#51A

.05

NOSE GEAR CHATTERING AND INADVERTENT LOWERING DURING FLIGHT

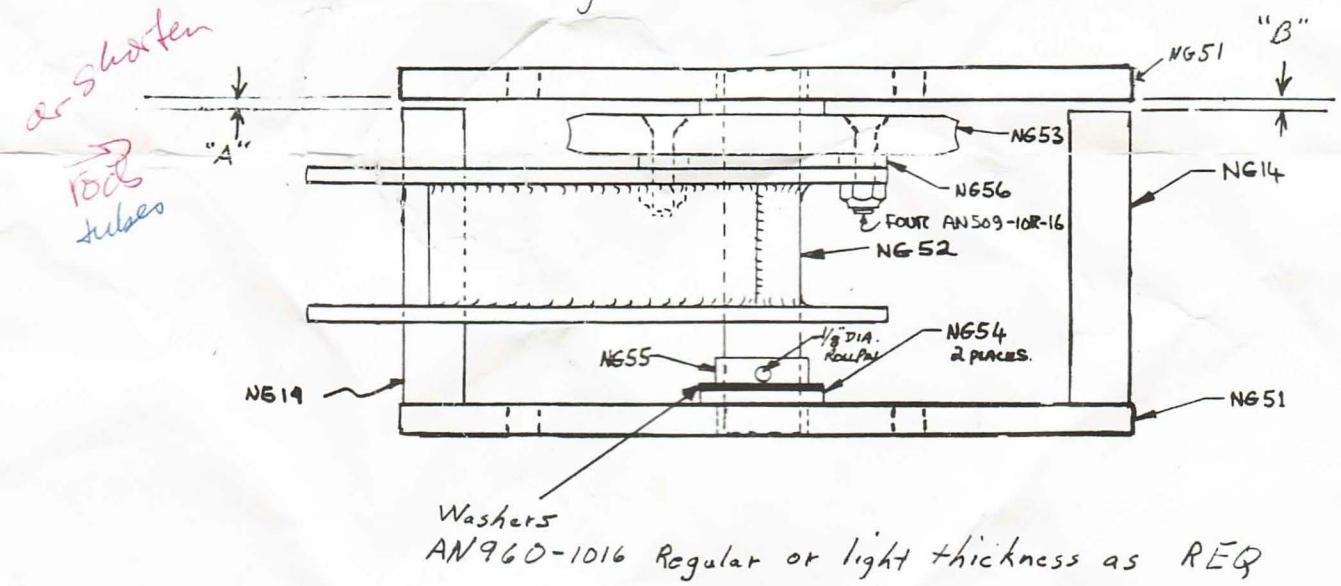
The following procedure will reduce and in most cases eliminate the chattering of the nose gear during lowering and some reported cases of inadvertent lowering in flight during turbulent weather conditions. This condition is caused by the weight of the nose gear wheel assembly pulling the gear housing arm (NG50) and causing it to over run the speed of the rotating worm gear (NG58) during lowering. An axial thrust load on the low speed shaft (NG52) will resist the weight and over running condition. The nose gear housing sides (NG51 and NG30) are considered a flexible gear housing and require a greater axial thrust load present on the low speed shaft (NG52) than a rigid gear housing to eliminate the low speed gear (NG53) over running the worm gear (NG58) during lowering which results in a chattering sound. This can eventually result in gear fatigue.

To accomplish the axial thrust load, [redacted] washers (AN960-1016), regular or light thickness, need to be added on the low speed shaft between the NG55 spacer and the NG53 bearing as required to achieve an even clearance of .030" to .060" at points A and B shown on figure #1. Clearance should be set before the gear housing is installed in the plane since you will be unable to determine the thrust load clearance when installed.

Both bearings (NG54) should be lubricated with a grease type lubricant before installation.

If there are any questions or problems, please feel free to give me a call or write: George Dyer, 6221 Chapman Ave., Garden Grove, CA 92645 (714-894-6448)

Figure #1



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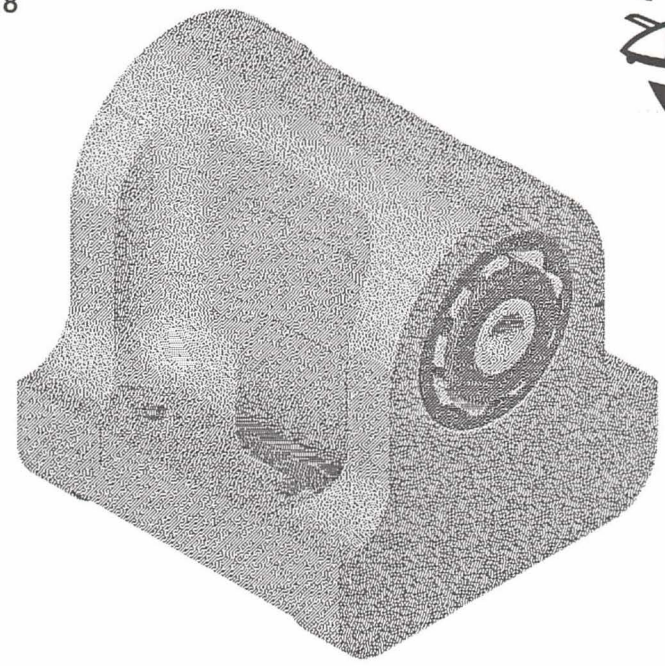

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- RETROFITABLE TO EXISTING NOSEGEAR ASSEMBLIES

ADDING GEAR DOORS TO YOUR LONG-EZ

by Verne "Catman" Simon

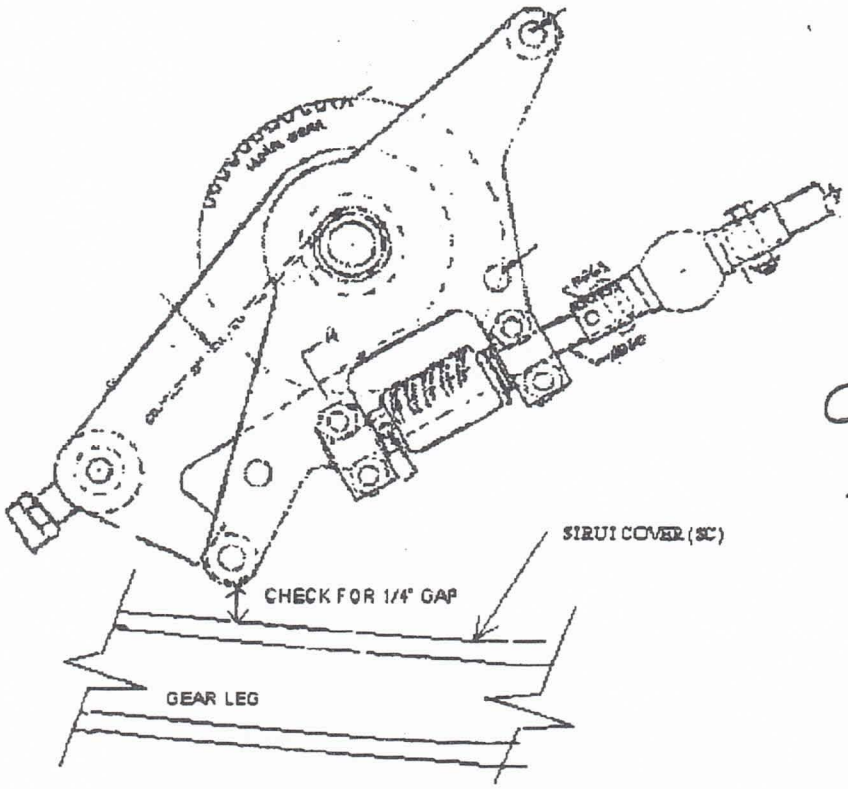
At this point the caveat of "Don't start vast projects with half vast ideas" should be observed. If you have the expectation that you will see a perceptible increase in speed as a result of this modification you may need a prescription for Haldol. On the other hand if you think gear doors are "cool" and you have weeks to invest in this project; proceed. You may get an increase but it will be in conjunction with other drag reduction efforts such as : burying antennae in your structures, wheel pants, modification to ducting of engine and (of course) more horsepower.

While my airplane languished awaiting repaired cylinders, I decided that I would finally install gear doors. The problem was that the opening was curved and gear doors hinge best along a straight line. My cat "Magneto" and I studied the opening and after due deliberation it was determined that a opening (similar to the one seen below) could be cut into the belly with little damage to paint and none to structure.

Doesn't look like our opening → Looks like gear to skin measurement — Do you mean in Step 4?

PLANNING

Before launching into this you should check to see if the wheel and fork are above the belly skin. If it is at least 1/4" or better above the belly your in good shape. If not check to see if you have at least 1/4" clearance between the strut and NG 14 (see illustration 1). If the strut is touching the retract assembly and the wheel is flush with the belly do not attempt this project unless you are willing to relocate the entire retract mechanism.



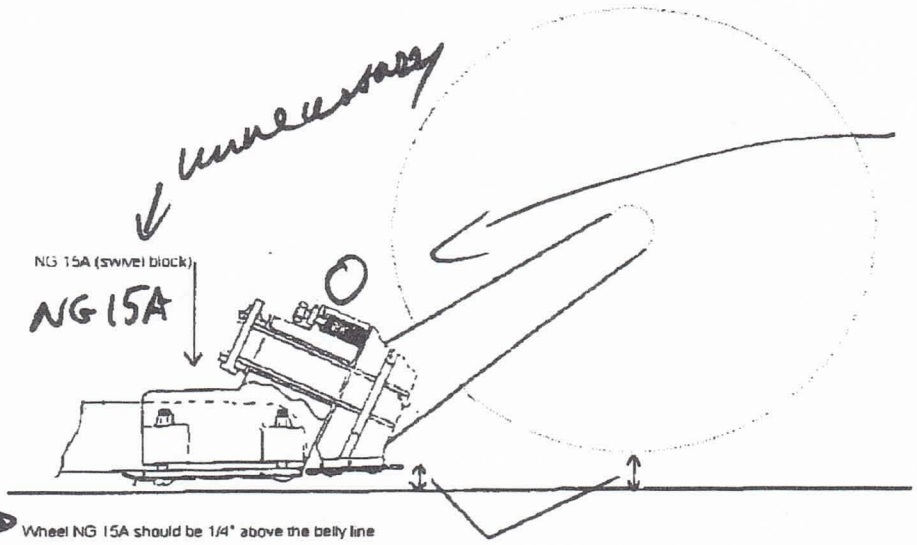
Covered in Step 3.

SECOND STEP

Remove the strut cover (SC) entirely. Next remove any fairings you may have installed on the nose strut.

THIRD STEP

Fully retract the gear. Verify that the wheel is 1/4" or greater above the bottom skin. This will prevent interference with the gear door reinforcements and retraction hardware.



unnecessary

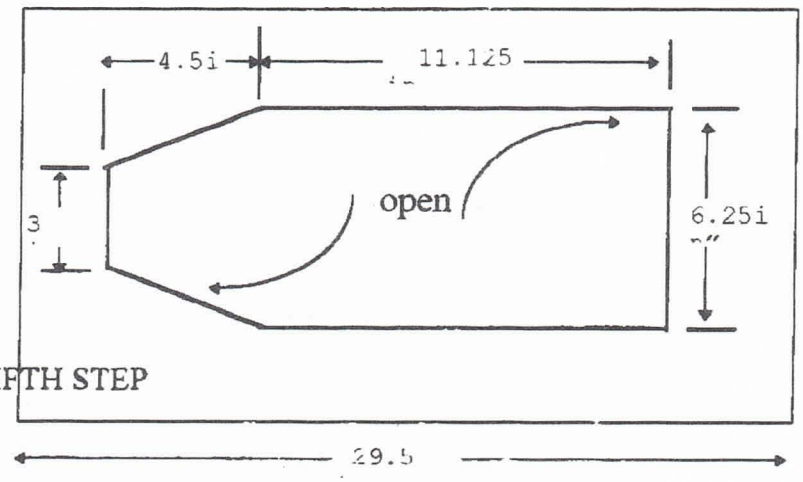
Could put spring here refer back to this drawing

Bigger

What's MDF?

FOURTH STEP

Extend the nose wheel. Fabricate a router template as shown in fig 2) made up of 1/2 MDF . Align the template so that it is centered over the opening and parallel to center line and then secure it to the belly with drywall screws. The Template should be at least a 1/4" wider than the widest part of the gear well. If not, enlarge the template as necessary.



Bold #5 ?

FIFTH STEP

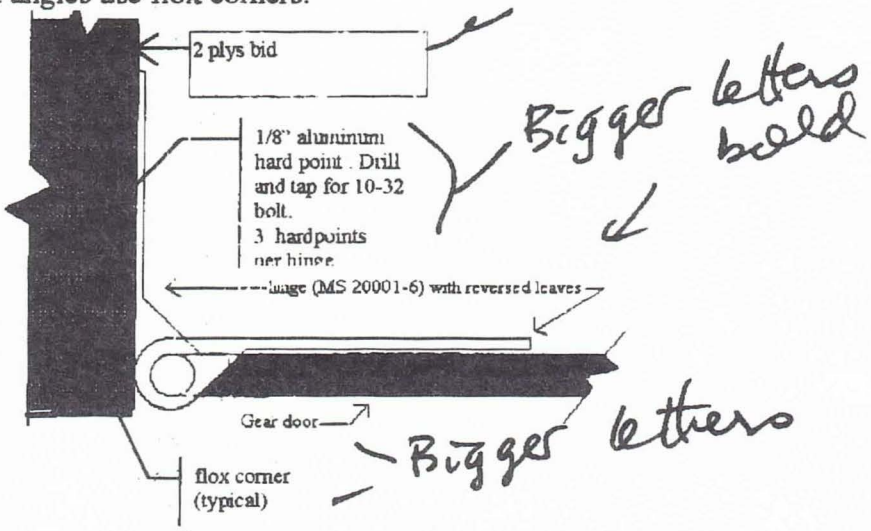
If you have never worked with a router before ,your airplane is not a good place to learn. Get somebody who has experience to help you. For this part you will need a router (obviously) ,1/2" template guide for your kind of router, 1/2" carbide router bit at least 3 inches in length, and goggles (it gets real messy).

Set the blade so that it extends at 1/2" below the opening of the template guide. Rest the base of the router on the MDF template you made. The blade should be free to rotate. Start the router and then move it around the template so that the template guide touches the edge of the template. Remove all unwanted foam and glass with the router. Reset the depth of the router so that it is at least 1 -1/4 in depth for your final cut. Once again remove all unwanted foam and glass with the router as before.

Seems rather drastic - reassure >

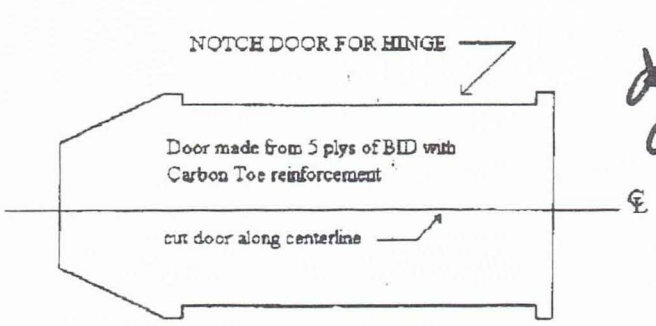
SIXTH STEP

At this point you have made an opening which looks like a very odd ironing board. Very impressive! Check to see if the hinge (MS 20001-6) will fit along the vertical wall of the opening. The wall should be 1 - 1/4" in depth . Install three evenly spaced 1/8" aluminum hard points so that they are flush with the foam.
A two ply BID lay-up is used to encapsulate exposed foam; and where new glass joins old at right angles use flox corners.

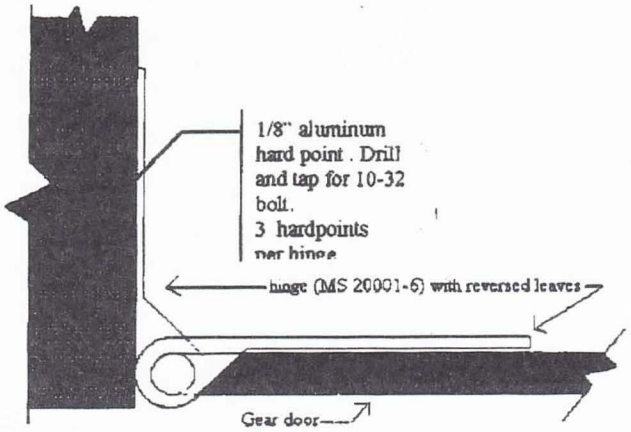


Seventh Step Caps

In this step you will construct the gear doors and a new strut fairing. Lay-up 5 plys of bid on a very flat surface approximately 7 "x 16 " If possible use carbon fiber. After cure trim the door to fit the new well. Cut the piece in half along its length



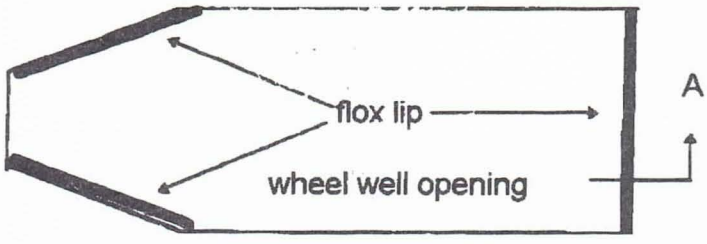
Reverse one leaf of a MS 20001-6 hinge and then cut it to fit the notch

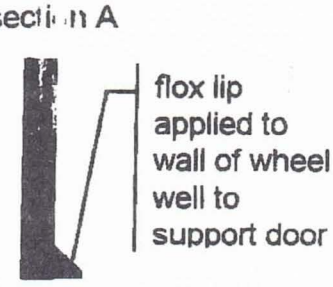


Rivet the gear door to the hinge with flat head rivets. If your door is made from carbon fiber it is recommended that regular fiberglass should be placed between the hinge and the carbon fiber to prevent electrolysis. Use your own judgment in the quantity and size of rivets (I used too many).

Locate the hardpoints you installed in step 6 . Cleco the gear doors to the side of the modified wheel well and check for proper alignment of the doors to one another and to the belly skin. You will note that the front of the doors do not follow the contour of the belly. Use your heat gun and some judicious bending to encourage the doors to align with the curve of the fuselage. Once your satisfied that the doors are where you want them drill the hinge through the hardpoint with a #____drill and tap for a 10-32 bolt.

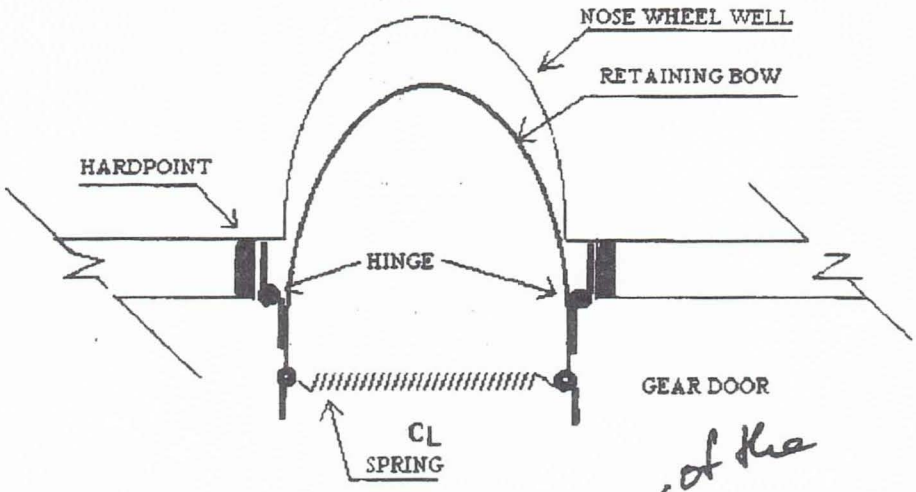
After you have completed the installation of the doors, a lip made from flox should be made to support the door against air loads. During this process gray tape is applied to the doors where it may come into contact with the flox. Only one door at a time can be done





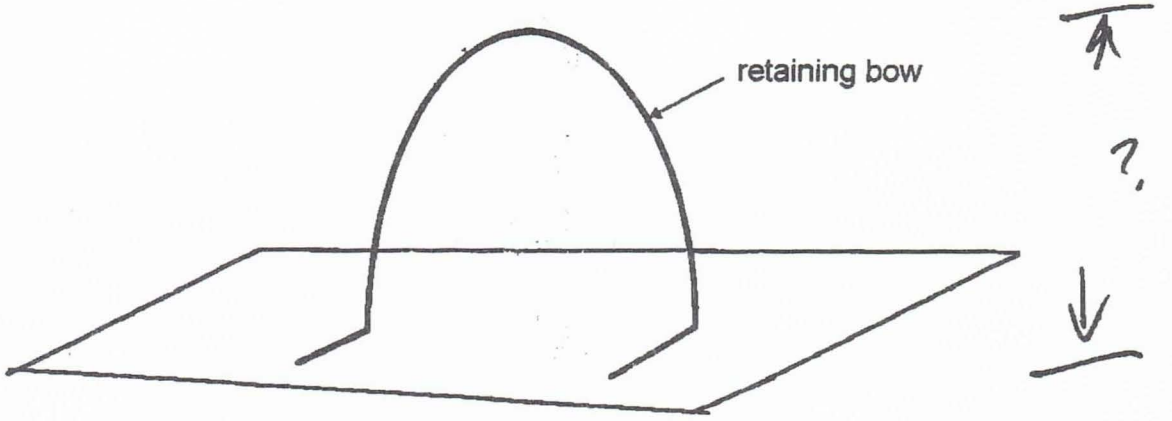
Eighth Step Cays

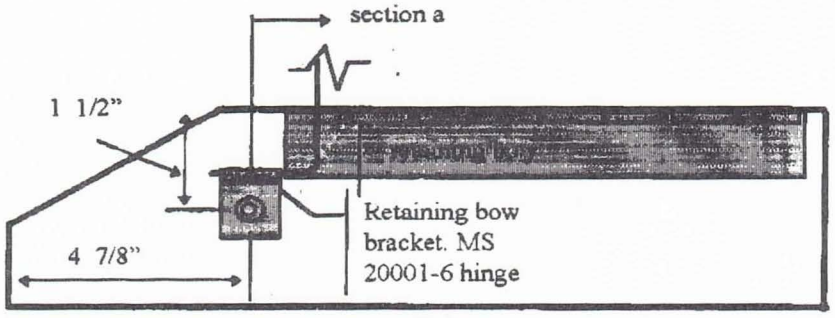
The gear door is aligned with the slip stream and kept from closing inadvertently with a simple piano wire bow (see illustration)

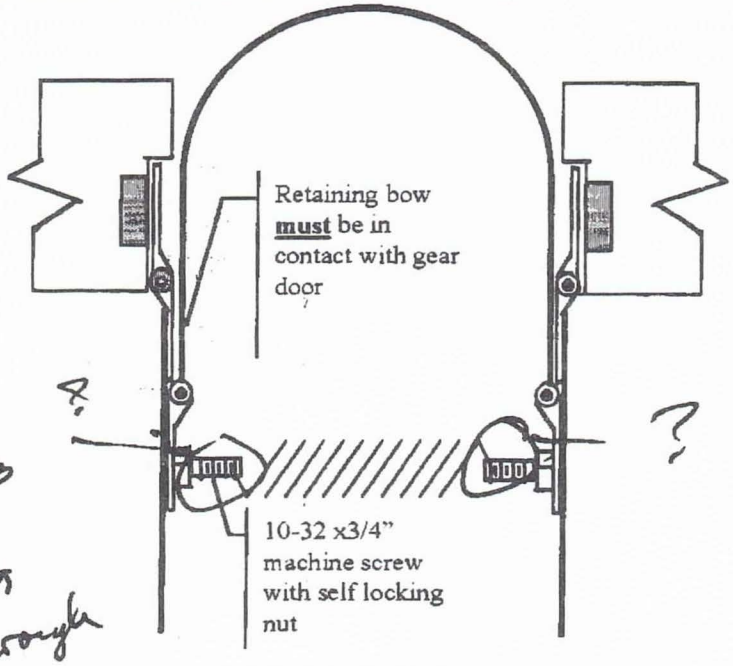


The door is pulled closed by the action of the nose strut engaging a spring at the swivel block (NG 15A-R). The spring stretches and then pulls the doors closed as the gear is retracted (usually when the majority of the wheel is inside the wheel well. I experimented with a number of springs and found that a spring with .037 wire size and approximately 25 windings per inch works well in this application. If ~~your~~ you are unsure about the spring you've selected, you only need to know that it should be easy to stretch by hand. If it isn't, then you have the wrong spring.

The retaining bow is fashioned from .093 piano wire and is attached to each door with a small piece of MS 20001-6 hinge.



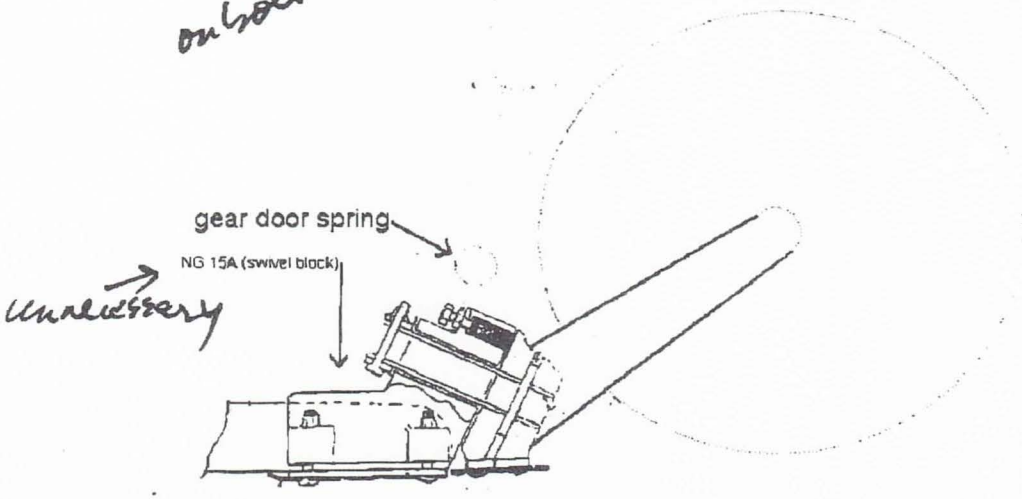




Section A

Spring to bolt unclear

Hole through bolt? why so long on bolt 3/4"?



↙ Darker Wheel

Ninth Step

At this point you are nearing completion. All that remains is a few adjustments to the retract mechanism. The spring should engage NG 15 A at the point shown in the illustration above. The retaining bow should be in contact with the gear door to prevent the doors from ~~swaying~~ – ? Rattling

Retract the gear and watch the gear enter the wheel well. The gear doors should not begin to close until the fork is near or above the hinge line. If the doors close prematurely, replace the spring with one with less tension. If the after the wheel is retracted the doors remain open or partially closed check for the following:

1. The wheel does not go up high enough into the well
   - A. The wheel is touching the top of the wheel well.
   - B. The retaining bow is too tall and is touching the top of the wheel well.
   - C. The strut is touching the retract mechanism at NG 14
   - D. The retraction spring is too weak.

When actually operating this device you should encounter a little more resistance in the operation of your retraction handle. If you do not have a ratchet assembly on your retraction handle I would strongly urge you to consider it. The spring loads the gear so that it forces it down. If your system is old the gear may extend inadvertently (a real bummer during a race) . Fix that and good flying

Nose Lift Installation Instructions

You should be able to start the installation process with one buddy helping (do not try to install this alone) on a Saturday morning, allow glass to cure over night and fly with the unit late Sunday afternoon.

If you are retrofitting -make a "space template" by tracing the full size drawing of the motor head (from F-22 aft) on some cardboard and check the location of the back of the actuator. You need to make sure that the unit will clear all radios and instruments (read step 3 carefully if you have a radio in the way) or other items which may interfere with the installation. The Cozy Mk-3 (see Chap.11 pg. #6) pitch trim bell crank PTB might need to be relocated to the right about 2 inches. Refer to the drawing for constructing the fiberglass saddle for the new location for PTB. It is important that you decide the clearance necessary for your plane, which may be a bit different from others.

STEP 1- Remove the canard and worm drive assembly. Refer to the nose lift plans and mark the section you will cut out of the F22 bulkhead to allow the actuator arms to pass through. Use the full size template. Remove the required material from the strut cover.

STEP 2- In this step you will attach the ramp contact interference plate called "the foot", the NG-3 replacement and reinforce the intersection of NG-30 and F-22, which will allow the landing loads to more uniformly be transferred into the F-22 bulkhead. Five-minute epoxy the triangular foam pieces into position as shown in the plans. Glass with 3 plys of BID lapping around the front of F-22 and on to the inside of NG-30 and 3 plys of BID lapping from the out side of NG-30 - around the back of F-22. Do not lay the glass on the inside of NG-30 where the SIDE ARMS of the actuator will go. The NG-3s (for Long EZ) and MKNG-3s (for Cozy MK-4) from Brock are not strong enough. Remove your bracket and trial fit the replacement bracket to the gear strut. Wrap enough plys of BID along with some flox around the strut to fill in the space between the fitting and strut to assure a tight fit. Clamp the NG-3 on the strut with light pressure. After a full cure, drill for the AN3 17-A bolt through the NG-3 as shown (no....your nose gear strut will not be weakened). Pull the plate off of the nose wheel casting and match drill (1/4 inch) the plate on "the foot". Bolt the "the foot" back on.

STEP 3- You will need a buddy to help you do a trial installation of the nose-lift unit. Carefully remove the limit switches, side arms and the motor head. Use a 9/16" wrench, remove the bolt on the top of the motor and twist and slide the motor off the actuator tube. Refer to the full size plans to locate where the side arms will go. Check to make sure the NG-30s have an inside dimension of 3 inches, and are parallel. Take a piece of wood and make a feeler gauge exactly 3 inches long and check the width where the side arms will go. If they are not parallel-make certain you sand the NG-30s and put wet flox on the side arms, allow it to cure until "firm" (6 hours at 70 degrees) or a much shorter time using a heat gun. and then squish into the NG-30s and snug the bolts until the side arms are parallel. If the sides are not exactly 3 inches wide- that's OK but they must be parallel. Slide the nose-lift and one of the side arms into position between the NG30s then attach the side arm to the actuator tube then slide the other side arm into position and

attach to the actuator tube. Now, you can slip the top two bolts through the slide plates and NG30s. Install the nuts and make the bolts snug not tight until final assembly. You will need to move the tube of the actuator up or down to install the bottom four bolts. The holes should line up perfectly. If this is a retrofit you may use the spacers and long bolts used in the Brock unit in the bottom four holes. Keep in mind that the side arms must fit tight against the NG-30s.

You may rotate the arms down from the plan location a small amount so the actuator will clear a radio. If you do this you will drill new mounting holes in the aluminum side arms for the top 4 bolts. You should not modify the bottom 2 holes.

You can now install the limit switches and motor on the actuator tube. Make all the bolts good and snug on the limit switches with locktight, but not so tight as you may crush the plastic housing of the switches.

STEP 4- Refer to the nose lift drawing (see section A-A) You will need to trim away enough material for the spring to pass through the opening as the gear is extended. Bolt the end of the unit to NG-3 (position the plane level on saw horses) check the angle that the fork assembly makes to the vertical Refer to your Cozy plans- Chapter 13, page 1. The angle should be very close to the 90 degree shown to prevent wheel shimmy.

Note that the manual over-ride shaft **is designed to break** with excessive torque....(if the motor engages when you are operating the manual over-ride the shaft will snap or break before structure or your hand is broken). The over-ride will also break if you try to spin the shaft with excessive torque. Turn it with care.

I DO NOT RECOMMEND THE USE ELECTRICAL POWER YET- CHECK THE TRAVEL BY CRANKING THE MANUAL OVER-RIDE UNTIL YOU HEAR THE LIMIT SWITCH CLICK. In the full up position the limit switch should "click" stopping the travel. Check the full down position. The limit switch should "click" when the gear is fully extended. You can adjust the stopping position of the gear leg by moving the adjustable screws on the slide bar, which engage the limit switches. IF you choose to use electrical power to check the limit switch location, run wires directly from a 12 V battery to the wires from the motor. Touch the wires briefly to check the direction of movement of the actuator. Pay attention to the slide bar as it approaches F-22. Make sure you have trimmed enough material away so that the slide bar does not contact F-22.

You can break or bend something if you extend the unit beyond the screw head that engages the limit switches Double check that everything electrically works properly before operating with the toggle switch on the panel.

Once you are satisfied with the stopping point of the nose gear strut - tighten the screws in the adjustable slot in the slide bar securely with *LOCTITE* (blue dot -removable)

CAUTION- if the limit switch fails, or the screw slips on the slide bar - the nose strut will continue in it's travel until it extends fully (engages the slip clutch) or contacts structure. Damage to structure can occur. Keep your fingers and hands clear of any moving parts - you could be seriously injured.

STEP 5- After you have **double-checked** that the side arms are securely bolted to NG-30, complete the wiring using the detailed wiring diagram. Using the correct aircraft electrical installation procedures is critical to problem free operation of the system. If you are not an expert in this area I suggest you contact Bob Nuckolls of AeroElectric Connection at 316-685-8617 and order his book on proper procedures on wiring an aircraft. Bob's procedures will assure that all of your electrical systems will be properly installed. Secure all wire connections (wire tie and silicone) so vibration will not cause a break in the connections. The retract control system (RCS) in your Nose Lift Kit includes the pre-wired control panel, control PC board, micro switches, low airspeed sensor, wiring diagram and system schematics. Carefully study the wiring diagrams before you install the RCS. You will note that the drawings on the wiring diagram do not look like the switches on the nose lift you were shipped. The "new" switches work the same as show on the drawings so hook them up the same as show to NC and COM. 12 gauge wiring is required to the motor, 12 Volts and ground and to the micro switches. RCS includes the pre-wired control panel, which simply plugs into the control PC board. The control panel mounts where the manual crank is shown in the aircraft plans book. This panel contains the gear switch, gear status lamp, test button and has terminals on the back for other lamp test and warning annunciators. The control PC board has the switching relays, lamp test, control logic, and terminal strip for connections to power, ground, and motor. The control PC board and panel can be mounted at anytime but I recommend you wait until you reach the final finishing stage of construction of your plane to avoid damage to the artwork on the control panel and you will change your mind on the final design of the instrument panel lay out many times during construction. If you are flying just put it where the manual crank was. The airspeed sensor is a normally closed switch and needs to be adjusted after your aircraft is finished. Plum it into your pitot system and GENTLY pressurize the Pitot tube to the minimum safe airspeed for a GEAR-UP condition. Using a 1/16" allen wrench adjust the sensor switch to an OPEN state. The switch should close as soon as you reduce the indicated airspeed. Check this setting a couple of times to be sure. The sensor can be easily damaged by over-tightening the set screw.....be careful. The low throttle micro switch can be mounted and adjusted after the aircraft is flying for a better "feel" for what will be a low throttle set point. Do NOT make a connection to the terminal marked 'DN LIMIT SWITCH NO" If you have Nav lights connect the lights to DIM+, this will reduce the intensity of the light on the gear-down and motor-on lamps next to the gear switch for night flying.

AIR LEAKS around where the actuator tube goes through F-22 the can be stopped with soft foam (the same as used for seat cushions) glued in the opening with rubber cement.

Good photos **of the Nose lift installed in a Cozy** and other interesting information to Canard builders can be seen at Wayne Hick's web sight at http://www.geocities.com/yosemite/falls/2027

Operation of the manual over-ride

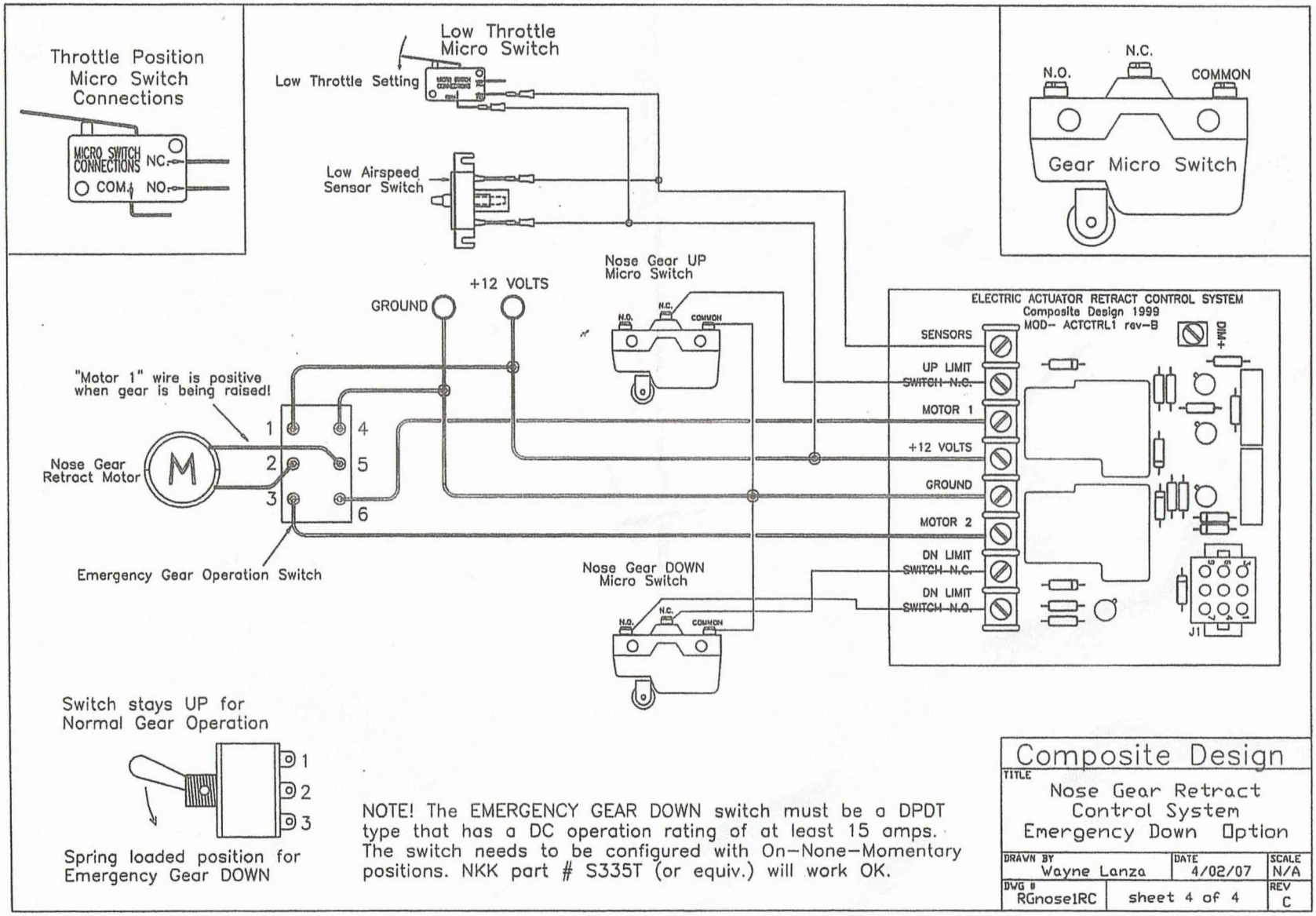
The purpose of the over-ride is to be able to manually crank the system down if something electrically fails **In flight.** If you attempt to manually lower the gear on the ground (manually lift the nose) the over-ride **will break** at the point where it goes into the electric motor. The over-ride shaft is designed to break with **excessive** torque on the shaft. Should you need to use the over-ride you must assume that during the retraction or extension an electrical problem like a bad connection just might be an intermittent connection and start the motor to turn again. Always assume that this may happen. You must therefore treat the manual over-ride crank like the propeller of your plane with the mags on. Just as you would not consider moving the prop without switching **off** the mags, you should not move the manual over-ride crank unless the NOSE-LIFT toggle switch is in the **off** position. With everything installed and hooked up electrically- always position the toggle switch in the **off** (center) position and then take the weight off the nose wheel before you try to crank the nose gear up or down manually (place the fuselage on a saw horse to take the weight off the nose wheel). If you begin cranking the manual over-ride up or down and the toggle switch is not in the off position, then when the limit switch rolls off the screw head, the electric motor is switched on and the manual over-ride will begin to spin. With the ratchet and quarter inch socket attached to the over-ride the ratchet will now begin to spin and break or destroy your hand or anything in its path. If it jams against something as it spins then the steel over-ride shaft is designed to break where it enters the motor.

Raising the gear electrically on the ground

You must check (look through the small Plexiglas window) the position of the nose wheel to make sure the wheel is straight before you retract the gear (lower the nose). If the wheel is cocked at an angle and the gear is retracted you will crush the bottom of the fuselage and destroy the nose fork assembly. This is not a concern on take-off as the wind will straighten the wheel for you.

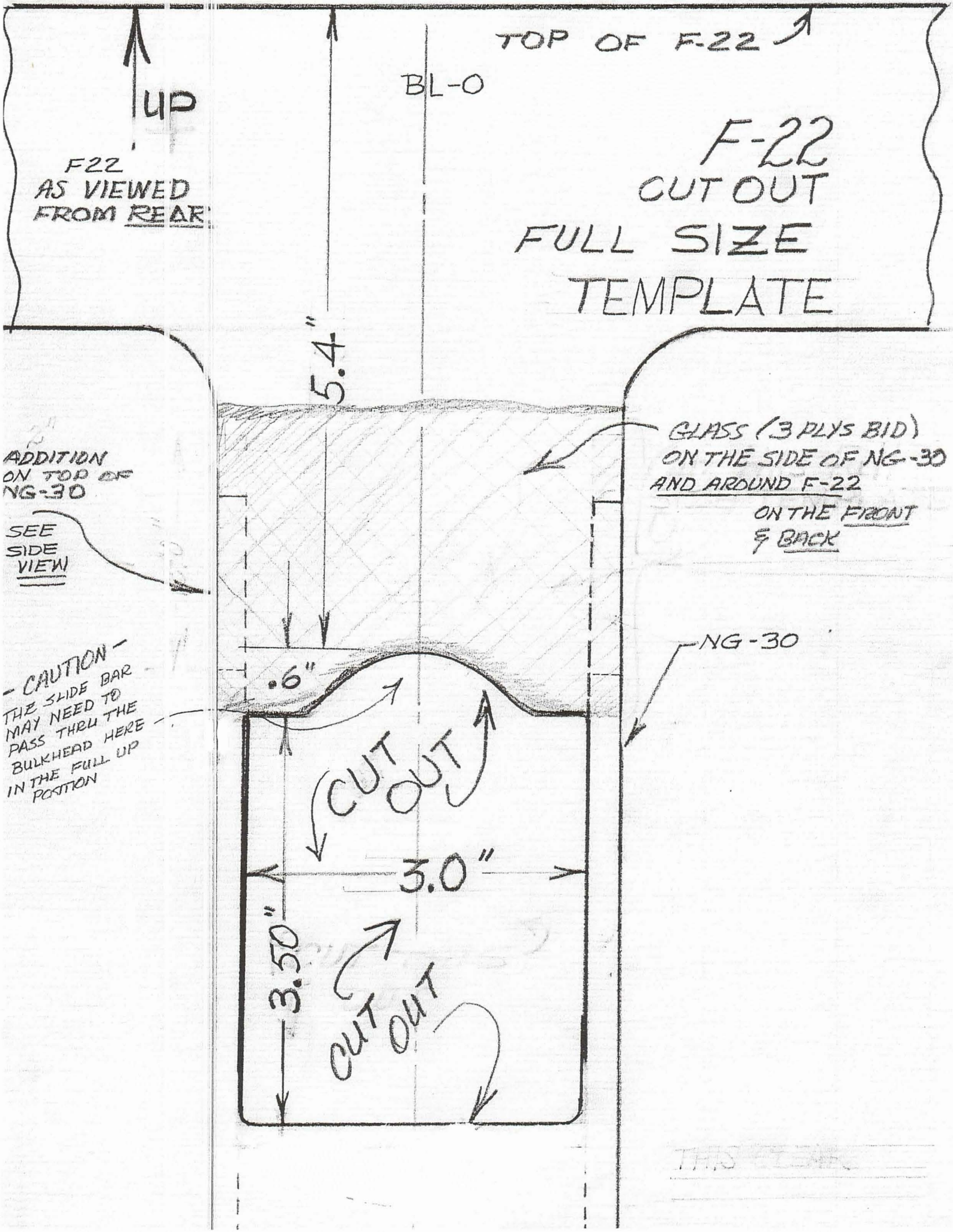
Enjoy -not having to lift that heavy nose anymore, **and** when you taxi up to the FBO and lower the nose electrically you will be the coolest dude on the ramp.

Standard Wiring Scheme — With Overide

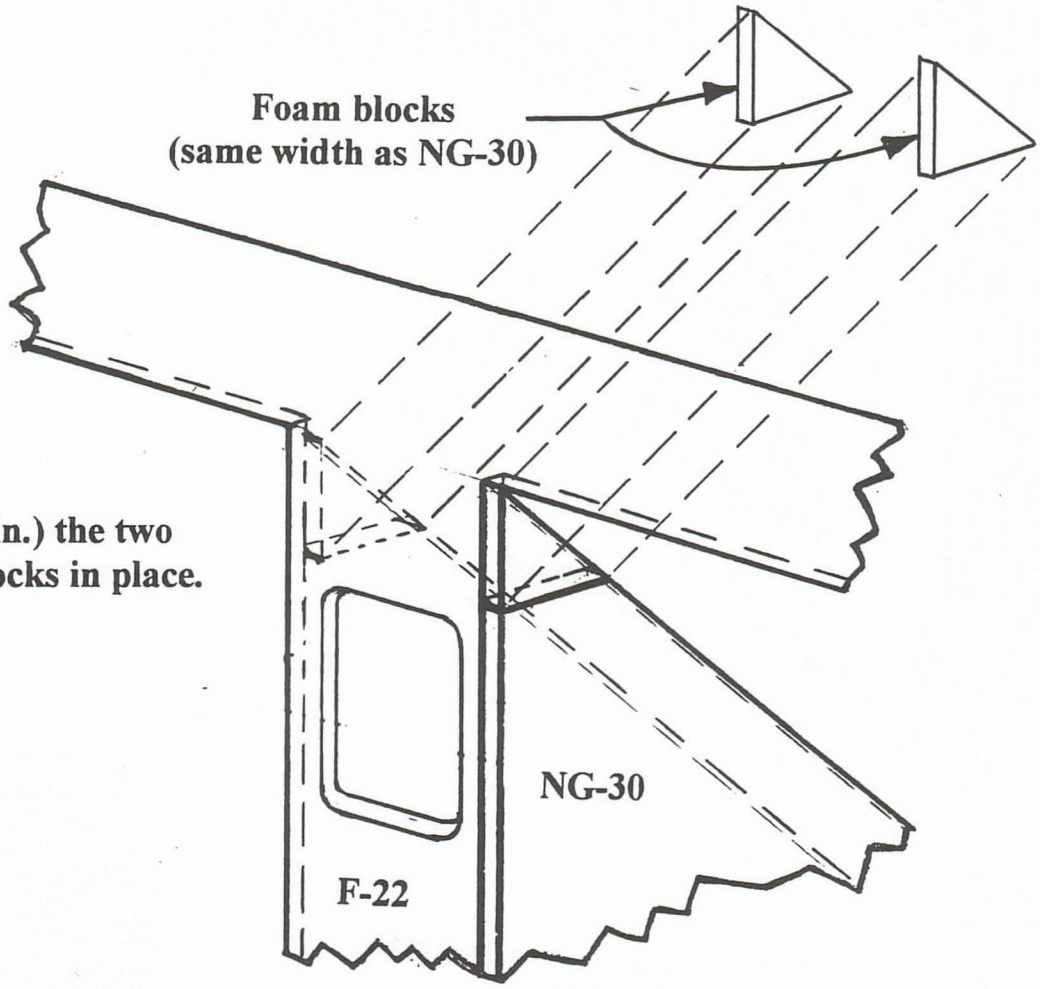


NOTE! The EMERGENCY GEAR DOWN switch must be a DPDT type that has a DC operation rating of at least 15 amps. The switch needs to be configured with On–None–Momentary positions. NKK part # S335T (or equiv.) will work OK.

Composite Design			
TITLE: Nose Gear Retract Control System Emergency Down Option			
DRAWN BY: Wayne Lanza	DATE: 4/02/07	SCALE: N/A	
DWG #: RGnose1RC	sheet 4 of 4	REV: C	

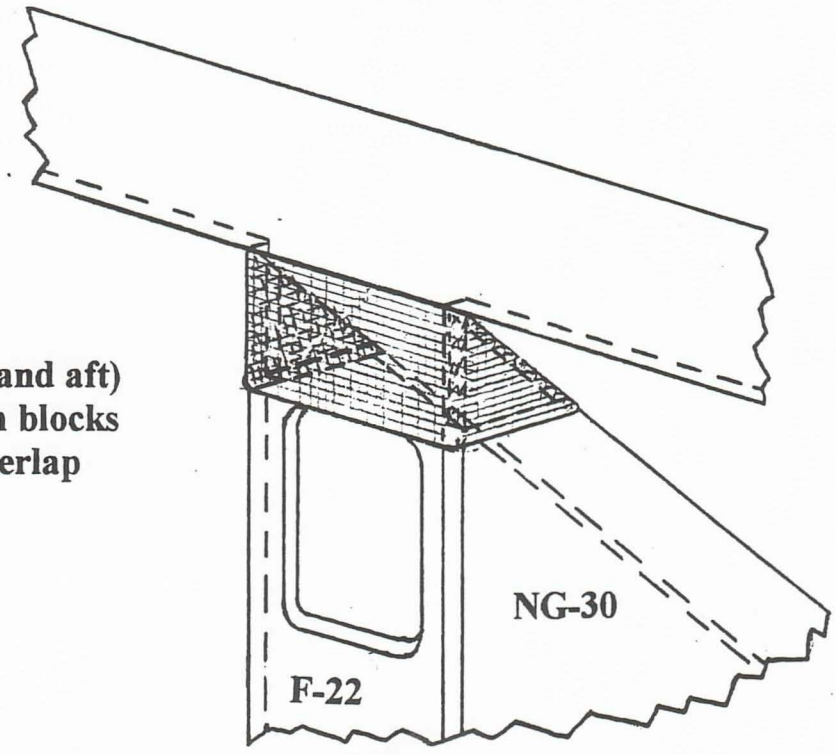

TOP OF F-22
BL-0
UP
F22
AS VIEWED
FROM REAR
F-22
CUT OUT
FULL SIZE
TEMPLATE
5.4"
ADDITION
ON TOP OF
NG-30
SEE
SIDE
VIEW
GLASS (3 PLYS BID)
ON THE SIDE OF NG-30
AND AROUND F-22
ON THE FRONT
& BACK
NG-30
- CAUTION -
THE SLIDE BAR
MAY NEED TO
PASS THRU THE
BULKHEAD HERE
IN THE FULL UP
POSITION
.6"
CUT
OUT
3.0"
3.50"
CUT
OUT

F-22 / NG-30 REIENFORCING DETAIL



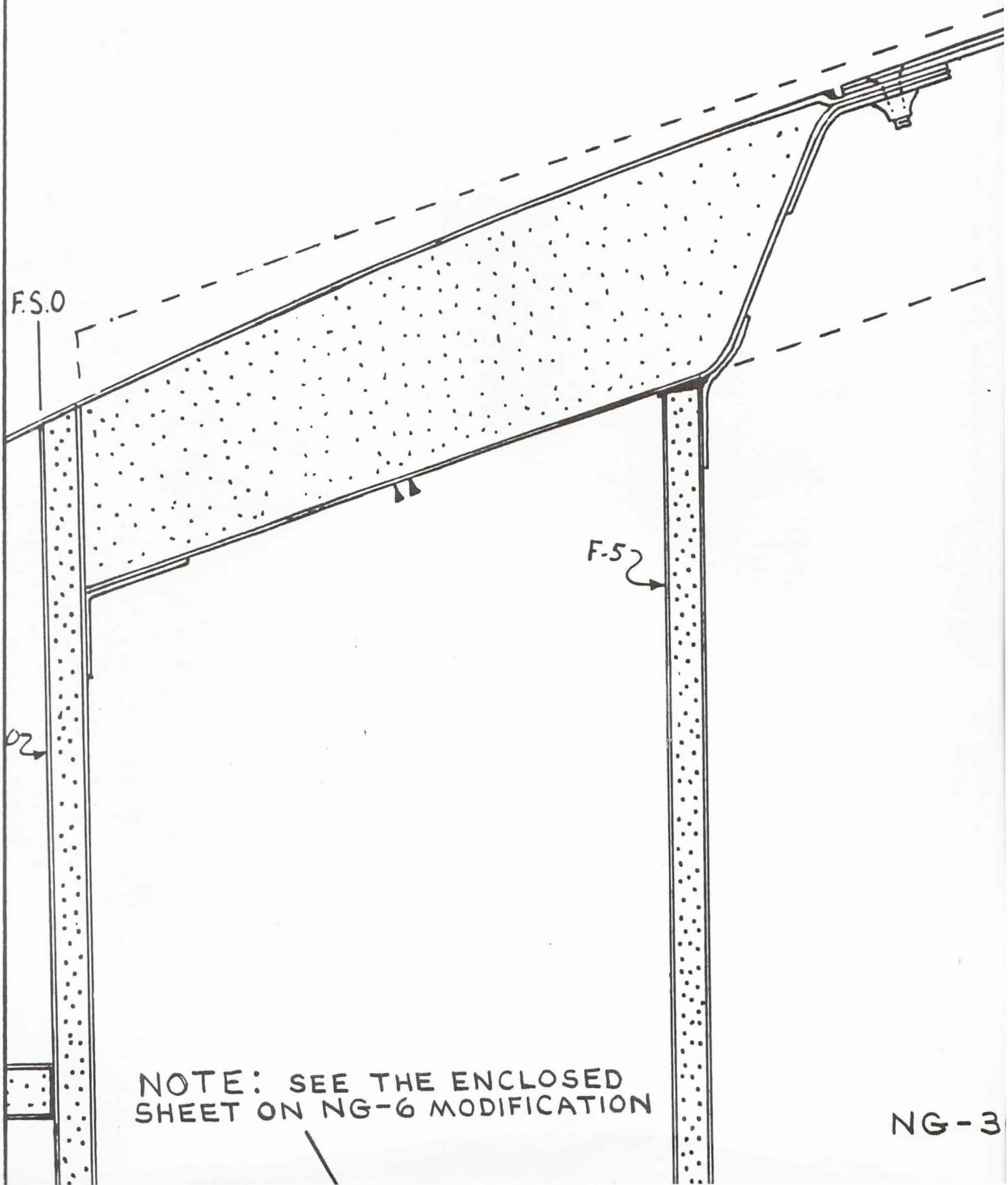
STEP 1

Cut to fit and epoxy (5 min.) the two Triangle Shaped foam blocks in place. (see plan, side view)



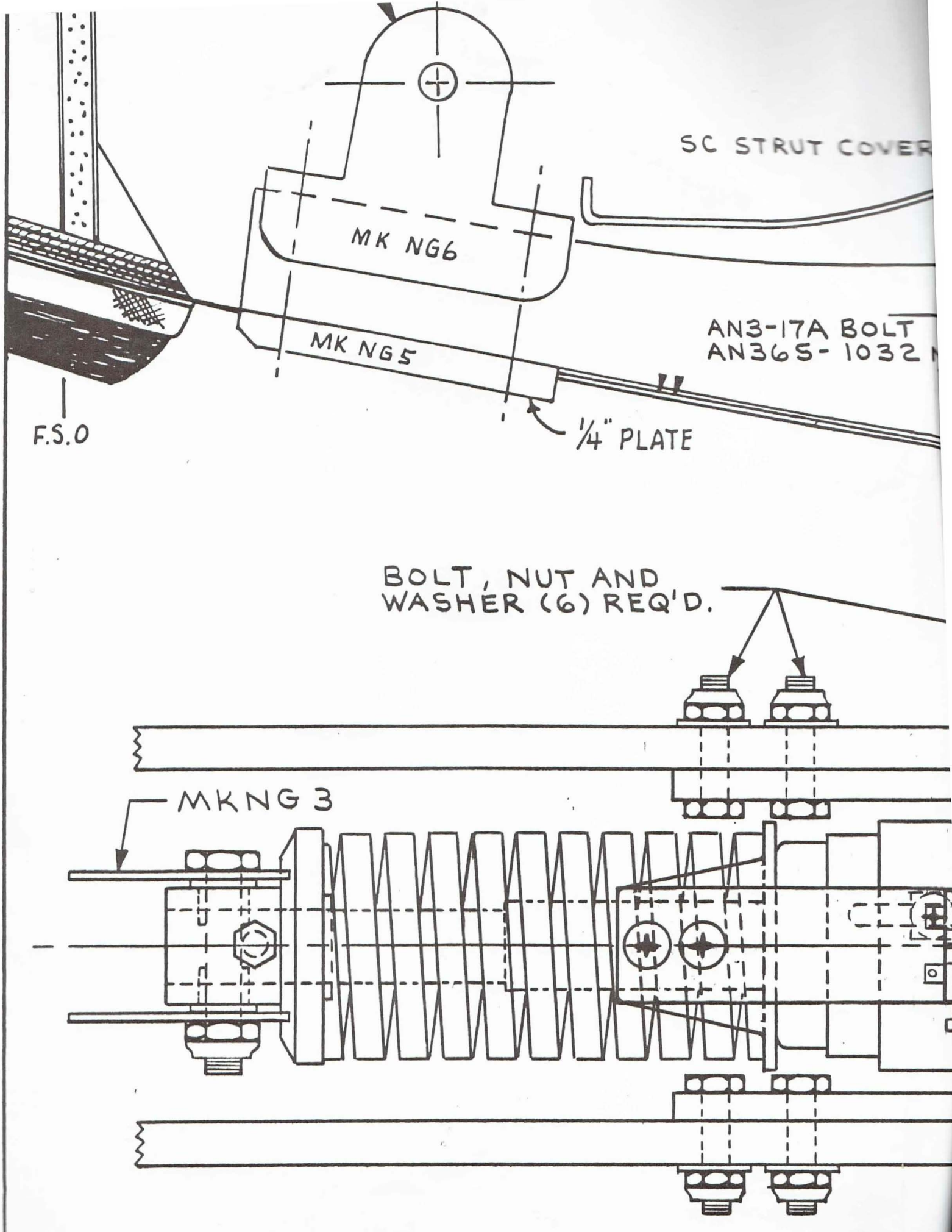
STEP 2

Glass inside and outside (fore and aft) Of F-22 and around new foam blocks with 3 Plys. of bid lapping. Overlap existing glass, ½ inch min.



NOTE: SEE THE ENCLOSED SHEET ON NG-6 MODIFICATION

NG-3

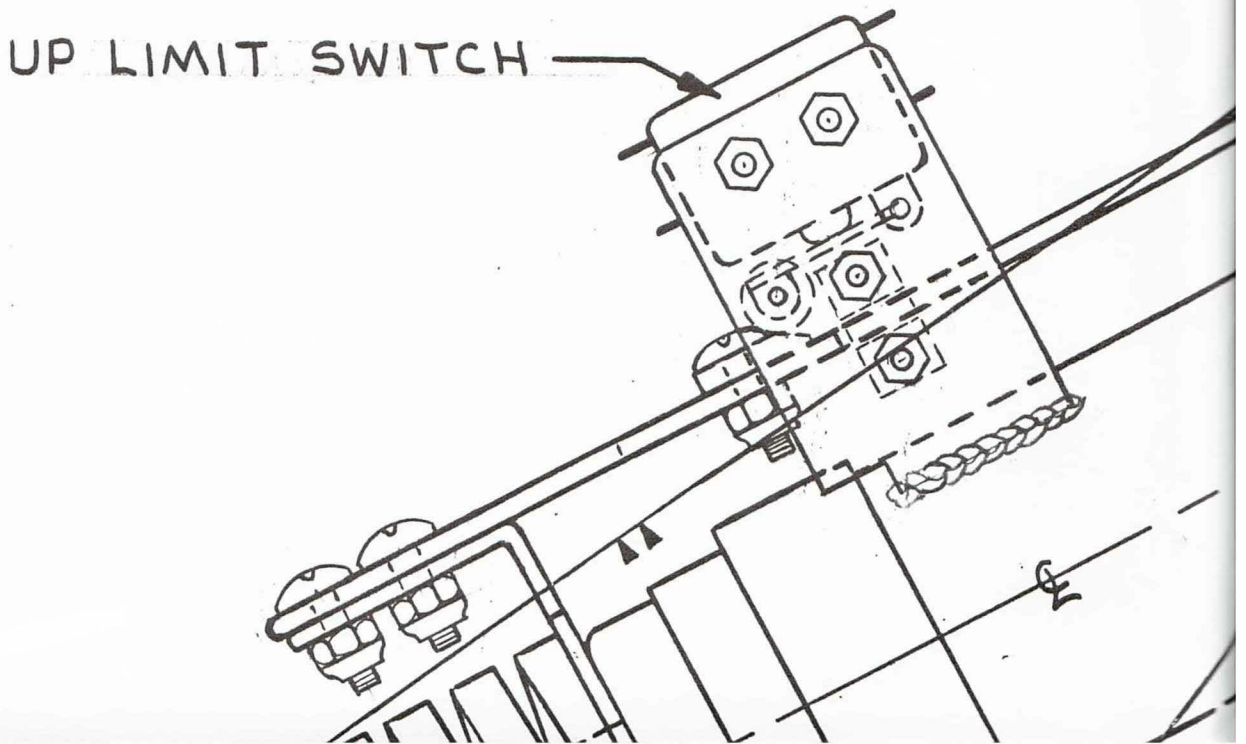

SC STRUT COVER
MK NG6
MK NG5
AN3-17A BOLT
AN365-1032
F.S.0
1/4" PLATE
BOLT, NUT AND
WASHER (6) REQ'D.
MKNG 3

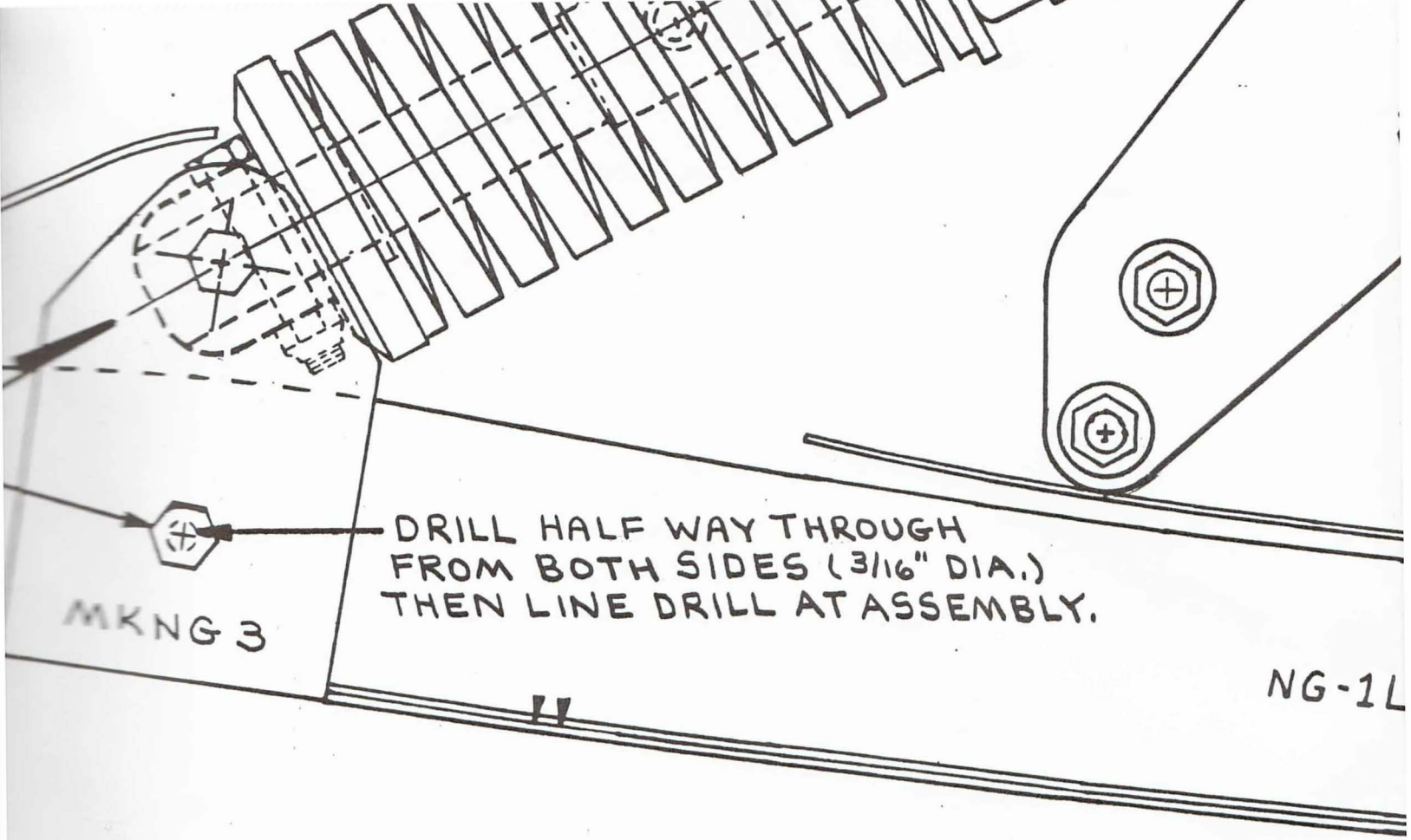
NOTE: FIVE MIN. E
(SAME AS USED IN
NG-30 AS SHOWN A
OF BID LAPPING 1 IN
OF F-22. GLASS T
BID LAPPING ON THI
- DO NOT GLASS WH
(SEE "F-22 / NG-3C

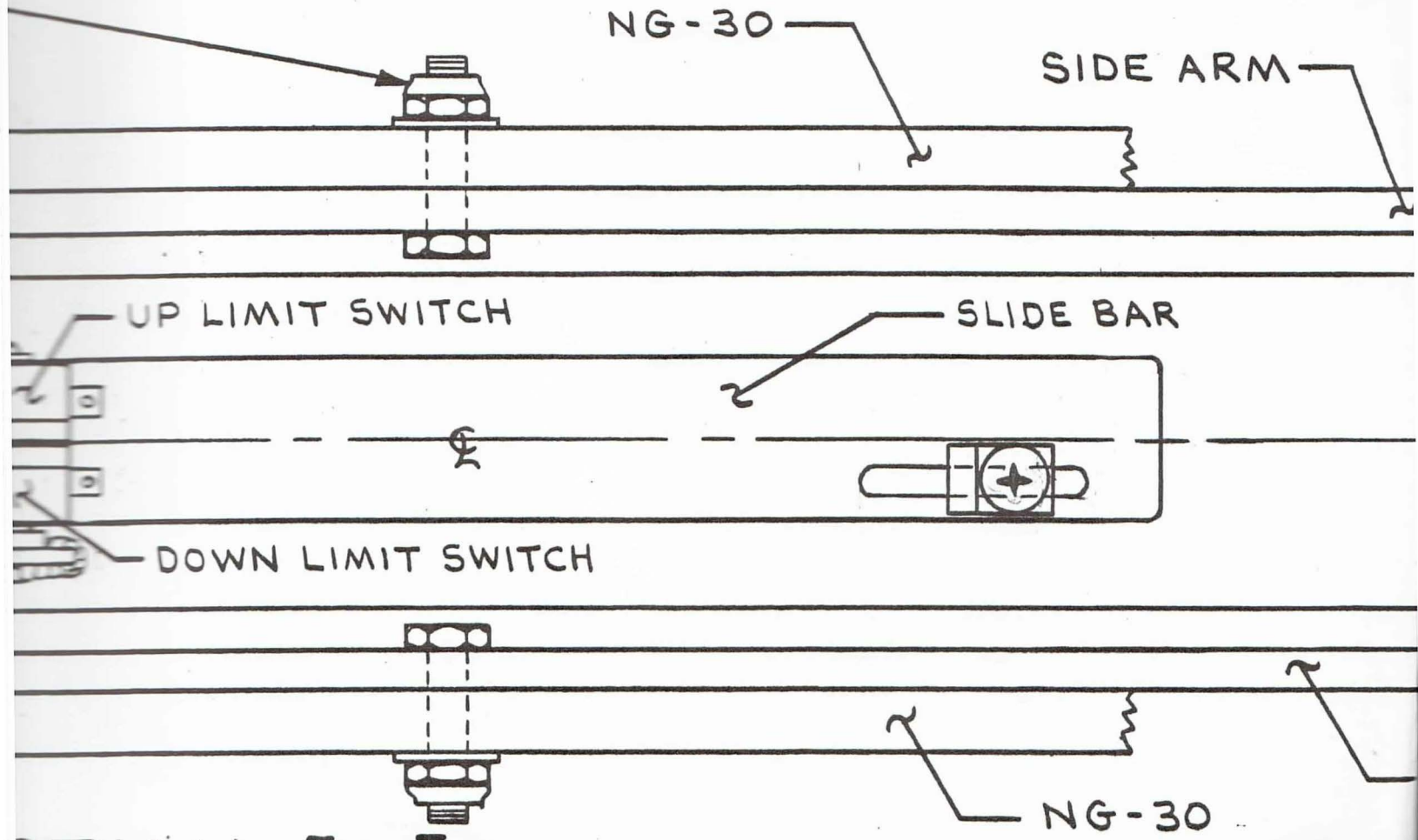
.: DUE TO THE HIGH LEVEL
BRATION - APPLY LOCTITE
E DOT REMOVABLE) TO THE
ENERS ON THE ACTUATOR.
PECIAL ATTENTION TO THE
SCREWS.

NG-

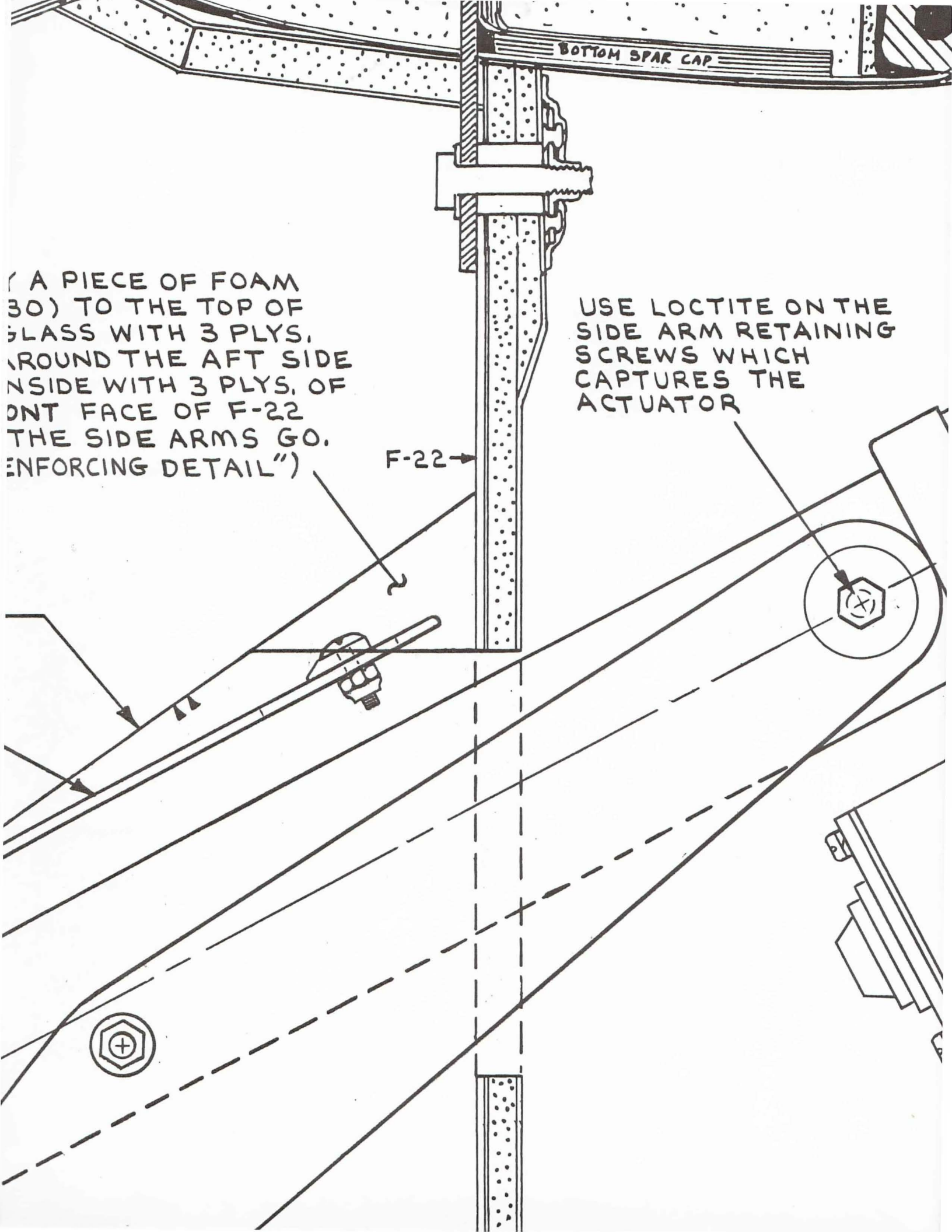
SLIDE BAR

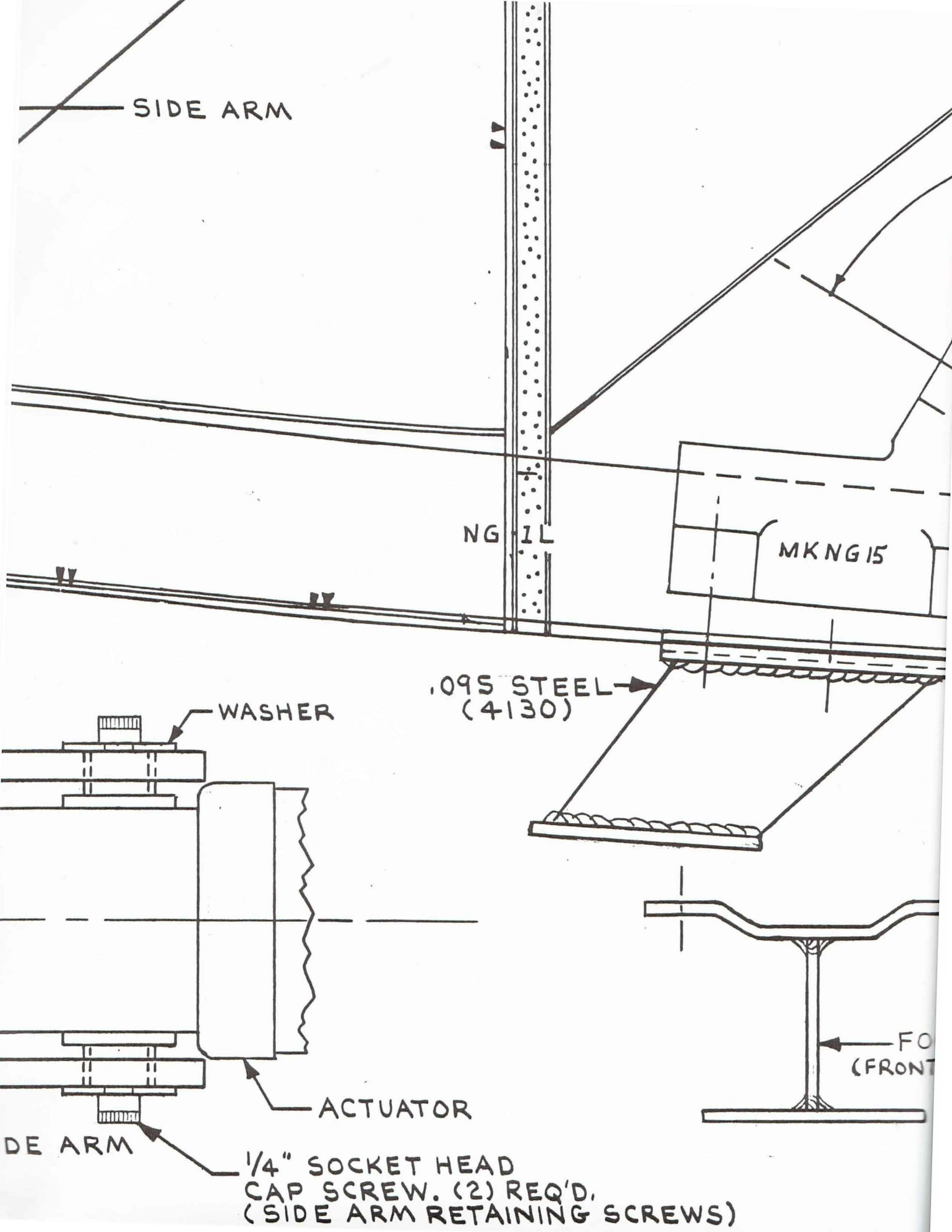


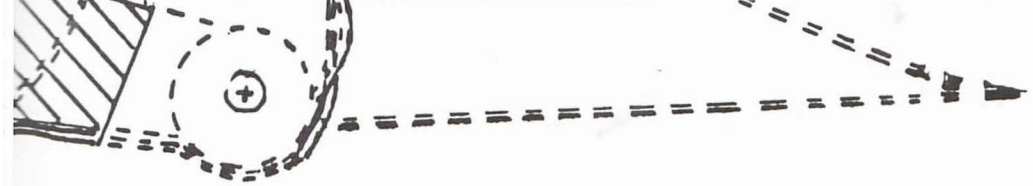


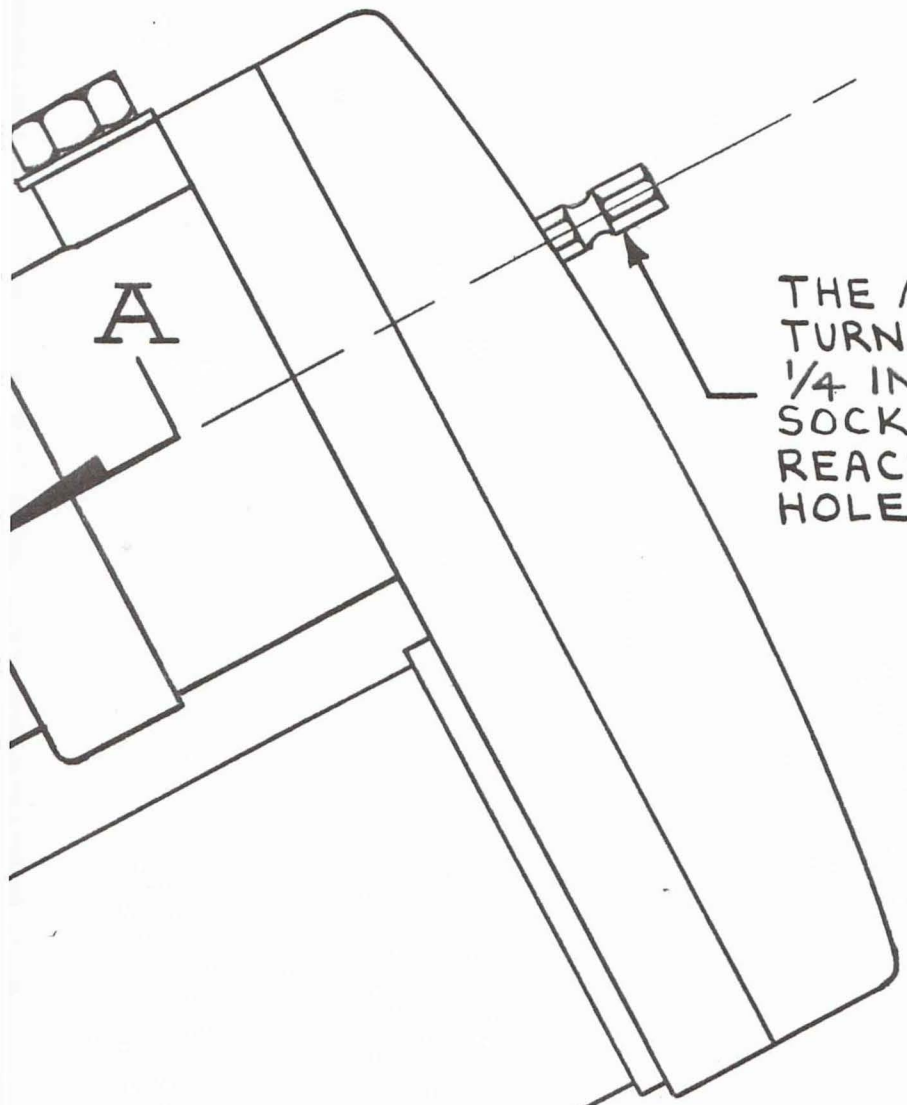


CTION A-A (TOP VIEW)

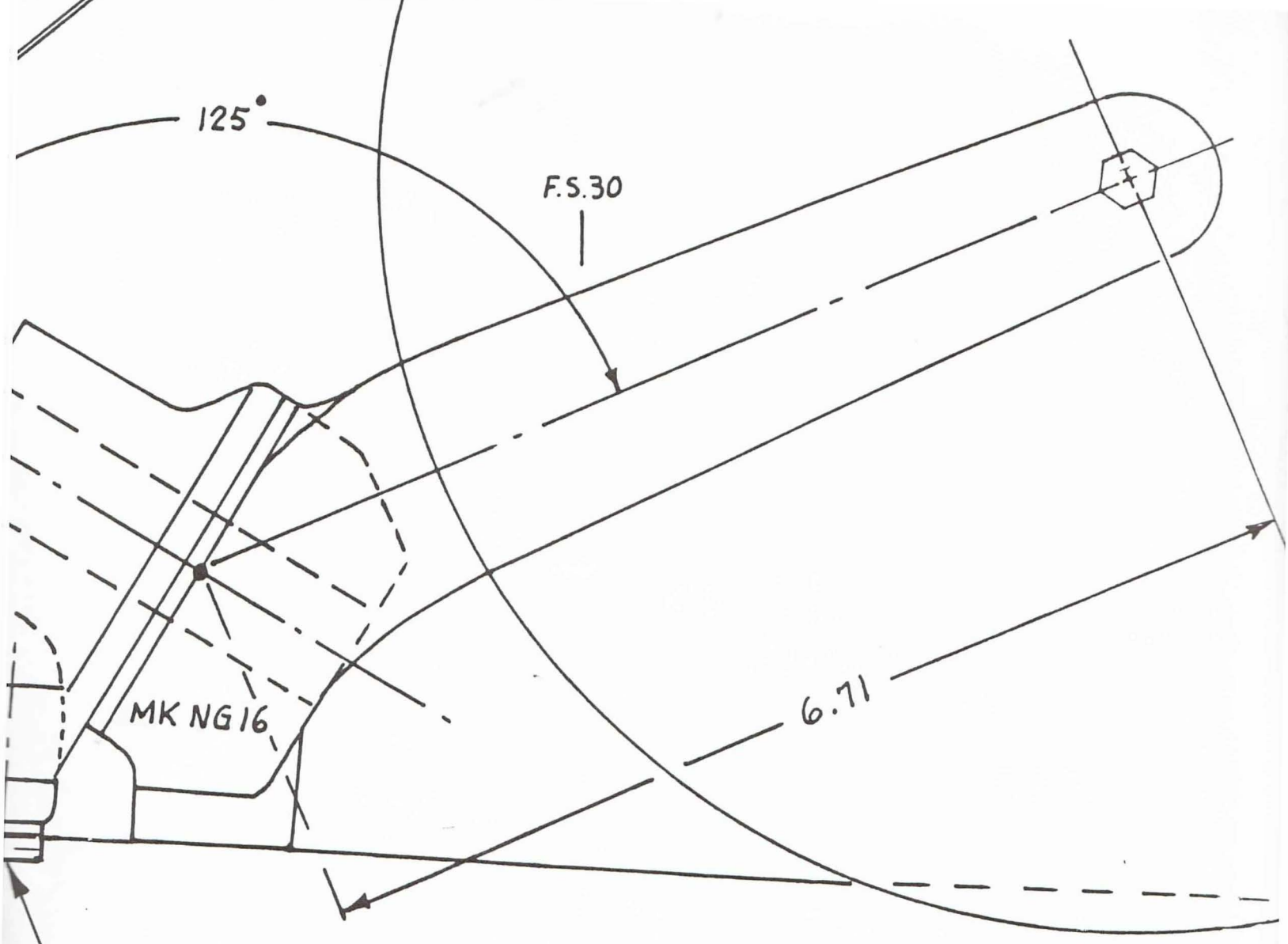

BOTTOM SPAR CAP
F-22
USE LOCTITE ON THE SIDE ARM RETAINING SCREWS WHICH CAPTURES THE ACTUATOR


SIDE ARM
NG 1L
MKNG 15
.095 STEEL
(4130)
WASHER
ACTUATOR
DE ARM
1/4" SOCKET HEAD
CAP SCREW. (2) REQ'D.
(SIDE ARM RETAINING SCREWS)
FO
(FRONT





THE MANUAL OVERRIDE IS TURNED WITH A STANDARD 1/4 INCH RATCHET AND SOCKET. THIS IS EASILY REACHED THROUGH THE LEG HOLES.



REMOVE YOUR STEEL PLATE AND MATCH DRILL THE PLATE ON THE "FOOT" FOR THE 1/4" BOLTS. INSTALL THE FOOT WITH WET FLOX. WAIT UNTIL THE FLOX HAS NEARLY HARDENED AND THEN TIGHTEN THE 4 BOLTS TO A LIMIT OF 10 INCH POUNDS. DO NOT OVER-TIGHTEN THE BOLTS AS A GREATER AMOUNT OF TORQUE WILL PLACE EXCESS STRESS ON THE EARS OF MKNG15 WHICH MAY CAUSE THE EARS OF THE CASTING TO FAIL.