

CHAPTER

72

ENGINE

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EFFECTIVITY: All

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GENERAL

Z 143 L

The TEXTRON LYCOMING O-540-J3A5 engine is the piston, four stroke, air-cooled, clockwise rotating six-cylinder.

Z 143 LSi

The TEXTRON LYCOMING IO-540-C4D5 engine is the piston, four stroke, air-cooled, clockwise rotating six-cylinder.

EFFECTIVITY: All

72-00-00

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ENGINE

DESCRIPTION AND OPERATION

The TEXTRON LYCOMING O-540-J3A5 engine is the piston, four-stroke, air-cooled, clockwise rotating six-cylinders with 175 kW (235 HP) constant power and 2400 RPM constant speed. The engine is without reduction gear and it is not supercharged. The engine is provided with single-chamber carburetor with manual mixture control and engine cut-off stop, i.e. the fuel supply is shut at the end of engine mixture leaning.

Basic technical data:

- bore	130,175 mm	(5,125 in)
- stroke	111,125 mm	(4,375 in)
- overall cylinder volume	8,875 litre	541,5 cu.in
- compression ratio	8,5 : 1	
- direction of rotation	clockwise	

Power - speed - consumption - manifold pressure:

Engine setting	Power		Speed	Consumption		Manifold pressure	
	kW	HP	RPM	l/h	US.gal./h	kPa	in.Hg
Max. continuous MC	175	235	2400	74	19,5	MAX.	
Cruising (75 % MC)	130	175	2200	53	14,0	84,6	25,0
Cruising (60 % MC)	104	140	2000	38,6	10,2	78,6	23,2

NOTE

The table contains values issued by engine manufacturer for 0 m altitude ISA.

Description and engine maintenance are issued in accompanying documentation of engine manufacturer.

DESCRIPTION AND OPERATION

The TEXTRON LYCOMING IO-540-C4D5 engine is the piston, four-stroke, air-cooled, clockwise rotating six-cylinder with max. 186 kW (250 HP) constant power and max. 2575 RPM constant speed. The engine is without reduction gear and it is not supercharged. The engine is provided with the fuel injector that works within the BENDIX RSA fuel injection system.

Basic technical data:

- bore 130,175 mm (5,125 in.)
- stroke 111,125 mm (4,375 in.)
- overall cylinder volume 8,875 litru (541,5 cu.in.)
- compression ratio 8,5 : 1
- direction of rotation clockwise

Power - speed - consumption - manifold pressure:

Engine setting	Power		Speed	Consumption		Manifold pressure	
	kW	HP	RPM	l/h	US.gal./h	kPa	in.Hg
Max. continuous MC	186,4	250	2575	78	20,6	Max.	Max.
Cruising (75 % MC)	139,8	187,5	2350	60	15,9	84,7	25,0
Cruising (60 % MC)	111,9	150	2200	43	11,4	79,8	23,5

NOTE

The table contains values issued by engine manufacturer for 0 m altitude ISA.

Description and engine maintenance are issued in accompanying documentation of engine manufacturer.

REPAIRS

NOTE

Maintain during engine repairs the instructions of engine manufacturer issued in engine manuals, service bulletins and service instruction. Use only **latest issue** of service bulletins and service instructions.

The engine valve check should be carried out according to: Service bulletin No. 301, Service bulletin No. 388, SPP 1176 Special Service Publication

Recommendation

In case the mechanical parts of starter infringe the operation it is possible to improve its serviceability especially in cold weather by greasing these parts according to Service instruction No. 1278. The application of this service instruction should be repeated during 100 hrs maintenance.

If during 100 hrs/annual maintenance check worsened engine run, drop of engine power, increased fuel consumption, and/or worsened engine start-up are detected. It is recommended to check compression in cylinders according to Service instruction No. 1191. In order to prevent the engine faulty operation it is recommended to record the results of maintenance check and graphically evaluate if appropriate.

MAINTENANCE

SERVICING

CLEANING OF FWD PART OF CRANK SHAFT

- a) Remove propeller (section 61-10-00).
- b) Wipe the space of fwd crank case with rag soaked in white spirit or other degreaser, e. g. VARSOL, etc., taking in mind neither degreaser nor dirt may enter the holes in lateral tube inside this space. Wipe the remnants of degreaser with clean dry rag.
- c) Reinstall the propeller (section 61-10-00).

ENGINE PRESERVATION AND DE-PRESERVATION

(Made out according to TEXTRON Lycoming Service Letter No. L 180 A)

A. ENGINE PRESERVATION

1. Serviceable airplane

CAUTION

WHEN CRANKING THE ENGINE MANUALLY BY PROPELLER THE ENGINE IGNITION SHOULD BE TURNED OFF (MAGNETO SWITCH IN **OFF** POSITION) AND THROTTLE LEVER AS WELL AS THE MIXTURE CONTROL SHOULD BE PULLED OUT TO THE VERY END.

THE SHORT TERM ENGINE STARTING CANNOT SUBSTITUTE MANUAL ENGINE CRANKING BY PROPELLER.

- a) Crank the engine by propeller five times at least once five days if the airplane is not used for flying so that the lube oil covers uniformly the cylinder walls.
- b) The airplane should fly for at least 30 minutes after 30 days parking. In case this flight is impossible it is necessary to start up the engine and let it run till it reaches at least minimum operational lube oil temperature.

NOTE

Avoid long term engine run on ground.

2. Airplane out of operation

CAUTION

PRESERVE ENGINE SUPPOSED TO BE OUT OF OPERATION FOR MORE THEN 3 DAYS.

NOTE

Use either proper conservation oil or a mixture of conservation fluid concentrate with aviation mineral engine oil. Read thoroughly manufacturer's instructions before using the conservation materials.

Recommended preservation oils are issued in last edition of Service letter No. 1014 and Service bulletin No. 318.

The preservation mixture is prepared by mixing three volume parts of mineral aviation engine oil according to MIL-L-6082C, Grade 1100 specification and one volume part of MIL-C-6529C, Type I specified concentrated preservation fluid. Mix the mixture thoroughly.

EFFECTIVITY: ALL

Procedure of engine preservation:

- Preservation of crank shaft and engine lube system
 - a) Drain all the lube oil from the engine and pour in 8 litres of preservation oil instead (preservation oil or preservation mixture).
 - b) Start up the engine and let it warm to operational temperature:
 - the oil temperature should be before engine cut - off at least 82 °C (180 °F) and if the ambient air temperature is below zero it should be at least 71 °C (160 °C)
 - the cylinder head temperature (CHT) should not exceed 246 °C (475 °F).
 - c) Cut-off the engine if the prescribed oil temperature is attained and move the airplane immediately to the area of further engine preservation.
 - d) Drain preservation oil (mixture) to the clean vessel.

Recommendation

Store preservation oil (mixture) for further use in properly closed vessel. This oil (mixture) may be used five times.

- Preservation of internal surface of engine cylinders

CAUTION

AS SOON AS THE SPARK PLUGS ARE SCREWED IN IT IS PROHIBITED TO CRANK THE ENGINE EITHER BY PROPELLER OR BY STARTER MOTOR TO PREVENT ENGINE DAMAGE BY HYDRAULIC SHOCK CAUSED BY PRESERVATION CYLINDER FILLING.

- a) Unscrew all the spark plugs.
- b) Spray internal space of each cylinder with 6 decagrams of clean preservation oil (mixture) while cranking about five times the engine by starter motor. Insert nozzle of spray gun into some spark plug hole. Be sure the preservation oil is heated to 93 up to 104 °C (200 to 220 °F).
It is necessary to use airless spray gun as the Gunjet, type 24A-8395 of Spraying Systems Co. In case the airless spray gun is not at the disposal it is necessary to provide air supply of spray gun with suitable desiccator.
- c) Repeat cylinder spraying with preservation oil (mixture) when the crankshaft is stationary. Screw the spark plugs in after cylinder preservation finishing.

Recommendation

It is recommended to screw in humid or sea resorts the desiccator plugs as TEXTRON Lycoming P/N 40 238 or equivalent into the spark plug holes.

- Preservation of engine fuel system of Z 143 L airplane
 - a) Disconnect hose from the upstream port of electric booster fuel pump and couple there the hose from the vessel with well-stirred mixture of fuel and 5% of the clean preservation oil.
 - b) Unscrew plug at the bottom carburetor flange, push the throttle lever and mixture control to the very end and turn FUEL PUMP switch of booster pump on. Turn booster pump off as soon as the preservation mixture starts pouring out of unplugged hole.
 - c) Screw the plug into the hole at the bottom carburetor flange, couple the fuel hose to upstream booster pump port and pull the throttle lever and mixture control to the very end.

- Preservation of injector of engine fuel system of Z 143 LSi airplane
 - a) Disconnect the electrical fuel pump from the airframe fuel system. Connect a hose to the inlet connection of the pump. The other end of the hose should be connected to the vessel with well - stirred mixture of fuel and 5 % of the dean preservative oil.
 - b) Disconnect the distribution piping from the engine cylinders nozzles.
 - c) Push both the throttle and fuel cockpit controllers to the very end. Turn on the electrical fuel pump (**FUEL PUMP** switch). Turn off the pump as soon as the preservative mixture begins to run out from the distribution piping.
 - d) Screw the distribution piping into the engine cylinders nozzles. Connect the electrical fuel pump to the airframe fuel system. Pull both the throttle and fuel cockpit controllers to the very end.
- Final works (Z 143 L)
 - a) It is recommended to insert sacks with desiccant into the engine exhausts before engine cooling down. Provide sacks with desiccant with red warning ribbons to ensure their removal during engine de-preservation.
 - b) Plug the engine exhaust, carburetor air intake and all the open holes with pipe couplings removed with PVC foil. Screw the foil plugging the air intake between carburetor and air filter casing.
 - c) Provide all PVC plugging with red warning stripes. In case the bottom engine cowling has not been removed insert the red warning stripe through the hole in cowling to be below airplane and well visible.
 - d) Provide propeller or propeller hub (if propeller removed) with warning placard:

ENGINE PRESERVED – DO NOT CRANK.

- e) Check the desiccant plugs of engine cylinders regularly and when their color changes from blue to pink repeat the preservation process again.
-
- Final works (Z 143 LSi)
 - a) Use a PE bag with desiccant to blind the engine exhaust. Indicate the bag by red warning ribbon.
 - b) Use the second desiccant bag to blind the injector air intake. Screw the bag between the air filter element and the air filter casing. Indicate the bag by red warning ribbon.
 - c) Use the Tesafilm red tape to blind the upper fuel distributor opening that is located on the upper part of the engine. Attach a red warning stripe to the tape.
 - d) Use the Tesafilm to tape up the root each fuel nozzle on each cylinder. Leave around 5 cm loose end of each tape.
 - e) Take out the red warning stripes of the engine space before closing the engine cowlings so that the stripes are clearly seen hanging from the bottom engine cowling hole.
 - f) Provide the propeller (or the propeller hub, if the propeller was removed) with the following warning placard:

ENGINE PRESERVED – DO NOT CRANK.

- g) Check the desiccant plugs of engine cylinders regularly. If their color changes from blue to pink, the preservation process must be repeated.

B. DE-PRESERVATION OF ENGINE

CAUTION

THE ENGINE THAT WAS STORED IN COLD ENVIRONMENT SHOULD BE PLACED FOR AT LEAST 24 HOURS IN TEMPERATURE OF 21 °C (70 °F) OR WARMED UP BY HOT AIR.

Procedure of engine de-preservation:

- De-preservation of internal engine space

CAUTION

IN CASE OF SILICA ENTRY TO ENGINE DUE TO DAMAGE OF DESICCANT CONTAINER IT IS NECESSARY TO REMOVE PERTINENT PART OF ENGINE AND CLEAN IT.

- a) Remove spark plugs, plugs, and desiccants (if used) from the engine.
- b) Drain preservation oil from the engine sump.
- c) Remove preservation oil from the engine cylinders after spark plug removal as follows:
 - crank the engine installed in the airplane several times by propeller to expel preservation oil from the engine cylinder
 - drain from engine suspended by crane the preservation oil from the cylinders by long term gradual tilting the engine to the sides. In case it is impossible to pour the preservation oil out of the engine cylinders this way it is possible to remove it by cranking by propeller when engine with propeller is installed in the airplane.
- d) Wipe accessible part of engine induction system dry with lint free clean rag.

CAUTION (Z 143 LSi airplane)

AVOID ANY OIL FLOWING DOWN FROM THE SUCTION PIPING ELBOW INTO THE INJECTOR.

- e) Check whether the groove in the narrowed part of the diffuser is clean. Check whether the four skew tubes at the injector inlet are clean. Absolutely no oil or gasoline is allowed here. Remove any remainders of preservative oil.
- f) Remove oil screen from engine sump, clean it e. g. with technical benzine, blow and mount to the engine.
- g) Mount ignition plugs and other removed parts to the engine.

- De-preservation of engine fuel system of Z 143 L airplane

- a) Turn the fuel booster pump on and simultaneously move throttle lever and mixture control to and from.
- b) Remove fuel filter from the carburetor, wash it in white spirit, blow it with compressed air and reinstall it back.

NOTE

Install the carburetor fuel filter by adaptation piece with rubber sealing ring in the direction to upstream hose and with spring to plug in opposite hole.

EFFECTIVITY: All

- De-preservation of engine fuel system of Z 143 LSi airplane

Fuel system de-preservation is carried out after the engine and propeller are fitted on the airplane.

- a) After the engine fuel system is connected to the airframe fuel system, turn on the airframe electrical fuel pump. At the same time, repeatedly push and pull the throttle controller and the mixture controller in the cockpit.
- b) De-preserve the fuel distributor and the nozzle tubes (after the tubes are disconnected from the nozzles): with full throttle and fully enriched mixture, turn on the airframe electrical fuel pump.
- c) Remove injecting nozzles, wash them e. g. in acetone and check visually whether they are clean (look through their openings). After installation, connect the fuel nozzles to the supply tubes.
- d) Clean the injector fuel filter: remove the filter from injector, wash it e. g. in benzine, blow it through and fit it on the engine.

CAUTION

USE AN ADAPTATION PIECE WITH RUBBER SEALING RING AND SMALL SPRING TO INSTALL THE FUEL FILTER TOWARDS THE SUPPLY HOSE AND TOWARDS THE PLUG OF THE OPPOSITE HOLE IN THE INJECTOR BODY.

- e) Finish the fuel system installation and secure the joints with tie wire.

REMOVAL / INSTALLATION

REMOVAL OF ENGINE

Preparatory works

- a) Remove engine cowlings (section 71-10-00).
- b) Remove propeller (section 61-10-00).
- c) Disconnect board battery from the electric network (subsection 24-32-00).
- d) Drain fuel from the airplane fuel system.
- e) Drain oil from the engine.
- f) Uncouple the hoses of engine lube system:
 - release and pull of the hose from the elbow of separator (Fig. 79-1, item 9)
 - uncouple the hose (Fig. 77-2, item 1) from T-coupling (2)
 - plug the hose, port in T-coupling and port of separator.
- g) Uncouple the hoses of fuel system:
 - uncouple the fuel engine upstream hose on the firewall supplying fuel to fuel pump (Fig. 28-2, item 6)
 - *only for Z 143 L airplane*: uncouple hose supplying fuel to engine priming system (16) (if primer installed)
 - uncouple the fuel overflow hose (7) from the fuel pump (6)
 - uncouple the hose (Fig. 77-3, item 1) from the fuel pressure sensor (2)
 - *only for Z 143 LSi airplane*: disconnect hose and tube (Fig. 77-3A, item 4, 7) from fuel consumption transmitter (5)
 - plug the hose and hole in fuel pump.
- h) Uncouple at the firewall the hose of manifold pressure gauge (Fig. 77-1).
- i) Remove hose (Fig. 37-1, item 3) from the vacuum pump (if installed).
- j) Disconnect engine and propeller controls:
 - disconnect fork (Fig. 61-3, item 5) from lever of propeller governor and holding of fwd tube (2) engine and engine mount structure (section 61-20-00)
 - *only for Z 143 L airplane*: disconnect fork (Fig. 75-2, item 5) from the shaft of flap control and remove joining the fwd tube (2) to the engine (section 75-10-00)
 - disconnect fork (Fig. 76-2, item 5) from the lever of throttle lever and disconnect joining the fwd tube (2) to the engine (section 76-10-00)
 - disconnect fork (Fig. 76-3, item 5) from the lever of mixture control and disconnect joining the fwd tube (2) to the engine (section 76-10-00).
- k) Uncouple the pipes of board battery and voltage regulator cooling (Fig. 75-3).
- l) Uncouple the heating hoses from the exhaust silencer heat exchangers (Fig. 21-1, item 2; 3).
- m) Uncouple the magnetos grounded cable.
- n) Disconnect flexible drive shaft (Fig. 77-4, item 2) of mechanical engine speed indicator.
- o) Disconnect engine electric system:
 - disconnect leads to alternator and starter motor
 - disconnect oil temperature probe (Fig. 77-5, item 1) cylinder head temperature pick-up (Fig. 77-6, item 1), EGT pick-up (Fig. 77-7, item 1)
 - *only for Z 143 L airplane*: disconnect carburetor temperature sensor (Fig. 77-8, item 1)
 - disconnect bonding between upper engine mounts and fwd fuselage structure.
- p) Shore rear fuselage.

EFFECTIVITY: All

Removal of engine

CAUTION

MAKE THE PRESERVATION OF THE ENGINE THAT IS SUPPOSED TO BE OUT OF OPERATION FOR MORE THAN 30 DAYS (section 72-10-00 MAINTENANCE.

- a) Suspend the engine with crane by two suspension eyes upon its upper part.
- b) Remove engine mount bolts from upper and bottom fuselage mounts (Fig. 71-2, items 2, 3).
- c) Move the crane with suspended engine out of airplane nose.
- d) Remove, if necessary, the engine mount and/or exhaust silencers.

Removal of engine mount

- a) Disconnect the bonding between engine and bottom engine mounts.
- b) Uncouple the joining of oil radiator and separator from the engine mount.
- c) Unclip the hoses and electric harnesses from the engine mount.
- d) Remove bolts (Fig. 71-2, item 6) - after removing cotter pins and unscrewing the nuts (7) from the mounts.
- e) Remove engine mount from the engine.

Removal of exhaust silences

- a) Remove hoses from the heat exchangers of exhaust silencers and remove the C springs and than the heat exchangers (Fig. 21-1, item 2; 3) from the exhausts.
- b) Disjoin the exhaust silencers (Fig. 78-1, items 2; 3) from the exhaust struts by removing the joining bolts (9).
- c) Unscrew nuts upon the flanges of exhaust collectors (5) and remove exhaust silencers from the engine.
- d) Plug the exhaust holes of the engine.

INSTALLATION OF ENGINE**NOTE**

Reinstall all the engine parts before removed to the engine again.

Installation of exhaust silencers

- a) Remove plugs from the engine exhaust holes.
- b) Provide flanges of exhaust silencers (Fig. 78-1, item 5) with sealing pads, fit there the exhaust silencers (2, 3) and join them by means of nuts with spring washers.
- c) Join the exhaust silencers to the brace holders (9) of exhaust system by screw with washers and spring.
- d) Provide exhaust silencers with heat exchangers (Fig. 21-1, items 2, 3) and lock them there with C-springs.
- e) Join the hoses to the exhaust heat exchangers.

Installation of engine mount

- a) Provide engine mounts with dampers:
 - fit the damper (4) from the firewall and damper (5) with the insertion piece from the propeller to the upper engine mounts (Fig. 71-2, detail A)
 - fit the damper (5) with insertion piece from the firewall and damper (4) from the propeller to the bottom engine mounts (detail B).
- b) Fit the engine mount structure upon the engine and insert bolts (6) into the engine mounts.
- c) Provide bolts with washers and screw the nuts (7) on bolts.
- d) Make sure the threads of bolts and nuts are clean and tighten them with 33 to 35 Nm (24 to 26 lbft) torque. Lock the joints with cotter pins.
- e) Join the holders of oil radiator and separator to the engine mount.
- f) Join the electric harness and hoses to the engine mount.
- g) Connect the bonding between engine and bottom engine mounts.

Installation of engine**CAUTION**

DE-PRESERVE PARTIALLY THE PRESERVED ENGINE (section 72-10-00, MAINTENANCE).
DE-PRESERVE THE ENGINE FINALLY AFTER THE ENGINE INSTALLATION TO THE AIRPLANE
BEFORE FIRST ENGINE START-UP.

- a) Move the engine suspended by the crane to the airplane nose and fit the engine mounts of engine mount structure to the engine mounts of fwd fuselage latticework (Fig. 71-2, items 2; 3).
- b) Insert fitted bolts into the engine mounts with the thread to the airplane longitudinal axis. Provide bolts with washers and screw the nuts on. Tighten the nuts with 23 to 29 Nm (17 to 21,4 lbf. ft) recommended torque and lock them with cotter pins.

EFFECTIVITY: All

Final works

- a) Couple the manifold pressure hose of manifold pressure gauge to pipe coupling marked **MANIFOLD PRESSURE** upon the firewall (Fig. 77-1). Lock the coupling with safety wire.
- b) Join the flexible drive shaft (Fig. 77-4, item 2) of mechanical RPM indicator to the engine drive pad.
- c) Connect engine electric system to the board electric network:
 - connect pertinent conductor leads to alternator and electric starter motor
 - connect oil temperature probe (Fig. 77-5, item 1), Cylinder head temperature pick-up (Fig. 77-6, item 1), EGT pick-up (Fig. 77-7, item 1).
 - *only for Z 143 L airplane:* connect carburetor temperature probe (Fig. 77-8, item 1)
 - connect bonding between upper engine mounts and fuselage latticework.
- d) Join heating hoses to the heat exchangers of exhaust silencers (Fig. 21-1, items 2; 3).
- e) Couple the magnetos grounded cable.
- f) Couple the battery and voltage regulator cooling hoses (Fig. 75-3).
- g) Join propeller and engine controls:
 - join fork (Fig. 61-3, item 5) to the lever of propeller governor and join fwd tube (2) to the engine and engine mount (section 61-20-00)
 - *only for Z 143 L airplane:* join fork (Fig. 75-2, item 5) to the shaft of flap control and join fwd tube (2) to the engine (section 75-10-00)
 - join fork (Fig. 76-2, item 5) to the lever throttle lever control and join fwd tube (2) to the engine (section 76-10-00)
 - join fork (Fig. 76-3, item 5) to the lever of mixture control and join fwd tube (2) to the engine (section 76-10-00).
- h) Couple the hoses of fuel system:
 - remove plugs
 - Couple fuel overflow hose (7) to fuel pump (Fig. 28-2, item 6)
 - *only for Z 143 L airplane:* couple the fuel priming hose to pipe coupling upon firewall marked **PRIMER** that is led to engine induction system (if fuel primer is installed) and join hose leading to fuel pump (6).
 - couple the hose (Fig. 77-3, item 1) to the fuel pressure sensor (2)
 - *only for Z 143 LSi airplane:* connect hose and tube (Fig. 77-3A, item 4, 7) to fuel consumption transmitter (5)
 - lock the couplings with safety wire.
- i) Couple the lube oil system hoses:
 - remove plugs
 - couple the hose (Fig. 77-2, item 1) to T-piece (2) and lock the coupling with safety wire
 - insert venting hose upon the separator elbow (Fig. 79-1, item 9) and lock it in place with clip.
- j) Insert the upstream hose of vacuum system upon inlet port of vacuum pump (Fig. 37-1, item 3) and fix it with clip (if installed).
- k) Fill the engine with oil (section 12-10-00). Fill the oil pressure measurement system (Fig. 77-2, items 1; 3; 4; 5; 6) with AeroShell Fluid 4 - remove the nozzle from oil pressure switch (6), fill the pressure switch using a syringe, mount back the nozzle-and deaerate.
- l) Fill the aircraft with the fuel and check the tightness of fuel system.
- m) Connect the board battery to board electric network (subsection 24-32-00).
- n) Install propeller (section 61-10-00).
- o) Install the engine cowlings to the engine (section 71-10-00).
- p) Remove shoring stand under the rear fuselage section.

EFFECTIVITY: All

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