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1.02	Revised Reaming Spar Attach Fittings.	02/15/2012	MST
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INTRODUCTION

The **Carbon Cub EX** is not another clone of the original Super Cub. Instead it is a highly re-engineered aircraft employing state-of-the-art carbon fiber composite technology and a completely re-engineered approach to the component parts. This re-engineering has resulted in the **Carbon Cub EX** having approximately half the parts that the original **Super Cub** has. This means a substantial savings in empty weight with a corresponding performance boost. For you, the builder, it means a faster, easier and more reliable build and a very sharp airplane, when completed.

This document has been carefully prepared to guide you, the builder through the assembly of a Carbon Cub. The **Carbon Cub EX** kit and this manual have been created in a way that should allow you to perform the assembly with a minimum of hassle, headache or frustration. In actuality, it should be a rewarding and enjoyable experience that results in you having an aircraft assembled from the highest quality components in a professional manner.

This manual is not a training tool to enable you to become an aircraft mechanic. This manual does not discuss or address all facets of the construction. For example, many parts in the Carbon Cub Kit are fully finished and do not need any alteration or modification by the builder. As such, the steps employed to create these parts is not addressed at all. If completion of the part requires a builder action, that action will be addressed in the manual.

The **Carbon Cub EX** kit is complete from the standpoint of structural elements. As such, you do not have to buy sheet aluminum or 4130 tubing. You don't have to weld anything. This manual will not deal with the techniques for modifications or alternative fabrications that you could employ.

DOCUMENT CONTROL AND REVISIONS

This is a living document. That is to say that there were many revisions to this document during its initial preparation, formal revisions that took place as things changed and there will be future revisions. When a given kit is shipped, the manual that accompanies the shipment is consistent (to the best of our ability) with the product that was shipped. This means the most appropriate drawings and instructions accompany each kit.

There is a CubCrafters Community Forum where an interchange of information takes place. CubCrafters receives comments and suggestions from the forum and responds by appropriately updating manuals, drawings, publishing clarifications on the forum website or other. CubCrafters will try to point out when adoption of a change is appropriate or not. For example, let's say that you have a late 2008 kit that shipped with a manual that prescribed a particular method for preventing chafing of the fuel lines. Later the manual is updated to prescribe an easier and better way of applying the chafe protection. The forum would indicate that it was acceptable to continue the old method but the builder would also be free to adopt the new method. It would be a matter of choice. Another example might pertain to a change in machining of a part that drove a change to the fastener length. In that case, the forum would indicate that the original fastener prescribed should be used unless the part was also changed.

If there is an important change that could affect safety, builders will be contacted by e-mail and a bulletin will be posted on the CubCrafters Community Forum.

Builders: If you change your e-mail address, please let CubCrafters know.

The number and date of the most current revision shows in the band at the bottom of each page.

IMPORTANT LEGAL MATTERS

Every purchaser of a CubCrafters **Carbon Cub EX** kit must execute a License Agreement and have that execution witnessed by a licensed Notary Public. A blank License Agreement form will be provided as part of your kit. The form below is just to show the content. After you have filled out the form and signed and after the Notary Public completes the document, please mail the completed License Agreement to CubCrafters to the attention of **Carbon Cub EX** kit Program Manager.



LICENSE AGREEMENT

- The undersigned builder, "Builder", agrees to construct only one aircraft from the components purchased as the **Carbon Cub EX** kit.
- The Builder agrees not to allow use of the plans, manuals or other information pertaining to the **Carbon Cub EX** kit by any other person or for projects by the Builder beyond the construction of one aircraft.
- The Builder agrees to not reproduce, distribute or allow to be reproduced by any other person any or all of the plans or components from the plans or components supplied in the **Carbon Cub EX** kit.
- It is further understood and agreed by the Builder that CubCrafters, Inc makes no warranty, expressed or implied, as to the quality or safety of the aircraft.
- The conditions set forth above in this License Agreement extend to and are included in any subsequent sale of any aircraft resulting from the assembly of the **Carbon Cub EX** kit; whether in partially completed or completed form.

_____	_____
Builder Signature	Notary Name
_____	_____
Builder Printed Name	Notary County and State
_____	_____
Date of Signature	Notary commission expiration

CUB CRAFTERS, INC. | 1918 SOUTH 16TH AVENUE | YAKIMA, WASHINGTON 98903 | p 509.248.9491 | f 509.248.1421 | cubcrafters.com

WAIVER AND RELEASE OF LIABILITY AGREEMENT

Every purchaser of a **Carbon Cub EX** kit must complete a Waiver and Release of Liability Agreement. A blank form will be supplied at the back of each manual. Only one form needs to be filled out and returned. After completing the form, please return the original to CubCrafters to the attention of **Carbon Cub EX** kit Manager.



WAIVER AND RELEASE OF LIABILITY AGREEMENT

This document acknowledges the release of liability of Cub Crafters, Inc. by the purchaser of one experimental aircraft kit, serial number _____. The undersigned understands and acknowledges that this waiver and release of liability agreement applies to the purchase, manufacture and subsequent operation of said aircraft. The undersigned also understands that such operations may be dangerous and may result in injury, including death, and the undersigned assumes this risk. The undersigned also acknowledges that no representations or inducements, other than the below terms herein, have been made by anyone to the undersigned.

For and in consideration of Cub Crafters Inc. kit aircraft, the undersigned voluntarily releases, discharges, waives, and relinquishes any and all actions or causes of action (known or unknown) for engaging in manufacture or subsequent operation of said kid aircraft. And the undersigned does for himself/herself, his/her heirs, next of kin, personal representative, executors, administrators, successors, agents, assigns and insurers, release, waive, discharge and relinquish any action or causes of action, aforesaid, which may hereafter arise for himself/herself or for his/her estate, and agrees that under no circumstances will he/she or his/her heirs, prosecute, or present any claim for personal injury, property damage or wrongful death against Cub Crafters Inc., its officers, agents, servants, or employees, in construction or operation of said kid aircraft for any of said actions or causes of action, whether the same shall arise by the negligence of any of said persons, or otherwise.

The undersigned, for himself/herself, his/her heirs, next of kin, personal representatives, executors, administrators, successors, agents, assigns and insurers, agrees that this agreement shall be governed only by the laws of the State of Washington, consents to the jurisdiction of the State of Washington only, and waives any other jurisdiction for any suit, action, notice, claim, or other legal proceeding arising out of this Agreement, and further agrees that the venue of any such suit or action shall be laid in the County of Yakima and the State of Washington.

IT IS THE INTENTION OF THE UNDERSIGNED BY THIS INSTRUMENT, ON HIS/HER OWN BEHALF, AND ON BEHALF OF HIS/HER HEIRS, NEXT OF KIN, PERSONAL REPRESENTATIVES, EXECUTORS, ADMINISTRATORS, SUCCESSORS, AGENTS, ASSIGNS AND INSURERS, TO EXEMPT AND RELIEVE CUB CRAFTERS, INC., ITS OFFICERS, AGENTS, SERVANTS, EMPLOYEES AND SUCCESSORS, FROM LIABILITY FOR PERSONAL INJURY, PROPERTY DAMAGE AND WRONGFUL DEATH CAUSED BY NEGLIGENCE IN THE DESIGN OF AND MANUFACTURE OF THE COMPONENTS SOLD AS THE KIT AIRCRAFT.

I HAVE CAREFULLY READ AND UNDERSTAND AND
I HAVE VOLUNTARILY SIGNED AND AGREED TO THIS WAIVER AND RELEASE AGREEMENT

Builder Signature	Notary Name	
Builder Printed Name	Notary County and State	
Date of Signature	Notary commission expiration	
Address		
City	State	Zip Code
Country		

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CERTIFICATION AND REGISTRATION

Amateur built experimental aircraft must be inspected and certified by the Federal Aviation Administration before flight. You must choose to pursue Experimental Amateur Built (EAB) certification.

The FAA and organizations like the Experimental Aircraft Association (EAA) have packages that contain instructions and the documents necessary to obtain certification of your completed aircraft. It is the responsibility of the Builder to understand the necessary steps and to complete them prior to flight. It is highly advised that you understand these documents prior to undertaking the assembly of the **Carbon Cub EX** kit so that you will be aware of some of the documentation requirements you will have to fulfill.

You can contact the EAA through their website (www.EAA.org) or the FAA through the General Aviation District Office or the Flight Standards District Office nearest you.

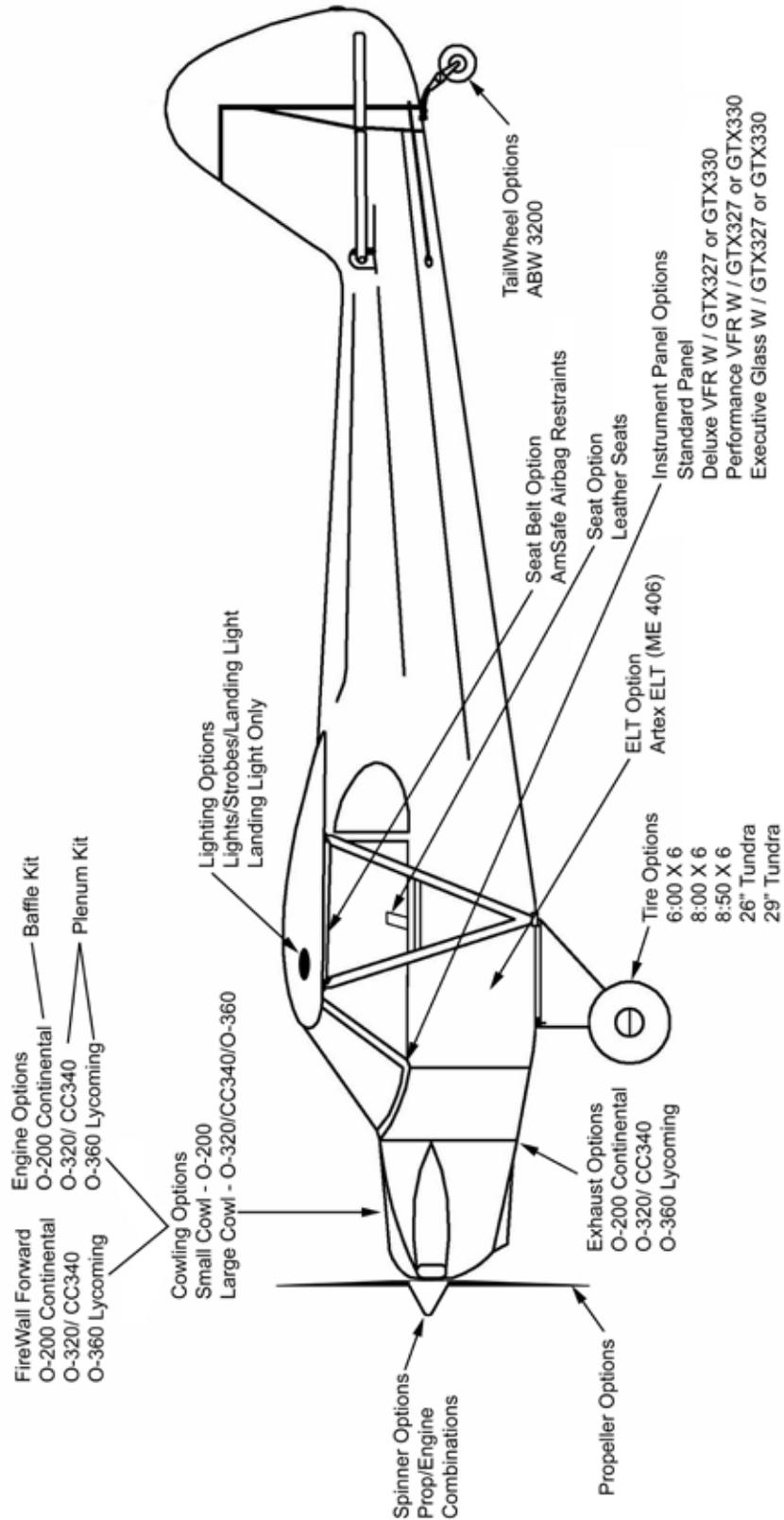
THE DECISION TREE FOR BUILDING A CARBON CUB EX KIT

Carbon Cub EX kit is pretty darn complete as kits go. However, the kit does not include (within the base prices) everything you could possibly need. Such that you understand what this means let's launch into the explanation. We'll start with the wings.

On the following pages, there is a schematic that shows some of the decisions the Builder will need to undertake. The Price/Option List will outline available CubCrafters options on the following pages. One choice is to let the Builders source the components and Do It Yourself ("DIY") as indicated by "Builder" in the schematic or the Builder can elect the option of purchasing the kits for his choices from CubCrafters. CubCrafters recognizes that there is a great deal of individuality in the creation of amateur-built experimental aircraft. As such, each option is the Builders as to how to proceed. If the Builder chooses, CubCrafters can supply everything or some options or nothing more than the nominal kits. We don't force you to build any particular configuration (except the most basic one) and we don't tell you where to stop in terms of making it your airplane.

If you don't see an option that you want, give CubCrafters a call and let's discuss it.

OPTION LAYOUT



This is a sample Carbon Cub EX order form. You will be able to find the most current order form on the CubCrafters website.

http://www.cubcrafters.com/pdfs/carboncubex_order_form.pdf



Carbon Cub EX - Order Form

Specifications, available options, and pricing effective December 7, 2011 - Subject to change without notice.

Airframe Kits

Wing Kit: \$22,250 Fuselage Kit: \$22,250 Finish Kit: \$22,250

Ready-to-Install Instrument Panels

For complete details on all of the optional instrument panels please visit cubcrafters.com

<p>MyPanel™: \$13,900</p> <p>MyPanel</p>	<p>Deluxe VFR II: \$16,390</p> <p>Garmin aera® 550</p>	<p>Performance VFR: \$19,900</p> <p>Garmin GDU 370</p>	<p>Executive GLASS: \$22,900</p> <p>Dynon D180 GDU 370</p>
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Avionics Upgrades

Garmin aera™ 560 \$550
* Also J30 radio & weather capabilities. Deluxe VFR II Panel required.

Garmin GDU 375 \$900
* Also J30 radio & weather capabilities. Performance VFR or Executive GLASS Panel required.

Garmin GTX330 \$3,190
(Also VFR II, Performance VFR or Executive GLASS Panel required)

TruTrak Autopilot \$4,100
* DigFlight IRS. * Terrain.

Firewall Forward Options

CC340 Engine (includes dual electronic ignition & starter) \$27,500

Continental O-200 Engine \$21,990

Lycoming O-360 Engine \$20,500

CC340/O-320 Firewall Forward - installation kit \$8,490

Continental O-200 Firewall Forward - installation kit \$6,490

Lycoming O-360 Firewall Forward - installation kit \$8,490

Catto 78" x 54" - CC340 Cowl Prop \$2,050

Catto 78" x 55" - CC340 Cowl Prop \$2,050

Sensenich Ground Adjustable - O-200 Prop \$2,556

Catto 72" x 40" - O-360 Cowl Prop \$2,050

Fuselage & Cabin Upgrades

Long-Range Fuel Tanks \$3,500
* 44 Gallons Total. (40 Gallons Usable)

Extended Baggage & Access Door \$1,800
* Full-width extended baggage area. * Side access baggage door.

Amsafe Airbags \$3,990
* Includes front & rear seat airbag harnesses & control unit.

Halon Fire Extinguisher \$150

LED Lighting & Strobe Package \$3,490
* Nav & strobe lights. * Left landing light.

Right Landing Light \$990
* Adds wing-wag function. (LED Lighting & Strobe Package required)

Rear Seat Trim Control \$790

Leather Seats \$1,495

Additional Options

Shipping** \$

**ALL FITS ARE FOB SNEAK, WA. * Shipping of aircraft available at additional cost. Contact CubCrafters for more details. (Includes only 100 now included)

Notes

Total Options & Price

Options: Total Price:



CERTIFIED SALES CENTER

CUSTOMER NAME _____

DATE _____

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Here's a photo sequence of the first **Carbon Cub** leaving the launch pad on the way to the stratosphere.



READ THIS SECTION BEFORE COMMENCING THE WORK

The following sections deal with a number of items that are important to the author-builder communication.

JOIN THE CUBCRAFTERS ONLINE FORUM

CubCrafters has an online forum for its products at www.cubcraftersforums.com. The forum addresses the various models of aircraft produced and/or sold by CubCrafters. This includes the **Carbon Cub EX & SS**, **Sport Cub**, and the **Top Cub**. The Builder is encouraged to join the forum, as it is a great vehicle for interacting with other builders and enthusiasts for CubCrafters products. There is great interaction and learning potential for the **Carbon Cub EX**. You can also see information and articles from the CubCrafters re-build shop. It may be that the article on servicing brakes is just what you need???

The forum is also a means by which important information can be immediately made available to the flying community. While some information will be emailed directly to registered owners/builders, it will also be revealed through the forum.

Check it out!!

NAMING CONVENTION

In this manual CubCrafters Inc will either be referred to by its corporate name or in the more familiar “We” or “Our”. You, the builder-assembler of the kit, will either be referred to as “Builder” or as “You”.

READING

There is no simple way to avoid it. You need to read this manual in its entirety. Our preference is that you start with that reading. Then, as each step is undertaken, re-read that step completely.

There’s a famous anecdote about a guy that quickly read “Throw the old horse over the fence...”. He was swooning at the thought of trying to throw a 1500 pound horse 5 feet in the air when he flipped the page and read “...some hay”. Humor aside, it is very important to coordinate the words with the figures and drawings and the photographs.

There aren’t a lot of places where you can go wrong but some people are pretty inventive about how they do things. Ultimately, failure to understand puts YOUR build at risk. For example, in the wing build manual the pictures show gluing the double ribs together to form an I-beam shape. If you glue the double ribs together inside out to make a box shape, you’ll need to buy more double ribs. Incorrectly assembled parts must not be used. In the example here, there is no way to un-glue the Methacrylate and re-glue the parts and still have the quality and safety that you need.

LEVEL OF DETAIL AND OBTAINING ASSISTANCE

This manual has been prepared with the intention that it is complete to a level of detail that a reasonably skilled individual can complete the work as we intend without having to resort to consultation. We assume that you have not built an airplane before. As such, there is a lot of detail that could be perceived as obvious (to some) but our intention is to be abundantly clear about what we want you to do. If, after careful reading and thinking hard, there is a point of the assembly that you do not understand, please contact CubCrafters before you “wing-it” and potentially mess-up parts that you could need to replace. Please consult the “Contact Us” section at CubCrafters.com to determine the best method of contact depending on your time zone, whether it’s a national holiday or other. Please remember that, like you, we’re not at work all the time.

TOOLS

You will need selected hand and power tools to assemble the **Carbon Cub EX** kit. These can be purchased from tool suppliers (see the many ads in aviation magazines and periodicals) or may be borrowed from other builders. Don't "cheap out" and buy "clone" tools. Some discount vendors sell clone tools. They look like real tools but are made of inferior materials and will not perform like "real" tools. If the tool costs 10-30% of the name brand, you will be getting a poor substitute tool.

It is recommended that the drills, reamers and cutting tools all be new. Dull or damaged tooling will not give the desired results. Try to purchase "real" aviation tools as some automotive tools may look alike but they have subtle changes in angles or other parameters. Also – very important - Don't forget to reward your buddy with lunch or appropriate beverage(s) for his generosity when you promptly return the tools he loaned you. If you break or wear out a loaned tool, be a good friend and replace it for your buddy.

ORDER OF ASSEMBLY

Our intention is that you will perform the assembly in the order presented in this manual. The order of build closely follows what is done at the CubCrafters factory. We try to work efficiently and know that your time is valuable also. As such, we haven't "dumbed it down". There will be places where delicate parts are installed, that if mishandled, will result in damage. But this is just real life. You must take care.

We've avoided step-order that leaves things half-done to minimize the chances of forgetting to finish a feature. We've also avoided having to take stuff apart that you already put together. We're not trying to say that this scheme is perfect or that there are not other ways of doing it but this scheme does work and will keep you out of trouble.

PARTS NOMENCLATURE

The CubCrafters parts system uses a 3-digit suffix to indicate left and right variants of parts. For example, the left wing is PC31000-001 and right wing is PC31000-002. If the part is common to both right and left, the default suffix is -001.

SUBSTITUTIONS AND MODIFICATIONS

The **Carbon Cub EX** kit represents the result of many years of development and testing. CubCrafters recommends that the kit be assembled only in the manner prescribed within this manual. If you choose to deviate and assemble the kit in another manner or using parts from other sources **YOU** are assuming responsibility for those changes. The airworthiness, fit, function and safety of your configuration or assembly are **YOUR** responsibility.

CubCrafters provides technical support for the original **Carbon Cub EX** kit but is under no obligation to provide support for modifications to the original parts or their assembly. If modifications are substantial, the build may become a one-of-a-kind and may not be considered a Carbon Cub for registration purposes. This could have implications to the insurability of the resulting plane. You may wish to contact your insurance company to discuss this matter.

The **Carbon Cub EX** kit is supplied complete with all of the fasteners you will need for the assembly. These fasteners comply with the appropriate aircraft component standards. Do not substitute nuts, bolts, washers, rivets or any other fasteners that you may have purchased at the local hardware store. We know it is very tempting for some individuals to buy components at Home Depot on the "aircraft components aisle" but **DON'T DO IT**. The same principle applies to all of the machined or sheet metal components supplied by CubCrafters. **DON'T MAKE SUBSTITUTIONS**. It is **YOUR** responsibility to assemble the aircraft in the proper manner using proper components. Substitutions could compromise the airworthiness of this aircraft.

DRAWINGS AND TABLES

This manual is a combination of written instructions, explanatory photographs, drawings and parts lists. While the instructions will, in most cases, list the major part to be placed, it is still necessary for the builder to read parts lists and compare them to the drawings. For example, you be instructed to place the “blocks” on the spar in the first steps. The part numbers for the blocks are listed in the instruction to be sure you know how many things to place. However, the position of each block is found by examining the drawing. There is no practical alternative to drawings. As such, please take the necessary time to develop your familiarity with the drawings.

PROTECTIVE EQUIPMENT

There are a lot of ways to get hurt in life. Power and cutting tools or strong chemicals are potential sources of injury. Your safety glasses, appropriate clothing, protective mask/respirator, and proper lighting are all important. Lifting smart and obtaining a helping hand (like when moving the wings) are all important to your safety.

As a personal anecdote, I (your author) nearly cut off several fingers. While trying to avoid plastic chips flying off a table saw my sight line was so skewed and my body angle so weird that I ended up pushing a couple of my fingers into the saw blade. Why was I so skewed? Answer: because I didn't have safety glasses or (better yet) a face shield. I was stupidly trying to “wing-it” at my sister's house and get the job done without the correct gear. Everything eventually worked out but it hurt a lot; was expensive and could have meant no flying for me. It's blunt but think about how much fun you'll have blind, with a wrecked back or with no fingers.

Please:

WEAR YOUR PROTECTIVE EQUIPMENT, WORK SMART AND BE SAFE IN ALL YOUR WORK SPACES

In the preparation section, some specifics about workspaces will be discussed. However, a few preparatory comments are in order. You will need a workspace that addresses the following:

- a) Adequate space to set out the parts. For each wing or the fuselage, this is about 8 by 24 feet. There is plenty of lore about guys building airplanes in attics, kitchens, living rooms, basements, chicken coops, etc. Be sure you have a space that allows you to work without a great deal of strain and pain.
- b) Adequate lighting to allow reading of instructions, reading measuring implements, etc. Working in the dark is dangerous and ineffective.
- c) Parts control. You want to assure that the valuable parts supplied in the kit don't disappear or get damaged. Some builders build racks for their parts. See pictures later.
- d) Flat workspace. This is workbench or table space to lay out parts, tools, assemblies, etc.
- e) Cleanliness. Filling your wings or fuselage with dust from a table saw or fluff from your lawn mower is not desirable.
- f) Painting. The parts are large and there are many considerations like overspray control, keeping bugs and other contamination out of the paint, temperature control, etc. It may be worthwhile if you don't have an appropriate space to consider having the painting done by an aviation painting professional in a booth. One option is to have CubCrafters paint for you but this will involve transporting your parts to Yakima Washington.

TOOL LIST

QTY.	TOOL
2	SAW HORSES (PLANS FOR THESE ARE PROVIDED IN THIS MANUAL)
1	DIE GRINDER WITH CUTOFF WHEEL AND SANDING DISKS
1	16" X 24" STEEL FRAMING SQUARE
1	12" RULER
1	16' TAPE MEASURE
1	AUTOMATIC CENTER PUNCH
2	36" LEVEL
1	DRILL MOTOR (CORDLESS IS HANDY BUT ELECTRIC OR AIR IS FINE)
1	ANGLE DRILL
1	#40 DRILL STOP
1	#30 DRILL STOP
1	#10 DRILL STOP
1	NUMBERED DRILL SET
1	CLECO PLIERS
30	NO. 30 CLECOS (COPPER COLOR)
30	NO. 40 CLECOS (SILVER COLOR)
10	NO. 20 CLECOS (BLACK COLOR)
10	NO. 10 CLECOS (YELLOW COLOR)
1	POP RIVET GUN FOR 1/8 INCH RIVETS (MARSON HP-2 RECOMMENDED)
1	RIVET GUN WITH NO. 30 RIVET SET AND BUCKING BAR
1	AIR COMPRESSOR AND BLOW NOZZLE
1	NO. 40 RIVET DIMPLING SET
1	RIVET SQUEEZER
1	DIGITAL LEVEL (SPI-TRONICS PRO3600 PN SPI 31-040-9 OR EQUIVALENT)
1	3/4 INCH UNIBIT (#1)
1	DIGITAL FISH SCALE (0 TO 15 POUNDS RANGE)
60	3" SPRING CLAMPS
6	VICEGRIP 6-SP CLAMPS
1	STRAIGHT TIN SNIPS (THESE TYPICALLY HAVE YELLOW HAND GRIPS)
1	TORQUE WRENCH (20 IN-LB TO 200 IN-LB)
1	12 INCH ADJUSTABLE SQUARE
7	LEADING EDGE SKIN CLAMPS
1	1/4 SOCKET SET WITH, AT LEAST, 3/8 TO 9/16 INCH SOCKETS
1	REAMER .250 INCH (1/4")
1	REAMER .3125 INCH (5/16")
1	REAMER .375 INCH (3/8")
1	DEBURRING TOOL
1	PAIR OF SCISSORS
1	#2 LEAD PENCIL
1	FINE FLAT FILE
1	TUBING CUTTER FOR PLASTIC TUBING
1	SHEET METAL NIBBLER
1	#10 HOLE FINDER
1	1/4" HOLE FINDER

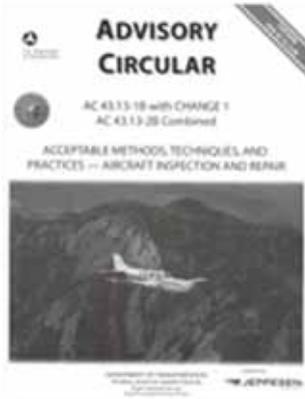
CONSUMABLE SUPPLY LIST

QTY.	DESCRIPTION
1	BOTTLE OF DENATURED RUBBING ALCOHOL
1	SOLDER ACID BRUSH
2	ROLLS OF 2" MASKING TAPE
2	ROLLS OF ¾" MASKING TAPE
2	24" SAW HORSES
6	WOOD BLOCKS
1	EXACTO KNIFE
5	SINGLE EDGED RAZOR BLADES
1	LITHIUM GREASE (STA-LUBE #SL3151)
1	TUBE OF CLEAR SILICONE SEALANT
1	LOCTITE #271
2	SCOTCHBRITE PAD (MEDIUM GRIT)
1	FINE POINT BLACK MARKER

GENERAL SHOP PRACTICES

The **Carbon Cub EX** is assembled without the use of much force. Almost everything will slide together easily or be tightened using light hand tools. The largest bolts in the assembly (AN6) are easily fastened with hand tools. You will **NOT** need cheater bars, pneumatic wrenches, the old splitting maul you keep in the shed or any other “persuaders” for the assembly in this manual. Overall, if something does not go together easily, the step is not being performed correctly. You’ve heard it before and it applies here big time: **IF IT DOESN’T FIT – DON’T FORCE IT.**

Most builders will want to learn about good shop practices. Several good publications are:



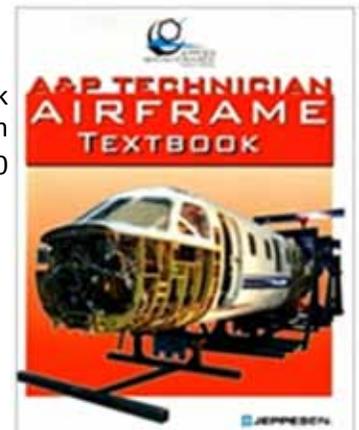
AC43.13 Acceptable Methods of Aircraft Repair
ISBN 9780884875048

Aviation Maintenance Technician Handbook
Otherwise known as AC65.9A
ISBN 9781560277163



A&P Airframe Handbook by the FAA
ISBN 9780891000808

A&P Airframe Textbook by Jeppesen
ISBN 9780884873310



SHOP PRACTICES PARTICULAR TO THE CARBON CUB EX KIT

The **Carbon Cub EX** kit is a highly finished kit. This means that there is not a lot of shaping, bending, cutting or other shop work normally associated with a kit built from plans. However, there is edge-finishing, hole deburring, drilling, riveting with blind rivets, riveting with AN rivets and some gluing. It is beyond the scope of this manual to teach you every attribute of these topics. As in the preceding section, there are a lot of good books that are devoted to that task. However, a few comments and a bit of guidance are in order.

MARKING PARTS

Use a Fine Point Sharpie pen to mark parts. Some people like black and others blue but you can make yourself happy with your own favorite. **DO NOT** use a scribe or a pencil as both of these marking methods can have negative consequences.

METHACRYLATE ADHESIVE

The **Carbon Cub EX** kit uses Methacrylate adhesive for the fastening of a number of parts. You won't glue anything right away but the system and our plan for your use of it needs to be understood.

First and foremost: We recommend that you wear gloves and a respirator whenever you are handling the Methacrylate system. In terms of getting it all over yourself and breathing the fumes – less is more.

The Methacrylate system is a fairly expensive system to use. You will receive the proper amount of adhesive and tips (each kit will have more adhesive and tips). You will only receive one gun and key. You will receive a new sleeve every time you receive a new adhesive cartridge. Do not discard the sleeve with the used tip. Tips will need to be discarded after setting for 45 minutes or more. It is recommended

that the key be used to turn off the adhesive distribution and the tip should remain on the gun until it is time to use the gun again. When you are ready, replace the tip, clear it as below and apply adhesive to the parts. **IF THE TRIGGER PULL IS HARDER THAN NORMAL, DO NOT FORCE IT. FORCING THE TRIGGER TO CLEAR A CLOG WILL RESULT IN A STRIPPED TRIGGER SYSTEM AND A GUN THAT DOESN'T WORK. IT MAY BE NECESSARY TO REMOVE THE TIP AND CLEAR A CLOG AT THE END OF THE CARTRIDGE.**

When using a new Methacrylate cartridge, dispense the adhesive until it achieves a gray color and then discard the first 6" as shown below. When using a new adhesive mixing tip, always discard the first 6" long bead. This will discard the improperly mixed adhesive. See the two pictures below for a demonstration.



Photo 001

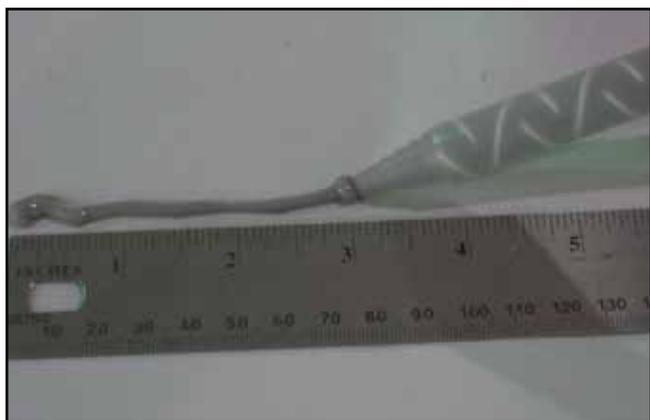


Photo 002

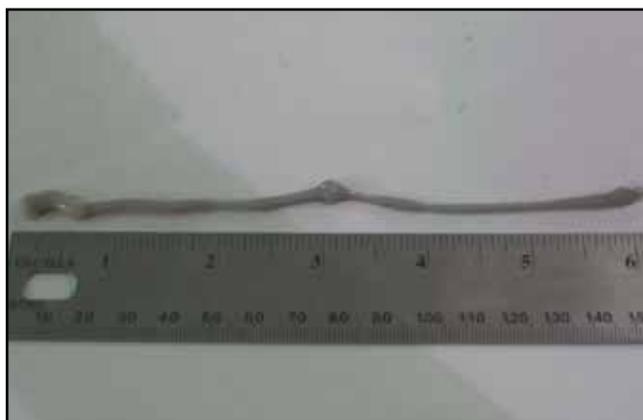


Photo 003

EDGE FINISHING

There are many aluminum parts in the **Carbon Cub EX** kit that have been sheared in the course of their creation. It is important that these parts be deburred. You can use ScotchBrite pads, a hand file, a Scotchbrite wheel on a grinder, a deburring tool or a burnishing tool. Each tool will do the job with some difference in the amount of effort and the degree of care in application. In the simple case, a Scotchbrite pad can be rubbed on the edge and fairly quickly the burr will disappear. You don't need to and don't want to remove any significant material, just the little tiny burr. If you can rub a rag on the edge and it feels smooth – you're done. Some people test the edge with their finger but a sharp burr can lead to the need for a bandage. Use your own judgment regarding burr detection.

DRILLING

You're going to drill a fair number of small holes and a few larger ones. A ¼ inch or 3/8-inch drill is quite sufficient. You can go with battery, electric or (the favorite) an air drill. If you go with air you will need a source of compressed air. For each drill you will need at least 1000 rpm in order to drill effectively. Drills as fast as 3-5000 RPM can be used for the small #30 and #40 bits. Keyless chucks are very convenient but not essential. The majority of the holes are #30 and #40. You will need some short drills (3-4 inch length) and at least one 10-12 inch example of each. Carbon steel bits are fine. You can spend more money to buy high-speed steel or even more to buy titanium nitride coated high-speed steel but these choices are not necessary. Whatever you do, do not buy cheesy knock-off brand bits, as they will not last. Buy a few high quality high carbon steel bits and things will work out just fine.

There are a couple of specialty bits that you will need. First is a Unibit or step drill. This will allow you to drill nice round holes in sheet metal where twist drills have trouble. The other bit is a deburring bit. You can accomplish this with a hand-spinner type or as a bit that you put in your battery drill. The single flute type gives the most uniform results.

Match drilling is where one hole (in the near part) is used to locate the hole in the part behind. Drill through the hole into the piece behind. Final drilling is where a starting hole is increased in size. For example a hole may be drilled initially with a #40 bit but needs to be drilled for a 1/8th inch rivet. The #40 hole would be final drilled with a #30 bit. All holes need to be deburred after drilling.

A parting comment about drill bits: When they are new and sharp they cut very nicely. Notice their pleasing performance. When they are old and dull they cut slowly and the holes produced are no longer round or the correct size. Keep a supply of fresh bits available by either sharpening your existing ones or by buying new ones. You can't do good work with dull tooling. It's false economy to just press harder and smoke the bit through the material. Besides you want to impress your buddies with what a great fabricator you are. You work to the highest standards.

BLIND RIVETS

Ah, the "Pop" rivets!! Much maligned but SO effective when used correctly. You will be "pulling" MS and Cherry-Max rivets. The MS rivets look like the Home Depot variety but they are actually made with better alloys and should not have substitutions. These rivets pull well with either a hand puller or a pneumatic puller. The pneumatic puller is nice, not too expensive but also not essential. You may develop a firmer grip if you pull the rivets by hand but your hand will certainly not fall off from the effort. The Cherry-Max rivets are a good deal tougher to pull. They come close to maxing-out a hand puller. There aren't a huge number of them to pull. For most builders, it will be OK to just pull the Cherry-Max rivets using a hand puller. The Marson puller (on the tool list) can pull Cherry-Max rivets without undue hand pressure. Pneumatic pullers for Cherry-Max rivets are quite expensive (above \$1200) and beyond the interest of most one-time builders. If you're a tool horse and "need" one – a GBP704F is a good one. You'll also need a nose piece (like the H781-456) for the GBP704F.

AN RIVETS

There are a number of close-up photographs of placed rivets in the wing portion of the manual. This will give you a good idea of the placement requirements. It is strongly suggested that you read one of the shop practices books and/or view some of the good EAA video on placing rivets. These teaching materials go much further than is practical in this section. As such, the discussion herein is brief. After you watch the video or read the book, get some scrap and practice until you can make perfectly finished rivets. The Carbon Cub fabrication is NOT a good place to practice. Qualify yourself ahead of that task.

Two types of rivets are used in the **Carbon Cub EX** kit assembly: 1) AN470 – universal head; and 2) AN426 – countersunk head. There are occasions where bucking the rivets is the only practical method of forming the head. In other circumstances, a rivet squeezer can be used. For each rivet placement, the manual will recommend which method you use, the specific rivet to be used and any counter-sinking.

BOLT TORQUE VALUES

There are some bolted assemblies in the **Carbon Cub EX** kit. It is important that each fastener be fastened to the correct torque. Under-torqueing and over-torqueing are both undesirable. There are no places where pneumatic wrenches are to be used.

Below is the torque in inch-pounds that should be applied to fasteners in this build (**UNLESS NOTED IN THE BUILD SECTION**).

BOLT TORQUE	
<u>Bolt Shank Size</u>	<u>Torque in Inch-pounds</u>
AN3	20-25
AN4	50-70
AN5	100-140
AN6	160-190

Use a calibrated inch-pound torque wrench not some 1000 foot-pound model your buddy uses on his Kenworth frame bolts. Please notice that the torque values set forth above are relatively small compared to many automotive applications. The AN6 bolt, for example, is only fastened to 13-15 foot-pounds. Most foot-pound automotive torque wrenches can't even be read to this precision. As such, a calibrated inch-pound torque wrench is desirable.

The manual will prescribe use of Loctite and Torque Seal on the bolted assemblies. Loctite helps to prevent the nut from loosening. Torque Seal facilitates inspection (if the seal is broken the nut has probably come loose). The torque values for the propeller mounting bolts and for the fasteners on the engine have been established by their manufacturers. Please use the manufacturer-recommended torque values.

BOLT LENGTH AND WASHER STACKUP

IT IS VERY IMPORTANT TO HAVE THE AT LEAST ONE THREAD PROTRUDING PAST THE NUT WHEN THE NUT IS PROPERLY TORQUED. THAT BEING SAID YOU WILL NOT WANT TO HAVE MORE THAN THREE THREADS SHOWING BEYOND THE NUT. THE WAY TO ACHIEVE THIS IS TO CHANGE THE WASHER TYPE AND AMOUNT. FOR INSTANCE, IF THE FIGURE CALLS OUT A AN960-416L UNDER THE BOLT HEAD. THIS WASHER COULD BE CHANGED TO A AN960-416 AND AN EXTRA AN960-416 OR AN960-416L MAY BE ADDED. AT NO TIME SHOULD MORE THAN TWO WASHERS INSTALLED. IF THE FIGURE DOES NOT CALL OUT FOR A WASHER, THEN NO WASHERS CAN BE ADDED, BUT IF THE FIGURE CALLS OUT FOR A WASHER ON THE BOLT SIDE AND THE NUT SIDE THE WASHER SUBSTITUTION MAY BE USED ON BOTH SIDES. IN SOME CASES A SHORTER BOLT MAY BE USED, BUT MAY NOT BE SUPPLIED IN THE KIT. KEEP IN MIND THAT IT MAY BE CRITICAL TO HAVE THE SHANK OF THE BOLT IN THE PART, NOT THE THREADS.

WIRING

There are about as many variations in wiring of airplanes as there are airplanes. CubCrafters has a multi-step program for “the electrification”. You can either buy kits as options or you can Do-It-Yourself (DIY). If you don’t have your mind made up, at this point, go back and look at the options again.

For emphasis: The basic kit includes the wiring for the stall warning and the elevator trim. There is no wiring for lighting, radios, the battery and the cabling to the solenoids, the master solenoid, the starter solenoid, instrumentation or any other appliances. You can order from a selection of panels and the associated harnesses. The same is true for all of the lighting (navigation lights, wing tip strobes, other strobes, landing light(s), etc.). For each of the options you buy, you will receive an additional manual that will provide additional explanations and photographs particular to the installation of that CubCrafters kit or option.

If you are the brave sort and wish to undertake the wiring yourself, CubCrafters will help. First, in the build sections that follow, the point in time for installation of wiring, harnesses, lighting, etc. will be identified. It’s not recommended to skip the steps as some things will get closed in and it may not be convenient to go back.

Second, here are a few basic considerations that you need to bear in mind if you choose the DIY route: 1) Battery, master switch and main bus; 2) breakers; 3) switches and/or switch-breakers; and 4) wire sizes. A detailed explanation of how to deal with each of these topics is beyond the scope of this manual. The shop practices books, on page 15, and a number of specialty books deal with the DIY instrument panel. Once you get the general idea, the specifics of what you want to include will loop back and drive the solution. The first list below is a popular set of “electrics” for basic VFR. You should plan for any of these that you want or need:

- Master switch
- Key switch or starter switch and magneto switches
- Landing light and/or taxi light
- Navigation lights (tail – white, right – green, left – red)
- Strobes
- Avionics/Radio master
- Com radio and antenna
- Transponder and antenna
- GPS and antenna
- Alternator switch
- Low voltage warning
- Ammeter and/or voltmeter
- EGT and CHT instrumentation
- Fuel flow and/or fuel totalizers
- Electric gyroscopic instruments
- Map light and/or cockpit light

The list doesn't include the new Dynon D-180 or other EFIS. All of the glass panel options are possible but things get complicated in a hurry. The list also gets long and more complicated (certified installations, etc.) once you start thinking about IFR. Again, this kind of installation goes beyond the scope of this manual. If you want an IFR panel and don't want the configuration offered in the option section, please contact CubCrafters to discuss your desire. Based on examination of the multitude of configurations already installed, the envelope of possibilities is really huge.

FIGURES VERSES PICTURES

IN THESE MANUALS THE FIGURES WILL ALWAYS TAKE PRIORITY OVER THE PICTURES, BOLT DIRECTION, WASHER PLACEMENT, AND SO ON. PAY CLOSE ATTENTION TO THE FIGURES AND USE THE PICTURES AS A REFERENCE.

FIGURE EXPLANATION

IN THESE MANUALS THE FIGURES WILL MOST OFTEN SHOW MORE PARTS THAN YOU ARE BEING ASK TO INSTALL. ONLY INSTALL THE PARTS THAT ARE NEEDED FOR THE SECTION THAT YOU ARE WORKING ON. YOU WILL MOST LIKELY SEE THAT FIGURE AGAIN IN A LATER SECTION AND INSTALL THE REST OF THE PARTS.

FINAL BIT OF INFORMATION

IF YOU NOTICE THERE AREAS IN RED TYPE AND ARE ALL CAPITAL LETTERS. THESE ARE PLACES THAT COULD TRIP YOU UP. PAY SPECIAL ATTENTION TO THESE AREAS.

A self-explanatory picture from Valdez just so you don't forget what this is all about....



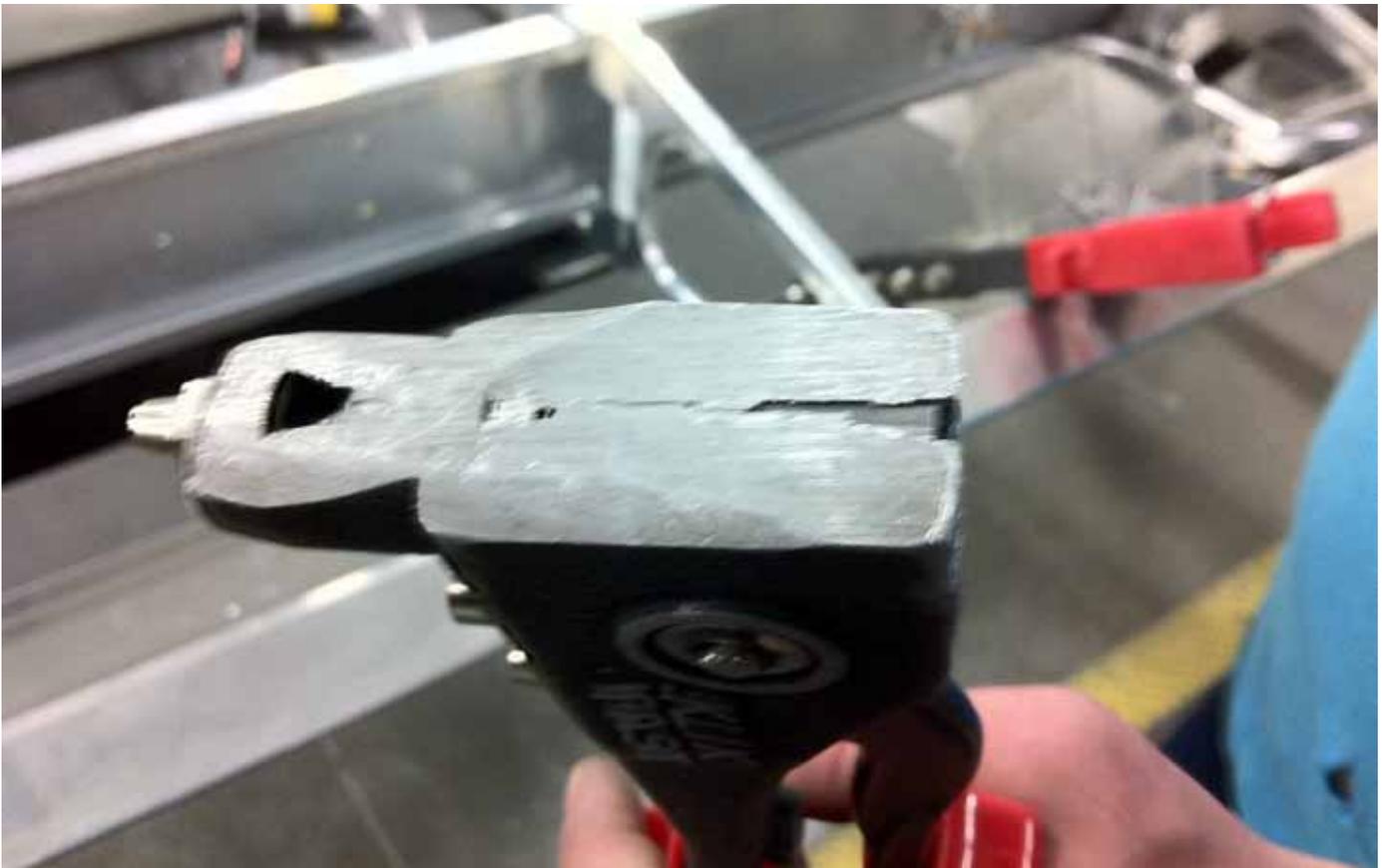
PREPARATORY STEPS

Let's begin by doing some tool building and setup!

MODIFYING THE RIVET PULLER

As you can see in the following photos we have taken a Marson HP-2 hand rivet puller and severely modified it. This puller will be needed to pull the Cherry-Max rivets in the flap and aileron hangers. This modification was done with a belt sander, but you can use anything that will remove aluminum. You will need to remove at least as much material as we have in these pictures.





BUILDING SAWHORSES

You will need two sawhorses for the wing construction. The sawhorses need to be essentially as drawn below but they don't have to be exact. The saw horses need to be strong, rigid and a comfortable working height. Experience shows that the "table" working surface should be close to the dimensions below but you can adjust for your own stature. Checkout the pictures in the following steps to see the essence of what the sawhorses need to be. Use Photo 008 to build a set of spar holding fixtures.

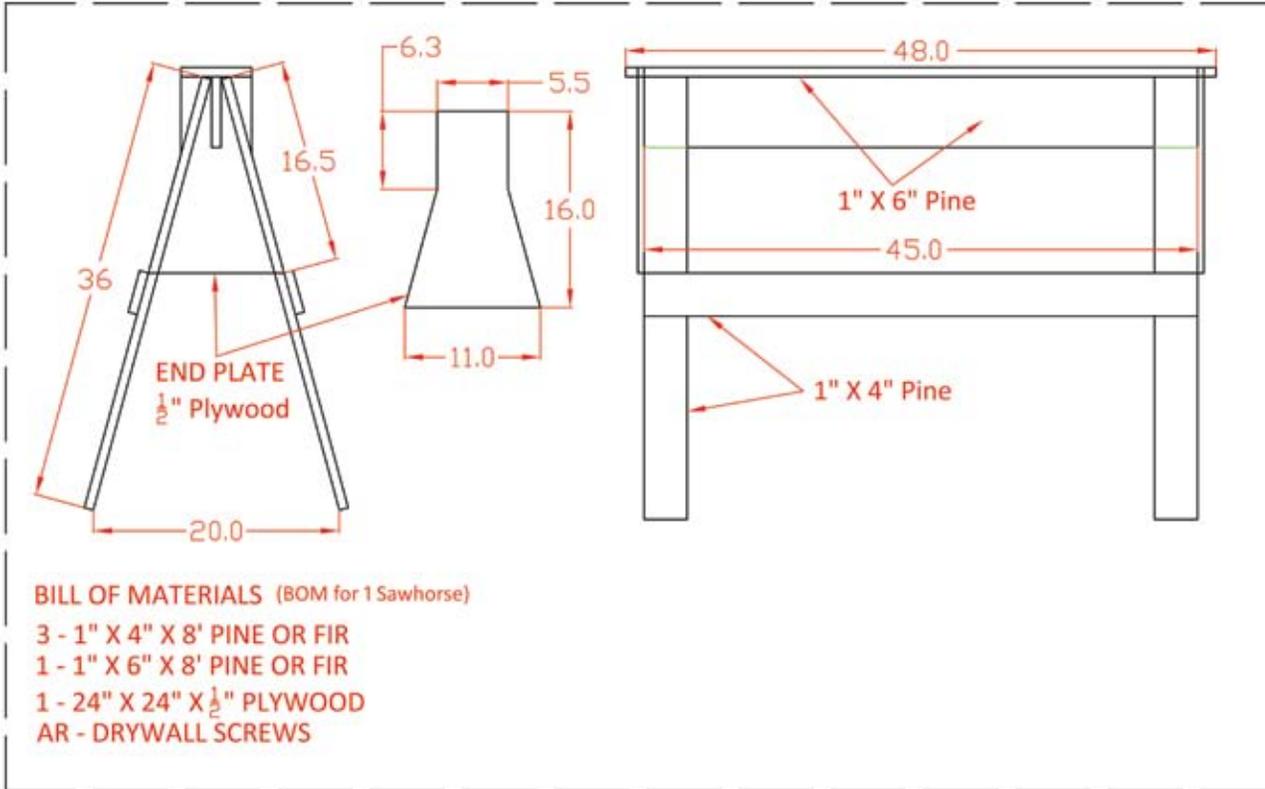


Photo 008

WORK AREA SETUP

You will need a working area of about 8 x 20 feet for each wing (left or right). You could build this in a tight space, but more space is good.

Select a suitable spot with reasonable lighting and set the sawhorses from Preparatory Step 2 as follows: On a level surface, with the long axes of the working surface parallel, set the centers of the sawhorses approximately 151 inches apart.

Square the ends of the sawhorses by using the front spar as a straight edge as shown in the pictures to the right.

Level the sawhorses side to side with the digital level using shims to adjust the heights.

Once the sawhorses are positioned and level, use 2" masking tape to mark the floor around the sawhorses. Mark one of the legs on each sawhorse and each leg and shim. This will allow removal and replacement of sawhorses without having to go through the leveling process again.

Build a 1" thick by approximately 1 1/2" X 6" block approximately 1" from each end. This block will be used to set the twist in the wing. As such, the 1-inch thickness is the key parameter. Install the block 3" from the end and in the center of the sawhorse that will hold the rear spar. See the picture below. The Left Wing is PC31000-001 and Right Wing is PC31000-002



Photo 009



Photo 010



Photo 011



Photo 012

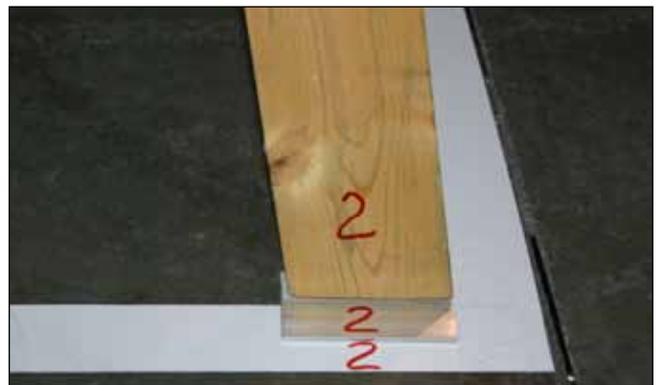


Photo 013

FORMING THE DRILL TEMPLATE

You will need a template for later steps. The pre-bend and after-bend condition of KFX30000-002 is shown below. Make a 90-degree bend in the small triangular section at one end using a hand seamer, a sheet metal brake or a vise.



Photo 014



Photo 015



Photo 016

SETTING UP FOR PARTS RETRIEVAL

The parts for your Carbon Cub come to you “bagged and tagged”. This means that they are either in poly bags with the part number on the bag or with string tags with the part number on the tag. Keeping track of all the parts and pieces for the build is a very good thing. One good idea for this is a parts board as shown here. If you don’t make a parts board do something to keep your parts clean, undamaged and accessible.

RIVET SQUEEZER MODIFICATION

Grind a rivet squeezer and the female part of the dimple die as shown in the picture below. This modification is necessary in order to get the squeezer onto some of the tighter fitting rivets.



Photo 017



Photo 018

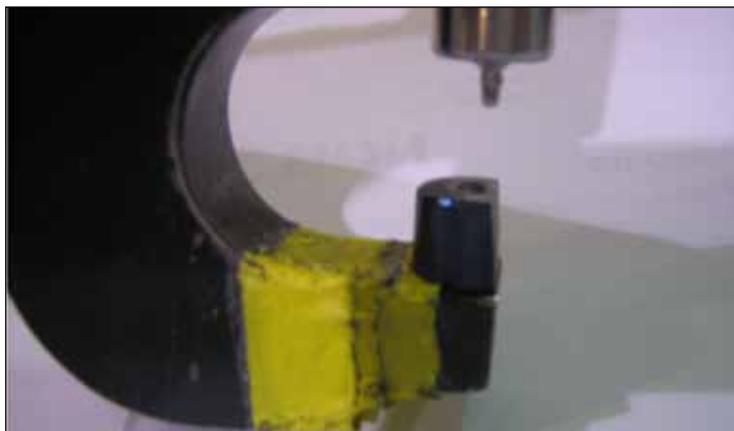


Photo 019

Spar Section Detail

The spar is a very important part of your wing and extreme care should be used when drilling and riveting parts to the spar. If you look at Photo 021 on the next page you will find the terminology that I will use to describe what precautions should be used when dealing with your wing spars.

First of all in the build manuals you will notice there are sentences that are bold and red. This is notice that you are about to perform a step that could result in damage to the parts that you are working on or cause an unsafe condition in your aircraft. **PLEASE PAY CLOSE ATTENTION TO THESE SENTENCES.**

The front and rear spars consist of the spar web and a spar cap on the top and bottom. Each leg of the spar cap has a bulb on the bottom shown in red in Photo 021.

You will notice in Photo 021 that it shows spots in the spar cap that can be drilled. You need to stay out of the radius in the corners and only drill in the sections shown in Photo 021.

At Cubcrafters factory, when drilling the spar cap. If the bulb is disturbed or drill into at all, the spar is scrapped and a new one installed. **PLEASE BE VERY CAREFUL IN THIS AREA.**

The spar web is not as critical as the spar caps and could be drilled through as necessary.

You will notice that in Photo 020 it shows the drill stop setup. Adjust the drill stop to allow for drilling of the material that you are drilling. You may need to adjust the drill stop frequently for drill operation if the thickness or proximity to material that you don't want nick with the drill bit changes. **REMEMBER TO BE AWARE OF THE DEPTH INCREASE THAT IS CAUSED BY THE SPRING.**

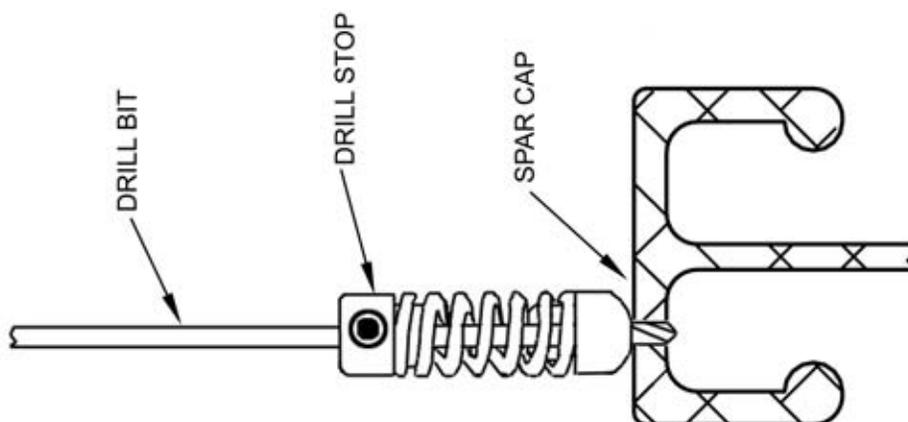


Photo 020

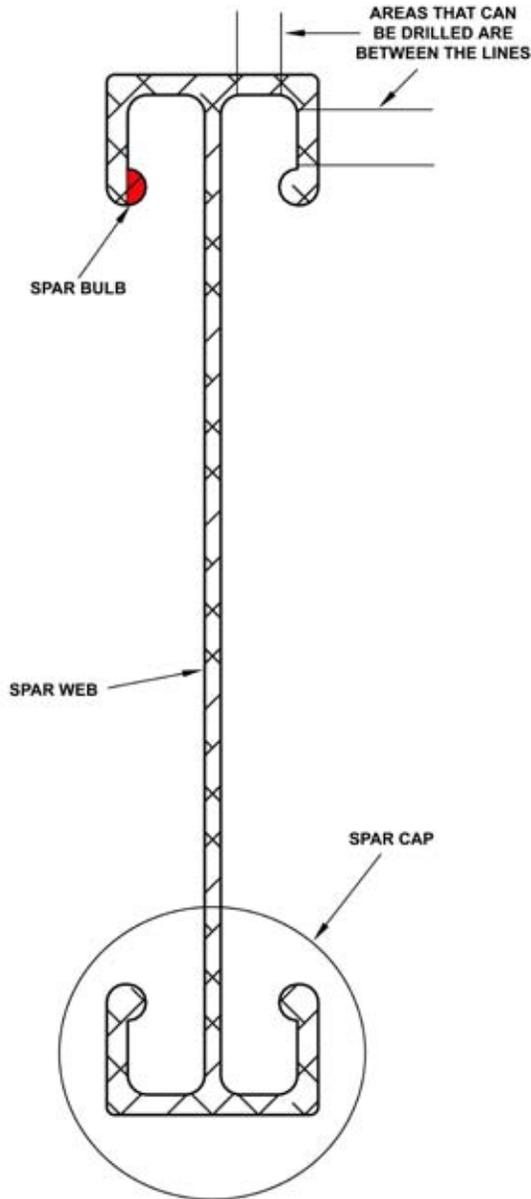


Photo 021

LOG & INSPECTION SHEET WING # 1

FABRICATION AND ASSEMBLY TASKS		A	B	C	D
		Mfr Kit/Part/Component	Commercial Assistance	Am-Builder Assembly	Am-Builder Fabrication
	Wings - 51 Listed Tasks				
	Task #				
W15	Fabricate Special Tools or Fixtures				X
W2	Assemble Wing Spars and Wing			X	

IN DROPBOX UNDER CCK PICTURES THERE IS A HUGE AMOUNT OF PICTURES THAT WILL HELP YOU BUILD YOUR KIT. PLEASE USE THESE PICTURE TO HELP YOU BUILD YOUR KIT.

OKAY LET'S BUILD THE WINGS.

HERE ARE THE DROPBOX LINKS THAT CONTAIN THE MOST CURRENT MANUALS AND ADDITIONAL PICTURES AND VIDEOS.

CCK Pictures: <https://www.dropbox.com/sh/up4e200nn4a3rif/5sdRBCLj3Y>

Manuals: <https://www.dropbox.com/sh/9t5uu3ijl6epp6p/vPXxokJp-j>

The wing build commences at this point. Please assure that you have a suitable work place and that you are prepared. Please follow the manual!!

SECTION 1 LAYOUT OF SPARS

- 1) Examine the spars carefully to ensure there are no flaws, deep scratches or nicks.
- 2) The picture below shows a typical shop setup. Lay the front and rear spars for the left wing on the sawhorses as shown on Figure W1. Figure W1 does show blocks and fittings that we haven't placed yet. The fittings help illustrate the layout. When the spars are in as-received condition, they have no hardware in place. The fuselage is shown in Figure W1 to provide further sense of scale but there is no need for the fuselage to be in that position at this time. If you have received your **Carbon Cub EX** kit fuselage, move it further away to allow easy access for the wing build.



Photo 022

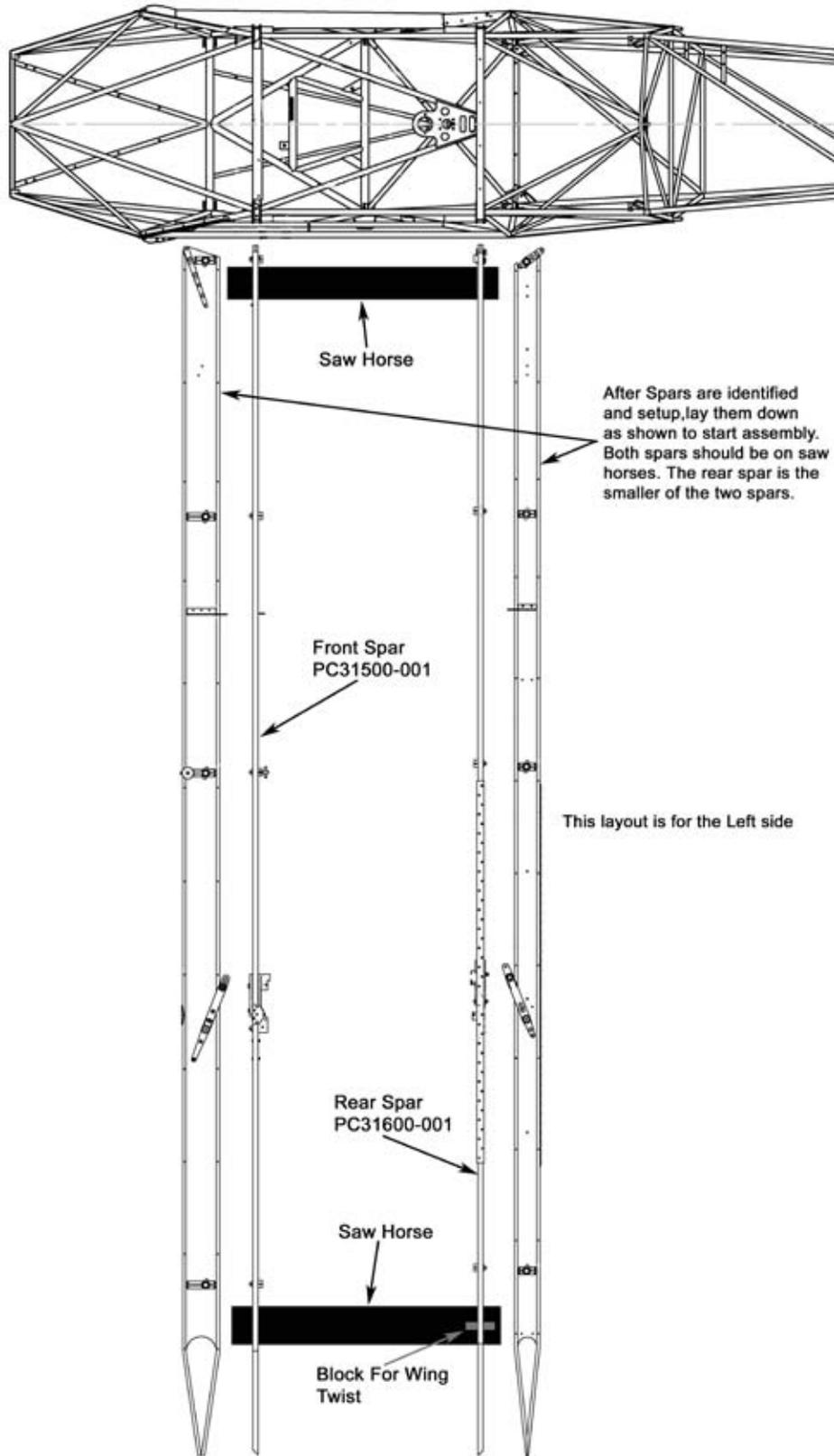


Figure W1

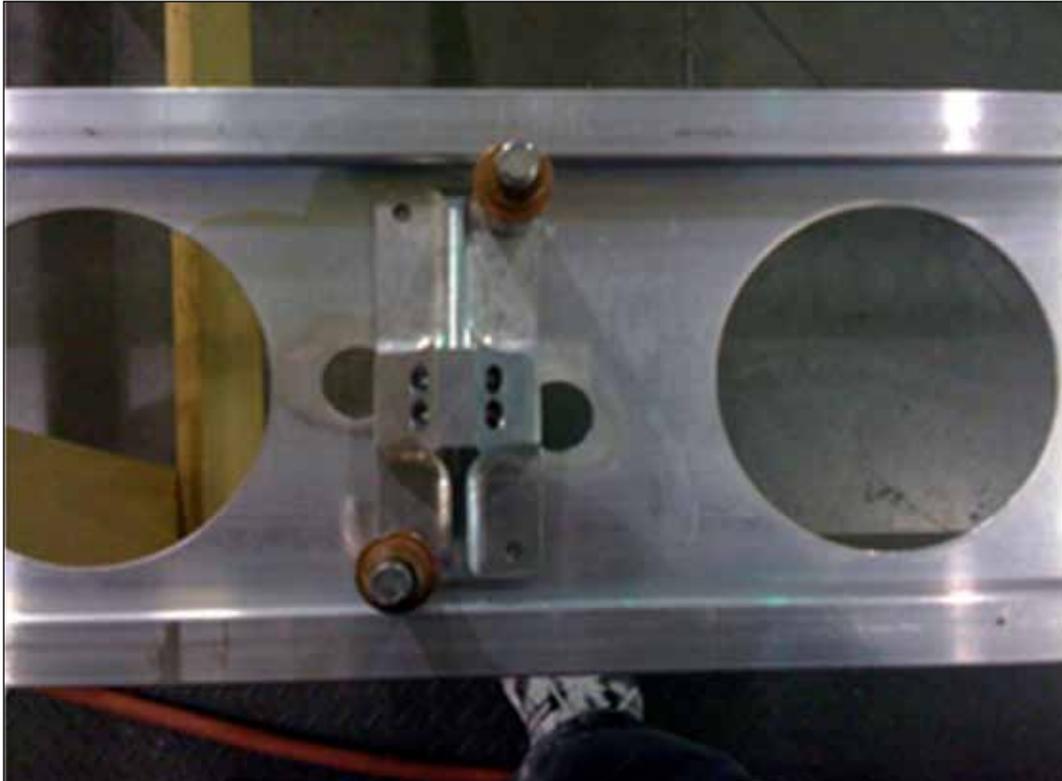


Photo 023

SECTION 2 PLACEMENT OF BLOCKS AND FITTINGS

Simple form of this step: “Use Clecos to attach the fittings and blocks to the aft and front spar.”

However, because we’re just getting started we’re going to go through this step in more detail. The detail will be reduced in succeeding steps as you become familiar with the build program, reading the drawings, etc.

Some novice builders may dread reading the drawings and tables because they are a “foreign language”. But don’t fret – this is a professionally guided tour and you won’t get lost.

There are four figures on the following pages. Figure W2 for the front spar and Figure W3 for the rear spar depict the layout of the parts used in the following steps. Figure W4 and Figure W5 show details of Figure W2 and Figure W3. The lettered circles A, B, C and D in Figure W2 have 4 expanded views two in Figure W4 and two in Figure W5. The front spar has 34 types of parts and the rear has only 26.

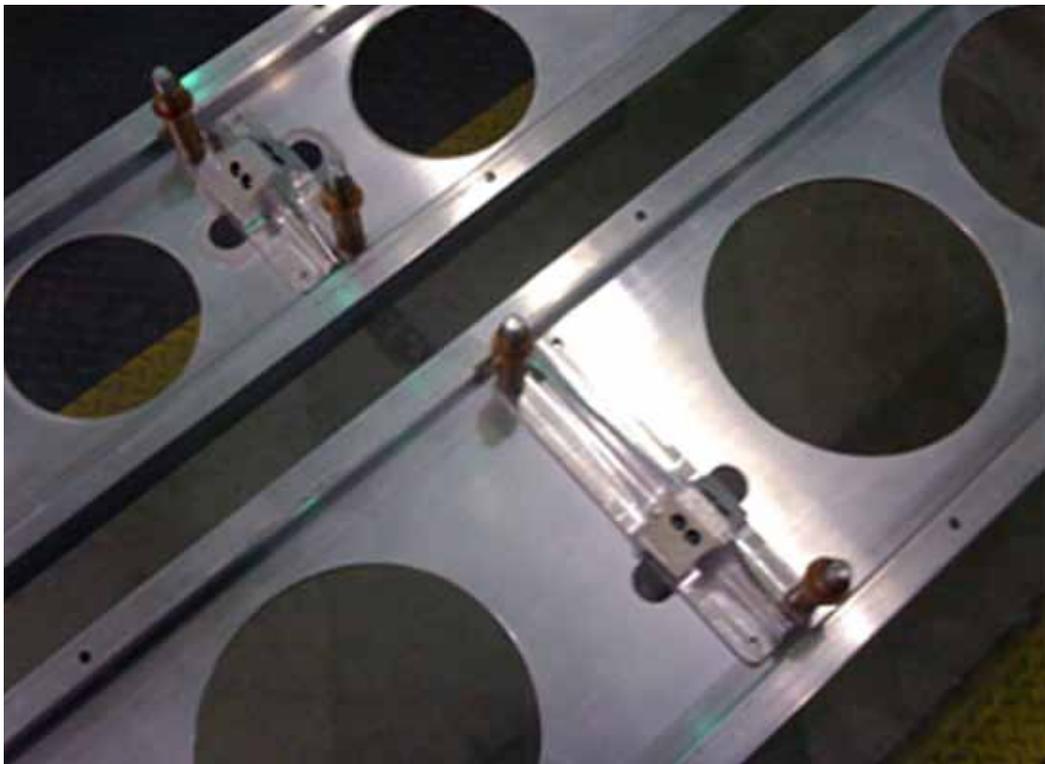


Photo 024

Let's start by looking at Figure W2. On the outboard side of the front spar you'll notice 3 instances of PN SC31001-001. Right now we'll just use Clecos to hold parts in place but later these parts will be riveted. Now look at Figure W2 again and notice the fittings (PN SC31050-001) on the inboard view of the front spar. There is no companion rivet number next to PN SC31050-001 or PN SC31303-001 because the rivets shown with parts SC31001-001 will be used to fasten the blocks to the spar to the fittings. You noticed that there are two parts SC31050-001 and one part SC31303-001. Right? There are more parts to find on the drawing: Fitting numbers PC31508-001 and PC31503-001, block number SC31502-001 and front spar bracket SC31506-001. This takes care of the front spar. Repeat this process for the rear spar using Figure W3 to see the part numbers in position. You should find the circled numbers SC31003-001, SC31002-001 and AN470AD4-6 in three places (SC31003-001=block, SC31002-001=fitting, AN470AD4-6=rivet). When you add numbers SC31609-001, SC31610-001, PC31607-001, PC31603-001 and SC31003-001, you've got the parts for this part of the rear spar.

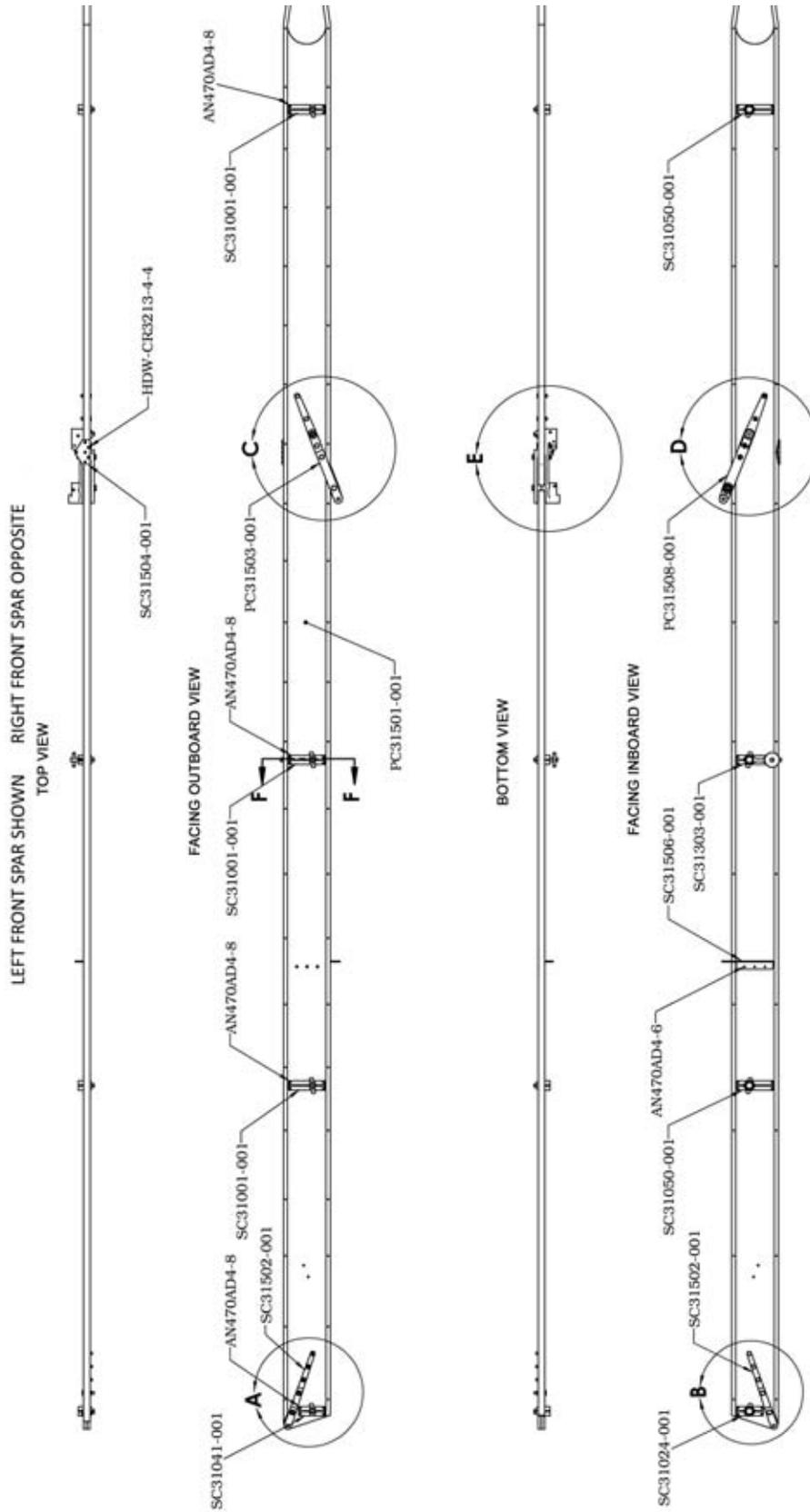


Figure W2

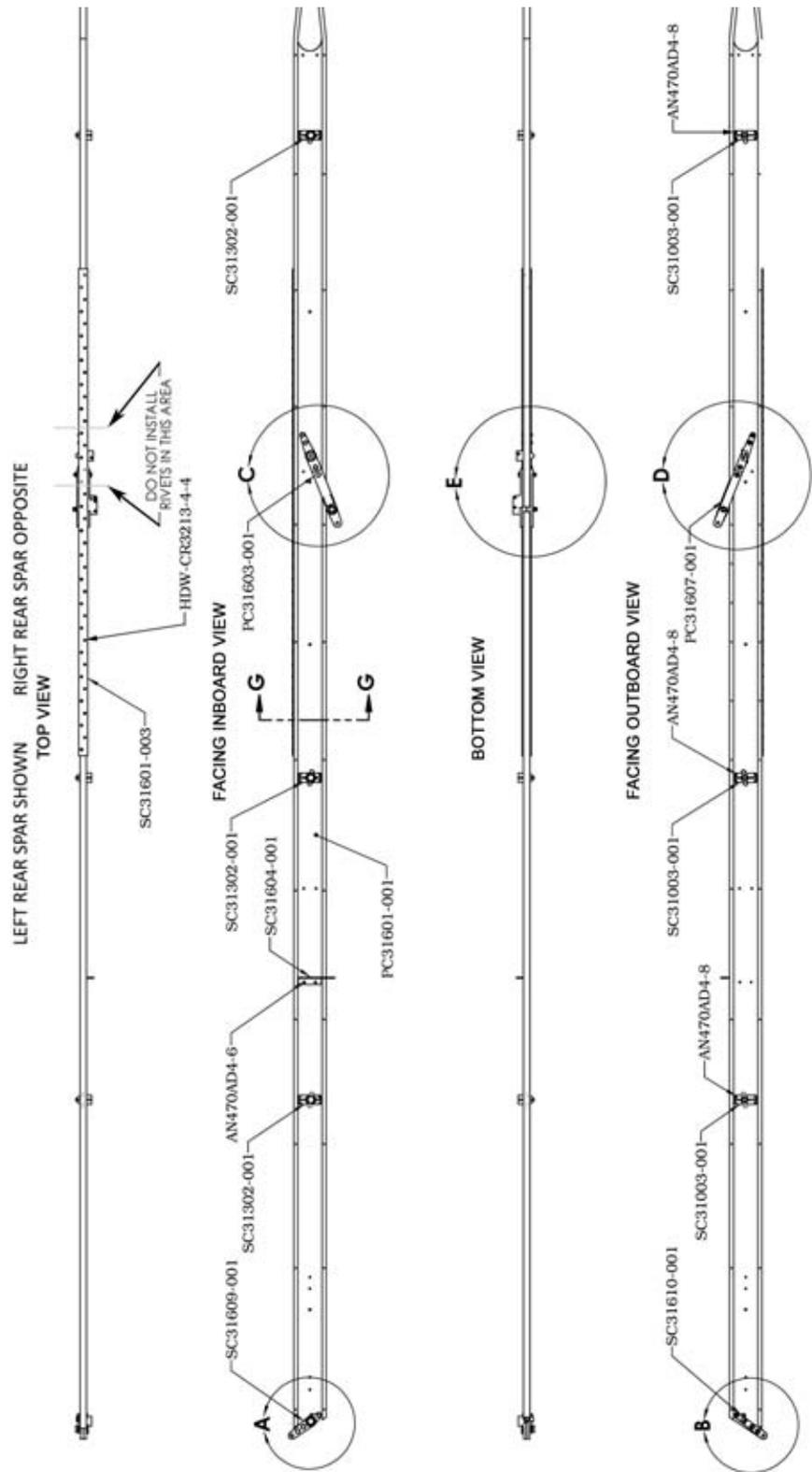


Figure W3

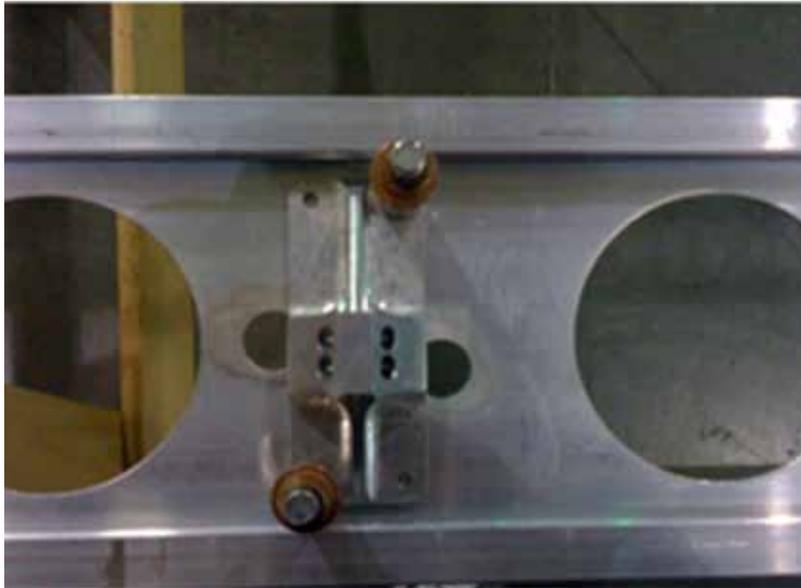


Photo 025

Now, go to your parts board and find the -001 series of these parts for the front and rear spars of the left wing. Use Figure W2 and Figure W3 to identify the correct part numbers. Don't be bashful about using a colored high lighter to mark Figure W2 and Figure W3 as you collect the parts. Be methodical.

If you are choosing to build both wings in parallel be sure to apply the parts correctly left versus right. The short end of each block or fitting needs to be at the bottom edge of the spar. A simple way of determining the short end of the block is to measure the back side of the block as shown in Photo 026.

If you are choosing to build both wings in parallel be sure to apply the parts correctly left versus right. **The short end of each block or fitting needs to be at the bottom edge of the spar.**



Photo 026

Now, take your Cleco pliers and fasten each of these block-fitting assemblies in place on the spar using the copper-colored Clecos. One method for this (but not the only one) is to: **1)** insert the Cleco through the block and then release the tension; **2)** find the appropriate spar hole; **3)** re-tension the Cleco and insert through the spar and release the tension; then **4)** re-tension the Cleco and push the fitting over the Cleco while holding everything tight from the first side. Once you've done this a couple of times it will be very easy. You should not have to "worry" the Clecos through the holes. Everything will fit snug but you should not have to "drill" the hole by pushing forcefully while twisting the Cleco into place.

SECTION 3**ATTACH SPAR HINGE BLOCKS**

SC31502-001 (two pieces) from Figure W2 will be installed on the front spar. See detail drawings A and B in Figure W4. In detail B you will see placement of 3 AN174 bolts and 2 AN175 with two different lengths. The heads of the bolts should be placed per Figure W4.

Use a 1/4" and/or 5/16" reamer to achieve a proper bolt fit. The fit should be quite snug. Don't oversize the holes, as this is an important load carrying part that needs to fit correctly. In Figure W4, you can see the application of washers and nuts. To not waste locknuts, use castle nuts (temporarily) for the 2nd and 3rd AN174 bolts on the front spar. We'll put the locknuts on after the tank straps are in place per Photo 027.

**Photo 027**

THIS STEP IS CRITICAL. MAKE SURE YOU READ AND UNDERSTAND THIS ENTIRE SECTION.

Reaming the spar attach and strut attach fittings is critical, so I will spend some time here and give you one way of doing it. First I recommend that you pick the #1 hole in the front attach and ream this hole in each fitting, then you will need to ream the hole in the front spar. It is recommended that you put the reamer through the hole, attach it to the drill and pull it through the hole. This gives you more control of the reamer and also helps you get a straighter hole. The first hole (5/16" reamer) in the fitting shown in Photo 028 needs to be as straight as possible through the fittings, it is worth extra time to set up a fixture or some device to help you. **ALWAYS USE A LUBRICANT WHEN REAMING ANY HOLES AND ONLY PULL THE REAMER THROUGH A HOLE 1 TIME.** When you are finished reaming the attach fittings and the spar, deburr the parts using a deburring tool as shown in Photo 029. Only remove the burrs, do not chamfer the holes.

**Photo 028****Photo 029**

ALWAYS PULL THE REAMER AS STRAIGHT AS POSSIBLE THROUGH THE HOLES

Next you will need to repeat the last step using a 1/4" reamer and the bottom hole of the fittings and spar. You can see the holes that have been reamed in Photo 030. Install bolts in both of these holes as shown in Photo 030 and Photo 031, this will give you the alignment that you need for the rest of the holes that will be reamed as an assembly. It is recommended that you use a soft faced clamp to hold the fittings together while reaming the next hole. Ream the second hole up from the bottom (Photo 032) as an assembly, deburr and install the proper hardware per Figure W4. Just snug the nut as you will come back and torque all of the fasteners at the same time.

**Photo 030****Photo 031****Photo 032**

Repeat the last step until you have all of the holes reamed and the hardware installed as shown in Photo 033, Photo 034, and Photo 035.



Photo 033



Photo 034

**Photo 035**

Torque the attach fittings (90inlbs. for 1/4" bolts and 180inlbs for 5/16" bolts), remember the tank strap nuts shown in Photo 027. These fasteners will be completed in a later section.

**Photo 036**

Test fit a 5/16" bolt into the hole shown in Photo 037. If the bolt will not pass through the fitting assembly, pull the 5/16" reamer back through the fitting assembly.



Photo 037

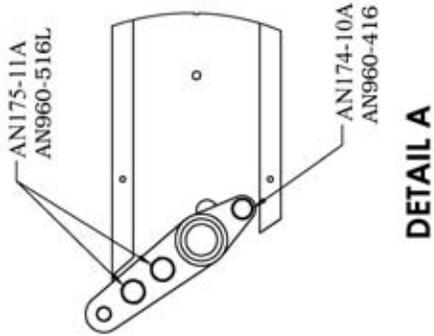


Photo 038

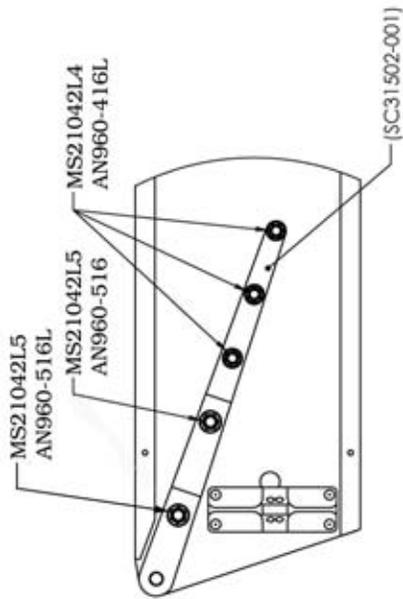
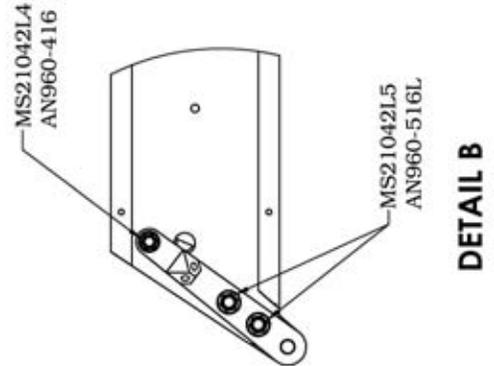
SC31609-001 and SC31610-001 will be installed in the rear spar. See detail drawings A and B in Figure W4. You will see one AN174 and two AN175 bolts. As with the front spar, the nuts and washers are set out in detail B.

You will need to repeat the reaming process that was used for the front spar fittings. When you use the upper bolt hole that does not sandwich the spar, use an AN960-516 washer between the two fittings. This will give you the spacing that is needed for reaming the remainder of the holes.

In Photo 038 you will see the rear spar with hinge blocks installed. Torque the attach fittings (90inlbs. for 1/4" bolts and 180inlbs for 5/16" bolts) It is a good idea to put some kind of marking on the nut and bolt to verify that they have been torqued.



REAR SPAR



FRONT SPAR

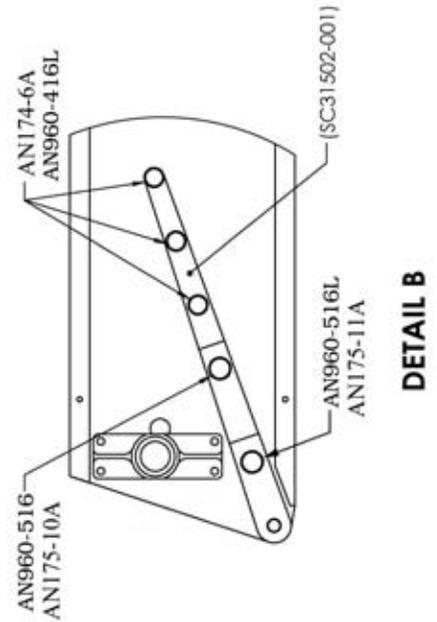


Figure W4



Photo 039



Photo 040

SECTION 4

ATTACH LIFT STRUT FITTINGS

Lay out the hardware needed per Figure W5 to install the lift strut fitting on the spars.

The use of a 1/4" and 5/16" reamer will be necessary to get a proper bolt fit. Start by temporarily putting the AN175-22A bolt in the first hole and then the AN6-21A bolt in the second hole and the 1/4" reamer in the 1/4" hole on the opposite end shown in Photo 039. Pull the reamer through that hole using the technique used in SECTION 3. Next ream the corresponding hole in the spar as shown in Photo 043. Assemble the fittings to the spar and install the pre reamed bolt (AN174-10A), leave the AN175-22A bolt in the strut attach hole and install the AN6 bolt in the next hole up. **DO NOT FORGET TO INSTALL THE AN960-616 (Photo 041) WASHER BETWEEN THE ATTACH FITTINGS.** Next snug up the AN6 and AN174 bolts, the fittings need to be able to move on the spar. Line up the holes in the spar with the holes in the fittings and ream the next 1/4" hole that is inboard. Install the hardware and snug up the bolt. For subsequent bolts (one at a time), ream the fitting (disconnecting the reamer and pulling it through the reamed hole after a single one-direction reaming pass). Repeat the process, changing the reamer appropriately, until all the bolts are installed and snug.

AN960-616 washer this one place only, front and rear spar.



Photo 041

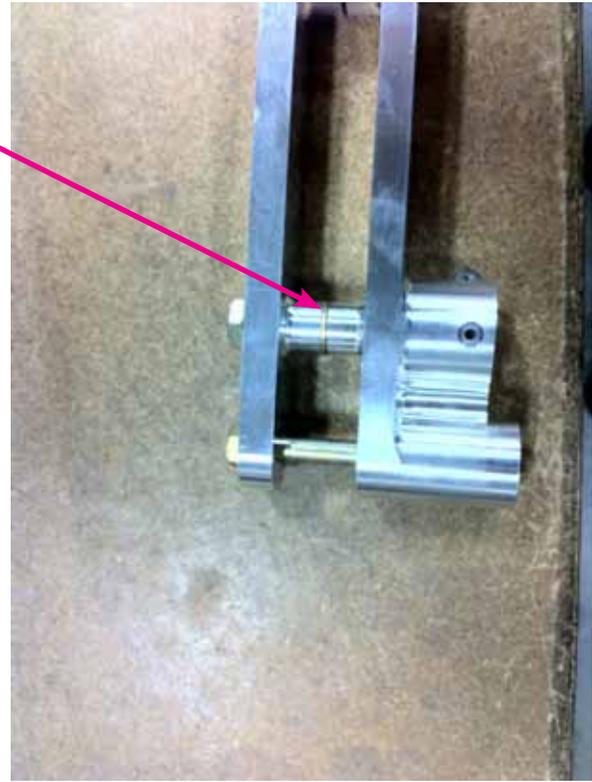


Photo 042



Photo 043



Photo 044

**Photo 045**

Up to this point the bolts are just snug. Using a calibrated torque wrench (if possible), torque all the bolts to their rated torque. In this case, torque to 250 in-lbs.

Standard torque values for fittings will be:

AN6 at 250 inch-pounds

AN5 at 180 inch-pounds

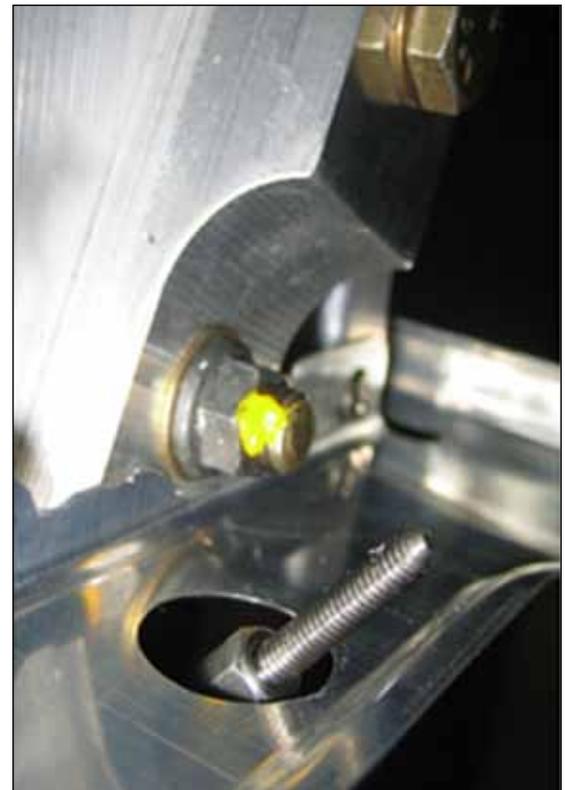
AN4 at 90 inch-pounds

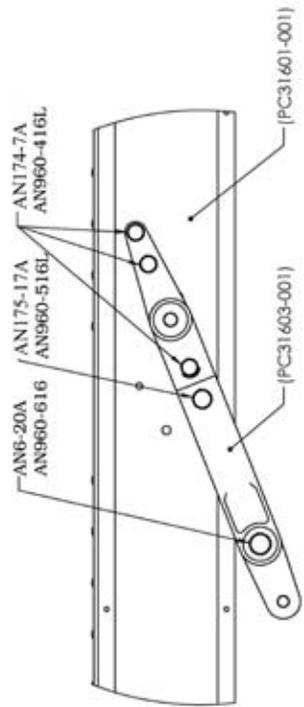
AN3 at 40 inch-pounds

Mark all installed bolts and nuts using Torque Seal.

Examine the pictures on the following two pages to check your progress.

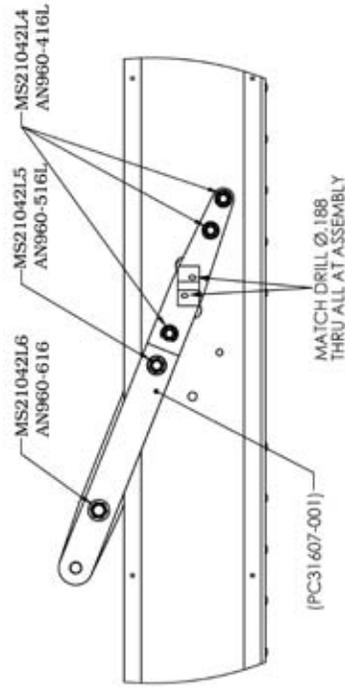
Pay particular attention to the bolt head orientation.

**Photo 046****Photo 047**

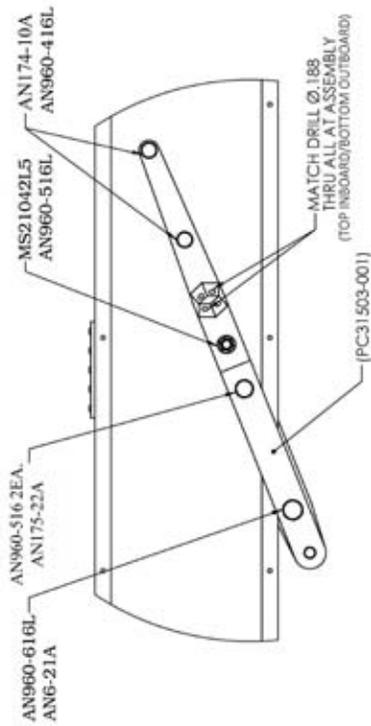


DETAIL C

REAR SPAR

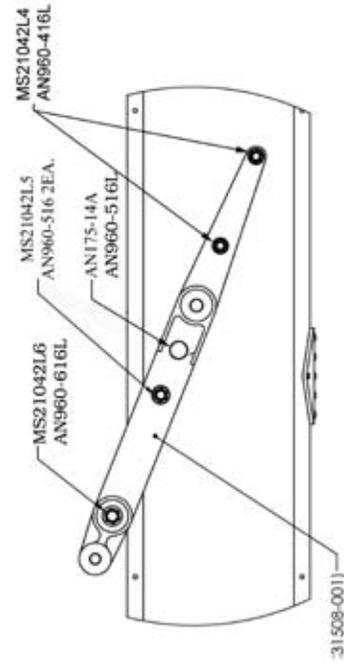


DETAIL D



DETAIL C

FRONT SPAR



DETAIL D

Figure W5

Inside of spars after placement of blocks and fittings



Photo 048



Photo 050

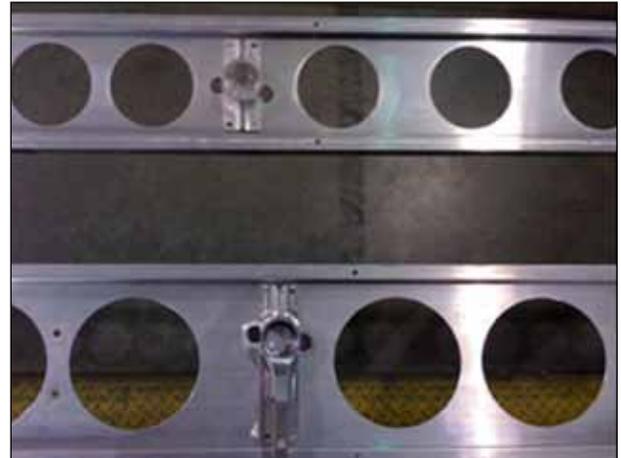


Photo 049



Photo 052



Photo 051

LOG & INSPECTION SHEET WING # 2

Log sheet

	FABRICATION AND ASSEMBLY TASKS	A	B	C	D
		Mfr Kit/Part/ Component	Commercial Assistance	Am-Builder Assembly	Am-Builder Fabrication
	Wings - 51 Listed Tasks				
	Task #				
W1	Fabricate Wing Spars	.75			.25
W2	Assemble Wing Spars and Wing			X	

Inspection point

	INSPECTION ITEMS	BUILDER	ALTERNATE
1.1	Ensure AN960-516 washer is installed between front and rear lift strut fittings.		
1.2	Ensure that all hardware is installed and torque striped, both front and rear spars.		

SECTION 5 PREPARE THE DOUBLE RIBS

We're going to prepare the two double ribs now so that the Methacrylate adhesive has time to set.

Take the #1 & #3 rib position center ribs (SC31047-001 and SC31047-002) and the #5 rib position center ribs (SC31044-001 and SC31044-002) and lightly scuff them with a red ScotchBrite pad.

Clean both glue surfaces with denatured alcohol.

Apply a thin bead of Methacrylate adhesive to one of the ribs. Keep the adhesive away from all holes and from the flutes that will interface with nose or tail ribs.

**Photo 053****Photo 054**

Use bolts, washers and nuts to make 3 indexing pins (to keep the ribs aligned). See below.

Place ribs together, align and clamp with Vice Grip clamps. A few spring clamps may be helpful. Keep clamps on the flat areas and don't smash any of the ribbing.

**Photo 055****Photo 056**

SECTION 6

INSERT TUBES IN FITTINGS

Test fit tubes into the fittings to ensure that the tubes slide into, and bottom out in the fittings.

Lay rear spar down and place tubes into the front spar fittings per Figure W6 to create the basic wing structure. Ensure that tubes bottom out in fittings.

Lift the rear spar and align fittings over the tubes. Use a clamp to help draw the two spars together. You should be able to draw each tube location together without needing to move back and forth between tubes.



Photo 057



Photo 058

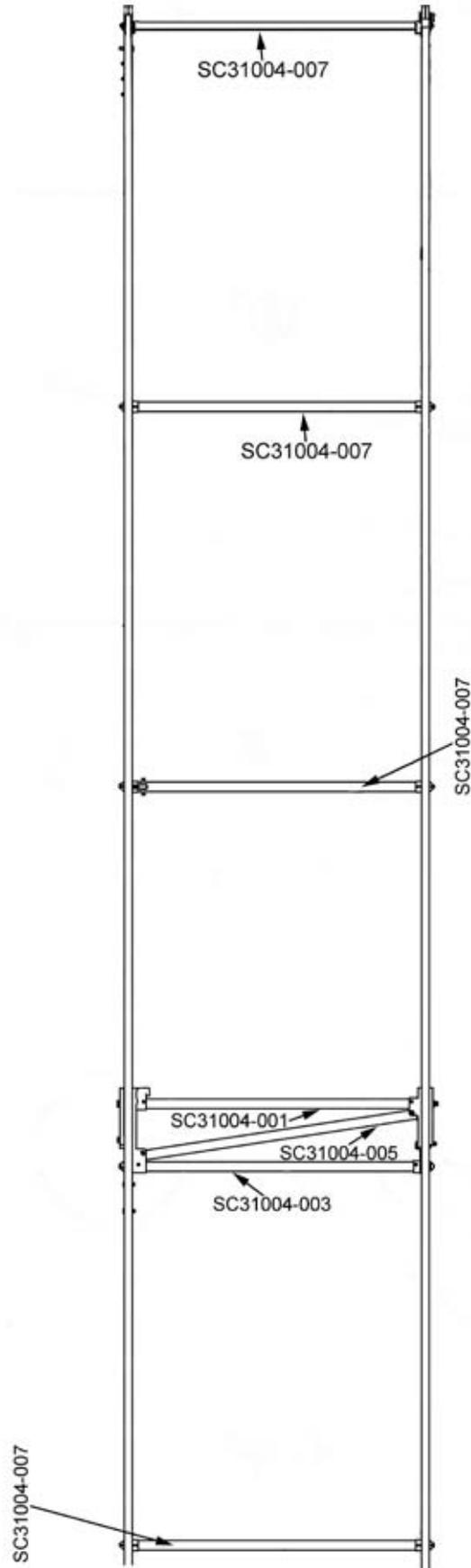


Figure W6

After the wing is square per Figure W6, match drill and insert rivets on top and bottom sides (tubes horizontal) of tubes shown in Figure W7.

(8 rivets required)

THESE 8 RIVETS ARE THE ONLY COMPRESSION TUBE RIVETS THAT WILL BE USED. ALL OTHER COMPRESSION TUBES ARE NOT RIVETED.



Photo 059

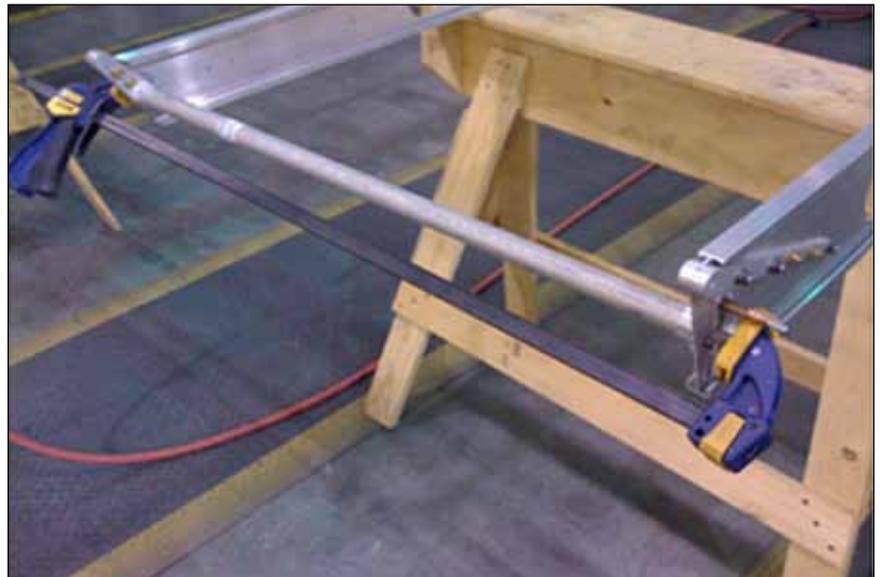


Photo 060



Photo 061



Photo 062

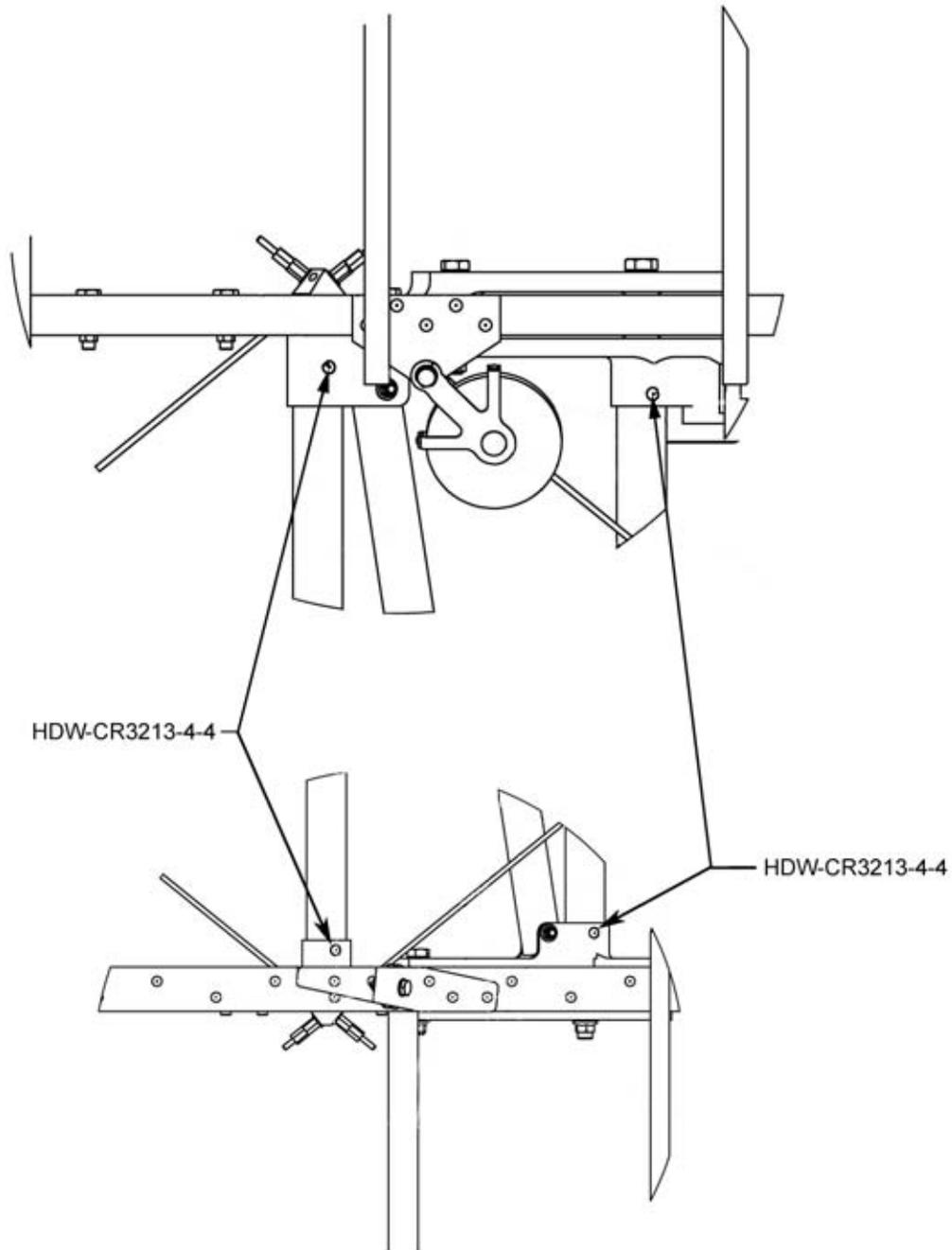


Figure W7

SECTION 7 RIVET BLOCKS/FITTINGS AND JURY STRUT FITTINGS

Using a #30 bit, drill all holes in the fittings and blocks installed previously. Buck rivets, removing the Clecos as you move from hole-to-hole. Its good practice to use a piece of masking tape on the rivet set to help avoid scarring the material adjacent to the rivet head. See below. The bucking bar is used without tape. Consult the Airframe and Powerplant Mechanics Handbook for information on proper riveting techniques.



Photo 063



Photo 064

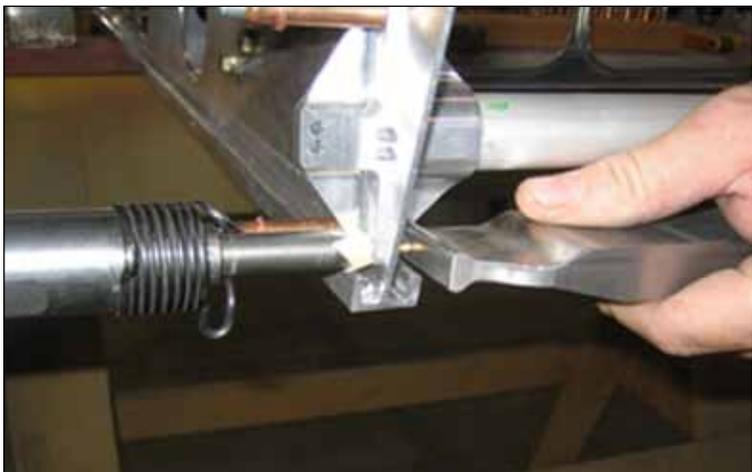


Photo 065

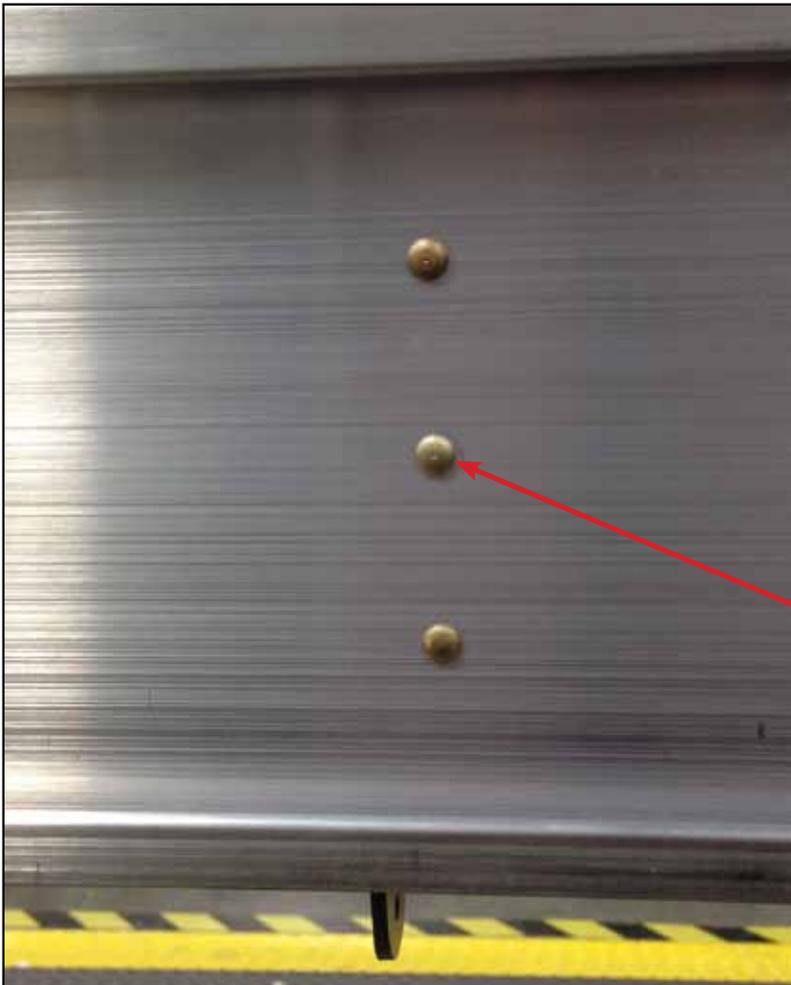


Photo 066

Now you will also rivet in the jury strut fittings shown in Figure W2 and Figure W3. These fittings are shown in Photo 066, Photo 067, Photo 068, Photo 069. You should be striving for rivets that look like this. Properly upset with clean heads and no “smiles” (caused by a tipped driver which marks the surface).

IF YOU ARE USING ONLY A RIVET SQUEEZER, THIS RIVET MAY BE REPLACED BY A CHERRYMAX RIVET CR3213-4-4



Photo 067



Photo 068



Photo 069

SECTION 8 INSTALL CENTER RIBS

Install center ribs in accordance with Figure W9. Do not install Rib #2 or #13 at this time.

It's a good idea to use a Sharpie pen to label each rib position. This will help avoid mistakes in placing parts.

Place two bolts AN3-3A and AN960-10L through holes in rear spar under rib #5 and #12 BEFORE riveting ribs in place using HDW-SS/SS42D Rivets. Loosely place nuts MS21042L3 on these bolts.

For rib #8 - do not insert bottom rivet on the front spar at this time.

INSTRUCTIONS ARE FOR THE LEFT WING, RIGHT WING WILL BE OPPOSITE.

When installing rib #1 the predrilled holes in the spar will be used to rivet rib SC31047-001. The holes in SC31047-002 will be matched drilled in the spars, the SC31047-001 rib is bent in the opposite direction from the SC31044-001 rib. When installing rib #3, the SC31047-002 rib will rivet into the predrilled holes in the spar. On rib #5 the predrilled holes in the spar will be used to rivet rib SC31044-001. The holes in SC31044-002 will be matched drilled in the spars, these ribs will go in the normal position and will align with the nose and tail ribs. See Figure W8 for details.

A good way to remember not to rivet specific holes is to fill those holes with Clecos.

Photo 070 shows rib #8.



Photo 070

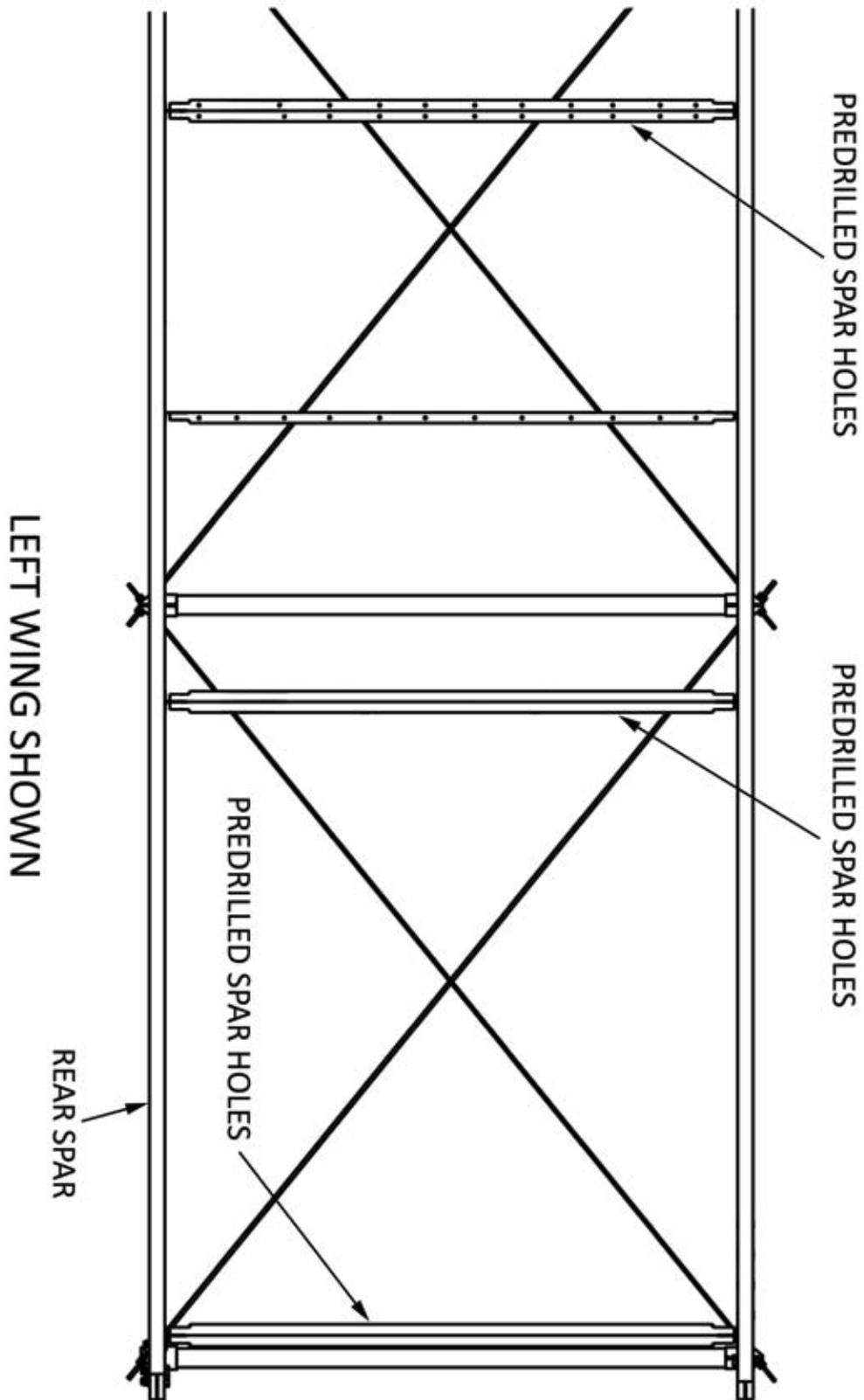


Figure W8

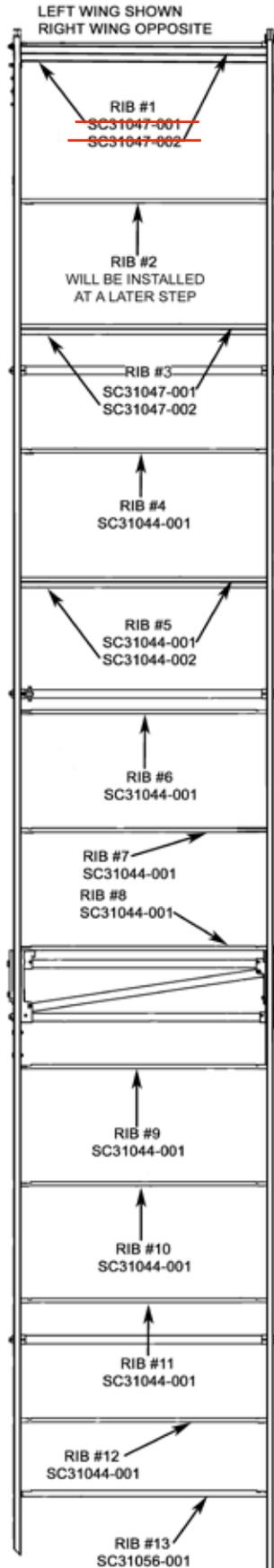
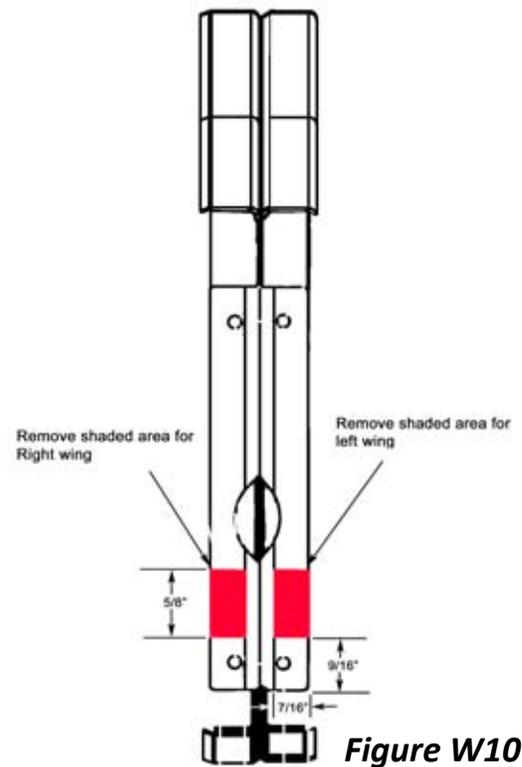


Figure W9

It is necessary to trim the rear of the rib #1 to fit around bolt head. Figure W10 gives the position of the material to be removed.

Remove the red section on figure W9. Be sure to check for the left and right sides.

**Figure W10****Photo 071****Photo 072**

The bonded double rib is installed at rib station #3 & #5 with the inboard rib riveted to the pre-drilled holes in the spars. With a #30 bit with a **DRILL STOP**, drill holes for the remaining 8 rivets and install rivets.



Photo 073



Photo 074

LOG & INSPECTION SHEET WING # 3

Log sheet

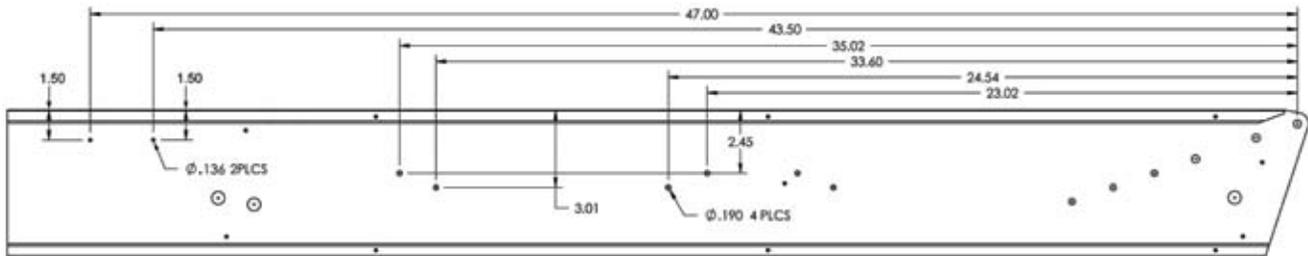
	FABRICATION AND ASSEMBLY TASKS	A	B	C	D
		Mfr Kit/Part/ Component	Commercial Assistance	Am-Builder Assembly	Am-Builder Fabrication
	Wings - 51 Listed Tasks				
	Task #				
W3	Fabricate Wing Ribs and Cores	.75			.25
W4	Assemble Wing Ribs or Cores to Wing			X	
W11	Fabricate Wing Brackets and Fittings	.75			.25
W12	Assemble Wing Brackets and Fittings to Wing			X	

Inspection point

	INSPECTION ITEMS	BUILDER	ALTERNATE
1.3	Ensure jury strut fittings are installed on correct side of spar (inboard side).		
1.4	Using a square, ensure #2 compression tube is square to the spars.		
1.5	Ensure that ribs are straight and all rivets are installed.		
1.6	Ensure all rivets have been installed correctly.		

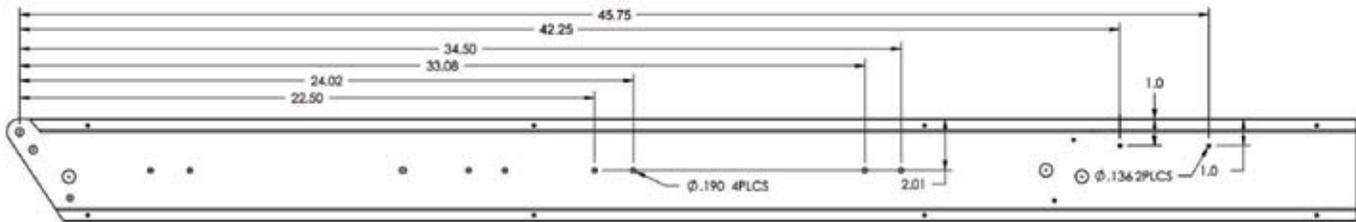
SECTION 9 Spar Inspection

Inspect the inboard sections of the front and rear spars per Figure W11 and Figure W12 to verify that the holes shown in these two Figures have been drilled into the spars. The kits will not have all of these holes, so the builders will have to layout and drill some of these holes.



PC31501 INBOARD SECTION

Figure W11



PC31601 INBOARD SECTION

Figure W12

SECTION 10 Installation of Tank Straps

Install tank straps per Figure W15. Figure W13 and Figure W14 will show the hardware required to install the tank straps. One SC36200-001 tank strap needs to have the hole drilled to .250". One SC36401-001 tank strap needs to have the hole drilled to .250" on one end. These straps will use the bolts with castle nuts placed previously. Once straps are in place, replace the castle nuts with the specified lock nuts.

*Photo 075**Photo 076*

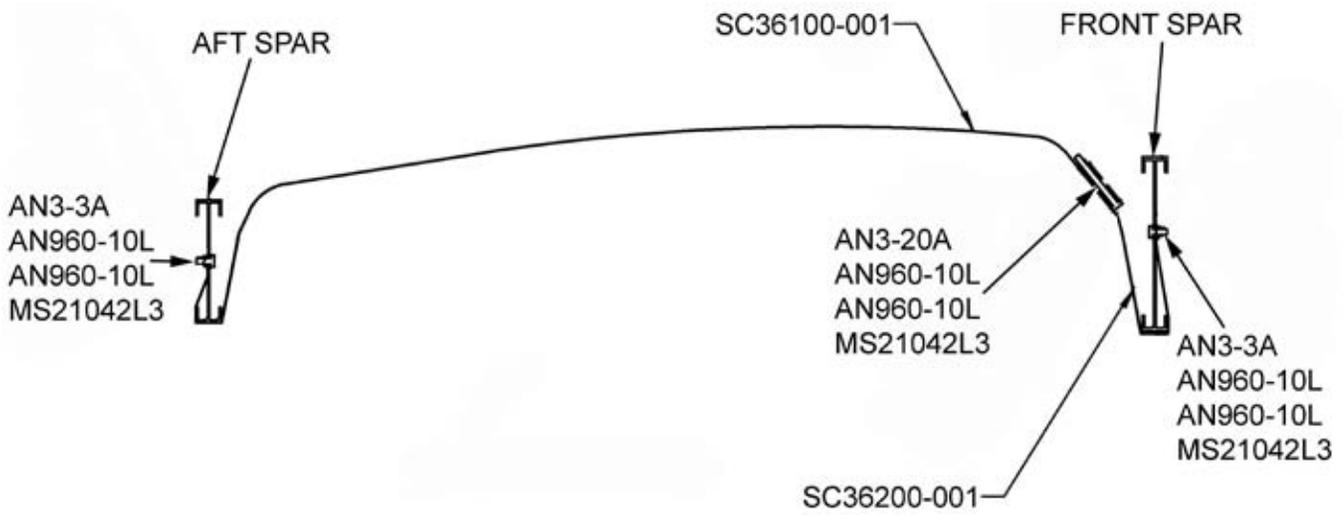


Figure W13

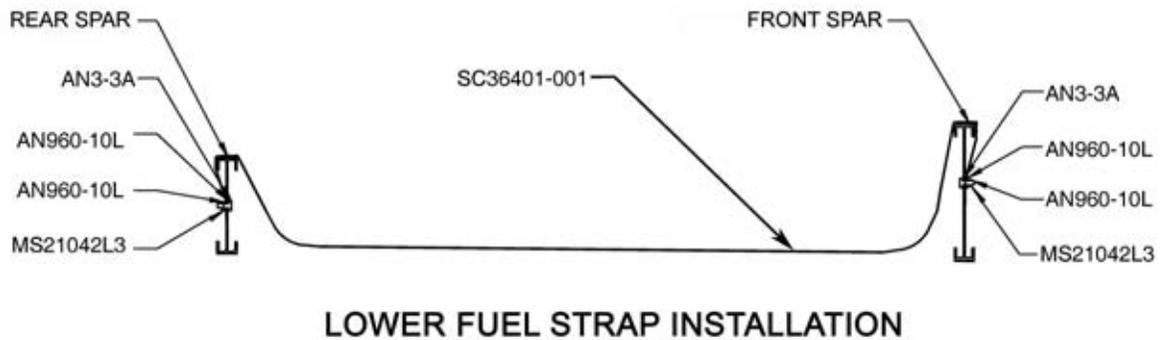


Figure W14

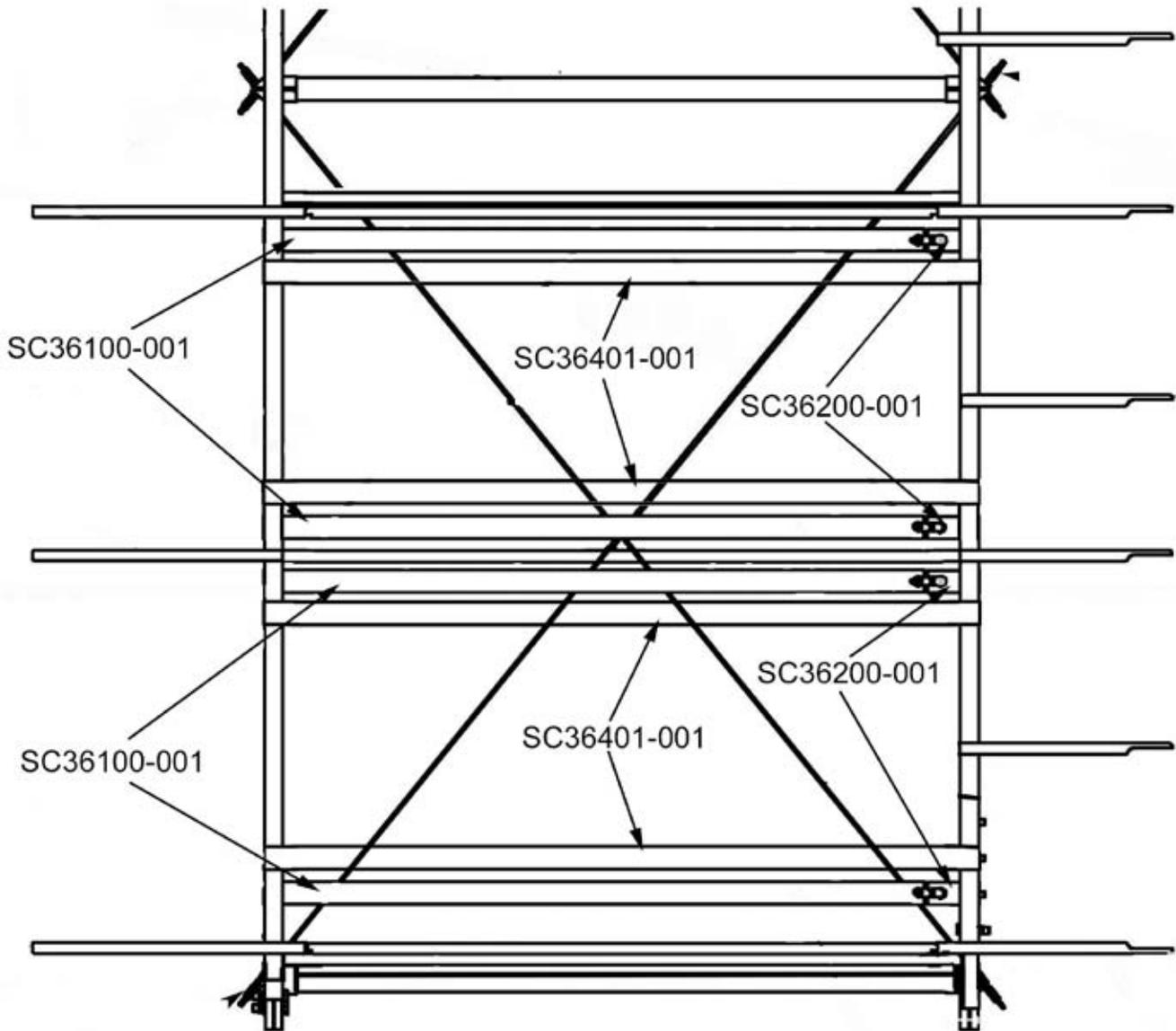


Figure W15

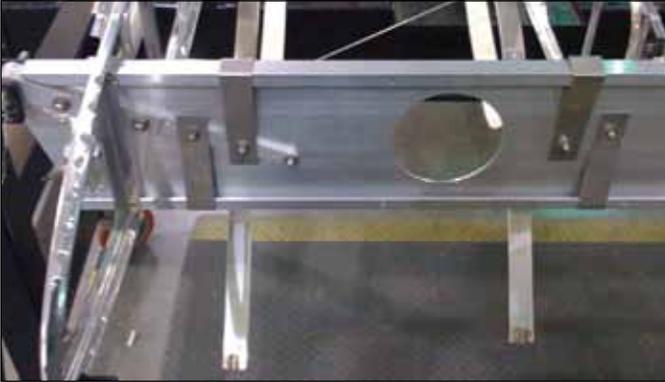


Photo 077

Ignore the nose rib that appears in photo above.



Photo 078

Hand form each strap to fit tightly over the spar. Some may be tempted to hammer these straps but **DO NOT**. Keep them nice and smooth – free of dents or defects of any kind.

Any place the tank will touch the strap should have felt there to protect the tank from damage. Typically, the felt pieces will need to be 5, 32 and 35 inches in length. Cut the felt to length. Clean the straps with denatured alcohol and then apply the felt (centered side-to-side).

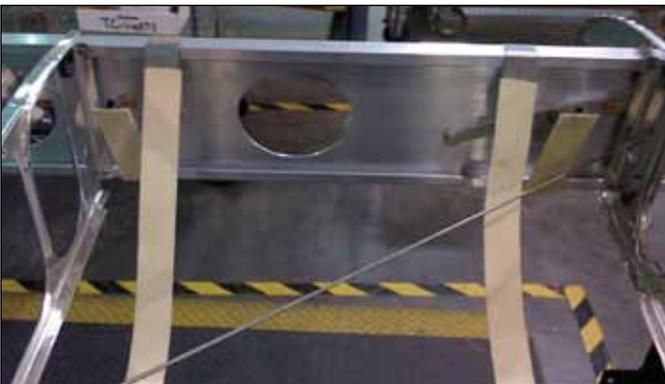


Photo 079



Photo 080

LOG & INSPECTION SHEET WING # 4**Inspection point**

	INSPECTION ITEMS	BUILDER	ALTERNATE
1.7	Ensure that all hardware is installed and torque striped, both front and rear spars.		
1.8	Ensure fuel tank and tank straps are installed per drawing.		

INTENTIONALLY LEFT BLANK

SECTION 11

Installation of Drag Wires

Notice in Figure W16 that there are two sets of drag wires in the wing (SC31002-001 and PC31002-001). The blocks where the thicker PC31002-001 wires go through need to be drilled out using a #9(.196) drill bit.

Using a 3/16" bit, drill the drag wire holes through the strut mount blocks for the ~~PC31002-001~~ wires. Use lube on the drill bit when drilling these holes. When holes have been drilled, use an air hose blowgun to clean chips out of the holes. Begin installing drag wires through the blocks. The wire running from the outboard rear spar to the inboard front spar should always be on top.

Ensure that there is a minimum of 1" of drag wire protruding from the block. Use Figure W16 for drag wire configuration.

Figure W17 shows both wires SC31002-001 and PC31002-001 and the washers and nuts to be used.

Simply make the wires finger tight at this stage.

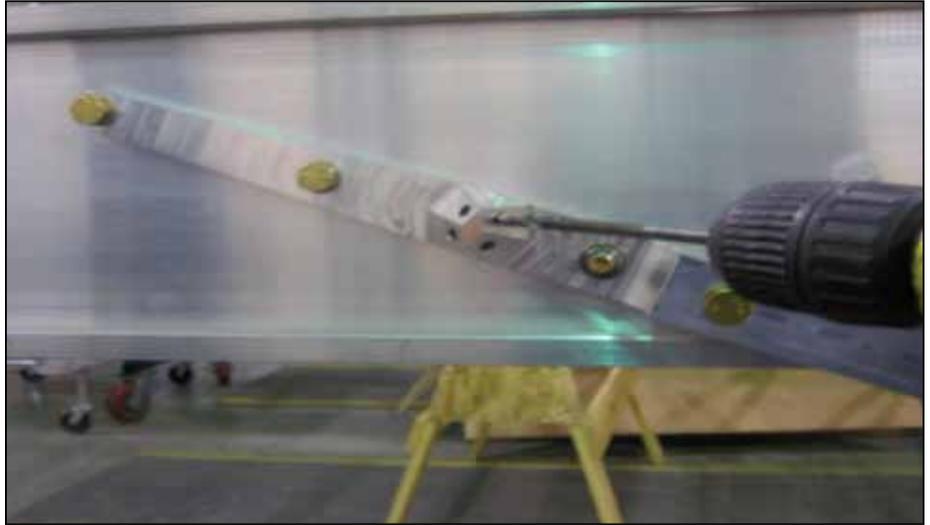


Photo 081



Photo 082



Photo 083

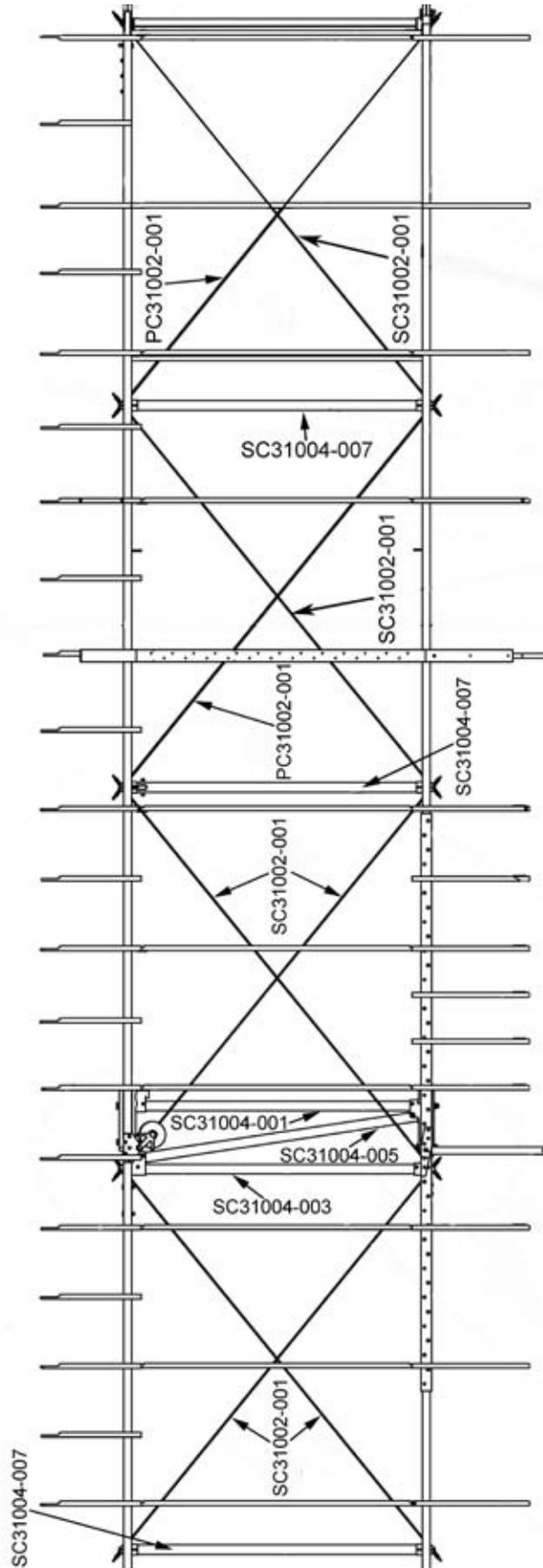
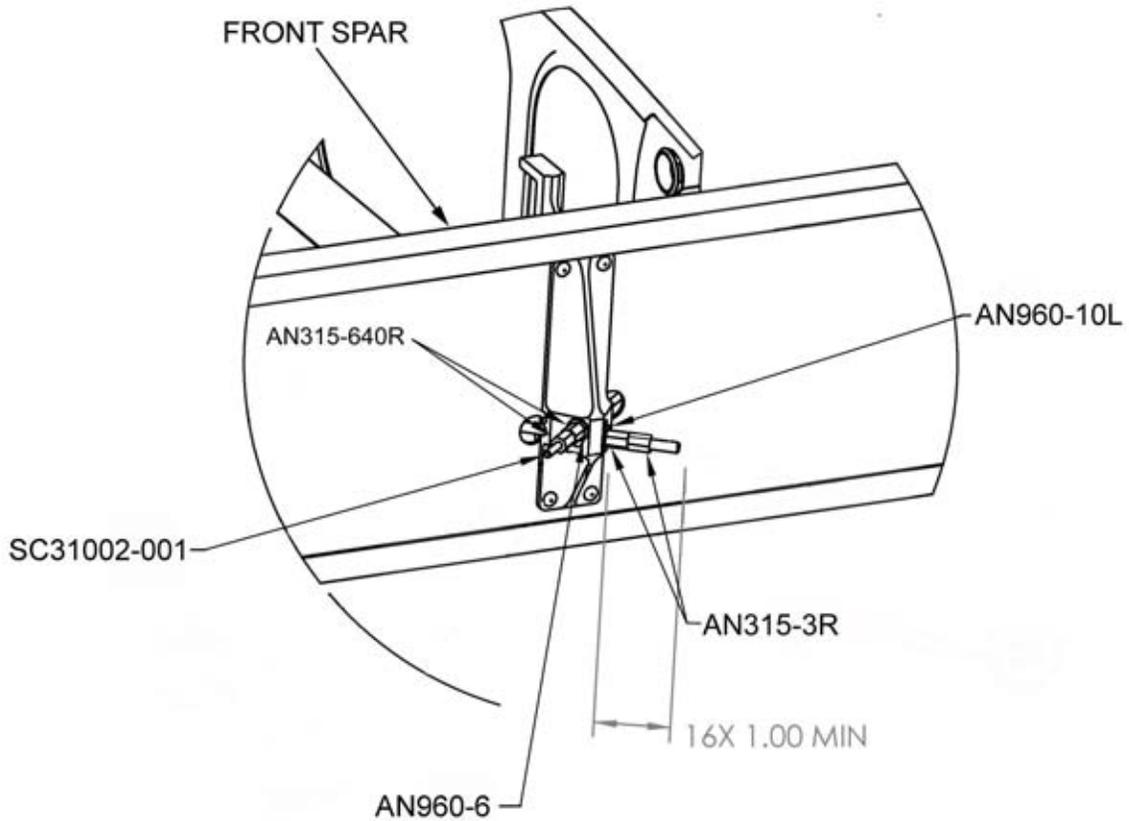


Figure W16



DRAG WIRE NUT INSTALLATION

Figure W17

Drag Wire Clearance

A modification may be made to rib #8 to allow clearance for the drag wire. Use a round file to make a notch in the rib as shown in Photo 084.

The wire will pass through the front hole in the center rib just behind the front spar. You need to create a minimum of 1/8-inch clearance around the wire.

Verify this clearance after drag wire tensioning (next steps)

NOTICE IN Photo 085 THAT THE DRAG WIRE GOES ON THE FRONT SPAR SIDE OF THE RIB UPRIGHT. ENSURE THAT YOU HAVE SOME TENSION ON THE DRAG WIRE. THIS WILL ELIMINATE THE CHANCE OF THE NOTCH BEING IN THE WRONG PLACE.



Photo 084



Photo 085

SECTION 12 Install Machined Tail Ribs

Install the two machined tail ribs (hangers) using the bolts that were inserted when installing center ribs #5 and #12. Refer to Figure W18 and Figure W19 for hardware

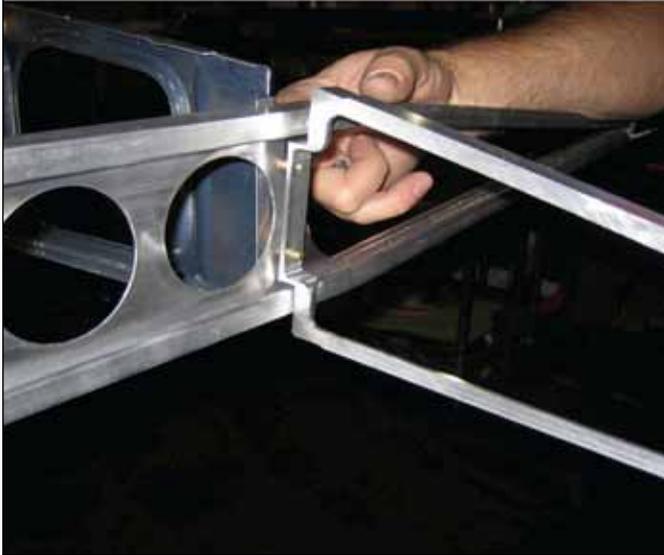
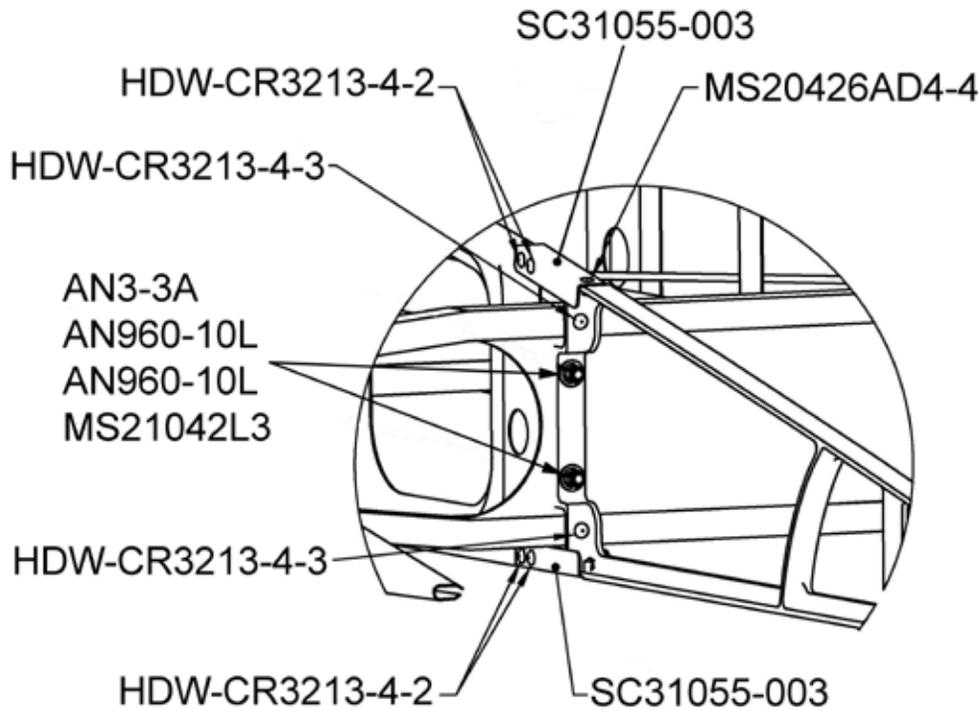


Photo 086



Photo 087



OUTBOARD AILERON TRAILING EDGE RIB
VIEW FROM OUTBOARD SIDE

Figure W18

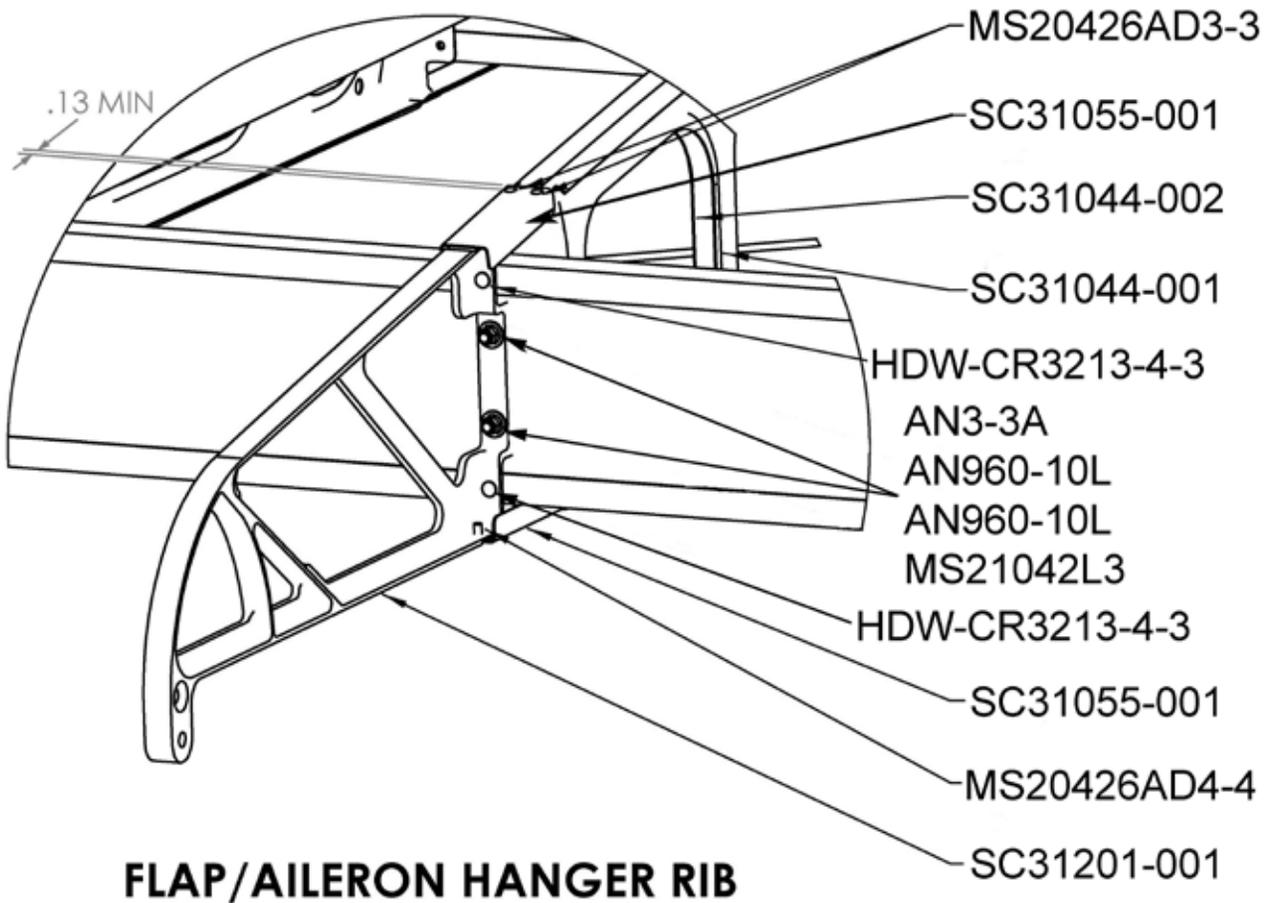


Figure W19

Install cherry max rivets to the #5 and #12 machined tail ribs per Figure W18 and Figure W19. Drill a #30 hole and rivet top and bottom. Drill two holes for rivets. Install cherry max rivets top and bottom. **THESE CHERRYMAX RIVETS NEED TO BE PULLED STRAIGHT OR THEY WILL NOT PULL CORRECTLY.**



Photo 088

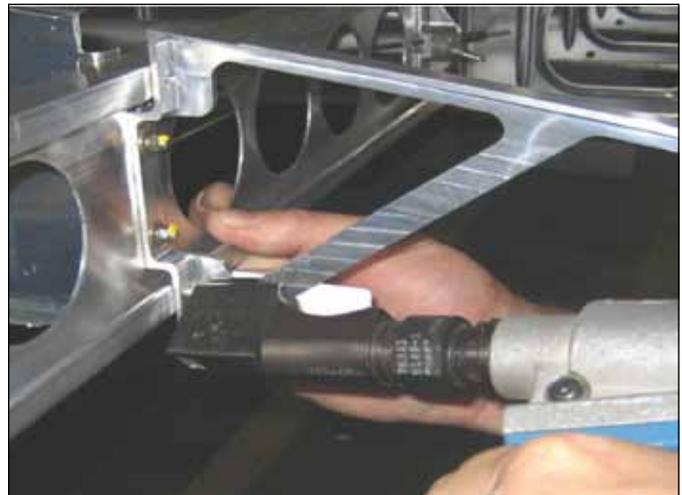


Photo 089

SECTION 13 Trimming the Nose Ribs

Remove the tabs from nose ribs, top and bottom, used in hydro forming the nose ribs, if not already done.

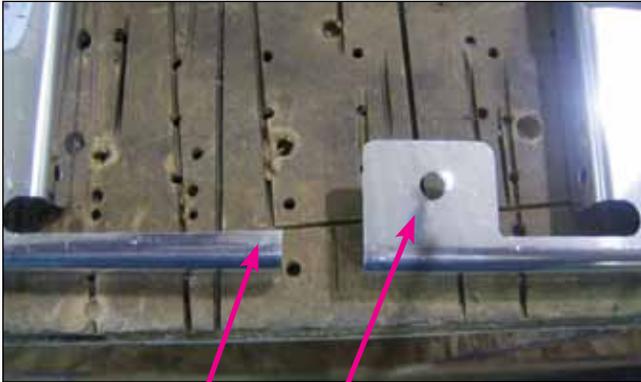


Photo 090

After

Before



Photo 091

The intermediate nose ribs (nose ribs that don't attach to a main rib) may be trimmed as shown in Figure W20 below.

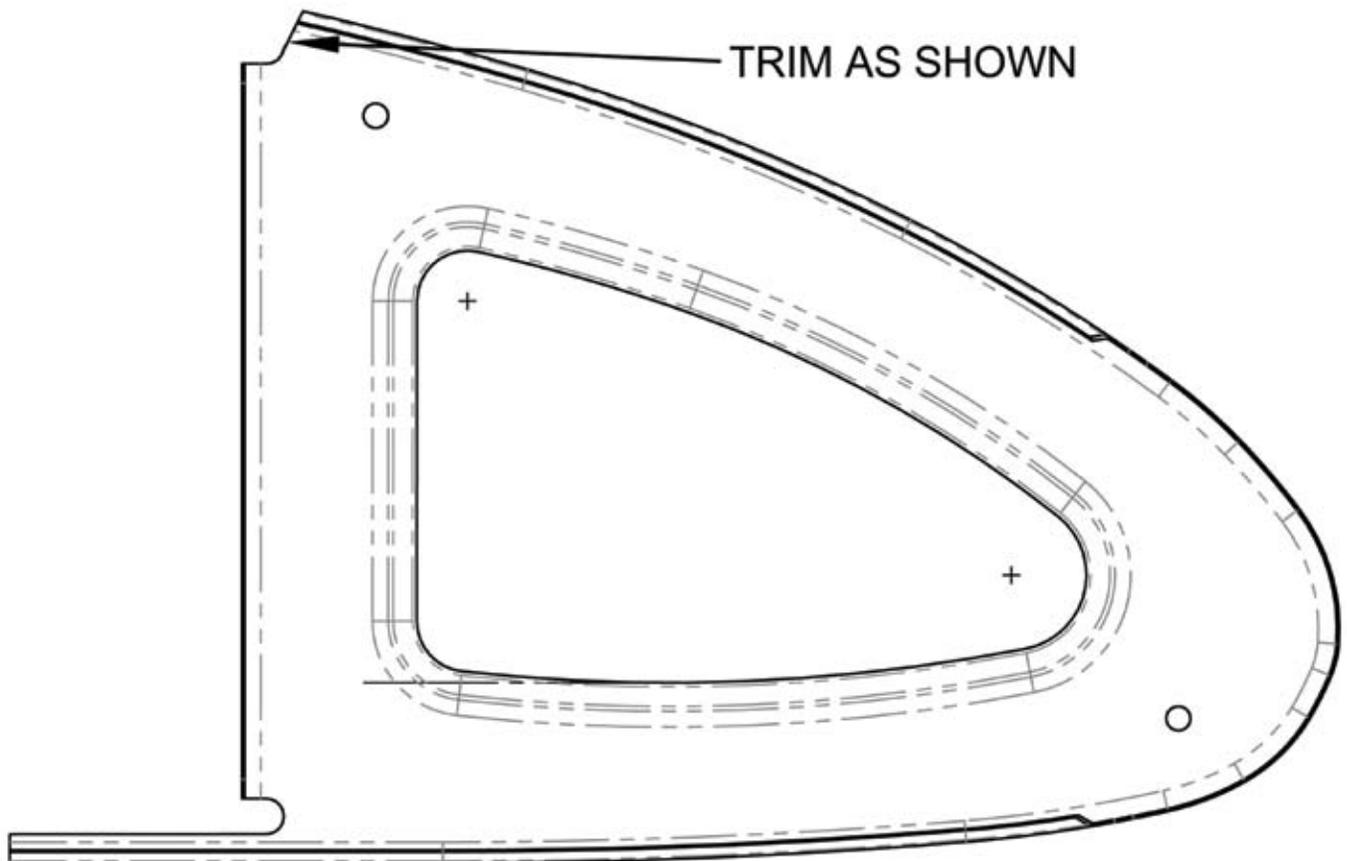


Figure W20

The nose rib between #8 and #9 center ribs needs to be modified before installing. Mark the hole location and trim lines per dimensions in the Figure W21 and Photo 092 below.

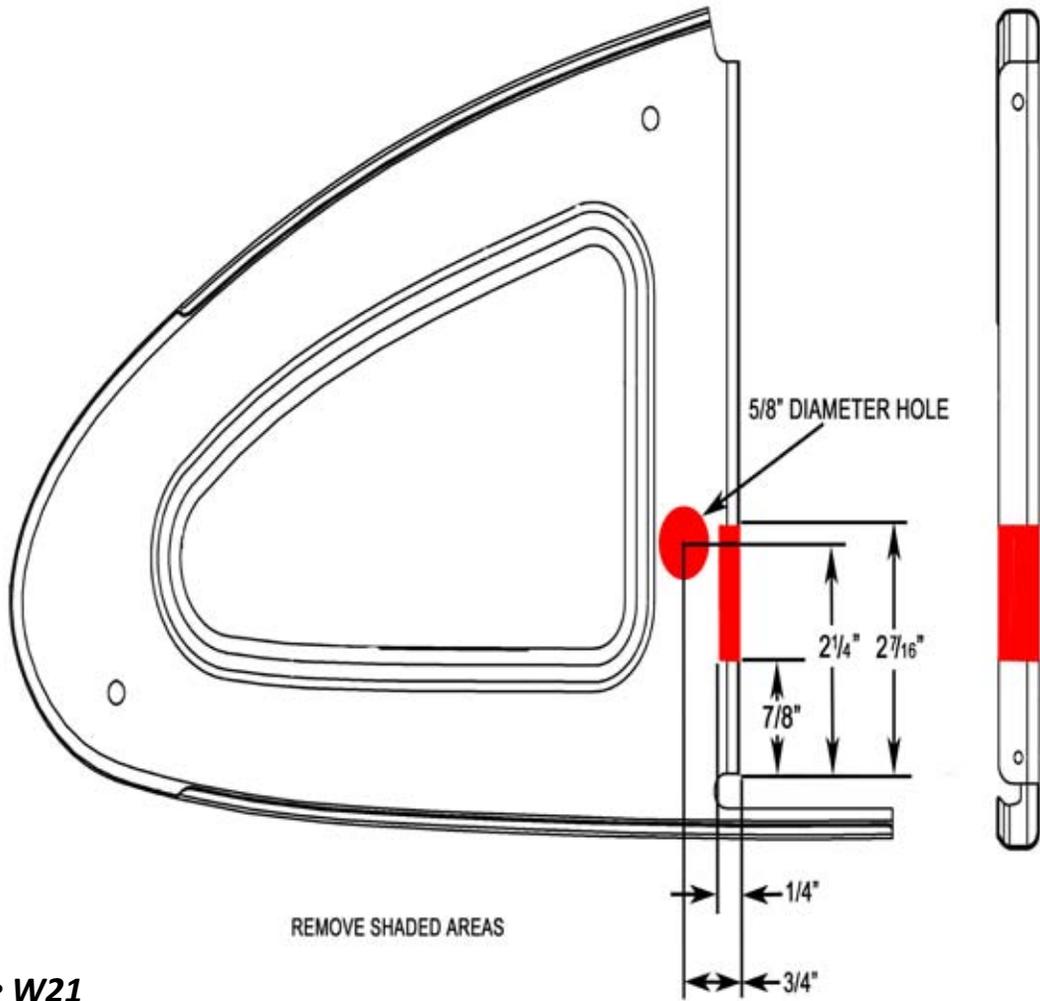


Figure W21



Photo 092

SECTION 14 Install Nose Ribs #1 and #12

In this step we will install 2 nose ribs per Figure W22 with rivets HDW-SS/SS42D.

Only two ribs are necessary at this time. They will be used to help hold the string for squaring the spars in the next step.

USE Figure W41 FOR HARDWARE CALLOUT.



Photo 093

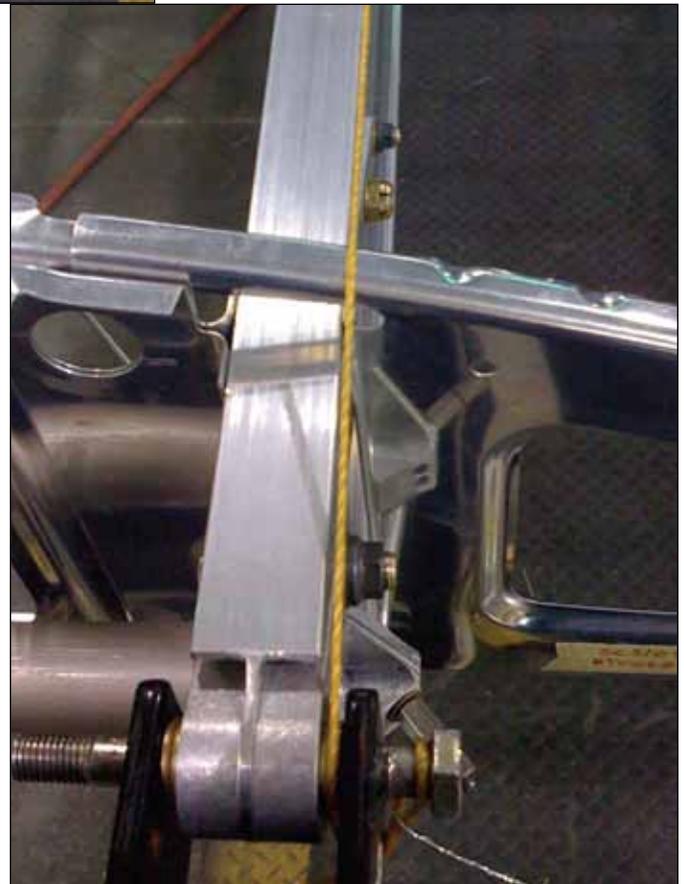


Photo 094

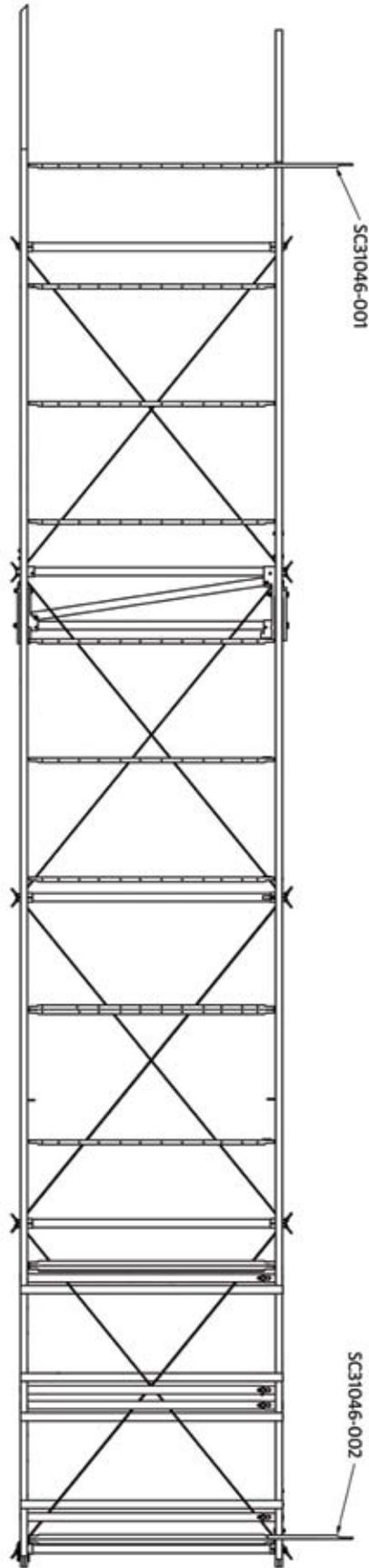


Figure W22

SECTION 15 Squaring the Wing

Ensure the 1" X 1" X 6" block is under the rear spar per sawhorse setup in prep section. The block should be under the rear spar for the rest of the wing build. Trammeling (squaring and straightening) the wing is a critical part of the wing build.

Start by loosening all of the drag-anti drag wire nuts. Start at the #2 compression tube, and check using your modified carpenters square to assure that the compression tube is square with the rear spar. It is critical in this process to make sure that it is square. If necessary, move the rear spar in or out to achieve square.

After the wing is square, lightly tighten the nuts in the first compression bay (this bay will have the fuel tank in it, later). The wires at the #1 rib should protrude from the fitting 1". Once you have 1" protrusion on the #1 rib wires, you will not move these nuts.

Recheck the wing for square. Continue if the wing is still square. If not, tighten one of the nuts at the second compression tube to achieve square. After checking square again, tighten both nuts at the second compression tube 1/2 turn and recheck square, then repeat this process (see next paragraph for goal)

USE THE SQUARE TO CHECK THE #2 COMPRESSION TUBE FROM THE FRONT SPAR AND THE REAR SPAR. THE COMPRESSION TUBE WILL BOW SLIGHTLY WHEN THE WIRES ARE PROPERLY TENSIONED. MAKE SURE THE OUT OF SQUARE CONDITION IS THE SAME ON THE FRONT AND REAR SPAR.

After 2 full turns with the wing still square, check the tension. Find the center of the small wire. Proper tension will result in 1/2" (you will notice that we start at the 1" mark on the rule) deflection equaling 13 to 15 pounds. Keep repeating the previous step until tension is correct and the wing is square. Once you have finished and the tension is correct, verify the wing is still square.



Photo 095



Photo 096

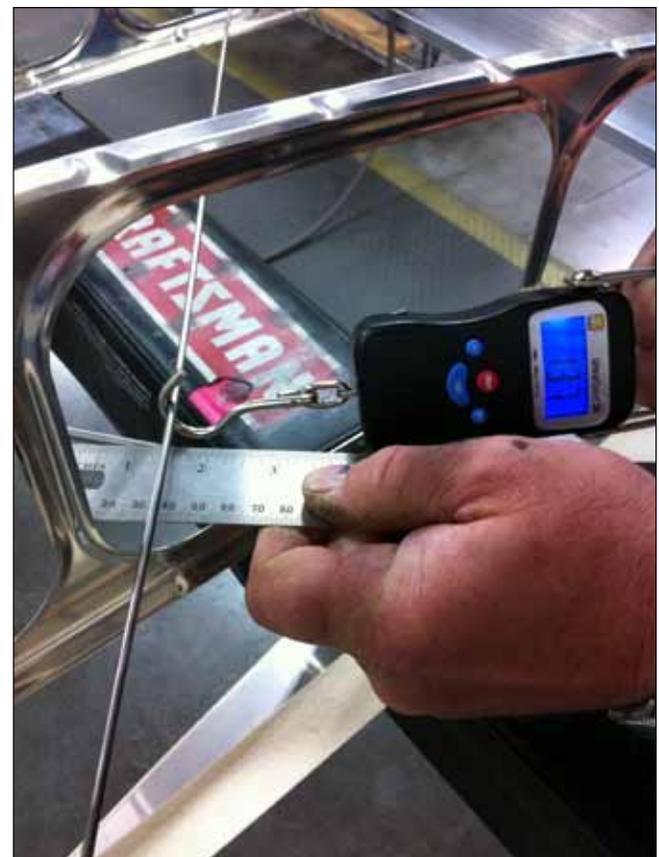


Photo 097


Photo 098

Photo 099

Photo 100

Prepare to square and straighten the remainder of the wing by attaching a string to the inboard end of the rear spar. Pull string to the outboard end of spar. Align the string with the trailing edge of the rear spar. Clamp in place with spring clamps as shown in photos below. Align string with aft edge of spar. Use a straightedge against the spar face and then keep the gap between the straightedge and the string constant. Start with the inboard drag wires and work toward the outboard end of wing. Adjust the nuts at the end of the drag wires to apply tension to them. Measure tension by pulling on wire (SMALL WIRES ONLY) with a scale until 1/2" (from where the wires cross) of wire movement equals a pull of 13 to 15 pounds on the scale. **THE OUTBOARD TRAILING EDGE OF THE WING SHOULD LAY ON THE SAW HORSE AND NOT WANT TO LIFT.**

After all drag wires are properly adjusted apply Loctite #271 to the wire above the 1st nut. Tighten the 2nd nut against the 1st. **DO NOT LOCTITE ANY OF THE INBOARD NUTS ON THE FIRST BAY OF THE WING AT THIS TIME.**



Photo 101



Photo 102

LOG & INSPECTION SHEET WING # 5

Log sheet

	FABRICATION AND ASSEMBLY TASKS	A	B	C	D
		Mfr Kit/Part/ Component	Commercial Assistance	Am-Builder Assembly	Am-Builder Fabrication
	Wings - 51 Listed Tasks				
	Task #				
W9	Fabricate Drag/Anti-drag Truss Members	.75			.25
W10	Assemble Drag/Anti-drag Truss Members to Wing			X	

Inspection point

	INSPECTION ITEMS	BUILDER	ALTERNATE
1.9	Ensure that fairleads are installed properly.		
1.10	Using a square, ensure #2 compression tube is square to the spars.		
1.11	Ensure that drag/anti drag wire tension is correct.		
1.12	Ensure that drag/anti drag wires are tight and saftied.		
1.13	Check for clearance between ribs and drag/anti drag wires.		

SECTION 16 Install Diagonal Cross-tube

Trim one end of tube SC31004-005 as shown in the photo below and Figure W23. Install end of tube with the cut out in the front spar fitting first, locating the cut out over the bolt head and then in rear spar fitting. Align the center of the tube with the center of the pre-drilled holes in the fittings. Match drill top and bottom of the front spar using a #12 drill bit and install bolts per Figure W24 and Figure W25.



Photo 103



Photo 104

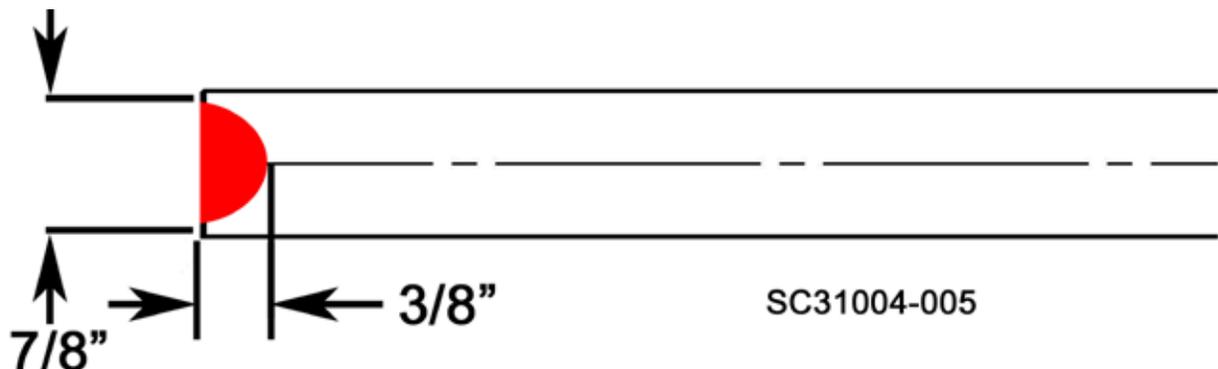


Figure W23

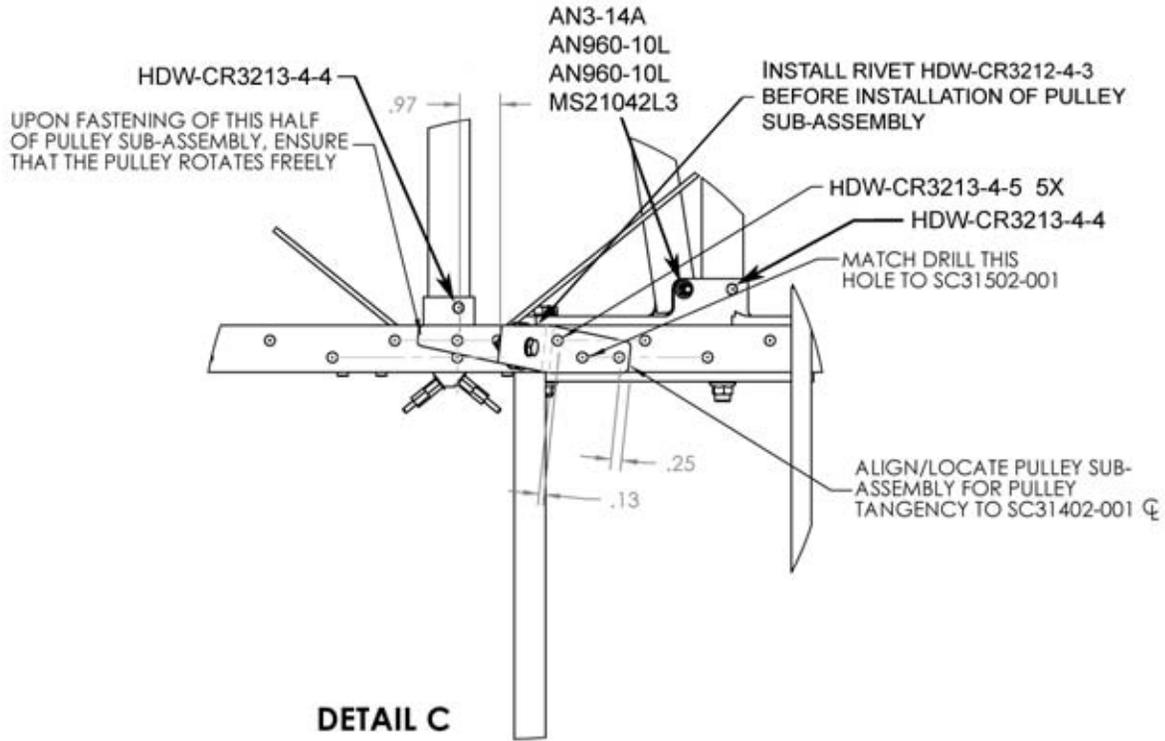


Figure W24

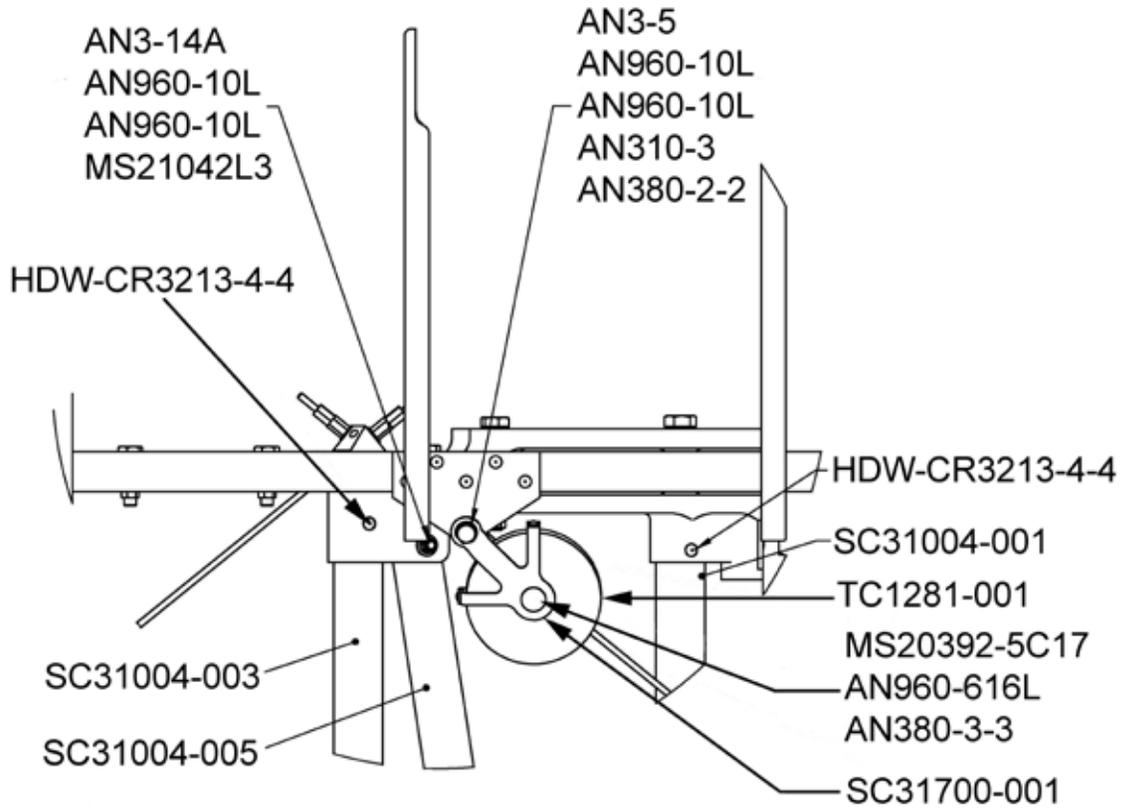
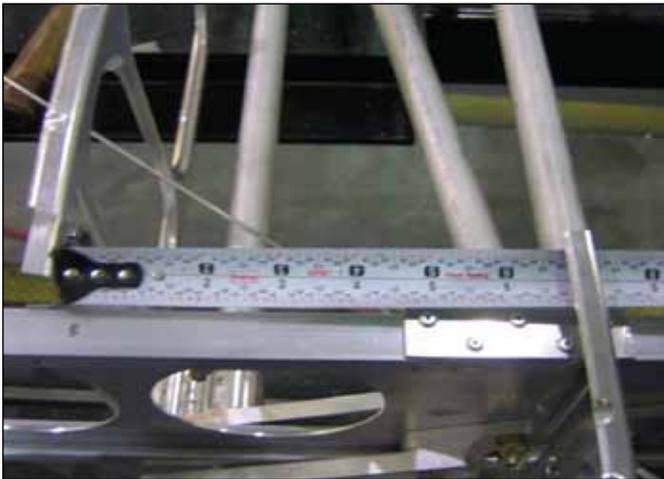
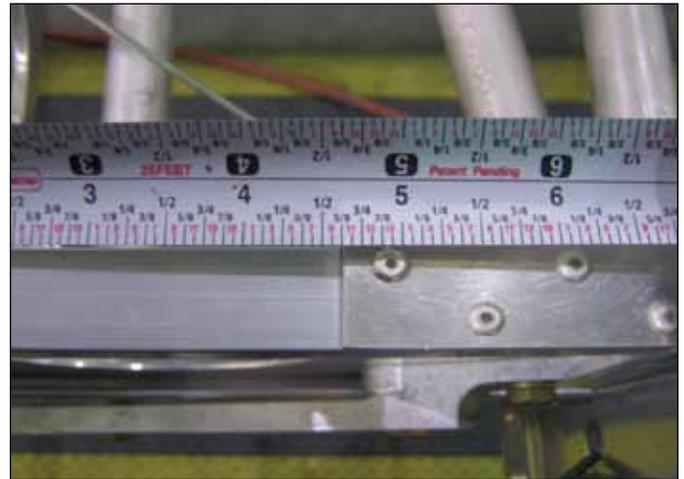
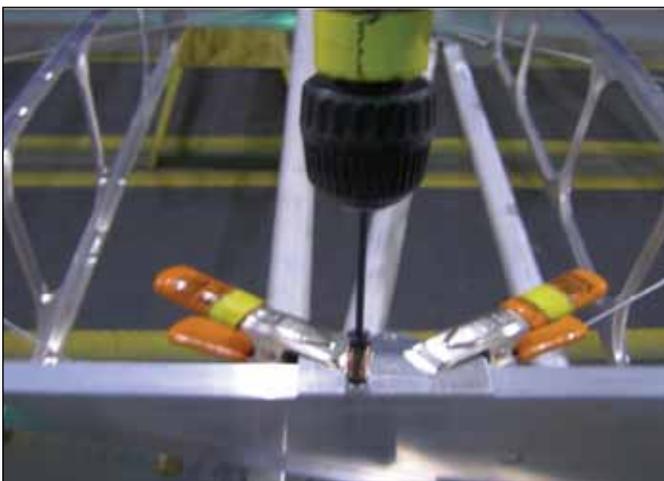


Figure W25

SECTION 17 Attach Front Spar Pulley Bracket

Install pulley bracket (P/N SC31504-001) to front spar. Location on the spar is critical. The spar top must be drilled between the webs. Measure from the #8 rib outboard 4 5/8" to the edge of the pulley bracket. Clamp bracket in place and drill, using a #30 bit, and then Cleco in place. Remove Clecos, one at a time, and install Cherry Max rivets HDW-CR3213-4-4. **USE A DRILL STOP WHEN DRILLING HOLES TO AVOID DAMAGE TO SPAR.**

*Photo 105**Photo 106**Photo 107**Photo 108*

SECTION 18 Attach Rear Spar Reinforcement

Install reinforcement strip, P/N SC31601-003. Insert bolt into butt hinge and hook the measuring tape end over the bolt. Use a spring clamp to hold the tape in place.

Measure down spar to $83 \frac{15}{16}$ " (+ $\frac{1}{16}$ - $\frac{3}{16}$).



Photo 109

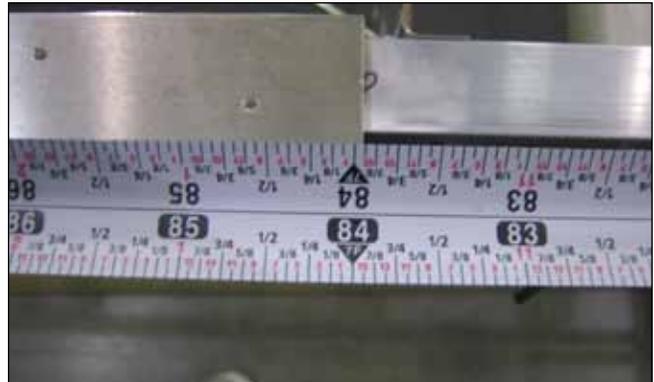


Photo 110

Center strip onto rear spar and clamp into place. Location on the spar is critical. Ensure the reinforcement strip is positioned correctly. Use Figure W25 to place reinforcement strip, notice the hole locations. The spar top must be drilled between the webs. **USE A SHARP #30 DRILL BIT WITH A DRILL STOP (NEEDED TO PREVENT DAMAGE TO BULB OF SPAR) TO MATCH DRILL HOLES IN SPAR.** Begin drilling holes from the inboard end of strip. Drill and Cleco every 6" checking that strip remains centered on spar. Counting from the inboard end, hole 22 and 24 are countersunk and hole 23 should be un-drilled. The countersinking is to allow for later placement of the pulley bracket. Make sure that the rivet stud is flush with the surface. File to remove the remnant if necessary. Hole 23 is match drilled to connect everything together.

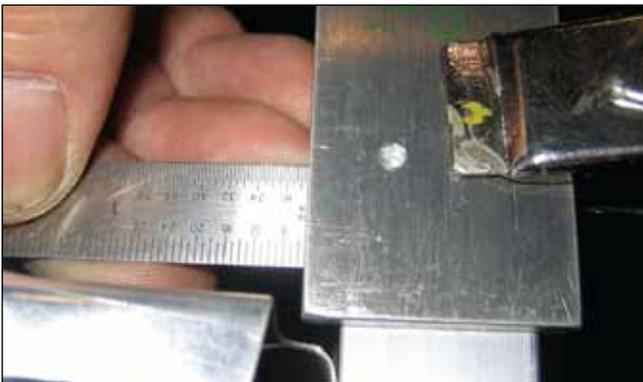


Photo 111



Photo 112

LEFT WING SHOWN

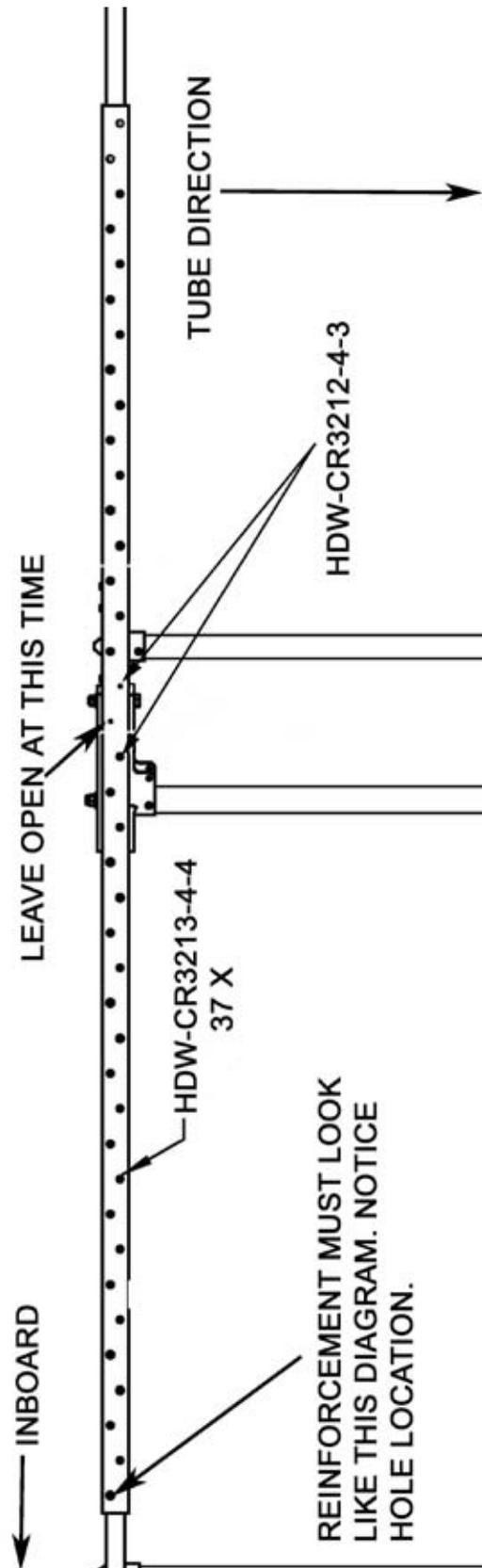


Figure W26

Deburr all holes. Insert Cherry Max rivets to complete installation of the strip.



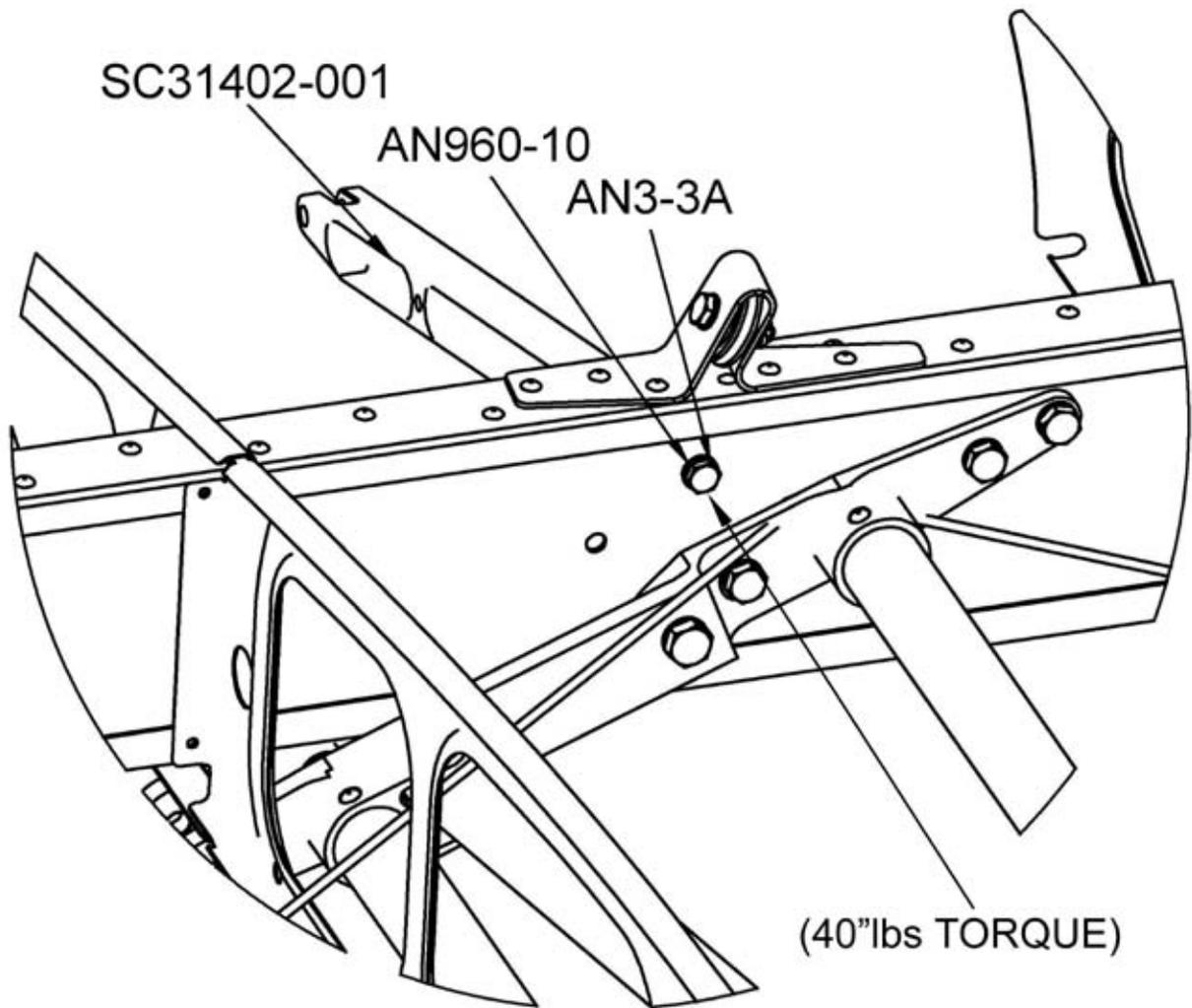
Photo 113



Photo 114

SECTION 19 Attach Aileron Center Hanger

Install center aileron hanger per drawing Figure W27. Use red Loctite #271 on the bolt before installing in hanger. Use a string through the center of the hole on the outboard aileron hanger to the center of the inboard hanger. The string will ensure that the holes in the center aileron hanger are parallel to the string. Later, this same procedure will be used when attaching the center hanger to the false spar.

**CENTER AILERON HANGER DETAIL***Figure W27*

SECTION 20 Attach Rear Spar Pulley Bracket

Assemble pulley and bracket as shown in Figure W28. **DO NOT INSTALL THE COTTER PIN AT THIS TIME.**

Attach string as shown in Photo 115 below. Route the string through the pulley as shown in photo Photo 116. The string should form as straight a line as possible from the pulley to the center of the aileron hinge.



Photo 115



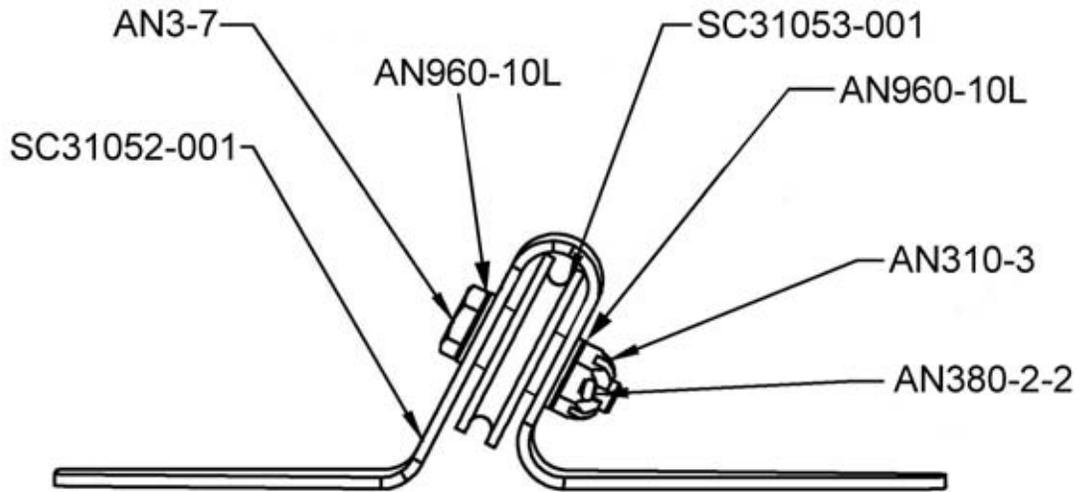
Photo 116



Photo 117



Photo 118



PULLEY SUB-ASSEMBLY

Figure W28

Drill and insert cherry max rivets per pictures and Figure W29. Please pay attention to the sequence of riveting in Figure W29. **USE A DRILL STOP WHEN DRILLING HOLES TO AVOID DAMAGE TO SPAR. YOU WILL BE REMOVING THE PULLEY AND ATTACHING HARDWARE BEFORE COVER. THE PULLEY, CABLE, AND ATTACHING HARDWARE WILL BE REINSTALLED AFTER THE WINGS HAVE BEEN INSTALLED.**



Photo 119

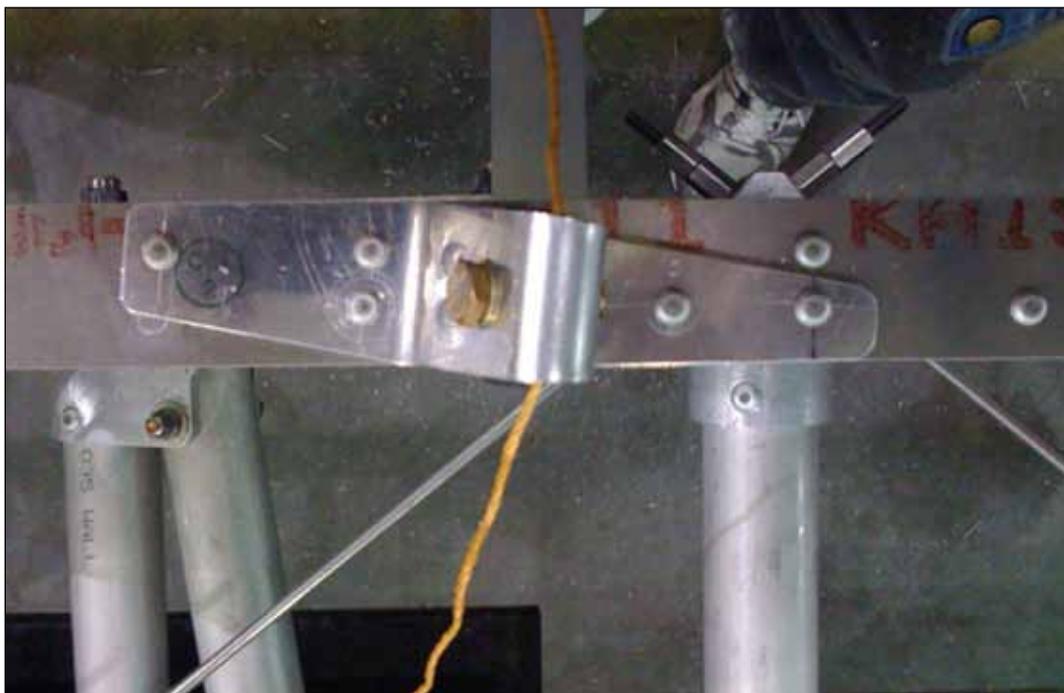


Photo 120

VIEWED FROM FRONT

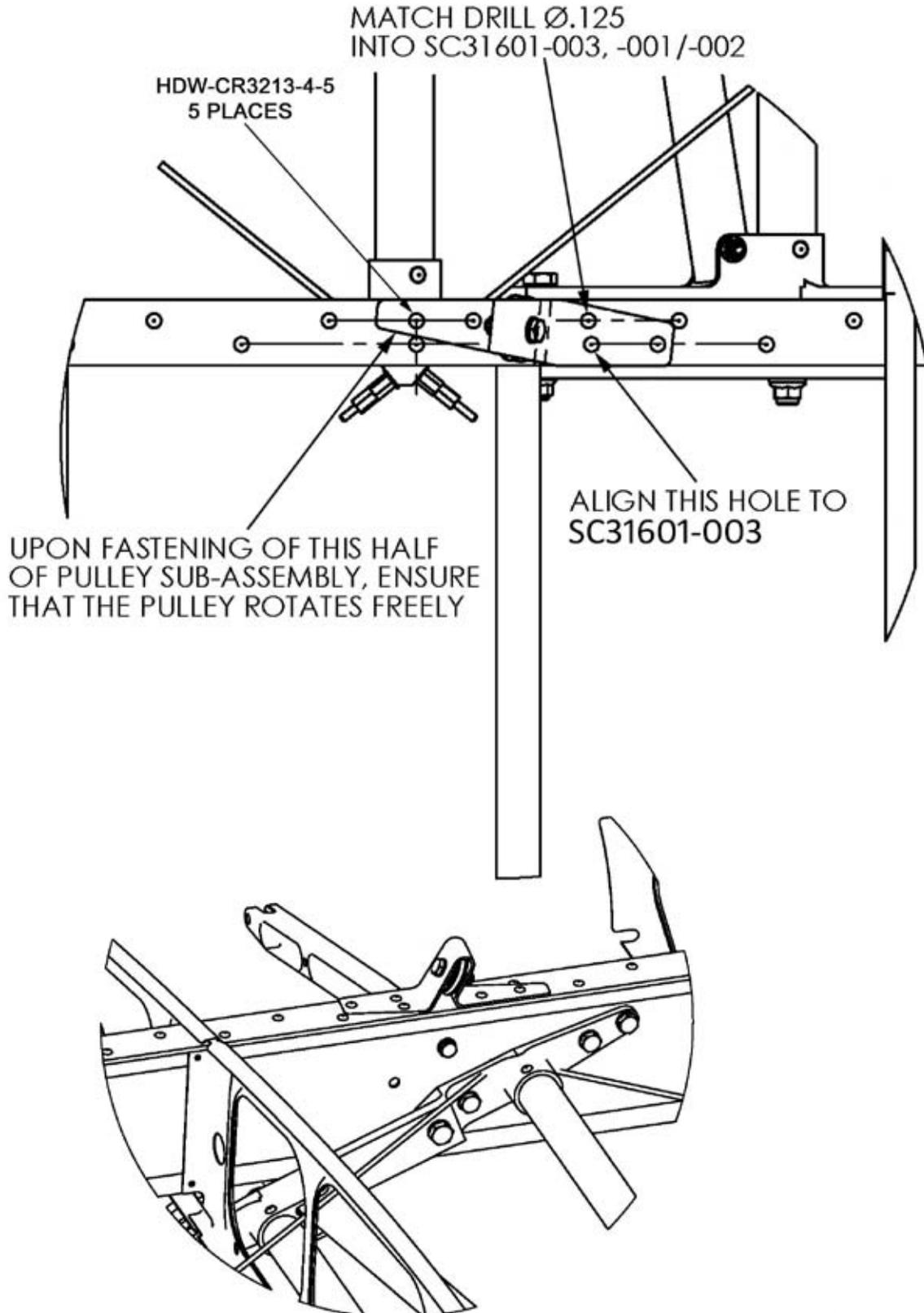
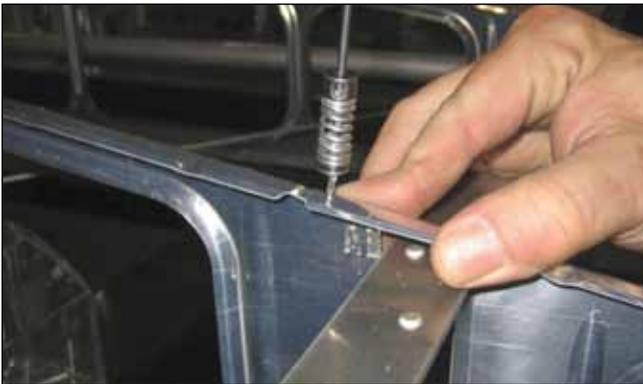
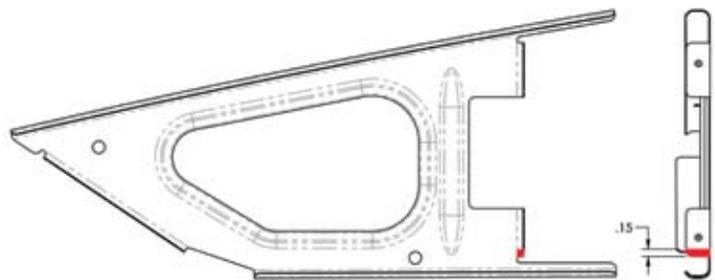


Figure W29

SECTION 21 Install Trailing Edge Ribs

Fasten tail ribs to the rear spar per Figure W31. Start at the #1 rib and work your way outboard through the flap ribs (see Figure W30 for number two trailing edge rib) and then the aileron ribs. Ensure that tail rib fits over the center rib (top and bottom) where they meet. **USE A DRILL STOP WHEN DRILLING HOLES TO AVOID DAMAGE TO SPAR.** Drill holes with a #30 bit and rivet with HDWSS/SS42D rivets. Tail rib fits over center rib. Attach tail rib to center rib. Use a #40 bit to drill holes, dimple and then squeeze rivet the tail rib to center rib top and bottom per Figure W32 for rivet positioning. Use the modified rivet squeezer as in previous steps.

**Photo 121****Photo 122****Photo 123****Photo 124****Photo 125****Figure W30**

Remove the red shaded area shown in Figure W30 to allow the false rib to fit between the spar and trailing edge rib. **THIS IS ONLY FOR THE NUMBER TWO MAIN TRAILING EDGE RIB. THE FALSE TRAILING EDGE RIB BETWEEN NUMBER ONE AND NUMBER TWO RIBS DOES NOT NEED TO BE TRIMMED.**

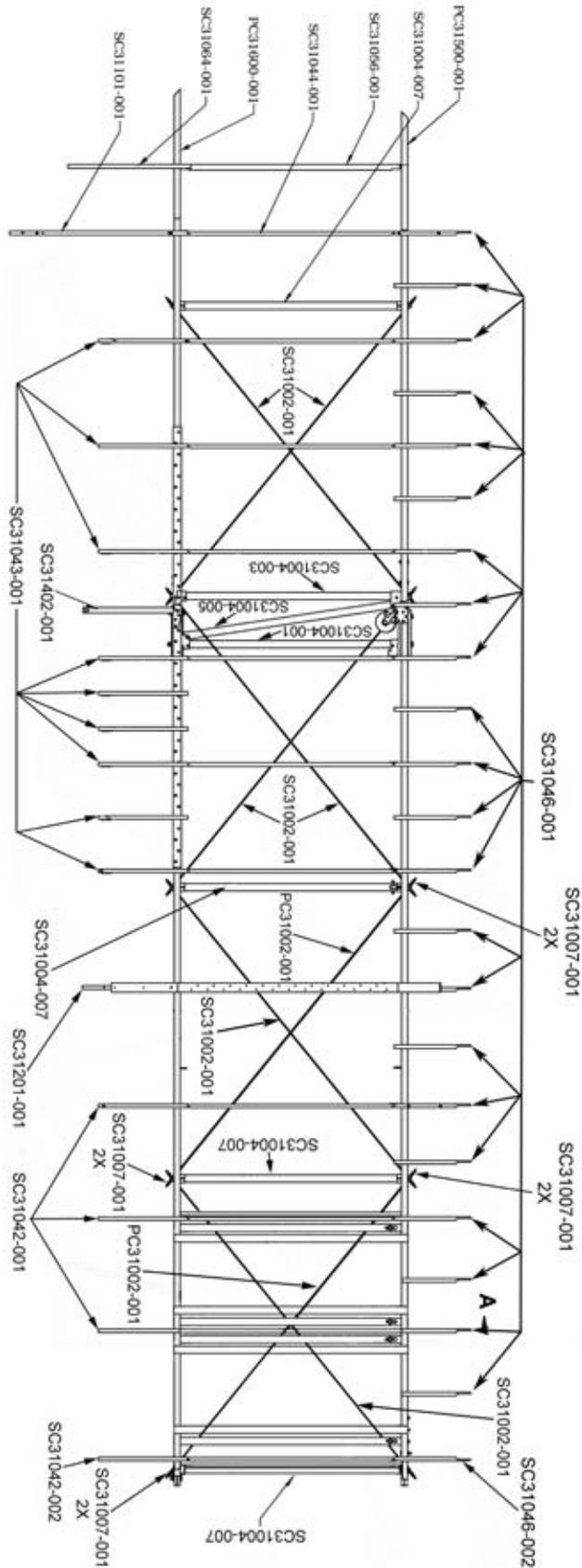
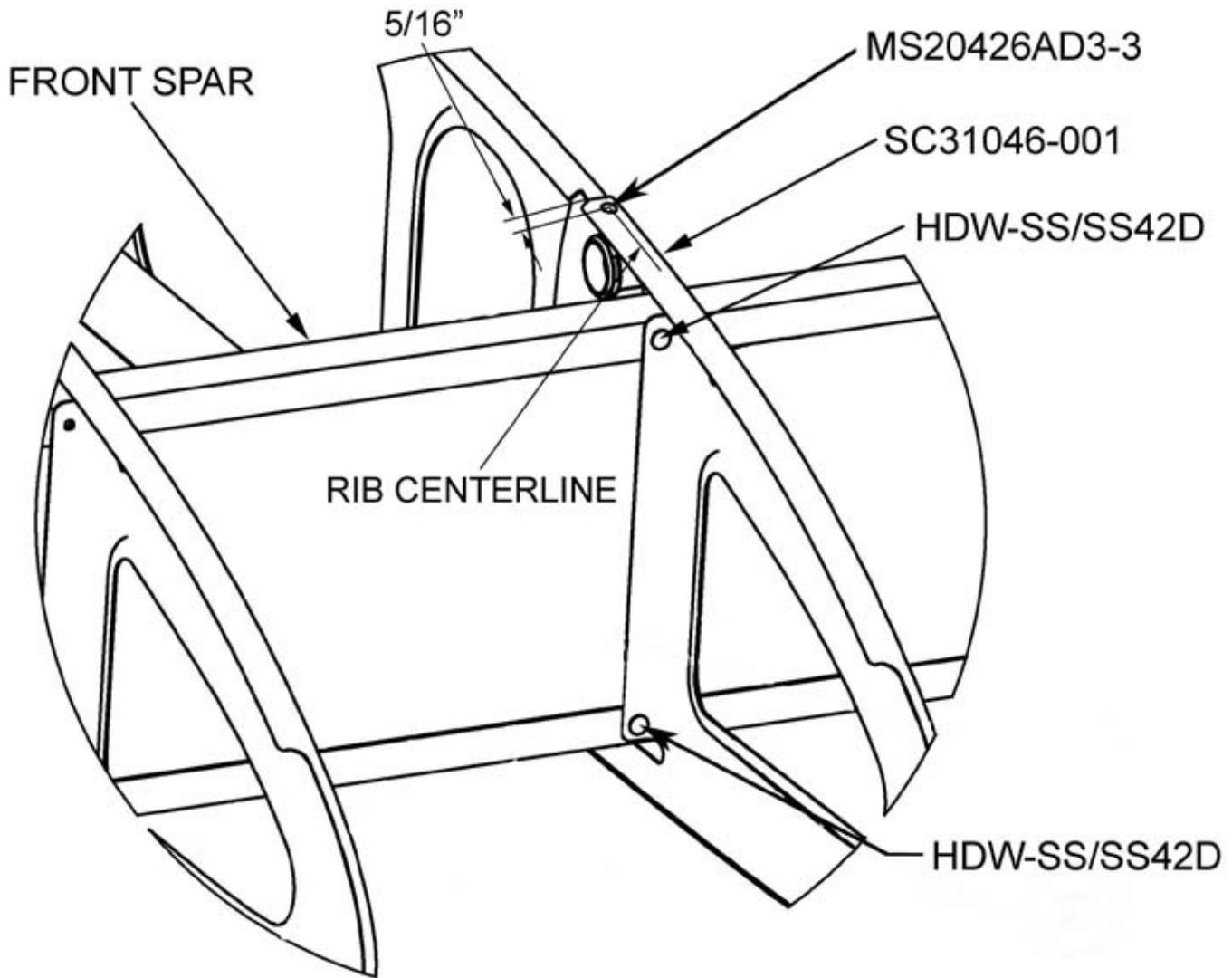


Figure W31



NOSE RIB AND TAIL RIB RIVET SPACING AND RIVETING

Figure W32

SECTION 22 Install False Spars

False spars will be installed moving from inboard to outboard per Figure W33. Press false spar into rib to eliminate gap. Clamp the lower edge of the first false spar in place. Ensure all tail ribs are at a 90° angle to spar. Use a small square to assure perpendicularity. Use Figure W34 and Figure W35 for rivet spacing. Using a #30 bit, drill hole and rivet (HDWSS/SS42D) the top edge first. Begin with the main ribs first then rivet the tail ribs. **READ SECTION 23 BEFORE STARTING THE FALSE SPARS.**



Photo 126



Photo 127



Photo 128



Photo 129



Photo 130

Do not drill the #1 rib top and bottom rivet holes until the cap strip are installed in SECTION 40

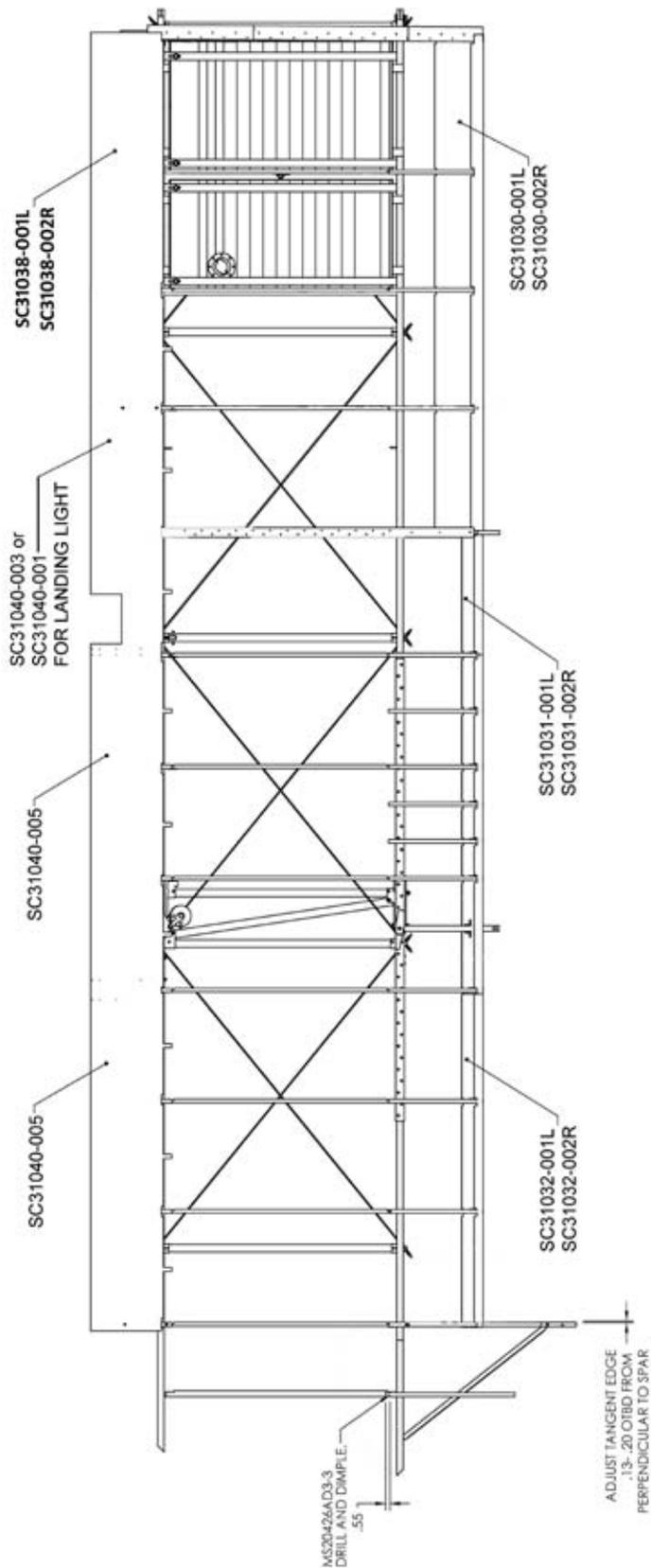


Figure W33

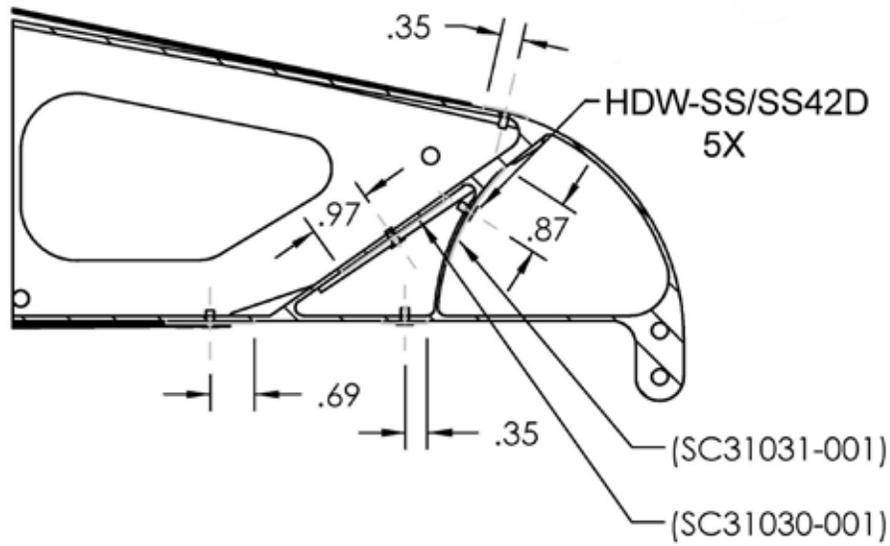


Figure W34

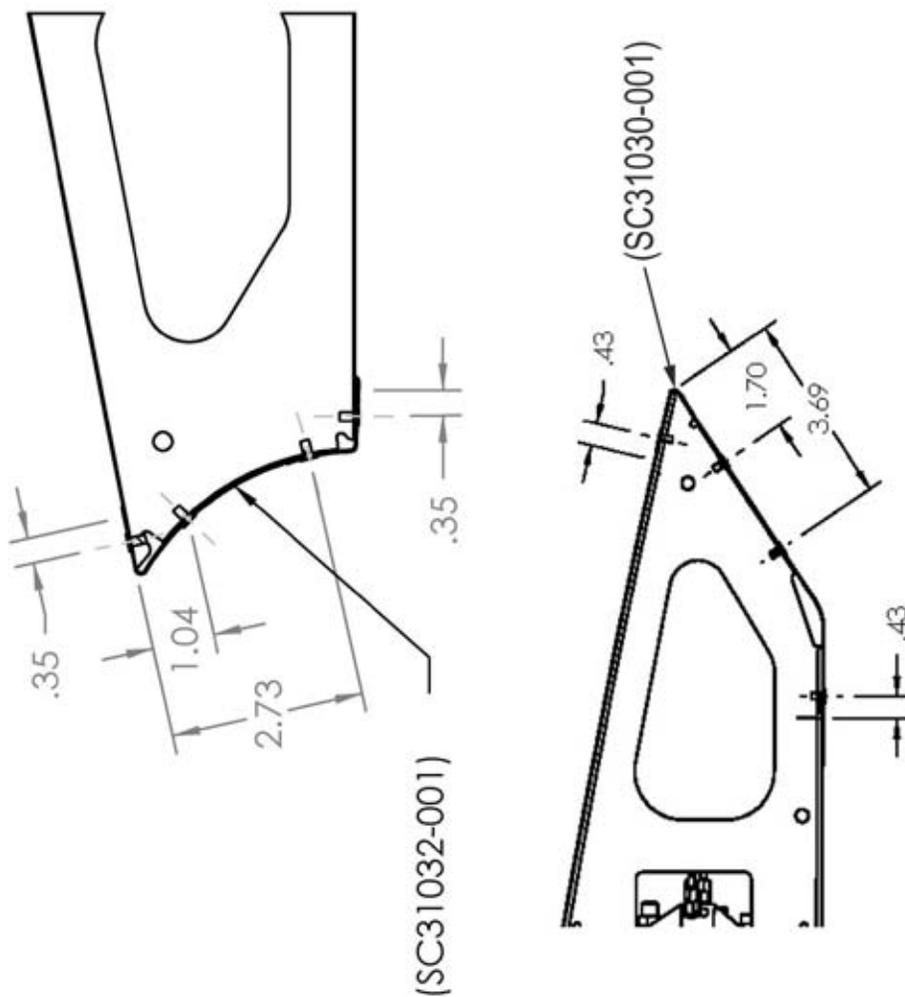


Figure W35

A simple marking template can save a lot of time marking the middle false spar rivet locations. Here is a simple template for the middle rivets in the flap false spar. In this method, a long drill is used so that the holes can be drilled from inboard to outboard. Install bottom edge rivets on inboard false spar last.

**Photo 131****Photo 132****Photo 133**

Typically the top and bottom rivets are 0.43 inch back for the flap section and 0.35 inch back for the aileron section. Keep false spar tight against the ribs during drilling and riveting.

**Photo 134**



Photo 135

When lapping false spar panels, the inboard section goes under the outboard section. Ensure that the location of rivet holes is in the center of the flap/aileron rib. In most cases the rib will be centered in the slots in the false spar. On rare occasions, a bit of trim is necessary to allow the spar to sit flush. Continue outboard until all but the last aileron false spar panels are in place. When you get to the aileron hanger, create a small rectangular hole to allow the false spar to fit.



Photo 136



Photo 137

Use an Angle Drill to drill holes for rivets on the flap/aileron hanger per Figure W34 for spacing. Before drilling and installing rivets in the flap/aileron hanger, use a square (as shown below) to verify that it is square with the rear spar. Hand squeeze rivets (HDW-SS/SS42D) at these two locations. Install rivet in bottom of flap/aileron hanger.

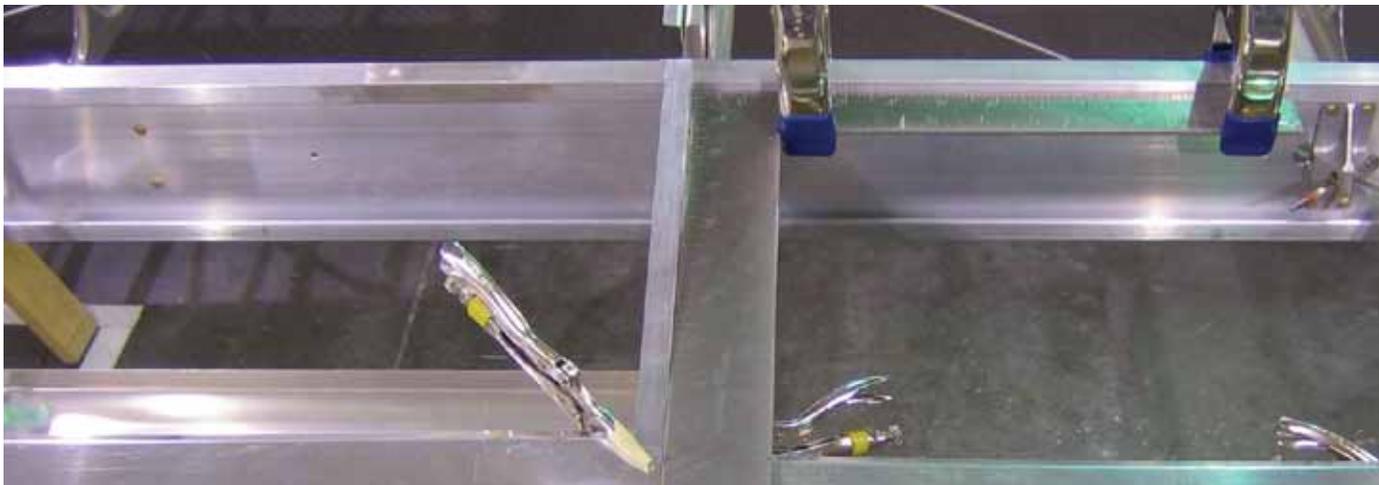


Photo 138



Photo 139



Photo 140



Photo 141

SECTION 23 Finalizing Aileron Hanger and Outboard Machined Rib

Using a string (through the holes) or sighting through the holes, assure that the holes in the outboard machined rib, center aileron hanger and inboard machined rib are in line. Install aileron as shown in the picture below. **BE SURE TO HAVE THE LAST OUTBOARD AILERON FALSE SPAR SET IN PLACE BEFORE THE AILERON IS INSTALLED. DO NOT RIVET THE LAST OUTBOARD AILERON FALSE SPAR UNTIL THE PROPER AILERON SPACING IS ACHIEVED. YOU MAY NEED TO MOVE THE LAST AILERON FALSE SPAR FOR PROPER FIT. ONCE THE AILERON SPACING IS CORRECT, YOU WILL BE ABLE TO INSTALL THE TOP AND BOTTOM RIVETS IT THE FALSE SPAR AND LOCK THE MACHINED IN PLACE.**



Photo 142

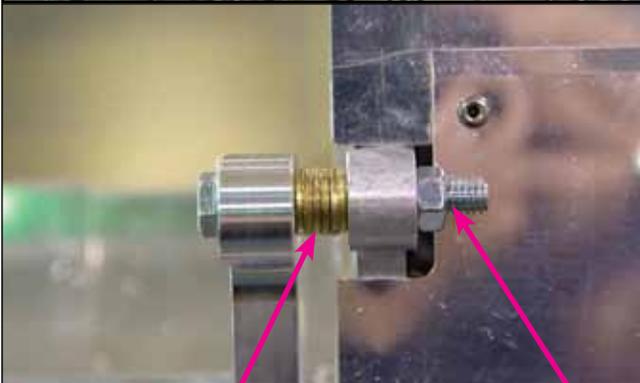


Photo 143

AN960-416 Washers (4 minimum).
INBOARD AILERON HANGER Any 1/4" bolt and nut.



Photo 144

Wrap with 5 wraps of masking tape to avoid damage to the aileron horn.

Hook the end of the tape measure to the outside of the flap/aileron hanger to the center of the aileron horn and verify that the measurement is 51 11/16" ±1/16"

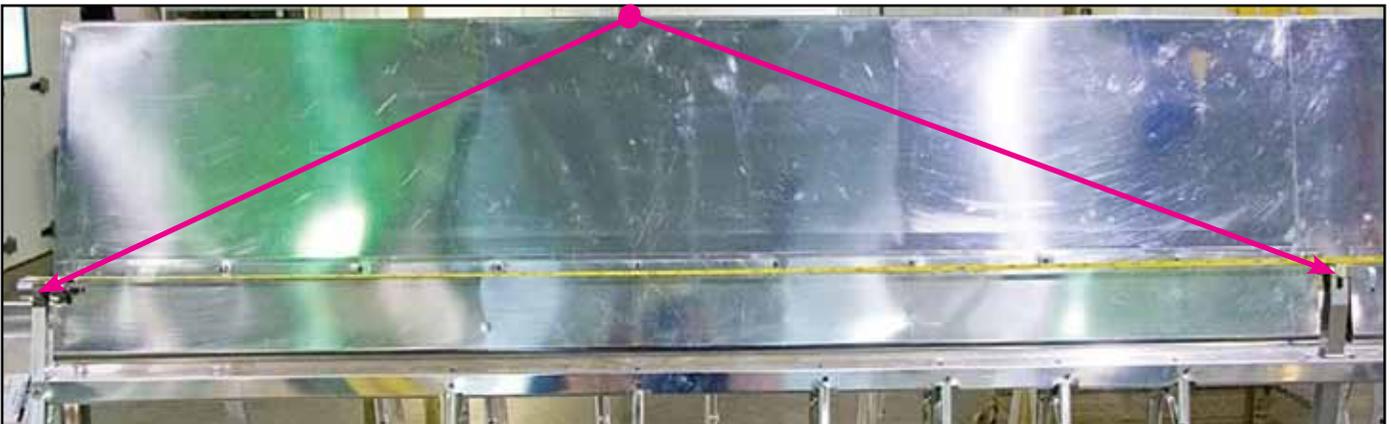


Photo 145

**Photo 146**

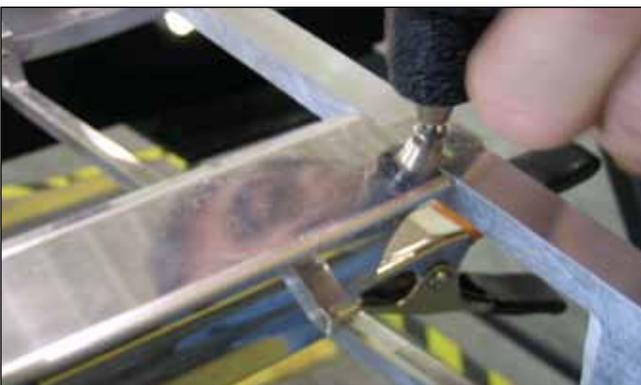
Once you have verified a measurement of 51 11/16" between outboard edge of the aileron hanger and center of aileron hanger, you can drill the false spar to position the aileron hanger. Using an angle drill and #30 bit to drill holes for rivets and install Clecos.

DO NOT RIVET AT THIS TIME.

**Photo 147**

Before drilling and riveting the outboard machined rib, make sure the offset is maintained per Photo 148. Use enough washers (shown in Photo 147) to achieve the 5/16" spacing between the outboard machined rib and the aileron.

THE SPACING BETWEEN THE AILERON AND THE OUTBOARD MACHINED RIB IS VERY CRITICAL. ONCE YOU SHRINK THE FABRIC, THE OUTBOARD MACHINED RIB WILL BE PULLED TOWARDS THE AILERON. TO ADJUST FOR THE FABRIC PULL, YOU WILL NEED TO MOVE THE OUTBOARD MACHINED RIB TOWARDS THE TIP BEFORE COVER. THAT IS WHAT IS BEING SHOWN IN Photo 148.

**Photo 148****Photo 149**

Using a #30 bit, drill holes for rivet on top and bottom of false spar into the machined rib.

Maintain a 2D edge distance when drilling rivet holes in outboard end of false spar and install rivets (HDW-SS/SS42D).

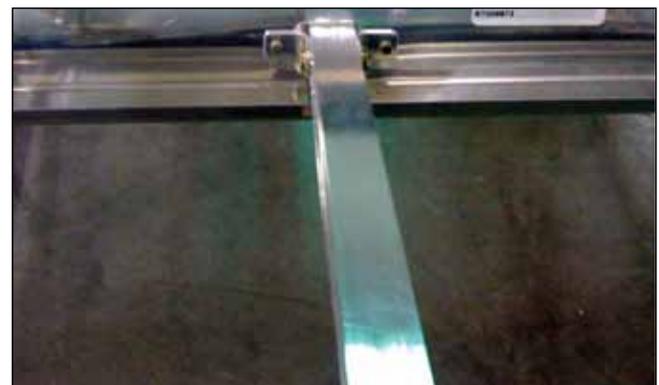
Remove aileron and store in a safe place.
Install angles to the aileron hanger per Figure W36.
Apply Red Loctite to the screws before installing.

**Photo 150**

Install rivets for aileron hanger per Figure W36.

**Photo 151**

When aileron hanger is finished it should look like
Photo 152 outside and Photo 153 inside.

**Photo 152****Photo 153**

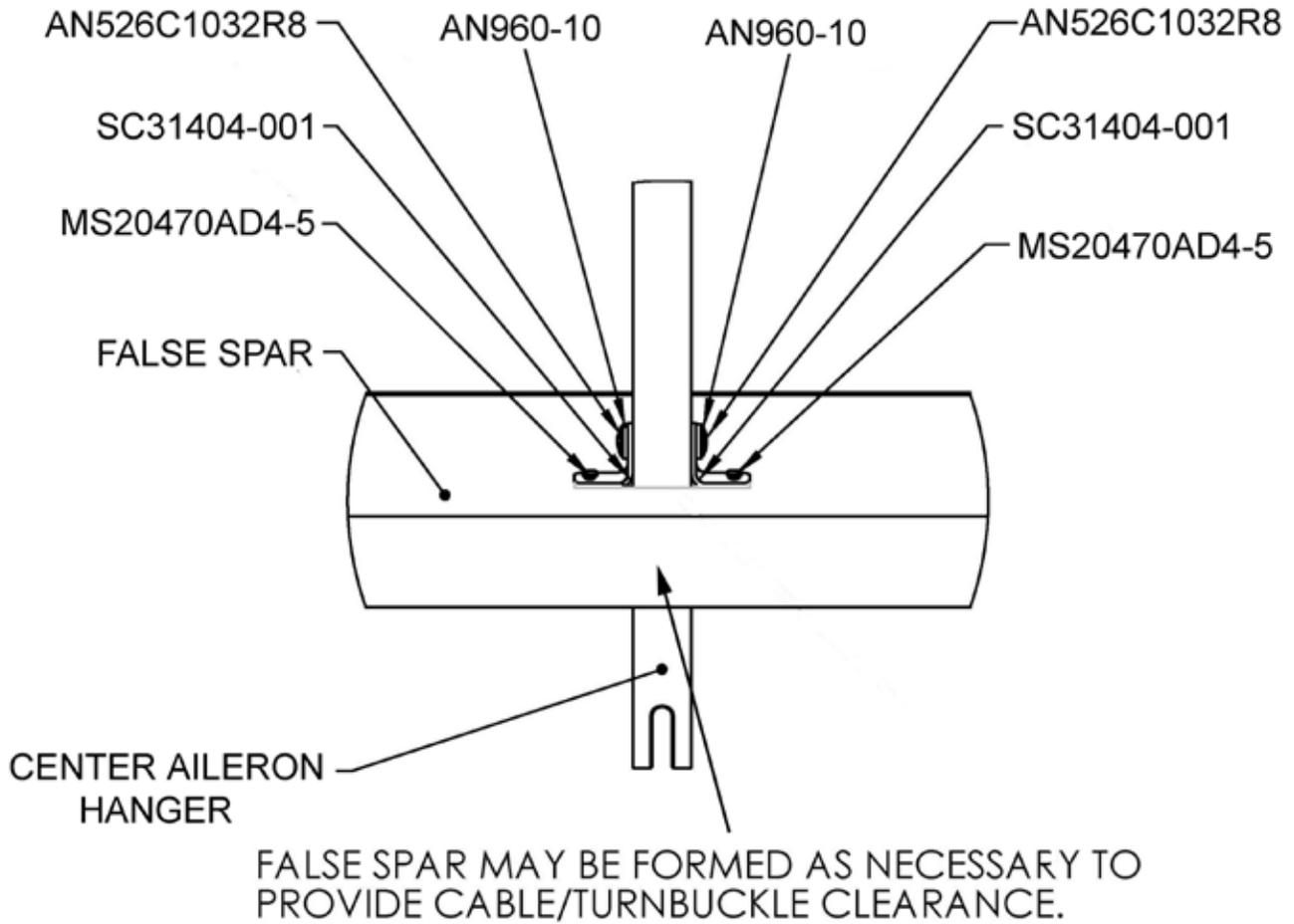


Figure W36

Install center rivet in outboard false spar and machined rib per picture below. Maintain a 2D edge distance when drilling rivet holes in outboard end of false spar. Install rivets (HDW-SS/SS42D).

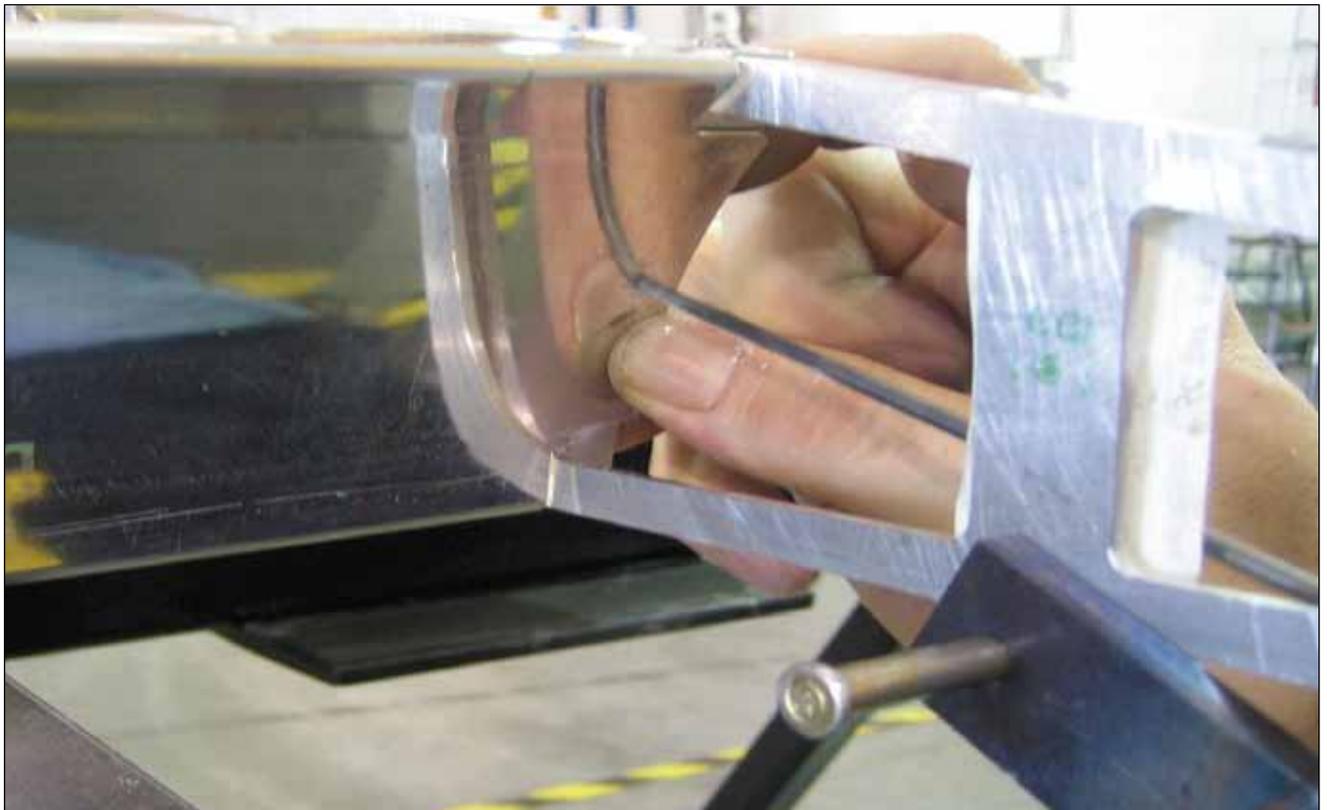


Photo 154

SECTION 24 Installing Machined Rib Clips

Install clip P/N SC31055 on top and bottom of #5 rib per Figure W37. Drill 2 holes with a #40 bit, dimple and rivet in place. The cap strip P/N SC31054-001 will locate the center hole for the tail rib rivet when installed on top clip only. **DO NOT INSTALL THIS RIVET AT THIS TIME.**

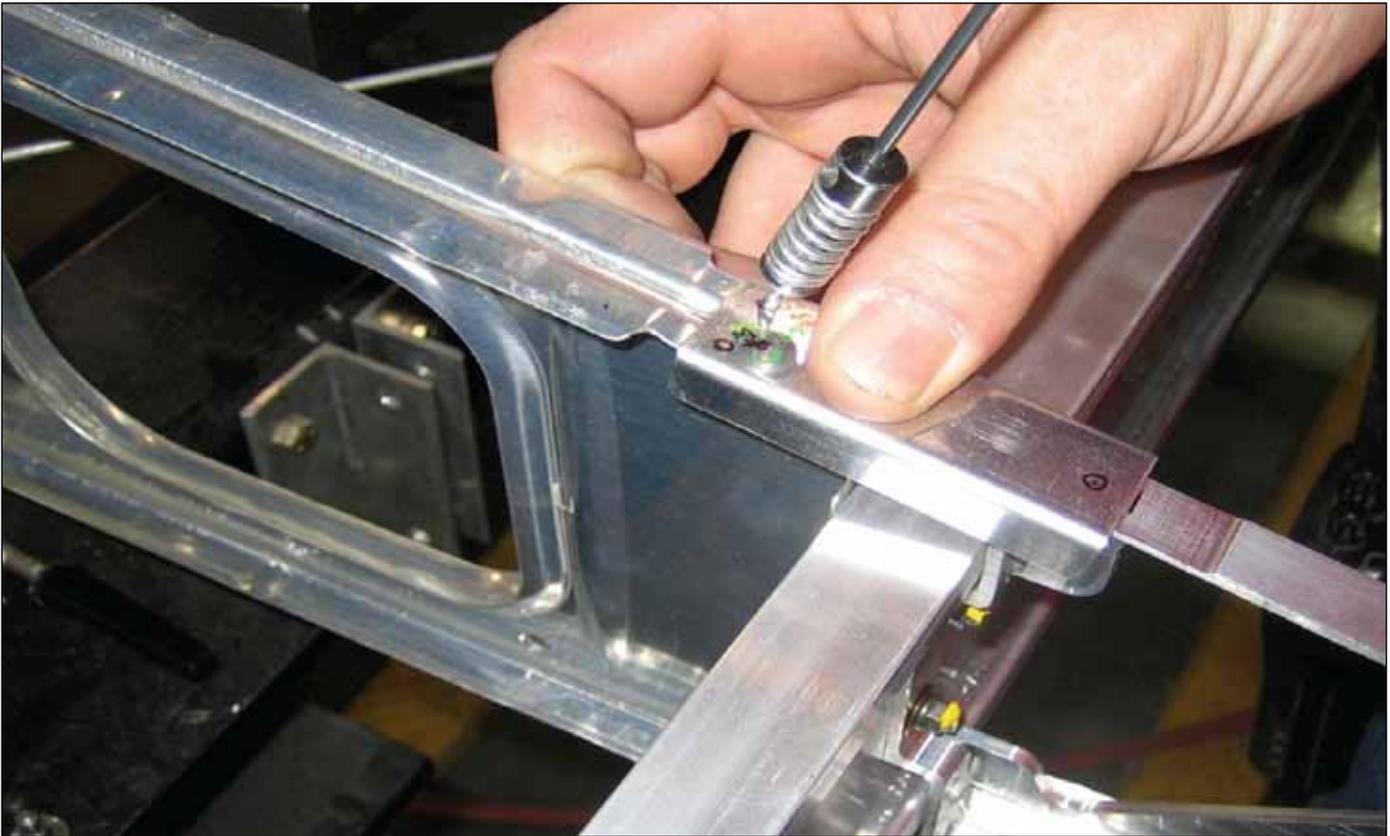


Photo 155

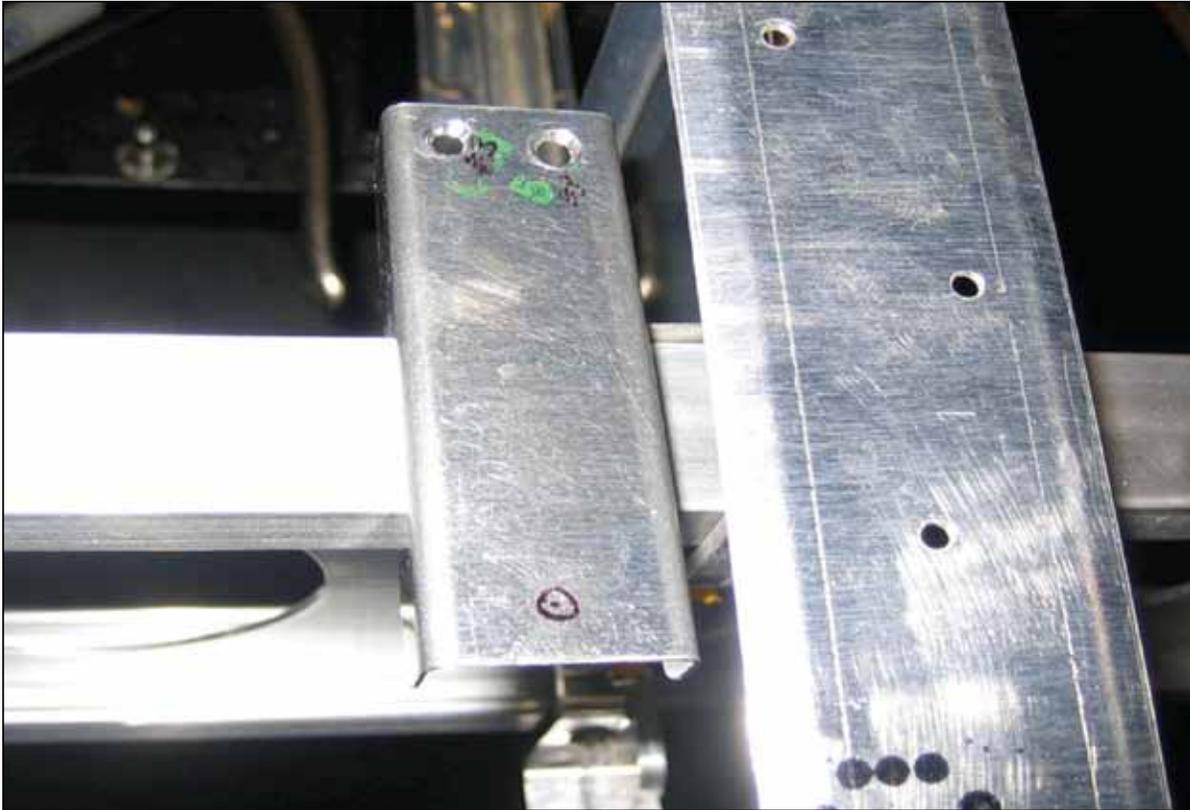


Photo 156



Photo 157

Install lower clip P/N SC31055 per Photo 173 on Rib #5 using 2 MS20426A3-3 in the front of the clip and 1 MS20426AD4-4 in the rear. Maintain 2D clearance. Countersink holes and rivet in place.

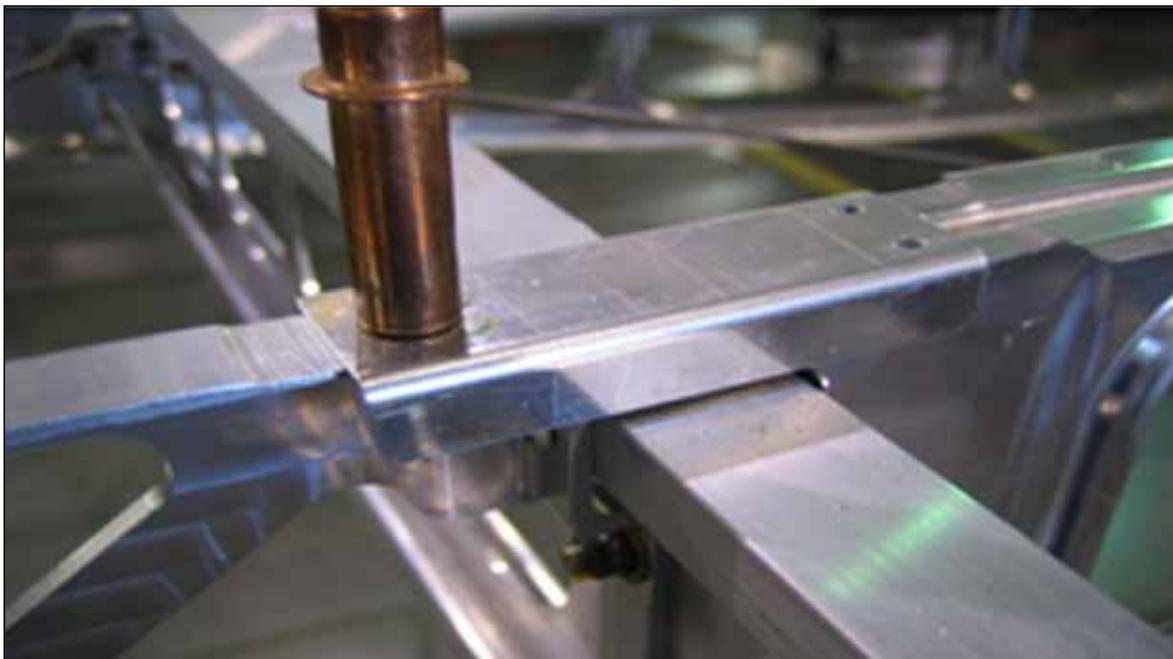


Photo 158

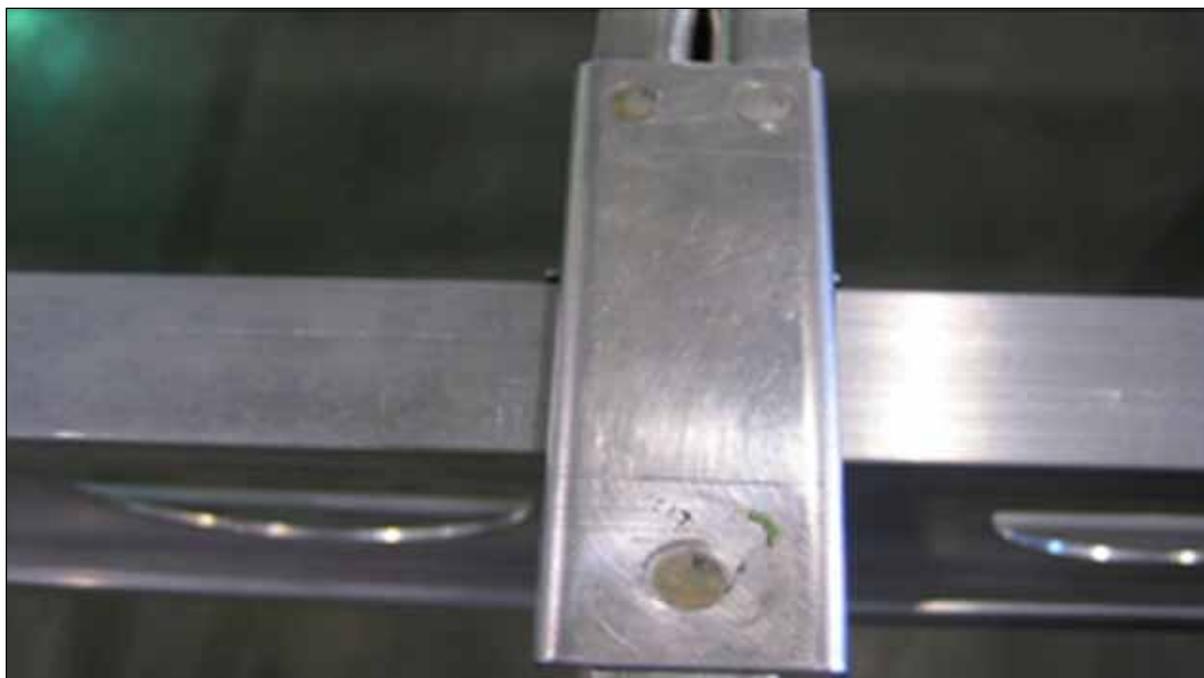
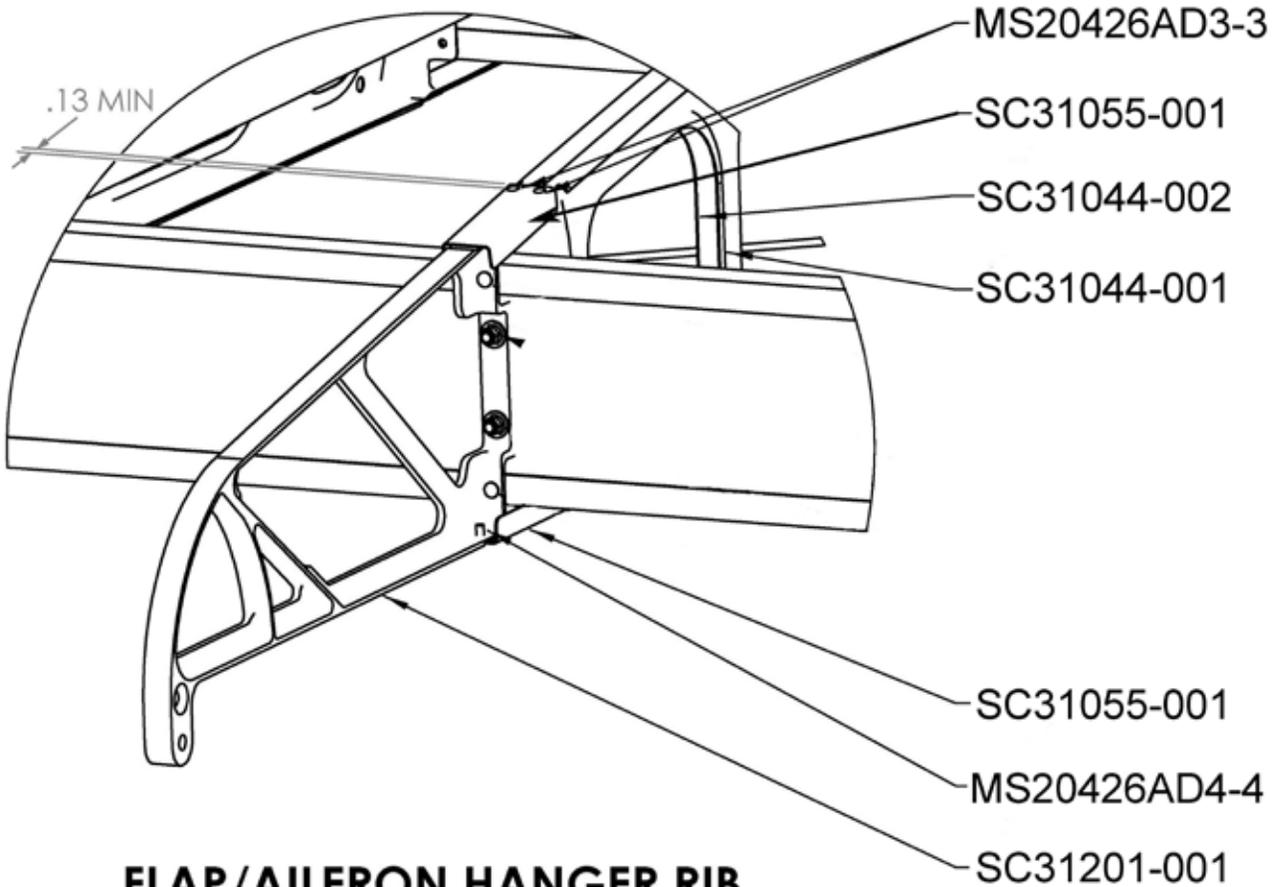


Photo 159



FLAP/AILERON HANGER RIB

Figure W37

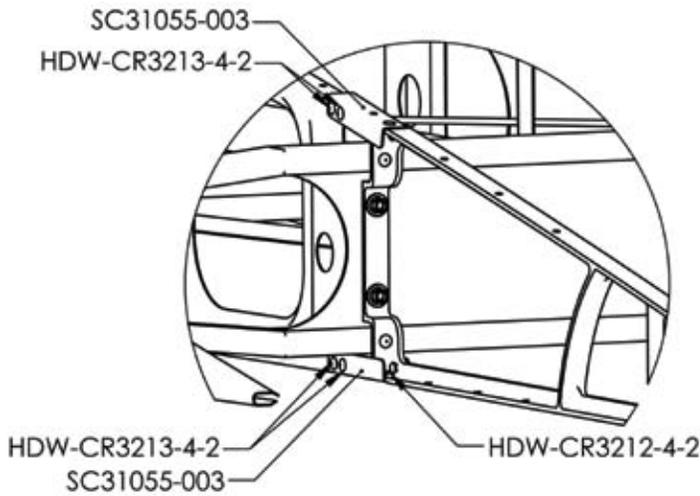
Install clips to join #12 center rib to the #12 machined rib per Figure W38. Clips will go on both top and bottom exactly the same. Drill and install the two side rivets(HDW-CR3213-4-2)as shown in Photo 155. Next install the rivets in the machined rib per Photo 160. Maintain 2D clearance. Countersink hole and rivet in place.



Photo 160

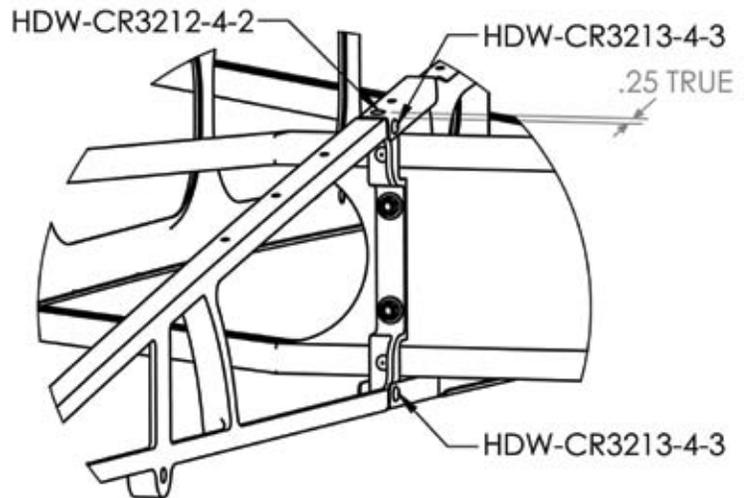


Photo 161



OUTBOARD AILERON TRAILING EDGE RIB
VIEW FROM OUTBOARD SIDE

Figure W38



OUTBOARD AILERON TRAILING EDGE RIB
VIEW FROM INBOARD SIDE

Figure W39

SECTION 25 Install Remaining Nose Ribs

Install remaining nose ribs per Figure W40. In SECTION 13 you trimmed all of the nose ribs and there was a difference between the nose ribs that connect to center rib and the intermediate nose ribs. When connecting a nose rib to a center rib ensure the nose rib and center rib form a straight line. Ensure that center rib fits inside the nose rib on top and bottom. Drill hole with a #40 bit, dimple and rivet per Figure W41. Repeat this process for the bottom of the nose rib. In SECTION 13 you trimmed one intermediate nose rib differently with a hole and a cutout, This intermediate rib goes between the #8 and #9 main rib shown in Photo 162.



Photo 162



Photo 163



Photo 164



Photo 165

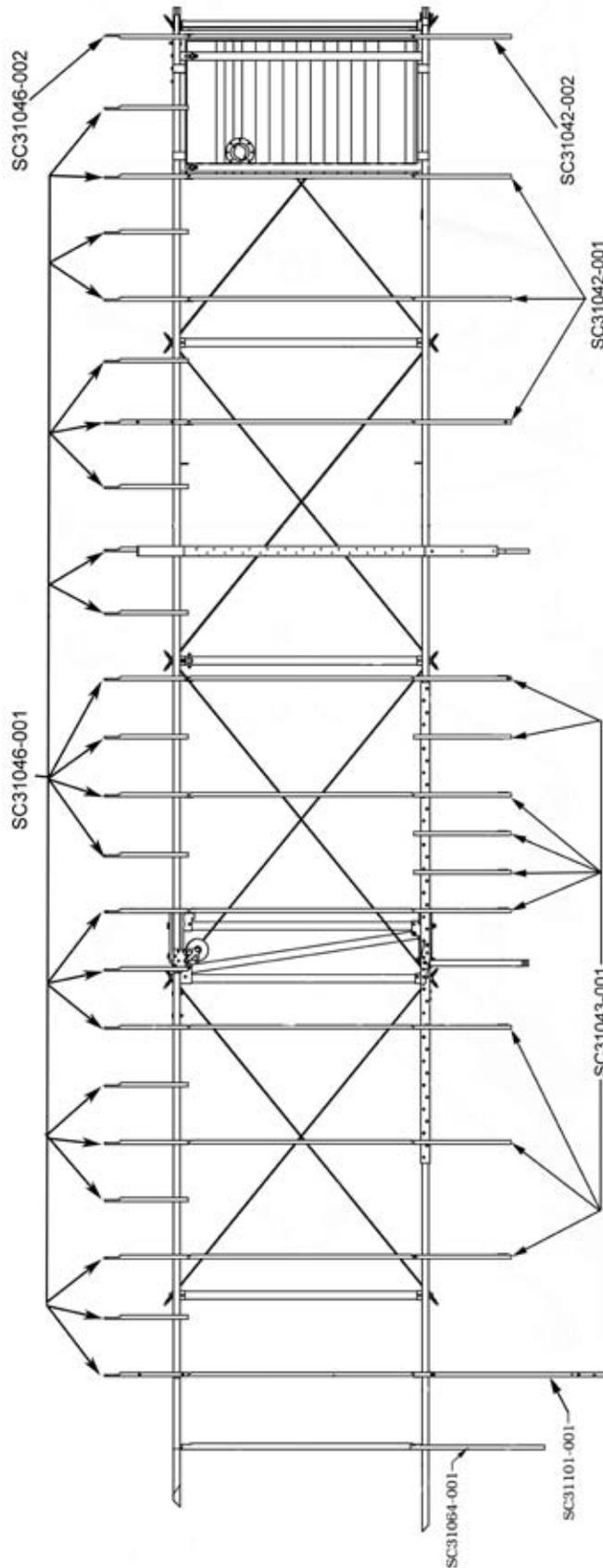
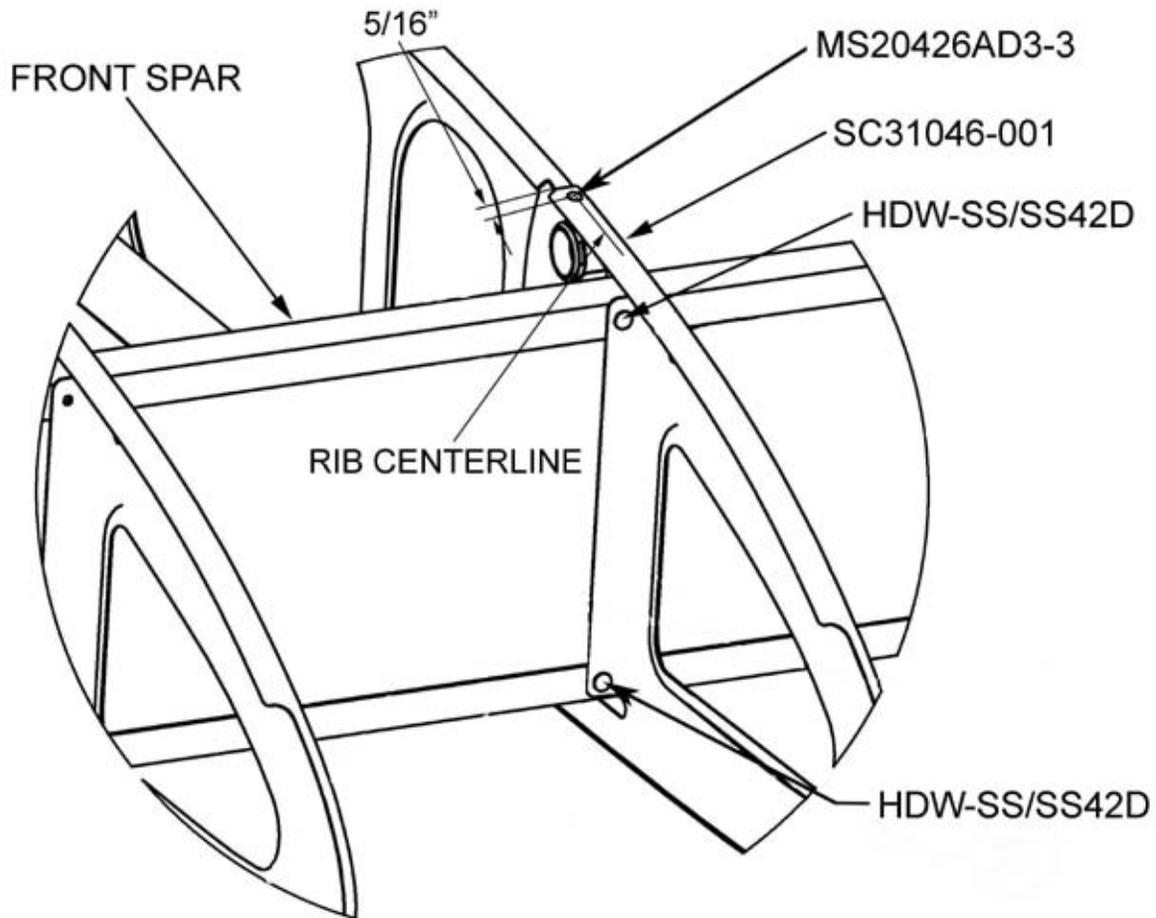


Figure W40



**NOSE RIB AND TAIL RIB
RIVET SPACING AND RIVETING**

Figure W41

Installing #8 Rib Bottom Rivet

After you have the nose rib installed on the number 8 rib, you will need to install the bottom rivet that was left out in SECTION 8.

Use masking tape to secure the nose ribs. Each rib needs to be square to the spar in preparation for the leading edge skins. The tape will remain in the wing unless you wish to carefully remove it after skins are fully riveted.

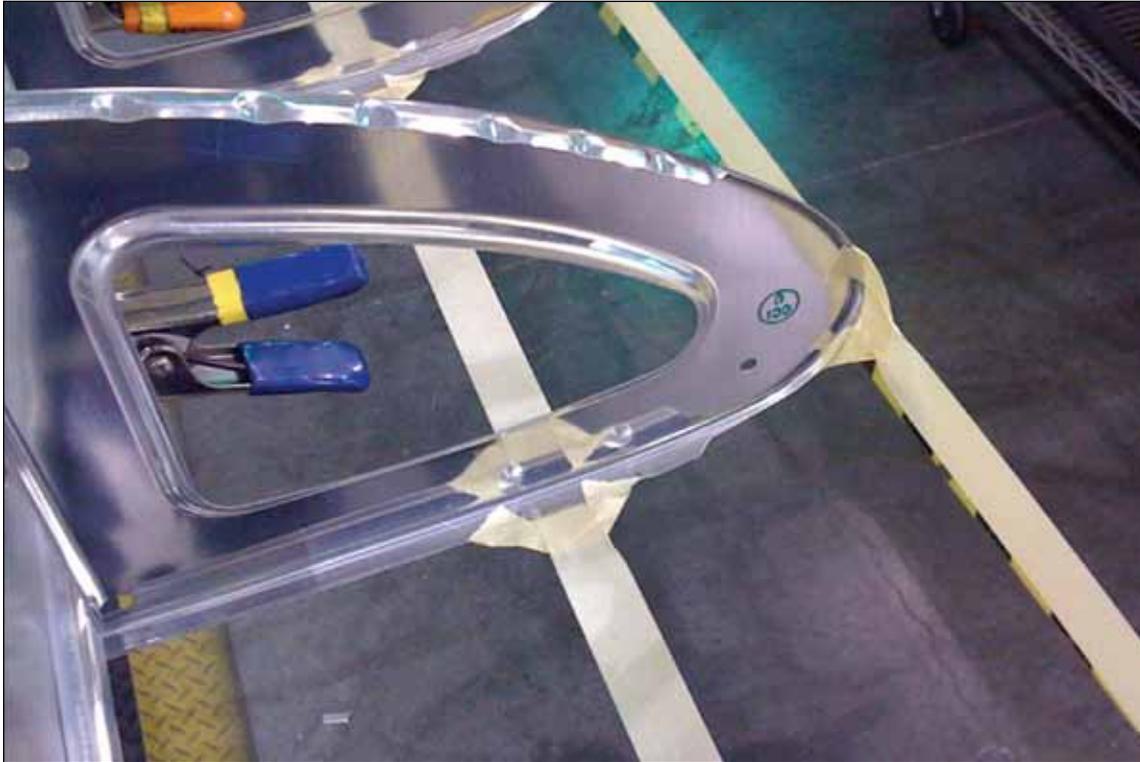


Photo 166



Photo 167

LOG & INSPECTION SHEET WING # 6

Log sheet

	FABRICATION AND ASSEMBLY TASKS	A	B	C	D
		Mfr Kit/Part/ Component	Commercial Assistance	Am-Builder Assembly	Am-Builder Fabrication
	Wings - 51 Listed Tasks				
	Task #				
W5	Fabricate Composite Cores	NA	NA	NA	NA
W6	Assemble Composite Cores to Wing	NA	NA	NA	NA
W7	Fabricate Wing Leading and Trailing	X			
W8	Assemble Wing Leading and Trailing Edges to Wing			X	

Inspection point

	INSPECTION ITEMS	BUILDER	ALTERNATE
1.14	Ensure that False Spars have no damage and all rivets are installed		

SECTION 26 WING WIRES AND PITOT TUBING

The left wing harness is included in the basic kit. However, whether you upgraded to buy the wiring from CubCrafters or have chosen to wire yourself, now's a good time for the installation.

The concept here is run wires from six inches inboard past the wing attach fitting and on the front side of the spar to the navigation/strobe light, stall warning switch, and landing light. The wires are run in the slot in the forward lower edge of the front spar. Photo 170 shows the wires that extends past the wing attach fitting. Photo 171 shows the landing light wires that terminate in bay number 5. Photo 172 shows the stall warning terminating in bay number 9. Photo 173 shows the Nav/Strobe wires extending past the end of the spar. The short stall warning wire can be connected to the spar web using a sheet metal screw or a stainless pop rivet. Photo 174 shows the wires in the spar tee. Photo 175 and Photo 176 show the silicone being applied to the wires in the spar. The silicone should be applied approximately every twelve inches. One of the wires (wires may be blue or orange) has been attached to the spar for grounding. A spring clamp works well to keep the wires in place.

Install the Pitot tube RM5594-004 per Photo 178 and Photo 180.

Pitot tube should extend outboard six inches past the jury strut fitting and inboard four inches past the wing attach fitting on the rear side of the spar.

Use silicone in several places to keep it secured to the spar.

Use the silicone around the Pitot tube where it passes next to the ribs to avoid chafing.

Silicone used to secure Pitot tube per Photo 181. The silicone will need to stop twelve inches before it reaches the jury strut fitting. Photo 180 shows the pitot tubing extending more than 6" past the jury strut fitting, six inches will be plenty.

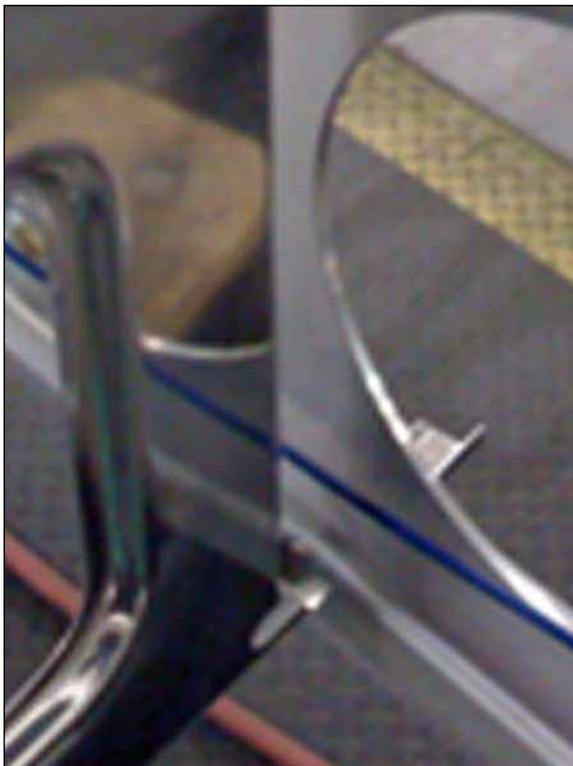


Photo 168



Photo 169



Photo 170



Photo 171



Photo 172



Photo 173



Photo 174



Photo 175



Photo 176



Photo 177



Photo 178



Photo 179



Photo 180



Photo 181

LOG & INSPECTION SHEET WING # 7
Log sheet

	FABRICATION AND ASSEMBLY TASKS	A	B	C	D
		Mfr Kit/Part/ Component	Commercial Assistance	Am-Builder Assembly	Am-Builder Fabrication
	Wings - 51 Listed Tasks				
	Task #				
W39	Fabricate Wing External Lighting Components.				X
W40	Assemble Wing Ext Lighting Components to Wing			X	
W44	Fabricate Cables Wires and Lines	.5			.5
W45	Assemble Cables Wires and Lines to Wing			X	
W52	Fabricate Pitot System	.25			.75
W53	Assemble Pitot System			X	

Inspection point

	INSPECTION ITEMS	BUILDER	ALTERNATE
1.15	Ensure landing light assembly is installed per manual.		
1.16	Ensure that landing light wire and ground are installed (left wing only).		
1.17	Ensure that navigation wire and ground wire are installed and secure.		
1.18	Ensure that stall warning wire and ground are installed and secure.		
1.19	Ensure that strobe wire is installed and secure (if applicable).		
1.20	Ensure continuity test is completed on wire harness before securing harness.		
1.21	Ensure that pitot line is installed and secure.		

SECTION 27 INSTALLING #3 RIB BRACING AND THE FALSE RIB

Attach the four braces TC1239-003 and TC1239-005 to the front and rear spars as shown in Figure W42 using the holes shown in SECTION 9. Match drill the braces to the #3 rib using a #30 drill bit and install the braces using the hardware called out in Figure W42. Install the false rib SC31048-001 in the #2 rib location per Figure W43. Be sure to center the false rib SC31048-001 between the nose rib and the tail rib. The two cutouts in the false rib will face up for fuel tank transfer tube clearance. Mark the nose and tail rib as shown in Figure W43 and match drill with a #30 drill bit. You will need to match drill holes for the rivets HDW-CR3213-4-3. Debur the holes and pull the HDW-CR3213-4-3 rivets. **NOW WOULD BE A GOOD TIME TO DRILL THE BOTTOM OF THE #2 AND #3 RIB FOR THE FABRIC RIVETS THAT WILL BE USED DURING THE WING COVERING PROCESS. USE Figure W43 FOR HOLE LAYOUT, DRILL RIVET HOLES WITH A #30 DRILL BIT.**

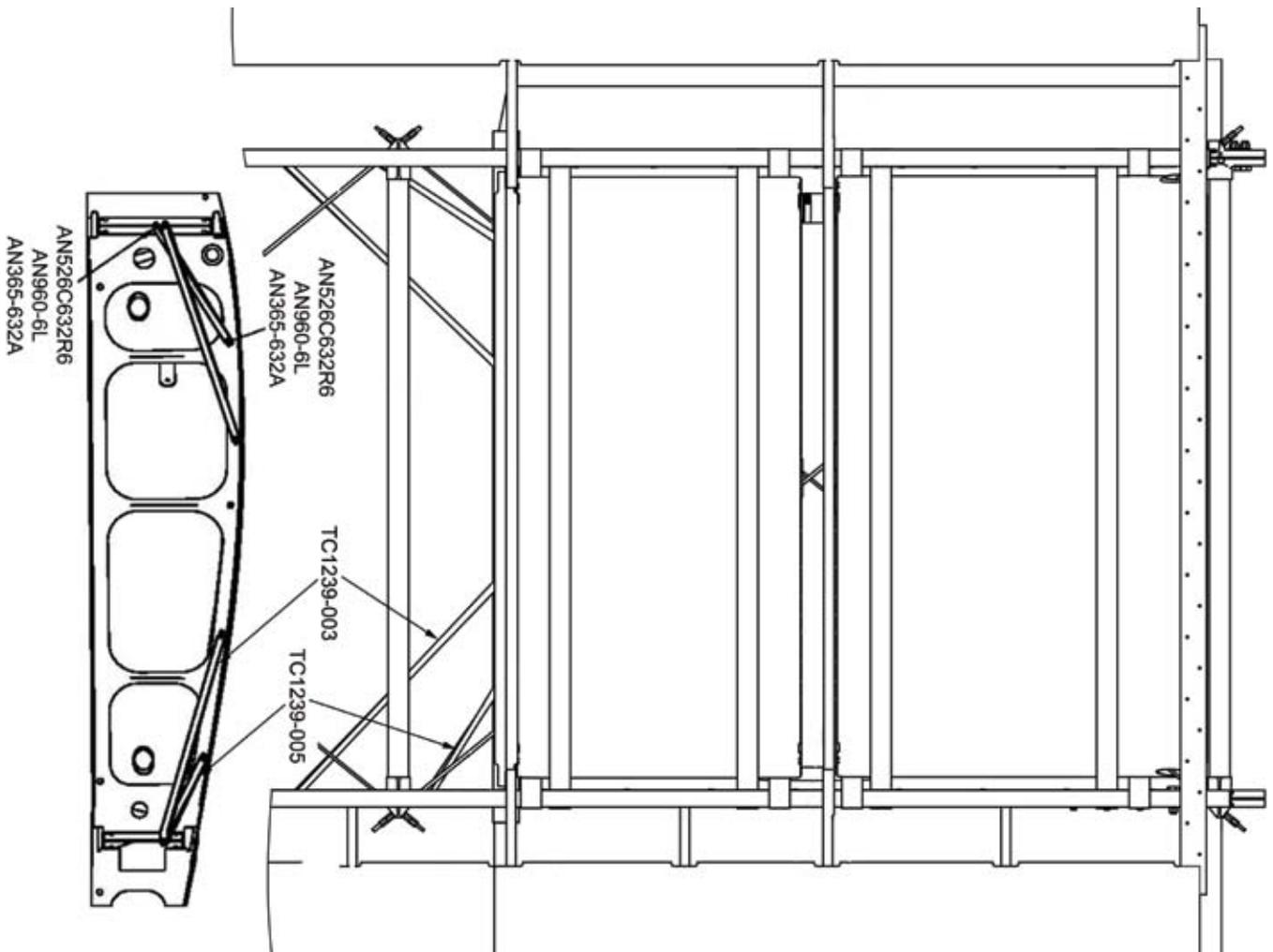


Figure W42

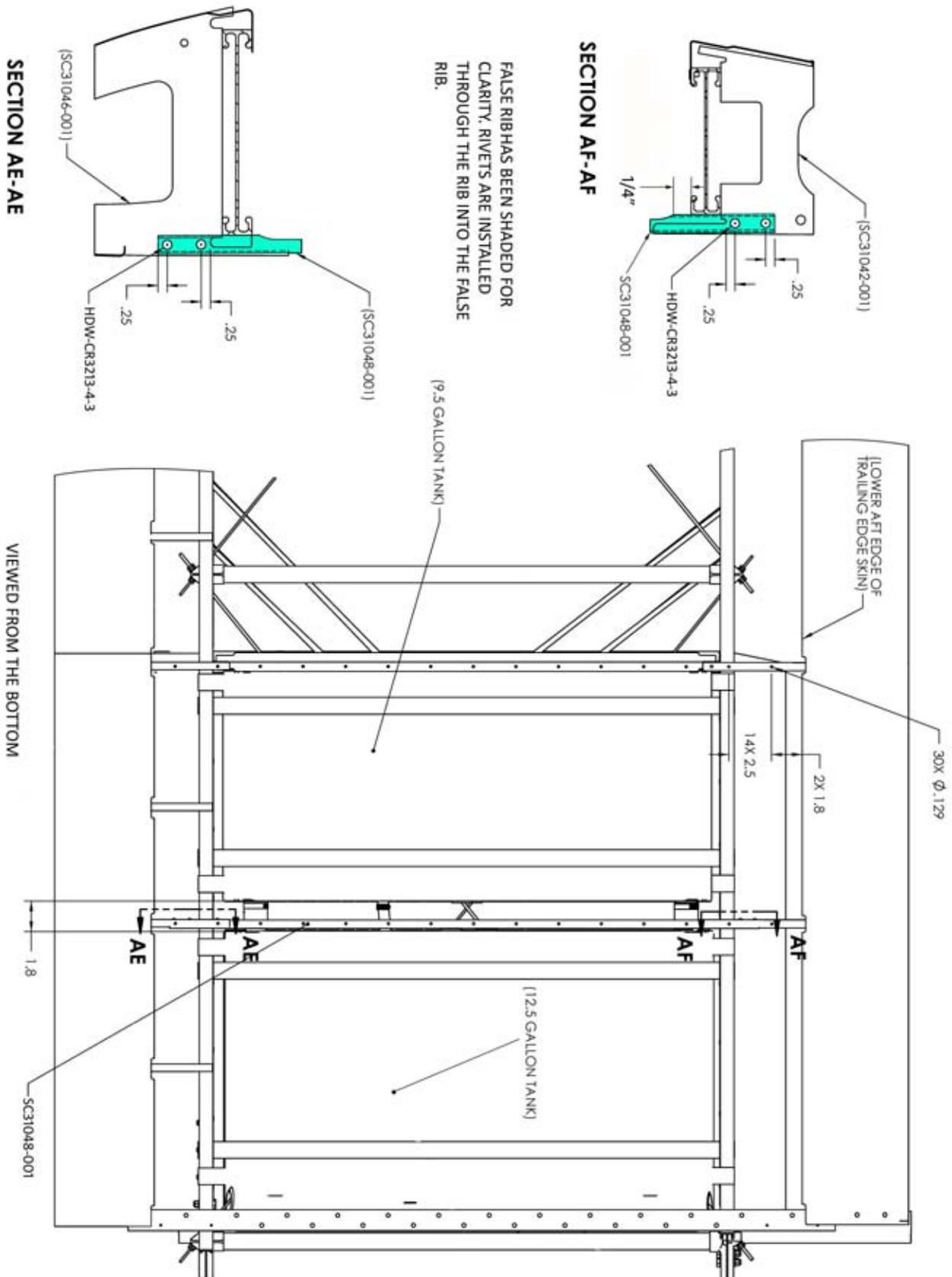


Figure W43

SECTION 28 Install Cap Strip at Rib #5

Mark the top #5 clip as shown in Figure W45 and Photo 183. The measurement is made from the top of the radius of the machined rib. Drill through the clip and machined rib using a #30 drill bit. **ENSURE THE SIDE TO SIDE MARK IS CENTERED ON THE MACHINED RIB.** Next enlarge the third #40 hole per Figure W44 from the bottom of the capstrip. The capstrip has six holes in the area of the machined rib, three small holes and three larger holes. The #40 holes are the smaller ones. This #40 hole that was enlarged to #30 will be clecoed into the hole just drilled into the clip and machined rib. Match drill the lower two #40 holes in the capstrip through the machined rib using a #30 drill bit. **AGAIN ENSURE THE HOLES IN THE CAPSTRIP ARE CENTERED ON THE MACHINED RIB.** Cleco these two holes and leave them until later. They will be installed in a couple of pages. Check the alignment of the capstrip with the rest of the rib, you will be able to fudge it side to side a little bit. Clamp the capstrip in place and drill the first hole in the capstrip/rib insert a cleco. Next skip four holes, drill and insert a cleco. Continue this until you get to the last hole in the capstrip.

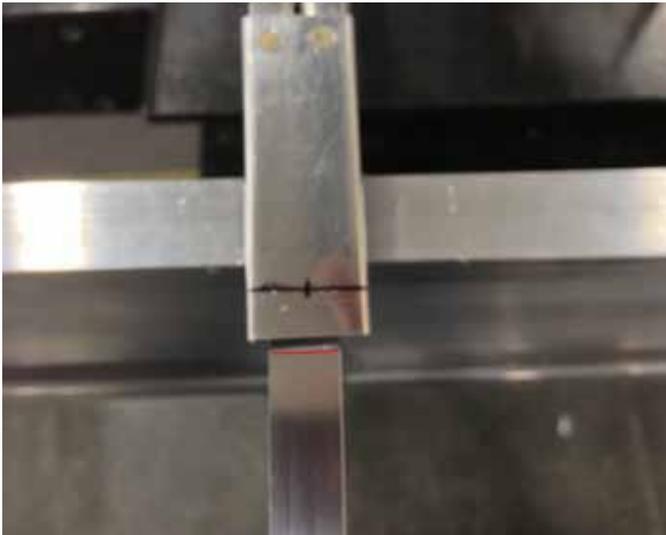


Photo 183



Photo 182



Photo 185



Photo 184



Photo 186

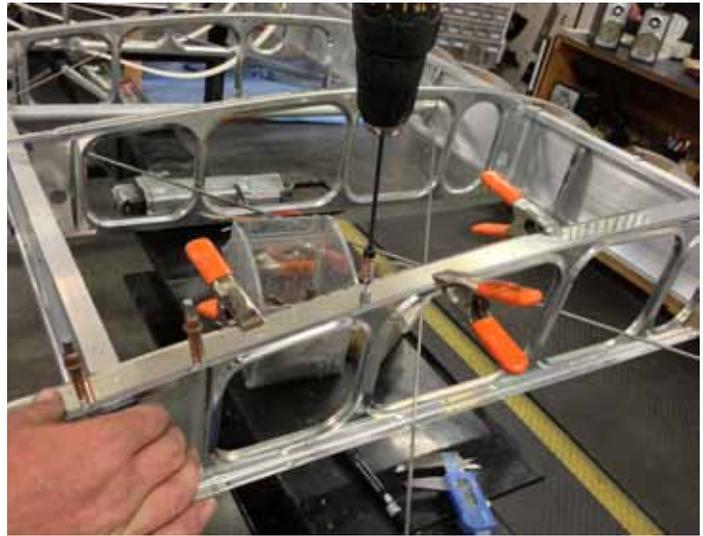


Photo 187

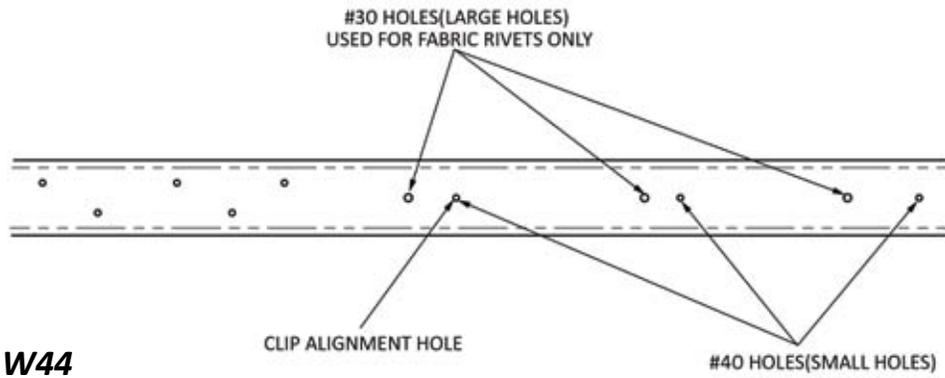


Figure W44

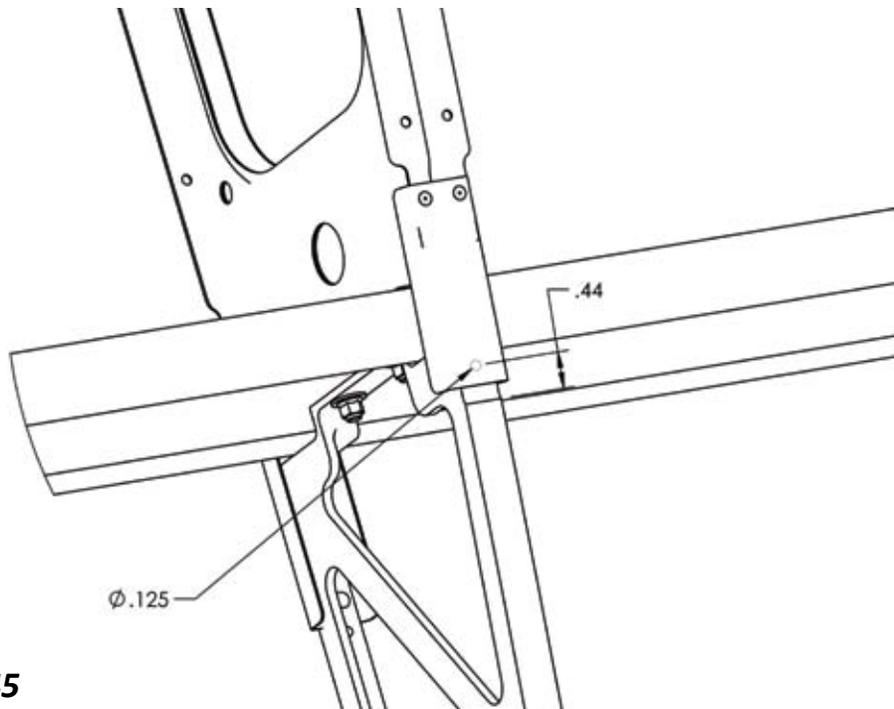
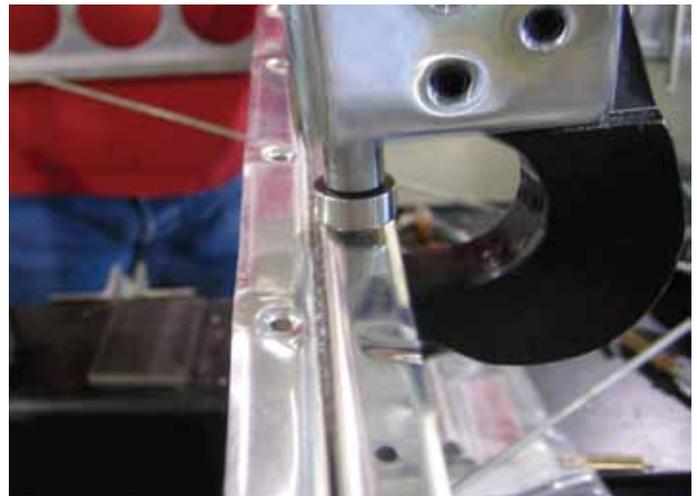
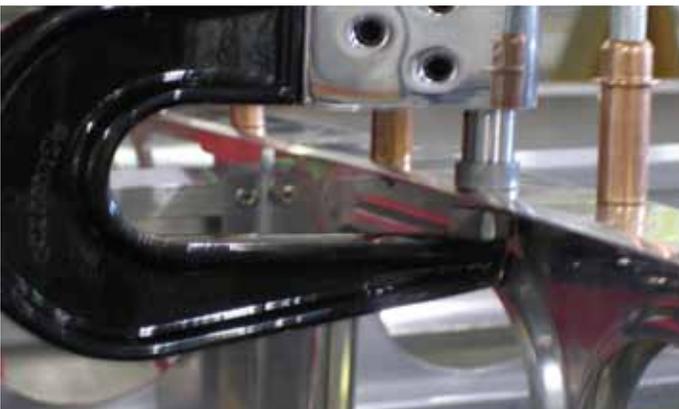
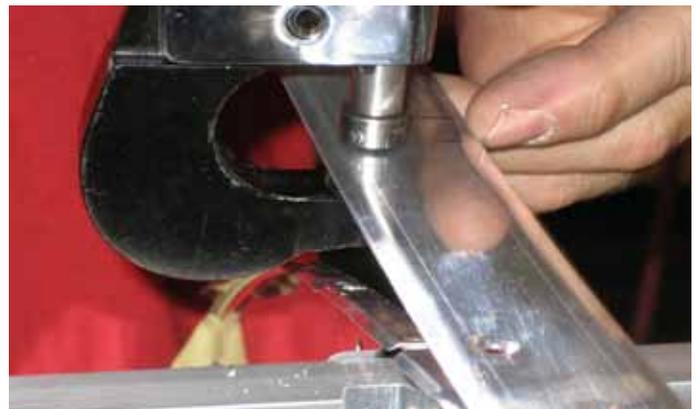


Figure W45

Mark the capstrip in the front as shown in Photo 188 and Photo 189. Trim the front of the capstrip on the mark made earlier. Match drill all of the rest of the #30 holes in the rib. Remove cap strip, deburr all the holes, and dimple the holes in the rib and the cap strip.

Dimple cap strip #30. Dimple the top of rib #30. Use Clecos to fasten cap strip onto rib. Squeeze rivets into open holes, remove Clecos and insert remaining rivets.

**Photo 188****Photo 189****Photo 190****Photo 191****Photo 192****Photo 193**

Match drill using a #40 drill bit, countersink and insert the MS2046AD3-3 rivet in the leading edge hole. (See Figure W46).

The last thing to do to the capstrip is to countersink and install the three CherryMax rivets in the capstrip/ machined rib per Figure W46.

IF YOU ARE PLANNING TO RIVET THE FABRIC, NOW WOULD BE A GOOD TIME TO MATCH DRILL THE FABRIC RIVET HOLES FROM THE RIB INTO THE CAPSTRIP. USE A #30 DRILL BIT.



Photo 194

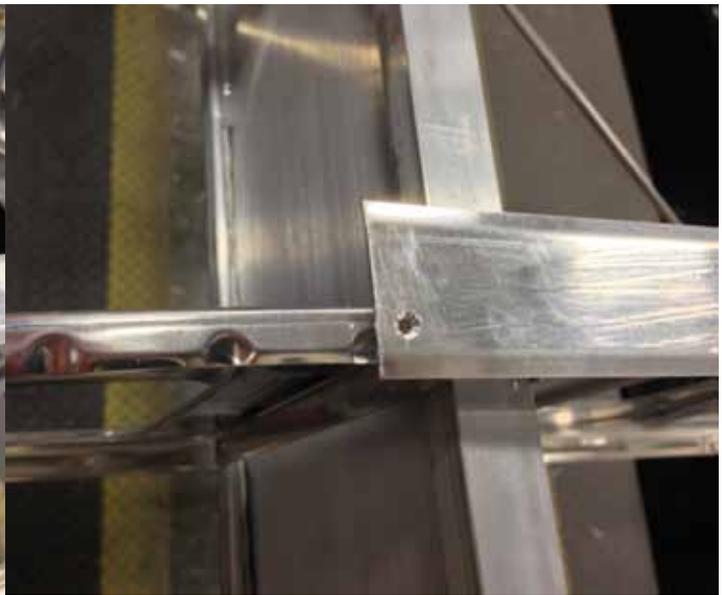


Photo 195

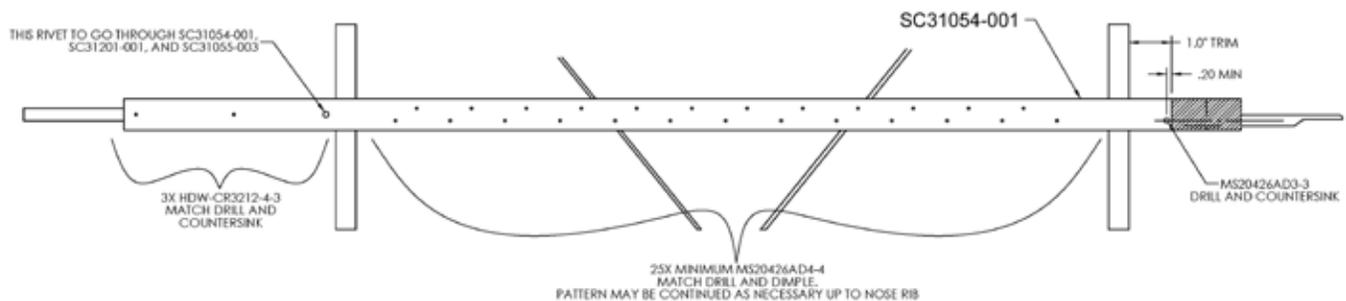


Figure W46

SECTION 29 INSTALL LANDING LIGHT

The landing light is a part of the optional lighting kit. If you purchased this option, you will be supplied with a separate manual for installation of the lighting components. However, in the overall sequence of build, now is the time to prep the landing light housing for installation. Four things need to happen during the landing light housing installation.

1. The inboard end of the second leading skin needs to be trimmed off flush with the inboard side of the #6 rib.
2. The landing light housing needs to be fitted between the #6 rib and the next inboard nose rib. It may be necessary to trim the sides of the housing slightly.
3. The landing light housing needs to be taped into place and up against the front spar before the leading edge skin is installed.
4. When installing the leading skin, move the skin inboard or outboard to center the housing in the leading edge skin cutout.



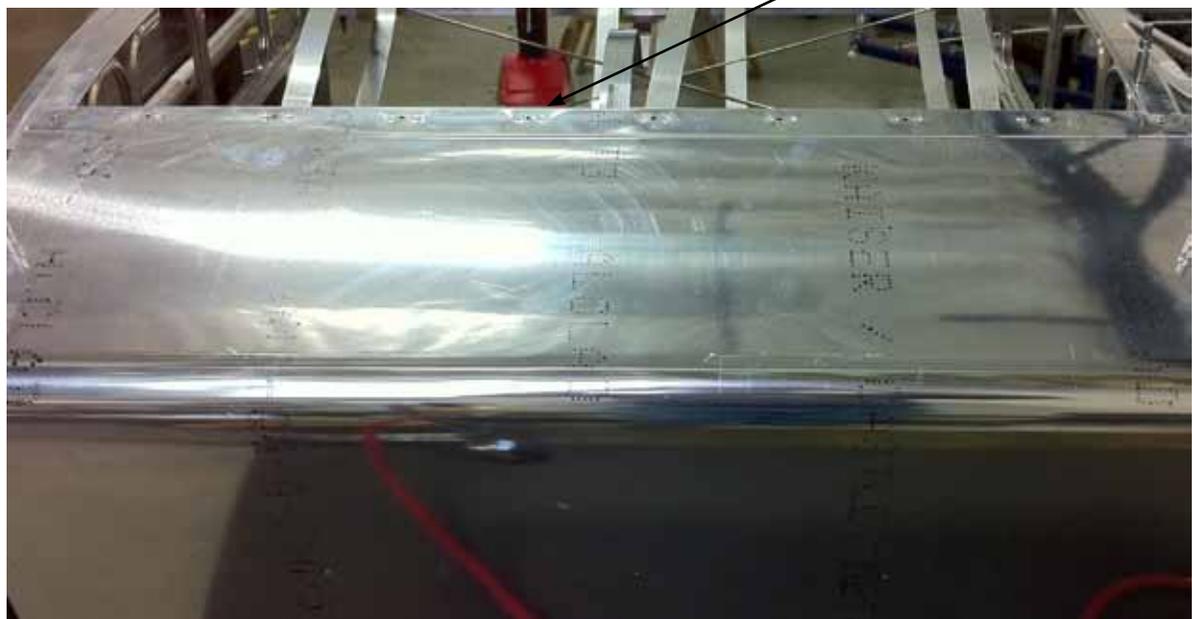
SECTION 30 PREP AND INSTALLATION OF LEADING EDGE SKINS

Now is the time to prep the inboard leading edge skin SC31038-001 and -002 with the tank lid nutplates. First you will need to dimple the nutplate rivet holes per Photo 196. Next you will install the nutplate MS21059L06K using MS20426A3-3 or HDW-04-00981 Rivets as shown in Photo 197 and Photo 198.

**Photo 196****Photo 197**

For skins that have nutplates installed, the first rivet should be located 1.75" forward of the inboard edge.

~~THE MOST INBOARD SKIN SHOULD OVERHANG THE #1 RIB BY ABOUT 1/2"~~

**Photo 198**

Inboard edge

Place a mark on the inside of the front spar under each intermediate nose rib.

AT THE FACTORY WE HAVE QUIT DRILLING THE TOP HOLE IN THE INTERMEDIATE RIBS. SEE Figure W48.

Mark locations of nose ribs.

Begin installing leading edge skins by placing the outboard skin in place per Figure W47.

THE OUTBOARD SKIN SHOULD OVERHANG THE #12 RIB BY ABOUT 1". THE MOST INBOARD SKIN SHOULD OVERHANG THE #1 RIB BY ABOUT 1/4".

You will work from the outboard end of wing to the inboard end of wing.

Apply duct tape to the center of the skin to hold it in place.

Using template (KFX30000-002) and Figure W48 mark location for top and middle hole on skin. Be sure to center the holes on the rib.

Using a #30 bit drill the marked holes. Use a Drill Stop when drilling holes to avoid damage to spar.

Insert a rivet on the top of the skin (each hole)
Do not install the first rivet in the #1, #3 and #5 rib at this time.

THE PLASTIC LEADING EDGE STRAPS SHOWN IN THE FOLLOWING STEPS ARE FOR REFERENCE ONLY. THE WAY YOU STRETCH THE SKINS SHOULD BE DETERMINED BY THE BUILDER.

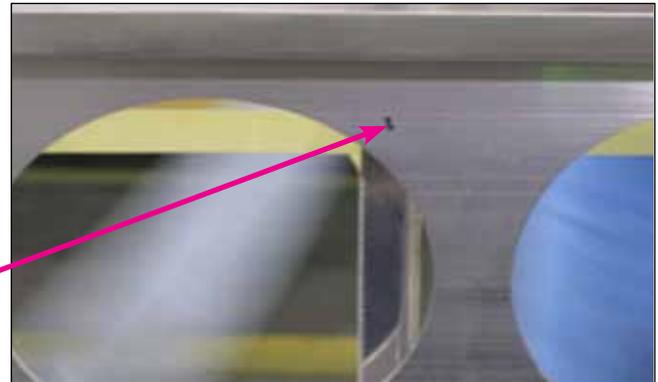


Photo 199

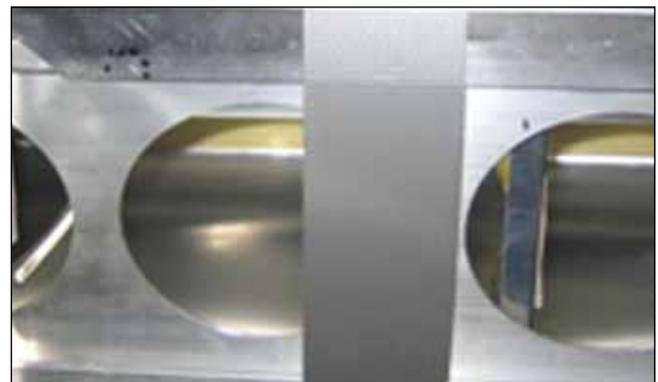


Photo 200

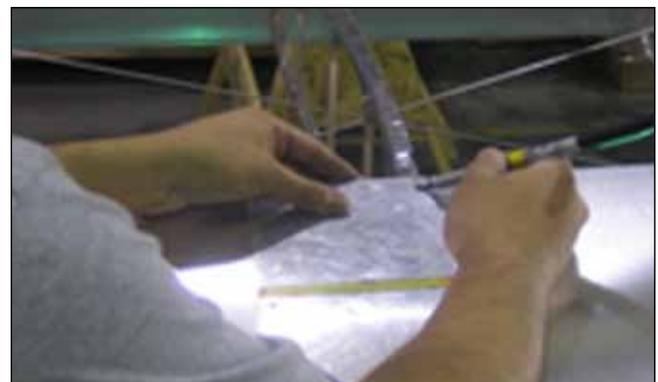


Photo 201



Photo 202

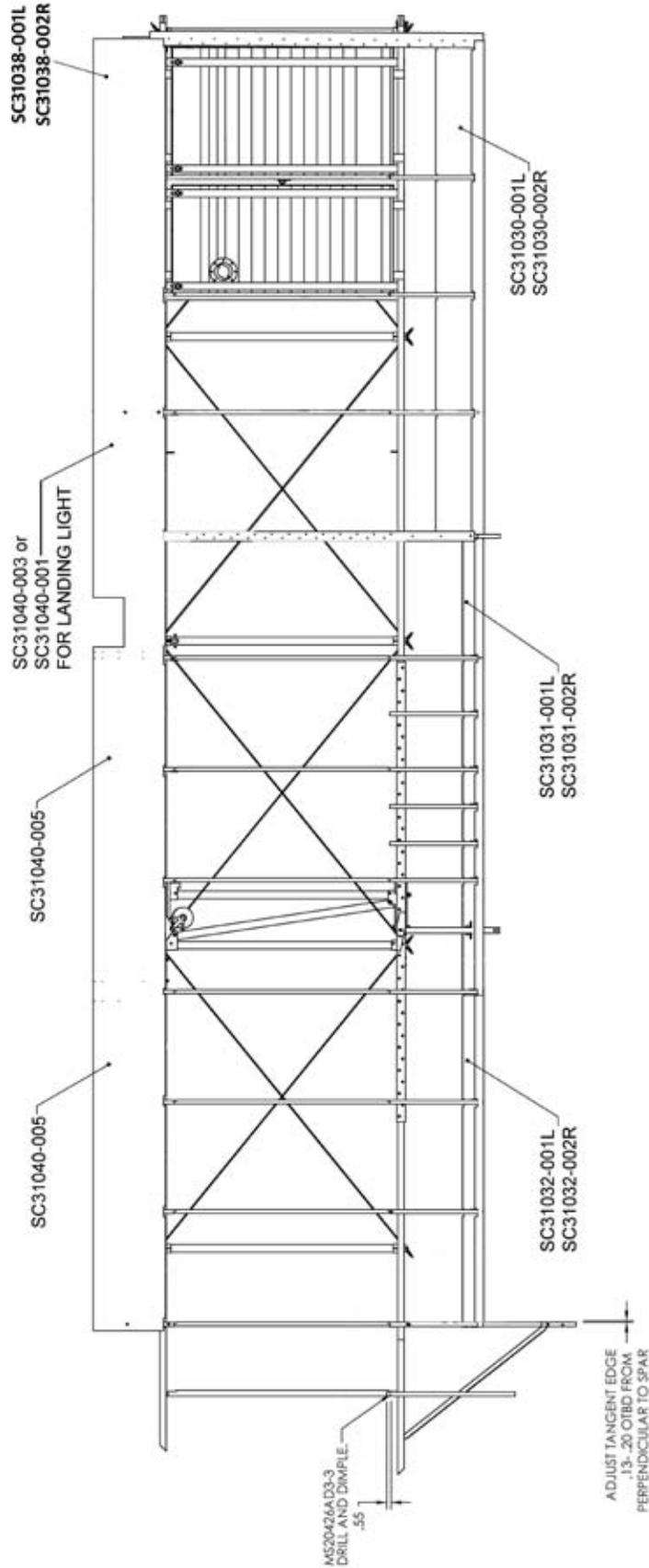


Figure W47

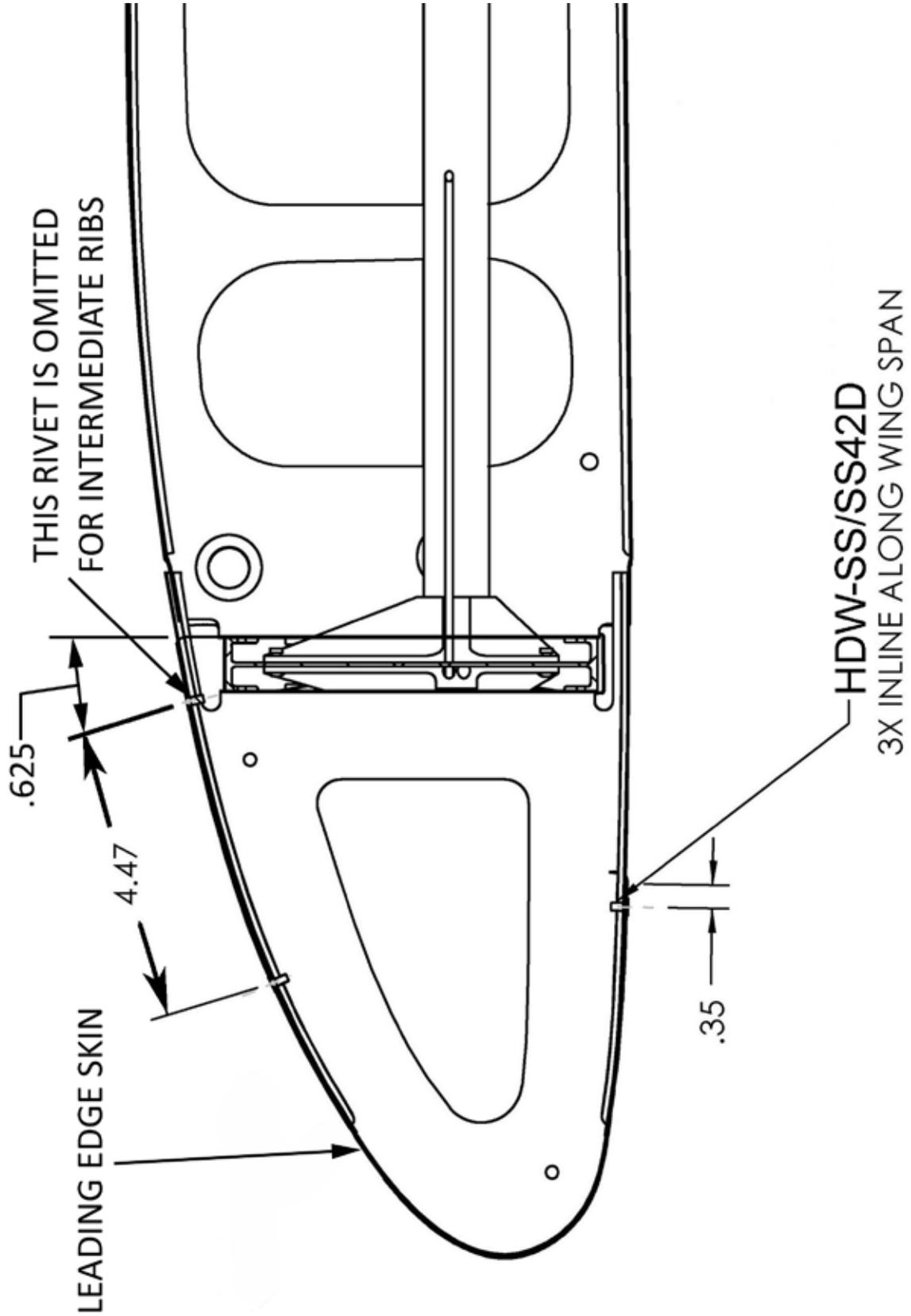


Figure W48

**Photo 203**

Install the center clamps first, and then the outboard clamps, and the inboard clamps last.

IMPORTANT: USE FIRM BUT NOT EXCESSIVE PRESSURE WHEN SETTING CLAMPS. SKINS ARE THIN AND CAN BE EASILY DAMAGED BY THE CLAMPS.

**Photo 204****Photo 205**

The clamps are there to ensure that the skin makes contact with the nose rib from top to bottom.

**Photo 206**

Start with the most centered rib to be drilled. There should already be a clamp close to this rib.

SECTION 31 LEADING EDGE SKIN RIVETING

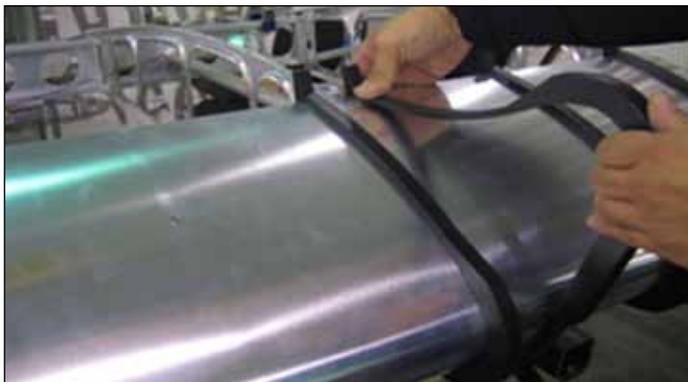
Read the entire step before completing any portions of this step. You will be moving from rib-to-rib and will repeat the sequence for each rib. Using a #30 bit drill and rivet the top edge of skin. Use a Drill Stop when drilling holes to avoid damage to spar. Drill the 2nd hole, ensuring that it is in the center of the nose rib, and install rivet.

Drill and insert rivet on the bottom edge of skin. All the leading edge skins will use HDW-SS/SS42D rivets.

**Photo 207****Photo 208****Photo 209****Photo 210**

After riveting the first rib slide the clamp back outboard to it's original position and move the inboard clamp to the position shown in the pictures below.

Drill and rivet this rib.

**Photo 211****Photo 212**

Move the clamps to the next rib outboard and rivet it. Continue until all the ribs outboard have been riveted. Move the clamps inboard and rivet the ribs inboard. **DO NOT RIVET THE LAST RIB INBOARD** until the next skin *has* been installed and this process has been started again.



Photo 213

Always start in the middle of the skins and work out. This will move any slack in the skin out of the center. Leave the skin clamp on the inboard rib until the next skin is installed and that rib has been riveted.



Photo 214



Photo 215



Photo 216



Photo 217



Photo 218

SECTION 32 LEADING EDGE SKIN TOP EDGE RIVETS

Mark the locations for the leading edge skin top edge rivets.

Rivets should be evenly spaced, no more than 5" maximum distance between rivets.

A good rule of thumb is to install 3 rivets in each bay without slots, 4 rivets in bays with slots and 5 rivets in the tank bay.

Refer to Figure W49. Tank bay shown.

Maintain a 1/4" edge distance on the leading edge skin and keep holes centered on the spar edge.

MAKE SURE TO MEASURE UP FROM THE SPAR (NOT THE SKIN) FOR RIVET DRILLING LOCATION. REFER TO Figure W49. DO NOT DRILL THE SPAR BULB.

Use a **Drill Stop** when drilling holes to avoid damage to spar web.

Drill one hole and install a rivet in each bay. Finish drilling and riveting remaining holes.

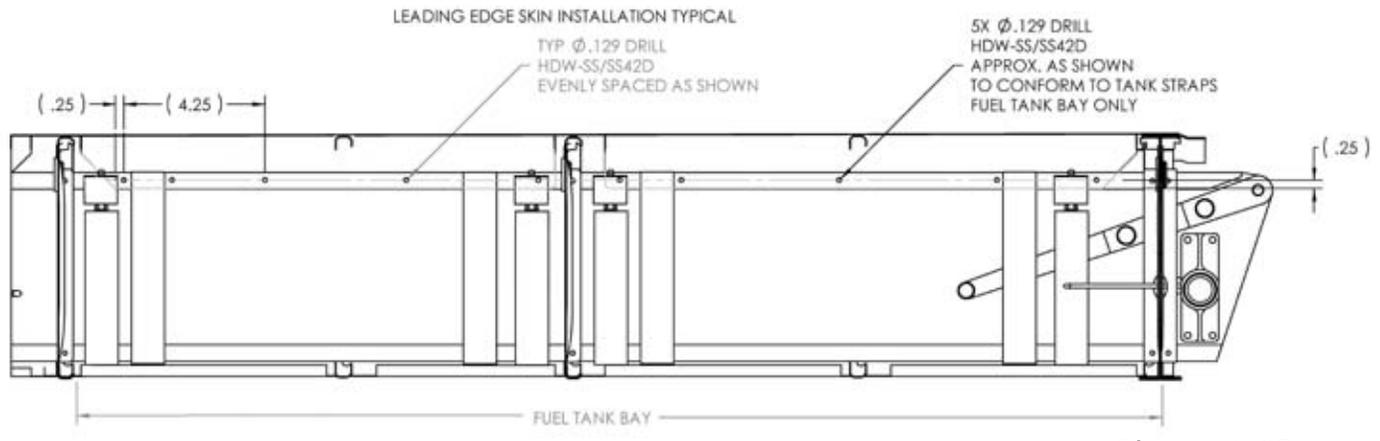


Figure W49



Photo 219

LOG & INSPECTION SHEET WING # 8

Log sheet

	FABRICATION AND ASSEMBLY TASKS	A	B	C	D
		Mfr Kit/Part/ Component	Commercial Assistance	Am-Builder Assembly	Am-Builder Fabrication
	Wings - 51 Listed Tasks				
	Task #				
W7	Fabricate Wing Leading and Trailing Edges	X			
W8	Assemble Wing Leading & Trailing Edges to Wing			X	

Inspection point

	INSPECTION ITEMS	BUILDER	ALTERNATE
1.22	Ensure that nose ribs are straight and rivets installed.		
1.23	Ensure that leading edge skins have no damage and all rivets are installed.		

SECTION 33 INSTALL OUTBOARD RIB

Install outboard rib P/N SC31056-002. Figure W50 shows the correct position. Locate per drawing and clamp into place.

Drill holes using #30 bit for rivets.

Install the leading edge rivets first due to the narrow tab on front of rib.

Then drill and install the trailing edge rivets.

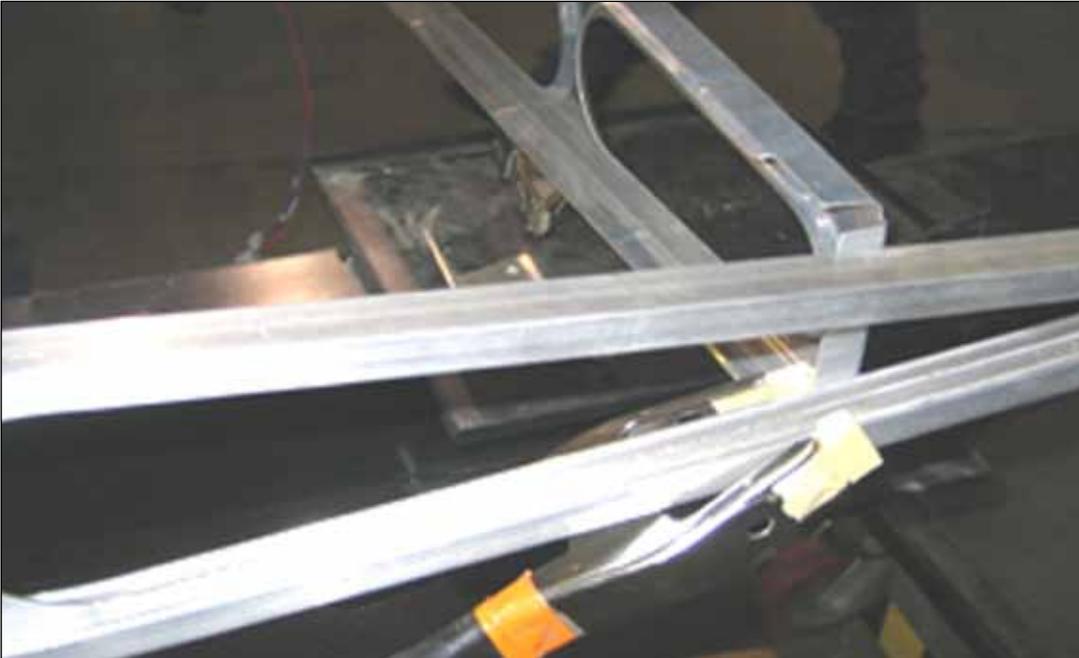


Photo 220

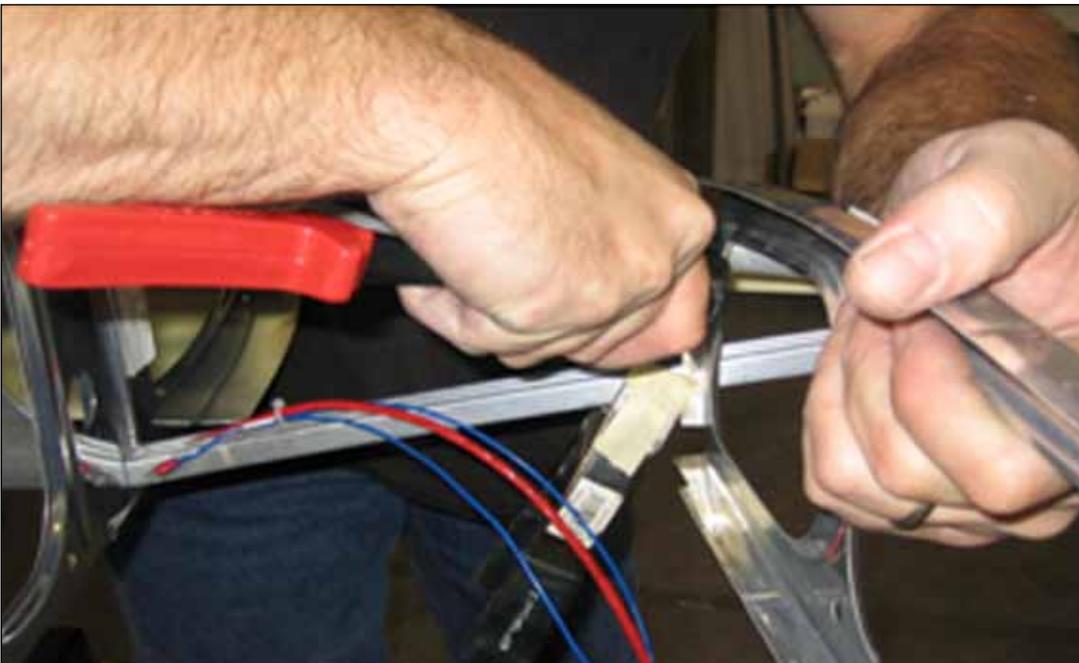


Photo 221

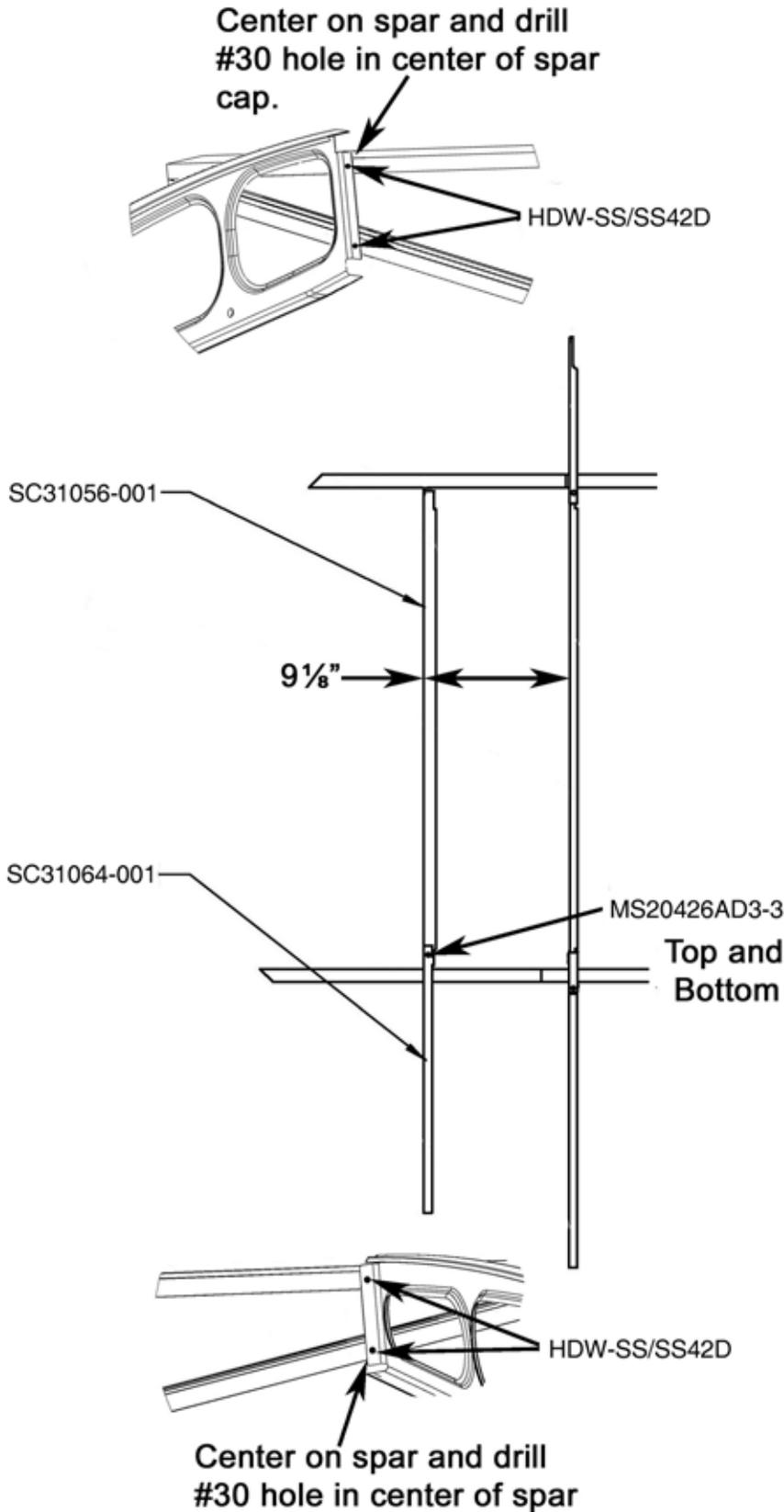


Figure W50

SECTION 34 INSTALL OUTBOARD RIB

Install the outboard tail rib per Figure W50.

Examine the tail rib where it lays over the center outboard rib. If necessary to achieve a close fit, hammer the outboard tail rib tail a bit to flatten it.

Drill holes with a #30 bit and rivet to spar.

Drill top and bottom with a #40 bit, dimple and rivet.

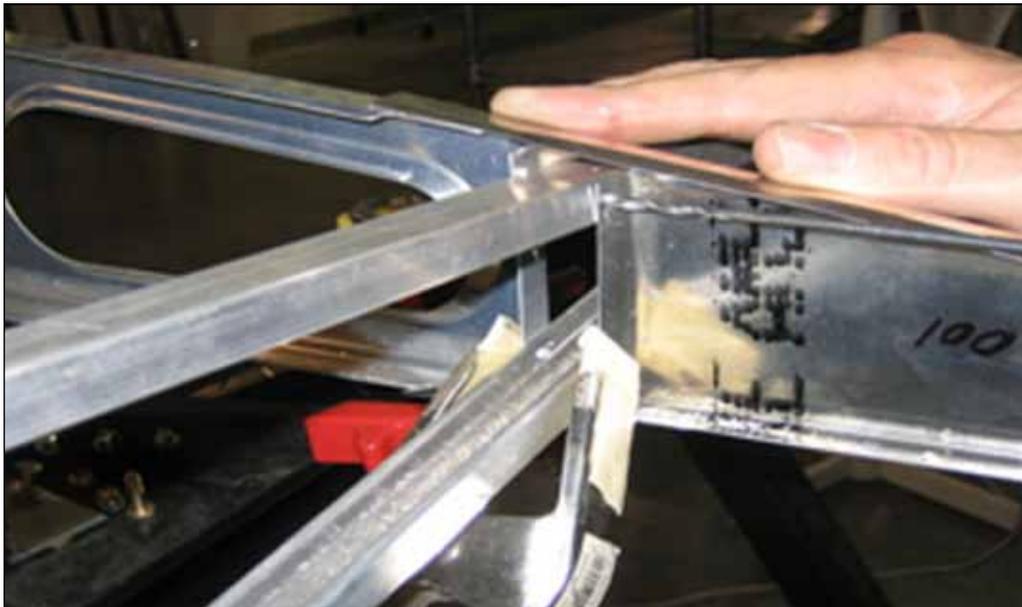


Photo 222



Photo 223

SECTION 35 TRIM SPAR TIPS AND MACHINED RIB

If necessary trim both spars and the #12 machined rib as shown. Use Figure W51 for dimensions and orientation.

IF YOUR SPARS HAVE BEEN TRIMMED AT THE FACTORY DISREGARD THE SPAR TRIMMING IN THIS SECTION.



Photo 224



Photo 225

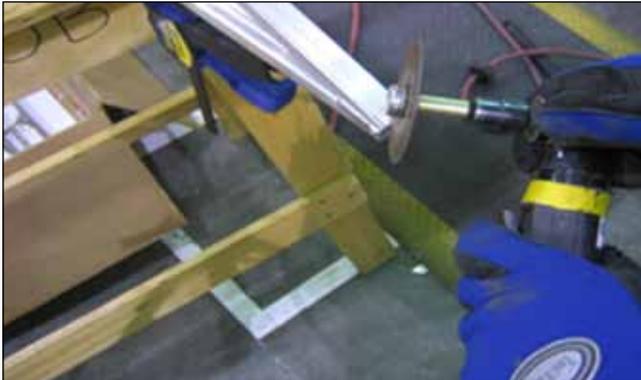


Photo 226



Photo 227



Photo 228



Photo 229

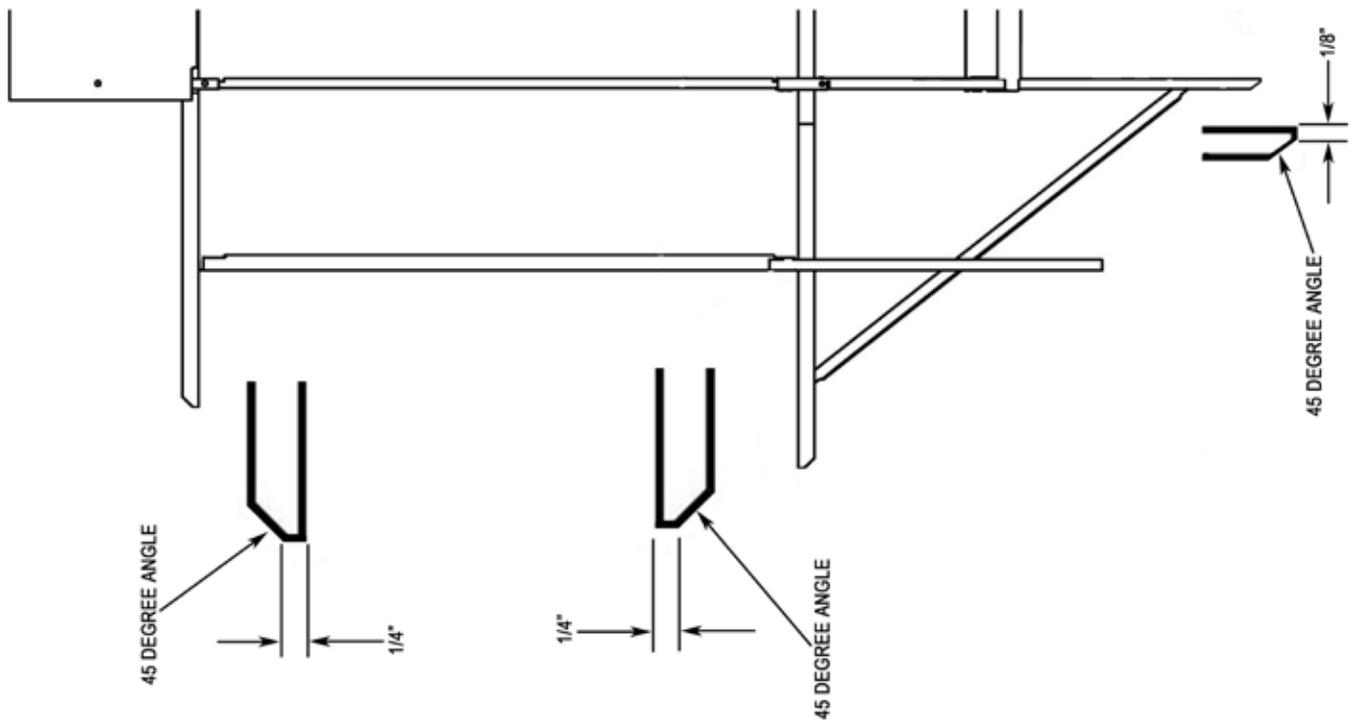


Figure W51

SECTION 36 INSTALL DIAGONAL CROSS BRACE

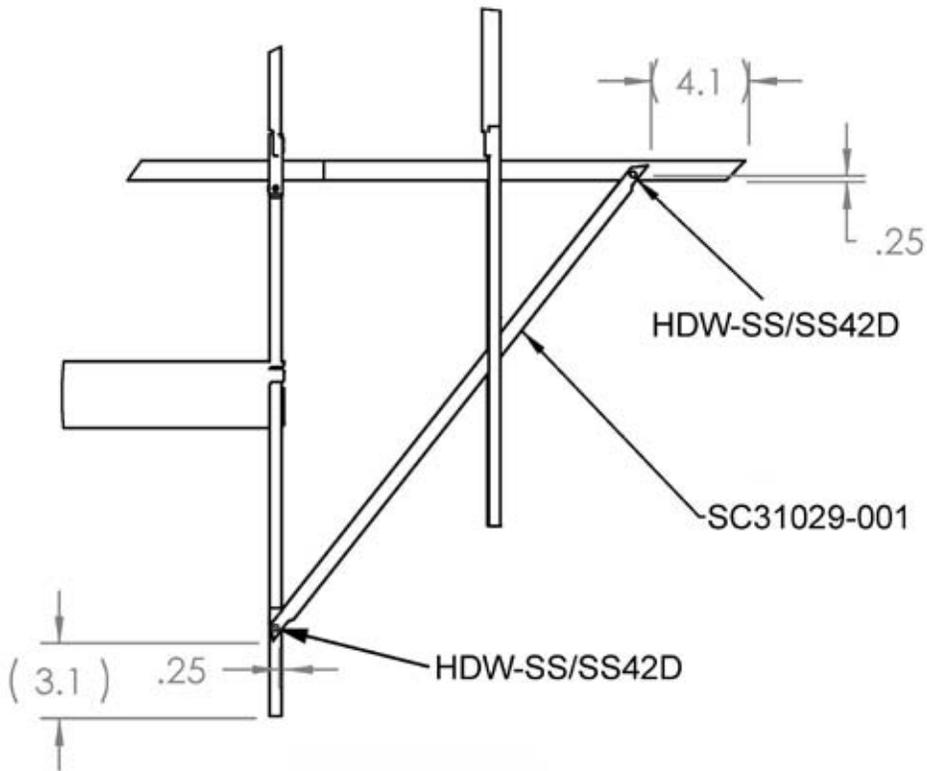
Install diagonal cross brace as shown and in Figure W52. Do not install the rivet in the trailing edge position at this time.



Photo 230



Photo 231



AS VIEWED FROM UNDERSIDE OF WING

Figure W52

SECTION 37 FIT TIP BOW

Place the tip bow onto the outboard end of the wing. Using spring clamps, clamp tip bow into place. Drill holes using #30 drill bit per Figure W53. Place Clecos into holes as they are drilled. Remove Clecos and the tip bow.

*Photo 232**Photo 233*

SECTION 38 GLUE AND RIVET TIP BOW

Clean all surfaces to be bonded with rubbing alcohol.

After surfaces are clean and dry, apply Methacrylate adhesive to areas that will contact the tip bow. Unless your shop is quite cool, you will only have about 8 minutes to complete this step before the adhesive begins to set up.



Photo 234

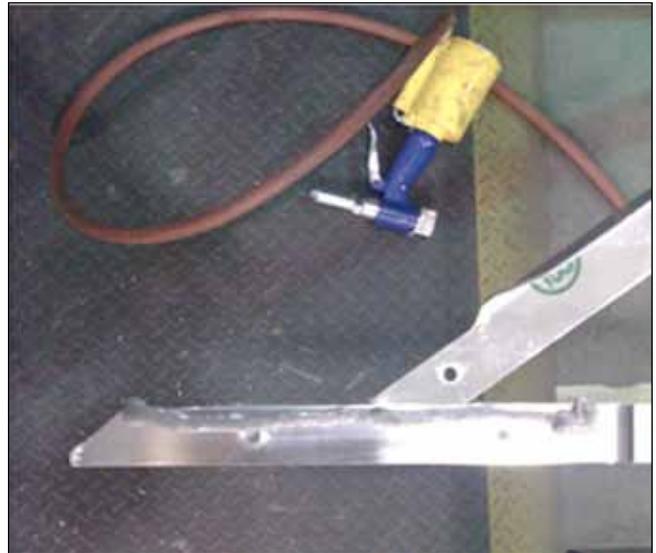


Photo 235



Photo 236



Photo 237

Fit tip bow into place and install the rivets.

Once the riveting is complete (so you aren't under time pressure any more), apply additional Methacrylate adhesive to areas to fill the gap between the tip bow and the ribs.



Photo 238



Photo 239



Photo 240



Photo 241



Photo 242

SECTION 39 TRIM TIP BOW

SOME OF THE TIP BOW TRIMMING MAY BE DONE AT THE FACTORY

Trim the trailing edge of the tip bow so that the rib and bow are flush.



Photo 243

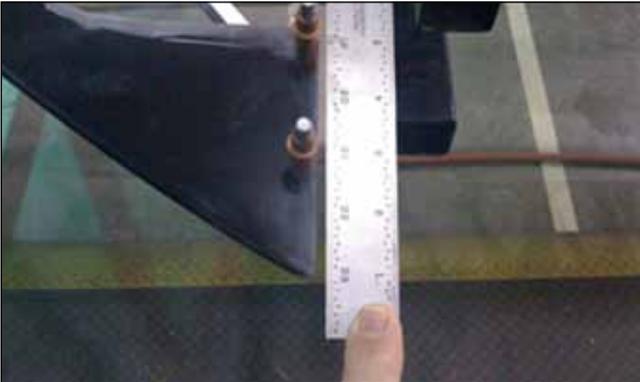


Photo 244

The outboard machined rib should be out of square slightly. Place a square on the rear spar and inboard side of the machined rib. You should have a gap of (0.15 to 0.20 inch). When confirmed, complete the riveting of the diagonal brace. This gap will be closed back up by the pull of the fabric during covering.



Photo 245

Trim the tip bow at top leading edge per Figure W53. Trim the top and bottom of the trailing edge.

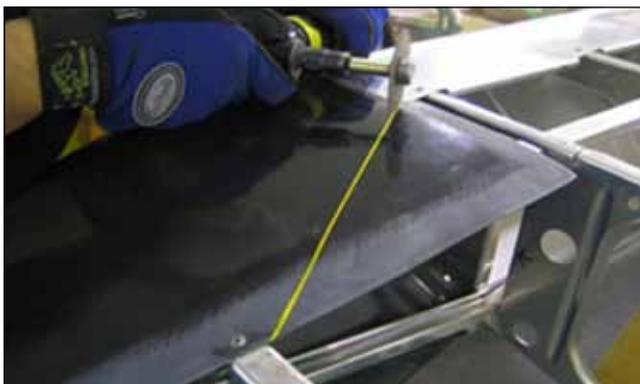


Photo 246

Mark a line to trim the bottom leading edge of the tip bow.

SECTION 40
RIB #1 AND #3 CAP STRIP

Install cap strip to rib #1 per Figure W54. Match drill rivet holes with #30 bit and Cleco strip into place. Work from trailing edge toward leading edge. Ensure cap strip remains flush with the inside edge of #1 rib. Countersink holes using a Microstop that has been properly adjusted for the rivet that will be used. Install countersunk Cherry Max rivets HDW-CR3212-4-2. After the cherry Max rivets have been installed, match drill the nutplate holes. Use a #20 drill bit for the center hole and a #40 drill bit for the outer holes. Deburr the holes and install the nutplates using HDW-04-00981 rivets. Install the #3 top rib cap the same way the #1 rib cap was installed only center the cap on the center of the rib. Use the pictures on this page and page 144 for installation help.



Photo 247

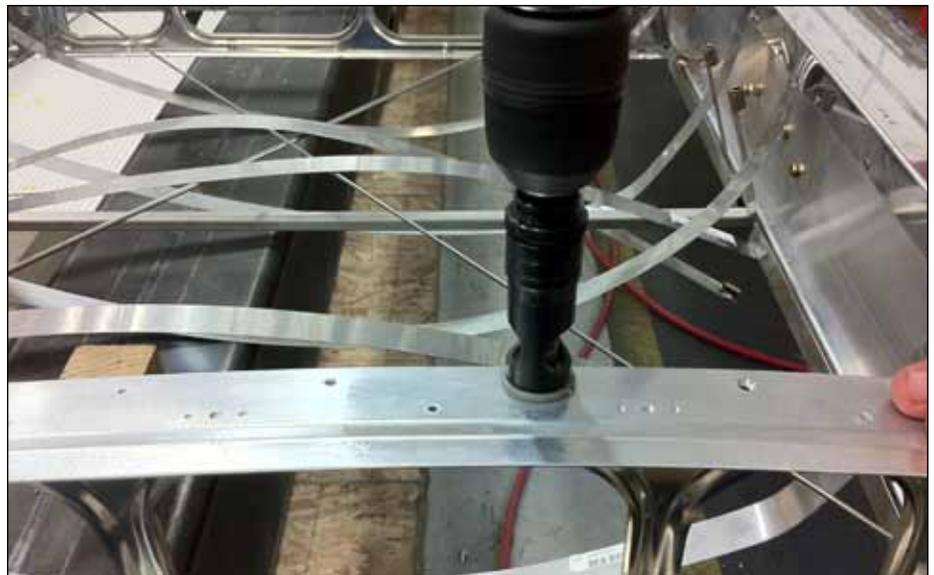


Photo 248



Photo 249



Photo 250



Photo 251



Photo 252



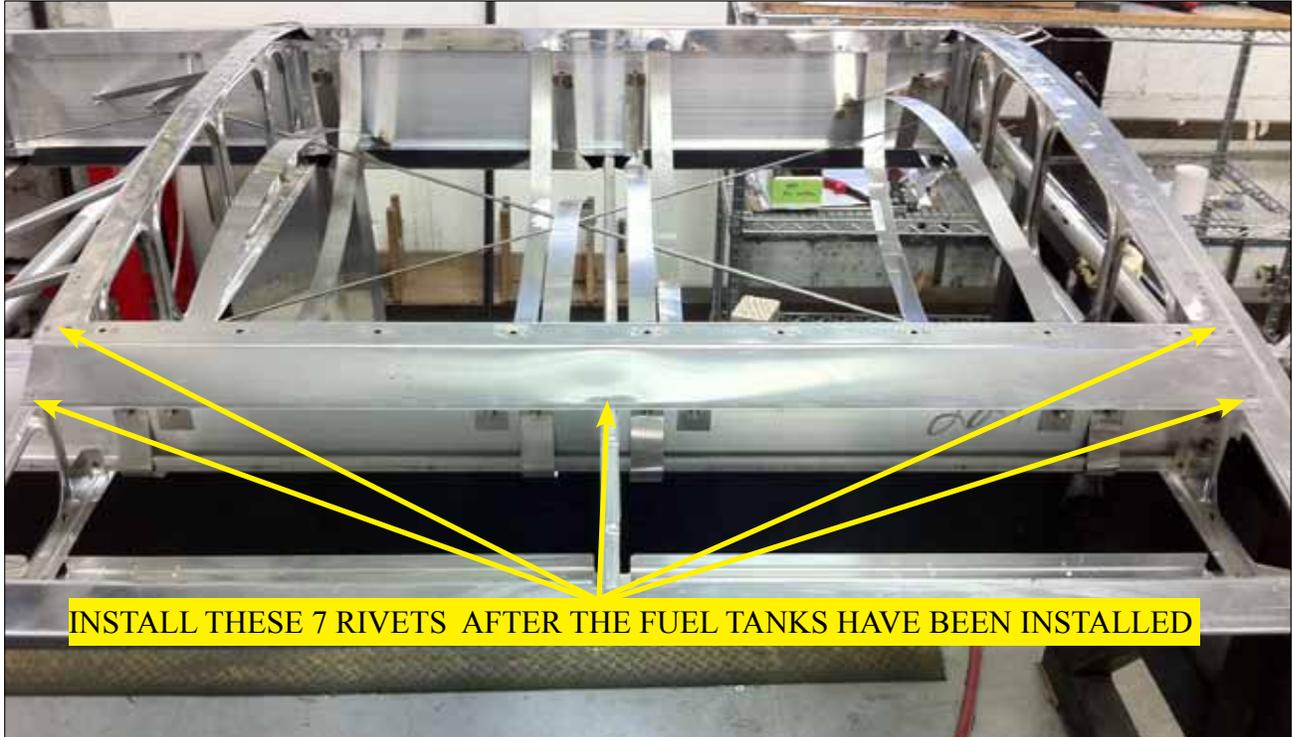
Photo 253



Photo 254

SECTION 41 TANK EXTENSION SKIN INSTALLATION

Before you install this tank extension skin make sure that all the nutplates have been installed and the top of the #2 tail rib has been trimmed to allow installation of the extension skin. Install the fuel tank extension skin SC31039 as shown in the photo's below and Figure W54. Use the same rivet spacing for the front of the extension skin as the rear of the leading edge skin Figure W49. This skin is installed with HDW-SS/SS42D rivets.

*Photo 255**Photo 256*

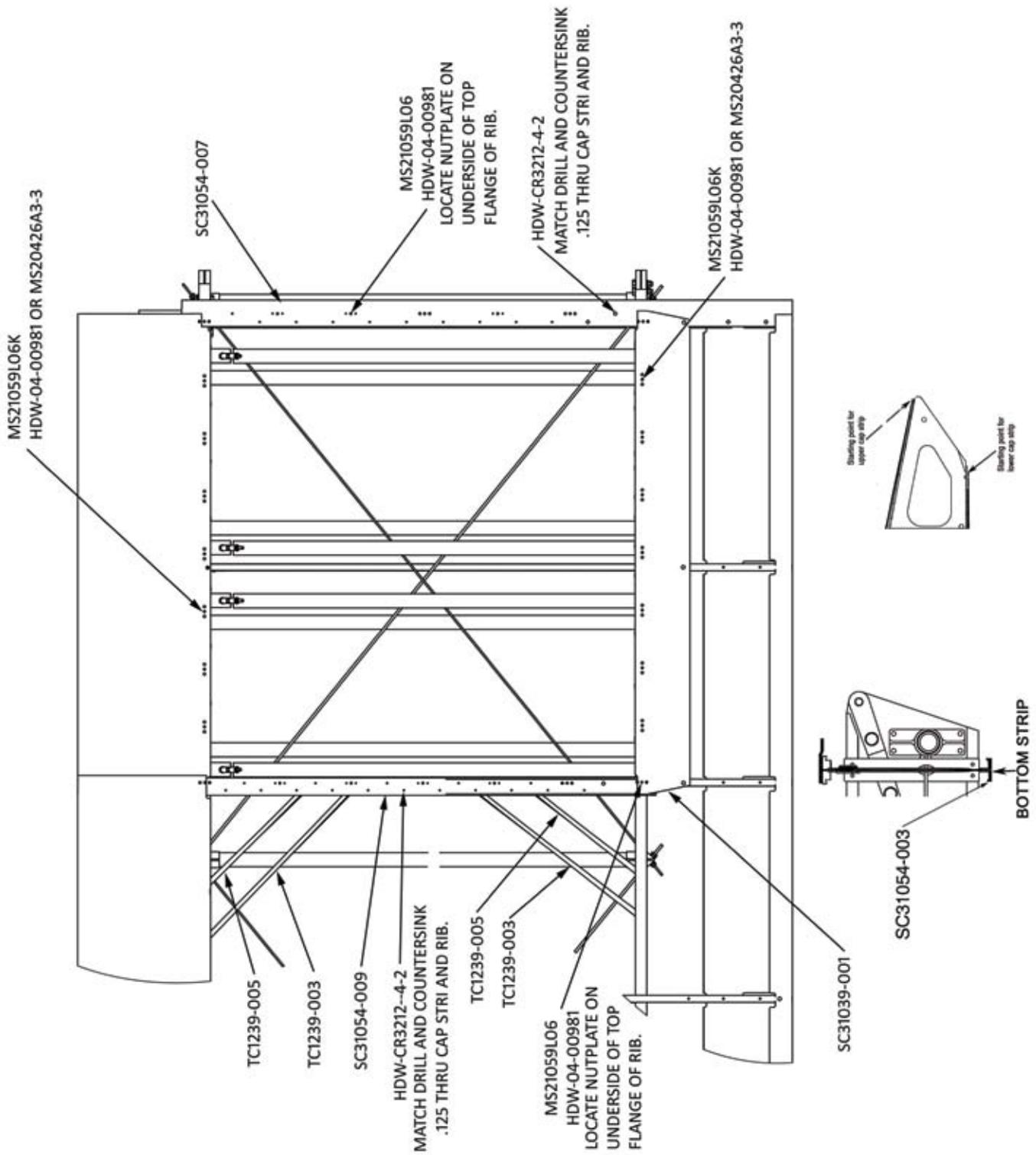


Figure W54

SECTION 42 INSTALL FUEL TANKS

Using a digital or Vernier Caliper measure the length of the drag/anti-drag wire threads protruding at the root end of the spar. Record both values. It helps to write the dimension on the butt rib next to the wire.

**Photo 257**

Release the root end of the tank bay drag/anti-drag wires by removing the nuts. These nuts should not have had Loctite applied earlier. Withdraw the small wire completely from the wing and set aside. The large wire will be retracted into the leading far enough to allow you to slide on a 42.5" piece of 5173K96 tubing and leave it loose as shown in Photo 258.

**Photo 258**

Cut the fuel tank transfer tube RM6102-001 to 1.5" long and install (fuel lube is your friend during this operation) onto one fuel tank and then slide the two hose clamps HDW-3720 over the fuel hose. Connect the Fuel hose between the two fuel tanks, DO NOT tighten the hose clamps at this time.

**Photo 259**

Install a 42.5" piece of RM5594-004 tubing through the tank holes from rear outboard to front inboard.

**Photo 260**

Install tanks by sliding them down the wire that was left loose in the previous step and place two 25-pound sandbags on the top of each tank (one near left edge at the middle and one near the right) to simulate the weight of fuel. Draw the drag/anti-drag wires back through the tanks and through the spar fittings. The large wire from outboard front to inboard rear **MUST** cross under the small wire. Re-thread the nuts to the position determined using the Vernier calipers at the beginning of this step. Apply Loctite to the threads once close to their final position. You need to assure that the original position of the drag and anti-drag wires is restored and that the original tension is restored. This is not a good time to be an overachiever by over-tightening.

Insert the bolts AN3-20A and washers AN960-10L into tank straps. This is a bit tricky because everything is a bit tight but it will go! Be sure that top of tanks follow the curve of the top of the ribs. The tanks must be centered. Adjust the tanks fore and aft, left and right as necessary to achieve the guidelines. Ensure nuts MS21042L3 and washers AN960-10L are seated onto bolts prior to moving tanks into proper position. Don't tighten the nuts until proper position is attained.

Now is the time to wrap the outboard end of the drag/antidrag with friction tape, this will keep the tubing from moving on the wires.

**Photo 262****Photo 261****Photo 263**

LOG & INSPECTION SHEET WING # 9

Log sheet

	FABRICATION AND ASSEMBLY TASKS	A	B	C	D
		Mfr Kit/Part/ Component	Commercial Assistance	Am-Builder Assembly	Am-Builder Fabrication
	Wings - 51 Listed Tasks				
	Task #				
W13	Fabricate Wing Tips				X
W14	Assemble Wing Tips to Wings			X	
W42	Fabricate Wing Fuel System components	.5			.5
W43	Assemble Wing Fuel System Components to Wing			X	
W49	Fabricate Fuel Tank	X			
W50	Assemble Fuel Tank to Wing			X	
W51	Calibrate Fuel System Components			X	

Inspection point

	INSPECTION ITEMS	BUILDER	ALTERNATE
1.24	Inspect tip bow for cracks and proper rivet and glue attachment.		
1.25	Tip bow should be min .13/max .20 out of square (outboard) to false spar.		
1.26	Ensure drain hole is open at trailing edge of tip bow.		
1.27	Distance from false spar to end of tip bow should be 12.625' ±.063		
1.28	Ensure the No. 1 rib has clearance for fuel line.		
1.29	Ensure fuel tank and tank straps are installed per drawing.		
1.30	Ensure ground wire installed between fuel tank and #1 rib is secure.		

SECTION 43 STALL WARNING

This step applies to the **LEFT WING ONLY**. Locate stall warning using the KFX30000-002 fixture as shown in Figure W55 below. Trace the cut out using the KFX30000-002 fixture. Drill 4 small holes and use the Unibit to drill out the large center hole.

THE STALL WARNING SWITCH WILL NOT BE INSTALLED UNTIL AFTER COVER AND PAINT BUT IT WOULD BE A GOOD IDEA TO TEST FIT IT NOW. AFTER TEST FIT, REMOVE IT AND SET IT ASIDE.

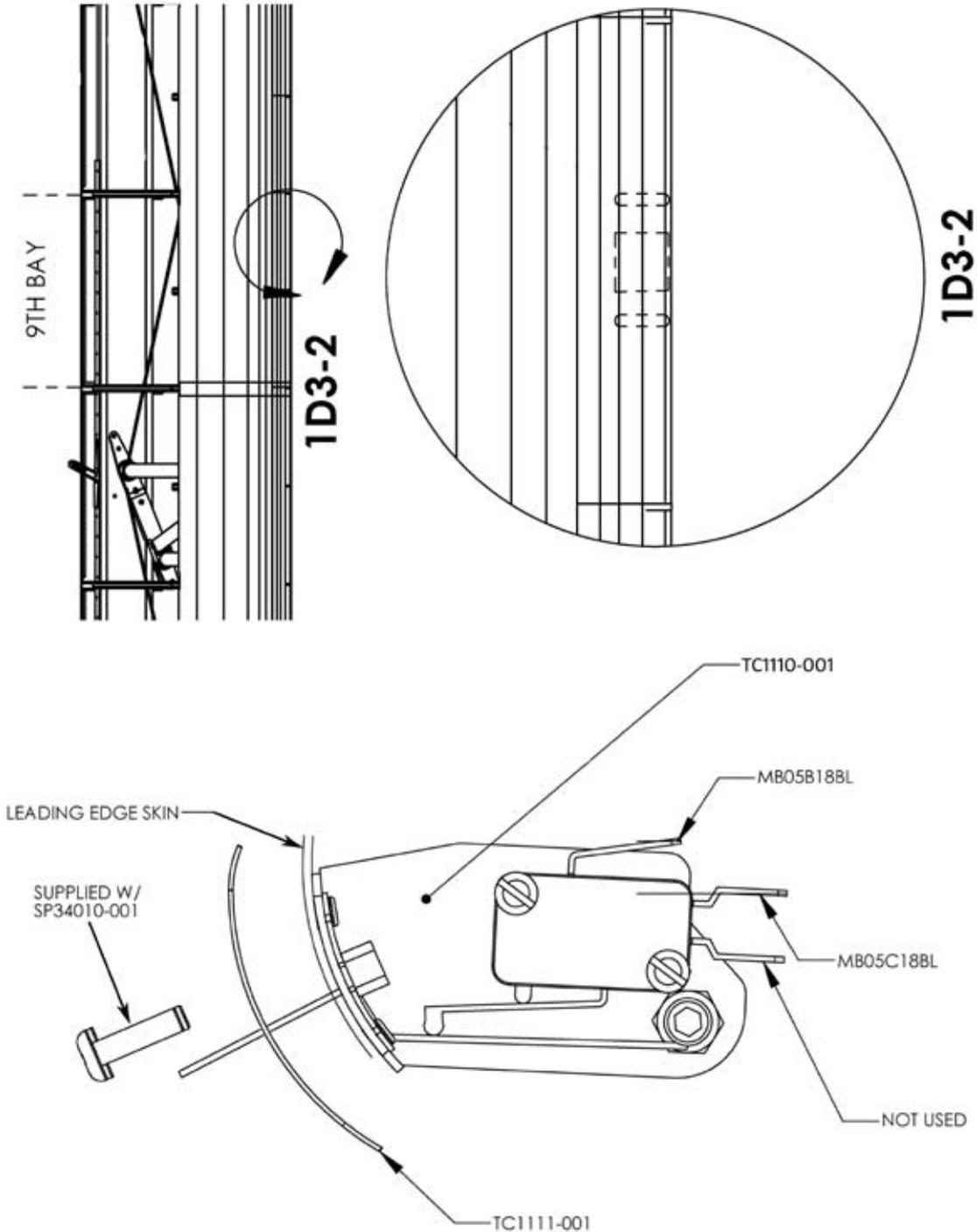


Figure W55

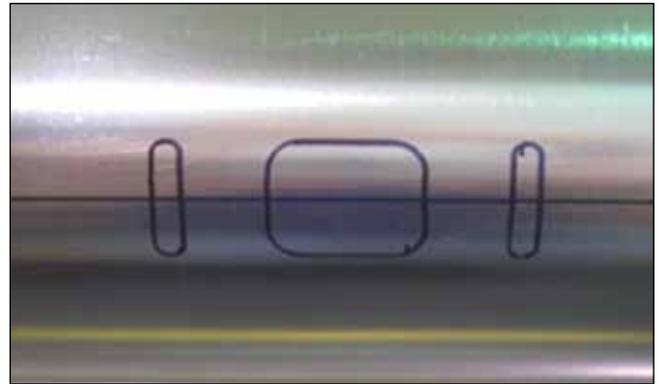


Photo 264

Use a nibbler and a file to remove excess material from the main opening.



Photo 265

Use a small round file to remove excess material from the slots.



Photo 266



Photo 267

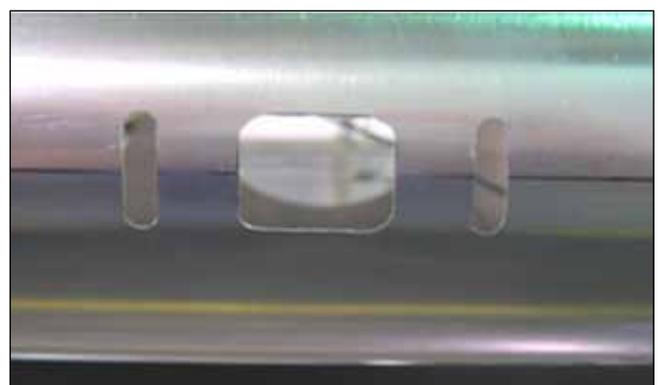


Photo 268

SECTION 44 FALSE SPAR CABLE RELIEF

Using thumb pressure, form a depression in trailing edge false spar directly over the center aileron hanger. This will give the proper clearance for the upper aileron cable. The depression should be approximately 3/16" deep.



Photo 269

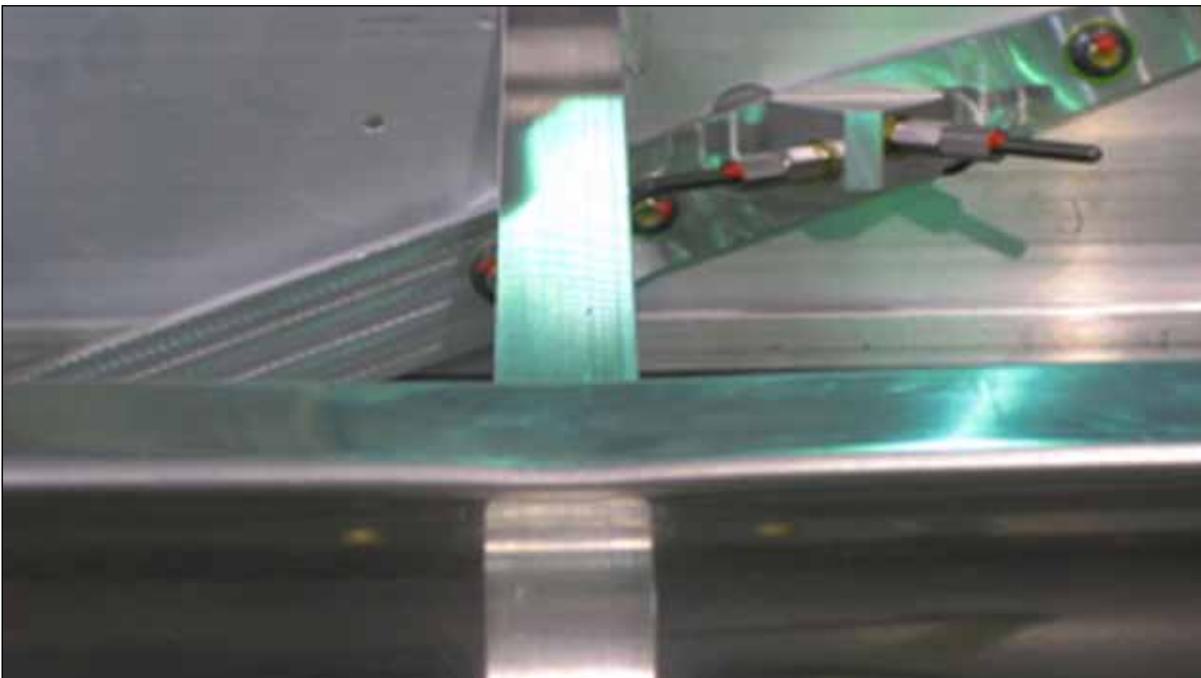


Photo 270

SECTION 45 Install Cable Fairleads

Install fair leads and associated circlips for the aileron cable in accordance with LOG & INSPECTION SHEET WING # 10.



Photo 271

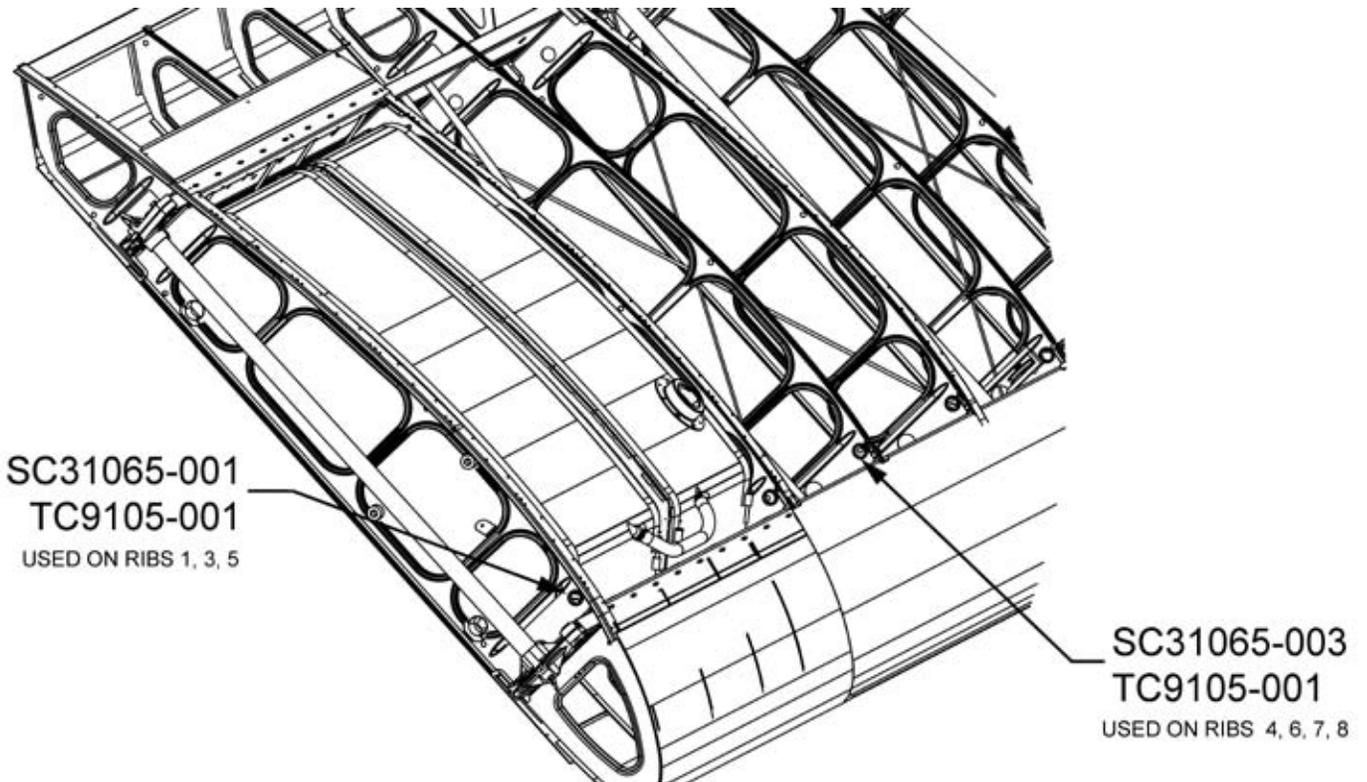


Figure W56

SECTION 46 AILERON CABLES

Thread aileron balance cable as shown when installing pulleys. SC97400-002 is the right balance cable. SC97400-001 is the left balance cable.

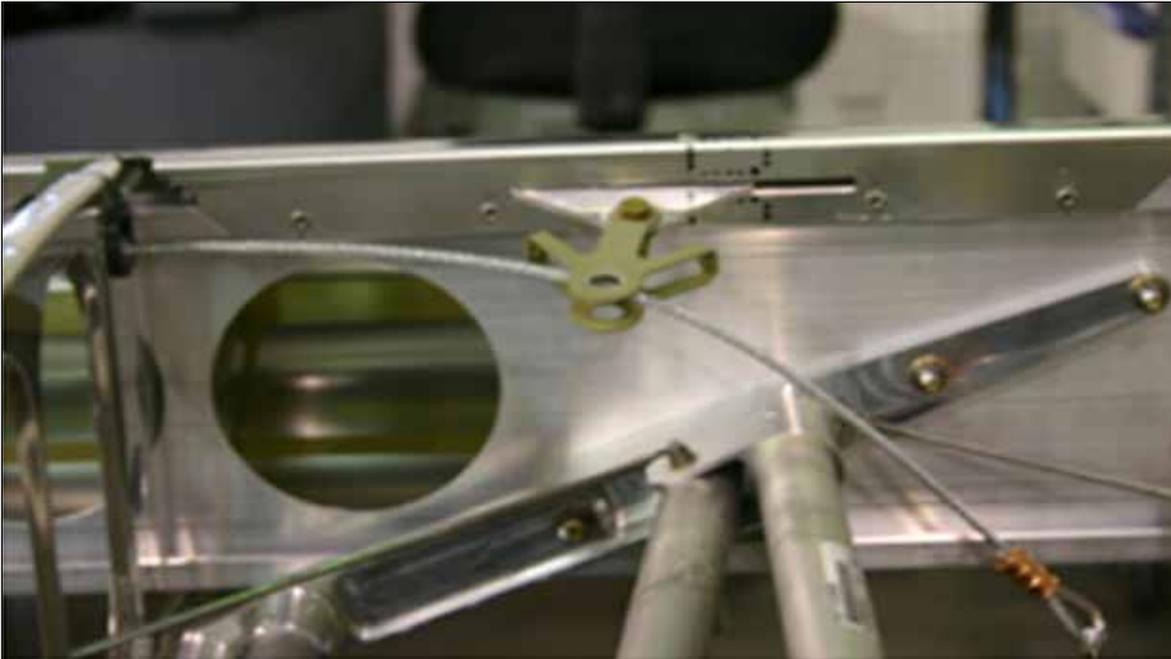


Photo 272

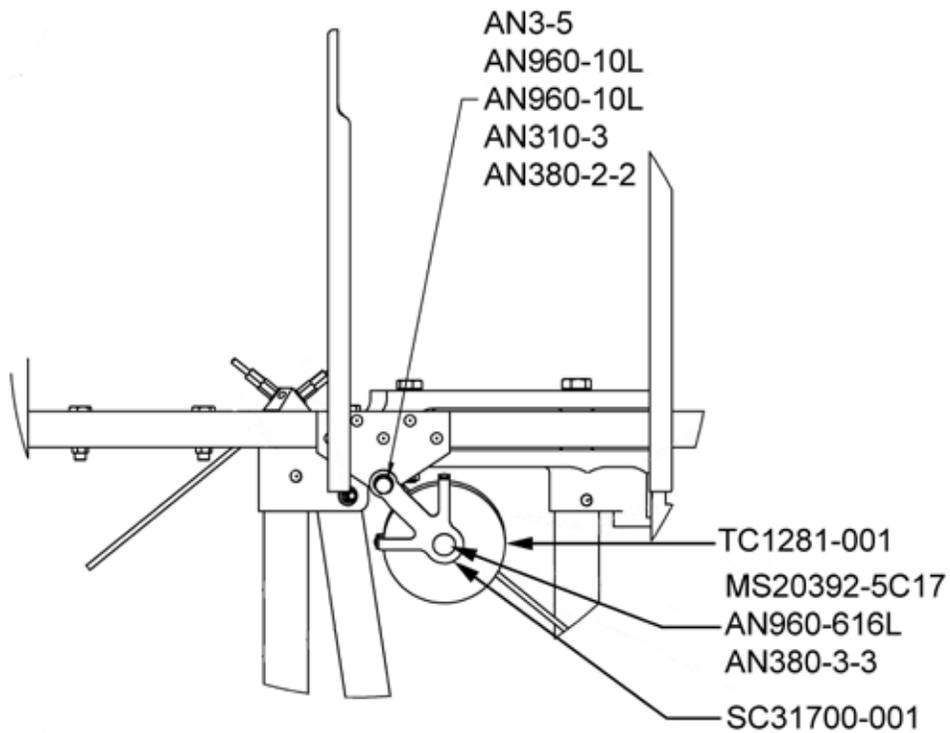
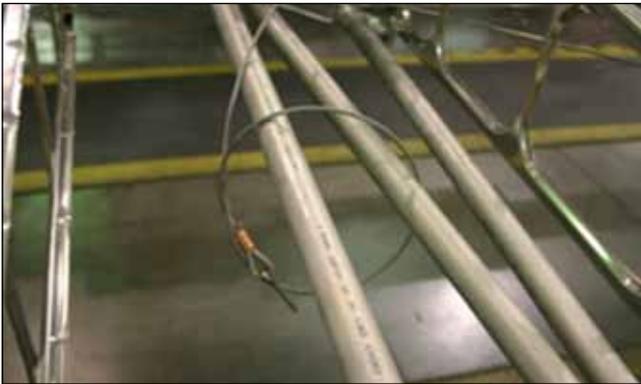


Figure W57

**Photo 275**

Terminate the cable in the LEFT wing in the second bay, and tape to the drag-antidrag wire as shown in Photo 275. This cable will be connected to the right cable in the #2 bay during final assembly.

**Photo 276**

Loosely wrap the outboard end of the cables around the N brace, to keep out of the way while covering.

**Photo 277**

Terminate the cable for the RIGHT wing on the outside of the # 1 rib as shown in the picture. Tape to the compression strut.

**Photo 278**

Loosely wrap the outboard end of the cables around the N brace, to keep out of the way while covering.

SECTION 48 INSTALL BOTTOM CAP STRIP AT RIB #1

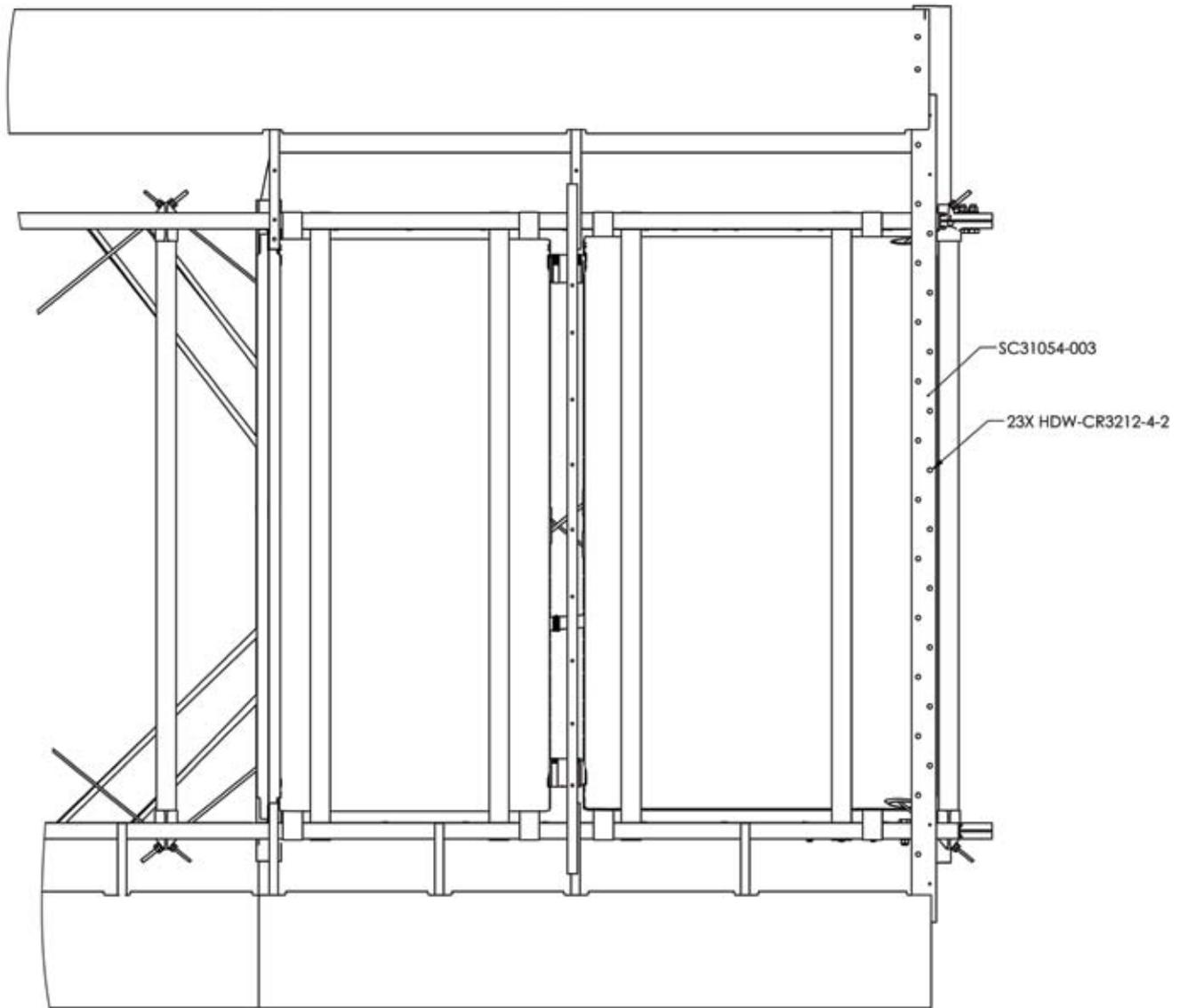
In the same manner as for the upper cap strip (installed previously in SECTION 40), install the bottom cap strip on the number one doubled rib. Use Figure W59 for part callout.

EACH END OF THE CAPSTRIP HAS A DIFFERENT MEASUREMENT FROM THE END TO THE FIRST HOLE. THE END WITH THE LONG MEASUREMENT GOES TOWARDS THE REAR FALSE SPAR.

NOW IS THE TIME TO INSTALL THE RIVETS IN THE LEADING EDGE AND THE FALSE SPAR THAT YOU LEFT OUT IN THE EARLIER STEPS.



Photo 279



BOTTOM VIEW

Figure W59

SECTION 49 FUEL TANK GROUND CABLE

Install ground strap between inboard tank and #1 rib and the outboard tank and rib #3 with hardware per Figure W60.



Photo 280



Photo 281

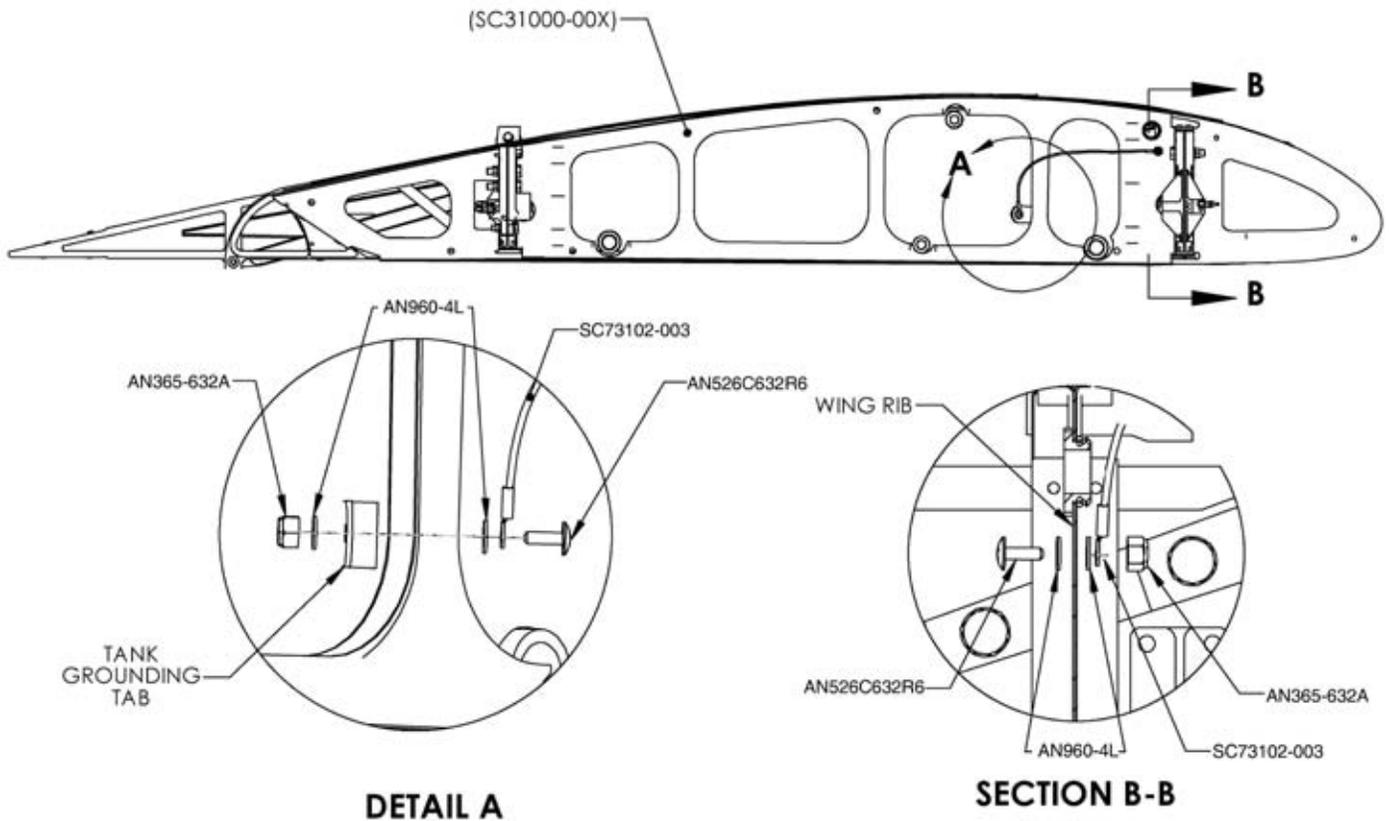


Figure W60

SECTION 50 FOAM SPACER BLOCKS

Before covering install a foam block per Photo 282, Photo 283, and Figure W61. You will need to make these blocks from high density foam (do not use ice chest foam). Any lumber yard will have high density foam used for building insulation. The purpose for this block is to keep the fabric from pulling the #1 rib out of alignment.



Photo 282



Photo 283

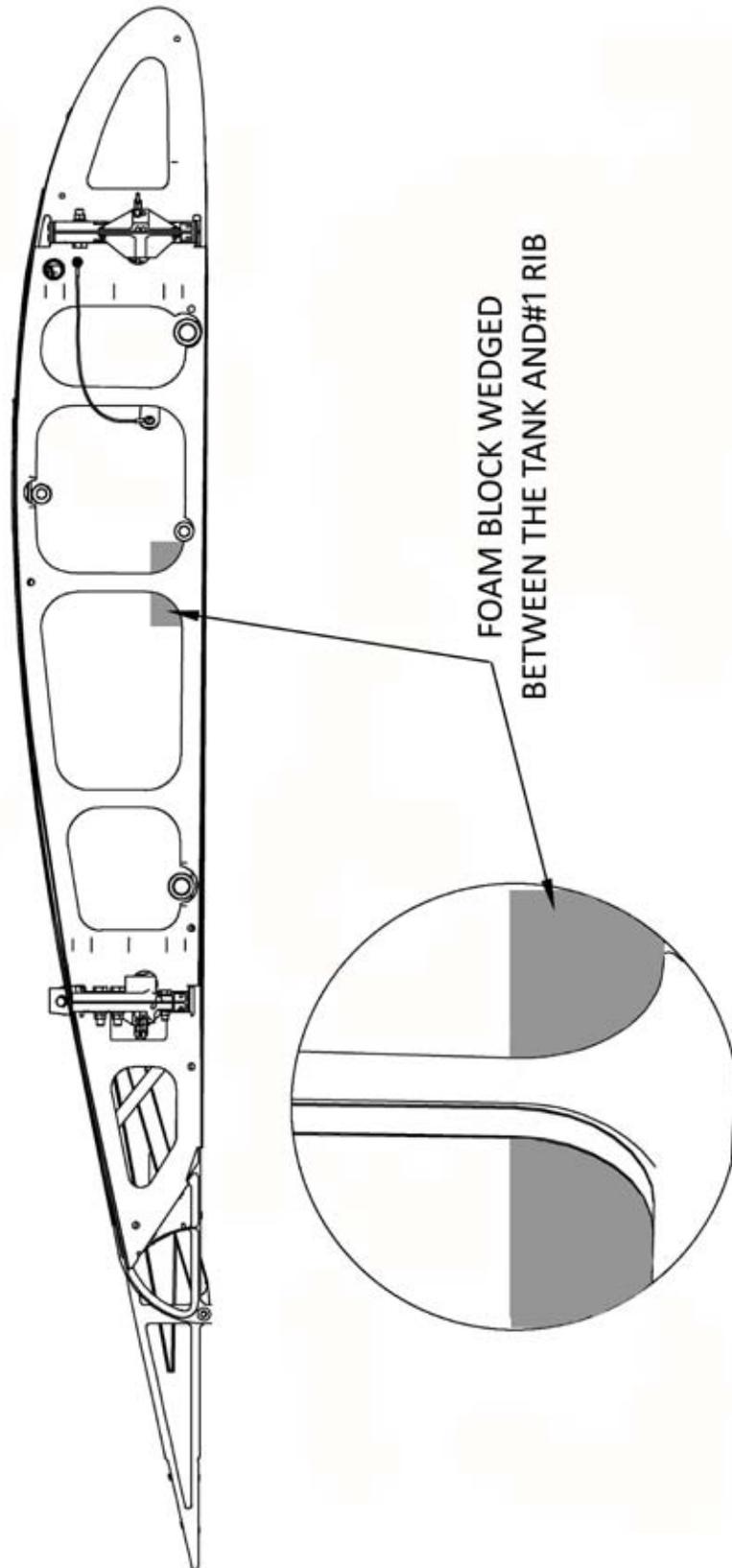
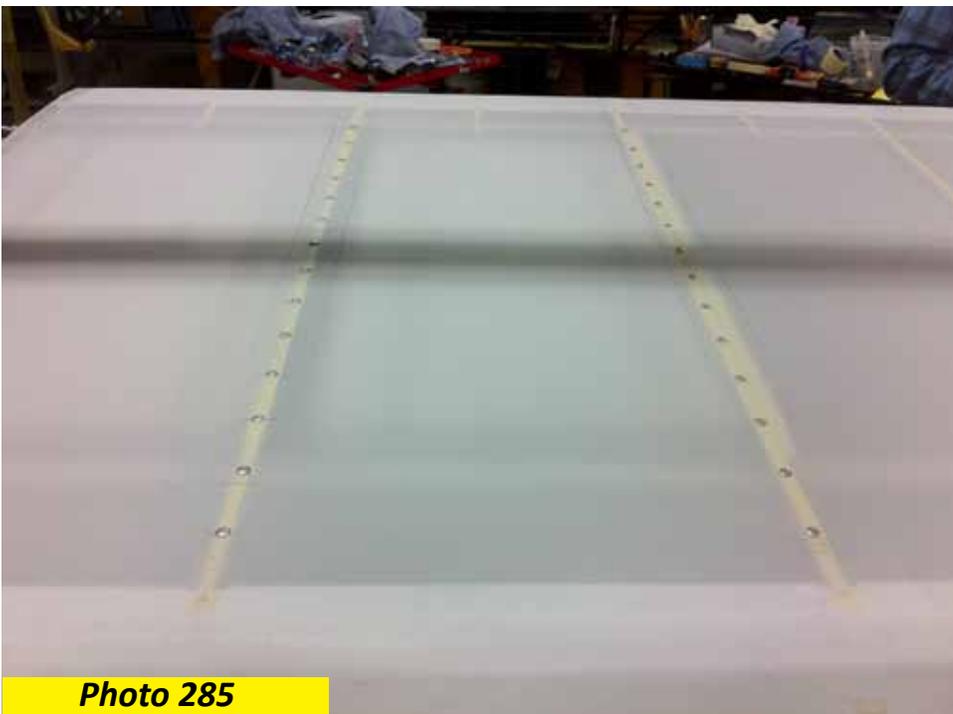


Figure W61

SECTION 51 ADDITIONAL COVERING INFORMATION

Before you start covering your wings, you will need to verify that you have predrilled the holes in the number two and three ribs as shown in Figure W62. When that is completed, use Figure W62 in conjunction with the covering manual. This figure only applies to the Extended Fuel Wings. When installing the covering, you will need to install the fabric reinforcement tape and rivets per Figure W62. The tank lid should be trimmed and installed after the wings have been hung, the twist and fabric pull will affect the tank lid fitting.

**Photo 284****Photo 285**

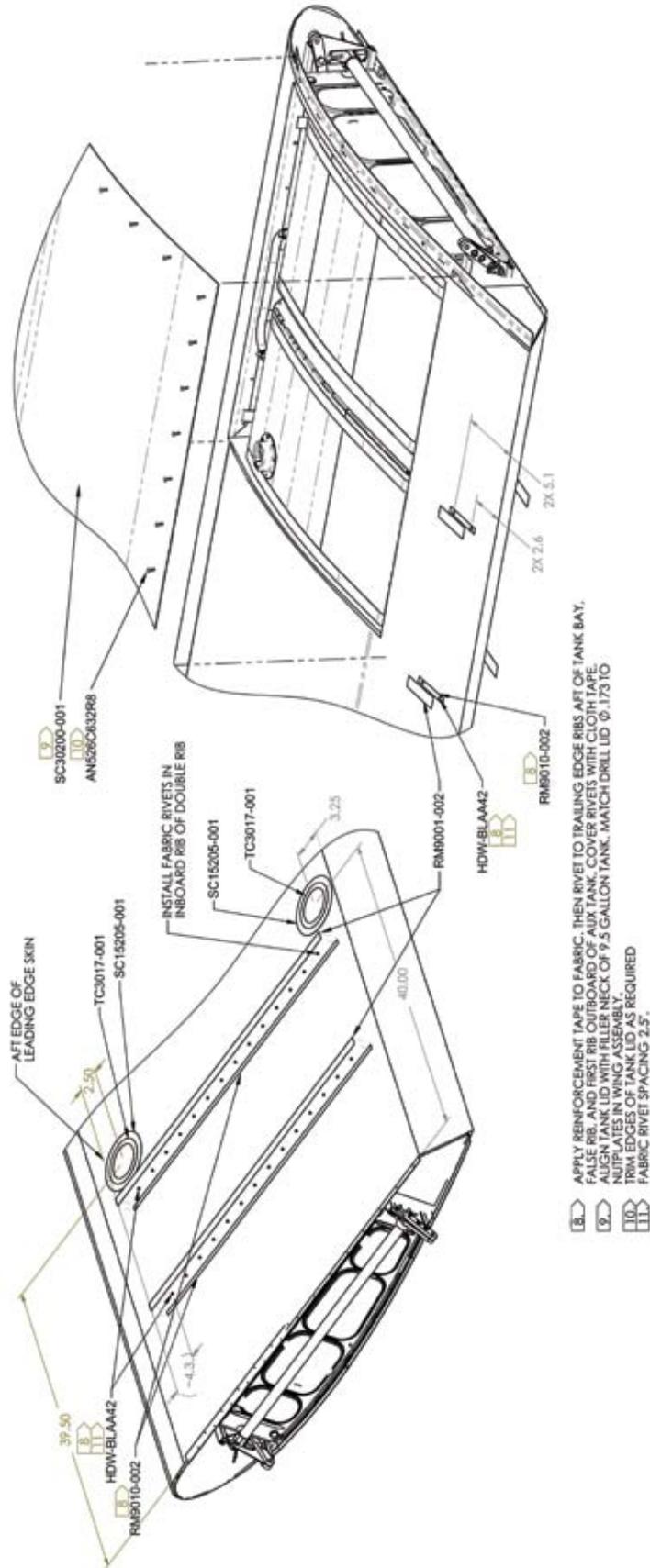


Figure W62

SECTION 52 ADDITIONAL HOLE DRILLING INFORMATION

If you are planning to rivet the fabric onto the wings instead of rib stitching the wings. You will need to drill the additional holes shown in Figure W63, Figure W64, Figure W65, and Figure W66.

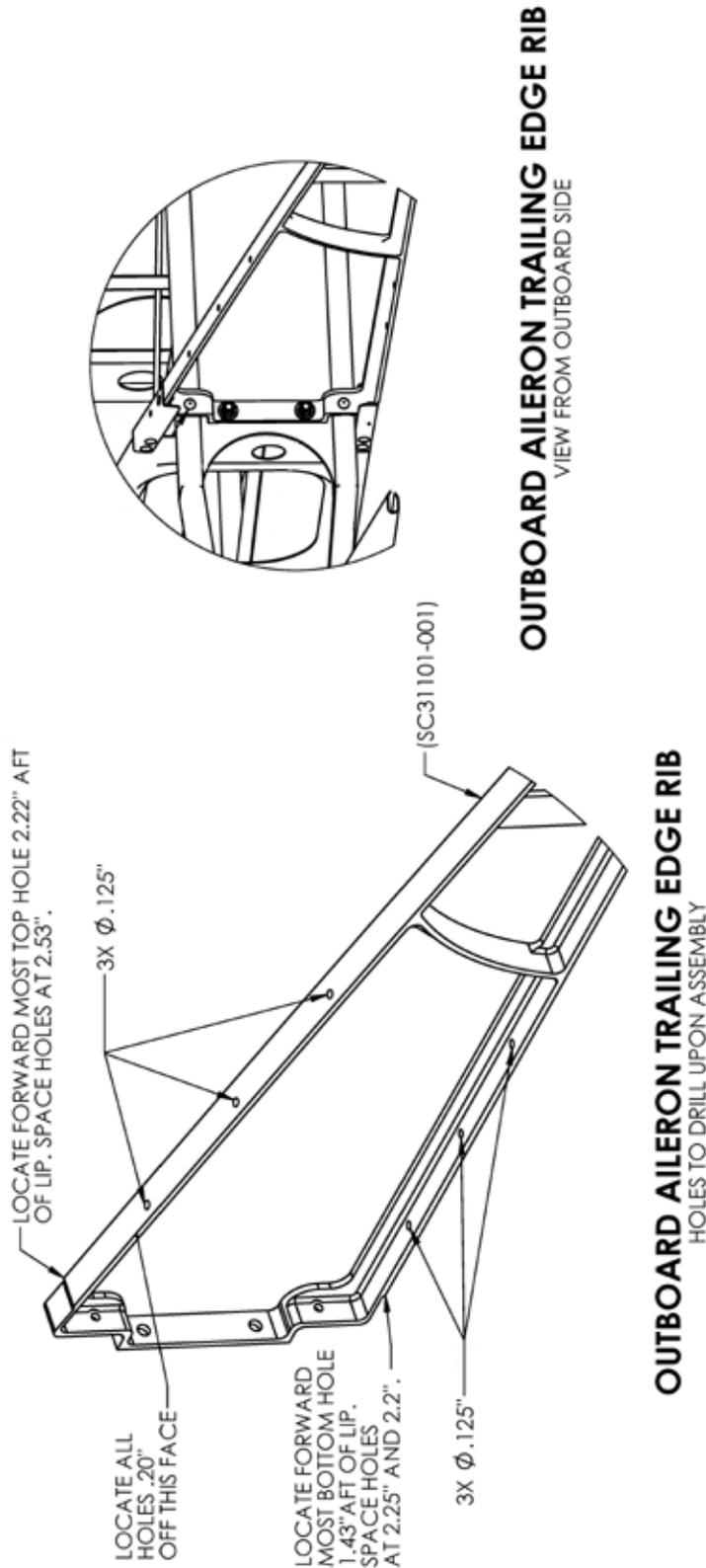


Figure W63

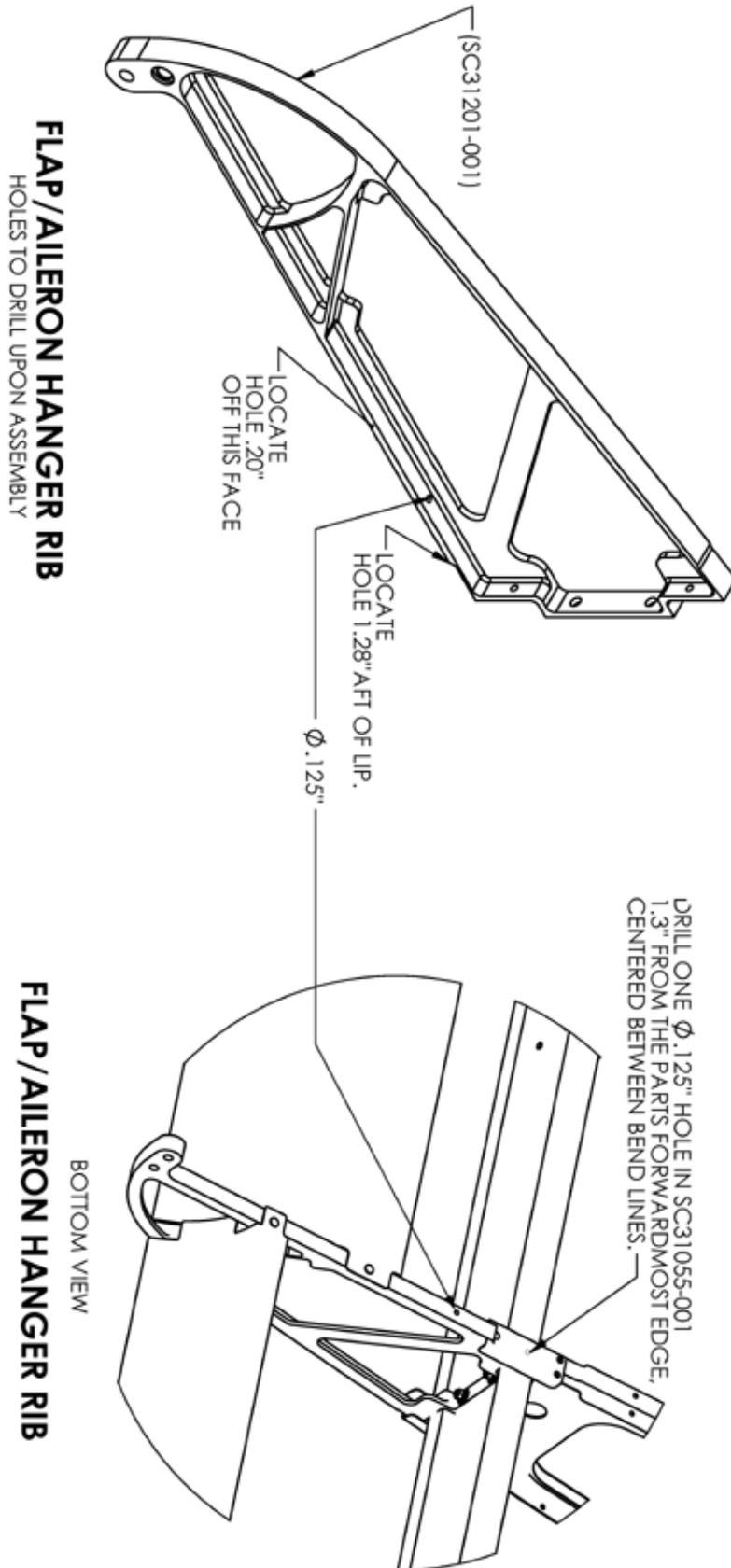
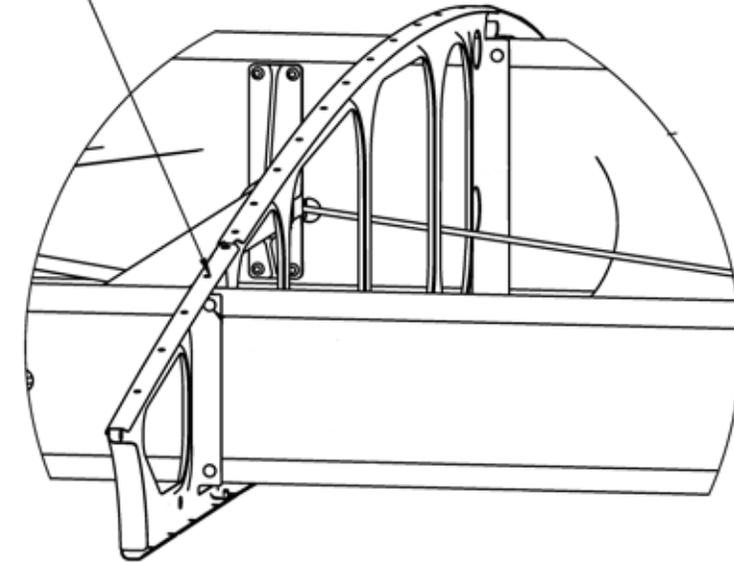


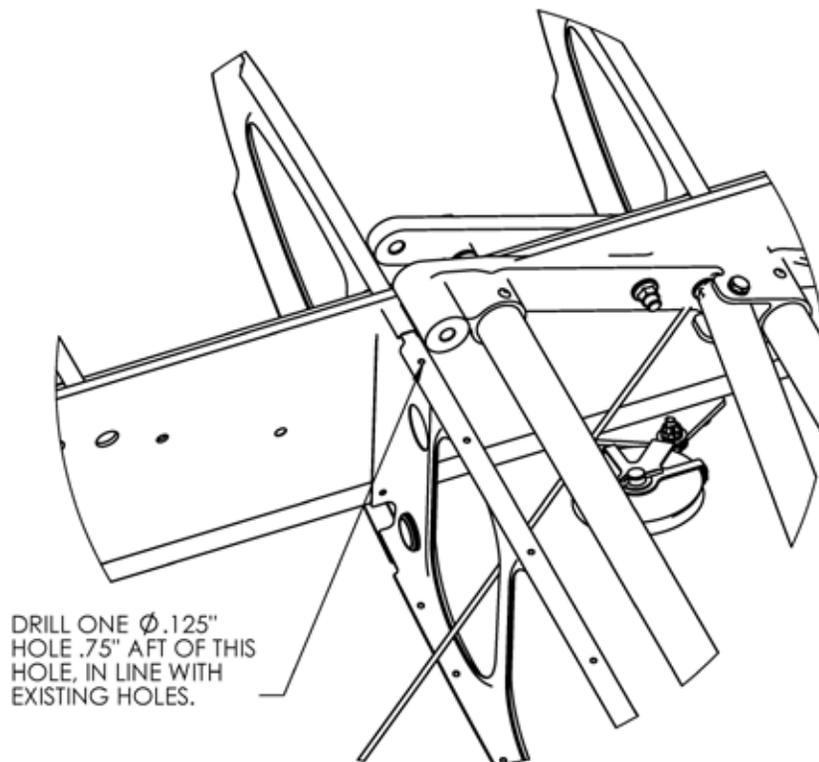
Figure W64

DRILL ONE ϕ .125" HOLE 2.75" FORWARD OF EXISTING HOLE ON TOP LEADING EDGE OF TRAILING EDGE RIB, CENTERED BETWEEN BEND LINES. DRILL THROUGH SC31045 TANK EXTENSION SKIN AND RIB WHERE INSTALLED.



ADDED TAIL RIB HOLE TYPICAL

Figure W66

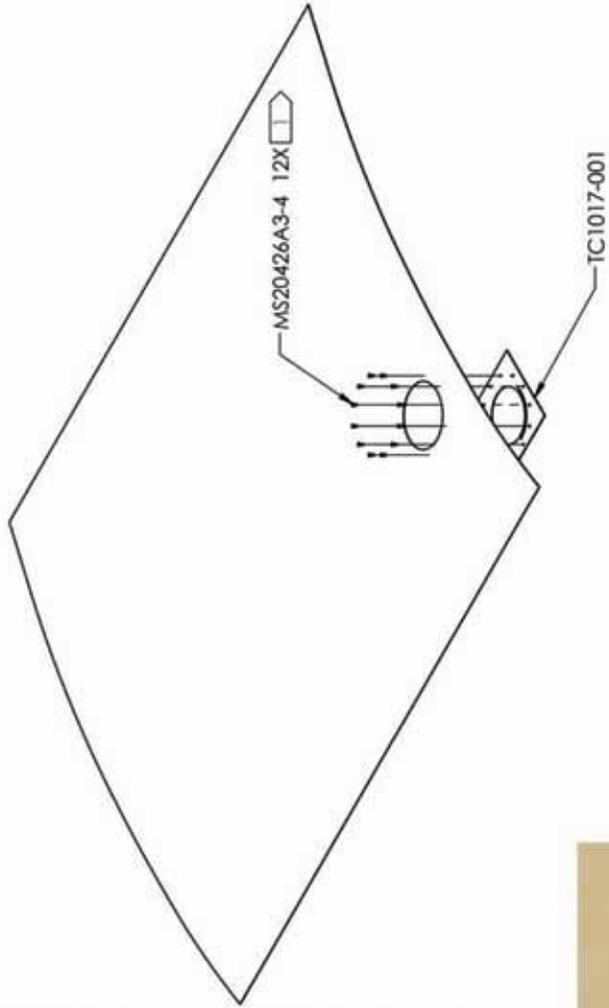


DRILL ONE ϕ .125" HOLE .75" AFT OF THIS HOLE, IN LINE WITH EXISTING HOLES.

#8 RIB DETAIL (BOTTOM ONLY)

Figure W65

SECTION 53 FUEL TANK COVER INSTALLATION



NOTE:



MATCH DRILL TANK COVER TO LID RING, 12X Ø.098.

**FUEL TANK BAY
COVER ASSEMBLY**

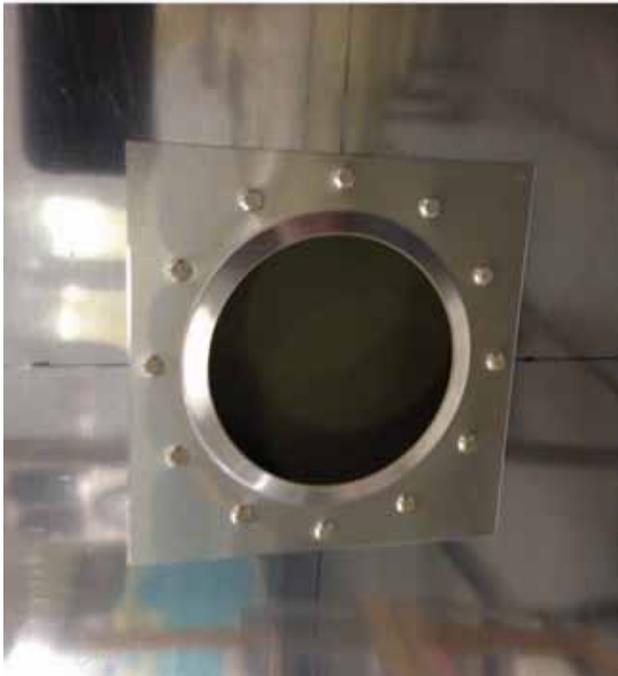


Figure W67

SECTION 54 QUALITY CONTROL (INSPECTION)

In any complex endeavor it becomes necessary to check one's work. That time has come for the building of the wings.

On the following 2 pages, there are Quality Control Inspection Procedures for the right and left wings. Please carefully examine the wing(s) that you have built and assure that each inspection step has been completed at the highest standard of workmanship. If you have any doubt about whether your work is acceptable or not, you can consult with CubCrafters or you can consult with a FAA certified airframe mechanic or mechanic with Inspection Authorization.

The second page of the Inspection Procedures are for recording of corrective action. Don't be bashful about writing about recording the necessary fixes or pick-up work. You don't want to forget to take care of it!

Assure absolutely, positively that the wing(s) have been properly assembled and that all steps are complete.

LOG & INSPECTION SHEET WING # 10

Log sheet

	FABRICATION AND ASSEMBLY TASKS	A	B	C	D
		Mfr Kit/ Part/ Component	Commercial Assistance	Am- Builder Assembly	Am-Builder Fabrication
	Wings - 51 Listed Tasks				
	Task #				
W41	Assemble Basic Wing Structure			X	
W46	Fabricate Wing Coverings or Skin				X
W47	Assemble Wing Covering or Skin to Wing			X	
W48	Fabricate Wing Struts/Wires	X			
W16	Fabricate Aileron Spars	X			
W17	Fabricate Aileron Ribs or Cores	X			
W18	Assemble Aileron Ribs or Cores to Aileron	X			
W19	Assemble Aileron Primary Structure	X			
W20	Fabricate Aileron Leading and Trailing Edges	X			
W21	Assemble Aileron Leading and Trailing Edges	X			
W22	Fabricate Aileron Brackets and Fittings	X			
W23	Assemble Aileron Brackets & Fittings to Aileron	X			
W24	Fabricate Aileron covering or Skin	X			
W25	Assemble Aileron Covering or Skin to Aileron	X			
W26	Fabricate Aileron Roll Trim	NA	NA	NA	NA
W27	Assemble Aileron Trim Tab/Roll Trim to Aileron	NA	NA	NA	NA
W28	Assemble Aileron to Wing	X		X	
W29	Fabricate Flap Spars	X			
W30	Assemble Flap Spars to Flap	X			
W31	Fabricate Flap Ribs or Cores	X			
W32	Assemble Flap Ribs or Cores to Flap	X			
W33	Assemble Flap Primary Structure	X			
W34	Fabricate Flap Leading and Trailing Edges	X			

LOG & INSPECTION SHEET WING # 11

FABRICATION AND ASSEMBLY TASKS		A	B	C	D
		Mfr Kit/Part/ Component	Commercial Assistance	Am-Builder Assembly	Am-Builder Fabrication
	Wings - 51 Listed Tasks				
	Task #				
W35	Assemble Flap Brackets and Fittings to Flap	X			
W36	Fabricate Flap Covering or Skin	X			
W37	Assemble Flap Covering or Skin to Flap	X			
W38	Assemble Faps to Wing			X	

Inspection point

	INSPECTION ITEMS	BUILDER	ALTERNATE
1.31	Ensure that aileron cable depression is in proper location and at proper depth.		
1.32	Ensure that #1 rib reinforcement caps are installed properly.		
1.33	Ensure aileron cable is installed properly.		
1.34	Ensure that aileron pulleys are saftied and rotate freely.		
1.35	Ensure ground wire installed between fuel tank and #1 rib is secure.		
1.36	Check for overall wing assembly and finish.		