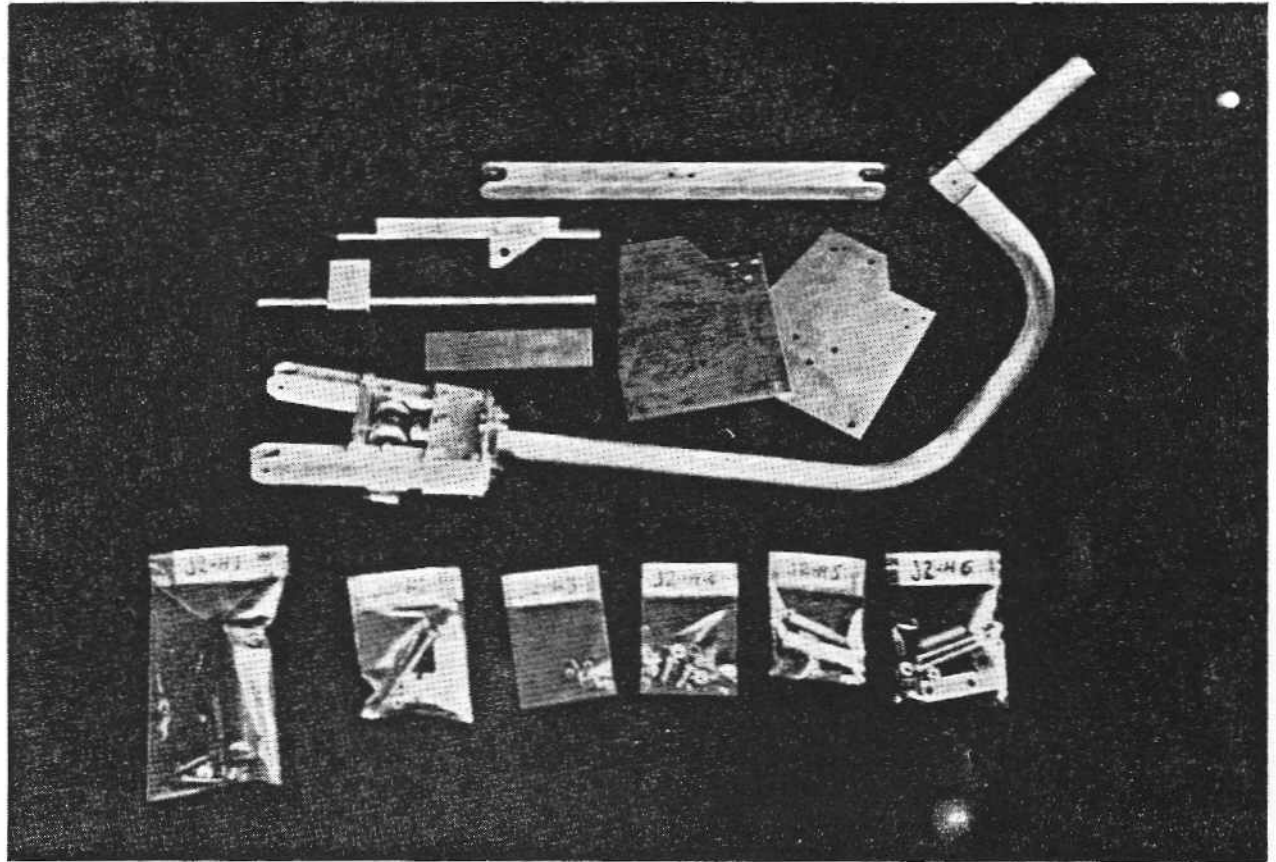




8-52-J2



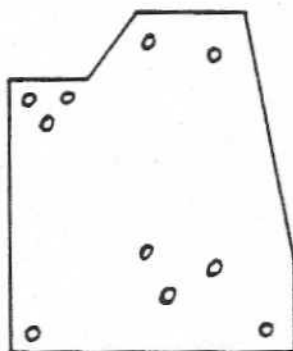
NEW

**J2
JOYSTICK**

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The Bensen 8-52-J2 Control System is designed to be used on the Model B-80A Glider-Trainer or B-80 Gyrocopter.

If your 8-41 Airframe Package was purchased as late as December 1981, you have the correct Cluster Plates, as shown at left. If yours do not look like this, a new set must be ordered before installing the Joystick.

This Joystick is not designed to be used with the Plans-Built Model B8M welded engine mounts.



Construction and Assembly Manual

The 8-52-J2 Joystick Control System is supplied in a factory-finished condition. The drilling of a small number of holes will be required to install the Joystick on your Airframe. Construction can be completed with common hand tools and a 1/4" Drill Motor.

All Holes to be drilled in your Control System will be 1/4" or less in diameter. 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 instructed otherwise 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!

ADVANTAGES

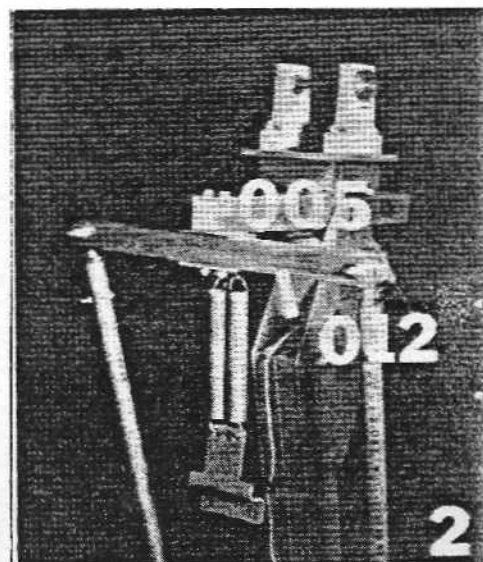
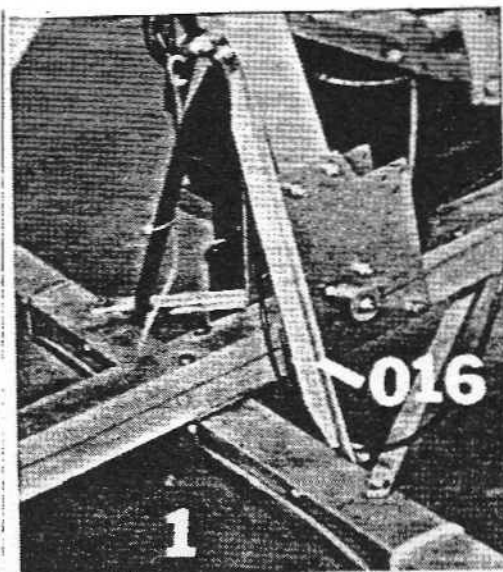
The NEW Bensen J-2 Joystick Control System is an ultra-simplified, light-weight Aluminum Joystick, supplied Factory-finished. It is:

- 1- Lighter in weight over the welded Joystick.
- 2- Designed with a minimum of pivots. Uses wear-proof grease packed, needle brgs.
- 3- New handle and stick geometry provides maximum in-flight comfort for the pilot's hand and wrist
- 4- Control Head motion has been reduced for less sensitivity of controls.
- 5- Provides positive stick limit stops, an important safety feature.
- 6- Incorporates a NEW Control Stick lock-down for rotor starting and stopping and forward stick travel limit.
- 7- Provides a "Natural Feel" of rotation control around C.G.

GENERAL:

If you are replacing an older style Joystick with this new J-2, several items will need to be changed. (1) Remove your existing -004 Cluster Plates, and replace them with newer ones included in the 8-41 Airframe if they do not look like those shown on the "Table of Contents" page. (2) Remove the -016 Steel Brace Angles. These angles are then reversed and installed with the angle webs facing out & to the rear of your machine as shown below in Photo 1. When re-bending the angle ends, pay close attention to any bending cracks that may form. IF ANY ARE NOTED, ORDER OR MAKE A NEW PAIR!

READ CAREFULLY THE FOLLOWING TEXT BEFORE ATTEMPTING AND MODIFICATION OR FABRICATION OF PARTS. LOCATE AND IDENTIFY ALL PACKAGE PARTS. AFTER ASSEMBLY COMPLETION, BE SURE TO ERASE ALL PENCIL LAY-OUT LINES AND RE-CHECK ALL STEPS TO MAKE SURE YOUR JOYSTICK IS INSTALLED correctly.



PACKING LIST -- 8-52-J2 Joystick Control

Part No.	Qty.	Material, Identification and Use
8-52-0J2	1	Formed and Finished Stick Assembly with Pivots
-015/-019	1	Stop Block and Pivot Tube Assembly
-007	1	Upper Stick Stop Angle Assembly
-012	1	1/8 x 3/4 x 3/4 x 13.5 Finished Joystick Crossarm
-022	1	1/8 x 1-1/2 x 6 Lateral Pivot Block Stop Strip

J2-H1 Control Stick Installation Hardware

3-25A	1	10-32 x 2-1/4 Grip Bolt
3-6A	4	10-32 x 3/8 Grip Bolt
960-10	5	3/16 x 7/16 Flat Washer
960-10L	10	3/16 x 7/16 THIN, Flat Washer
FNL2A-02	5	10-32 Feather Weight Lock Nut
J2-011	1	.090 x 3/8 x 1.475 Aluminum Spacer Tube
J2-017	1	1/4 x 1 x 1.5 Neoprene Bumper Pad
91F-001B	1	7/8 ID Rubber Hand Grip (For Glider Use or Copter with side-Mount Throttle)

J2-H2 Joystick Crossarm (-012) Installation

4-25A	2	1/4-28 x 2-3/16 Grip Bolt
960-416	4	1/4 x 1/2 Flat Washer
364-428	2	1/4-28 Lock Nut
J2-005	1	Slotted Aluminum Insert Block
J2-013A	1	1/8 x 1 x 2.5 Crossarm Gusset Strip

J2-H3 Upper Stick Stop Angle (-007) Attachment

3-4A	2	10-32 x 1/8 Grip Bolt
960-10	2	3/16 x 7/16 Flat Washer
FNL2A-02	2	10-32 Feather Weight Lock Nut

J2-H4 Lateral Pivot Block Stop Strip (-022) Attachment

4-5A	2	1/4-28 x 3/16 Grip Bolt
960-416	2	1/4 x 1/2 Flat Washer
364-428	2	1/4-28 Lock Nut

J2-H5 Handle Lever Installation

23-10A	1	10-32 x 5/8 Grip Clevis Bolt
125-0625	1	1/8 x 5/8 Roll Pin
960-10L	1	3/16 x 7/16 THIN, Flat Washer
J2-0SG	1	3 x 2.5 Spring
380-3-3	1	3/32 x 3/4 Cotter Pin
J2-016	1	5/8 x 2.5 Tapered Aluminum Lever

J2-H6 Stop Block Assembly and Lower Pivot Installation (-021, -015/-019)

960-616	4	3/8 x 5/8 Flat Washer
960-616L	2	3/8 x 5/8 THIN, Flat Washer
J2-020	1	.058 x 1/2 x 1.5 Aluminum Tube Sleeve
J2-021	1	1/8 x 2-3/4 Drilled and Formed Lower Pivot
4-26A	2	1/4-28 x 2-5/16 Grip Bolt
364-428	2	1/4-28 Lock Nut

FABRICATION AND INSTALLATION

OPERATIONAL USE

The J-2 Joystick represents the best compromise between ground handling requirements and the most desirable in-flight characteristics for the Gyrocopter. The longitudinal control travel amplitude for ground handling, rotor starting and stopping, is far greater than required for any inflight maneuvers.

Hand-starting, pre-rotation, and rotor stopping demand the rotor to be in a horizontal position, if wind is present, to prevent severe rotor "flapping" at low rotor RPM. When the "flapping" rotor strikes its stops on the Control Head, possible destructive damage to the Rotor Blade, Control Head or Airframe can occur. The Control Head must have 8-1/2 degrees to 9-1/2 degrees of forward tilt when the rotor is horizontal.

To accelerate the rotor to flight RPM on your take-off run, 8 degrees of rearward Control Head tilt is required when hand-starting. With a mechanical pre-rotator, 6 degrees of rearward tilt is adequate. (A 6 degree replacement pivot block is available from B.A.C. for this correction.)

All in-flight maneuvers can be accomplished with + or - 3 degrees of head tilt in all directions when C.G. hang test of Gyro is 1 degree forward.

To satisfy both control requirements of ground handling and flight use, a down-lock and forward stick limit stop are provided with the NEW J-2 Joystick. When the down-lock is engaged, the forward stick travel allows 8-1/2 to 9 degrees of forward head tilt. By releasing the down-lock and tilting the stick rearward, the down-lock automatically becomes a forward stick stop, restricting the forward head tilt to 4 to 5 degrees forward.

The fixture-built J-2 has built-in lateral stops, allowing + or - 5 to 6 degrees of lateral control travel.

USE OF JOYSTICK DOWN-LOCK

The Joystick is locked forward when your Gyro is parked; at a slow speed taxi with or without rotor turning; when hand-cranking; or mechanically pre-rotating the rotor until RPM is sufficient to tilt the rotor rearward; or after landing and your Gyro has stopped ground roll and you wish to stop the rotor.

INSTALLATION

- 1- The new Bensen 8-41 Airframe Package contains new, different, Mast-to-Keel Cluster Plates which have a notched ledge on the forward face, and a cluster of 3 pre-punched holes below this ledge. To mount the J-2 Joystick on an older airframe, the Cluster Plates must be changed. The steel -016 Brace Angles that attach from the Mast to Axle tube must be reversed and re-mounted with the angle faces, or web, **facing rearward & outward as shown in photo 1.**
- 2- Locate your assembled Joystick under the seat bottom with Joystick handle forward. The Joystick vertical pivot blocks have milled flats, which are inserted inside the Cluster Plates. The ledge of the pivot blocks seat on top of Cluster Plate notched ledge. Flush the front edge of vertical pivot blocks with the front edge of Cluster Plates. Temporarily clamp blocks in this posi-

tion. Move the Joystick full-forward, to contact the Keel tube. Check to assure the stick is centered on the Keel. If not, move vertical pivot blocks fore or aft slightly to center on Keel and re-clamp. (See Photo B)

Locate the top-forward pre-punched hole in Cluster Plate. Using this hole as a guide, drill a (B) hole through each vertical pivot block. Attach block to plate with a 3-25A bolt, with a THIN washer under the bolt head, a -011 Spacer Tube between blocks, a THIN washer, and FN12A-02 nut. Torque to 20-25 inch-lbs.

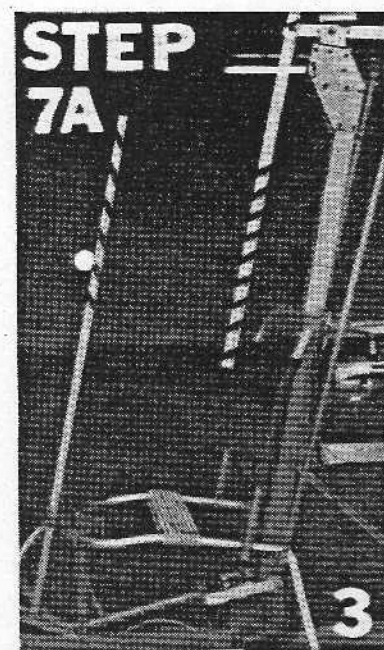
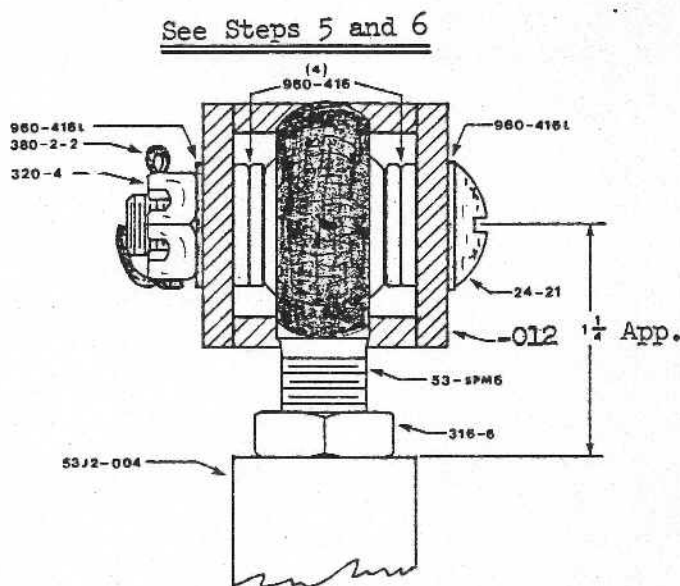
Drill through the remaining 2 pre-punched holes in each Cluster Plate, and attach with (4) 3-6 A bolts with THIN washers under head and nut as above. Place bolt heads on outside of Cluster Plate to clear lateral stick stop. Cement the -017 Bumper Pad to Keel tube. Pad should contact low point of formed Joystick tube. (See sketch 5 & 2 & Photo 8)

- 3- Attach -012 Joystick Crossarm to the bottom of the Gimbal Head Torque Tube as follows: (See photo 2)

- a. Insert -005 Slotted Insert Block into Torque Tube end.
- b. The -013 Slotted Trim Bracket is placed between Torque Tube and Crossarm.
- c. The -013A Crossarm Gusset is located on the bottom of Crossarm.
- d. Attach with (2) 4-25A bolts, with 960-616 washers under bolt head and nut.
- e. Torque to 40 to 50 inch-lbs.

PUSH ROD/CONTROL LINKAGE INSTALLATION AND ADJUSTMENT

- 4- Follow instructions as contained with the 8-53-J2 package for Push Rod assembly, and complete all steps.
- 5- Temporarily attach one end of each 55-inch Push Rod assembly to Joystick or Crossarm with a 24-21 Clevis Bolt. Use (2) 1/16 thick washer spacers on each side of rod-end bearing.
- 6- Space each Rod-End Bearing approximately 1-1/4" from end of pushrod as shown. Leave check-nut loose. (See sketch 1)



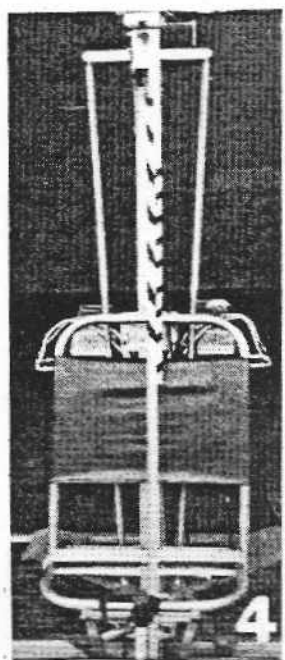
The Gimbal Head must contact its lateral and longitudinal stops to prevent excessive loads from rotor flapping, ground handling, etc., from being absorbed by the Control Linkage. Normal in-flight loads on the Control System are only a few ounces on the Control Stick Handle, but heavy stress may be generated by excessive blade flapping.

The Joystick Control System must also contact positive lateral and longitudinal stops to prevent excessive loads from "man-handling", and abuse.

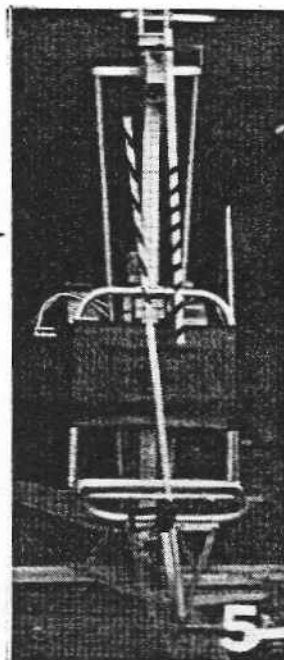
FORE AND AFT ADJUSTMENT

- 7- Push Joystick full forward against Bumper Pad on Keel tube. Screw the rod end bearing, in or out, on each pushrod, with Control Head and Stick near vertical laterally, until the Control Head contacts its forward tilt stop. Temporarily connect Pushrod end with bolt. Check Joystick travel several times making sure that the Joystick bottoms on the Bumper Pad when the Control Head contacts its forward stop. Re-adjust Rod-End Bearings until both contact simultaneously.

To assure that Control Stick is centered laterally and vertically when Control Head is vertical, proceed as follows: (Note photos 3, 4, & 5)



← **RIGHT**
WRONG →



Note angles, or strips, clamped to Control Stick and Gimbal Head Torque Tube. Black strips aid identification.

Photo 4 shows strips exactly parallel with Mast Tube.

Photo 5 shows incorrect alignment which must be corrected as shown in Photo 4.

Note Joystick Crossarm and Pushrods are in position.

- Obtain (2) pieces of straight wood strips, dowel, or aluminum angle, approximately 3 or 4 feet long. Clamp one strip to the side of the Control Head Torque Tube front. Clamp the other on Control Stick Handle as shown. The strips should be parallel with the Mast tube as viewed from the side. (Stick should be in the forward-down position.)
- Move Control Stick laterally until strip clamped to head is parallel with the Mast. (Viewed from front of Gyro.)
- Differentially adjust the Rod Ends on each Pushrod until the strip attached to the Control Stick Handle is also parallel with the Mast. (Remember, your Rod-Ends are adjusted correctly for forward tilt, therefore if one Rod End is screwed out $1/2$ or 1 turn, the other must be screwed in the same amount.)

When both Control Stick and Control Head are vertical and parallel with the Mast, insert Clevis Bolt with (4) side spacer washers and a THIN washer under bolt head and nut. (See sketch 1) Torque Castellated Nut to 40 to 50 inch-lbs, and safety with a Cotter Pin.

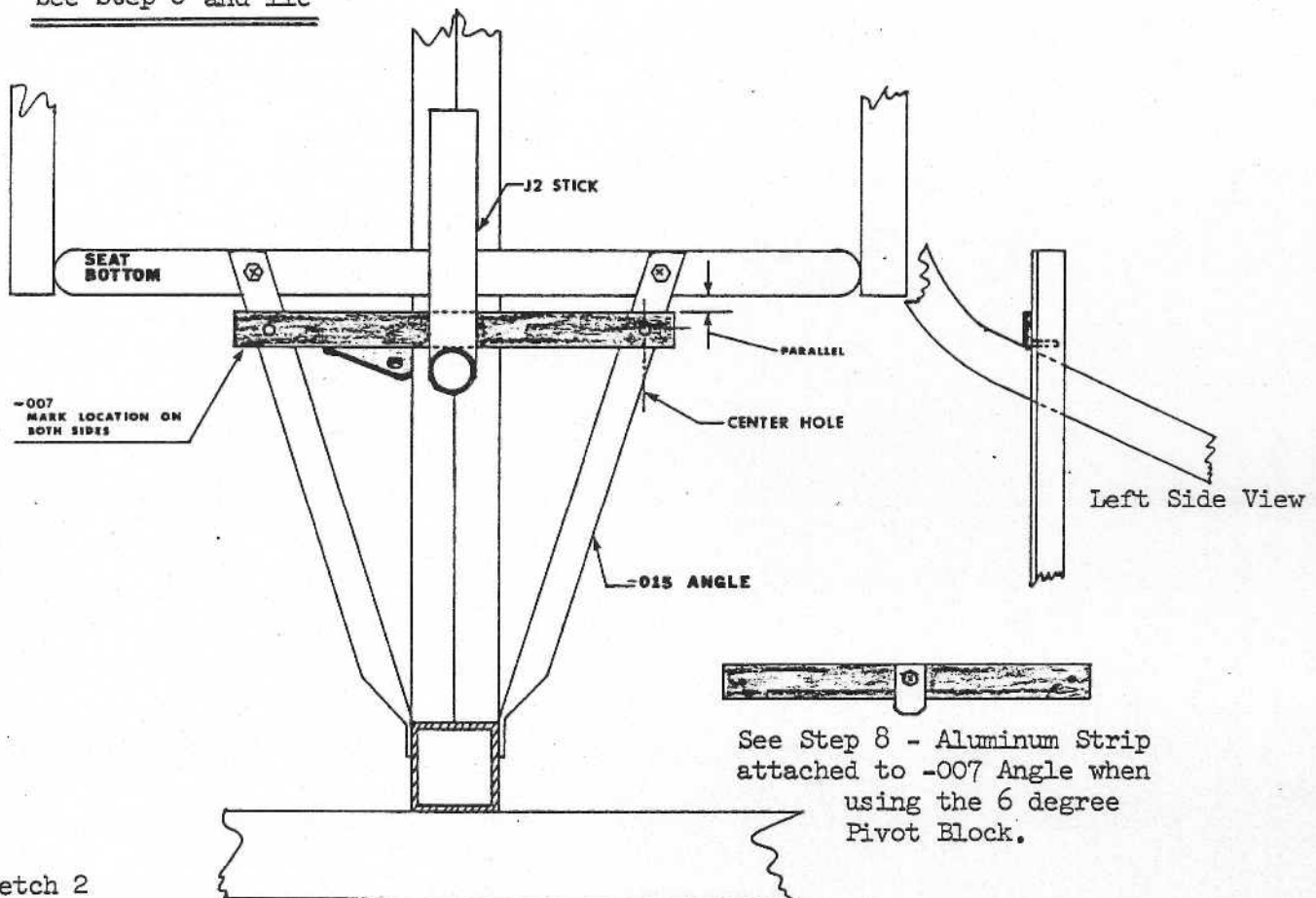
LOCATION OF -007 "STICK UP" LONGITUDINAL STOP

- 8- Pull Control Stick back until the Control Head contacts its rearward stop. Place the -007 Stop Angle on top of stick tube, and against Seat Bottom -015 Brace Angles. Have the riveted upper pivot ear face forward. Level angle with Seat Bottom. With a pencil, mark the vertical location of -007 angle on -015 Brace Angle. Clamp in this position. Move Control Stick fore and aft several times to assure that the stick stops make contact at the same time Control Head stops are reached. (See sketch 2)

NOTE: If you are rigging your Gyro for towed flight, or for hand-starting the rotor, the 8 degrees rearward stop Pivot Block on the Gimbal Control Head must be used.

When you fly under power, as with the Gyrocopter, and intend to use a pre-rotator and 34-inch Rotor Hub, a 6 degree rearward stop Pivot Block should be installed on your Gimbal Head. A strip of Aluminum must also be attached to the -007 Up-Stop Angle, which will contact the Joystick Tube providing a positive up-stop when the head contacts its 6 degree rearward stop. (See sketch 2)

See Step 8 and 11c



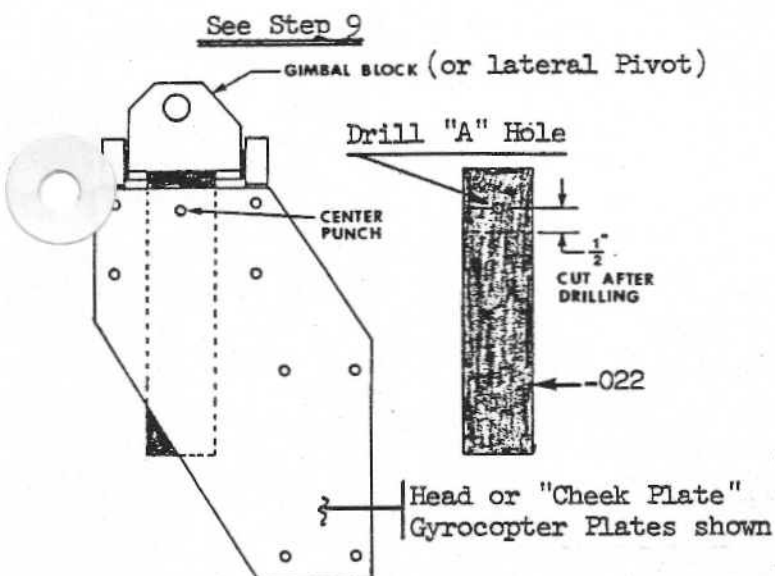
Sketch 2

INSTALLATION OF LATERAL STOPS ON GIMBAL CONTROL HEAD

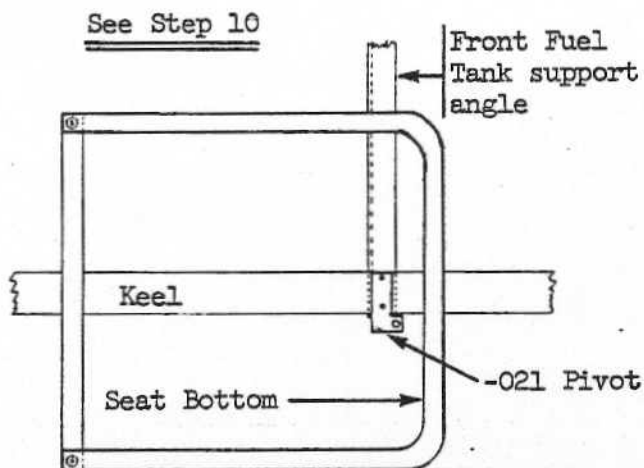
- 9- Production Gimbal Head "Cheek Plates" normally allow + or - 6-1/2 to 7 degrees of lateral tilt of the Control Head. The fixture location of the Joystick Lateral Stops will allow + or - 5 to 6 degrees of lateral motion of the Gimbal Control Head. **POSITIVE LATERAL STOPS MUST BE INSTALLED ON THE HEAD TO MAKE CONTACT AT THE SAME TIME THE JOYSTICK CONTACTS ITS LATERAL STOPS.**

In the event the lateral pivot block on the Gimbal Head stops on the head plates before the Joystick reaches its lateral stop, the top of the Head Plate should be filed off to allow simultaneous stop contact.

If the pivot block does not contact the Head Plate with full lateral motion of the Joystick, "Head Stops" are then installed as follows: (See sketch 3)



Sketch 3



Sketch 4

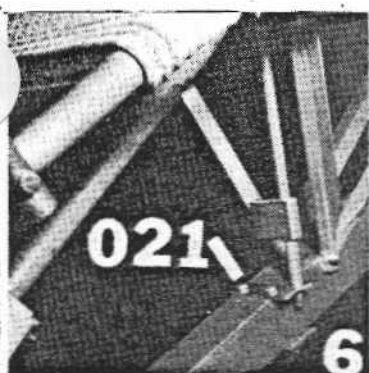
- Locate and center-punch a hole location on each Head Plate, 1/2" from the top of plate and centered between the (2) upper head attaching bolts. Tilt head away from the side you are installing the Stop.
- The 1/8 x 1-1/2 x 6" aluminum strip, -022, provided is slid-up the inside face of Head Plate until the 1-1/2 end contacts the base of the lateral Pivot Block of Gimbal Head. Move strip fore and aft to center on block and lightly clamp strip in this position. Tilt Head toward you, forcing strip down until the Joystick contacts its lateral stop. Securely clamp strip in this position.
- Drill a (A) hole through Head Plate and Strip using the pre-punched location as a guide. Remove strip and mark its position on Head Plate. Cut drilled end of strip 1/2" below the 1/4" drilled hole. Locate cut section on its marked position inside Head Plate and secure with a 4-5A bolt. Torque to 50 to 70 inch-lbs.
- Repeat this procedure on the opposite Head Plate and attach.

INSTALLATION OF CONTROL STICK LOCK-DOWN AND IN-FLIGHT STICK LIMIT STOP

- 10- Install the -021 Lower Pivot on top of Keel tube using the (2) 1/4" holes attaching the front fuel tank support angles. (See sketch 4 & Photo 6)

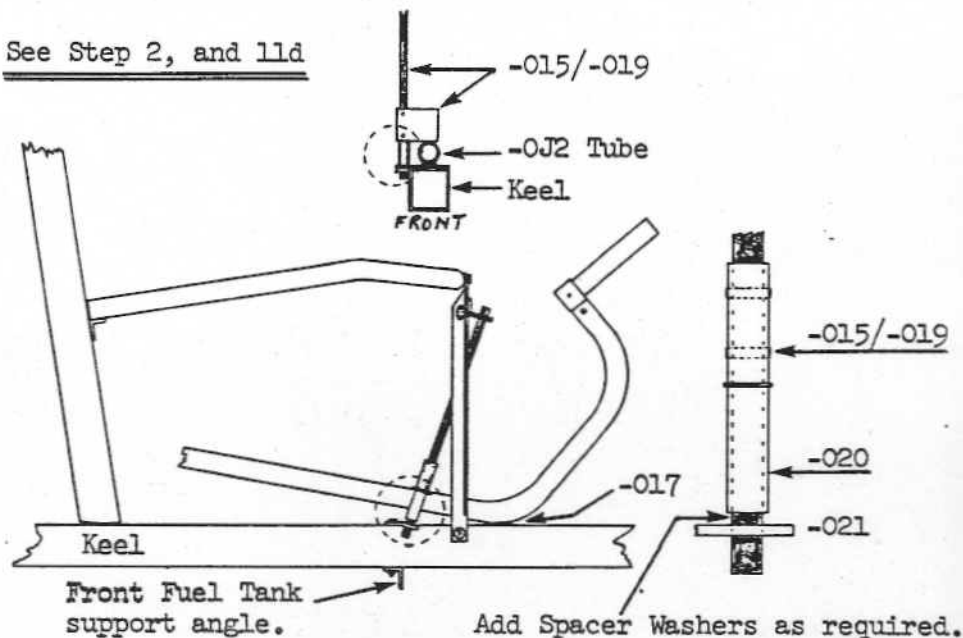
11- The assembled Pivot Tube and Stop Block, -015/-019, are installed as follows:

- a. Place a THIN 3/8" washer over the 3/8 tube shorter end. Next install the -020 Sleeve, and insert -015 Pivot Tube into -021 Lower Pivot. (See sketch 5)
- b. Insert the upper end of Pivot Tube into 3/8 hole of -007 "Up-Stop" Angle. Position -007 Angle at the pre-marked location and clamp in position. With Control Stick forward, measure the distance from side of stick to center of 3/8 Pivot Tube. Raise Control Stick to the full up position and check the distance from side of stick to the center of Pivot Tube. Shift -007 angle right or left to obtain the same measurement as when stick was forward. Clamp angle in this location. The 3/8 Pivot Tube should now be parallel with Mast and parallel to the up and down motion axes of Control Stick.
- c. Locate a hole position on each end of -007 Stop Angle which centers angle and centers the face of each -015 Seat Bottom Support Angle. Drill a 3/16" hole through the angles. (See sketch 2)



Location of -021 Lower Pivot. See Step 10 and Sketch 4.

See Step 2, and 11d



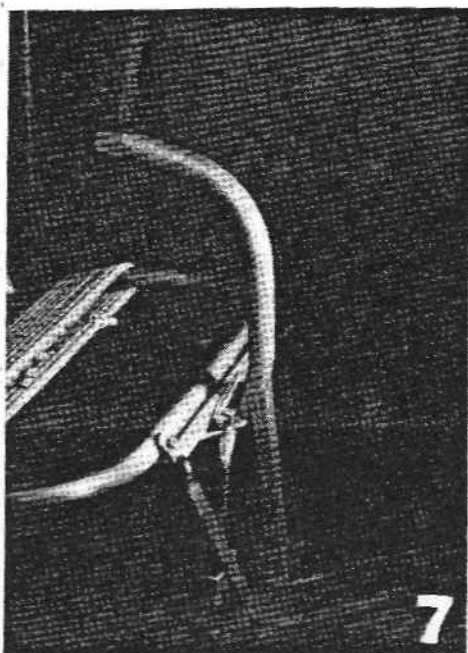
Sketch 5

- d. Move Control Stick fully forward against the Bumper Pad and compress Pad slightly. Rotate Stop Block over top of Joystick Handle Tube, 90 degrees to Keel. Note how many 3/8 washers are required between -020 Sleeve and Lower Pivot to maintain this vertical spacing of Lock-Down Stop Block. Add the required Spacer Washers to tube. (See sketch 5)
- e. Remove the -007 Up-Stop Angle from 3/8 Pivot Tube. Slide -016 Lever over tube with the 1/8" pre-drilled hole on the inside. Replace the -007 angle assembly over 3/8 tube. Locate on Seat Bottom and secure with (2) 3-4A bolts.
- f. Position Lock-Down Block over top of the fully forward Control Stick, 90 degrees to Keel Tube. Temporarily screw 23-10A Clevis bolt into tapped hole on top of Lever. Rotate lever clockwise until Clevis bolt bottoms on edge of Upper Pivot. Re-check for 90 degree position of Stop Block.

- g. Clamp Stick to Keel. Weight or tie stick to compress Bumper Pad. Push up on Lever to contact bottom of Upper Pivot while holding down-pressure on the 3/8 Pivot Tube. Hold in this position and drill a 1/8" hole through pre-drilled hole in Lever through Pivot tube and other side of Lever. Secure Lever with a 125-0500 Roll Pin. (See sketch 6)

Unlock Control Stick by rotating Lever counterclockwise to screw stop. Lock-down Block should clear Stick, allowing it to move in any position. Check Stop mechanism for free rotation and lightly oil pivots. With Stick rearward, rotate Lever clockwise to Stop. Block should be at right angles to Keel and when stick is pushed forward, stick will stop on top of Block. which will restrict the forward tilt of Control Head to 4 to 5 degrees.

The end of Pivot Tube should extend approximately 5/8" above the Upper Pivot. The excess can be cut-off.



Handle-bend resting on -017 Bumper Pad and "Stop-Lock" Block over Handle tube.

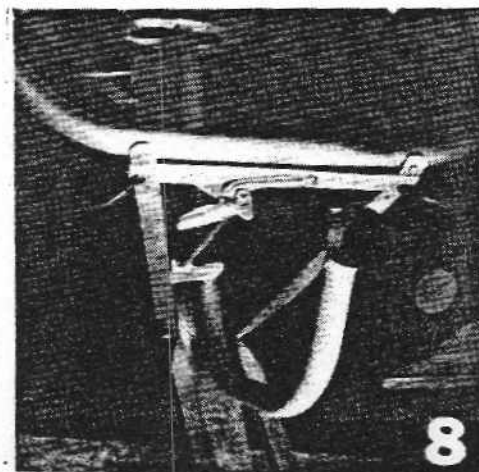


Photo on left shows J2 Stick in its full-back, or rearward position and against -007 "Up-Stop" Angle. Note position of -016 Lever and -015/-019 Stop Block and Pivot Tube Ass'y.

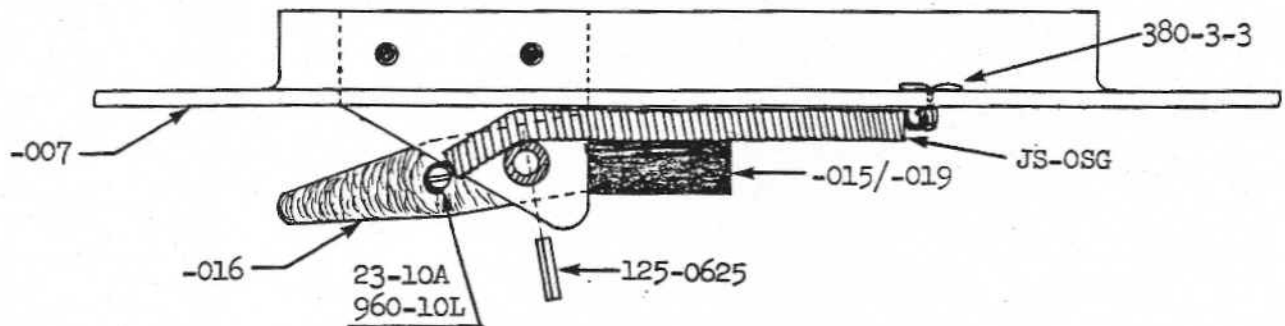
Photo above shows Joystick fully forward. Note

INSTALLATION OF POSITIONING SPRING

- 12- Remove Clevis bolt from Lever. Place a THIN washer on bolt and insert bolt through the end loop of Spring. (Rotate spring so the loop is on the bottom side.) Screw bolt into Lever with Spring on top of Upper Pivot. Spread a 380-3-3 Cotter Pin open to straddle loop on other end of spring. Close Cotter Pin and wrap spring behind the 3/8 Pivot Tube, next to Seat. Stretch spring and insert Key into pre-drilled hole in Stop Angle. Seat Pin and spring on face of angle and secure by spreading legs of Pin on inside of -007 Angle. (See sketch 6) (Note Photo's 7 & 8 above)

Re-check function of Lock. Spring should hold Stop Block 90 degrees to Keel when rotated counterclockwise to clear Block off Control Stick tube. When released, the Block should snap back to its 90 degree position.

See Steps 11f, 11g, and 12



Sketch 6

When installing Pushrods as instructed with the 8-53-J2 Package, pay attention to the following statement.

Rotate pushrods to leave the same amount of rod-end thread exposed on each end. Align pushrod bushing retention bolts at 90 degrees to Keel tube with the bolt heads on the inside, and threads out, toward the wheels. Align rod-ends on each pushrod to allow free pivot of ends in all stick positions. Tighten check nuts, while holding rod-ends with a wrench.

MAINTENANCE

The -015 Stop Block has a wrap of vinyl tape to prevent chafing of Joystick handle. This may require replacement with use.

Occasional oiling of Stick Lock-Down pivots may be required.

(The Rod-End Bearings are a special composite of Nylon impregnated glass filaments and suspended molybdenum disulfide (a super lubricant), and should not require any lubrication.)

If your Gyro has been exposed to weather elements for long periods of time, the Universal Cross Arm Pivot Bearings might become contaminated. They are sealed with a composition gasket seal, and grease packed. If they are removed for any reason, be very careful as the very small needle bearing rollers can fall out.

REMEMBER: A GOOD PILOT ALWAYS INSPECTS HIS MACHINE BEFORE FLIGHT. THIS INCLUDES THE ENTIRE CONTROL SYSTEM! DON'T ALLOW ANYTHING IN IT TO GO SLOPPY OR LOOSE.

Refer to the 8-20A Manual supplied with the Gimbal Control Head for proper trim adjustments of the bungee springs for hands-off flight trim.

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