SECTION VIII

POWER PLANT
(NORMALLY ASPIRATED)

8-1. INTRODUCTION. This section covers non-turbocharged power plants used in the PA-23 airplanes and is comprised of instructions for the removal, minor repair, service and installation of the engine cowling, propeller, propeller governor, engine, engine shock mounts, induction system, carburetor, fuel injector, fuel air bleed nozzle, ignition system and lubrication system. For more detailed information, refer to the engine or component manufacturer's service manuals.

8-2. DESCRIPTION. The PA-23 is powered by two Avco-Lycoming O-540 or IO-540 series six cylinder, direct drive, wet sump, horizontally opposed, air-cooled engines. (Refer to Pilot's Operating Handbook for fuel octane ratings.)

Cowlings completely enclose the engines. The cowling is of cantilever construction attached at the firewall. There are access panels on both sides to allow inspection of the accessory section. The cowl flap doors are an integral part of the lower cowl and are operated through mechanical linkage.

Propellers are Hartzell full feathering, constant speed, each controlled by a governor mounted on the engine supplying oil through the propeller shaft at various pressures. Oil pressure from the governor moves the blades into low pitch (high RPM). The centrifugal twisting moment of the blades also tends to move the blades into low pitch. Opposing these two forces are blade counterweights or the force produced by compressed air between the cylinder head and the piston, which tends to move the blades into high pitch in the absence of governor oil pressure. Thus, feathering is accomplished by counterweights or compressed air.

The airframe induction system consists of a dry type air filter and alternate air door. The fuel system of the O-540 series engines consists of a Marvel-Schebler MA-4-5 carburetor and AC diaphragm type fuel pump. The fuel system on the IO-540 series engines consists of a Bendix RSA-5AD1 type injector and a Lear-Seigler fuel supply pump. These engines are normally aspirated with no restrictions on maximum power output.

Bendix Scintilla S-20 or S-200 series magnetos are installed with their associated components. The S-20 series system consists of two single contact magnetos. The left magneto incorporates an impulse coupling to aid in starting.

The S-200 series system consists of a single contact magneto, a dual contact magneto to obtain the retard spark necessary for starting, a starter vibrator, magneto switches and starter switch.

In addition to the previously mentioned components, each engine is equipped with a generator or alternator, geared starter, hydraulic pump and pressure pump. Engine mounts are steel tubing construction attached at the firewall and incorporate vibration absorbing mounts. The exhaust stacks and extensions are positioned one for each bank of cylinders. The stack on the right side has a heat muff on it to heat the alternate air plenum. Both stacks merge into one at the lower aft end of the engine nacelle.

The lubrication system is of the full pressure wet sump type. The oil pump, which is located in the accessory housing, draws oil through a drilled passage leading from the oil suction screen located in the sump. The oil from the pump then enters a drilled passage in the accessory housing, which feeds the oil to a threaded connection on the rear face of the accessory housing, where a flexible line leads the oil to the external oil cooler. Pressure oil from the cooler returns to a second threaded connection on the accessory housing from which point a drilled passage conducts oil to the oil pressure filter. In the event that cold oil or an obstruction should restrict the oil flow to the cooler, an oil cooler by-pass valve is provided to pass the oil directly from the oil pump to the oil pressure filter.

The oil pressure filter element, located on the accessory housing, is provided as a means to filter from the oil any solid particles that may have passed through the suction screen in the sump. After being filtered in the pressure filter, the oil is fed through a drilled passage to the oil pressure relief valve, located in the upper right side of the crankcase in front of the accessory housing.

This relief valve regulates the engine oil pressure by allowing excessive oil to return to the sump, while the balance of the pressure oil is fed to the main oil gallery in the right half of the crankcase. Residual oil is returned by gravity to the sump where, after passing through a screen, it is again circulated through the engine.

8-3. TROUBLESHOOTING. Troubles peculiar to the power plant are listed in Table VIII-III in the back of this section, along with their probable causes and suggested remedies. When troubleshooting engines, ground the magneto primary circuit before performing any checks on the ignition system.

8-4. STANDARD PRACTICES - ENGINE. The following suggestions should be applied wherever they are needed when working on the power plant.

a. To insure proper reinstallation and/or assembly, tag and mark all parts, clips, and brackets as to thier location prior to their removal and/or disassembly.

b. During removal of various tubes or engine parts, inspect them for indications of scoring, burning or other undesirable conditions. To facilitate reinstallation, observe the location of each part during removal. Tag any unserviceable part and/or units for investigation and possible repair.

c. Extreme care must be taken to prevent foreign matter from entering the engine, such as lockwire, washers, nuts, dirt, dust, etc. This precaution applies whenever work is done on the engine, either on or off the aircraft. Suitable protective caps, plugs, and covers must be used to protect all openings as they are exposed.

NOTE

Dust caps used to protect open lines must always be installed OVER the tube ends and NOT IN the tube ends. Flow through the lines may be blocked off if lines are inadvertently installed with dust caps in the tube ends.

d. Should any items be dropped into the engine, the assembly process must stop and the item removed, even though this may require considerable time and labor. Insure that all parts are thoroughly clean before assembling.

e. Never reuse any lockwire, lockwashers, tablocks, tabwashers or cotter pins. All lockwire and cotter pins must fit snugly in holes drilled in studs and bolts for locking purposes. Cotter pins should be installed so the head fits into the castellation of the nut, and unless otherwise specified, bend one end of the pin back over the stud or bolt and the other end down flat against the nut. Use only corrosion resistant steel lockwire and/or cotter pins. Bushing plugs shall be lockwired to the assembly base or case. Do not lockwire the plug to the bushing.

f. All gaskets, packings and rubber parts must be replaced with new items of the same type at reassembly. Insure the new nonmetallic parts being installed show no sign of having deteriorated in storage.

g. When installing engine parts which require the use of a hammer to facilitate assembly or installation, use only a plastic or rawhide hammer.

h. Whenever adhesive tape has been applied to any part, the tape and all residue must be removed and thoroughly cleaned with petroleum solvents prior to being subjected to high temperature during engine run. This would also apply to parts that have corrosion preventive compounds applied.

i. Anti-seize lubrication should be applied to all loose-fit spline drives which are external to the engine and have no other means of lubrication. For certain assembly procedures, molybdenum disulfide in either paste or powdered form mixed with engine oil or grease may be used.

CAUTION

Ensure that Anti-seize compounds are applied in thin even coats, and that excess compound is completely removed to avoid contamination of adjacent parts.

j.Temporary marking methods are those markings which will ensure identification during ordinary handling, storage and final assembly of parts.

8-5. ENGINE COWLING.

8-6. REMOVAL OF ENGINE COWLING. (PA-23-250; PA-23-235; and PA-23-250 (six place), Serial Nos. 27-2000 to 27-2504 incl.)

a. Ascertain that the master switch and magneto switches are in the off position.

b. Release the quarter turn fasteners and remove the two access panels from both sides of the nacelle.

c. Remove the attaching screws from the front and rear of the top cowling section and lift it off.

d. Remove the fillet fairings from both the inboard and outboard sides of the nacelle by removing attaching screws.

e. Remove the carburetor air scoop by releasing the quarter turn fasteners.

f. Release the four quarter turn fasteners holding the carburetor air bellows to the air filter.

g. Remove the screws at the rear of the bottom cowling assembly and remove by pulling forward and down.

h. The nose cowl may be removed by removing the screws at each side thus separating the upper and lower half.

8-7. REMOVAL OF ENGINE COWLING. (PA-23-250 (six place), Serial Nos. 27-2505 and up.)

a. Ascertain that the master switch and magneto switches are in the off position.

b. Release the quarter turn fasteners and remove the two access panels from both sides of the engine nacelle.

c. Remove the attaching screws from the front and rear of the top cowling section and lift it off.

d. Remove the fillet fairings from both the inboard and outboard sides of the nacelle by removing attaching screws.

e. Disconnect all drain lines attached to the bottom cowl.

f. Remove the attaching bolts and disconnect the cowl flap linkage from the cowl doors.

g. Remove the screws from the front and rear of the bottom cowling assembly and pull it forward and down.

h. Split and remove the nose cowl by pulling out the two (upper and lower) hinge pins.

8-8. CLEANING, INSPECTION AND REPAIR OF ENGINE COWLING.

a. The cowling should be cleaned with a suitable dry type solvent and then wiped with a clean cloth.

b. Inspect the cowling for dents, cracks, loose rivets, damaged or missing fasteners and damaged skin or fiberglas.

c. If repair is necessary, refer to Structural Repairs, Section IV.

8-9. INSTALLATION OF ENGINE COWLING. (PA-23-250; PA-23-235; and PA-23-250 (six place), Serial Nos. 27-2000 to 27-2504 incl.)

NOTE

As engine shock mounts age, the engine will tilt forward and down. To ensure clearance underneath the engine, pull down on nose of cowl during installation.

a. Place the bottom cowling assembly in position and fasten to the rear engine nacelle with attaching screws.

b. Attach the carburetor air bellows to the air filter by the four quarter turn fasteners.

c. Place the carburetor air scoop in position and secure with the quarter turn dzus fasteners.

d. Position the fillet fairings in place on both inboard and outboard sides of the engine nacelle and secure with attaching screws.

e. Place the top cowling section in position and secure with attaching screws.

f. Position the two inboard and outboard access panels on the engine nacelle and secure with the quarter turn dzus fasteners.

8-10. INSTALLATION OF ENGINE COWLING. (PA-23-250 (six place), Serial Nos. 27-2505 and up.)

a. Install the nose cowl halves and insert the hinge pins.

b. Position the bottom cowling assembly and secure with the attaching screws.

c. Connect the drain lines to the bottom of the cowling.

d. Position the fillet fairings in place on both inboard and outboard sides of the engine nacelle and secure with attaching screws.

e. Place the top cowling section in position and fasten with attaching screws.

f. Connect the cowl flap linkage to the doors with the attaching bolts and adjust per instructions in paragraph 8-16.

g. Position the two inboard and outboard access panels in place and secure with the quarter turn fasteners.

8-11. ENGINE COWL FLAP. (PA-23-250) (six place), Serial Nos. 27-2505 and up.)

8-12. REMOVAL OF COWL FLAP ASSEMBLY. (Refer to Figure 8-1.)

a. Remove the two side cowl panels from the engine where the cowl flaps are to be removed.

b. Note the position of the rod end (11) to the cowl flap and remove the self-locking nut on the rod end disconnecting it from the cowl flap.

c. Remove the cowl flap by removing the cotter pin, nut, washer and bolt from the hinge bracket on each side.

d. If the operating mechanism is to be removed, the following procedure may be used:

1. Disconnect the control cable clevis end (3) from the torque tube arm by removing cotter pin and clevis pin.

2. Remove the bearing blocks holding each end of the torque tube assembly in place by removing the self-locking nut, washer and bolts.

3. Remove the self-locking nuts, washers and machine screws from the center bearing block. Remove the bearing block.

4. Remove the operating mechanism from the nacelle.

5. The mechanism may be further disassembled as necessary.

e. For removal of the cowl flap control cables, refer to paragraph 8-13.

8-13. REMOVAL OF COWL FLAP CONTROL CABLE.

a. Remove the engine access panels from the sides of the nacelle, if not previously removed.

b. Remove the top center section of the nacelle by removing attaching screws.

c. Remove the access panel from the bottom of the fuselage between the wings by removing attaching screws.

d. Disconnect the clevis end of the control cable by removing the cotter pin and clevis pin.

e. Remove the clevis end from the cable.

f. Remove the clamp securing the cable to the engine mount by removing the self-locking nuts and machine screws.

g. Draw the cable through the fire wall to the center section of the nacelle.

h. Loosen the cable clamps inside the center section of the nacelle.

i. Draw the cable through both clamps.

j. Loosen the clamp securing the cable inside the bottom of the fuselage.

k. Disconnect the cable from the control handle, inside the fuel control box by removing the bolt, washers, and self-locking nut.

l. Remove the cable by drawing it from the nacelle into the bottom of the fuselage and through the clamp.

8-14. INSTALLATION OF COWL FLAP CONTROL CABLE.

a. Draw the cable end through the clamp in the bottom of the fuselage and connect the cable end to the control handle inside the fuel control box.

b. Install the cable through the engine control tube in the wing.

c. Install the cable through the clamps in the center section of the nacelle.

d. Install the cable through the firewall and attach it with a clamp on the engine mount.

e. Install the clevis end and jam nut to the control cable.

f. Check the position of the cable to be certain there are no sharp bends or anything that might hamper proper operation.

g. Tighten all cable clamps.

h. With cowl flaps installed, check rigging and adjustment of cowl flaps as described in paragraph 8-16.

i. Install all access panels.

8-15. INSTALLATION OF COWL FLAP ASSEMBLY. (Refer to Figure 8-1.)

a. If the operation mechanism was removed, reinstall by the following procedure:

1. Position the torque tube and bearing blocks inside the nacelle and secure with bolts, washers and self-locking nuts.

2. Install the bearing block around the center of the torque tube with machine screws, washer and self-locking nuts.

3. Install the rod assembly if removed from the torque tube.

b. Position the cowl flap to the nacelle and secure with bolt, washer, nut and cotter pin.

c. Connect the rod assembly to the cowl flap.

d. Rig and adjust the cowl flaps as described in paragraph 8-16.

e. Install all access panels.

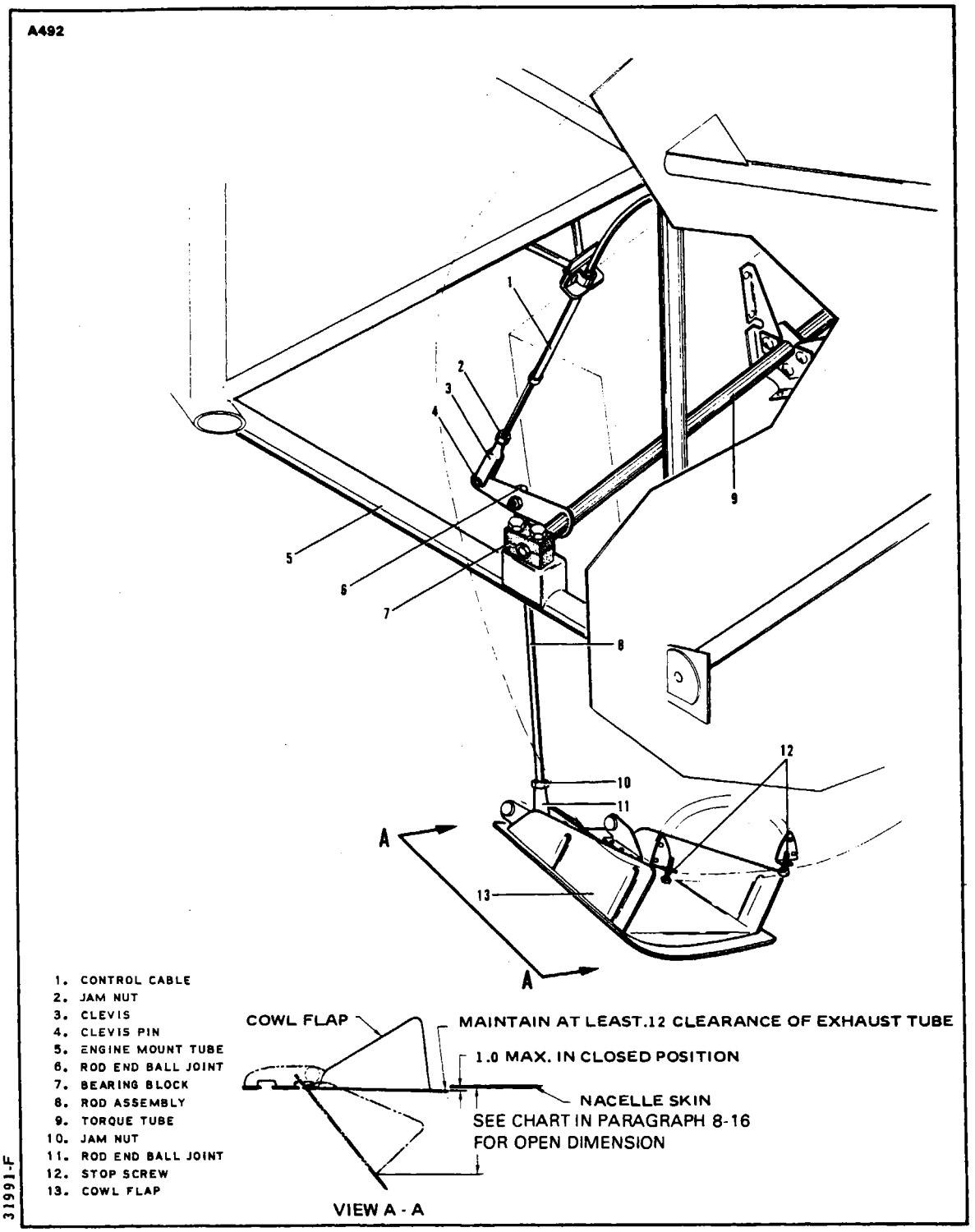

Figure 8-1. Cowl Flap Installation

8-16. RIGGING AND ADJUSTING ENGINE COWL FLAPS. (Refer to Figure 8-1.)

a. Remove the two side cowl panels from each engine.

b. Ascertain that the cowl flap mechanism is properly installed. (Refer to Paragraph 8-15.)

c. With the cowl flap selector in the cabin placed in the OPEN position, adjust the rod ends (6 and 11) of the rod assembly (8) so the cowl flap is open to the dimension shown in Figure 8-1 for the particular serial numbers noted in the following chart.

SERIAL NUMBERS	DISTANCE	
	MINIMUM	MAXIMUM
27-2505 to 27-2868 incl. *	3 inches	3.75 inches
27-2869 and up	3.50 inches	
*Airplanes with Serial Numbers 27-2505 to 27-2868 inclusive which have been modified to a gross weight of 5200 pounds use 3.50 min. to 3.75 max. inches.		

d. This dimension should be measured normal to the nacelle skin. (Refer to Figure 8-1.) Divide the adjustment between both rod ends, and check all rod ends and clevis ends for adequate thread engagement.

e. Move the selector in the cabin to the CLOSED position and check that the trailing edge of the outboard cowl flap clears the exhaust tube by at least .12 of an inch. Do not exceed one inch opening on either the outboard or inboard cowl flap. The dimension is measured normal to the nacelle skin and trailing edge of the cowl flap.

f. It may be necessary to readjust the OPEN position slightly to obtain these measurements.

g. Adjust the two stop screws(12) at the trailing edge of the cowl flaps until they contact the cowl flaps firmly.

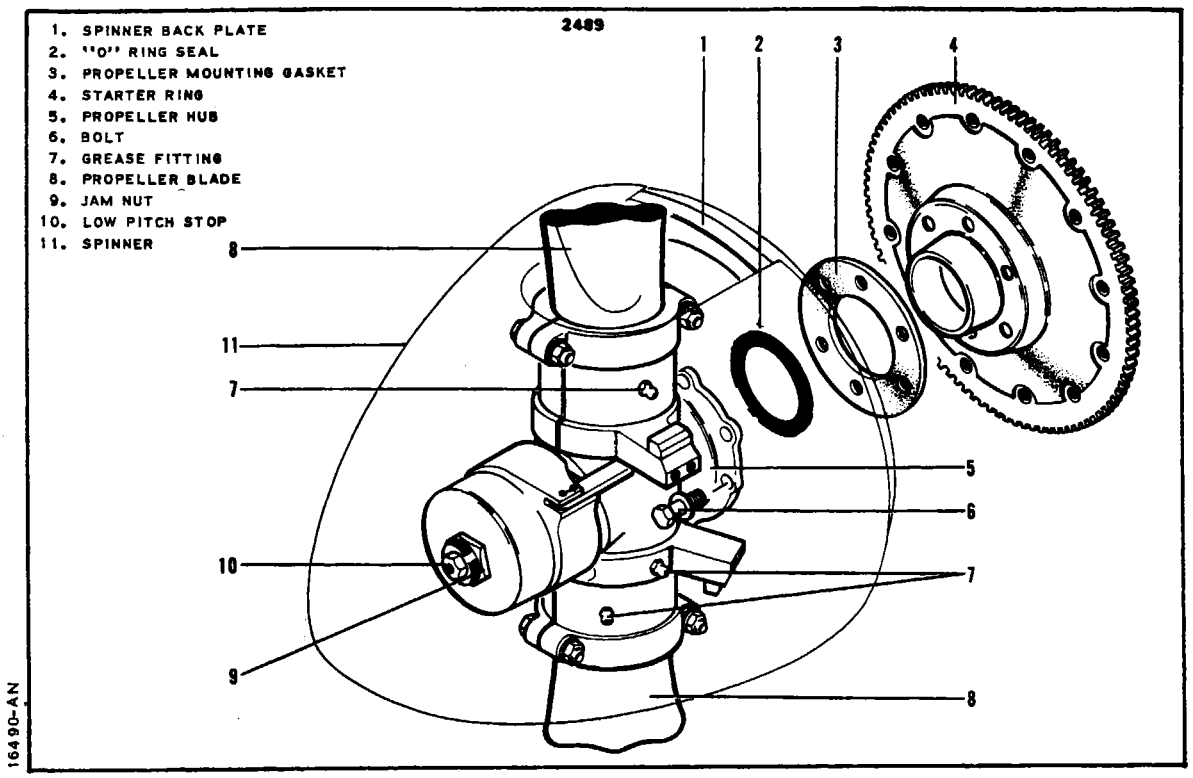

Figure 8-2. Propeller Installation
PA-23-250; PA-23-235; and PA-23-250 (six place),
Serial Nos. 27-2000 to 27-2504 incl.

8-17. PROPELLER.

WARNING

Before performing any service functions on the propeller, ascertain that the master switch is OFF, the magneto switches are OFF (grounded) and the mixture control is in the IDLE CUT-OFF position.

8-18. REMOVAL OF PROPELLER. (PA-23-250; PA-23-235; and PA-23-250 (six place), Serial Nos. 27-2000 to 27-2504 incl.) (Refer to Figure 8-2.)

a. Ascertain that the master switch and magneto switches are in the off position and the mixture control lever in the idle cut-off position.

b. Place the propeller control levers in the feather position.

c. Remove the spinner by removing the screws from the outside edge.

d. Place a drip pan under the propeller to catch the oil spillage.

e. Slide a feathering paddle on each propeller blade and turn the blades slightly in the low pitch direction to relieve the high pitch stop pins.

f. Push both pins into their brackets and feather propeller blades completely.

g. Remove the bolts which hold each of the high pitch stop brackets to the propeller hub and remove brackets.

h. Remove the propeller hub mounting bolts holding the propeller hub to the crankshaft flange.

i. Remove the propeller.

8-19. CLEANING, INSPECTION AND REPAIR OF PROPELLER.

a. Check for oil and grease leaks.

b. Clean the spinner, propeller hub interior and exterior, and blades with a non-corrosive solvent.

c. Inspect the hub parts for cracks.

d. Steel hub parts should not be permitted to rust. Use aluminum paint to touch up, if necessary, or replate during overhaul.

e. Check all visible parts for wear and safety.

f. Check blades to determine whether they turn freely on the hub pivot tube. This can be done by rocking the blades back and forth through the slight freedom allowed by the pitch change mechanism. If they appear tight and are properly lubricated, the pitch change mechanism should be removed so that each blade can be checked individually. If blades are tight, the propeller should be disassembled by an authorized service center.

g. Inspect blades for damage or cracks. Nicks in leading edges of blades should be filed out and all edges rounded, as cracks sometimes start from such places. Use fine emery cloth for finishing. Refer to Figure 8-4 for propeller blade care.

h. It is recommended that for severe damage, internal repairs and replacement of parts, the propeller should be referred to the Hartzell Factory or Service Station.

i. Grease blade hub through zerk fittings. Remove one of the two fittings for each propeller blade, alternate the next time. Apply grease through the zerk fitting until fresh grease appears at the fitting hole of the removed fitting. Care should be taken to avoid blowing out hub gaskets.

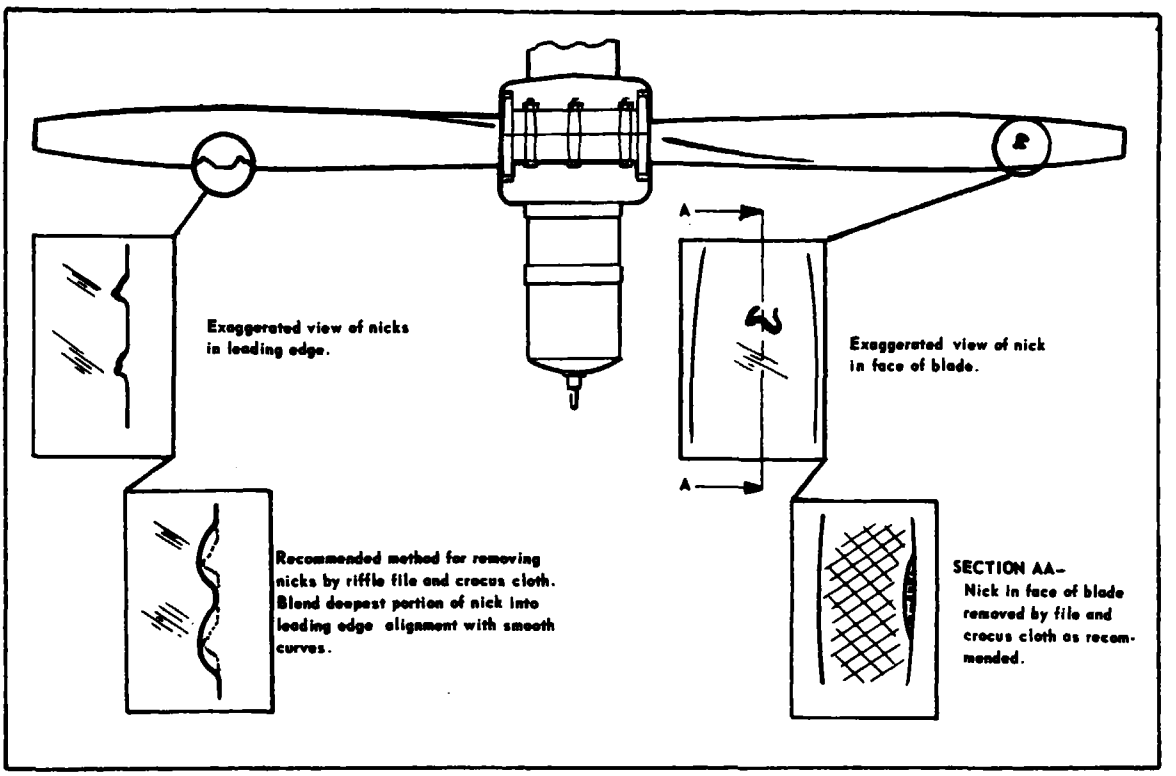

Figure 8-3. Typical Nicks and Removal Method

8-20. INSTALLATION OF PROPELLER. (PA-23-250; PA-23-235; and PA-23-250 (six place), Serial Nos. 27-2000 to 27-2504 incl.) (Refer to Figure 8-2.)

a. Ascertain that the master switch and magneto switches are in the off position.

b. Place the propeller control levers in the feather position.

c. Observe the starter ring gear to make sure it is mounted properly on the engine crankshaft flange. One of the bushings on the crankshaft is stamped with an "O" mark and it must be inserted in the starter ring gear hole, likewise identified by an "O" mark.

d. Install a new "O" ring on the crankshaft and the gasket on the propeller mounting bushings.

TABLE VIII-I. PROPELLER SPECIFICATIONS

PA-23-250; PA-23-235; and PA-23-250 (six place), Serial Nos. 27-2000 to 27-2504 incl.		
Blade Angle (2 Blades)	Low Pitch (High RPM) High Pitch (Low RPM)	15.5° (1) 80° (1) (Feathered)
(1) MEASUREMENT TAKEN AT 30 INCH RADIUS		
Propeller RPM Setting	Engine Static High RPM Engine Static Low RPM	2575 RPM Max. 1900 RPM Min.
Propeller Torque Limits	Description	Required Torque (Dry)
	Spinner Bulkhead (Aft)	50-70 inch pounds
	Propeller Mounting Bolts	60 foot pounds
	Spinner Attaching Screws	40 inch pounds

NOTE

The reason for this arrangement is that it is necessary to have the timing marks located in the proper position. The timing marks appear on the gear ring in the form of a punch mark which must be lined up with a punch mark or pin on the starter gear drive housing.

e. With the propeller blades feathered completely, raise the propeller into position with the engine and slide the propeller onto the propeller mounting bushings.

f. Install the hexagon head propeller hub mounting bolts and ferry screws and tighten them to 60 foot pounds of torque. Safety with MS20995-C41 wire.

g. Install the high pitch stop brackets making sure there are a sufficient number of shim washers behind the bracket to attain proper alignment of the pin with the pitch stop.

h. Check tightness of all the propeller bolts and safety.

i. Install the spinner and secure with attaching screws.

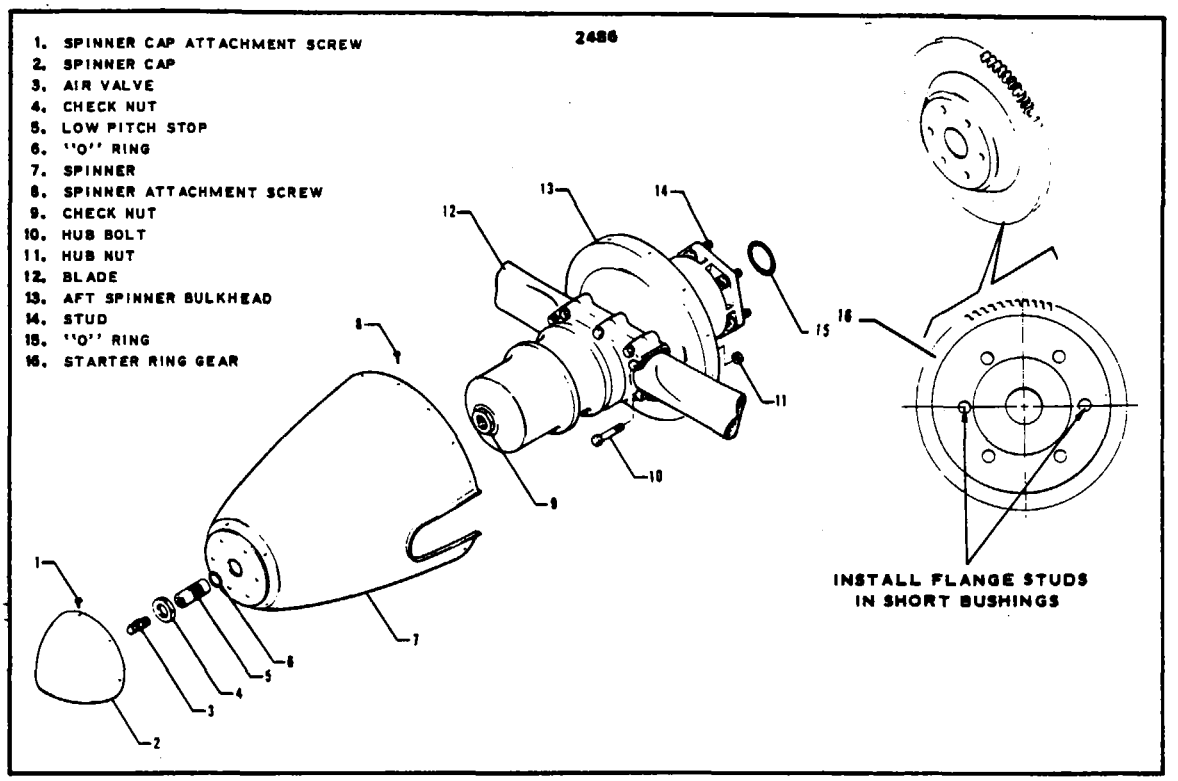

Figure 8-4. Propeller Installation
PA-23-250 (six place), Serial Nos. 27-2505 and up

8-21. REMOVAL OF PROPELLER. (PA-23-250 (six place), Serial Nos. 27-2505 and up.) (Refer to Figure 8-4.) This includes all propellers, standard and with spring backup kit installed, identified by a letter "S" in the dash number.

NOTE

When removing the propeller, it is unnecessary to remove the spinner, feather the blades, or remove the air charge. When the propeller is removed for service or overhaul, the propeller with the spring kit installed should be feathered on the aircraft (see following CAUTION) and the spinner on either prop must be removed according to section d of this paragraph.

TABLE VIII-II. PROPELLER SPECIFICATIONS
PA-23-250 (six place), Serial Nos. 27-2505 and up.

Blade Angle	Low Pitch (High RPM)	14.5° 15.2° (1)
	Feathered	80°
MEASUREMENT TAKEN AT 30 INCH RADIUS (1) TIO-540-C1A ENGINES ONLY		
Propeller RPM Setting	Engine Static High RPM	2575
Propeller Torque Limits	Description	Required Torque (Dry)
	Spinner Bulkhead (Aft)	22 foot-pounds
	Propeller Mounting Bolts	60 foot-pounds
	Spinner Bulkhead Check Nut	35-40 foot-pounds
	Spinner Attachment Screws	40 inch-pounds

CHAMBER PRESSURE REQUIREMENTS WITH TEMPERATURE

HC-E2YR-2RB or HC-E2YR-2RBF or HC-E2YK-2RB or HC-E2YK-2RBF

Temp. °F	Press. (psi)	Temp. °F	Press. (psi)
100	188	30	165
90	185	20	162
80	182	10	159
70	178	0	154
60	175	-10	152
50	172	-20	149
40	168	-30	146

HC-E2YK-2RBS or HC-E2YK-2RBSF or HC-E2YR-2RBS or HC-E2YR-2RBSF

Temp. °F	Press. (psi)
100	74
70	70
40	66
10	62
-20	58

NOTE: Do not check pressure or charge with propeller in feather position.

WARNING

Do not attempt to disassemble the propeller assembly any further than stated in this manual. Only personnel at a certified repair shop are authorized for repair and overhaul of the propeller mechanism.

CAUTION

Under NO condition should blade paddles be used on either propeller, except to unfeather a propeller with the spring kit installed (see paragraph 8-23). If a propeller is to be feathered on the ground, it should be done with the engine operating, by use of the propeller control on the throttle quadrant.

WARNING

Prior to performing any work on the propeller, ascertain that the master switch and magneto switches are OFF (grounded) and the mixture control is in the IDLE CUT-OFF position.

a. Remove all hardware that attaches the nose cowl to the top and bottom engine cowls. The top and side panels of the main cowl assembly may be removed for greater accessibility. Work the nose cowl as far forward as possible, reach through the opening and split the cowl by pulling the upper and lower hinge pins. Pliers may be needed to pull the pins. The two halves of the cowl may be pulled forward and to either side of the propeller, which should be in a vertical position for ease in removing the cowl.

NOTE

In some appropriate manner, index the propeller and starter ring to facilitate installation. (Example - paint stripe.) Do not scratch the surface.

b. Place a drip pan under the propeller to catch oil spillage.

c. Cut safety wire around the propeller mounting studs and remove the studs (14) from the engine flange by wrenching the nuts. These nuts are "frozen" to the studs with loctite and secured with roll pins, so the studs should turn with the nuts. Pull the propeller from the engine shaft.

d. In the event that the spinner and spinner bulkhead are to be removed for cleaning, inspection, adjustment of pitch stop, etc., remove the spinner nose cap attaching screws and cap (1 and 2). Remove the spinner (7) by removing the safety wire and check nut (4) from the propeller at the forward end of the forward spinner bulkhead and the screws (8) that secure the spinner to the aft bulkhead (13). The aft spinner bulkhead may be removed from the hub by removing the locknuts (11).

8-22. CLEANING, INSPECTION AND REPAIR OF PROPELLER.

CAUTION

Prior to performing any work on propeller, release the dome pressure first.

a. Check for oil and grease leaks.
b. Clean the spinner, propeller hub and blades with a non-corrosive solvent.
c. Inspect the hub parts for cracks.
d. Steel hub parts should not be permitted to rust. Use aluminum paint to touch up, if necessary, or replate during overhaul.
e. Check all visible parts for wear and safety.
f. Check the blades of the standard propeller to determine whether they turn freely on the hub pivot tube. This can be done by rocking the blades back and forth through the slight freedom allowed by the pitch change mechanism. Do this by hand being careful not to slam the internal mechanism against the stops. If blades appear tight and are properly lubricated, the propeller may need internal repair. (See WARNING under "Removal of Propeller".) This cannot be done with the spring propeller due to the pressure exerted by the spring even though the dome pressure is discharged.
g. Inspect blades for damage or cracks. Nicks in leading edges of blades should be filed out and all edges rounded , as cracks sometimes start from such places. Use fine emery cloth for finishing. Refer to Figure 8-3 for propeller blade care.
h. Check condition of propeller mounting nuts and studs.

NOTE

It is recommended that for severe damage, internal repairs and replacement of parts, the propeller should be referred to the Hartzell Factory or Certified Repair Station.

i. Each blade face should be sanded lightly with fine sandpaper and painted, when necessary, with a flat black paint to retard glare. A light application of oil or wax may be applied to the surfaces to prevent corrosion.

8-23. INSTALLATION OF PROPELLER. (PA-23-250 (six place), Serial Nos. 27-2505 and up.) (Refer to Table VIII-II and Figure 8-4.)

WARNING

Prior to performing any work around propeller, ascertain that the master switch and magneto switches are OFF (grounded) and the mixture control is in the IDLE CUT-OFF position.

a. Clean the propeller flange, starter ring and crankshaft flange.

b. Install spinner bulkhead (13) on propeller hub and secure with locknuts. Torque bolts to specifications given in Table VIII-II.

c. Ascertain that the starter ring gear is properly on the crankshaft flange. The oversize hole in the starter ring must go over the oversize bushing.

d. Position the prop flange and starter ring gear so the two short bushings are horizontal. (Refer to Figure 8-4.)

e. Lubricate and install O-ring (15) in prop hub.

f. Place the propeller in a horizontal position and mount to the engine crankshaft. Check alignment of paint stripe (refer to NOTE under paragraph 8-21). Screw each stud into its mating engine flange bushing a few threads at a time until all are tight. Torque the studs to the specifications given in Table VIII-II.

g. Safety studs with MS20995-C41 wire. Safety wire is inserted through the roll pins.

h. Install spinner (7). Torque spinner screws (8) and check nut (4) per Table VIII-II. Safety check nut with MS20995-C41 wire.

NOTE

Do not check pressure or charge with **PROPELLER** in feather position.

CAUTION

To obtain an accurate pressure reading when checking propeller dome air pressure or to insure complete release of all air pressure, place the propeller **CONTROL** in the feather detent before measuring or releasing propeller air pressure. This procedure will insure the free flow of all air within the prop dome and prevent possible error in pressure readings or injury to service personnel should the low pitch stop be removed.

NOTE

If the propeller is in feather on the ground, it is undesirable to run it out of feather through engine operation due to roughness which will occur possibly causing severe damage to

engine mount and exhaust system. Remove the air charge, unfeather the blades with equal pressure applied by means of blade paddles used on both blades as close to the hub as possible. Listen for the quiet distinctive "clicks" of the high pitch stop pins, then stop and remove the paddles.

i. Charge the cylinder through air valve (3) with dry air or nitrogen gas to the prescribed pressure. Refer to Table VIII-II of this manual for an exact pressure for the existing temperature. It is most important that an accurate charge be maintained.

k. The amount of air pressure per existing temperature, as shown by Table VIII-II, is very important and should always be used. If excessive pressure is used in the propeller, there is a possibility of feathering taking place at idle speed when the engine is warm and the oil viscosity is low. An accurate air pressure gauge should always be used. A pressure gauge and valve kit, part number 756 771, may be purchased through a Piper Dealer or Distributor.

l. When recharging the propeller, dry air or nitrogen gas should be used. It is important not to allow moisture to enter the air chamber as this could cause the piston to freeze during cold weather operation.

m. Test for leakage by using a soap solution or equivalent and applying it around the air valve stem and adjustment stop nut.

n. To reinstall engine cowling, first put the propeller in a vertical position then fit the two halves of the nose cowl together behind the spinner bulkhead and pin them together with the two hinge pins through the top and bottom hinges. Slide the nose cowl back and into proper location with the engine cowls. Locate holes and install all hardware that attaches the cowls together. Install top and side engine cowl panels if removed. Install spinner cap.

8-24. ADJUSTMENT OF LOW PITCH BLADE ANGLE AND STOP. (PA-23-250; PA-23-235; and PA-23-250 (six place), Serial Nos. 27-2000 to 27-2504 incl.)

a. The propeller comes from the factory with the low pitch stop adjusted for proper blade angle. If, however, this adjustment has been disturbed, the following procedure is given for obtaining blade angle:

1. The blade angle (refer to Table VIII-II) is determined by placing a propeller protractor on the face side of the propeller at the 30 inch station as measured from the hub centerline. The blade must be horizontal.

2. The low pitch stop is adjusted by rotating the blades in the clamps. This is done by loosening the outer clamp bolts and moving the blades, using a blade bar or plastic mallet. Rotating the blade 0.031 of an inch at the circumference of the blade shank ordinarily will change the static RPM by about 100. Torque the 3/8 bolts to 20 to 22 foot-pounds and the 7/16 bolts to 40 foot-pounds.

b. After the low pitch stop has been adjusted for proper blade angle, the governor should then be adjusted to obtain maximum rated engine RPM during take-off and climb as described in paragraph 8-30.

8-25. ADJUSTMENT OF LOW PITCH BLADE ANGLE AND STOP. (PA-23-250 (six place), Serial Nos. 27-2505 and up.)

NOTE

Both types of propellers referred to, come from the factory with the low pitch stop adjusted for proper blade angle. If, however this adjustment has been disturbed, the procedure given below is used for obtaining blade angle, but applies only to the propeller without the spring kit A-2273 installed. There is no way to check the low pitch blade angle of the propeller, with the spring kit installed, in the field. This is due to the internal spring producing a force near to that of the air charge in the standard propeller which can and has to be released to make this adjustment. The spring supplies constant pressure to the blades making it very difficult to rotate the blades to a point where the low pitch stop is contacted. Therefore, if the blade angle on a spring propeller is suspected to be wrong it should be referred back to the Hartzell factory or Certified repair shop.

a. Procedure for obtaining blade angle and adjusting low pitch stop.

1. The blade angle (Refer to Table VIII-II) is determined by placing a propeller protractor on the face side of the propeller at the 30-inch station as measured from the hub centerline. The blade must be horizontal.

2. The low pitch stop is adjusted by rotating a screw in the nose of the propeller cylinder. Rotating the screw clockwise increases the low pitch angle and reduces the static RPM by about 100 RPM for each half turn, or vice versa.

CAUTION

Before adjusting the low pitch stop screw, the air pressure should be dropped to zero. Unless this is done, it is possible to unscrew the low stop far enough to disengage the threads, allowing the air pressure to blow the stop screw out with great force. To insure the complete discharge of all air pressure within the dome, place the propeller **CONTROL** in the feather detent. There should be at least four threads of the stop screw engaged.

b. After the low pitch stop has been adjusted for proper blade angle, torque the low pitch stop jam nut to 30 foot-pounds. The governor should then be adjusted to obtain maximum rated engine RPM during take-off and climb.

8-26. BLADE TRACK. Blade track is the ability of one blade tip to follow the other, while rotating, in almost exactly the same plane. Excessive difference in blade track - more than 0.062 of an inch, may be an indication of bent blades or improper propeller installation. Check blade track as follows:

a. With the engine shut down and blades vertical, secure to the airplane a smooth board just under the tip of the lower blade. Move the tip fore and aft through its full "blade-shake" travel, making small marks with a pencil at each position. Then center the tip between these marks and scribe a line on the board for the full width of the tip.

b. Carefully rotate propeller by hand to bring the opposite blade down. Center the tip and scribe a pencil line as before and check that lines are not separated more than 1/16 of an inch.

c. Propellers having excessive difference in blade track should be removed and inspected for bent blades, or for parts of sheared "O" ring, or foreign particles, which have lodged between hub and crankshaft mounting faces. Bent blades will require repair and overhaul of assembly.

8-27. PROPELLER GOVERNOR.

8-28. REMOVAL OF PROPELLER GOVERNOR.

a. Remove the upper engine cowl per paragraph 8-6 or 8-7.

b. Disconnect the control cable end from the governor control arm.

c. Remove the governor mounting stud nuts. It will be necessary to move the governor out from the mounting pad as the nuts are being removed before the nuts can be completely removed.

d. Remove the mounting gasket. If the governor is to be removed for a considerable length of time and another unit not substituted, it is advisable to cover the mounting pad to prevent damage caused by foreign matter.

8-29. INSTALLATION OF PROPELLER GOVERNOR.

a. Clean the mounting pad thoroughly, making very certain that there are no foreign particles in the recess around the drive shaft.

b. Place the governor mounting gasket in position with the raised portion of the screen facing away from the engine.

c. Align the splines of the governor shaft with the engine drive and slide the governor into position.

d. With the governor in position, raise the governor enough to install washers and start mounting nuts. Torque nuts even.

e. Connect the control cable end to the governor control arm. The ball stud is installed in the inner hole of the control arm.

f. Adjust governor control per paragraph 8-30.

g. Install engine cowl per paragraph 8-9 or 8-10.

8-30. RIGGING AND ADJUSTMENT OF PROPELLER GOVERNOR. (Refer to Figure 8-5.)

a. Start the engine and warm in the normal manner.

b. To check high RPM, low pitch setting, move the propeller control all the way forward to the INCREASE PROPELLER position. At this position the governor speed control arm (3) should be against the high RPM fine adjusting screw (4). With the throttle full forward, observe engine RPM which should be 2575 RPM with high RPM properly adjusted.

c. Should engine RPM not be as required, the high RPM setting should be adjusted as follows:

1. Shut down the engine and remove the upper engine cowl.

2. Adjust the governor by means of the fine adjustment screw (4) for 2575 RPM. To do this, loosen the high RPM fine adjustment screw locknut and turn the screw in a clockwise direction to decrease engine speed or in a counterclockwise direction to increase engine speed.

NOTE

One revolution of the fine adjustment screw will increase or decrease the engine speed approximately 20 RPM.

3. Reinstall upper engine cowl and repeat step b to ascertain proper RPM setting.

4. After setting the proper high RPM adjustment, run the self-locking nut on the fine adjustment screw against the base projection to lock.

5. Ascertain that the governor control arm (3) is adjusted to the proper angle on the control wheel (2) as shown in Figure 8-5.

d. With the high RPM adjustment complete, the control system should be adjusted so that the governor control arm will contact the high RPM stop when the cockpit lever is 0.062 of an inch from its full forward stop, which is located in the control pedestal. To adjust the control lever travel, disconnect the control cable end from the control arm, loosen the cable end jam nut and rotate the end to obtain the desired lever clearance. Reconnect the cable end and tighten jam nut.

e. It is usually only necessary to adjust the high RPM setting of the governor control system, as the action automatically takes care of the positive high pitch setting.

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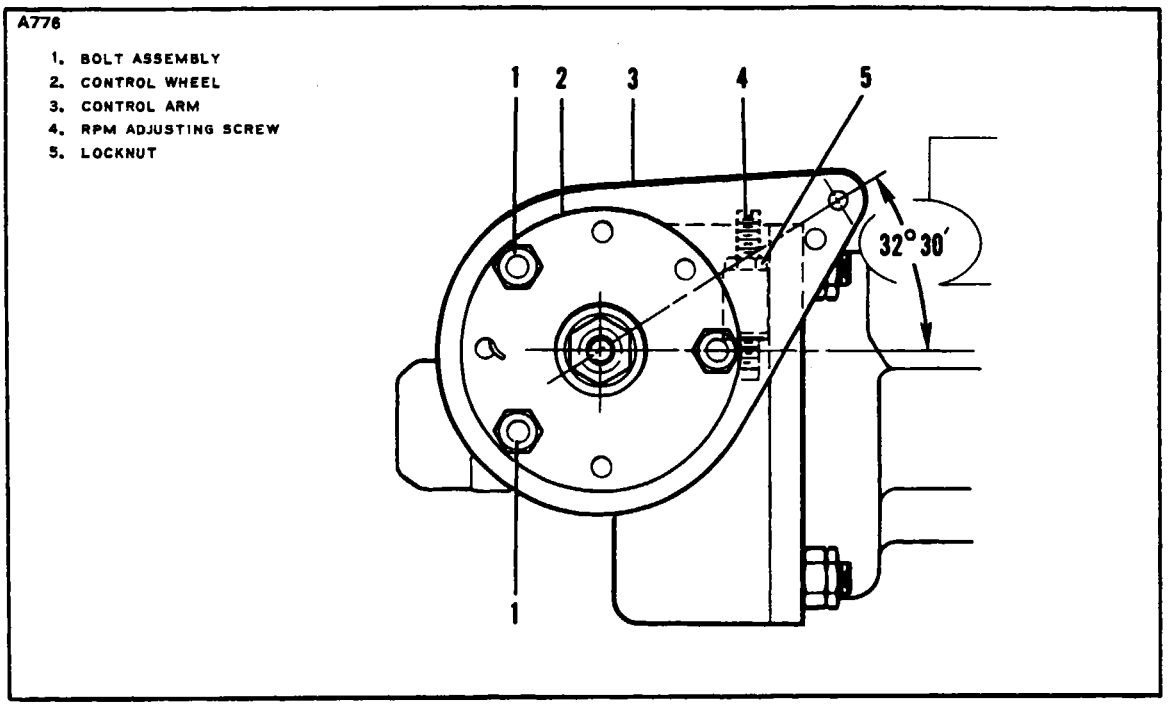

Figure 8-5. Propeller Governor

8-31. ENGINE.

8-32. REMOVAL OF ENGINE. PA-23-250; PA-23-235; and PA-23-250 (six place), Serial Nos. 27-2000 to 27-2504 incl.)

NOTE

On airplanes equipped with fuel injection, refer to paragraph 8-34 for Removal of Engine.

The removal of either engine is basically the same procedure, though the routing of some wires, cables, lines, etc. does vary between engines. Each line should be identified to facilitate reinstallation and covered, where disconnected, to prevent contamination.

a. Turn off all cockpit switches and then disconnect the battery ground wire at the battery.

b. Move the fuel valve control lever located on the outboard side of the fuel selector panel to the OFF position.

c. Remove the engine cowling per paragraph 8-6.

d. Drain the engine oil, if desired.

e. Remove the propeller per paragraph 8-18.

f. Disconnect the starter cable at the starter, remove the cable clamps at the left side of the engine and engine mount, and draw the cable aft through the engine baffle to the firewall.

g. Disconnect generator wires and remove the wire clamps, pull the wires aft through the engine baffling to the firewall.

h. Disconnect the governor control cable from the governor.

i. Disconnect the vacuum pump lines from the pump.

j. Disconnect the engine oil cooler air duct bellow by means of the square split type clamp.

k. Disconnect the primer line at the tee connecting fitting.

l. Disconnect the mechanical fuel pump fuel inlet line connected to the right side of the pump and from the connection at the electric fuel pumps.

m. Disconnect the mechanical fuel pump line from the "Y" connection fitting at the left side of the pump.

n. Disconnect the "P" leads from the magnetos and the oil temperature wire at the bulb.

o. Disconnect the tachometer cable, cylinder head temperature thermocouple, oil pressure line and manifold pressure line.

p. Remove the clamp holding manifold pressure line to the rear baffle.

q. Disconnect the engine breather line from the rear of the engine.

r. Disconnect the oil cooler hoses at the rear of the engine.

s. Remove both magneto cooling baffles and rotate magnetos to clear the engine mount.

t. Disconnect the hydraulic lines from the pump on the left engine.

u. Remove the bonding straps from the rear of the engine.

v. Remove engine control support bracket by removing bolts attaching bracket to the engine crankcase.

w. Remove the carburetor mounting nuts and allow the carburetor and carburetor air box to hang by means of the attached engine controls.

x. To prevent damage to the tail when removing the weight of the engine, attach a stand to the tail skid.

y. Attach a one-half ton (minimum) hoist to the hoisting hook and relieve the tension on the mounts.

z. Remove the cotter pin, nuts, washers and front rubber mount from each bolt and remove sleeve. Slide bolts out of attaching points. Swing engine free and place on a suitable support, being careful not to damage any attached parts, and remove rear rubber mounts.

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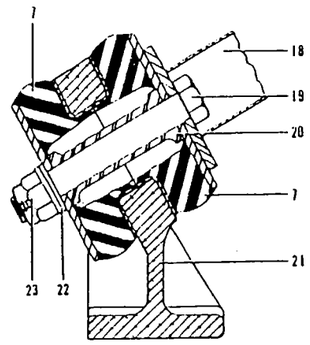
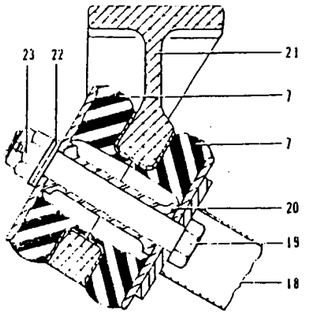
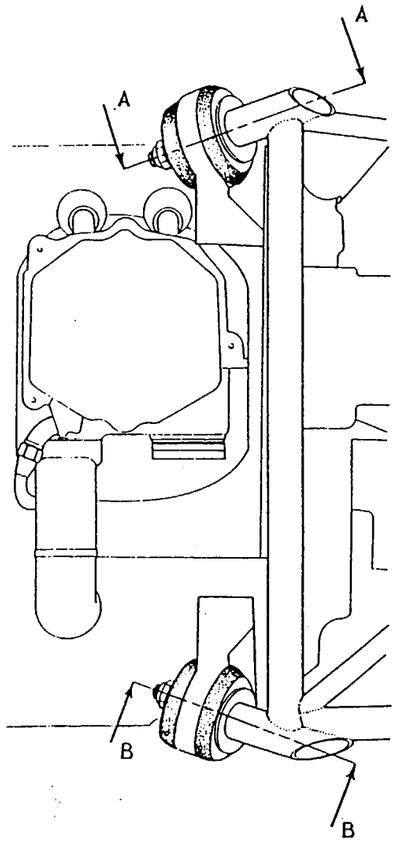


SECTION A-A



SECTION B-B



SKETCH A

1. OIL COOLER
2. MAGNETO, LEFT
3. OIL PRESSURE SCREEN
4. VACUUM PUMP
5. MAGNETO, RIGHT
6. ENGINE MOUNT ASSEMBLY (SEE SKETCH A)
7. SHOCK MOUNT
8. OIL PRESSURE RELIEF VALVE
9. LIFTING STRAP
10. SPARK PLUG
11. STARTER RING GEAR
12. FUEL PUMP
13. HYDRAULIC PUMP
14. OIL SUCTION SCREEN
15. CARBURETOR
16. INDUCTION INTAKES
17. EXHAUST STACK
18. ENGINE MOUNT FRAME
19. BOLT
20. BUSHING
21. ENGINE MOUNT FITTING
22. WASHER
23. NUT

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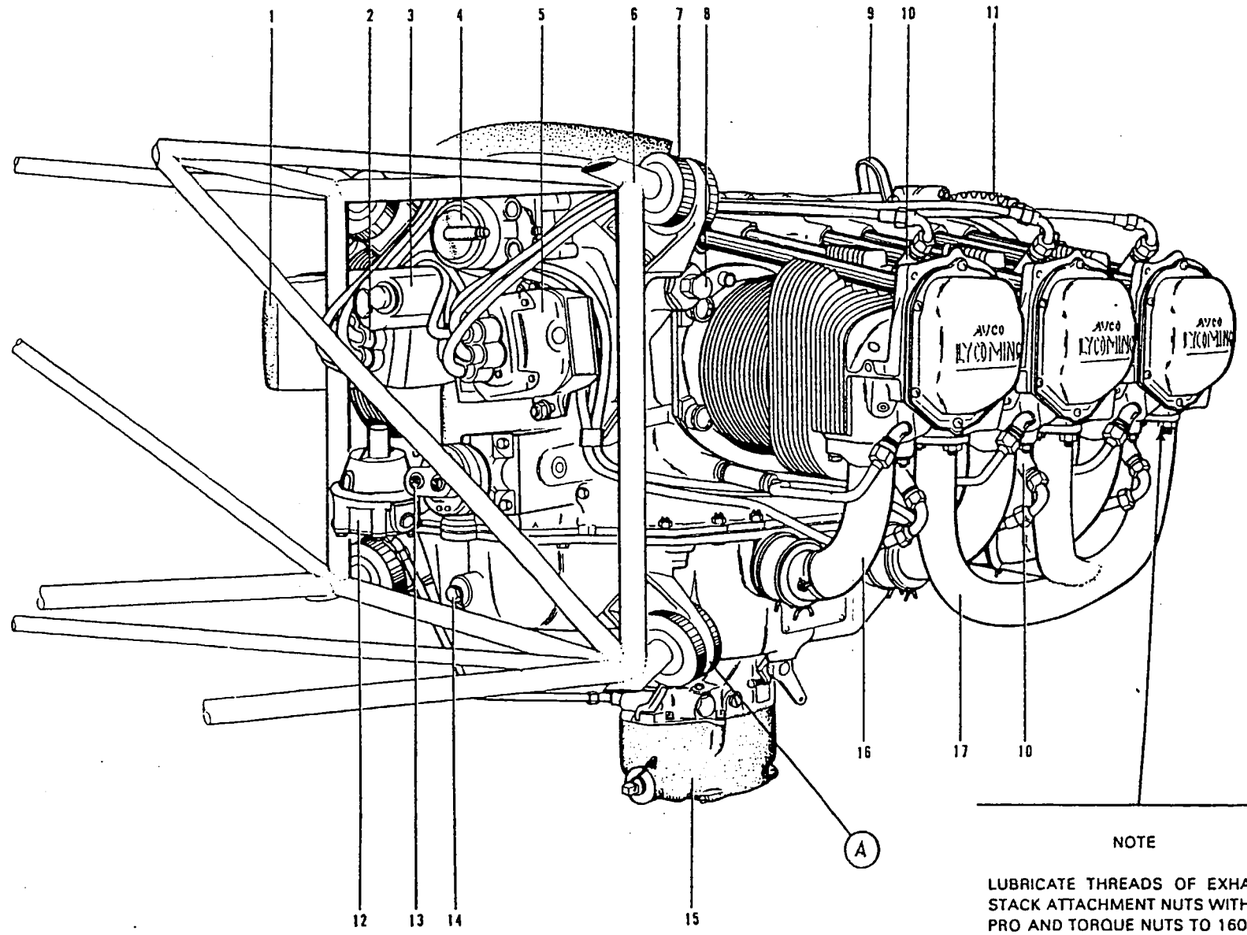


NOTE

LUBRICATE THREADS OF EXHAUST STACK ATTACHMENT NUTS WITH FEL PRO AND TORQUE NUTS TO 160-180 INCH-POUNDS.

Figure 8-6. Engine Installation, PA-23-250; PA-23-235; and PA-23-250 (six place), Serial Nos. 27-2000 to 27-2504 incl.

8-33. INSTALLATION OF ENGINE. (PA-23-250; PA-23-235; and PA-23-250 (six place). Serial Nos. 27-2000 to 27-2504 incl.)

NOTE

On airplanes equipped with fuel injection, refer to paragraph 8-35 for Installation of Engine.

a. Attach a one-half ton hoist to the lifting eye and lift the engine. Tilt the rear of the engine downward and out of line until the magnetos clear the ring of the engine mount. Position the mounting lugs of the engine so they align with the engine mount attaching points.

b. Insert a mounting bolt into the engine mount until its threaded end extends one or two threads from the mount itself. Slide a shock mount in between the engine mount and the engine.

c. Repeat the procedures described in step b at the three remaining attachment points.

NOTE

When installing engine, always use new rubber shock mounts.

d. Install the front engine shock mounts on the bolts and over the forward end of the mount spacer; check to see that the shock mounts are not binding. Install a washer and castellated nut on each mounting bolt. Tighten the nuts progressively, following a circular sequence and torque to 40 foot-pounds. Install cotter pins.

e. Place gasket, carburetor, and carburetor air box to bottom of engine and attach with nuts and pal nuts.

f. Attach engine control support bracket with controls attached to the bottom of the engine crankcase with bolts.

g. Install the bonding straps to the rear of the engine.

h. Install both magneto cooling baffles.

i. Connect the oil cooler hoses to rear of engine and hydraulic lines to pump on left engine.

j. Connect the tachometer cable, cylinder head temperature, oil pressure line, oil temperature wire and magneto "P" leads.

k. Connect the fuel lines to the fuel pump.

l. Connect the primer line at tee connection fitting.

m. Connect the vacuum pump hoses.

n. Connect the oil cooler air duct bellows by means of a square split type clamp.

o. Install the governor control cable bracket and the control cable on the governor.

p. Connect the generator wires and clamp them on the rocker arm oil return lines.

q. Connect the starter cable and clamp it to the rocker arm oil return lines and engine mount.
r. Ascertain that the magneto switches are off and install the propeller per paragraph 8-20.
s. Install the proper grade and mount of engine oil. (Refer to the latest revision of Lycoming Service Instruction No. 1241.)
t. Connect the battery ground wire at the battery.
u. Turn on the fuel valve, open the throttle full, open mixture control and turn on the electric fuel pump and check the fuel lines for leaks.
v. Perform an engine operational check.
w. Check for oil leaks.
x. Install the access plate on the engine nacelle and the cowling per paragraph 8-9.

8-34. REMOVAL OF ENGINE. (PA-23-250 (six place), Serial Nos. 27-2372 and up.) The removal of either engine is basically the same procedure, though the routing of some wires, cables, lines, etc. does very between engines. Each line should be identified to facilitate reinstallation and covered, where disconnected, to prevent contamination.

a. Turn off all cockpit switches and then disconnect the battery ground wire at the battery.
b. Move the fuel valve control lever, located on the fuel control box between the two front seats, to the OFF position.
c. Remove the engine cowling per paragraph 8-7.
d. Drain the engine oil, if desired.
e. Remove the propeller per paragraph 8-21.
f. Disconnect the starter cable at the starter, remove the cable clamps and pull it aft to the firewall.
g. Disconnect the alternator wires and wire clamps, pull the wires aft to the firewall.
h. Remove the governor control cable and injector control cables.
i. Disconnect the cylinder head temperature, manifold pressure, oil pressure, fuel pressure and fuel flow gauge vent lines.
j. Disconnect the engine oil breather, magento "P" leads, oil temperature wire and tachometer cable.
k. Disconnect the vacuum hoses, air oil separator line to the engine, oil cooler lines and remove oil cooler.
l. Disconnect fuel lines at the fuel pump, hydraulic pump lines and bonding straps.
m. Loosen the magneto mounting nuts and rotate the magnetos to clear the engine mount.

n. To prevent damage to the tail when removing the weight of the engine, attach a stand to the tail skid.

o. Attach a one-half ton (minimum) capacity hoist to the engine lifting eye and relieve the tension on the mount bolts.

p. Remove the cotter pin, nut, washer, front rubber mount and sleeve from all four mount bolts.

q. Slide mount bolts out of their attaching points and slowly swing engine free. Place on a suitable support being careful not to damage any attached parts.

r. Remove the rear rubber mounts.

8-35. INSTALLATION OF ENGINE. (PA-23-250 (six place), Serial Nos. 27-2505 and up.) Refer to Figure 8-7 for the proper arrangement of the engine mount shock assemblies. The top shocks are assembled so the silver colored shocks are aft and the gold colored shocks are forward. The lower shock mounts are installed opposite of the top shock mounts.

a. Attach a one-half ton hoist to the lifting strap and lift the engine. The exhaust stacks, injector and accessories may be installed.

b. Swing the engine into position with the nose slightly high and inward. Allow the magnetos to clear the ring of the engine mount. Position the mounting lugs of the engine so they align with the engine mount attaching points.

NOTE

When installing engine, always use new rubber shock mounts.

c. Insert a mounting bolt into the engine mount until its threaded and extends one or two threads from the mount itself. Insert a shock mount between the engine mounting bracket and the mount. Slide the mount bolt on through the mount and insert a mount spacer over the bolt and through the engine mounting bracket.

d. Repeat the procedures in step c with the remaining three attaching points.

NOTE

A heat shield is installed with the bottom outboard shock mount. Adjust so as to give maximum protection against exhaust tube heat.

e. Install the front engine shock mounts on the bolts and over the forward end of the mount spacer; check to see that the shock mounts are not binding. Install washers and self-locking nut on each mounting bolt. Tighten the nuts progressively, following a circular sequence and torque to 34 to 42 foot-pounds.

f. Connect the fuel lines to the fuel pump hydraulic pump lines, left engine only, and bonding straps.

g. Connect the vacuum hoses, air oil separator line to the engine.

h. Install the oil cooler and connect oil cooler hoses.

i. Connect engine oil breather, magneto "P" leads, oil temperature wire to bulb and tachometer cable.

j. Connect cylinder head temperature, manifold pressure, oil pressure, fuel pressure and fuel flow gauge vent line.

k. Install governor control cable bracket and cable.

l. Connect injector unit control cables.

m. Connect alternator wires and clamp the wires to rocker arm oil return lines.

n. Connect starter cable and clamp cable to rocker arm oil return lines.

o. Ascertain that the magneto switches are off and install the propeller per paragraph 8-23.

p. Install the proper grade and amount of engine oil. (Refer to latest revision of Lycoming Service Instruction No. 1241.)

q. Connect the battery ground wire at the battery.

r. Turn on the fuel valve, open the throttle full, open mixture control and turn on the electric fuel pump and check the fuel lines for leaks.

s. Perform an engine operational check.

t. Check for oil leaks.

u. Install the access plates on the engine nacelle and the cowling per paragraph 8-10.

8-36. REMOVAL OF ENGINE MOUNT AND SUPPORT ASSEMBLIES. (Refer to Figure 8-7.)

a. Remove the engine per Paragraph 8-34.

b. Disconnect all wires and vent lines that are attached to the firewall.

c. Remove the rivets and screws that secure the firewall assembly and remove the firewall.

d. Remove the bolts that secure the engine mount assembly and remove the mount assembly.

e. Remove the nacelle top center skin assembly and the access plate on the rear section assembly.

f. Disconnect the landing gear actuating cylinder, remove the bolts that secures the engine mount support assembly and remove the support assembly.

8-37. INSTALLATION OF ENGINE MOUNT AND SUPPORT ASSEMBLIES. (Refer to Figure 8-7.)

a. Position the engine mount support assembly, connect landing gear actuating cylinder and secure support assembly with appropriate bolts. Do not torque the bolts at this time.

b. Position the engine mount assembly and secure with appropriate bolts. Do not torque the bolts at this time.

c. Shim the front mounts of the support assembly and lower mounts of the engine mount assembly as required (not to exceed .125). Refer to Parts Catalog for shim part nos.

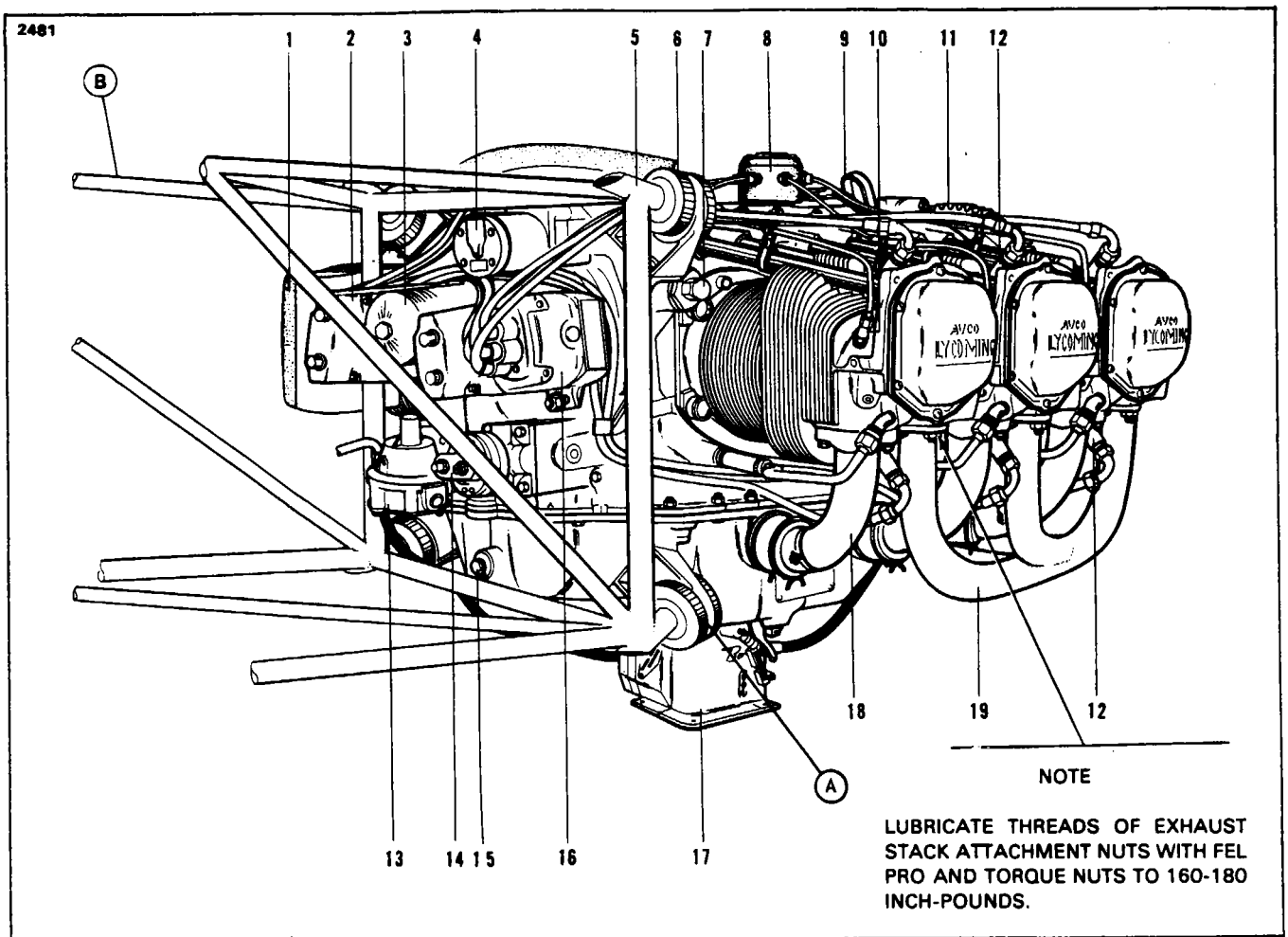
d. Torque support assembly mounting bolts to 50-70 inch-pounds and the lower mounting bolts of the engine mount assembly to 160-190 inch-pounds.

e. Position the firewall, secure it with appropriate rivets (AN441-3-3P and AN426AD3-3) and screws.

f. Connect all wires and vent lines previously disconnected.

g. Install the nacelle to center skin assembly, access plate on the rear section assembly.

h. Install the engine per Paragraph 8-35.



1. OIL COOLER
2. MAGNETO, LEFT
3. OIL FILTER
4. VACUUM PUMP
5. ENGINE MOUNT ASSEMBLY (SEE SKETCH A)
6. SHOCK MOUNT
7. OIL PRESSURE RELIEF VALVE
8. FUEL INJECTOR MANIFOLD
9. LIFTING STRAP
10. AIR BLEED NOZZLE
11. STARTER RING GEAR
12. SPARK PLUG
13. FUEL PUMP
14. HYDRAULIC PUMP
15. OIL SUCTION SCREEN
16. MAGNETO, RIGHT
17. FUEL INJECTOR
18. INDUCTION INTAKES
19. EXHAUST STACK
20. NUT
21. ENGINE MOUNT FITTING
22. BUSHING
23. BOLT
24. ENGINE MOUNT FRAME
25. WASHER
26. ENGINE MOUNT SUPPORT ASSEMBLY
27. BOLTS TORQUE 50-70 IN. LBS.
28. SHIMS (NOT TO EXCEED .125)
29. ENGINE MOUNT ASSEMBLY
30. BOLT TORQUE 160-190 IN. LBS.
31. SHIM (NOT TO EXCEED .125)
32. FIREWALL ASSEMBLY
33. RIVETS AN441-3-3P 18 REQ.
34. RIVETS AN426AD3-3 11 REQ.

Figure 8-7. Engine Installation, PA-23-250 (six place)
Serial Nos. 27-2505 and up

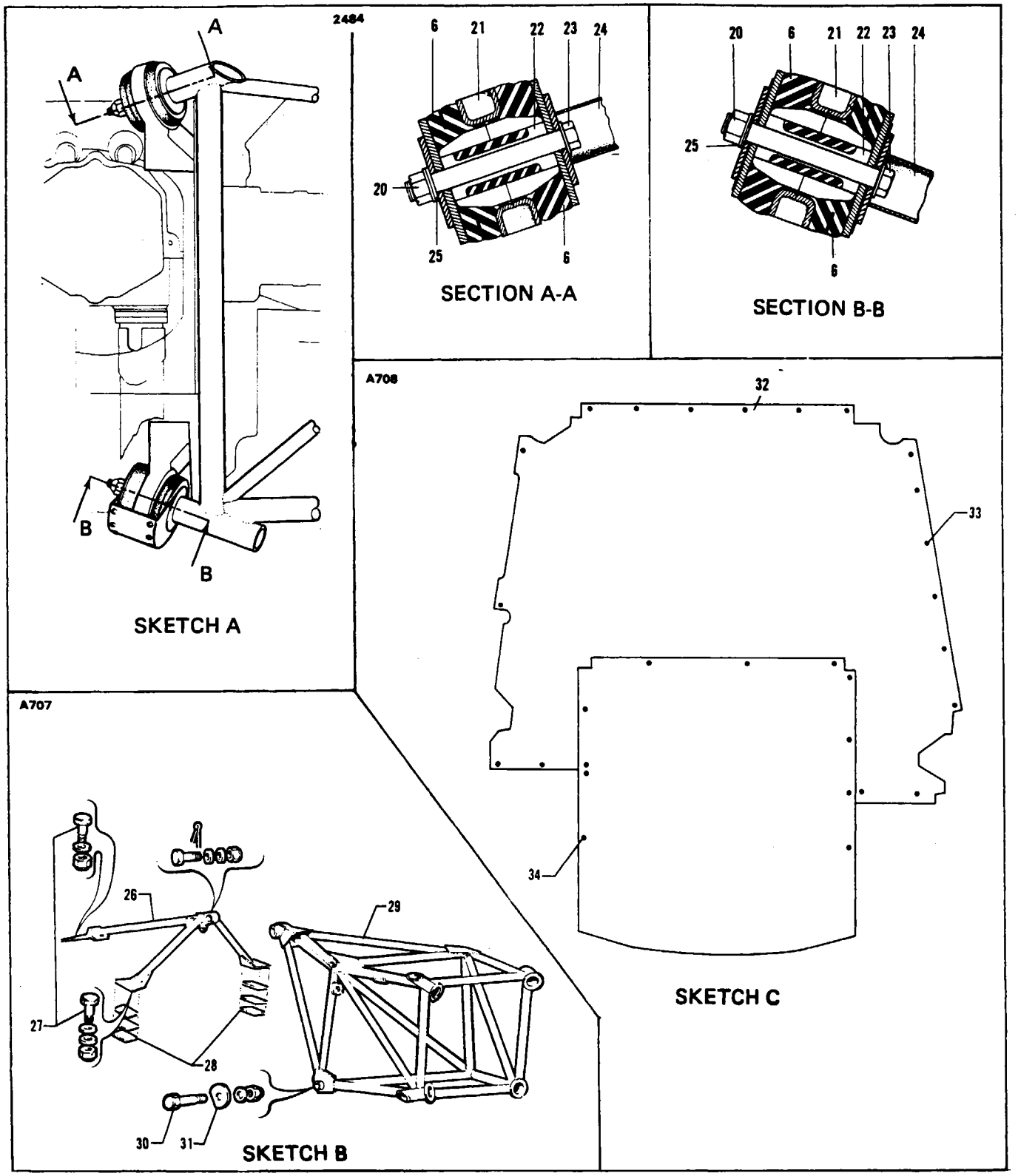


Figure 8-7. Engine Installation, PA-23-250 (six place)
Serial Nos. 27-2505 and up (cont.)

8-38. ENGINE SHOCK MOUNTS. Replace at engine T.B.O. or on condition.

NOTE

Reasons for replacing mounts on condition and prior to engine TBO are:

1. Severe cracking of rubber.
2. Signs of high temperature or burning.
3. Separation of rubber from metal surfaces.
4. Excessive "sag" or permanent deflection resulting in internal bottoming with spacer, engine and cowl interference, unusual vibration.

8-39. REPLACING ENGINE SHOCK MOUNTS. The engine shock mounts may be replaced with the engine installed as well as removed from the airplane. Refer to Figure 8-6 or 8-7 for the arrangement of the shock mount assemblies. On PA-23-250 (six place), Serial Nos. 27-2505 and up, the top mounts are assembled so the silver colored shocks are aft and the gold colored shocks are forward. The lower shock mounts are installed opposite of the top shock mounts. The procedure described in this paragraph is with the engine installed.

a. Remove the engine cowling. (Refer to Paragraph 8-6 or 8-7.)

b. Attach a one-half ton (minimum) hoist to the engine hoisting hooks and relieve tension from the shock mounts.

c. Loosen the upper shock mount attaching nuts.

d. Remove the lower mount attaching nuts, washers, heat shield, forward shock mounts and spacers.

e. Remove the lower attaching bolts just far enough to allow the aft shock mounts to be removed. The bushing in each lower mount must be removed with the bolt.

CAUTION

Care should be taken not to introduce adverse stresses on the control cables, electrical cables, hoses and other items attached to the engine while hoisting the engine.

f. Raise the nose of the engine enough to remove the lower aft shock mounts and replace with new ones.

g. Lower the engine, slide the attaching bolts with bushings into place and install the spacers, forward shock mounts, heat shield, washers and nuts. Start nuts only a few threads. Rotate the shield to provide greatest protection against exhaust heat.

h. Remove the upper mount attaching bolts, nuts, washers, forward shock mounts and spacers.

i. Lower the engine enough to replace the upper aft shock mounts. Raise the engine into position.

j. Install the spacers, forward shock mounts, mounting bolts, washers and nuts.

k. Tighten attaching bolts 34 to 42 foot-pounds.

8-40. CARBURETOR. (PA-23-250; PA-23-235; and PA-23-250 (six place), Serial Nos. 27-2000 to 27-2504 incl.)

8-41. CARBURETOR MAINTENANCE. In general, little attention is required between carburetor overhauls. However, it is recommended that the following items be checked during periodic inspection of the engine.

a. Check tightness and lockwire of all nuts and screws which fasten the carburetor to the engine.

b. Check all fuel lines for tightness and evidence of leakage.

c. Check throttle and mixture control rods and levers for travel, tightness and lockwiring.

d. Clean the fuel inlet screen. (Refer to Figure 8-8.)

e. Remove plug at aft position of carburetor and drain any accumulation of foreign matter.

f. Check carburetor air box for wear and full travel of heat door.

g. Check adjustment of idle mixture and idle speed.

8-42. REMOVAL OF CARBURETOR.

a. Ascertain that the fuel selector on the fuel control box inside the cabin is in the off position.

b. Remove the bottom section of the cowling as described in paragraph 8-6 or 8-7.

c. Disconnect the throttle and mixture control cables at the carburetor.

d. Disconnect the fuel lines at the carburetor.

e. Disconnect the air box by removing safety wire and cap bolts. Allow box to swing free of carburetor.

f. Remove the pal locknuts and nuts securing the carburetor to the engine.

g. Remove the carburetor.

8-43. INSTALLATION OF CARBURETOR.

a. Position the carburetor and a new gasket to the engine, and secure with nuts and pal locknuts.

b. Attach the carburetor air box with gasket and secure with cap bolts. Safety bolts with MS20995-C41 wire.

c. Connect the fuel lines to the carburetor.

d. Connect the throttle and mixture cables to the carburetor and adjust as described in paragraph 8-44.

e. Check adjustment of idle mixture as described in paragraph 8-45.

f. Check the adjustment of idling speed as described in paragraph 8-46.

g. Check the area around the carburetor for evidence of fuel leakage.

8-44. ADJUSTMENT OF THROTTLE AND MIXTURE CONTROLS. Throttle and mixture controls are adjusted so that when the throttle arm on the carburetor is rotated forward against its full throttle stop and the mixture control is rotated forward against its full rich stop, the cockpit control knob or lever of the throttle and mixture should have 0.062 of an inch springback when in the forward position.

a. The throttle may be adjusted as follows:

1. At the carburetor, disconnect the clevis end of the throttle control cable from the control arm. Loosen the jam nut that secures the clevis end.

2. Adjust the linkage by rotating the clevis end on the cable to obtain 0.062 of an inch springback when the control is in the forward position.

3. Reconnect the clevis end to the control arm and safety.

b. The mixture may be adjusted as follows:

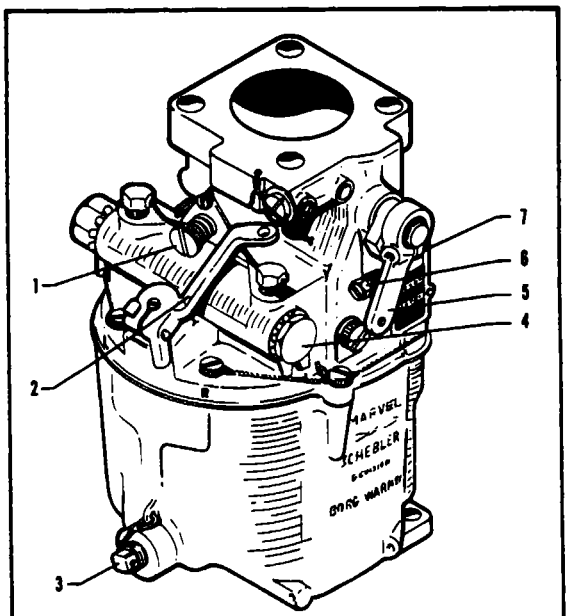
1. At the carburetor, loosen the swivel fitting that connects the wire of the control cable to the mixture arm.

2. Reposition the swivel fitting on the wire to obtain 0.062 of an inch spring back between the knob and plate when the mixture control arm is against its stop.

3. Tighten the swivel fitting and safety. The control wire should be straightened to align with the control cable casing after tightening the swivel fitting.

c. Check security of cable casing attachments.

d. Pull throttle and mixture knob in cockpit full aft to ascertain that the idle screw contacts its stop and the mixture control arm contacts its lean position.



1. IDLE MIXTURE ADJUSTMENT
2. MIXTURE CONTROL ARM
3. BOWL DRAIN
4. FUEL INLET SCREEN
5. THROTTLE ARM
6. IDLE ADJUSTMENT
7. ARM SET SCREW

Figure 8-8. Carburetor

8-45. ADJUSTMENT OF IDLE MIXTURE.

WARNING

When performing engine warm-up indoors, provide a barrier about the engine to prevent serious injury. Also, provide adequate means of ventilating the work area.

a. After performing the standard engine starting procedure, operate the engine for at least two minutes between 800 and 1200 RPM to insure proper engine warm-up.

b. Draw back on the cockpit throttle control lever to obtain a reading of approximately 550 RPM on the tachometer.

c. Turn the idle adjustment screw, located near the rear of the carburetor, clockwise, leaning the fuel mixture. Continue to do this until the engine begins to run roughly, at which time the engine speed will decrease.

d. Turn the screw counterclockwise until the engine runs smoothly again. Continue to turn the screw in the same direction until the engine begins to run roughly once more. At this point, the fuel mixture will be too rich and engine speed will decrease again.

e. Now advance the screw to a midway position between the lean and rich fuel mixture; the RPM of the engine will reach a maximum speed for idle mixture settings.

8-46. ADJUSTMENT OF ENGINE IDLING SPEED.

a. Pull back the cockpit throttle control lever until it is completely aft and in the closed position. Observe the engine speed on the tachometer.

b. Adjust the idle adjustment screw to obtain from 550 to 600 RPM. Rotate screw clockwise to increase the speed of the engine; counterclockwise to decrease engine speed. The screw is located on the throttle arm.

NOTE

One complete revolution of the carburetor idle screw provides a variation of approximately 100 RPM in idling speed.

8-47. FUEL INJECTOR. (Serial Nos. 27-2322 and up.)

CAUTION

Extreme caution should be exercised when handling or working around the injector to prevent oil or fuel from entering the air sections of the injector. As explained previously, damage to the air diaphragm will result. Fluid can easily enter the air section of the injector through the impact tubes or the annular groove around the venturi. For this reason, a protective plate should be installed on the scoop mounting flange when performing routine maintenance on the engine, such as washing down the engine and air scoop, servicing the air filter (surplus oil on the element), or when injecting preservative into the engine prior to storing or shipping.

8-48. FUEL INJECTOR MAINTENANCE.

a. In general, little attention is required between injector overhauls. However, it is recommended that the following items be checked during periodic inspection of the engine.

1. Check tightness and lock of all nuts and screws which fasten the injector to the engine.

2. Check all fuel lines for tightness and evidence of leakage. A slight fuel stain adjacent to the air bleed nozzles is not cause for concern.

3. Check throttle and mixture control rods and levers for tightness and lock.

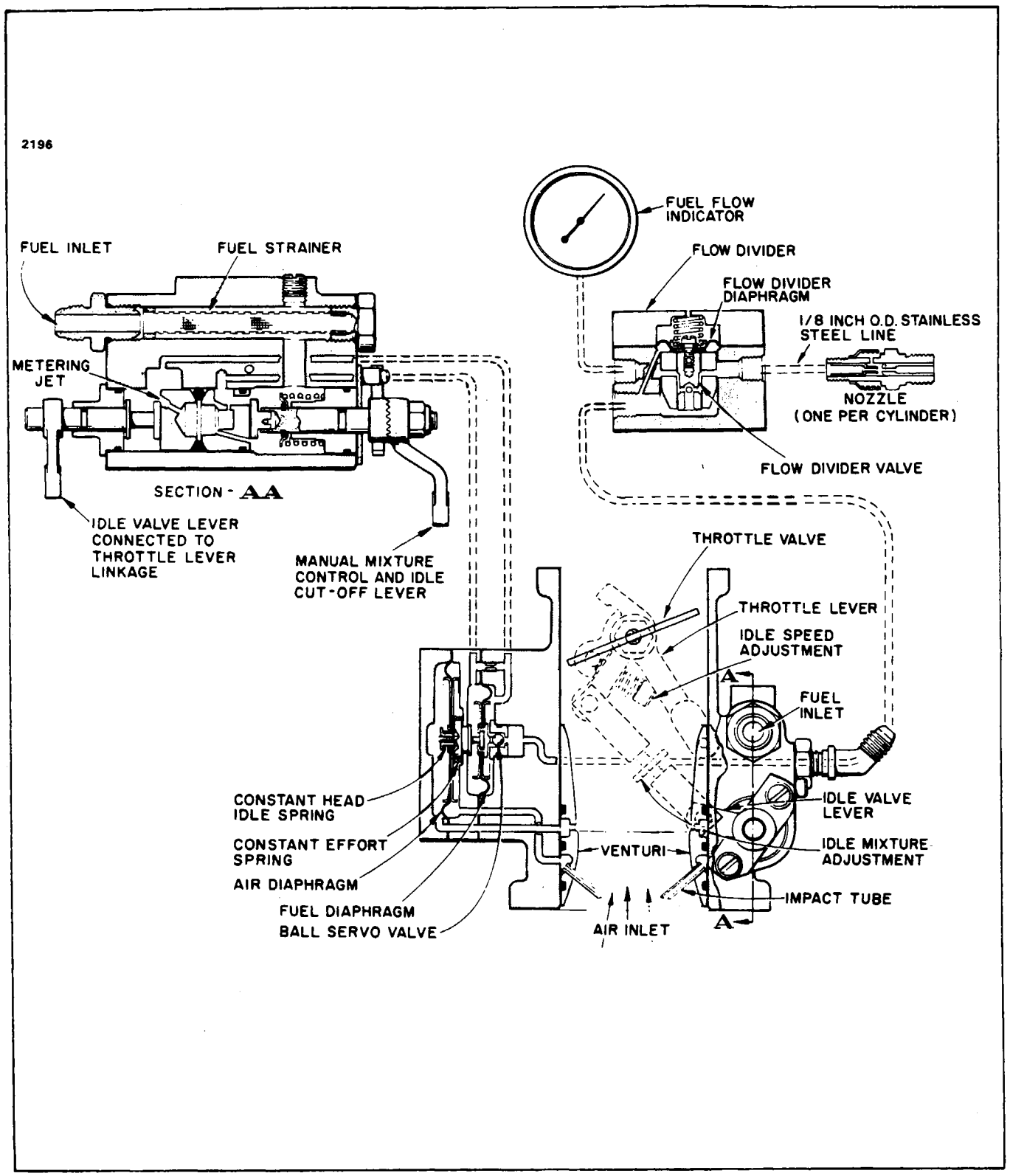


Figure 8-9. Schematic of RSA Fuel Injection System

4. Remove and clean the injector fuel inlet strainer at each 50 hour inspection. Damaged strainer "O" rings should be replaced.

b. Tests prove that gasoline which becomes stale due to prolonged storage absorbs oxygen rapidly. This stale oxidized gasoline acquires a very distinctive odor similar to varnish; causes rapid deterioration of synthetic rubber parts; and also forms a gummy deposit on the internal metal parts. This condition, however, does not occur during normal operation of the injector where fresh fuel is being constantly circulated.

8-49. LUBRICATION OF FUEL INJECTOR.

a. There is very little need for lubrication of the injector in the field between regular overhauls. However, the clevis pins used in connection with the throttle and manual mixture control levers should be checked for freedom of movement and lubricated, if necessary.

b. Place a drop of engine grade oil on the end of the throttle shaft in such a manner that it can work into the throttle shaft bushings.

8-50. REMOVAL OF FUEL INJECTOR, NOZZLE LINES, FUEL LINES AND FUEL FLOW DIVIDER.

a. Remove engine cowling. (Refer to Paragraph 8-6 or 8-7.)

b. Disconnect throttle and mixture control cables at the injector.

c. Remove air box by removing bottom access panel on the air box and remove four attaching screws holding air box to the injector unit.

d. Disconnect fuel inlet line at the injector.

e. Disconnect fuel outlet line to the flow divider at the injector.

f. Remove attaching nuts and remove injector unit.

g. Disconnect the nozzle lines from the air bleed nozzles.

h. Disconnect the fuel flow meter line at the rear baffle.

i. Disconnect the inlet fuel line at the flow divider.

j. Remove the two attaching bolts and remove fuel flow divider and nozzle lines as a unit.

k. Remove air bleed nozzles, (Refer to Paragraph 8-56.)

8-51. PREPARATION FOR STORAGE. Any unit taken out of service, or units being returned for overhaul, must be flushed with preserving oil (Specification MIL-O-6081, Grade 1010). using the following procedure:

CAUTION

Do not exceed air pressure given in step a, below as internal damage to the injector may result. See additional CAUTION in Paragraph 8-47.

a. Remove plugs and drain all fuel from the injector. If available, apply 10 to 15 psi air pressure to the fuel inlet until all fuel is discharged from the injector.

b. Replace plugs and apply flushing oil filtered through a 10-micron filter at 13 to 15 psi to the injector inlet until oil is discharged from the outlet.

c. Replace fuel inlet shipping plug.

d. After filling with preservative oil, the injector should be protected from dust and dirt and given such protection against moisture as climatic conditions at the point of storage require. In most cases, storing the unit in a dry area will be sufficient.

e. If the unit is to be stored near or shipped over salt water, the following precautions should be observed:

1. Spray the exterior of the injector with an approved preservative oil.

2. Pack in a dustproof container, wrap the container with moisture and vapor-proof material, and seal. Pack the wrapped unit in a suitable shipping case. Pack a one-half pound bag of silica gel crystals in the dustproof container with injector. The bag must not touch the injector.

CAUTION

Extreme caution should be exercised when handling or working around the injector to prevent oil or fuel from entering the air sections of the injector.

8-52. INSTALLATION OF FUEL INJECTOR.

a. Install air bleed nozzles. (Refer to Paragraph 8-58.)

b. Install fuel flow divider and nozzle lines, attach divider to the crankcase with attaching bolts and connect lines to nozzles.

c. Connect the inlet fuel line and fuel flow meter line.

d. Install a gasket and attach the injector unit to the engine sump with washers and nuts.

e. Install the air box with attaching bolts and attach bottom access plate with screws.

f. Connect the throttle and mixture control cables. Check and adjust controls as described in paragraph 8-53.

g. Connect the inlet and outlet fuel lines.

h. Install the cowling as described in paragraph 8-9 or 8-10.

i. Adjust the idle speed and mixture of the injector as described in paragraph 8-54.

8-53. ADJUSTMENT OF THROTTLE AND MIXTURE CONTROLS. The throttle and mixture controls are adjusted so that when the throttle arm on the injector is rotated forward against its full throttle stop and the mixture arm is rotated forward against its full rich stop, their respective cockpit control levers should be 0.062 to 0.125 of an inch in from their full forward stops, which are located in the control pedestal.

a. At the injector, disconnect the throttle and/or mixture control cable end from its control arm.

b. Loosen the jam nut securing the cable end.

c. Adjust the linkage by rotating the cable end to obtain the 0.062 to 0.125 of an inch spring back of the cockpit control lever when the throttle or mixture control arm contacts its stop.

d. Reconnect the cable end to its control arm and secure jam nut.

e. Pull the throttle and mixture control lever in the cockpit full aft to ascertain that the injector idle screw contacts its stop and the mixture control arm contacts its lean position.

8-54. ADJUSTMENT OF IDLE SPEED AND MIXTURE.

a. Start the engine and warm up in the usual manner until oil and cylinder head temperatures are normal.

b. Check magnetos. If the "mag-drop" is normal, proceed with idle adjustment.

c. Close the throttle to idle. If the RPM changes appreciably after making the idle mixture adjustment during the succeeding steps, readjust the idle speed to the desired RPM.

NOTE

The idle mixture must be adjusted with the fuel boost pump ON.

d. When the idling speed has been stabilized, move the cockpit mixture control lever with a smooth, steady pull toward the Idle Cut-Off position and observe the tachometer for any change during the "leaning" process. Caution must be exercised to return the mixture control to the Full Rich position before the RPM can drop to a point where the engine cuts out. An increase of more than 50 RPM

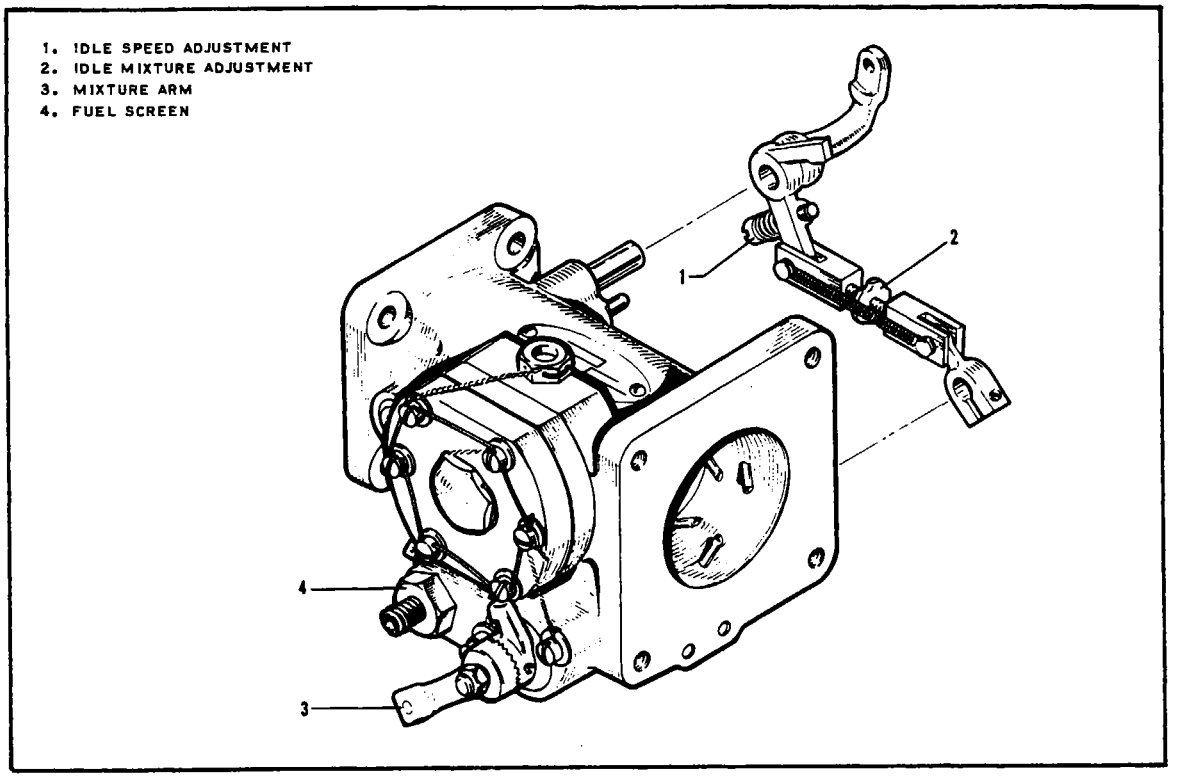


Figure 8-10. Fuel Injector

while "leaning out" indicates an excessively rich idle mixture. An immediate decrease in RPM (if not preceded by a momentary increase) indicates idle mixture is too lean.

e. If the above indicates that the idle adjustment is too rich or too lean, turn the idle mixture adjustment in the direction required for correction, and check this new position by repeating the above procedure. Make additional adjustments as necessary. Each time the adjustment is changed, the engine should be run up to 2000 RPM to clear the engine before proceeding with the RPM check. Make final adjustment of the idle speed adjustment to obtain from 550 to 600 RPM with closed throttle. The above method aims at a setting that will obtain maximum RPM with minimum manifold pressure. In case the setting does not remain stable, check the idle linkage; any looseness in this linkage would cause erratic idling. In all cases, allowance should be made for the effect of weather conditions and field altitude upon idling adjustment.

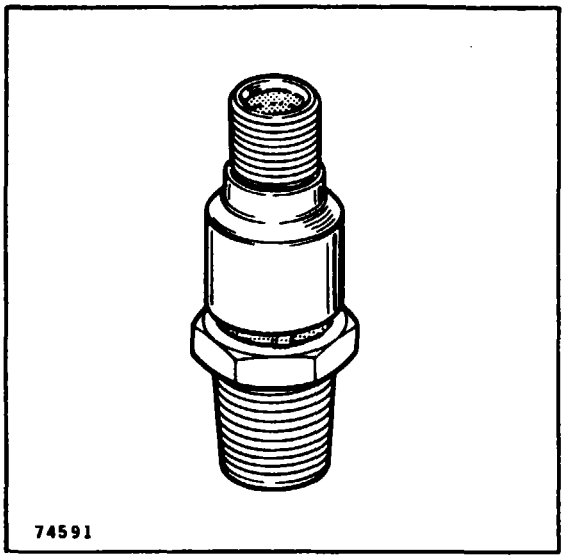


Figure 8-11. Fuel Air Bleed Nozzle

8-55. FUEL AIR BLEED NOZZLE.

8-56. REMOVAL OF FUEL AIR BLEED NOZZLE. The nozzles must be carefully removed as they or the cylinders may be damaged.

a. Remove the engine cowl. (Refer to paragraph 8-6 or 8-7.)

b. Disconnect the fuel line from the nozzle.

c. Carefully remove the nozzle, using the correct size deep socket.

d. Clean and inspect the nozzle as given in paragraph 8-57.

8-57. CLEANING AND INSPECTION OF FUEL AIR BLEED NOZZLE.

CAUTION

Do not immerse "O" rings in cleaning fluid. The rings may swell.

a. Clean the nozzle with acetone or equivalent and blow out all foreign particles with compressed air in the direction opposite that of the fuel flow. Do not use wire or other hard objects to clean orifices. (Refer to latest revision Lycoming Service Instruction No. 1275.)

b. Inspect the nozzle and cylinder threads for nicks, stripping or cross-threading.

c. Inspect for battered or rounded hexagons.

d. A test procedure for air bleed nozzles is described in latest revision Lycoming Service Instructions No. 1275.

8-58. INSTALLATION OF FUEL AIR BLEED NOZZLES.

a. It is important for the nozzles to be correctly positioned with the air bleed hole facing up.

b. Install the nozzles and tighten the nozzles to a little less than 60 inch-pounds torque.

c. Continue to tighten the nozzles until the letter or number stamped on the hex of the nozzle is facing down. In this position the air bleed hole will be facing up.

NOTE

Do not exceed 60 inch-pounds torque on nozzles when aligning air bleed hole.

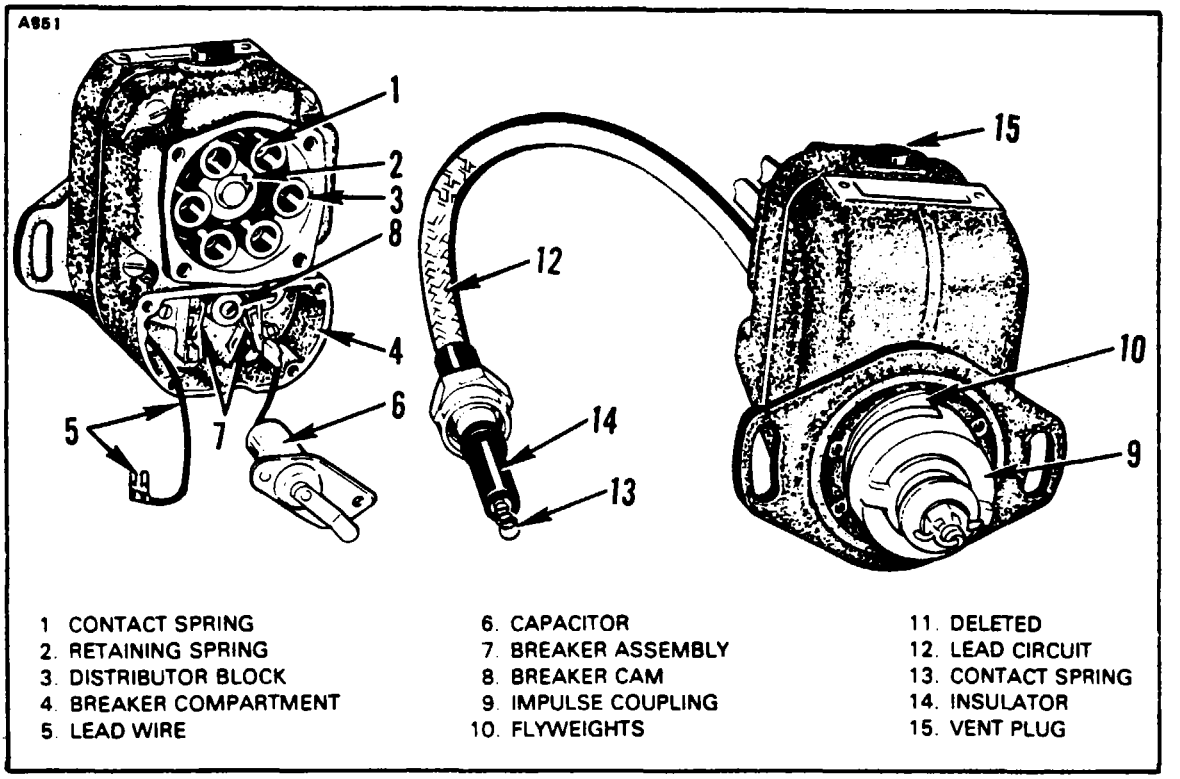


Figure 8-12. Magneto Inspection

CAUTION

Start the nozzle and line coupling by hand to prevent the possibility of cross-threading.

d. Connect the fuel line to the nozzle.
e. Install the engine cowl. (Refer to Paragraph 8-9 or 8-10.)

8-59. MAGNETO.

CAUTION

Ascertain that the primary circuits of both magnetos are grounded before working on the engine.

8-60. INSPECTION OF MAGNETOS. At time of engine inspection or when a magneto has been removed from the engine, the following checks may be performed. Each step in the checklist is keyed by number to a part shown in Figure 8-12.

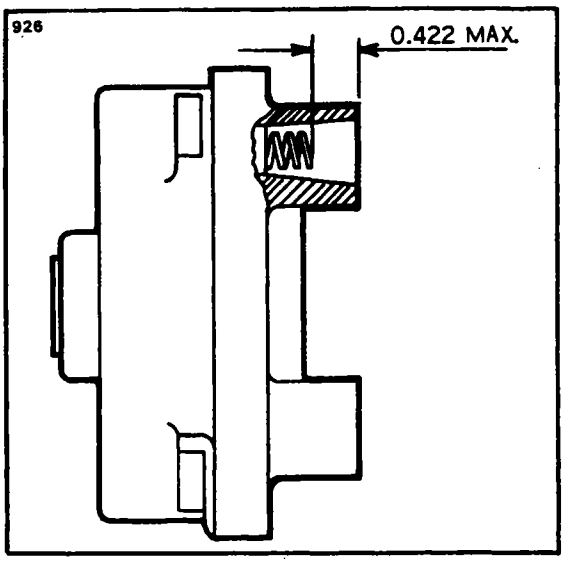


Figure 8-13. Contact Spring Inspection

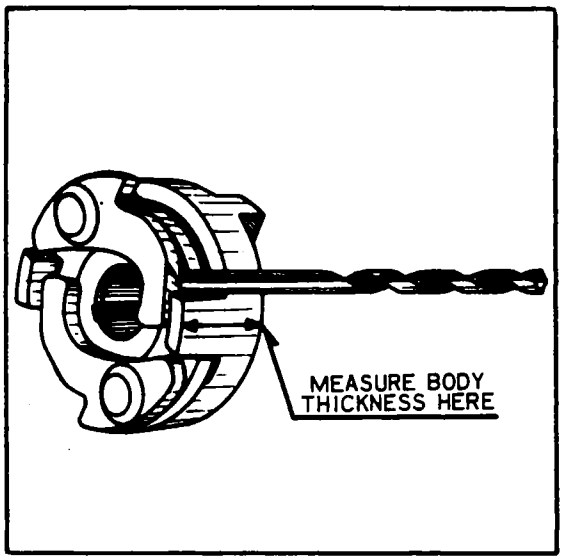


Figure 8-14. Impulse Coupling

a. Inspect distributor block contact springs. Top of spring must not be more than 0.422 inches below top of tower. (Refer to Figure 8-13.) If broken or corroded, they should be replaced.

b. Inspect oil felt washer. It should be saturated with oil. If dry, check for worn bushing. If O.K., add No. 30 oil.

c. Inspect distributor block for cracks or burned areas. The wax coating on the block should not be removed. Do not use solvents.

d. Look for excess oil in breaker compartment. If present, it may mean a bad oil seal or oil seal bushing at drive end. Check manufacturer's overhaul procedure.

e. Look for frayed insulation or broken wire strands in leads in back of magneto. See that terminals are secure. Be sure wires are properly positioned.

f. Inspect capacitor visually. If possible, test for leakage, capacity and series resistance. Remember, an electrical failure of an aircraft capacitor is rare.

g. Adjustment of breakers must be correct for proper internal timing of magneto. (Refer to paragraph 8-62.)

h. Check if breaker cam is clean and smooth, if cam screw is tight (25 inch-pounds). If new points are installed, blot a little oil on cam.

i. Inspect impulse coupling (-21 magneto) flyweights for excessive looseness on the axles. Design couplings having 0.927 inch thick body are checked with a 1/8 drill. Couplings having 0.974 inch thick body are checked with a No. 18 drill. If drill fits between cam and flyweight, the fit is too loose and coupling should be replaced. (Refer to Figure 8-14.)

j. Check impulse coupling for excess wear on the contact edges of body and flyweights.

k. Check that the impulse coupling flyweight axle rivets are tight and there are no cracks in body.

l. Look at the lead conduits. A few broken strands won't hurt, but if the insulation looks tired, you may be in for trouble. The special high temperature coating, used on lightweight harnesses, is provided chiefly for vibration resistance and mechanical protection. The integrity of the harness is not sacrificed if small areas of the braid show peeling or flaking of this coating.

m. Check the springs for breaks, corrosion or deformation. If possible, check continuity from block with tester or light.

n. Check insulators for cracks, breaks, or evidence of "old age." Be sure they are clean.

o. Timing and ventilator plugs. Ventilator has drilled holes and should be in lowest hole in magneto to serve also as drain for excess water or oil. Solid plug is used in other hole or in location exposed to rain or water.

NOTE

The magneto service instructions in this manual are to cover minor repairs and timing. For further repairs and adjustments of the magnetos, it is recommended that the manufacturer's service instructions be followed.

8-61. REMOVAL OF MAGNETO. Before removing the magneto, make sure magneto switches are off.

a. Remove the engine access plates from the side of the engine to be worked on.

b. On PA-23-250; PA-23-235; and PA-23-250 (six place) airplanes, Serial Nos. 27-2000 to 27-2504 inclusive, remove the magneto cooling baffles.

WARNING

The magneto is not internally grounded; when the ground lead is disconnected, the magneto is hot. Removing the harness assembly terminal plate first and installing them last minimizes the danger of starting the engine accidentally when the ground lead is removed from the magneto.

c. Remove the harness assembly terminal plate from the magneto.

d. Disconnect the ground leads from the left and/or right magneto and, where applicable, the retard spark lead on the left magneto, at the magneto.

e. Remove the nuts and washers and draw the magneto from the engine.

8-62. TIMING PROCEDURE. (Internal Timing) (-20 and -200 Series Magnetos). When installing new or adjusting breaker points and before timing the magneto to the engine, it is important that the internal timing of the magneto be correct.

a. Timing procedures for magnetos without timing marks in the breaker compartment.

1. Attach a timing template and pointer as follows:

(a) Using two 8-32 RH screws 1/4 inch long, secure timing template to bottom of breaker housing. (Refer to Figure 8-17.)

(b) Attach a pointer to the magneto cam.

NOTE

A timing kit, including timing plate, etc., may be purchased through the engine or magneto manufacturer.

NOTE

A pointer may be formed as shown in Figure 8-16 using soft wire. Solder formed wire to a flat washer similar to the one used with cam screw. A pointer can also be made by wrapping a piece of soft wire tightly around the head of the cam securing screw and bending it to extend to the timing template. Position pointer at the zero mark when rotor is in its neutral position.

2. Remove the timing inspection plug from the top of the magneto. Turn rotating magnet in its direction of rotation until the painted chamfered tooth on the distributor gear is approximately in center of inspection window. Then turn it back until rotating magnet locates in its neutral position.

3. Remove cam screw and flat washer from cam shaft if pointer was fabricated as in preceding note. Holding magnet in neutral position, install timing pointer on cam shaft so it indexes with the 0 degree mark on the timing plate. Secure pointer in this position with cam screw.

4. Turn rotating magnet in proper rotation until pointer indexes with the respective 10 degree mark ("E" gap). Using the timing light, adjust main breaker contacts to open at this point. Turn rotating magnet until breaker cam follower is on the high point of the cam lobe. Measure contact clearance. It must be 0.018 ± 0.006 of an inch. If not, readjust breaker and recheck to be sure that contacts will open within "E" gap tolerance of $\pm$ 4 degrees. Replace breaker assembly if "E" gap tolerance and contact clearance cannot be obtained.

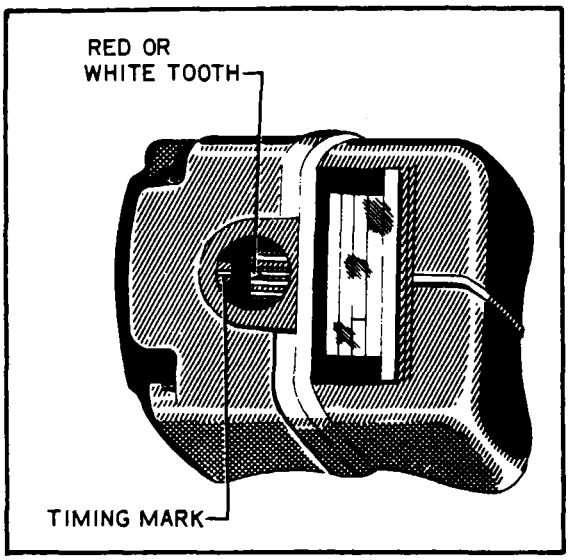


Figure 8-15. Magneto Timing Marks

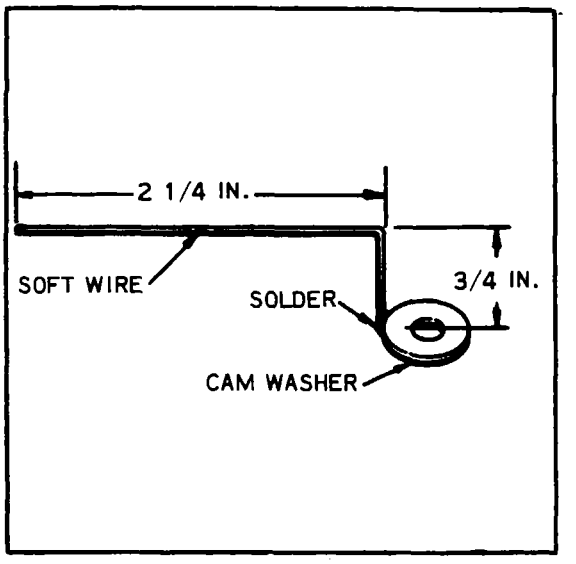


Figure 8-16. Timing Pointer

5. On retard breaker magnetos, the retard breaker is adjusted to open 37.5 degrees after the main breaker opens within +2 -0 degrees. The degree of retard for any particular magneto is stamped in the bottom of the breaker compartment for convenience. At the exact point of main breaker opening, note the degree reading. Add the degrees retard to this noted reading to determine retard breaker opening point. Using the timing light, adjust retard breaker to open at this point +2 -0 degrees. Measure contact clearance. It must be 0.018 $\pm$ 0.006 of an inch. If not, readjust breaker and recheck to be sure that contacts will open within retard degree tolerance. Replace breaker assembly if retard degree tolerance and contact clearance cannot be obtained. Remove pointer and replace flat washer, lockwasher and screw. Torque to 16 to 20 inch-pounds.

b. Timing procedure for magnetos incorporating timing marks in the breaker compartment.

1. On each side of the breaker compartment there are timing marks indicating "E" gap and various degrees of retard breaker timing. The marks on the left hand side, viewed from the breaker compartment, are for clockwise rotation. The marks on the right hand side are for counterclockwise rotation. The timing marks indicate "O" position, "E" gap and various degrees of magneto retard. The point in the center of the "E" gap boss indicates the exact "E" gap position. The width of the boss on either side of the point is the allowable tolerance of $\pm$ 4 degrees. (Refer to Figure 8-18.) In addition to these marks, some cams have an indented line across their end for locating "E" gap position of the rotating magnet when aligned with the mark at the top of the breaker housing.

2. If the cam does not have an indented line across its end, proceed as follows:

(a) Turn rotating magnet in direction of rotation until painted chamfered tooth on distributor gear is approximately in center of inspection window. Then turn rotating magnet back until it locates in its neutral position.

(b) Attach a pointer. A pointer may be fabricated as shown in Figure 8-16. Remove cam screw and flat washer from cam. Holding magnet in neutral position, install pointer on cam shaft so it indexes with the 0 degree mark. Secure pointer in this position with cam screw.

(c) Turn rotating magnet in proper rotation until pointer indexes with "E" gap mark. At this point, scribe a line on end of cam so it indexes with mark at top of breaker compartment. Remove cam from magnet shaft. Using a three corner file, file an indent on scribe mark at end of cam.

(d) Install cam, pointer and cam screw to magnet shaft and time magneto in accordance with the following paragraphs.

3. Turn rotating magnet in direction of rotation until painted chamfered tooth of distributor gear is just becoming visible in timing window. Continue turning rotating magnet until line on end of cam is aligned with the mark at top of breaker housing.

4. Attach a pointer. A formed pointer is installed by removing cam screw and flat washer from cam shaft of magneto and install pointer.

NOTE

A pointer can be made by wrapping a piece of soft wire tightly around the head of cam securing screw and bending to extend over timing marks in breaker compartment.

5. With indented slot on cam aligned to the mark at top of breaker compartment and with painted chamfered tooth on distributor gear visible in timing window, set pointer on the "E" gap mark on side of breaker compartment. (The magnet is at its exact "E" gap position.) Connect the timing light across main breaker. Adjust main breaker contacts to open at this point. Turn magnet until cam follower is on the high point of the cam lobe. Measure contact clearance. It must be 0.018 ± 0.006 of an inch. If necessary, readjust breaker and recheck to be sure that contacts will open within "E" gap tolerance. Replace breaker assembly if "E" gap tolerance and contact clearance cannot be obtained.

6. On retard breaker magnetos, the retard breaker is set to open a predetermined number of degrees after the main breaker opens within +2 -0 degrees. The degree of retard for any particular magneto is stamped in the lower portion of left hand side of the breaker compartment. (Refer to Figure 8-18.) Move the

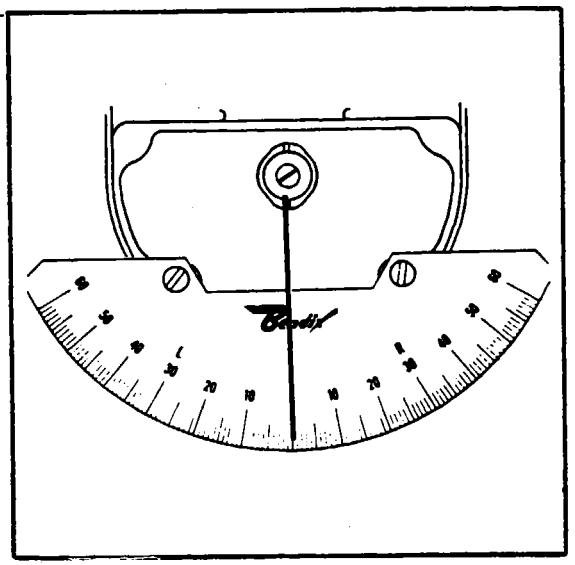


Figure 8-17. Timing Kit Installed

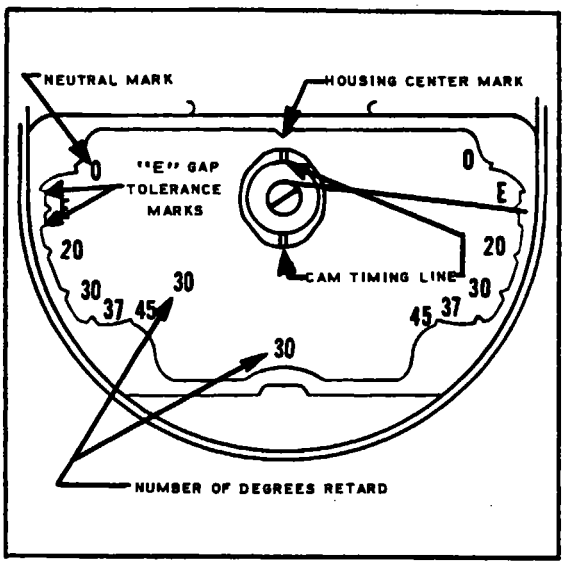


Figure 8-18. Breaker Compartment With Cast Timing Marks

rotating magnet back to the point of main breaker opening. Hold the magnet in this position and move pointer to the "O" mark. Now turn magnet until pointer is over the required retard degree mark. Using the timing light, adjust retard breaker contacts to open at this point. A tolerance of .062 of an inch past the point can be used to get proper contact clearance. Continue turning magnet until cam follower is on the high point of the lobe. Measure contact clearance. It should be 0.018 $\pm$ 0.006 of an inch. If not, readjust breaker and recheck to be sure that contacts will open within retard degree tolerance. Replace breaker assembly if retard degree tolerance and contact clearance cannot be obtained.

8-63. INSTALLATION AND TIMING PROCEDURE. (Timing Magneto to Engine.)

a. Remove a spark plug from No. 1 cylinder and turn crankshaft in direction of normal rotation until the compression stroke is reached.

b. Continue turning the crankshaft until the advance timing mark on the starter ring gear is in alignment with the small hole located on the top face of the starter housing at the two o'clock position. (Refer to Figure 8-19.)

c. Remove the inspection plug on the left magneto and turn the drive coupling in direction of normal rotation until the first painted chamfered tooth is aligned in the center of the inspection hole. (Refer to Figure 8-15.) Without allowing the gear to turn from this position, assemble gasket and magneto to the engine. Secure in place with washers and nuts; tighten only finger tight.

d. Fasten ground wire of electric timing light to any unpainted portion of the engine, and one of the positive wire of the timing light to a suitable terminal connected to the ground terminal of the magneto. Then turn the engine crankshaft several degrees from the advance timing mark in direction opposite to that of normal rotation.

NOTE

Impulse Coupling Magneto - The crankshaft should not be rotated more than 35^{o} in direction opposite normal rotation, as the pawl on the impulse coupling will engage with the stop pin and late timing will be indicated through the impulse coupling mechanism. If this should happen, rotate engine in direction of normal rotation until sharp click is heard, which will indicate that impulse coupling has passed through firing position; then turn crankshaft in direction opposite normal rotation to approximately 35^{o} before top center and proceed with timing check.

e. Turn on the switch of the timing light, which should be lit. Turn the crankshaft slowly in direction of normal rotation until the mark on the starter gear aligns with the hole in the starter housing, at which point the light should go out. If not, turn the magneto in its mounting flange and repeat the procedure until the light goes out. Repeat the same procedures with the right magneto.

NOTE

Battery powered timing lights operate in the reverse manner from that described above; the light goes on when the marks align.

f. After both magnetos have been timed, leave the timing light wires connected and recheck magnetos as previously described to make sure that both magnetos are set to fire together. If timing is correct, both timing lights will go out simultaneously when the timing marks are in alignment. Tighten nuts to specified torque.

g. After magnetos have been properly timed, replace breaker cover and secure.

h. Install the ground lead on both magnetos and the retard spark lead, if required, on the left magneto.

i. Place the harness terminal plate on the magneto and tighten nut around the plate alternately to seat cover squarely on magneto. Torque nuts to 18 to 22 inch-pounds.

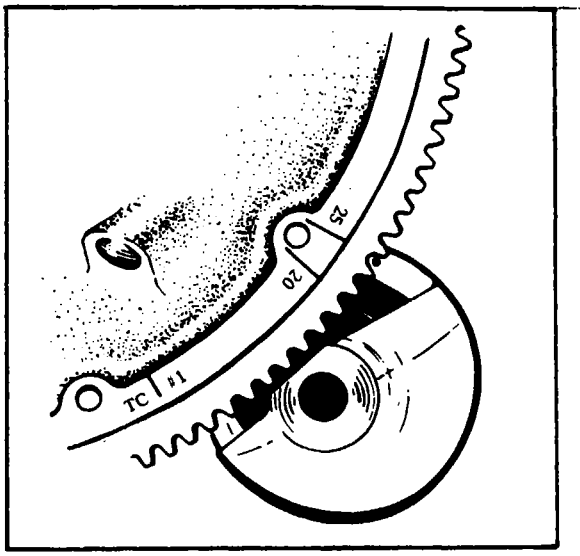


Figure 8-19. Engine Timing Marks

8-64. HARNESS ASSEMBLY.

8-65. INSPECTION OF HARNESS.

a. Check lead assemblies for nicks, cuts, mutilated braiding, badly worn section or any other evidence of physical damage. Inspect spark plug sleeves for chafing or tears and damaged or stripped threads on coupling nuts. Check compression spring to see if it is broken or distorted. Inspect grommet for tears. Check all mounting brackets and clamps to see that they are secure and not cracked.

b. Using an ohmmeter, buzzer, or other suitable low voltage device, check each lead for continuity. If continuity does not exist, wire is broken and must be replaced.

c. Minor repair of the harness assembly, such as replacement of contact springs, spring retainer assemblies, insulating sleeves or of one lead assembly, can be accomplished with the harness assembly mounted on the engine. However, should repair require replacement of more than one lead assembly or of a cable outlet plate, the harness should be removed from the engine and sent to an overhaul shop.

8-66. REMOVAL OF HARNESS.

a. Disconnect the clamps that secure the wires to the engine and accessories.

b. Loosen the coupling nuts at the spark plugs and remove the insulators from the spark plug barrel well. Use caution when withdrawing the insulator not to damage the insulator spring.

c. Place a guard over the harness insulators.

d. Remove the harness assembly terminal plate from the magneto.

e. Remove the engine baffle plate that receives the harness assembly.

f. Remove the harness from the airplane.

8-67. INSTALLATION OF HARNESS. Before installing harness on magneto, check mating surfaces for cleanliness. Spray entire face of grommet with a light coat of Plastic Mold Spray, SM-O-O-TH Silicone Spray or equivalent. This will prevent harness grommet from sticking to magneto distributor block.

a. Place the harness terminal plate on the magneto and tighten nuts around the plate alternately to seat cover squarely on magneto. Torque nuts to 18 to 22 inch-pounds.

b. Route ignition wires to their respective cylinders.

c. Clamp the harness assembly in position and replace the engine baffle plate.

d. Connect the leads to the spark plugs.

8-68. SPARK PLUGS.

8-69. REMOVAL OF SPARK PLUGS.

a. Loosen the coupling nut on the harness lead and remove the terminal insulator from the spark plug barrel well.

NOTE

When withdrawing the ignition cable lead connection from the plug, care must be taken to pull the lead straight out and in line with the center line of the plug barrel; otherwise, a side load will be applied which frequently results in damage to the barrel insulator and connector. If the lead cannot be removed easily in this manner, the resisting contact between the neoprene collar and the barrel insulator will be broken by a rotary twisting of the collar. Avoid undue distortion of the collar and possible side loading of the barrel insulator.

b. Remove the spark plug from the engine. In the course of engine operation, carbon and other combustion products will be deposited on the end of the spark plug and will penetrate the lower threads to some degree. As a result, greater torque is frequently required for removing a plug than for its installation. Accordingly, the torque limitations given do not apply to plug removal and sufficient torque must be used to unscrew the plug. The higher torque in removal is not as detrimental as in installation, since it cannot stretch the threaded section. It does, however, impose a shearing load on this section and may, if sufficiently severe, produce a failure in this location.

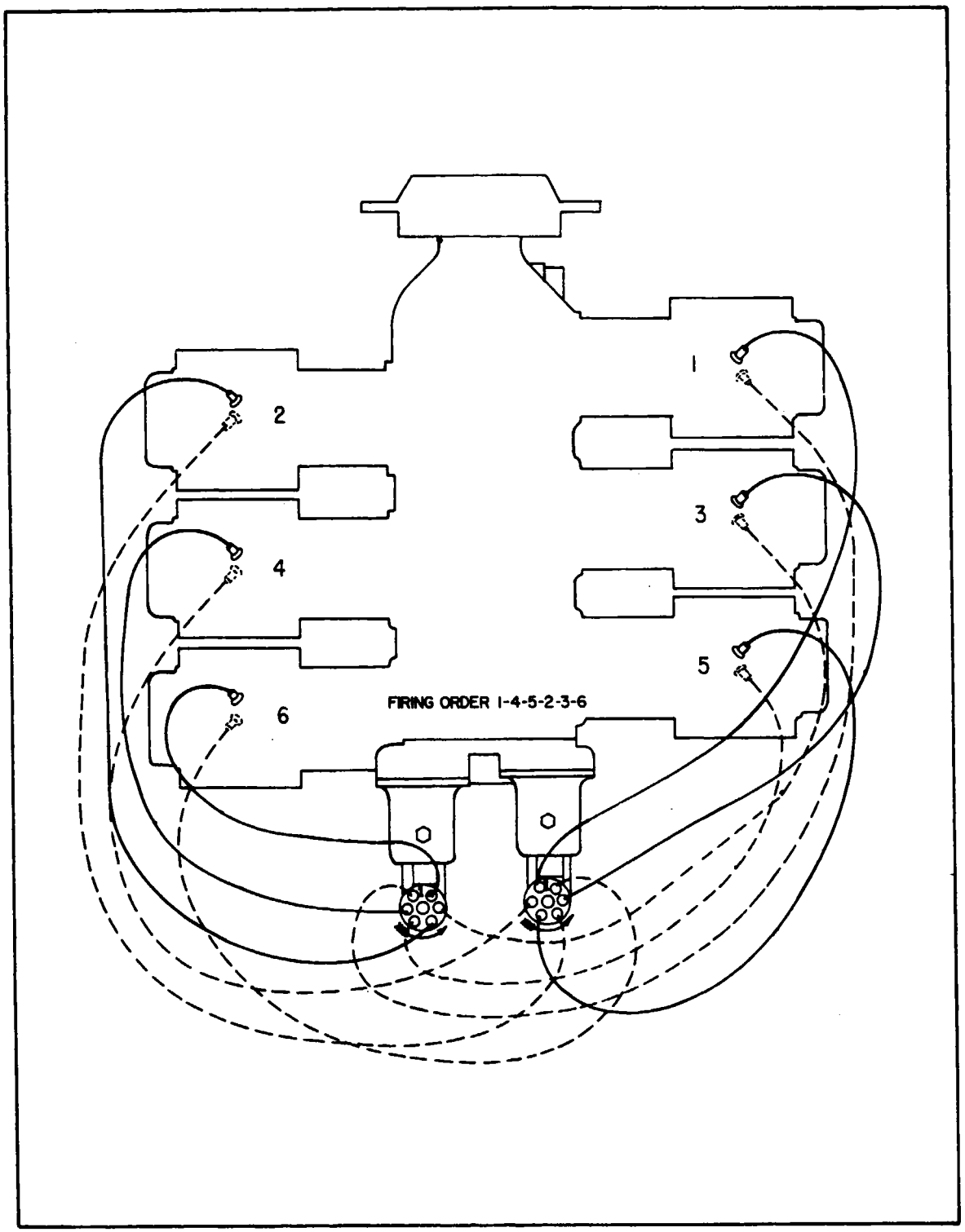


Figure 8-20. Ignition System Schematic

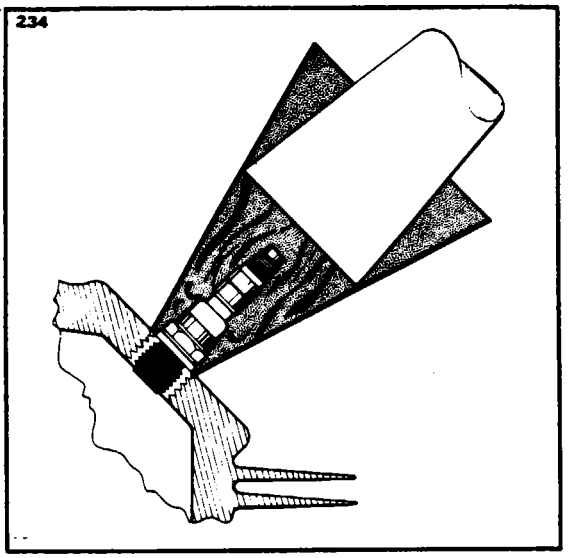


Figure 8-21. Removing Spark Plug Frozen to Bushing

NOTE

Torque indicating handle should not be used for spark plug removal because of the greater torque requirement.

c. Place spark plugs in a tray that will identify their position in the engine as soon as they are removed.

NOTE

Spark plugs should not be installed if they have been dropped.

d. Removal of seized spark plugs in the cylinder may be accomplished by application of liquid carbon dioxide by a Conical metal funnel adapter with a hole at the apex just large enough to accommodate the funnel of a CO_2 bottle. (Refer to Figure 8-20.) When a seized spark plug cannot be removed by normal means, the funnel adapter is placed over and around the spark plug. Place the funnel of the CO_2 bottle inside the funnel adapter and release the carbon dioxide to chill and contract the spark plug. Break the spark plug loose with a wrench. A warm cylinder head at the time the carbon dioxide is applied will aid in the removal of an excessively seized plug.

e. Do not allow foreign objects to enter the spark plug hole.

8-70. INSPECTION AND CLEANING OF SPARK PLUG.

a. Visually inspect each spark plug for the following non-repairable defects:

1. Severely damaged shell or shield threads nicked up, stripped or cross-threaded.
2. Badly battered or rounded shell hexagons.
3. Out-of-round or damaged shielding barrel.
4. Chipped, cracked or broken ceramic insulator portions.
5. Badly eroded electrodes worn to approximately 50% of original size.

b. Clean the spark plug as required, removing carbon and foreign deposits.

c. Test the spark plug both electrically and for resistance.

d. Set the electrode gap. (Refer to latest revision Lycoming Service Instruction 1042.)

8-71. INSTALLATION OF SPARK PLUGS. Before installing spark plugs, ascertain that the threads within the cylinder are clean and not damaged.

a. Apply anti-seize compound sparingly on the upper threads. Do not apply anti-seize compound on bottom two threads to prevent plug failure. Install gasket and spark plugs. Torque 360 to 420 inch-pounds.

CAUTION

Make certain the deep socket is properly seated on the spark plug hexagon as damage to the plug could result if the wrench is cocked to one side when pressure is applied.

b. Insure terminal insulator is free of carbon and dirt and carefully insert in the spark plug and tighten the coupling nut.

8-72. STARTING VIBRATOR. (14 and 28-Volt System)

8-73. STARTING VIBRATOR CHECKING PROCEDURE.

a. Disconnect all spark plug leads from the left magneto at the spark plugs.

WARNING

Be sure all left magneto spark plug leads are removed, thus preventing cross-firing of the magneto and the possibility of hazardous conditions.

b. Rotate engine crankshaft until number one cylinder is in its retard firing position. Using the timing light, check to see that both magneto contact assemblies are open.

c. Disconnect left starter solenoid terminal wire, coded in electrical schematics P20A.

WARNING

It is necessary that the starter be electrically removed from the circuit before the vibrator is put into operation to eliminate possibility of starter being energized during the test.

d. Place left magneto switch in its ON position.
e. Hold left starter switch in the energized position.
f. Holding the number one cylinder spark plug lead approximately 0.187 to 0.250 of an inch away from a good ground, a series of hot sparks should occur.

WARNING

Grasp the spark plug lead far enough away from the connection so as not to produce any dangerous electrical shock.

g. If the spark does not jump the gap, check the applied voltage to the starting vibrator. This voltage should be 14 or 28-volts depending on the electrical system installed in the airplane.
h. If voltage is correct, check the contact points of the magneto. Both sets of contact points shall be opened.
i. Reject all units not complying with the preceding requirements or which show any visual defects.

8-74. REMOVAL OF STARTING VIBRATOR.
a. Remove the left access panel to the nose section interior at station 70.0.
b. The starter vibrator is attached to the extreme left front side of the forward fuselage bulkhead at station 81.0.

NOTE

Make note of positions of the wires before disconnecting electrical leads to facilitate reinstallation.

c. Disconnect the electrical leads from the vibrator.
d. Remove the vibrator from the bulkhead by removing the attachment screws.

8-75. INSTALLATION OF STARTING VIBRATOR.
a. Position the vibrator on the bulkhead and secure with screws.
b. Connect the electrical leads to the vibrator.

NOTE

On 28-volt electrical system only, make sure that the lead with the red marker has been put on the "IN" terminal of the starting vibrator.

c. Check operation per Pargaraph 8-73.
d. Install access panel.

8-76. LUBRICATION SYSTEM.

8-77. ADJUSTMENT OF OIL PRESSURE RELIEF VALVE. The O-540 and IO-540 series engines are equipped with either a non-adjustable or adjustable oil pressure relief valve located above and to the rear of number 5 cylinder. A brief description and setting procedure for both types follows:

a. Oil Relief Valve (Non-Adjustable): The function of the oil pressure relief valve is to maintain engine oil pressure within specified limits (60 psi, min. to 90 psi, max.). This valve is not adjustable; however, the pressure can be controlled by the addition of a maximum of three STD 425 washers under the cap to increase pressure or the use of a spacer (Lyc. P/N 73629 or 73630) under the cap to decrease pressure. Particles of metal or other foreign matter lodged between the ball and seat will result in a drop in oil pressure. It is advisable, therefore, to disassemble, inspect and clean the valve if excessive pressure fluctuations are noted. The oil pressure relief valve is not to be mistaken for the oil cooler by-pass valve, whose function is to permit pressure oil to by-pass the oil cooler in case of an obstruction in the oil cooler.

b. Oil Relief Valve (Adjustable): The adjustable oil relief valve enables the operator to maintain engine oil pressure within the specified limits (60 psi, min. to 90 psi, max.). If the pressure under normal operating conditions should consistently exceed the maximum or minimum specified limits, adjust the valve as follows:

With the engine warmed up and running at approximately 2000 RPM, observe the reading on the oil pressure gauge. If the pressure is above maximum or below minimum specified limits, stop engine and screw the adjusting screw out to decrease pressure and in to increase pressure. Depending on installation, the adjusting screw may have only a screwdriver slot and is turned with a screwdriver; or may have the screwdriver slot plus a pinned 0.375-24 castellated nut and may be turned with either a screwdriver or a box wrench.

8-78. INSTALLATION OF OIL COOLER.

a. When installing fittings in the oil coolers, care should be used to prevent excessive torque being applied to the cooler. When a rectangular fitting boss is provided, backup wrench should be used, employing a scissor motion, so that no load is transmitted to the cooler. When the oil cooler has a round fitting boss, care should be taken not to permit excessive torque on the fitting.

b. If a pipe thread fitting is used, it should be installed only far enough to seal with sealing compound.

c. Apply Lubon No. 404 to all male pipe thread fittings; do not allow sealant to enter the system.

d. If fitting cannot be positioned correctly using a torque of 10 to 15 foot-pounds, another fitting should be used.

e. When attaching lines to the cooler, backup wrench should be used.

f. After installation, inspect the cooler, for distorted end cups.

g. Run-up engine. After run-up, check for oil leaks.

8-79. CHECKS AND ADJUSTMENTS OF BALL JOINT EXHAUST SYSTEM. (Refer to Figure 8-22.) Refer to the latest revision of Piper S/B No. 662.

a. Remove both engine cowls. (Refer to Section VIII, Paragraph 8-7.)

b. Visually inspect both outboard exhaust stacks for alignment of ball joint tubes, crossover tubes, and for any cracks which may have developed in the welds.

c. The centerline of the short slip joint tube on the tail pipe must be parallel with the centerline of the tail pipe tube. (Remove the figure eight clamp.)

NOTE

If the checks described in Step c show any misalignment between the two tubes or cracks at any of the welds, the tail pipe assembly should be replaced.

d. The centerline of the ball joints must match the centerline of the mating tubes.

e. If the ball joints are not properly aligned, remove the outboard exhaust stacks and crossover tube to properly realign the stacks.

NOTE

To facilitate alignment, the complete exhaust system should be loosened.

CAUTION

Use a strip of masking tape to show the reference mark. Do not scribe a reference mark or use a grease pencil, as this could cause a weak spot or hot spot on the tube.

f. Clean and apply Fel-Pro C5A High Temperature Anti-seize Compound to both ends of the crossover tube and its mating slip joint, covering approximately two inches of both pieces. To determine that the slip joints are installed properly, insert the crossover tube into the slip joints as far as it will go, then place a reference mark of masking tape on the tube, in line with the end of the slip joint. Separate the slip joints, measure and record the engagement dimensions.

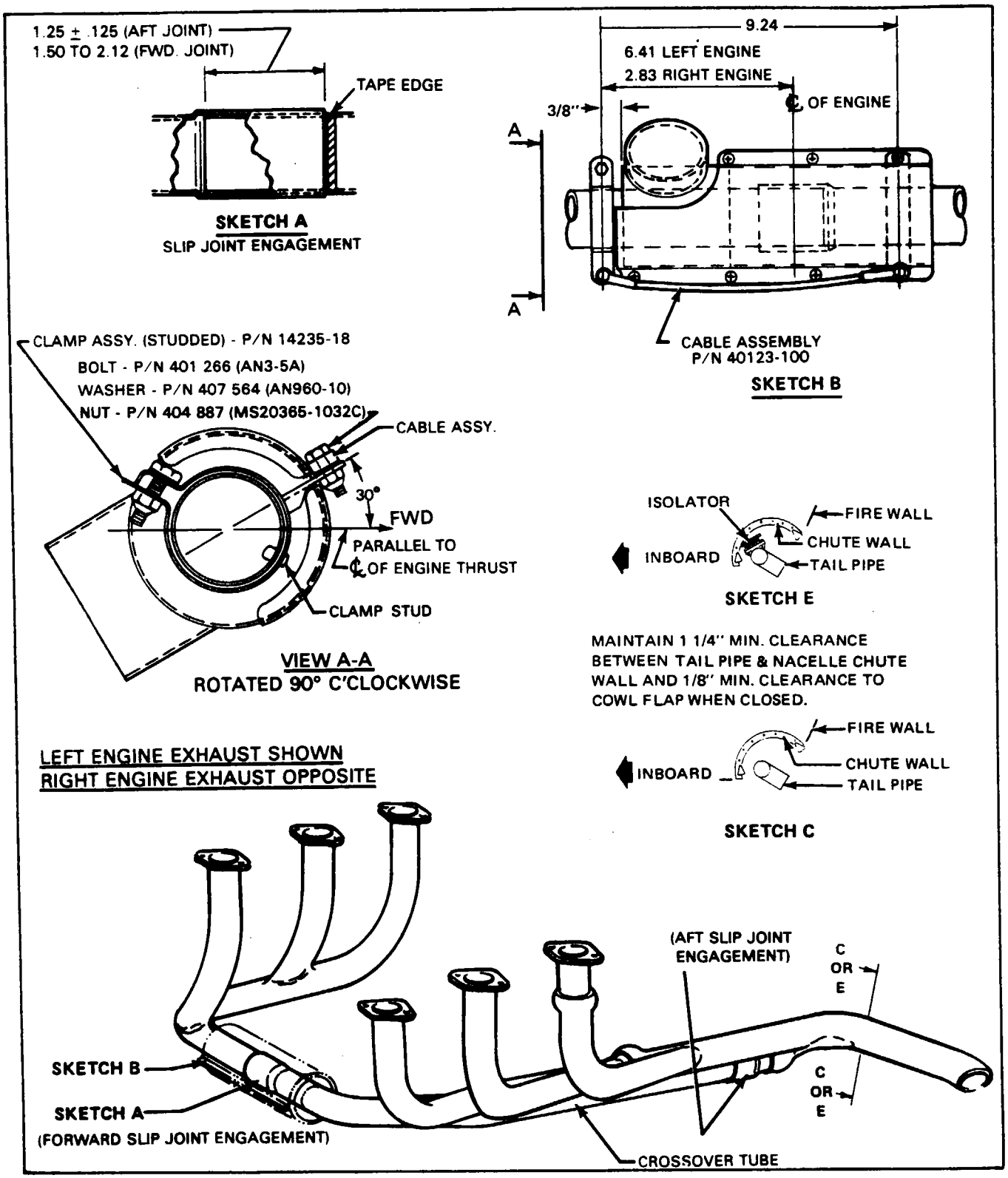


Figure 8-22. Adjustment of Ball Joint Exhaust System

g. Align the ball joint centerline with the centerline of the mating tube, forward and aft of the ball joint as shown in Figure 8-22. Ascertain that the crossover tube is properly positioned in the slip joints by checking the location of the previously made reference marks. Retighten the exhaust system. Measure the distance between the slip joint end and the tape. Subtract this dimension from the dimension recorded in step f. Refer to Figure 8-22 for min./max. slip joint engagement dimensions.

h. Ascertain that the support bracket is shimmed to clear the counterbore on the sump housing with AN960-416 and AN960-416L washers (.062 max.). Adjust the support bracket so there is no preloading on the exhaust system.

i. Adjust the clamp at the end of the support bracket to securely hold the tube. (Refer to Figure 8-22, Sketch B.)

NOTES

1. The crossover tube must be free to move at both slip joints prior to clamping or attaching isolator.
2. There must be a minimum clearance of 1-1/4 inches between the tail pipe and the fire wall chute, as shown in Figure 8-22, Sketch C. If this dimesnsion is not obtainable, the system is not set properly and should be readjusted.
3. Items h and i above not applicable if isolator type exhaust support, per Sketch E, is installed. Isolators are not to be compressed or stretched thus putting excessive load or severe bending on cables.

j. Replace existing shroud assembly with the new assembly P/N 33178-02 and 33178-03. Ascertain that 3/8 of an inch clearance is maintained between the end of the takeoff assembly and the flange on the new shroud. (Refer to Figure 8-22.) The mounting holes in the new assembly should match the existing holes of the clamp assembly. The clamp should be moved to locate the shroud and maintain the end clearance. Attach cable assembly to shroud half retaining screw and studded clamp assembly.

k. Ascertain that the takeoff assembly is securely fastened to the stack; this may require bending the ears of the takeoff assembly down over the stack before tightening the clamp. (Refer to Figure 8-22.)

l. Recheck all fasteners for tightness and reinstall the engine cowlings.

TABLE VIII-III. ENGINE TROUBLESHOOTING (CARBURETOR)

Trouble	Cause	Remedy
Failure of engine to start.	Lack of fuel.	Check fuel system for leaks. Fill fuel cell. Clean dirty lines, strainers, or fuel cocks.
	Underpriming.	Prime with four or five strokes of primer.
	Overpriming.	Place control in "idle cut-off", open throttle and "unload" engine by turning in counter clockwise direction.
	Incorrect throttle setting.	Open throttle to one-tenth of its range.
	Defective spark plugs.	Clean and adjust or replace spark plug or plugs. Refer to Table II-I for spark plug gap adjustments.
	Defective ignition wire.	Check with electric tester and replace any defective wires.
	Defective or weak battery.	Replace with charged battery.
	Improper operation of magneto or breaker points.	Check internal timing of magnetos, paragraph 8-62. Clean points.
	Water in carburetor.	Drain carburetor and fuel lines.

TABLE VIII-III. ENGINE TROUBLESHOOTING (CARBURETOR) (cont.)

Trouble	Cause	Remedy
Failure of engine to start (cont)	Internal failure	Check oil sump strainer for metal particles. If found, complete overhaul of the engine may be indicated.
	Improper switch wiring for left magneto starting.	Reverse magneto switch wires.
	Magnetized impulse coupling - if installed.	Demagnetize impulse couplings.
	Frozen spark plug electrodes.	Replace spark plugs or dry out removed plugs.
	Mixture control in idle cut-off.	Open mixture control.
	Shorted ignition switch or loose ground	Check and replace or repair.
Failure of engine to idle properly.	Incorrect carburetor idle adjustment.	Adjust throttle stop to obtain correct idle.
	Idle mixture.	Adjust mixture, paragraph 8-45 or refer to engine manufacturer's handbook.
	Leak in the induction system.	Tighten all connections in the induction system. Replace any parts that are defective.

TABLE VIII-III. ENGINE TROUBLESHOOTING (CARBURETOR) (cont.)

Trouble	Cause	Remedy
Failure of engine to idle properly (cont)	Low cylinder compression.	Check cylinder compression.
	Faulty ignition system	Check entire ignition system.
	Open primer.	Lock primer.
	Improper spark plug setting.	Check spark plug gap.
	Dirty air filter.	Clean or replace.
Low power and uneven running engine	Mixture too rich; indicated by sluggish engine operation, red exhaust flame and black smoke.	Check primer. Readjustment of carburetor paragraph 8-45.
	Mixture too lean; indicated by overheating or backfiring.	Check fuel lines for dirt or other restrictions. Check fuel supply.
	Leaks in induction system.	Tighten all connections. Replace defective parts.
	Defective spark plugs	Clean or replace spark plug.
	Improper grade of fuel.	Fill fuel cell with recommended grade.
	Magneto braker points not working properly.	Clean points. Check internal timing of magneto, paragraph 8-62.

TABLE VIII-III. ENGINE TROUBLESHOOTING (CARBURETOR) (cont.)

Trouble	Cause	Remedy
Low power and uneven running engine (cont)	Defective ignition wire	Check wire with electric tester. Replace defective wire.
	Defective spark plug terminal connectors	Replace connectors on spark plug wire
	Restriction in exhaust system.	Remove restriction
	Improper ignition timing	Check magnetos for timing and synchronization
Failure of engine to develop full power	Throttle lever out of adjustment	Adjust throttle lever, paragraph 8-44.
	Leak in induction system	Tighten all connections and replace defective parts
	Restriction in carburetor air scoop	Examine air scoop and remove restriction
	Improper fuel	Fill fuel cell with recommended fuel.
	Propeller governor out of adjustment	Adjust governor, paragraph 8-30.

TABLE VIII-III. ENGINE TROUBLESHOOTING (CARBURETOR) (cont.)

Trouble	Cause	Remedy
Failure of engine to develop full power (cont)	Faulty ignition.	Tighten all connections. Check system. Check ignition timing, paragraph 8-63.
Rough running engine	Cracked engine mounts	Repair or replace engine mount.
	Unbalanced propeller	Remove propeller and have it checked for balance
	Defective mounting bushings	Install new mounting bushings.
	Lead deposit on spark plug.	Clean or replace plugs.
	Primer unlocked.	Lock primer.
Low oil pressure.	Insufficient oil.	Check oil supply
	Dirty oil strainers.	Remove and clean oil strainers.
	Defective pressure gauge	Replace gauge.
	Air lock or dirt in relief valve.	Remove and clean oil pressure relief valve.
	Leak in suction line or pressure line.	Check gasket between accessory housing crankcase.

TABLE VIII-III. ENGINE TROUBLESHOOTING (CARBURETOR) (cont.)

Trouble	Cause	Remedy
Low oil pressure (cont)	High oil temperature.	See "High Oil Temperature" in trouble column.
	Stoppage in oil pump intake passage.	Check line for obstruction. Clean suction strainer.
	Worn or scored bearings.	Overhaul.
High oil temperature.	Insufficient air cooling.	Check air inlet and outlet deformation or obstruction.
	Insufficient oil supply.	Fill oil sump to properly level.
	Clogged oil lines or strainers.	Remove and clean oil strainers.
	Failing or failed bearing.	Examine sump for metal particles and, if found, overhaul engine.
	Defective thermostats.	Replace.
	Defective temperature gauge.	Replace gauge.
	Excessive blow-by.	Usually caused by weak or stuck rings. Overhaul.
	Improper engine operation.	Check entire engine.
	Excessive external dirt on engine.	Clean engine.

TABLE VIII-III. ENGINE TROUBLESHOOTING (CARBURETOR) (cont.)

Trouble	Cause	Remedy
Excessive oil consumption	Failing or failed bearing.	Check sump for metal particles and, if found, overhaul of engine is indicated.
	Worn or broken piston rings.	Install new rings.
	Incorrect installation of piston rings.	Install new rings.
	External oil leakage.	Check engine carefully for leaking gaskets, "O" rings or sand holes.
	Leakage through engine fuel pump vent.	Replace fuel pump seal.
	Engine breather or vacuum pump breather.	Check engine and overhaul or replace pump.
Inaccurate oil pressure readings.	Cold weather.	In extremely cold weather oil pressure readings up to 100 pounds do not necessarily indicate malfunctioning.
Overpriming.	Cold weather.	Rotate the crankshaft in the counter-clockwise direction with throttle FULL OPEN and ignition switch OFF.

TABLE VIII-III. ENGINE TROUBLESHOOTING (CARBURETOR) (cont.)

Trouble	Cause	Remedy
Inaccurate oil pressure readings.	Cold weather.	High or low pressure readings due to extremely cold weather are not necessarily a malfunction. Small and long oil lines will not transfer pressure readings accurately until engine is quite warm.

TABLE VIII-III. ENGINE TROUBLESHOOTING (FUEL INJECTION)

Trouble	Cause	Remedy
Failure of engine to start.	Lack of fuel.	Check fuel system for leaks. Fill fuel tank. Clean dirty lines, strainers or fuel cocks.
	Underpriming.	Prime by holding switch 4 to 10 seconds. Check fuel flow indicator.
	Overpriming.	Place control in "idle cut-off". Open throttle and unload engine by turning over with starter.
	Incorrect throttle.	Open throttle to ⅛ of its range.
	Defective spark plugs.	Clean and adjust or replace spark plug or plugs.
	Defective battery.	Replace with charged battery.
	Improper operation of magneto breaker points.	Clean points. Check internal timing of magnetos, paragraph 8-62.
	Air bubbles in fuel system.	Check fuel vent.
	Boost or auxiliary fuel pump failure.	Replace pump.
	Fuel line restricted.	Check inlet line.
	Lack of sufficient fuel pressure.	Check fuel strainer and fuel adjustments.

TABLE VIII-III. ENGINE TROUBLESHOOTING (FUEL INJECTION) (cont.)

Trouble	Cause	Remedy
Failure of engine to start. (cont)	Internal failure.	Check oil sump strainer for metal particles. If found, complete overhaul of the engine may be required.
Failure of engine to idle properly.	Incorrect idle adjustment.	Adjust throttle stop to obtain correct idle, paragraph 8-53.
	Insufficient fuel pressure.	Check fuel strainer and pump pressure adjustment.
	Clogged injector nozzles.	Remove and clean, paragraph 8-55.
	Leak in induction system.	Tighten all connections in the induction system. Replace any defective parts.
	Low cylinder compression	Check condition of piston rings and valve seats.
	Faulty ignition system.	Check entire ignition system.
Low power and uneven running.	Mixture too rich; indicated by sluggish engine operation, red exhaust flame at night. Extreme cases indicated by black smoke from exhaust.	Injector may need recalibration by authorized personnel.

TABLE VIII-III. ENGINE TROUBLESHOOTING (FUEL INJECTION) (cont.)

Trouble	Cause	Remedy
Low power and uneven running. (cont)	Mixture too lean; indicated by overheating or back-firing.	Check fuel supply. Check fuel lines for obstructions or restrictions.
	Clogged injector nozzles.	Remove and clean, paragraph 8-55.
	Dirt in inlet screen.	Remove screen and flush with solvent. Blow with compressed air.
	Dirt in "T" fitting.	Remove "T" fitting at distributor, clean in solvent. Blow through orifice with compressed air - 100 psi.
	Fuel supply pressure excessively high.	Readjust fuel pump for lower pressure.
	Leak in manifold line	Tighten fittings.
	Leak in induction system.	Tighten all connections. Replace defective parts.
	Defective spark plugs.	Clean or replace spark plugs.
	Poor fuel.	Fill fuel cell with fuel of recommended grade.

TABLE VIII-III. ENGINE TROUBLESHOOTING (FUEL INJECTION) (cont.)

Trouble	Cause	Remedy
Low power and uneven running. (cont)	Magneto breaker points not working properly.	Clean points. Check internal timing of magnetos.
	Defective ignition wire.	Check wire with electric tester. Replace defective wire.
	Improper ignition timing.	Check magnetos for timing and synchronization.
	Defective spark plug terminal connectors.	Replace connectors on spark plug wire.
Flow meter reads high.	Clogged nozzle.	Remove and clean, paragraph 8-55.
Failure of engine to develop full power.	Throttle lever nut out of adjustment.	Adjust throttle lever.
	Leak in induction system.	Tighten intake pipe mounting flange nuts and tighten intake manifold. (Replace defective gasket as req'd.)
	Mixture too lean.	Injector must be recalibrated.
	Throttle linkage limiting travel of throttle valve.	Check throttle linkage and throttle valve opening.

TABLE VIII-III. ENGINE TROUBLESHOOTING (FUEL INJECTION) (cont.)

Trouble	Cause	Remedy
Failure of engine to develop full power. (cont)	Restrictions in inlet air scoop.	Examine air scoop and remove restrictions.
	Improper fuel.	Fill fuel cell with recommended aviation fuel.
	Faulty ignition.	Tighten all connections. Check system with tester. Check ignition timing.
Rough engine	Cracked engine mount.	Replace mount.
	Unbalanced propeller.	Remove propeller and have it checked for balance.
	Defective mounting bushings.	Install new mounting bushings.
Low oil pressure.	Insufficient oil.	Fill oil sump with oil of recommended viscosity.
	Leak in suction line or pressure line.	Check gasket between accessory housing and crankcase.
	Dirty oil strainers.	Remove and clean oil strainers.
	Air lock or dirt in relief valve.	Remove and clean oil pressure relief valve.
	High oil temperature.	See "High Oil Temperature" in "Trouble" column.
	Relief valve out of adjustment.	Adjust valve.

TABLE VIII-III. ENGINE TROUBLESHOOTING (FUEL INJECTION) (cont.)

Trouble	Cause	Remedy
Low oil pressure. (cont)	Defective pressure gage.	Replace gage.
	Stoppage in oil pump intake passage.	Check line for obstruction. Clean suction strainer.
	Failing or failed bearings.	Check screens and sump for metal particles.
High oil temperature.	Insufficient oil cooling.	Check air inlet and outlet for deformation or obstruction.
	Insufficient oil supply.	Fill oil sump to proper level with specified oil.
	Low grade of oil.	Replace with oil conforming to specification.
	Clogged oil lines or strainers.	Remove and clean oil strainers.
	Excessive blow-by.	Usually caused by worn or sticking rings.
	Failing or failed bearings.	Examine sump for metal particles. If found, overhaul of engine is indicated.
	Defective temperature gage.	Replace gage.
Excessive oil consumption.	Low grade of oil.	Fill oil sump with oil conforming to specification.

TABLE VIII-III. ENGINE TROUBLESHOOTING (FUEL INJECTION) (cont.)

Trouble	Cause	Remedy
Excessive oil consumption. (cont)	Failing or failed bearings.	Check screens and sump for metal particles. If found, overhaul of engine is indicated.
	Worn piston rings.	Install new rings.
	Incorrect installation of piston rings.	Install new rings.
Cold weather difficulties.	Cold oil.	Move aircraft into a heated hangar. Heat oil.
	Inaccurate pressure readings.	In extreme cold weather, oil pressure readings up to approximately 100 lbs. Do Not necessarily mean malfunctioning.
	Overpriming.	Rotate crankshaft in direction of normal rotation with throttle "full open", and mixture in "idle-cut-off" and ignition switch "OFF".
	Weak battery.	Install fully charged battery.
	Faulty ignition switch.	Check ground wires.