

Section 21

Electrical System

Procedures covered in this section:

Install instruments and instrument panel; install rotor tach sender, wiring harness, ignition modules, FADEC electrical components, spark plug wires, and overhead switch panel; fabricate inertia switch bracket and install inertia switches; fabricate compass mounting bracket and install compass; install secondary temp gauge and sensor.

Cards used in this section:

HARDWARE CARD	E32 CARD 1F	E35 CARD 2F	E36 CARD 2F
E25 CARD 4F	E35 CARD 1F	E36 CARD 1F	E45 CARD 1F

Prints used in this section:

E23-2000	E30-2000	E35-2001
E25-2001	E35-2000	E49-2001

Templates used in this section:

E25-2	E35-2
E32-1	E36-1

Tools required for this section:

Air or electric drill	Files	Pop rivet gun	Wire strippers
Band saw or hacksaw	Heat gun	Screwdrivers	
Crimpers	Pliers	Soldering iron	

Drill bits of the following sizes: 1/8", 3/16", 13/64", 1/4", 19/64", 5/16", 25/64"

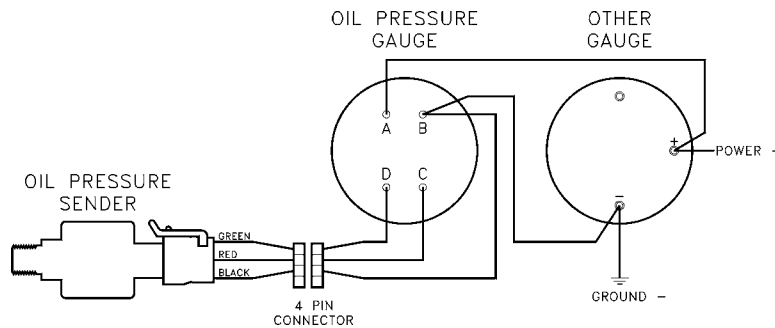
Ratchet with sockets of the following sizes: 3/8", 7/16", 1/2"

Wrenches of the following sizes: 3/8", 7/16", 1/2"

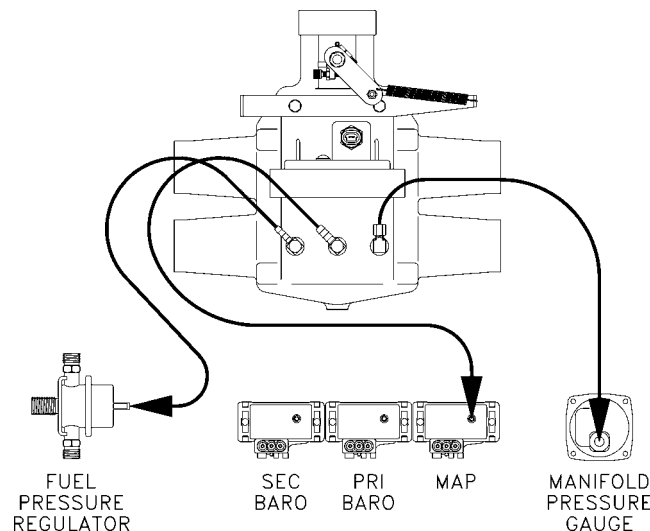
Notes:

1. **BEFORE WIRING:** See next section (Section 22) for installation of seat bulkhead, floor pan and tub, which is required at this point for routing of electrical wires.
2. **SECURE WIRES:** Wiring should be secured with wire ties as necessary. Do not stretch the wires tight, but allow some flexibility between components. Wires that are under tension may pull out of the connector.
3. **CONNECTORS:** Before plugging in connectors, inspect for any debris or foreign material inside the plug and remove if necessary. Check to make sure the pins are straight. **NEVER** force a plug into the matching socket or connector. Make sure the weather-tight seals are in place on the plugs that are equipped with them.
4. **STARTER RELAY:** Mount the starter relay to the pilot's side fuel tank bracket.
5. **IGNITION SENDERS:** The connectors for the ignition senders are joined together for shipping.
6. **MANIFOLD PRESSURE LINES:** Connect the nylon manifold pressure line from the fitting on the plenum to the gauge. See hose routing diagram on next page.
7. **FUEL PRESSURE SENSOR:** Plug the connector into the fuel pressure sensor. Shorten the wires to the correct length and install them in the 4 pin plug provided. See print E35-2001 for correct pin positions.

8. The FADEC wiring harness connects to the NEGATIVE terminal on the battery. DO NOT connect this to the positive battery terminal.
9. ROTOR TACH SENDER: To make it easier to remove the completed instrument panel assembly, cut the rotor tach sender wires and install a plug near the connectors on the instrument panel wiring harness. See print E35-2001.
10. BATTERY: The battery for the Exec 162F is shipped dry, without electrolyte (acid). This is a common product that can be obtained from virtually any local auto parts store.
When installing the wiring, do not connect the cables to the battery until all other wiring has been completed.
11. FUEL PUMPS: The pumps should be mounted so that the black (negative) terminals are facing towards each other (see Section 20 page 8, photo 24). Attach the negative wires to the black terminals, and the positive wires to the yellow terminals.
12. INSTRUMENTS: Connect wires to the instruments as shown on print E35-2001.
13. **IMPORTANT: SECURE ALL WIRING AWAY FROM THE MAIN ROTOR SHAFT.**
14. OIL PRESSURE SENSOR: Screw the sensor into the hose fitting on the oil filter mount. Complete the wiring, and install a 4-pin connector in a convenient location to make future removal easier. Connect wires to the gauge as shown below.



15. DUAL ENGINE/ROTOR TACH: See Section 26, Page 7 for testing procedures before installation.
16. PLENUM HOSE ROUTING: The following diagram shows hose connections from the fittings on the plenum. Attach the smaller hose at left to the fuel pressure regulator, the middle hose to the MAP sensor, and the 1/8" nylon tube to the manifold pressure gauge.



INSTRUMENT PANEL

Photo #1

Fit the instrument panel into the opening of the pod. Wax the back of the instrument panel (to prevent the fiberglass resin from sticking) and clamp it in the pod in the desired location.

Note: The instrument panel should be recessed about 1/2" into the pod, from the edge of the opening to the face of the panel. This provides room for the rubber molding to be mounted around the edge of the pod.

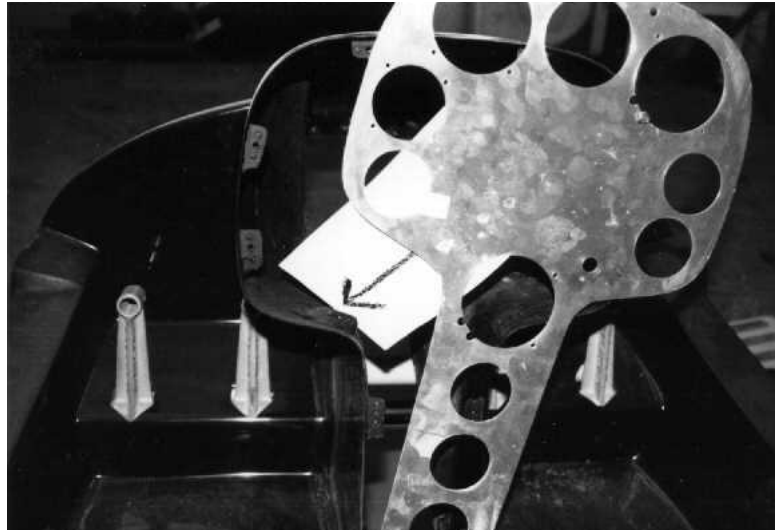


Photo #2

Cut the fiberglass angle material into 1-1/4" lengths. Position them on the back of the panel and the inside wall of the pod. (Refer to the instrument panel diagram on page 3 of this section for mounting hole locations.) Fiberglass the angles to the walls of the pod using the resin and mat supplied.

Note: Any excess angle material that interferes with instrument mounting may be trimmed off.

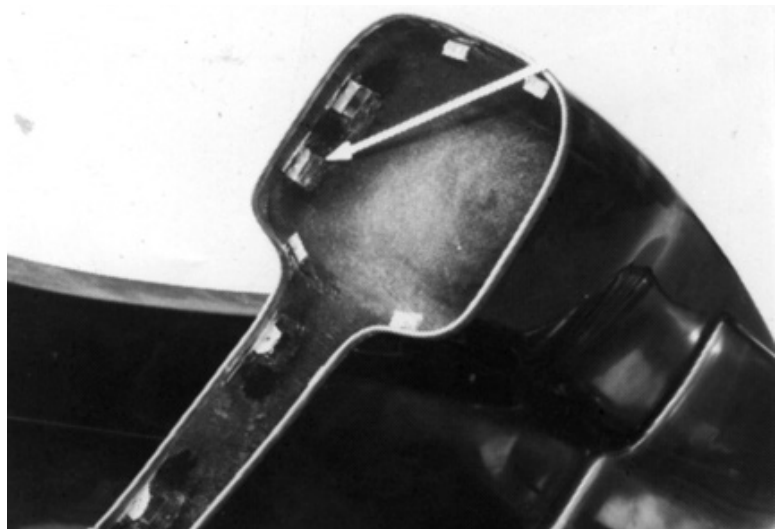


Photo #3

Drill the mounting holes through the instrument panel and the angle brackets. Install nut plates on the fiberglass angles.

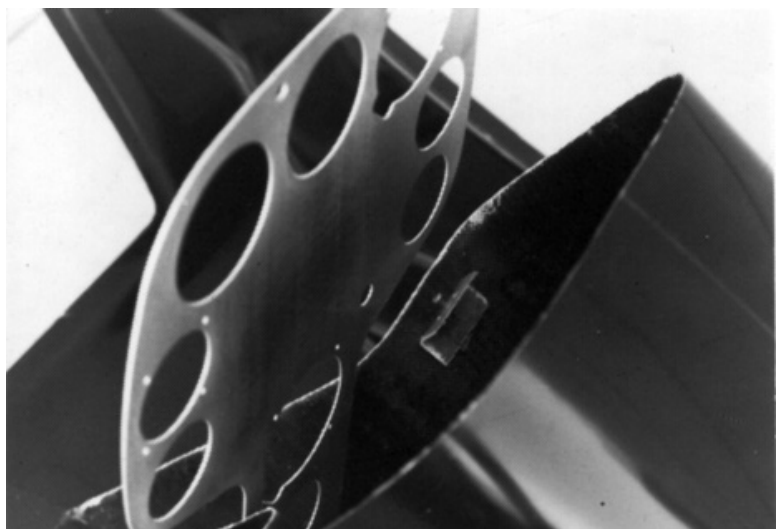




Photo #4

Drill holes and install the full range tach, volt meter, fuel pressure gauge and secondary temp gauge on the floor pan behind the pedals, facing the pilot. Install the hour meter on the side of the instrument pod.

Note: Refer to page 15 of this section for installation of the secondary temp gauge sensor.

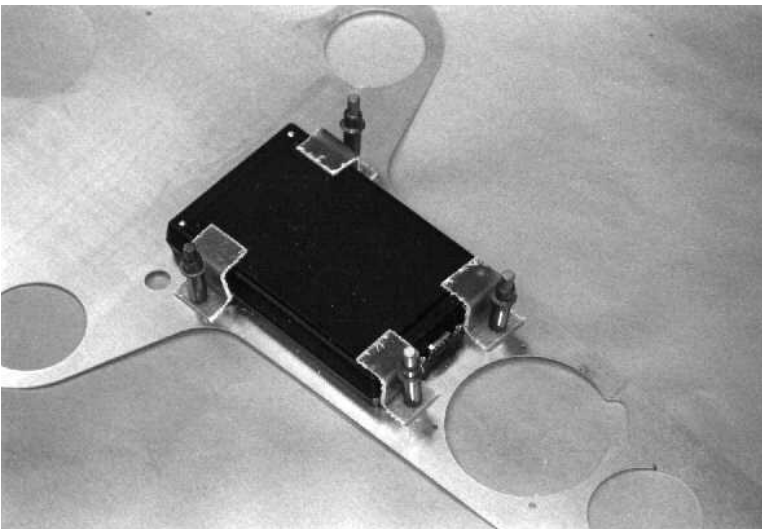


Photo #5

Cut the fiberglass angle material into four equal pieces to hold the digital display in place. Drill mounting holes through the instrument panel and the angles. Then pop rivet a nut plate to each mounting angle. Secure the angles to the panel with 8-32 screws.

Note: If necessary, file or sand the corners of the opening in the instrument panel so that the digital display will fit through. The display should extend out from the face of the panel slightly.

Photo #6

Cover the instrument panel with the black panel fabric. Trim the fabric as required, then install the instruments. Mount the instrument panel in the pod. Glue the rubber molding around the edge of the pod opening.

Note: The rubber molding is the same as used for the skid pants, and is found on E45 CARD 1F.



INSTRUMENT LOCATIONS

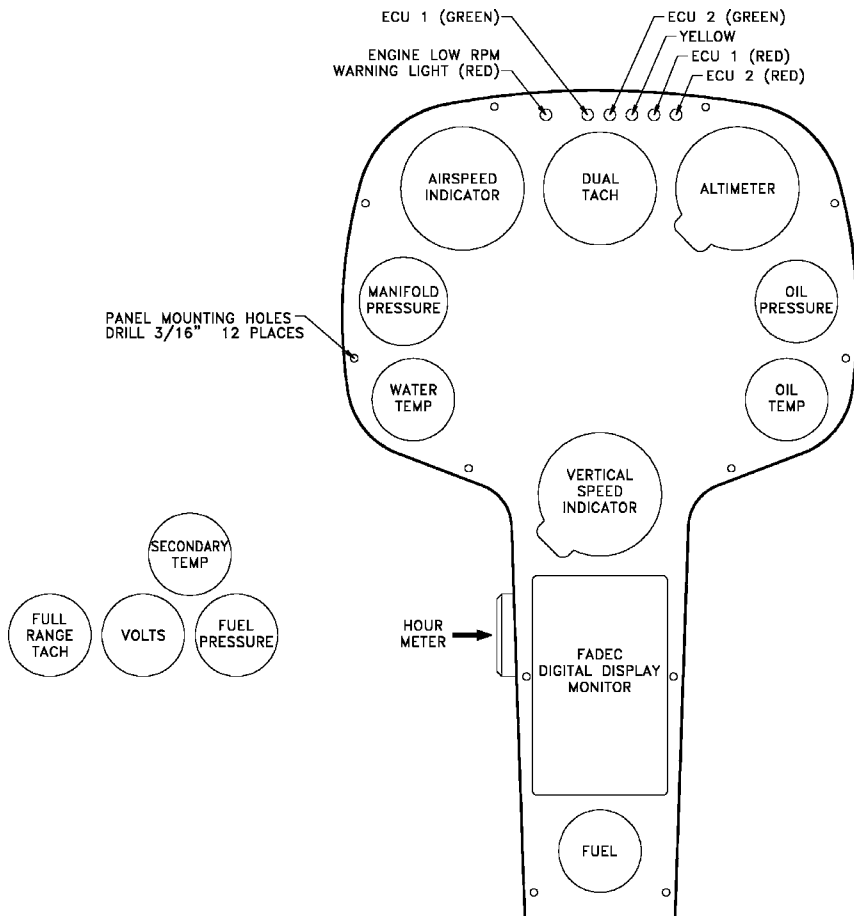
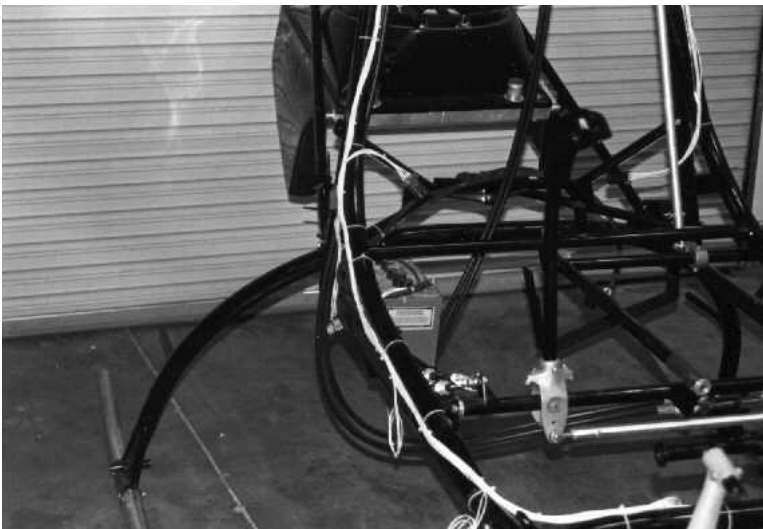




Photo #7

Mount the rotor tach sender under the hood bracket and install the magnet ring on the main rotor shaft. The center of the sender should be mounted over the center of the magnets, with a gap of about 1/8". **CAUTION:** Do not let the sender hit the magnets. To minimize interference from the electrical system and to get a steady reading on the tach, route the wires from the sensor to the tach down the pilot's side of the airframe.



WIRING HARNESS

Photo #8

Route the wiring harness down the passenger side of the airframe.
Note: Hold the wiring in place with a few wire ties until final position is determined, then use as many ties as needed.

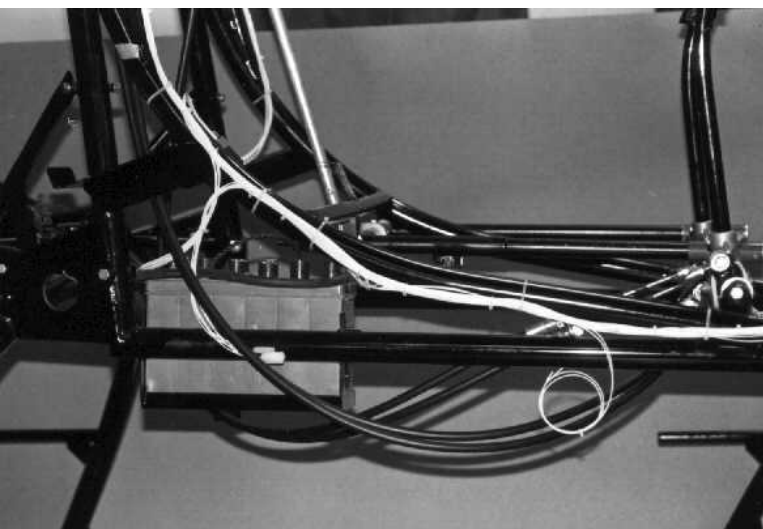


Photo #9

Another view of the harness on airframe. Route the wires along the outside of the airframe tube to prevent interference with the fiberglass seat bulkhead.

Photo #10

Route the wires to the instrument panel along the front landing gear tube.

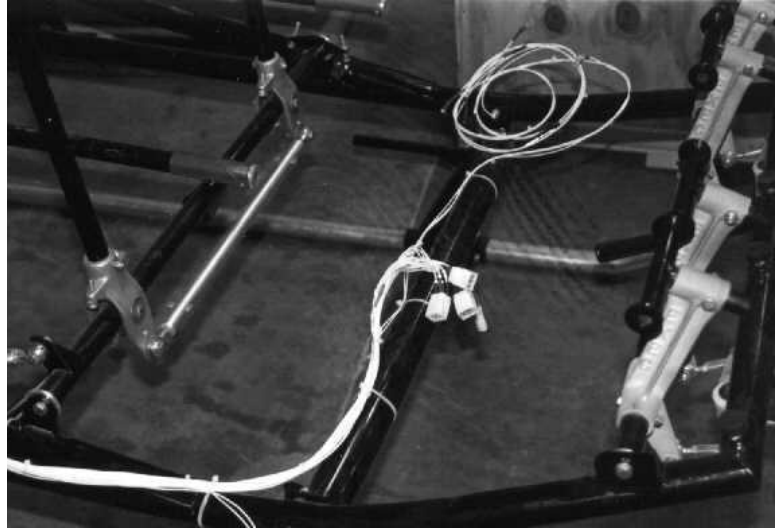
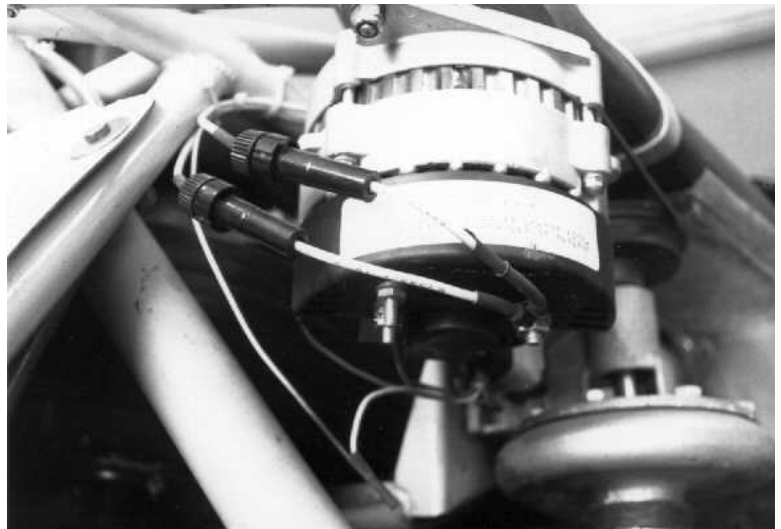


Photo #11

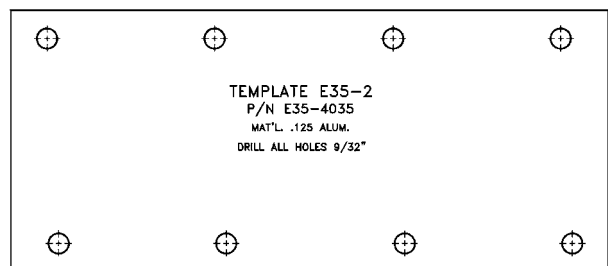
Connect the wires to the alternator.
Note: The inline fuse holders and alternator on your helicopter may be different than shown in this photo.



IGNITION MODULES

Photo #12

Using template E35-2, cut out and drill the ignition module backing plate. The holes must be loose enough so that the bolts do not bind. The ignition modules must sit flat against the backing plate without binding or twisting. When they fit properly on the backing plate, drill the matching holes in the seat back inspection panel according to template E32-1. Apply a film of dielectric grease between the ignition modules and the backing plate, and between the plate and the inspection panel.



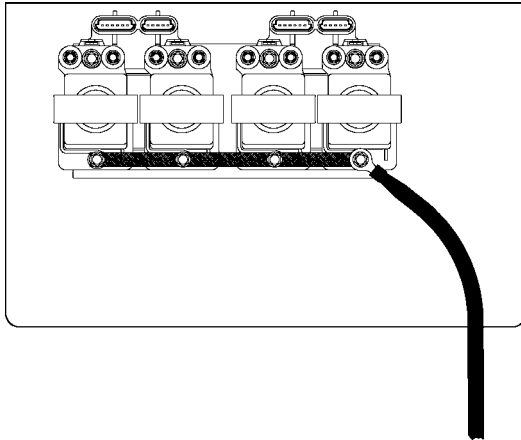


Photo #13

Bolt the ignition modules to the seat back panel using 8 button head bolts. Insert the bolts from the cabin side of the panel, using no washers under the heads. Install the braided grounding strap across the four lower bolts as shown. Install the long insulated ground strap from the lower right bolt to the engine mount bolt on the airframe. Use a thin washer and small hex locknut on each bolt. Gradually tighten the bolts, alternating from one to another, until snug. Tighten the bolts to 75 inch pounds.

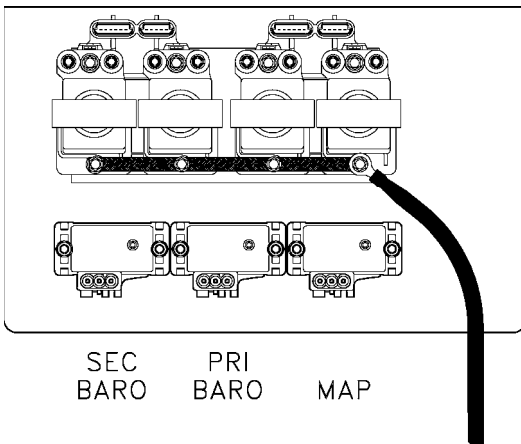


Photo #14

Mount the man/baro sensors on the inspection panel according to template E32-1, using the long 10-32 button head bolts. Connect the hose from the manifold pressure sensor (MAP) to the 1/4" 90 degree hose barb on the plenum (the one in the middle) and secure it with plastic hose clamps. Note: All three sensors are identical. Because of wire lengths, the FADEC wiring harness connections should be attached as shown here.

If equipped with optional ACIS, wiring and hose connections are different than described here. Refer to Section 27 for ACIS instructions.

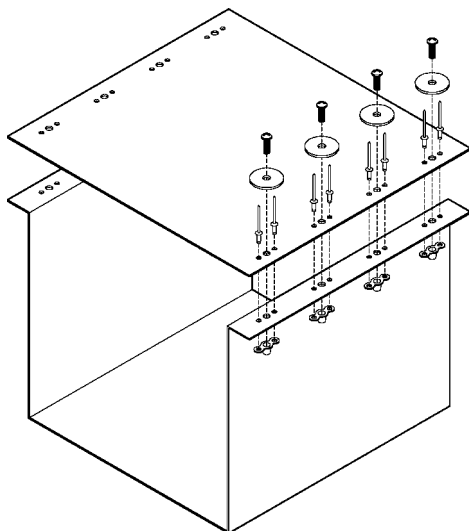


Photo #15

Fabricate the ECU tray from .050 aluminum using template E32-1. The top plate should measure 8-3/4" wide and 8" long. Use pop rivets to hold the nut plates, top plate and tray together. The tray will be attached to the underside of the fiberglass seat bulkhead with eight screws and fender washers.

Photo #16

Mount the two ECUs in the tray, using the short 10-32 button head screws to hold them in place. Attach rubber stripping to the inside of the tray to prevent the ECUs from rubbing against the walls. Note: Both ECUs look the same. Primary and secondary can be identified by the "P" and "S" stamped on the face plate near the connectors. Mount the primary ECU on the bottom.

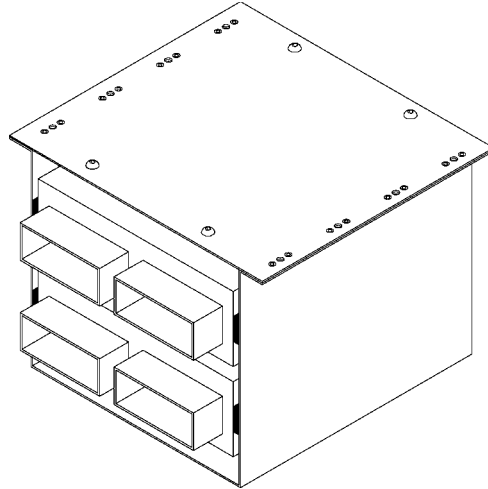


Photo #17

Make sure each ECU has a grounding strap installed on the rubber foot as shown here.

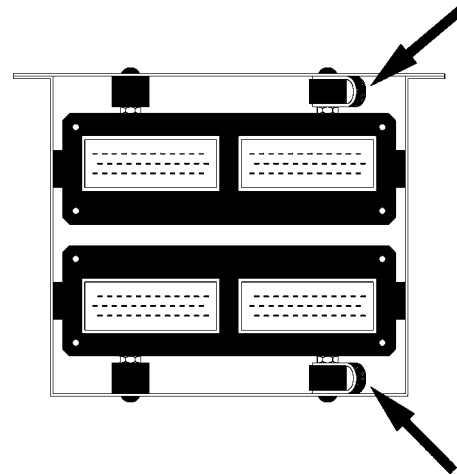
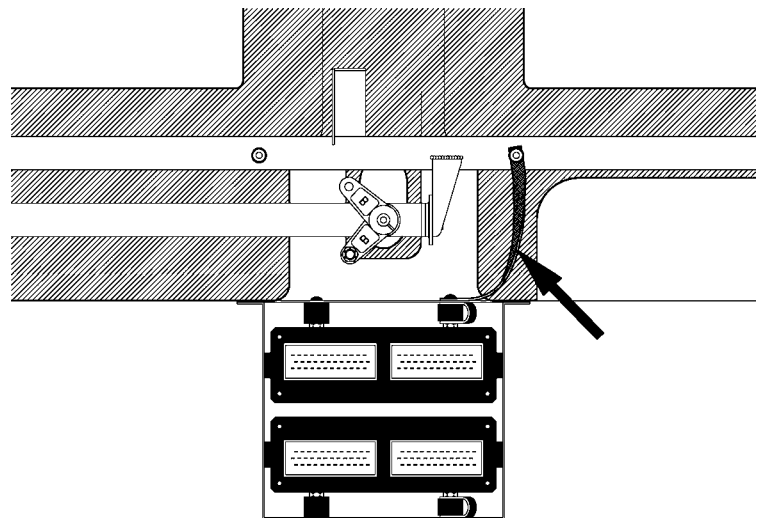


Photo #18

Mount the ECU tray on the underside of the seat bulkhead, using 8-32 screws with fender washers. Check fore/aft location to make sure that the plugs on the FADEC wiring harness are long enough to reach the ECUs. The connector terminals should be facing aft. Connect the grounding strap (arrow) from the ECU tray to the bolt on the 1" round airframe tube as shown. This is one of the bolts that holds the fiberglass seat bulkhead to the airframe, and is also used for the seat belts. Note: Remove paint where the strap touches the tube for good electrical contact.



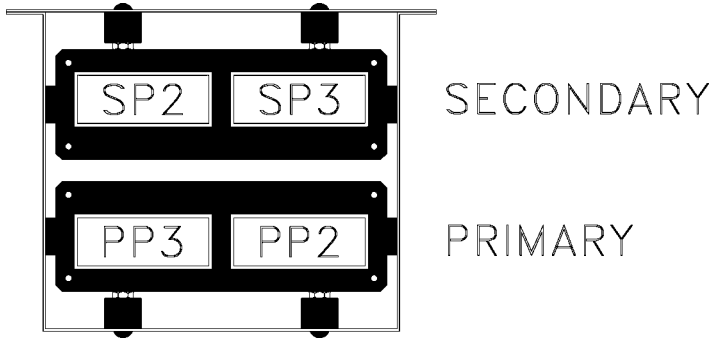


Photo #19

Plug in the connectors to the ECUs as indicated here.

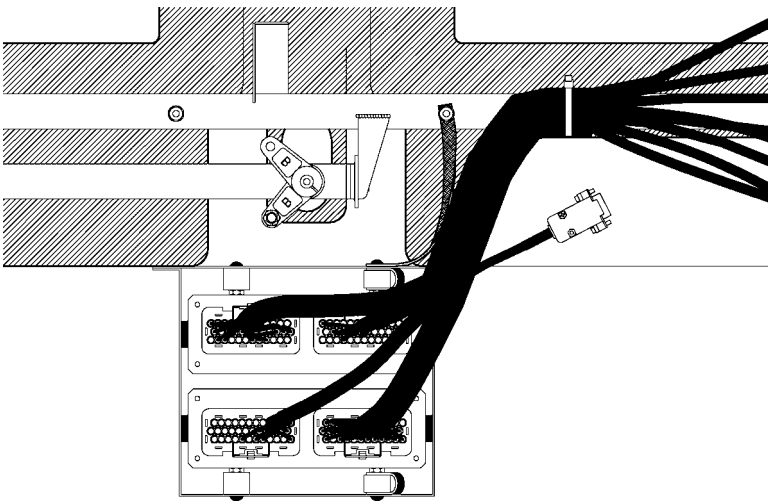


Photo #20

Position the FADEC wiring harness as shown. Secure the harness to the airframe tube with wire ties.

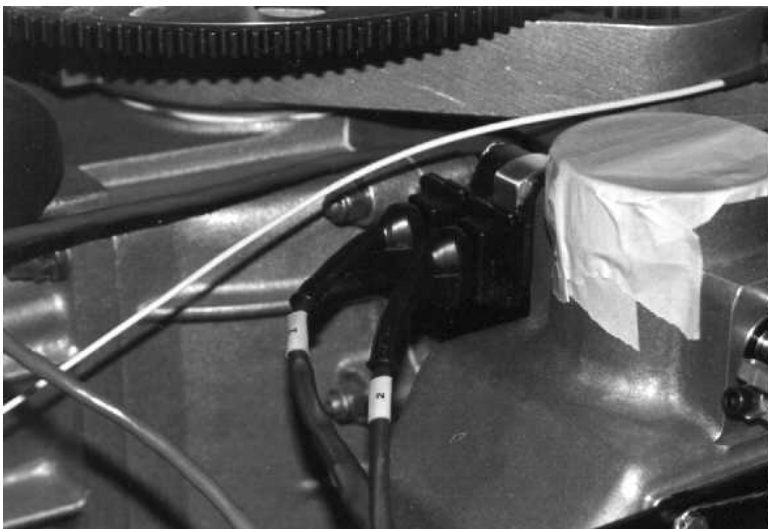


Photo #21

Plug in the connectors to the throttle position sensors. The primary sensor is aft, and the secondary sensor is forward.

Note: Before installing a connector, inspect for any debris or foreign material inside the plug and make sure the pins are straight. Make sure the weather-tight seals are in place on the plugs that are equipped with them.

Photo #22

Plug in the connectors to the primary fuel injectors. It will be necessary to rotate the injectors slightly to install the connectors.



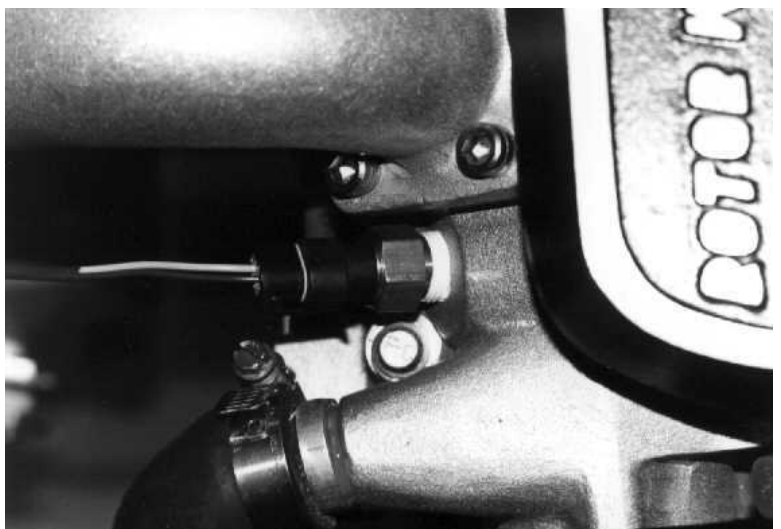
Photo #23

Another view of the connectors to the primary fuel injectors. Note the final position of the connector on the inboard side of the fuel rail. The connectors must not bind against the intake manifold runners on the engine.



Photo #24

Plug in the connector to the water temp sensor, located on the pilot's side of the engine.



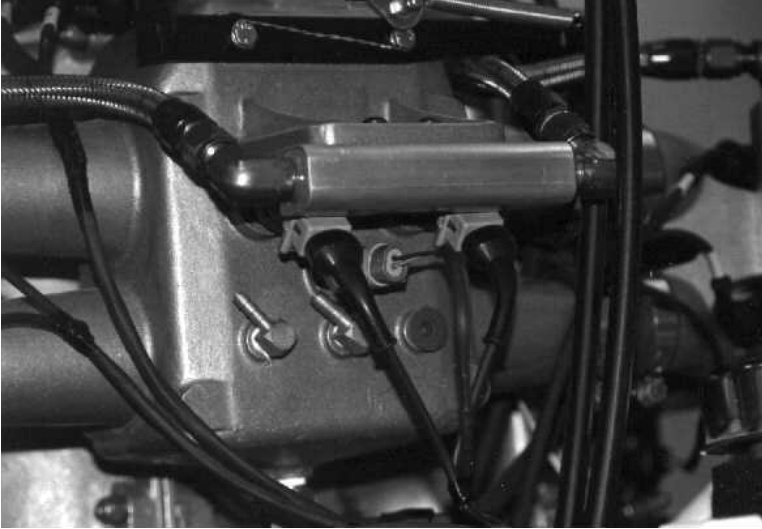


Photo #25

Plug in the connectors to the secondary fuel injectors and the primary air temp sensor.

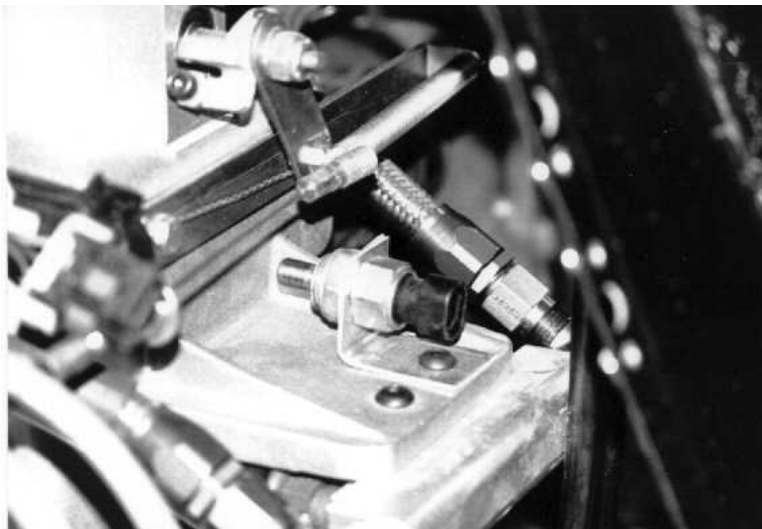


Photo #26

The secondary air temp sensor is located on the plenum just above the secondary injectors. If this sensor is not already installed, fabricate a mounting bracket from .050 aluminum as shown, then bolt it to the plenum using one of the button head screws that hold the fuel rail in place. Plug in all remaining connectors.

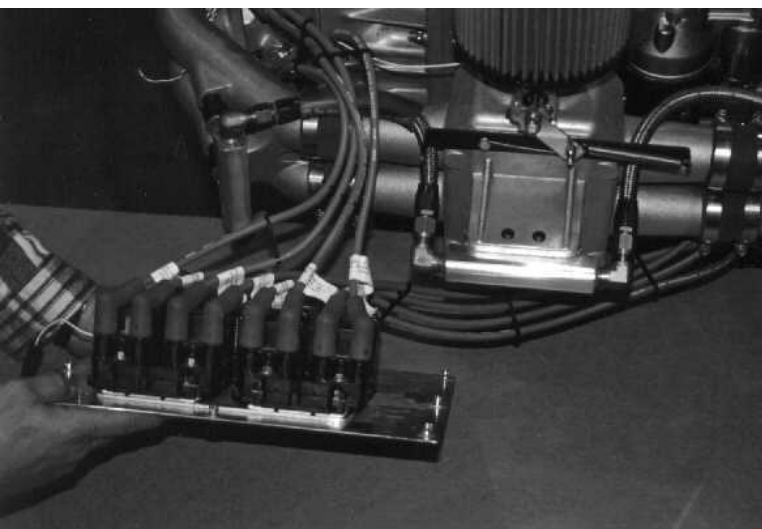


Photo #27

Install the spark plug wires. Route them from cylinders 1 and 2 (pilot's side) under the intake runners and plenum to the ignition modules. Route the wires from cylinders 3 and 4 (passenger side) over the runners.

Note: The braided fuel hose (at left) is covered with a sleeve to prevent it from wearing through the spark plug wires. The wires should not be allowed to touch each other or ANYTHING else except the sleeve on the hose. Use spark plug wire separators as necessary.

Photo #28

The wires are labeled to indicate which ends attach to the ignition modules. If desired, mark the wire numbers on the back of the upper panel for future reference.

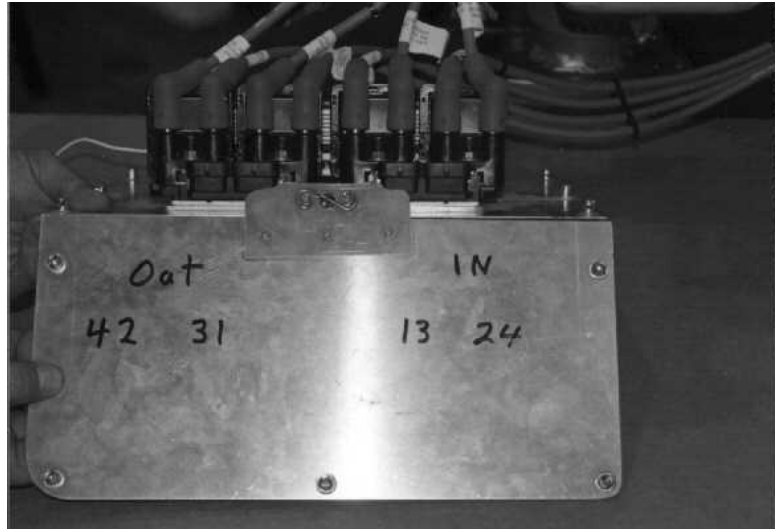
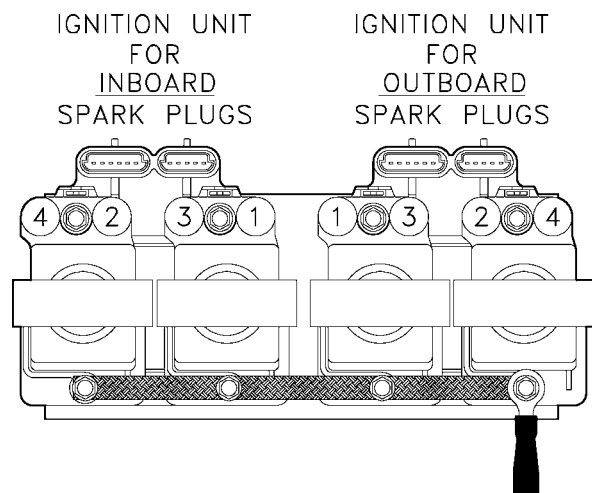


Photo #29

This diagram shows the placement of the spark plug wires on the ignition modules.



OVERHEAD SWITCH PANEL

Photo #30

Cut an opening in the cabin roof panel 3/4 inch smaller than the overhead switch panel on all sides. Hold the switch panel and fiberglass cover in place on the roof panel, then drill holes for the mounting screws through all three pieces.



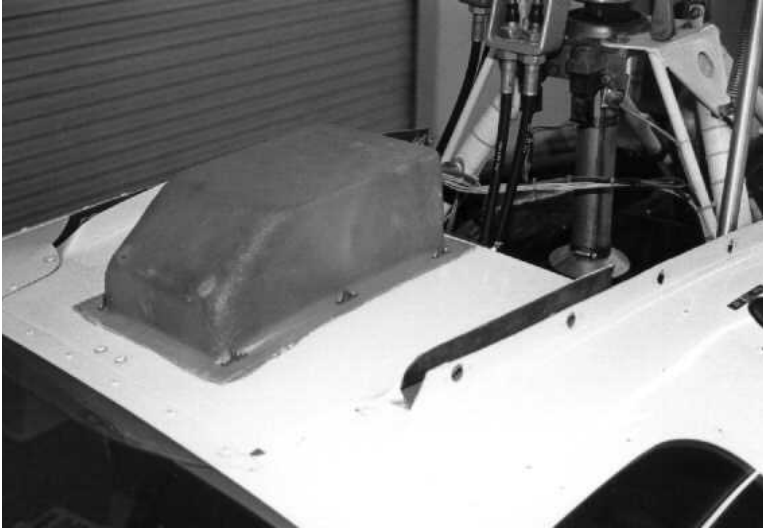


Photo #31

Attach nut plates to the fiberglass cover. Route the wires through the rear of the cover and plug in the connectors to the airframe wiring harness. On final installation, seal the cover to the roof panel with silicone, then install the screws.

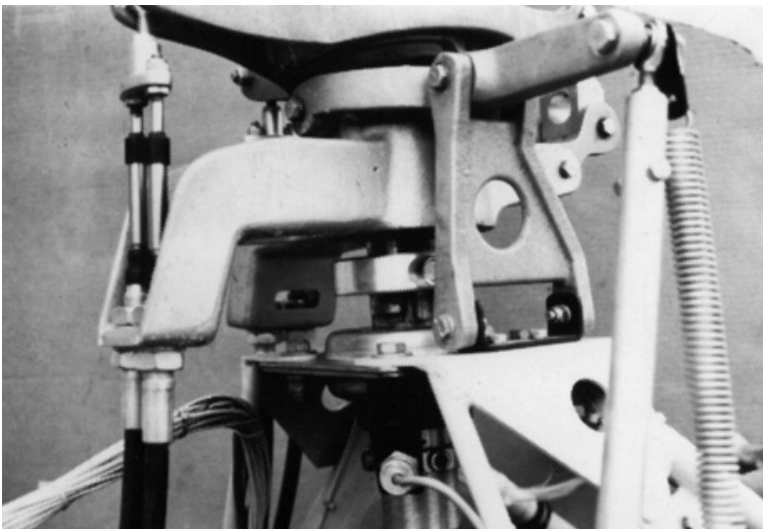


Photo #32

Important: Secure all wiring away from the main rotor shaft.

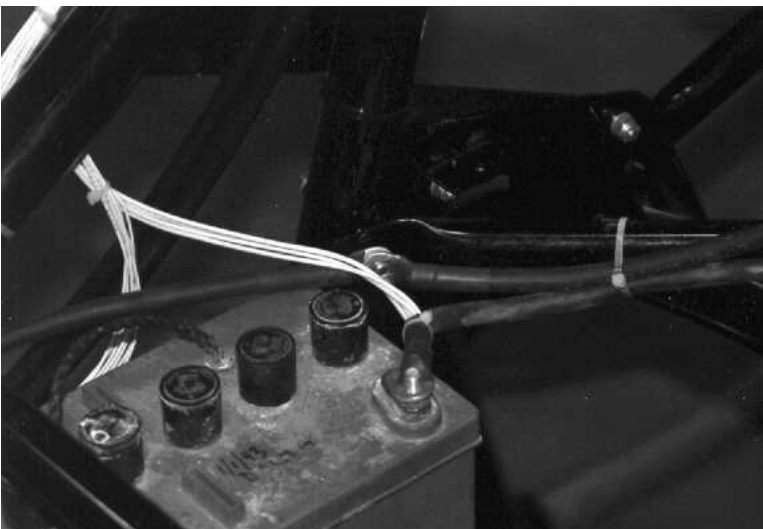


Photo #33

Attach the negative battery cables from the battery and engine to the lower engine mount bolt on the passenger side. The FADEC wiring harness also connects to the negative battery terminal.

CAUTION: DO NOT connect the FADEC wiring harness to the positive battery terminal. Do not connect the cables to the battery until all wiring is completed.

FUEL PUMP INERTIA SWITCHES

Photo #34

Using template E25-2, cut out and drill the inertia switch bracket.

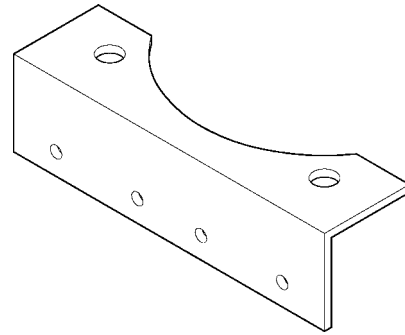


Photo #35

Mount the inertia switches on the bracket.

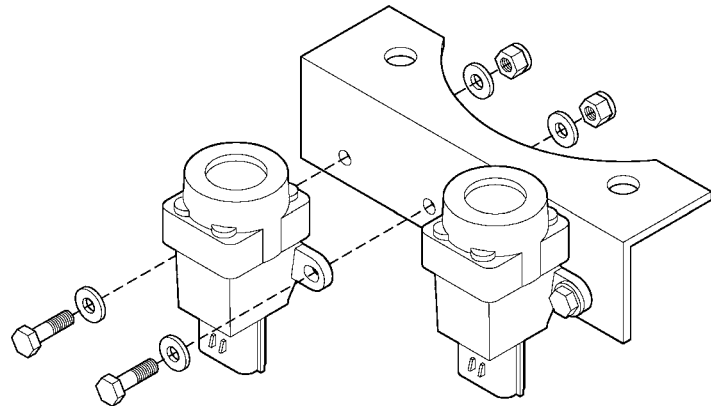
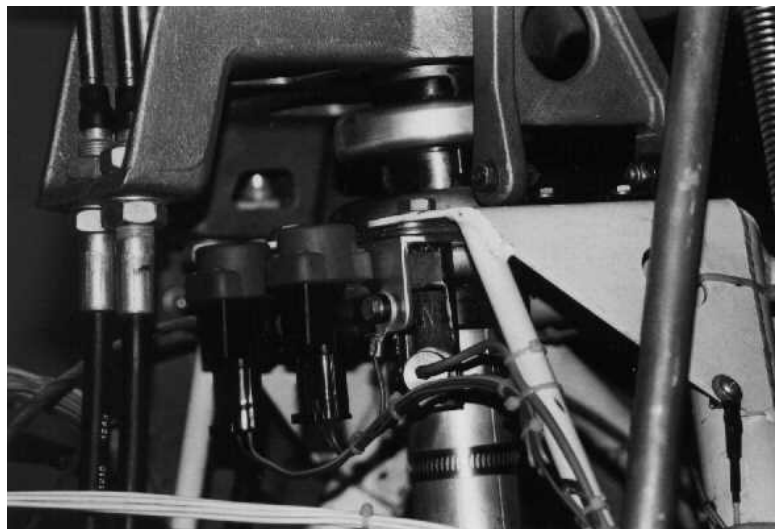
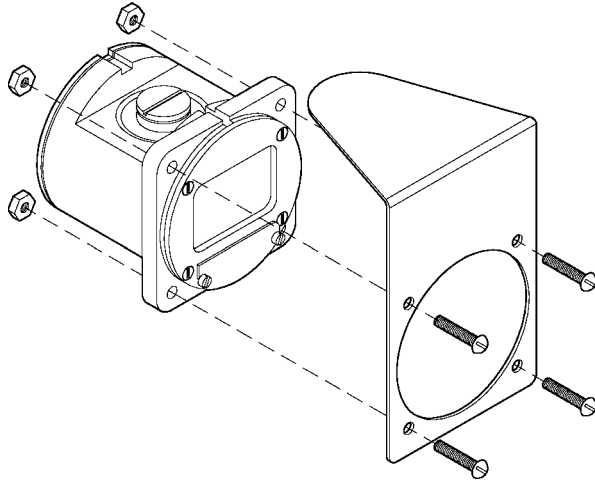


Photo #36

Install the bracket underneath the main bearing flange, using the two front 3/8" bolts that hold the flange to the hood bracket. Plug in the connectors from the switches to the wiring harness.





COMPASS MOUNTING BRACKET

Photo #37

Using template E36-1, fabricate the compass mounting bracket from .050 aluminum. Attach the compass to the bracket with screws as shown. Bend the bracket as necessary to match the angle of the windscreen.

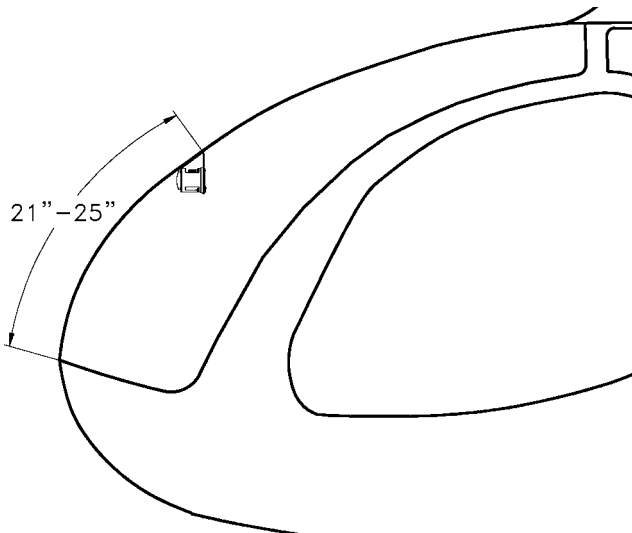


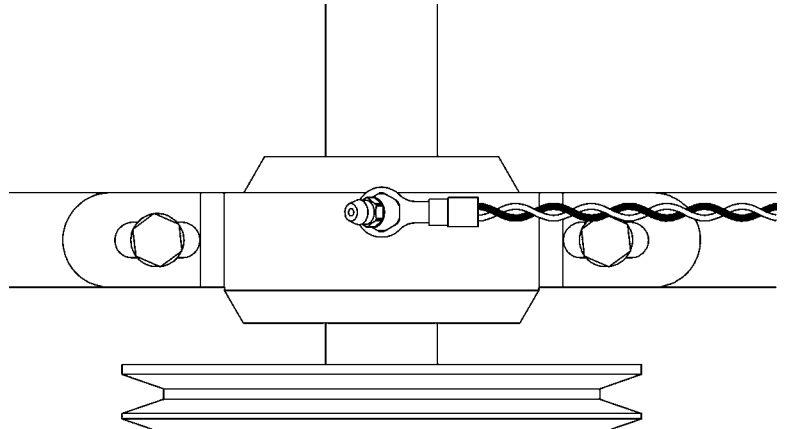
Photo #38

This shows the approximate location of the compass and bracket on the windscreen. The exact location is not critical and is determined by pilot's preference. Use silicone to attach the bracket to the windscreen.

SECONDARY TEMPERATURE GAUGE SENSOR

Photo #39

Unscrew the grease fitting on the secondary upper bearing housing. Place the threaded part of the fitting through the hole in the sensor, then re-install the fitting. Avoid tightening the fitting past the original position – the inner tip of the fitting must not come in contact with the bearing. When tightened, the fitting should be oriented in about the same direction as it was before removal (accessible from the pilot's side of the aircraft). If necessary, one or two washers can be added between the fitting and the sensor to achieve the right position. Route the wires towards the passenger side, and secure them with wire ties. Cut the sender wires and corresponding wires on the wiring harness to the right length and install a 2 pin connector as shown on print E35-2001.



After the helicopter is assembled and flying, it is important to establish a “base temperature” or normal operating temperature of the secondary unit. Once this is determined, any sudden rise in temperature can be noted by the pilot and corrective measures can be taken before a failure occurs. Many factors may cause a temporary rise from the base temperature, such as high power requirements, excessive grease, bearing contamination or changes in airflow through the engine compartment.

Due to many different factors, the gauge might not read the same as the heat sensitive temperature strip on the bearing housing. Although the numbers may not coincide, the gauge does not eliminate the need for the strip. The pilot should continue to check the strip after every flight.