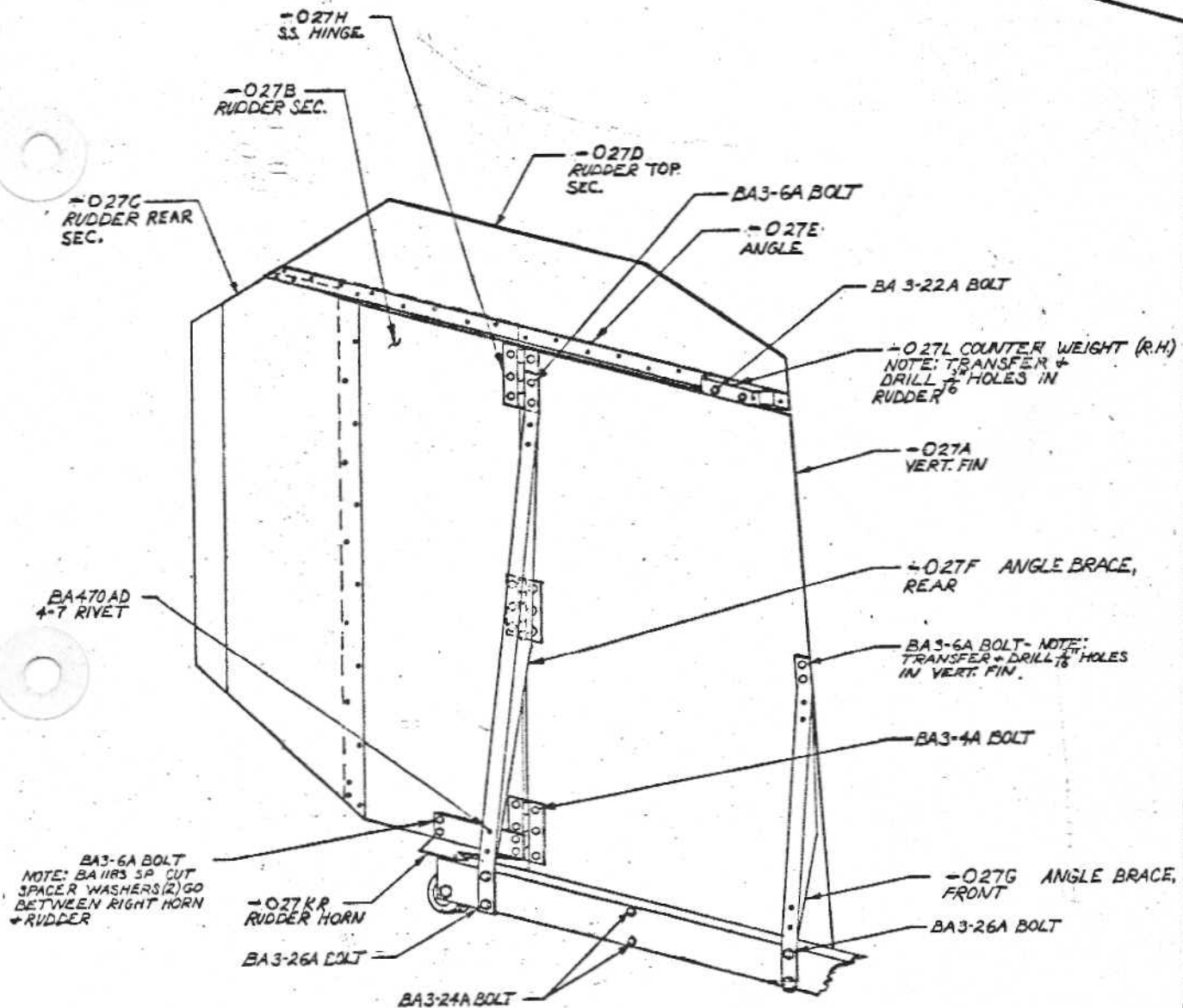


**BENSEN**

# 8-61 RUDDER



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## Construction and Assembly Manual

The 8-61 Metal Rudder construction can be completed with common hand tools and a 1/4 Drill Motor. A STAND MOUNTED DRILL MOTOR IS BETTER, if available, to obtain perpendicular holes. As suggested in the opening page, refer to the "B-80 Construction and Tooling Manual" for proper drilling procedures and correct procedure for "setting" your rivets.

ALL HOLES to be drilled in your Rudder System will be 1/4" or less in diameter, and not over 1/4" deep. All holes to be drilled will have their diameters listed on the drawing, or will be noted as follows:

1/4" diameter --- "A"

3/16" diameter --- "B"

### HARDWARE SELECTION AND PLACEMENT

All hardware is identified on the Packing List by a PART NUMBER, with sizes. All hardware placement is identified on the drawings by this PART NUMBER. A Flat washer is installed under all attaching nuts, unless otherwise instructed in the steps. All Castellated Nuts are safetied with a Cotter Pin.

### RECOMMENDED TORQUE VALUES

	<u>Bolts In Shear</u>	<u>Bolts in Tension</u>
3/16 Dia. Bolts -----	12 - 15 inch lbs.	25 inch lbs.
1/4 Dia. Bolts -----	30 - 40 inch lbs.	60 inch lbs.

USE THESE VALUES CONSISTENTLY UNLESS INSTRUCTED OTHERWISE IN THE PROCEDURE!

The components included with this package are sheared to final dimensions. All parts that require bending, milling, notching, etc., are complete.

An assortment of a few small "C" clamps is required to hold the metal tail components in place while drilling. A part of a sheet of plywood or hardboard will be required for a work-board on which to fabricate the assembly.

Before rigging your Rudder Cables from the Rudder to the Rudder Pedal Assembly, you must have completed the mandatory "Hang-Test", and your Rudder Pedal position must be determined, and the Rudder Pedal Assembly mounted to the frame. Instructions were included in the 8-41 Airframe package for these operations.

# 8-61 RUDDER SYSTEM

## SUPPLIED PARTS & MATERIAL LIST

MODEL B-80A & B-80

Drawings & Instructions Attached

Part No.	Qty.	Description and Use
8-61-027A	1	Vertical Fin ... Sheared 1/8 Aluminum Sheet 15-1/2 x 27-1/2
-027B	1	Rudder Section ... Sheared 1/8 Aluminum Sheet 9 x 26-1/8
-027C	1	Rudder Tab Section ... Sheared 1/16 Aluminum Sheet 8-1/2 x 25-3/4
-027D	1	Top Rudder Section ... Sheared 1/16 Aluminum Sheet 5-1/2 x 26-5/16
-027E	1	Angle Stiffener ... 1/8 x 3/4 x 3/4 x 27
-027F	1	Rear Angle Brace & Stiffener ... 1/8 x 3/4 x 3/4 x 26-3/8
-027G	1	Front Angle Brace & Stiffener ... 1/8 x 3/4 x 3/4 x 15-3/4
-027H	3	Prepunched Stainless Hinges
-027K	1pr.	Left and Right Sheared Angle Rudder Horns
-027L	2	Rudder Counterweights (lead)
-028	1	Formed Butterfly Horizontal Stabilizer
-028A	2	1/8 x 1 x 19-3/4 Formed Stabilizer Braces
-032	1	3/32 x 17' Rudder Cable

### 8-61-H1 Installation Hardware. Refer to Assembly Drawings for Hardware Placement

470AD4-5	27	1/8 x 5/16 Rivets
470AD4-7	14	1/8 x 7/16 Rivets
3-4A	15	10-32 x 1/8 Grip Bolts
3-6A	8	10-32 x 3/8 Grip Bolts
3-6	4	10-32 x 3/8 Grip Bolts
3-22A	2	10-32 x 1-7/8 Grip Bolts
3-24A	2	10-32 x 2-1/8 Grip Bolts
3-25A	4	10-32 x 2-1/4 Grip Bolts
3-26A	4	10-32 x 2-3/8 Grip Bolts
3-5A	5	10-32 x 1/4 Grip Bolts
61-021J	1	.032 x 1/4 x 1-1/2 Steel Tube
64-1032	40	10-32 Lock Nuts
10-10	52	3/16 x 7/16 Flat Washers
10-83	16	3/16 x 3/4 Flat Washers
1183SP	2	3/16 x 3/4 Flat Sheared Washers
310-3	4	10-32 Castellated Nuts
380-2-2	4	1/16 x 1/2 Cotter Pin
100-3	4	1/16 to 3/32 Thimbles
18-2-G	4	3/32 Nicopress Oval Sleeves

## CONSTRUCTION STEPS

The following procedural steps have been developed for the easiest construction of the 8-61 Rudder System. We suggest that you complete one step at a time, following the numerical sequence of steps. Be SURE TO READ this entire Manual before beginning your construction.

### -027B Rudder Section

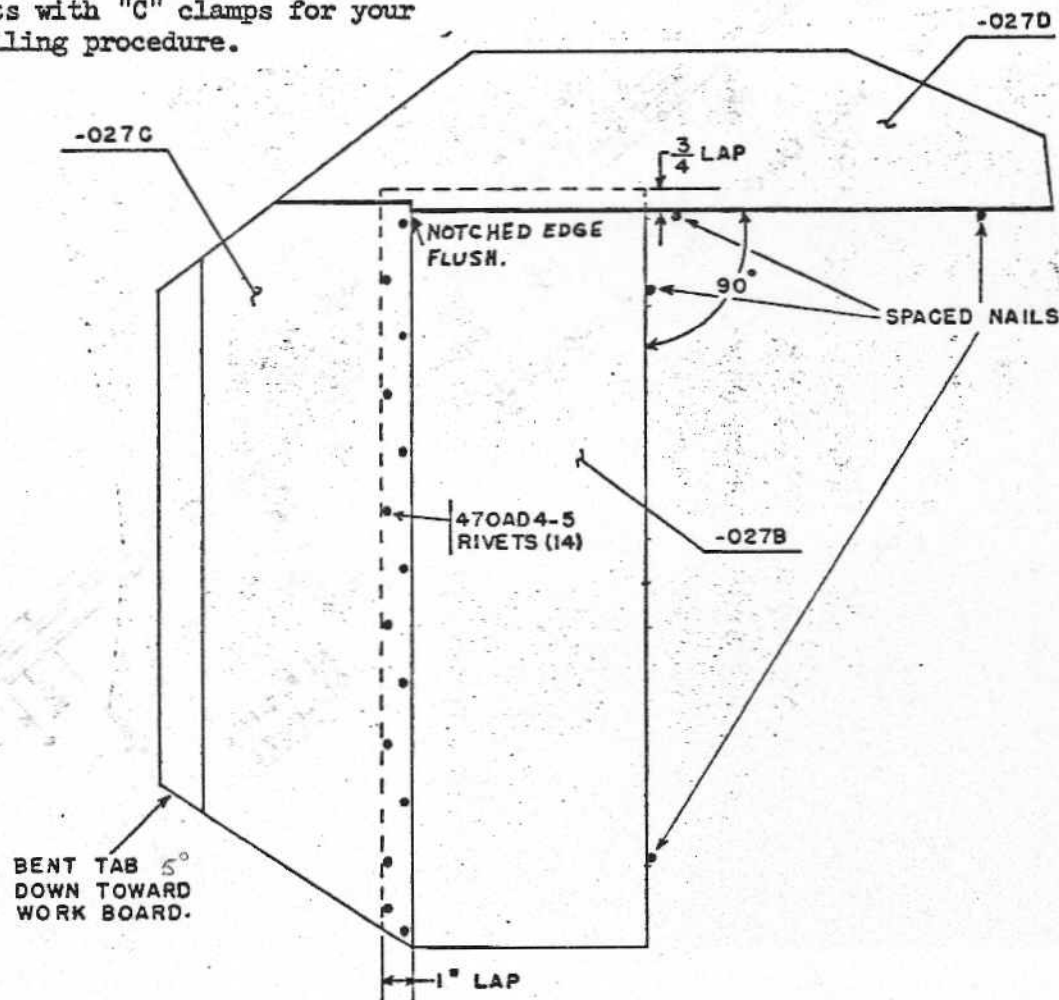
1. Mark an accurate pencil line on the left side, 1" from the rear edge, full length. Mark an accurate pencil line  $\frac{3}{4}$ " from the top edge, full length. Place part on workboard.

### -027C Rudder Tab Section

2. Place in position on workboard, lapping -027B one-inch, to match with pencil line. (Note: Bent tab is down next to workboard.)

### -027D Top Rudder Section

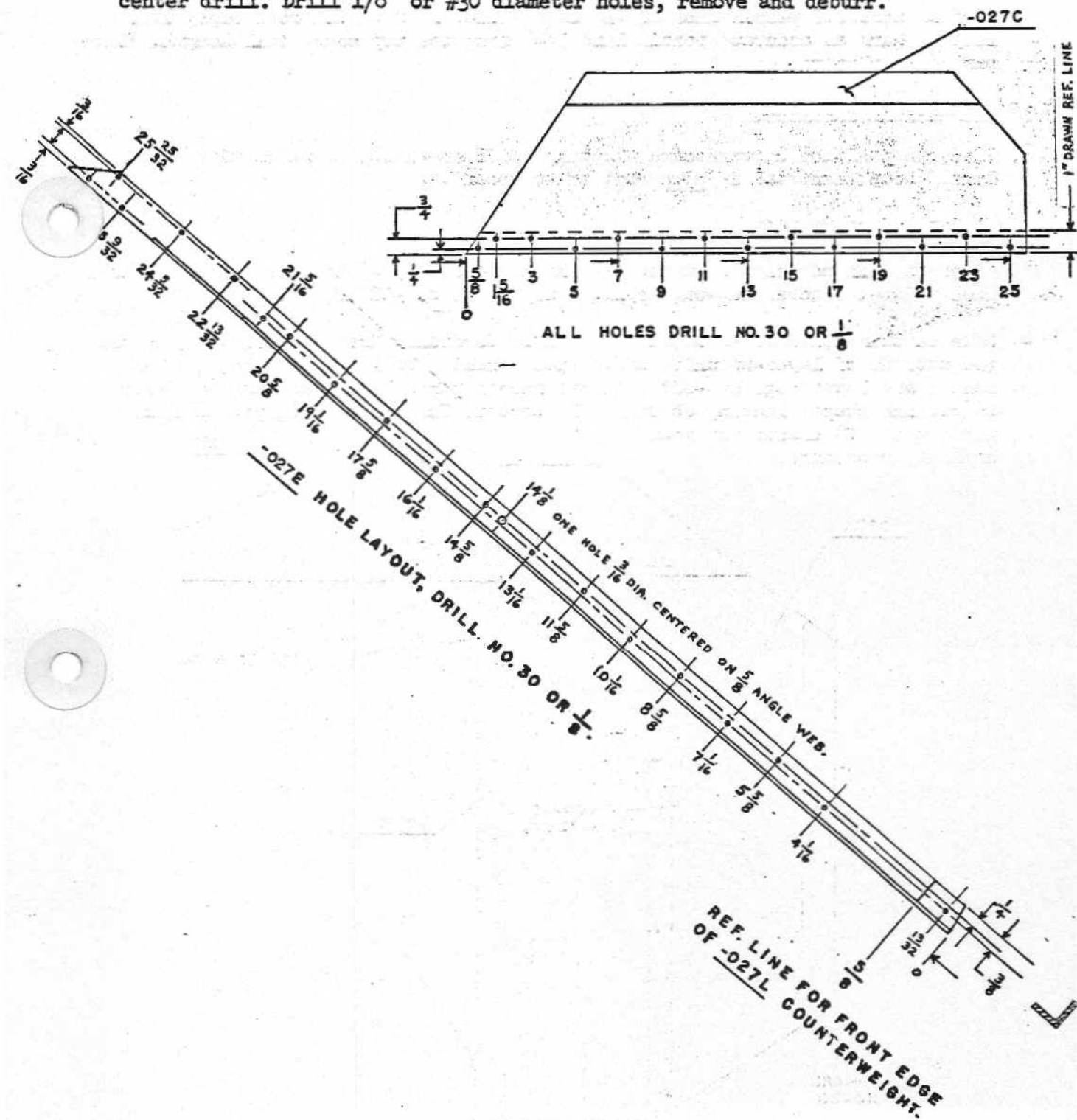
3. Place part in position on workboard, lapping -027B  $\frac{3}{4}$ " to match with pencil line. (Note: Notched cut-out is flush with edge of -027C.)
4. Make certain -027D is 90 degrees to -027B. Carefully draw a pencil line around the outside of layed-up unit. Drive spaced nails, to locate leading edge of Rudder and lower edge of -027D. Remove rudder parts from board and saw board to outline shape, leaving about a  $\frac{1}{2}$ " border. This will allow you to clamp parts with "C" clamps for your drilling procedure.



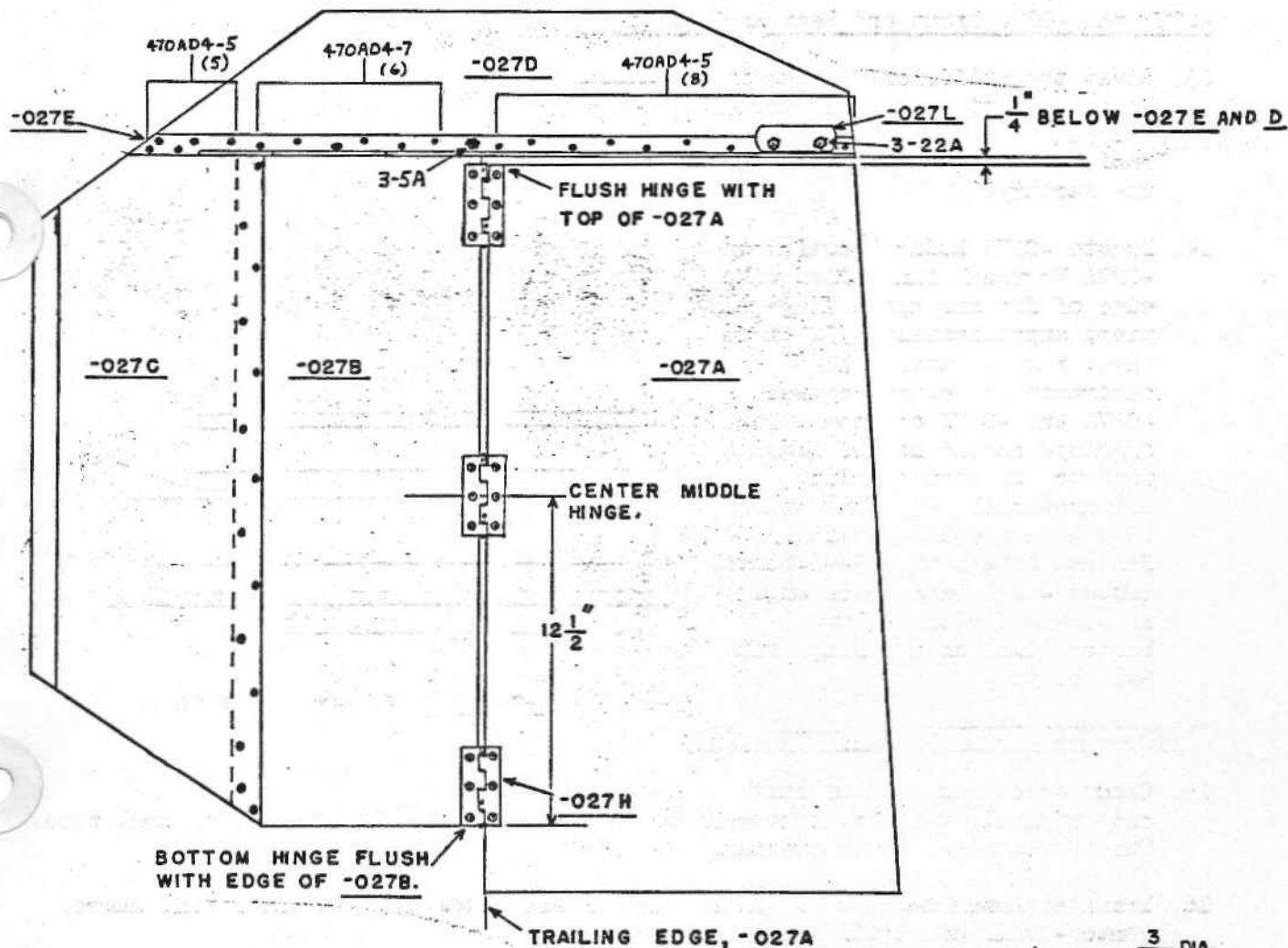


-027C Rudder Tab Section and -027E Angle Stiffener

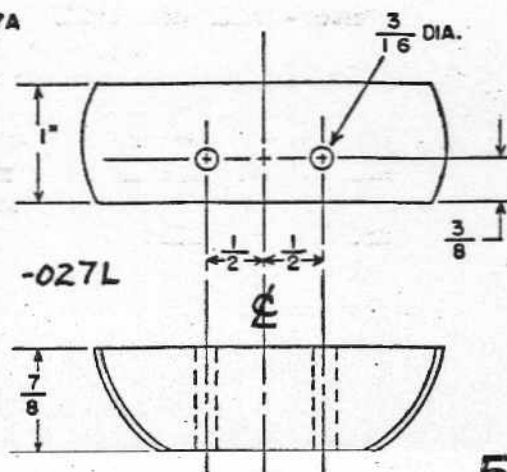
5. Lay out and center-punch hole locations for  $1/8$ " rivets in both parts. Note on drawing the addition of a 3-5A bolt through -027E and -027B. Drill a  $3/16$ " hole at the  $14-1/8$ " dimension on -027E.
6. Re-assemble all preceding parts in their proper position on workboard. Shim under parts if necessary to assure parts have a flat support. Clamp securely, and recheck for proper alignment. Pick up pre-punched hole centers and lightly center drill. Drill  $1/8$ " or #30 diameter holes, remove and deburr.



7. Align and assemble parts, insert rivets and set. (Note: A properly set rivet head should be 1-1/2 times the diameter of rivet, and 1/2 the diameter high.)
8. Locate pre-punched hinges on -027B on the right side, with hinge pin pivot down. The top hinge is 1/4" below -027D as noted. Align pin pivot with edge of rudder. Space pin pivot approximately 1/32" from edge to allow free pivoting of hinge. Clamp and drill the (9) 3/16" attaching holes in -027B through the pre-punched hinge holes and attach with 3-4A bolts. Leave the bottom hinge bolt out for now.



9. Lay out and drill (2) 3/16" holes in each -027L Counterweight.
10. Place counterweights in position on -027E and clamp. Through drill (2) 3/16" holes and attach with above noted bolts.



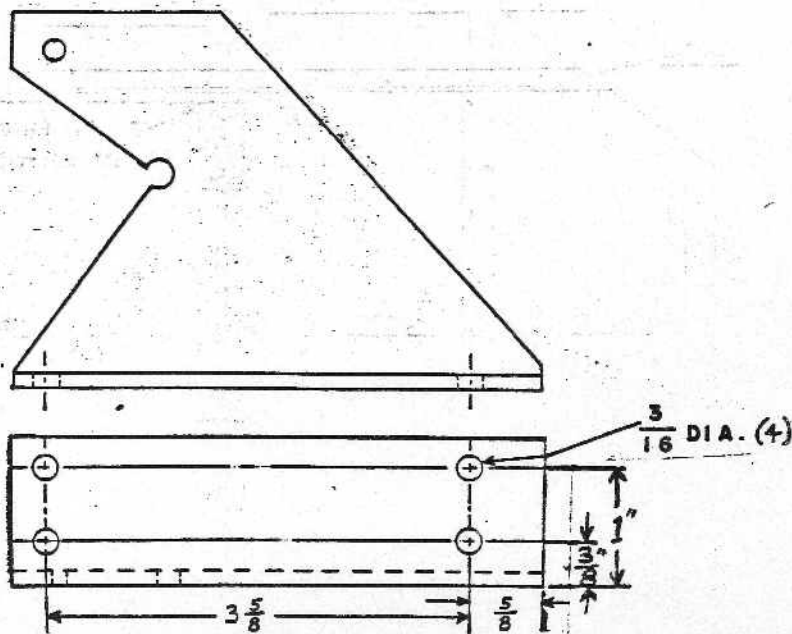
### -027k Rudder Horns

11. Lay out (4) 3/16 holes on one horn base; center-punch and center-drill. Clamp left and right horns, base to base, through drill and deburr.
12. Locate one rudder horn with bottom hinge bolt omitted previously, and align with bottom of -027B rudder section. Clamp and through-drill the (3) 3/16" holes. Deburr and attach left and right horns. (Note: Two spacer washers, 1183SP are required between rudder horns and rudder, on hinge side only.)

### -027F and -027G Front and Rear Angle Brace

13. Rivet the stiffeners to the inboard ends of both brace angles. Stiffeners are taped to angle ends as they were drilled at the factory.

Locate -027B Rudder Section on -027A Vertical fin. Align with edge of fin and space hinge pin pivot approximately 1/32" from edge. Make certain a 1/4" clearance gap exists between -027A and -027D as shown. Top of hinge should now be flush with top of Vertical Fin. Through-drill (9) 3/16" holes through hinge and Vertical Fin and attach with 3-4A bolts. (Note: -027F Rear Brace angle is attached with the two bottom bolts in top hinge with 3-6A bolts.



-027KR (LEFT SIDE OPPOSITE)

### INSTALLATION PROCEDURE ..Drawing 61-1

14. Clamp assembled unit on left side of Keel, with trailing edge of -027A located 97" from front of Keel tube. The bottom edge should overhang Keel 1/8".
16. Transfer-punch the (6) "B" holes through Keel, to -027A Vertical Fin. Remove center-drill and drill.
17. Re-locate above assembly on Keel, hold in place with inserted bolts.
18. Make sure lower end of -027F angle brace centers the drilled Keel attachment holes. Move fin left or right as necessary to position. When fin is vertical to Keel, clamp braces. Transfer-punch the (2) "B" attachment holes, remove, center-drill and drill.



COMPLETED ASSEMBLY

7

61-1

RUDDER CABLE IS ATTACHED TO THIS  
RIGHT SIDE RUDDER HORN ONLY, TO THE  
TOP OF HORN WITH BOLT THROUGH BOTTOM  
AND NUT ON TOP.

1183 SP WASHER  
UNDER THESE  
TWO HORN HOLES  
ONLY.

3-6 A

-027 F

3-4 A  
(15)

-027 G

470AD4-7 RIVETS  
(8)

3-6 A

-032 RUDDER CABLE

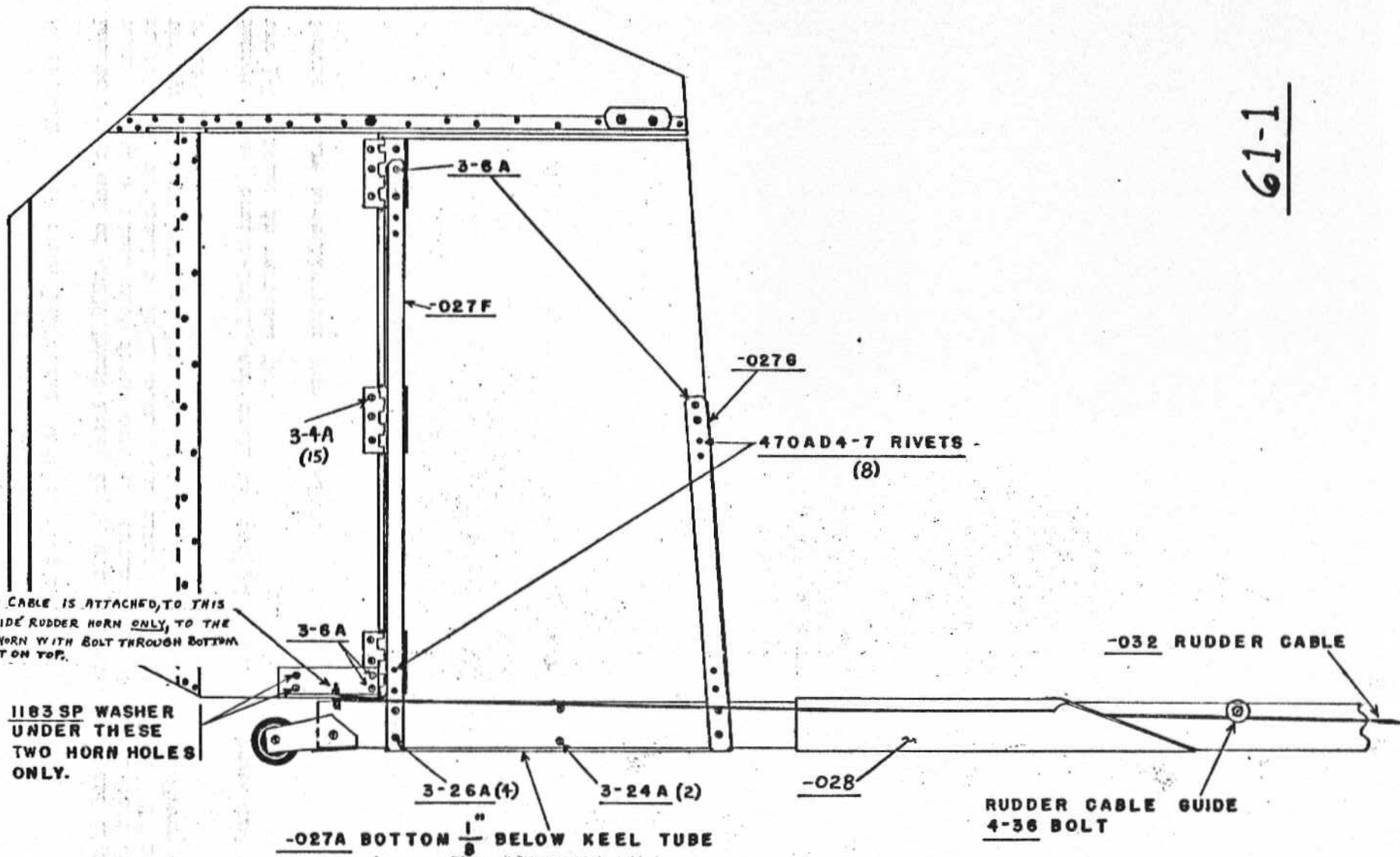
3-26 A (1)

3-24 A (2)

-028

RUDDER CABLE GUIDE  
4-36 BOLT

-027 A BOTTOM  $\frac{1}{8}$ " BELOW KEEL TUBE



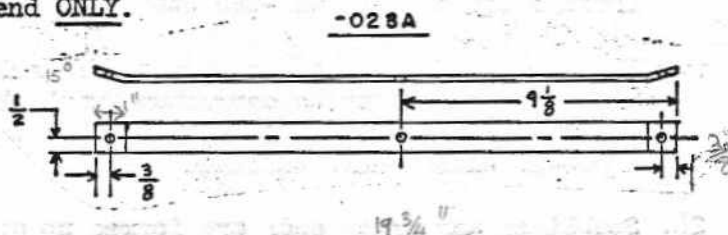
19. Re-install -027F brace and attach with bolts provided.
20. Locate lower end of -027G Front Brace angle with inserted bolt and lightly clamp top to be flush with front edge of vertical fin. Move fin left or right until vertical to Keel. Secure and clamp. Transfer the (2) "B" holes through brace to Vertical Fin. Transfer the 3/16" upper hole on lower end of brace through Keel tube.
21. Remove brace, center-drill, and drill the one 3/16" hole in brace and the two 3/16" holes in vertical fin.
22. Secure entire assembly with provided bolts.

# INSTALLATION, -028 HORIZONTAL STABILIZER

23. Lay out, transfer punch, and drill (3)  $\frac{3}{16}$ " holes in each preformed -028A brace, centered on the 1" width dimension and at the following span location:

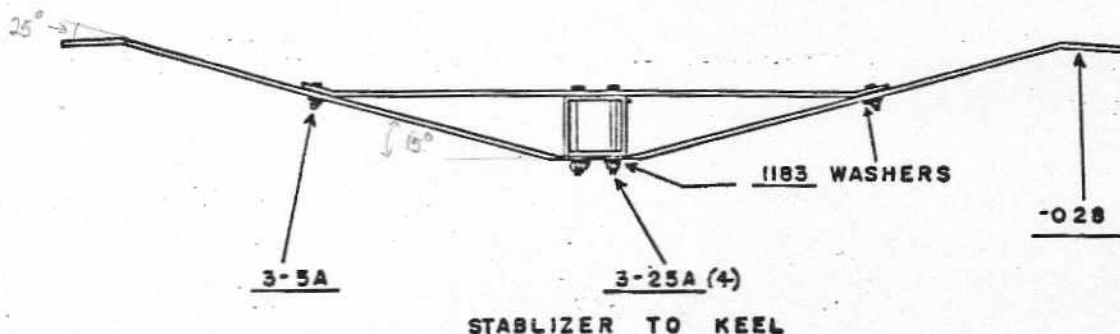
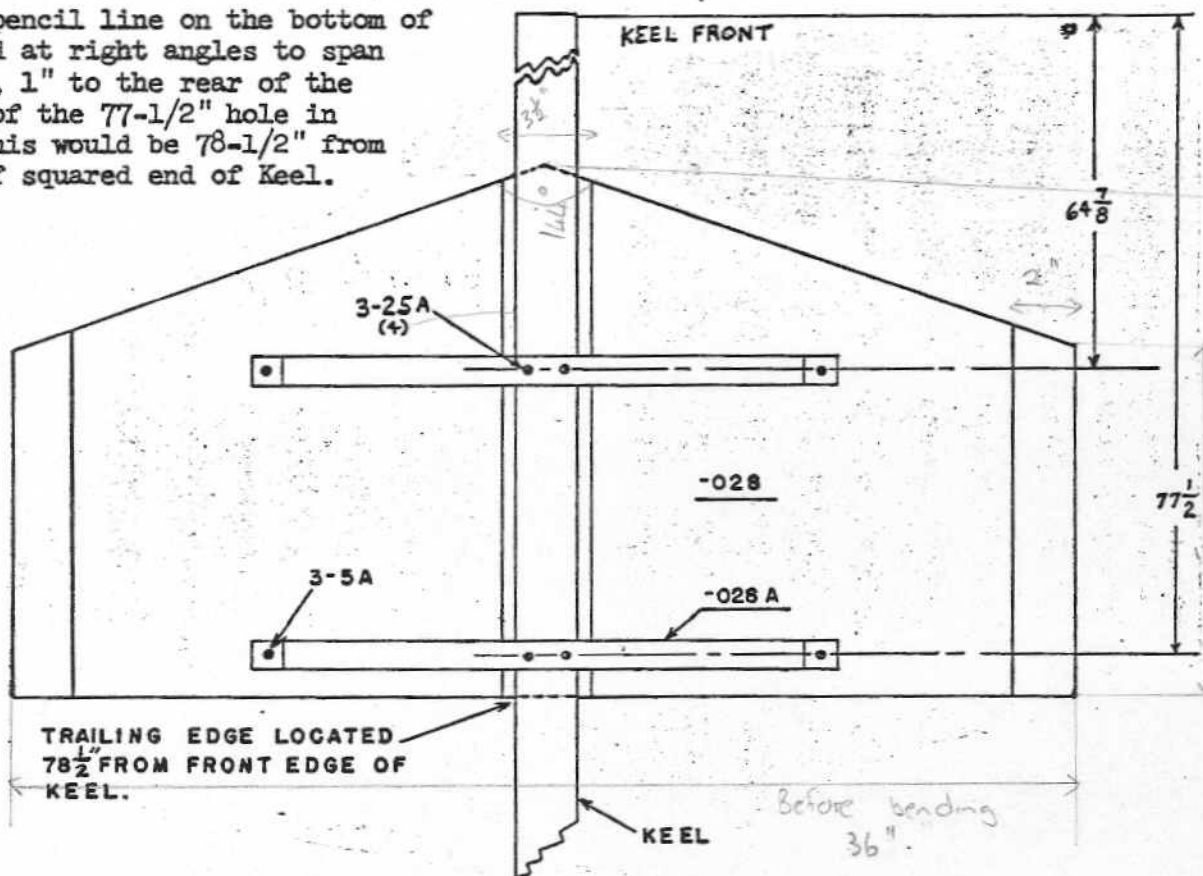
- (1) hole,  $\frac{3}{8}$ " in from each end.
- (1) hole,  $9\frac{1}{8}$ " in from one end ONLY.

24. Locate and center one -028A brace on top of Keel tube with the preformed end up, at the  $64\frac{7}{8}$ " dimension from squared front of Keel with a  $\frac{3}{16}$  bolt through Keel and hole drilled in brace.



Square to right angles to Keel, transfer punch outer attaching hole through Keel. Locate the other brace at the  $77\frac{1}{2}$ " dimension, square and center-punch. Center drill and drill (1)  $\frac{3}{16}$ " hole in each brace.

25. Draw a pencil line on the bottom of Keel and at right angles to span of Keel, 1" to the rear of the center of the  $77\frac{1}{2}$ " hole in Keel. This would be  $78\frac{1}{2}$ " from front of squared end of Keel.



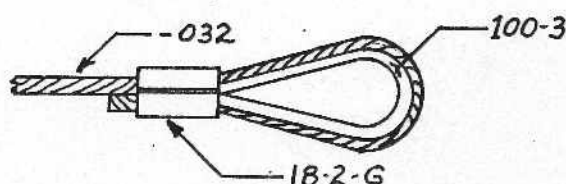
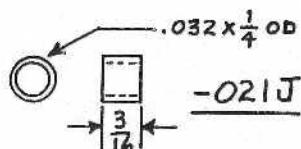
26. Position the -028 Stabilizer on bottom of Keel with "Vee" up and pointed end forward. Align trailing edge of -028 with line drawn on Keel. Center the stabilizer on either side of Keel and make sure its trailing edge is at right angles to Keel. Clamp in this position and transfer-punch the (4)  $3/16$ " holes through top of Keel to -028 Stabilizer. Center-drill and drill the (4) holes.
27. With the -028 Stabilizer on bottom of Keel and -028A Braces on top of Keel with formed ends up to correspond with the angle of Stabilizer, attach with the (4) bolts provided. Place (1) 1183 washer against Stabilizer surface, and a 960-10 washer next to brace surface.
28. Stabilizer and brace ends are formed up at 15 degrees. Adjust each side to this 15 degree angle, and clamp brace to stabilizer. Transfer-punch and drill the (4) brace attachment and stabilizer holes. Attach with proper bolts, with a 1183 washer under stabilizer, and a 960-10 Washer next to Brace.

Before completing this section your "Hang-Test", and Rudder Pedal position must be determined, and the Rudder Pedal Assembly mounted to the frame.

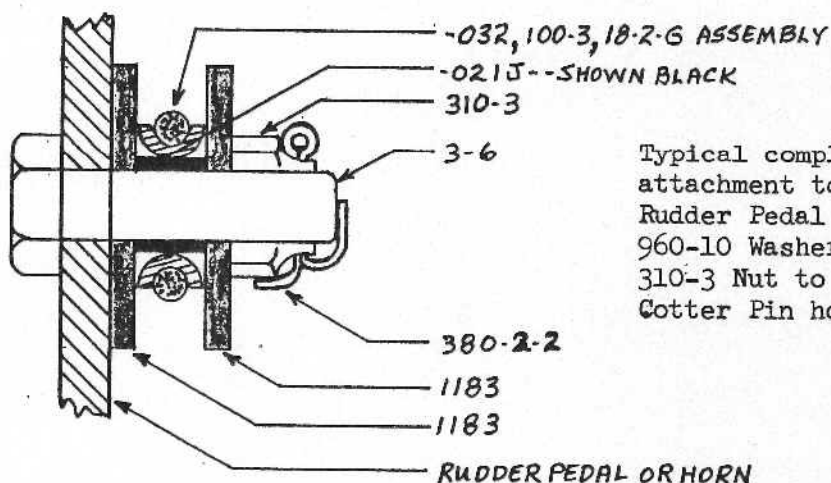
# RIGGING INSTRUCTIONS FOR RUDDER TO RUDDER PEDAL ASSEMBLY -- See Drawing No. 30B-3

To compensate for yaw on the Gyrocopter, the Rudder Trim Tab is bent to the left, which deflects the Rudder to the right in flight. The Rudder deflection in flight is approximately 10 degrees to the RIGHT. The Rudder pedals are rigged to be parallel with each other, and forward 20 degrees. (Pedal Neutral Position.)

1. Your 8-61 Rudder should now be constructed and mounted on the rear of Keel tube as instructed with the 8-61 package. Set Rudder deflection 10 degrees to the right. (2-3/8" front offset of rudder from vertical fin.) Clamp Rudder in this position. (Refer to 30B-3 drawing.)
2. Set even and parallel with each other, both Rudder Pedals at the 20 degree forward "neutral" position, referring to a vertical line from Keel tube. Lock Pedals in this position by clamping.
3. Cut length of -.032 (3/32") Rudder cable in half which should be approximately 8-1/2' each length. Install on ONE END ONLY of each cable a 18-2-G Nicopress Sleeve and 100-3 Thimble. Squeeze Sleeve. (Check "B-80 Construction and Tooling Manual" for maximum O.D. of a squeezed sleeve.)



4. Cut (4) -021J Spacers to length and deburr.



Typical completed cable assembly attachment to Rudder Horn, or Rudder Pedal frame. (Note: A 960-10 Washer may be required under 310-3 Nut to correctly space Cotter Pin hole.)

5. Mount the manufactured end of Rudder Cable on the BOTTOM SIDE OF THE LEFT RUDDER HORN OF RUDDER.
6. Mount the manufactured end of other Rudder Cable on the TOP SIDE OF THE RIGHT RUDDER HORN of Rudder. (Side with Rudder Braces.) Install with the bolt head DOWN AND THE NUT ON TOP OF CABLE ASSEMBLY for assured clearance of assembly to Keel tube and braces.



6. Thread each cable between "Butterfly" Horizontal Stabilizer and its top braces -- through Cable Guides located at the 59" Keel hole -- through Cable Guides mounted on Cluster Plates -- and to top of Rudder Pedal inside angles, next to Keel tube.
7. Install Thimble, Spacer, and Washer on the Rudder Pedal angle, on a 3-6 bolt with its threads pointing to Keel tube. Thread Rudder Cable through 18-2-G Sleeve, loop over thimble, and snug cable to remove slack. Clamp cable end to cable. Re-check your 10 degree Rudder offset, and Pedal Neutral of 20 degrees. Squeeze Nicopress sleeve, check O.D., and secure to Rudder Pedals with Washer, Nut, and Cotter Pin. Cut-off excess cable.
8. Remove the Pedal and Rudder "lock-clamps", and check Pedal and Rudder movement for FREE TRAVEL. Make sure Cable is not "dragging" on Cable Guides. The Rudder Pedals should travel from UP STOP (5 degrees rearward), to DOWN STOP (45 degrees forward). Rudder deflection should be 35 degrees right and 20 degrees left. \* SEE DRAWING NOTE FOR STOPS

Now the Control Linkage for the 8-30B, Rudder-to-Steering can be rigged and springs installed. Refer to 8-30B Unitized Steering Assembly instructions, -- Installation and Adjustment of Control Linkage, Rudder Steerable Fork Pack.

