Power Plant

71 Power Plant

CHAPTER 71

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CHAPTER 71 - POWER PLANT

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"END"

GENERAL - DESCRIPTION AND OPERATION

The Duke is equipped with Lycoming TIO-541-E1A4 and/or TIO-541-E1C4 engines. They are rated at 380 horsepower at 2900 rpm and 41.5 in. Hg, and are turbochargered for high performance at altitudes to 30,000 feet. The engines power three-bladed, 74 inch diameter, constant speed, full feathering, hydraulically controlled propellers.

"END"

TROUBLESHOOTING
ENGINE

	TROUBLE	*PROBABLE CAUSE*	*REMARKS*
1.	Failure of engine to start.	a. Lack of fuel.	a. Check fuel system for leaks. Fill fuel cell. Clean dirty lines, strainers or fuel valves.
		b. Overpriming.	b. Unload engine by standard clearing procedure.
		c. Incorrect throttle setting.	c. Open throttle to 1/4 of its range.
		d. Defective spark plugs.	d. Clean and adjust or replace spark plugs.
		e. Defective ignition wire.	e. Check with tester and replace any defective wires.
		f. Improper operation of magneto.	f. Clean points. Check timing.
		g. Internal failure.	g. Check oil screens for metal particles. If found, complete overhaul of engine is indicated.
2.	Failure of engine to idle properly.	a. Incorrect idle mixture.	a. Adjust mixture control.
		b. Incorrect idle speed.	b. Adjust idle speed.
		c. Leak in induction system.	c. Tighten all connections, replace any defective parts.
		d. Uneven cylinder compression.	d. Check condition of piston rings and valve seats.
		e. Faulty ignition system.	e. Check ignition system.
3.	Low power and uneven running.	a. Mixture too rich, indicated by sluggish engine, red exhaust flame. Extreme cases indicated by black smoke at exhaust.	a. Readjust fuel injector.
		b. Mixture too lean; indicated by overheating and back-firing.	b. Check fuel lines for restrictions. Readjust mixture.
		c. Leak in induction system.	c. Tighten all connections, replace any defective parts.
		d. Defective spark plugs.	d. Clean and gap or replace spark plugs.

TROUBLESHOOTING
ENGINE (Cont'd)

TROUBLE	PROBABLE CAUSE	REMARKS
3. Low power and uneven running. (Cont'd).	e. Improper fuel.	e. Fill cell with fuel of recommended grade.
	f. Magneto breaker points not working properly.	f. Clean points, check timing.
	g. Defective ignition wire.	g. Check wires with tester, replace any defective wires.
	h. Defective spark plug terminal.	h. Check and replace connectors if necessary.
4. Failure of engine to develop full power.	a. Leak in the induction system.	a. Tighten all connections replace any defective parts.
	b. Throttle lever out of adjustment.	b. Check travel of throttle linkage.
	c. Improper fuel flow.	c. Check strainers and flow at fuel injector.
	d. Restriction in air scoop.	d. Examine air scoop and remove any obstruction.
	e. Improper fuel.	e. Drain and refill cell with fuel of recommended grade.
	f. Faulty ignition.	f. Check ignition system.
5. Rough engine.	a. Cracked engine mount.	a. Replace or repair mount.
	b. Defective mounting bushing.	b. Replace bushing.
	c. Uneven compression.	c. Check compression.
6. Low oil pressure.	a. Insufficient oil.	a. Fill sump with oil.
	b. Air lock or dirt in relief valve.	b. Remove and clean oil pressure relief valve.
	c. Dirty oil strainers.	c. Remove and clean oil strainers.
	d. High oil temperatures.	d. See step 7.
	e. Defective pressure gage.	e. Replace gage.
	f. Stoppage in oil pump inlet passage.	f. Check line for obstruction.
7. High oil temperature.	a. Insufficient oil supply.	a. Fill sump with oil of recommended grade.

TROUBLESHOOTING
ENGINE (Cont'd)

TROUBLE	PROBABLE CAUSE	REMARKS
7. High oil temperature.(Cont'd).	b. Low grade of oil.	b. Drain and fill sump with oil conforming to specifications.
	c. Clogged oil lines or strainers.	c. Clean oil lines and strainers.
	d. Excessive blow-by.	d. Usually caused by worn or stuck rings.
	e. Failed or failing bearings.	e. Examine oil strainers for metal particles. If found, overhaul of engine is indicated.
	f. Defective temperature gage.	f. Replace gage.
8. Excessive oil consumption.	a. Low grade of oil.	a. Fill sump with oil conforming to specifications.
	b. Failing or failed bearings.	b. Check sump for metal particles.
	c. Worn piston rings.	c. Install new rings.
	d. Incorrect installation of piston rings.	d. Install new rings.
	e. Failure of rings to seat (nitrided barrels).	e. Use mineral base oil. Climb to cruise altitude at full power and operate at 75% cruise power setting until consumption stabilizes.

"END"

GENERAL - MAINTENANCE PRACTICES

ENGINE REMOVAL

CAUTION

The engine induction air is supplied through a fiberglass duct located in the right hand section of the engine compartment. Care should be taken when removing or installing the engine that no dirt or foreign objects, be allowed to enter the induction system. Be careful not to damage the fiberglass ductwork attached to the firewall.

a. Check the magneto switches for "OFF" position.

WARNING

To be safe, treat all magnetos as hot whenever the ground lead is disconnected. To ground the magneto, disconnect the magneto switch lead wire at the capacitor and ground the capacitor pole. If this is impractical, remove the ignition harness distributor cap, or disconnect the spark plug leads.

b. Remove the upper and lower engine cowling. (Refer to Chapter 71-10-00.)

c. Remove the propeller. (Refer to Chapter 61-10-00.)

d. Disconnect all plumbing at the firewall. Be sure to cap all open lines and fittings.

CAUTION

Place the fuel selector valve handle in the "ON" position to relieve approximately 60 psi of pressure in the fuel line from the firewall to the fuel pump.

e. Disconnect and identify all electrical wiring at the firewall.

f. Disconnect all engine controls.

g. Place a wing stand under the opposite wing and a support under the tail.

h. Position the engine hoist and attach the hoisting sling to the three lifting eyes on the engine.

i. Remove the slack from the hoisting cable and remove the bolts that attach the engine mounts to the firewall.

j. Remove the engine and place in a suitable work stand.

ENGINE BUILD-UP

Engine build-up consists of the removal of accessories and equipment from the old engine and installing them on the new engine. Refer to the Lycoming Engine Overhaul Manual, P/N 60294-6, for proper torque values.

NOTE

Tag or identify all hoses, bolts, washers, nuts, electrical connectors, and note harness clamp locations for reinstallation on the new engine. Cap all open hoses and engine ports to prevent contamination.

NOTE

Torque engine mount (isolators) bolts to 250-300 inch-pounds.

ENGINE INSTALLATION

a. Observe the WARNING and CAUTION notes in ENGINE REMOVAL.

b. Position the engine hoist and attach the hoisting sling to the three lifting eyes on the engine.

c. Move the hoist into position in front of the firewall, align the bolt holes of the engine mount and those of the firewall. Install the engine mount bolts and torque to 350 - 390 inch-pounds.

NOTE

If the engine mount bolt nuts are replaced, use a magnet to ensure they are steel.

f. Disconnect the hoisting sling and move the hoist clear of the aircraft.

g. Connect all electrical wiring at the firewall.

h. Connect all plumbing at the firewall, and all ducting.

i. Connect and adjust all engine controls. (Refer to Chapter 61-00-00.)

j. Install the propeller. (Refer to Chapter 61-00-00.)

k. Install the upper and lower engine cowling. (Refer to Chapter 71-10-00.)

l. Perform an engine run-up and complete final adjustments.

NOTE

If a new or newly overhauled engine has been installed, the engine fuel and oil system must be depreserved and serviced. (Refer to Chapter 12-10-00 for Servicing.)

GROUND RUNNING AND WARM-UP

Because the turbocharged engines depend on forward air speed for cooling, caution should be used to prevent overheating on the ground. The following precautions should be followed when performing power checks or engine run up:

a. Head the aircraft directly into the wind.

b. Operate the engines on the ground with the propeller in the low pitch position (unfeathered position).

c. Maintain the cylinder head temperature between 150°C and 246°C. Never allow the cylinder head temperature to exceed 246°C.

d. The turbine inlet temperature (TIT) gage, must not exceed 900°C.

e. Extended periods of idling at low rpm may result in fouled spark plugs.

f. The mixture control should remain in the "FULL RICH" position unless leaning is required during the checkout.

g. Warm up the engine at 1000 to 1500 rpm.

NOTE

The oil pressure should be within the red radial in 30 seconds; normal oil pressure should be approximately 90 psi at maximum rpm.

The oil seals incorporated in the turbocharger derive their sealing capabilities from oil pressure. At low engine idle speeds, the seals will allow some oil seepage onto the turbocharger shaft, which will cause coking (oil and carbon deposit buildup). Therefore, during taxiing, engine runup or ground test, it is advisable to maintain idling speeds of approximately 1200 rpm until the turbocharger temperature has stabilized. This engine speed will exert enough oil pressure against the shaft seals to prevent oil seepage. When the turbocharger temperature has stabilized, the engine may be shut down with a minimum of coking.

IDLE SPEED AND MIXTURE ADJUSTMENT

(Figure 201)

a. Start the engine and run at 1000 to 1500 rpm until the oil and cylinder head temperature gages read normal.

b. Check magneto drop-off. (See MAGNETO DROP-OFF CHECK, Chapter 74-10-00.) Maximum drop-off should not exceed 175 rpm. If the magneto drop-off is within limitations, proceed with the idle adjustment.

c. Slowly retard the throttle lever to the idle position. The engine tachometer should indicate 700 rpm (normal idle setting). To adjust, turn the idle speed adjusting screw at the throttle lever stop until the desired rpm is reached.

d. When the idle speed has stabilized, move the mixture control lever with a smooth, steady pull into the "IDLE CUT-OFF" position. Observe the tachometer for any change during the leaning out process.

CAUTION

Return the mixture control to the FULL RICH position before the rpm can drop to a point where the engine cuts out.

Idle and Mixture Adjustment
Figure 201

An increase in rpm while leaning out indicates the idle mixture is on the rich side of best power. An immediate decrease in rpm (if not preceded by a momentary increase) indicates that the idle mixture is on the lean side of best power. The desired idle setting is a compromise between one that is rich enough to provide a satisfactory acceleration under all conditions and lean enough to prevent spark plug fouling or rough operation. A rise of 25-50 rpm, during the leaning process, will usually satisfy both of these conditions.

e. Adjustment of the mixture is accomplished by turning the "STAR" adjustment screw, one or two notches, in the direction required, as noted on the linkage blocks with an R for Rich, and an arrow for direction of rotation.

NOTE

For major adjustments refer to Bendix Manual Form 15-468.

f. After each idle mixture adjustment change, clear

the engine by running it up to 2000 rpm before making a mixture check.

g. Recheck the idle speed as stated in step "c". Make final idle speed adjustment, if necessary.

NOTE

If the idle setting does not remain stable, check the idle linkage; any looseness on this linkage will cause erratic idling. In all cases, allowances should be made for the effect of weather conditions upon idling adjustments.

THROTTLE–LANDING GEAR WARNING HORN SWITCH ADJUSTMENT

a. In flight, place the propeller lever in low pitch. Slowly pull both throttle levers back until 12 to 14 in. Hg manifold pressure is indicated. Mark this position on the quadrant.

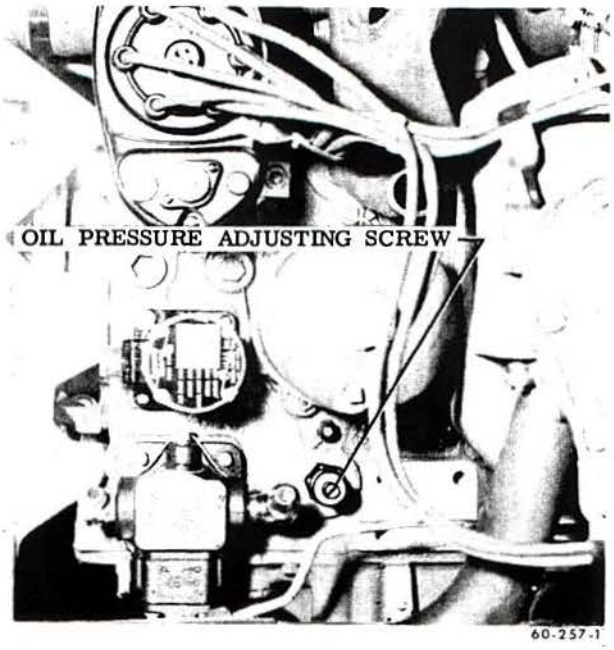
b. Land the airplane and shut the engine down.

NOTE

The landing gear warning horn micro-switches are located on a bracket, at the lower end of the throttle linkage, in the console.

c. Position the throttle levers on the mark previously made. Raise or lower the micro-switches until the cams "click" the switches closed. Secure the switches in this position.

d. Fly the airplane to check adjustment.



Oil Pressure Adjustment
Figure 202

OIL PRESSURE ADJUSTMENT
(Figure 202)

The oil pressure adjustment screw is located approximately 3 inches directly below the oil filter housing. To adjust, turn the adjusting screw clockwise to increase or counterclockwise to decrease oil pressure. Run the engine at 2600 rpm with normal operating oil temperature and set the oil pressure at 80 psi.

"END"

COWLING - MAINTENANCE PRACTICES

COWLING REMOVAL

a. Check the magneto switches for OFF position.
b. Disconnect the cowl flap actuator from the cowl flap.
c. Open both cowl doors, remove the two screws on each side of the nose bug.
d. Support the lower cowl and remove either the upper or lower two screws in each cowl fairing channels aft of the propeller spinner.
e. Remove the screws across the aft end of the upper and lower cowls and remove cowls from the engine.

COWLING INSTALLATION

a. Check the magneto switches for OFF position.
b. Position the upper cowl over the engine and install screws across the aft end.
c. Support the lower cowl against the engine and install the screws across the aft end.
d. Install the four screws on each side of the nose bug and in each cowl fairing aft of the propeller spinner.
e. Connect the cowl flap actuator to the cowl flap. Check cowl flap actuator rigging.

COWL FLAP AND ACTUATOR REMOVAL

a. With the cowl flap open, disconnect the cowl flap actuator rod end from the cowl flap clip.
b. Remove the bolts from the cowl flap hinges and remove the cowl flap.
c. Remove the AMP terminals from the cowl flap actuator leads.
d. Remove the bolt holding the cowl flap actuator to the actuator support arm and remove the actuator.

COWL FLAP AND ACTUATOR INSTALLATION

a. Install the bolt attaching the upper end of the actuator to the nacelle structure.
b. Connect the AMP terminals to the actuator leads.
c. Align the cowl flap hinges and install the attaching bolts.
d. Connect the actuator rod end to the cowl flap clip. Check actuator rigging.

RIGGING THE COWL FLAP ACTUATOR

a. Set the actuator to 11.43 inches open (extended).
b. Install the actuator on the actuator support arm and attach the rod end to the cowl flap clip.
c. Adjust the actuator so that the cowl flap sides will extend into the cowl by .25 inches minimum when open. If the cowl flap does not meet the minimum required extension into the cowl, adjust the actuator to obtain this position. A minimum of .06 inch clearance is required between the actuator lug and actuator support, and between the actuator rod end lug and the cowl flap clip through the entire range of movement. Install a new cotter pin.

"END"