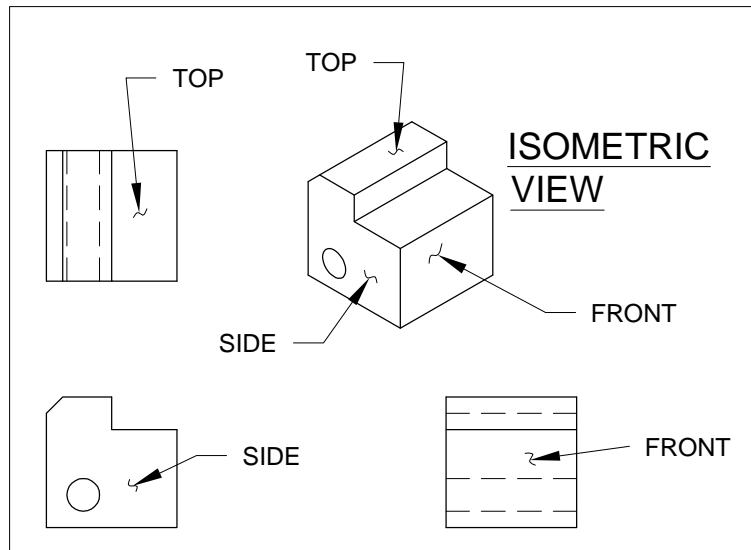


FIGURE 1: ORTHO VIEWS

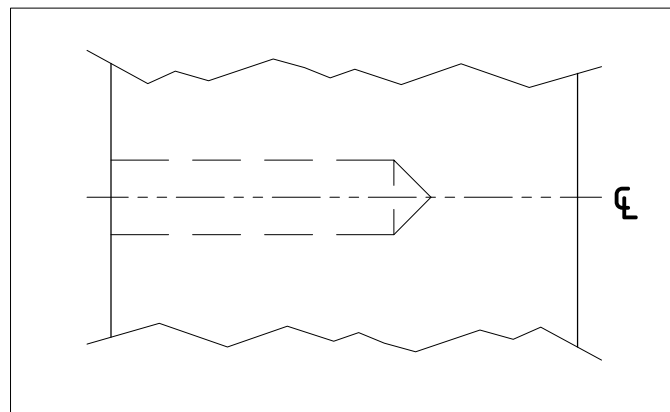


FIGURE 2: DRILLED HOLE  
(NOTE THE POINTED TIP)

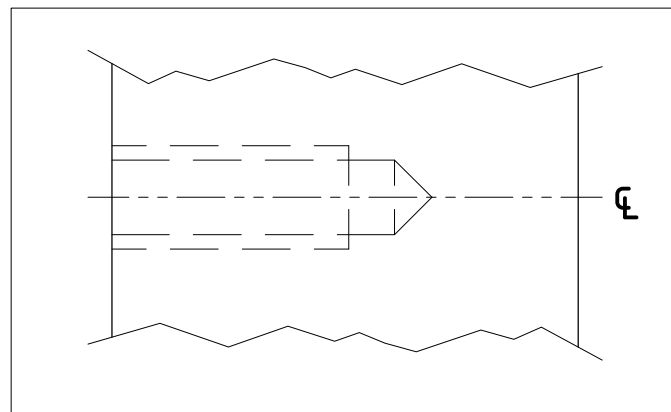


FIGURE 3: DRILLED AND THREADED HOLE  
(NOTE DOUBLE LINE SEGMENT INDICATING DEPTH OF THREAD)

**Center Line:** Used for the center line of holes, tubes, discs, and any other part which is symmetrical on each side of the center line. This is a series of long and short dashes.

**Detail "X":** Denotes that the portion of the drawing enclosed within the circle is shown elsewhere in greater detail.

**Dimensions:** Holes and radius parts are dimensioned from the center of the hole or from the center point of the arc describing the rounded surface. Thus, the overall height of the part is the base to radius center plus the arc radius. The overall height dimension is not usually given, but if it is, would be listed as a reference dimension because the other is primary.

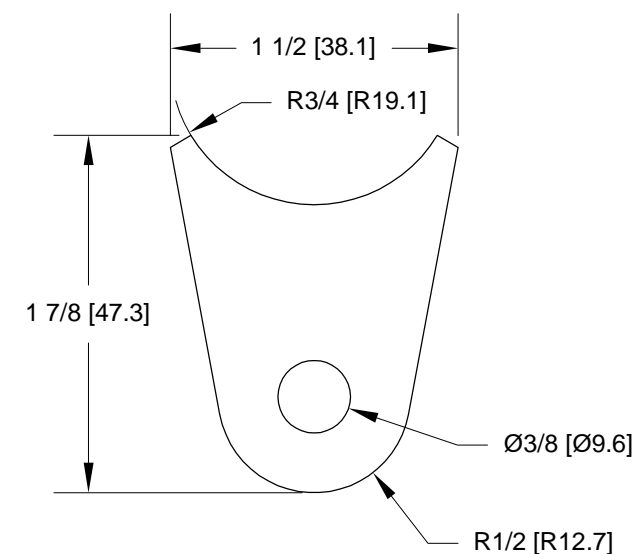


FIGURE 4: DIMENSIONED PART

### PLANS PAGE TEMPLATE SCALING

Some plans pages contain templates that are printed at a scale of 1:1. Double check that a plans page is scaled correctly by measuring the border **before using the template!** A properly scaled border is shown in Figure 5.

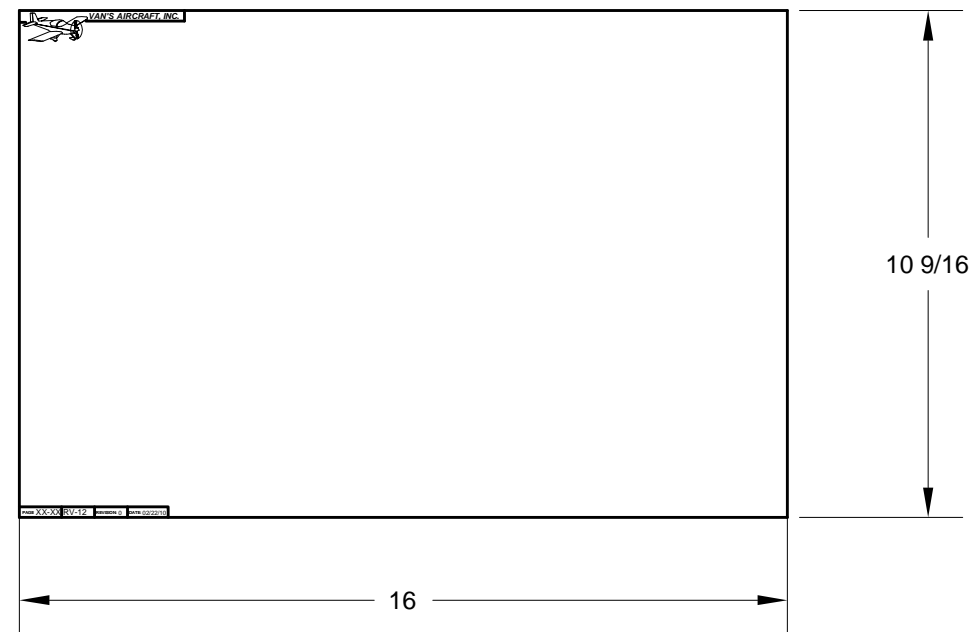


FIGURE 5: BORDER DIMENSIONS