

SECTION/OPERATION

10

CONTROL SYSTEMS

<u>COMPONENT</u>	<u>PROCEDURE</u>	<u>PRINT #</u>	<u>TEMPLATE</u>
CYCLIC CONTROL (E14-2000)		E14-2000	E14-1 E14-2 E14-3
COLLECTIVE CONTROL (E15-2000)		E15-2000	E15-1
DIRECTIONAL CONTROL (E16-2000)		E16-2000	E16-1 E16-2

NOTES

CYCLIC CONTROL: When mounting the clevis to the shaft, make sure that there is a minimum of end play on the cyclic clevis and that there is no excessive pre-load on the pivot bushings.

COLLECTIVE CONTROL: The collective stick action and twist grip throttle action must function smoothly. Any roughness or binding will make flight operations extremely difficult, especially for the novice pilot.

DIRECTIONAL CONTROL: The foot pedals must operate smoothly and without excess friction throughout their entire range of travel.

ROTORWAY

TOOLS REQUIRED FOR OPERATION 10:

Band saw	
Drill bits of the following sizes:	1/8"
	3/16"
	1/4"
	Letter "D"
File	
Framing square	
Grinder	
Hacksaw	
Hand drill (air or electric)	
Pliers	
Ratchet with sockets of the following sizes:	3/8"
	7/16"
	1/2"
Vise	
Vise grips	
Welding equipment	
Wrenches of the following sizes:	3/8"
	7/16"
	1/2"

CYCLIC CONTROL

Fabricate the cyclic control components per dimensions on print E14-2000. Due to the simplicity of the cyclic control, an exploded view is not necessary. The hardware locations are called out for easy identification. Pay particular attention to dimensions when constructing the cyclic shaft and the bracketry welded to the shaft. When mounting the cyclic clevis to the shaft, be sure that there is a minimum of end play on the cyclic clevis and also that there is no excessive pre-load on the nylon pivot bushings.



Photo #1

Use print E14-2000 and templates E14-1, E14-2, and E14-3 when constructing this assembly. Parts as received from RotorWay International for the cyclic control.

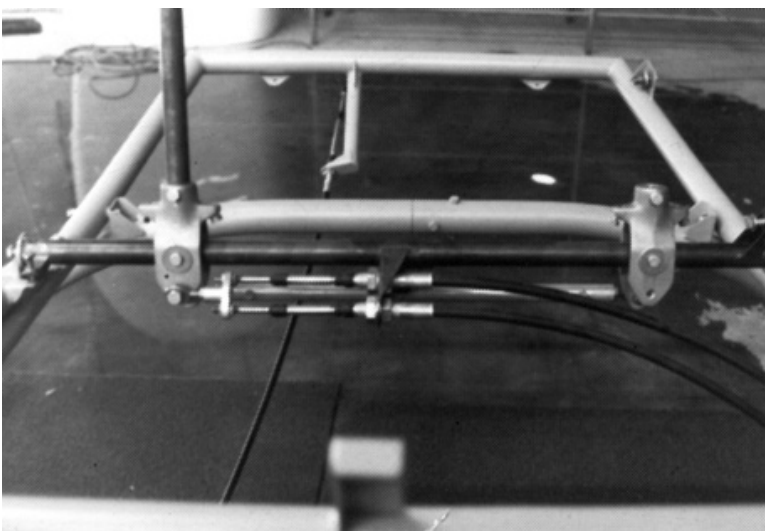


Photo #2

This photo shows the installation of the cyclic from the pilot seat. Pilot's cyclic has the push button for the starter installed. The push button must be wired in when the wiring harness is installed. Take care to insure that the wires do not fray where they exit the cyclic stick. This could cause a short, resulting in starter engagement at full RPM during operation.

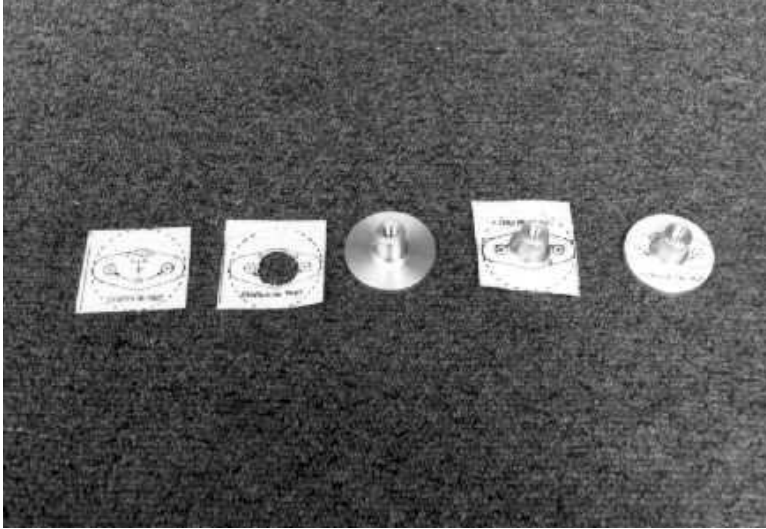


Photo #3

Using template E14-2, cut out and drill the holes in the push/pull control cable "T".



Photo #4

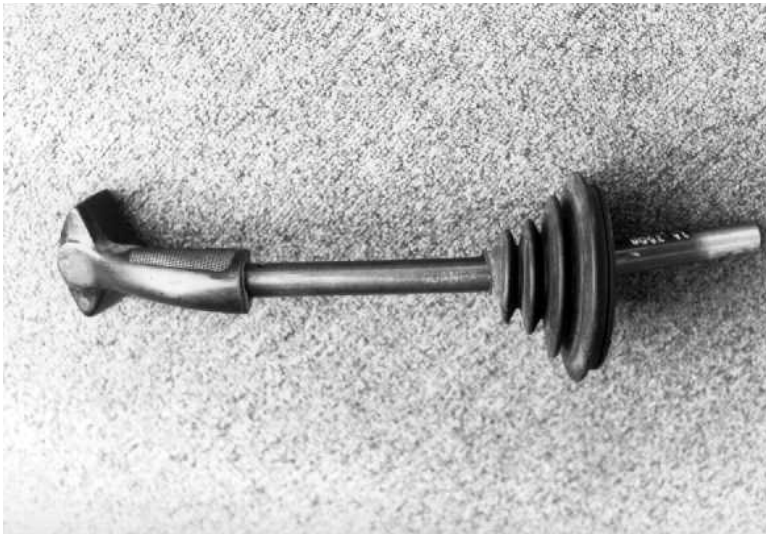
Using template E14-1, cut out and bend the lateral push-pull bracket, fore/aft cyclic stop bracket, and the fore/aft actuator bracket.



Photo #5

Use template E14-3 to cut out the cyclic handle covers.

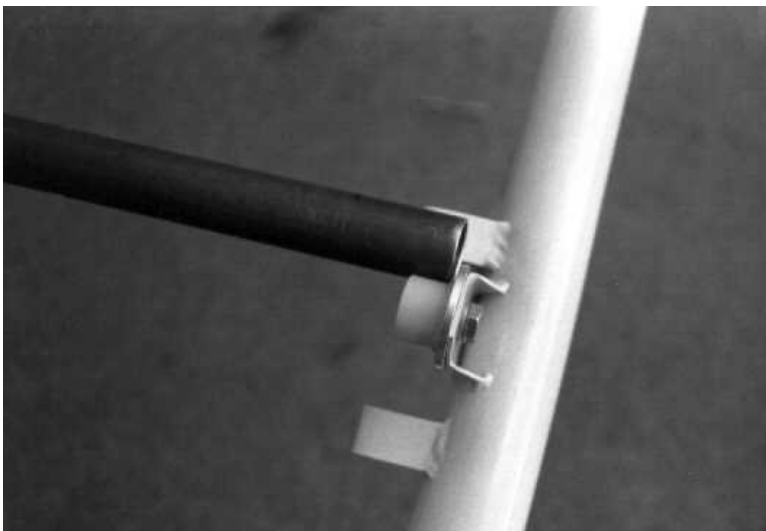
Photo #6



Fit the cyclic stick to the cyclic handle, the cyclic clevis, and the cyclic boot. Note: After wiring is completed, the handle and back cover must be attached to the cyclic stick. The best glue to use is a two part epoxy; however this does not always work, particularly if the stick has been chrome plated. An alternative would be to install pop rivets at the bottom of the handle into the cyclic stick after fitting. This will keep the handle from turning and give the glue a better chance to bond to both surfaces.

If electrical wires have been installed, caution should be taken when drilling the holes for the rivets.

Photo #7



Install the aluminum control bushings and nylon pivot bushings on both cyclic control airframe mounting brackets.

Note: Before cutting the cyclic control tube to length, the front landing gear and seat must be temporary installed and tightened in place. Failure to do this will give the wrong length to cut the cyclic control tube.

Check the length of the cyclic shaft by holding it next to the pivot bushings. Cut it to length for a snug fit. You may need to cut off both ends of the shaft to keep the center of the shaft on the aircraft's center line.



Photo #8

Opposite end shown for better understanding.

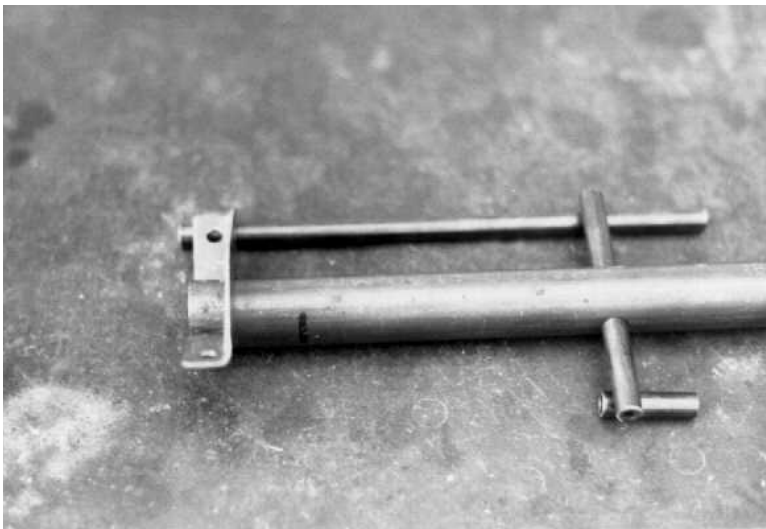


Photo #9

This is an easy way to hold the alignment of the fore and aft cyclic stop bracket when tack welding it in place on the cyclic shaft.

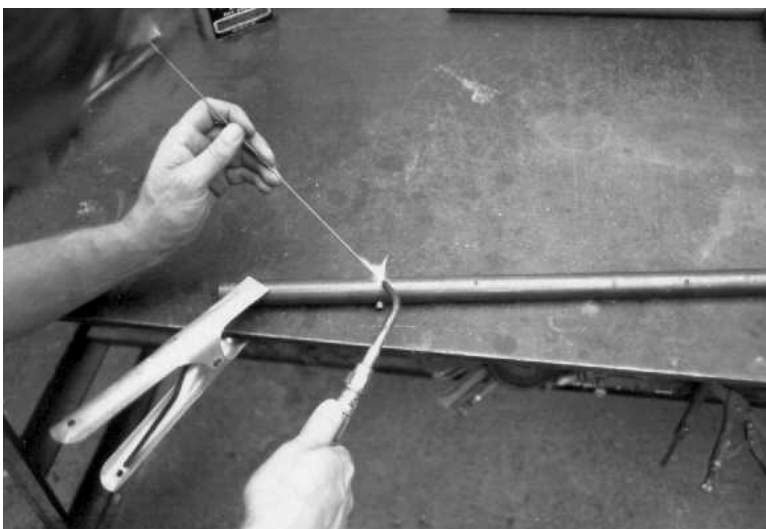


Photo #10

Weld the bushing in the cyclic shaft. Leave the bushings as long as possible. After the welding is finished, cut the bushings to the correct length to fit the cyclic clevis and drill the bushings with a letter "D" drill bit. This will ensure a close tolerance fit with the cyclic clevis bolt.

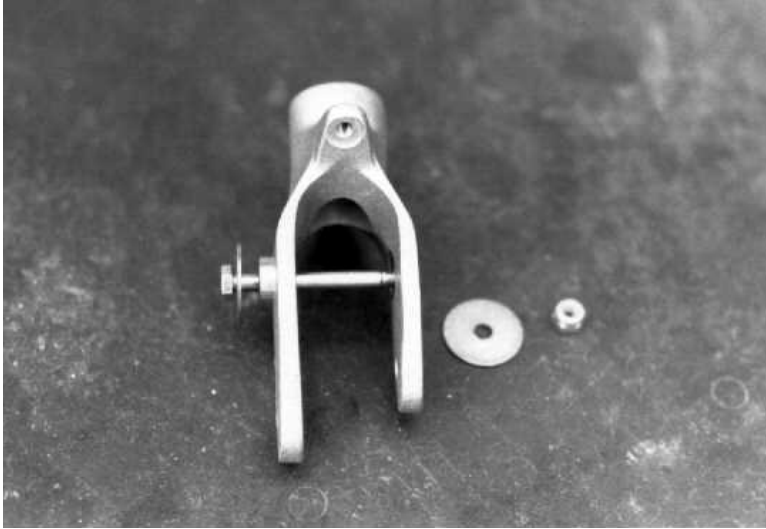


Photo #11

Exploded view of the bolt, nut, washers, and nylon bushings that hold the cyclic clevis to the shaft.



Photo #12

Tack weld the lateral push-pull cable bracket to the cyclic shaft. Install the cyclic clevis on the cyclic shaft. Install the cyclic cables to check the cable alignment. They must be parallel and straight for smooth operation. The ends of the cyclic shaft must be perpendicular to prevent binding.

Note: Heat will destroy the cables. Do not attempt to weld the bracket with cables in place.

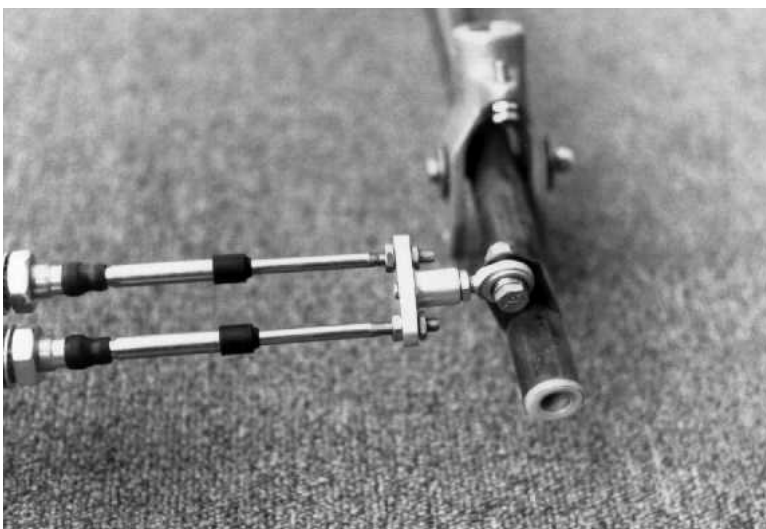


Photo #13

Tack weld the fore and aft actuator bracket to the cyclic shaft. Install the shaft in the airframe and check the cable alignment. They must be parallel and straight for smooth operation.

Note: Heat will destroy the cables.

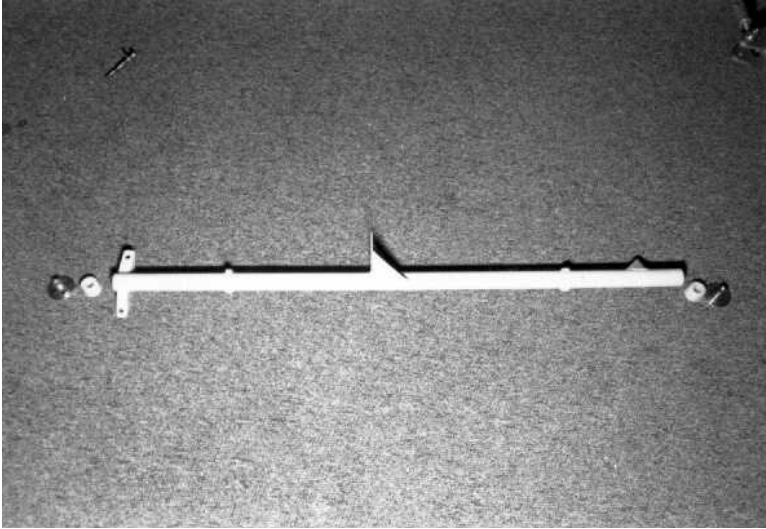


Photo #14

When the brackets have been checked for alignment and position, remove the shaft and final weld the brackets.

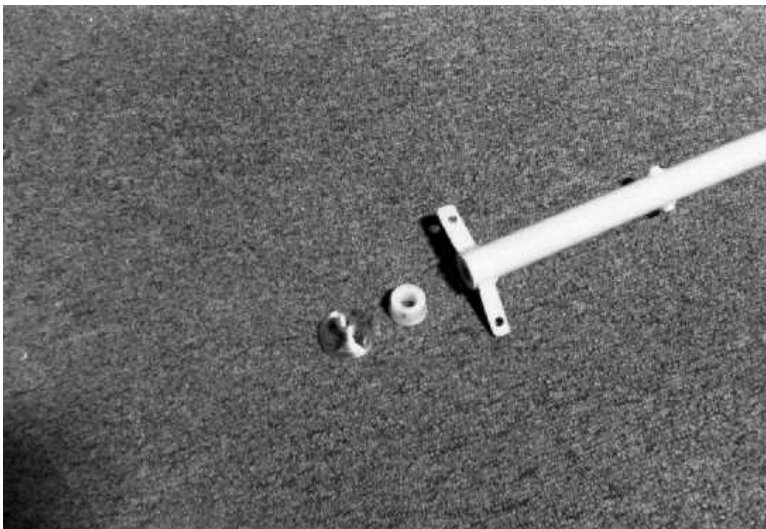


Photo #15

When final installing the assembly onto the airframe, be sure to apply grease to all mating parts.

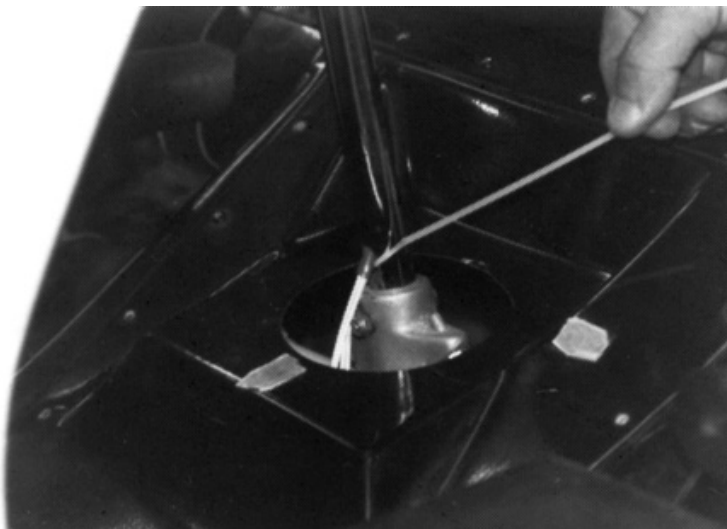


Photo #16

The cyclic clevis is shown assembled to give a better understanding of where the parts go. Make a slot 1/4" wide x 1/2" long in the cyclic stick just above the cyclic clevis to route the starter button wiring.



Photo #17

On final assembly, check that the pivot bolt is tight. The large fender washer should be as close to the side of the clevis as possible without touching.



Photo #18

Install the cross tube in the airframe to make the correct stick travel adjustments. Use the bolts where the arrow indicates to set the lateral cyclic stick travel. Note: Be sure that the cyclic shaft is able to rotate freely without any excess side-to-side play.



Photo #19

Use the bolts where the arrow indicates to set the fore and aft cyclic stick travel.



Photo #20

On final installation, be sure to apply grease between the aluminum control bushings and nylon pivot bushings.

Note: Make sure the cyclic shaft is free to rotate without binding and without excess side to side play.



Photo #21

On final installation, apply Loctite to the threads of the end bolts and make sure they are tight.

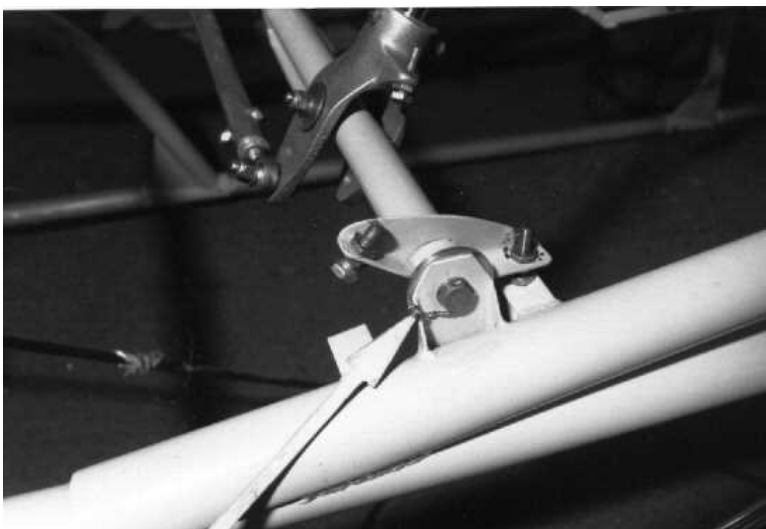


Photo #22

Safety wire the bolt to the airframe bracket. (See general construction procedures on safety wiring methods.)

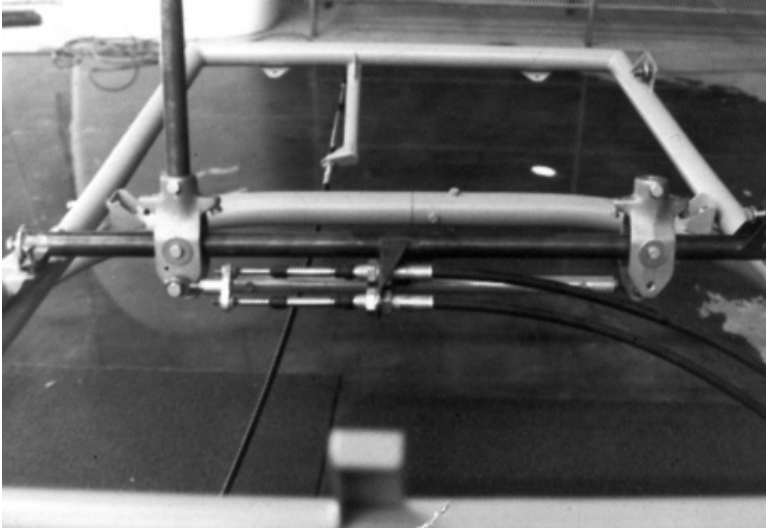


Photo #23

Install the cyclic control cable. This is a close-up view of the cyclic control from the pilot's seat. Check security of all stop nuts and tightness of all mounting hardware in the cyclic control system, including the double nuts which secure the cables to their mounting brackets. Check the full travel of the control for freedom of movement.

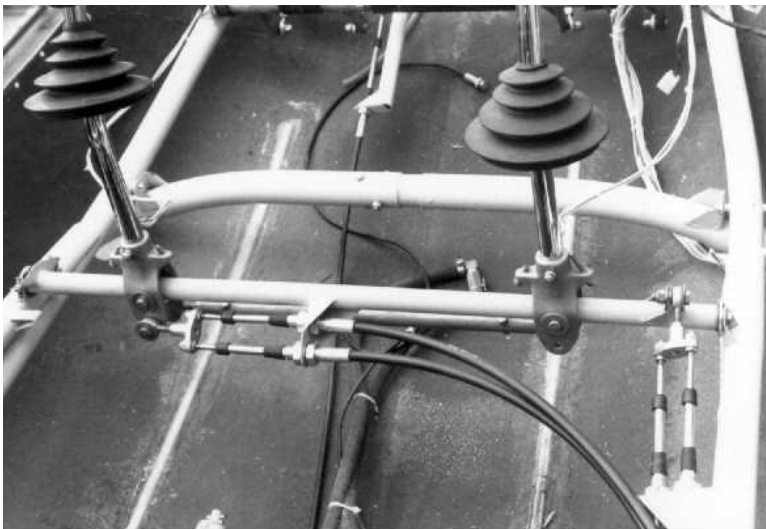


Photo #24

Overall view after final assembly in the airframe. Check full travel of control for freedom of movement.

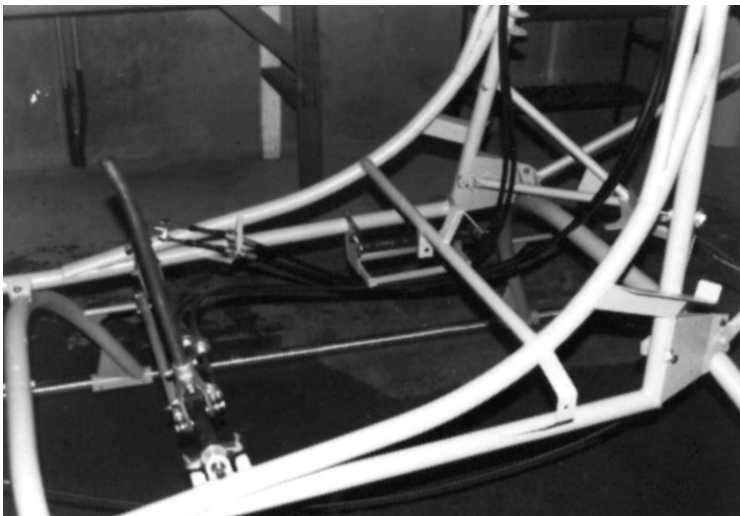


Photo #25

Route the lateral cyclic cable as shown to prevent kinking and interference with the gas tank.

COLLECTIVE CONTROL

Fabricate the collective control components according to the instructions and dimensions on print E15-2000. This print also contains information on the construction of the dual control collective stick. In order to make it easy to identify which hardware is used, the bolt part numbers are called out on the print. Pay close attention to the throttle rigging instructions. If the throttle rigging is not set up properly it will be extremely difficult to maintain rotor RPM within the prescribed limits. The collective stick action and twist grip throttle action must function smoothly. Any roughness or binding will make flight operation extremely difficult, especially for a novice pilot.



Photo #26

Use print E15-2000 and template E15-1 when constructing this assembly.

Parts as received from RotorWay International for the collective control.

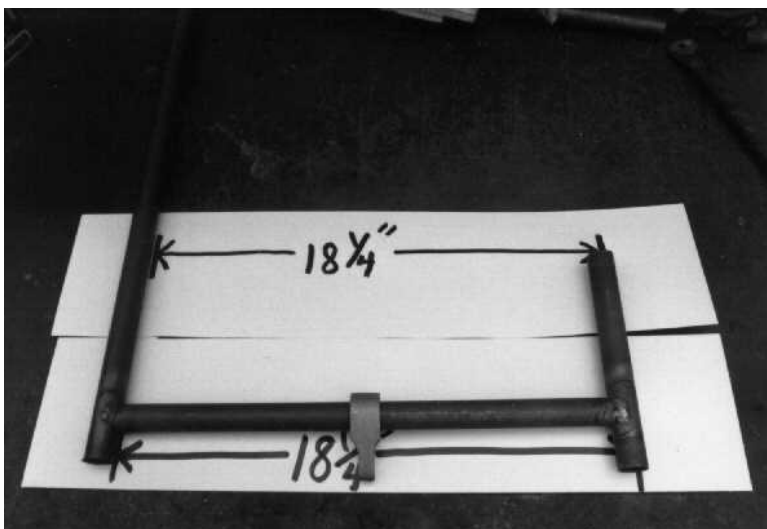


Photo #27

Cut the tubes to match print dimensions. Grind a radius or fish-mouth in both ends of the collective cross tube to fit the other tubes. Allow for this when cutting the cross tube to length. The centerline of the pilot collective stick and the control stick stub must be parallel. Install control arm "G" on collective cross tube before tack welding. Control arm "G" will be positioned and drilled during rigging.

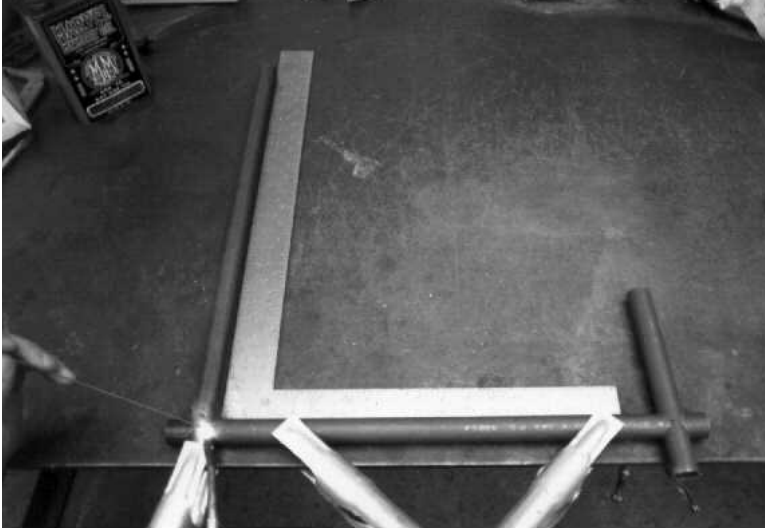


Photo #28

Use a large square and the measurements shown on print E15-2000 to align the tubes. Again, the tubes must be parallel to each other and both must be 90 degrees to the cross tube. Tack weld in position.



Photo #29

Cut and radius the short end tubes which will extend on the outside of the cross tube. Use a notched board to align them with the cross tube while tack welding.



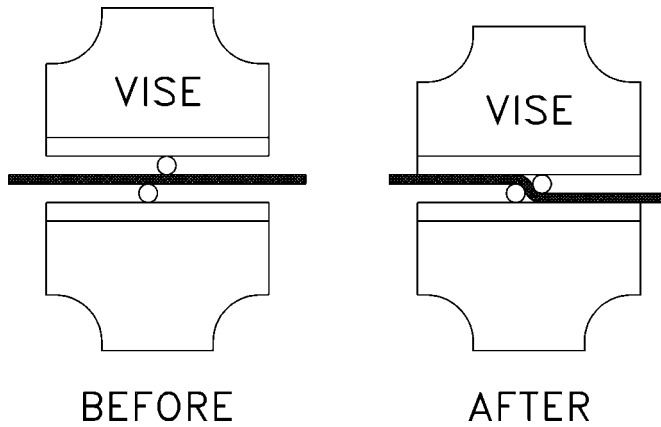
Photo #30

Remove the boards and finish welding the joints.



Photo #31

Cut and form the throttle stop using template E15-1. An easy way to make an "S" bend in a piece of metal is to place it in a vise with a small rod on each side as close together as possible, then close the vise.



Line drawing of the above description for clarity.



Photo #32

Vise shown closed. Use 1/8" rods or drill bits to form this bend. This method leaves no score marks in the bends.