CHAPTER 79

ENGINE OIL
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Section 79-00 General

This chapter describes only those components of the engine oil system that are external to the engine. For internal components, refer to the “lubrication” subchapter of the engine chapter. For more detailed information about internal components consult the Teledyne Continental Motors IOF-240-B Maintenance Manual, TCM p/n: M-22.

Figure 79-1 View Of Engine Oil Components, from Aft Looking Forward
Section 79-10 Storage

The IOF-240-B’s oil supply is stored in a welded steel oil sump secured to the bottom of the crankcase. Capacity of the sump is 6.0 US quarts.

An oil filler tube is secured to the (airplane’s) right side of the sump and extends upward. Its top end is accessible through a small door inset into the engine upper cowling. The removable oil filler tube cap incorporates a dipstick for preflight determination of oil quantity (See Figure 79-1).

A fitting at the rear of the oil sump accepts a hose connection allowing oil from the engine crankcase breather hose to return to the sump by gravity. No other external oil lines are connected to the sump: the engine oil pump suction tube extends through the center of the opening where the sump is bolted to the crankcase, while return oil drains from the engine into the sump around the periphery of the same opening.
Section 79-20 Oil System Distribution

Components of the oil system external to the engine include a full flow oil filter and oil cooler.

The full flow oil filter element is attached directly to the oil filter adapter at the lower right rear of the engine accessory gear-case. Oil flows to and from the filter element via internal passages in the adapter.

Figure 79-2 Exploded View of Engine Oil Cooler Installation

Section 20-01 Oil Cooler

Mounted on the left side of the firewall is the oil cooler. The oil cooler connects to the oil cooler adapter by supply and return hoses. An air duct directs air from the low-temperature/high-pressure portion of the cowling (above the engine cooling baffles) downward to the oil cooler. After passing through the oil cooler, the air is discharged overboard through the opening at the rear of the lower cowling. An internal “Vernatherm” unit in the oil cooler allows part or all of the oil flow to bypass the cooling passages in the oil cooler, thus regulating oil temperature.

Section 20-02 Air/Oil Separator

Some Liberty Aerospace, Inc. XL-2 airplanes come with an air/oil separator mounted on a bracket secured to the inboard electronic control unit (ECU) mounting bolts, see Figure 79-3. Crankcase oil vapors are routed from the crankcase breather to the air/oil separator, where the oil is separated from the vapors. The oil is then routed back to the oil tank, and the vapors are routed overboard, at the bottom of the engine cowling.

Figure 79-3 Exploded View of Air/Oil Separator

Section 20-03 Oil System Procedures

This section contains the procedures to remove and install the oil cooler and oil cooler hose, the air oil separator, the oil filter, and to change the engine oil.
OIL COOLER OR OIL COOLER HOSE REMOVAL

Perform this procedure to remove the oil cooler or oil cooler hoses.

1. Position the ALT and BAT master switches, the FADEC PWR A and B switches, and the ignition switch to OFF.

2. Pull the BAT1 (CB001) circuit breaker to OPEN.

3. Pull the SYSTEM, START circuit breaker to OPEN

4. Remove upper and lower cowling in accordance with Chapter 71 – Power Plant of this manual

5. Position container and/or absorbent material below connections to be removed to accommodate unavoidable minor spillage.

It is not necessary to drain engine oil for maintenance on oil cooler, oil cooler connections, or oil filter.


8. If hose(s) have been disconnected from oil cooler but remain attached to engine, secure free end of hose above level of top of oil sump to prevent possible (unlikely) siphoning or spillage.

9. Install caps on hoses and/or engine and oil cooler connections as required.

10. If necessary, remove bolts securing oil cooler to air duct; remove oil cooler.

This completes the Oil Cooler or Oil Cooler Hose Removal procedure.
OIL COOLER OR OIL COOLER HOSE INSTALLATION

Perform this procedure to install the oil cooler or oil cooler hose.

1. Position the ALT and BAT master switches, the FADEC PWR A and B switches, and the ignition switch to OFF.
2. Pull the BAT1 (CB001) circuit breaker to OPEN.
3. Pull the SYSTEM, START circuit breaker to OPEN.
7. Push the BAT1 (CB001) circuit breaker to CLOSE.
8. Push the SYSTEM, START circuit breaker to CLOSE.
9. Perform engine operation test in accordance with Chapter 71 – Power Plant of this manual.
10. Inspect oil cooler and hoses for leaks.
11. Install upper and lower cowl in accordance with Chapter 71 – Power Plant of this manual.

This completes the Oil Cooler or Oil Cooler Hose Installation procedure.
Air/Oil Separator Removal

Perform this procedure to remove the air/oil separator.

1. Position the ALT and BAT master switches, the FADEC PWR A and B switches, and the ignition switch to OFF.
2. Pull the BAT1 (CB001) circuit breaker to OPEN.
3. Pull the SYSTEM, START circuit breaker to OPEN
4. Remove upper and lower cowling in accordance with Chapter 71 – Power Plant of this manual.

Figure 79-4 Air/Oil Separator Removal

5. Remove the clamps and hoses from the separator as shown in Figure 79-4
6. Remove the inboard mounting bolts and hardware from #1 and #2 ECU’s.
7. Remove the “P” clamps holding the separator to the mounting bracket.

This completes the
Air/Oil Separator Removal procedure
**AIR/OIL SEPARATOR INSTALLATION**

Perform this procedure to install the air/oil separator.

1. Install the “P” clamps holding the separator to the mounting bracket.
2. Install the inboard mounting bolts and hardware from #1 and #2 ECU’s.
3. Install the clamps and hoses from the separator as shown in Figure 79-5.
4. Inspect line routing and adjust lines clear of abrading structures.
5. Position the BAT1 (CB001) circuit breaker - CLOSED.
6. Push the SYSTEM, START circuit breaker to CLOSE.
7. Perform engine operation test in accordance with Chapter 71 – *Power Plant* of this manual.
8. Inspect oil cooler and hoses for leaks.
9. Install upper and lower cowl in accordance with Chapter 71 – *Power Plant* of this manual.

This completes the Air/Oil Separator Installation procedure.

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**Figure 79-5 Air/Oil Separator Removal**

3. Install the clamps and hoses from the separator as shown in Figure 79-5.
4. Inspect line routing and adjust lines clear of abrading structures.
5. Position the BAT1 (CB001) circuit breaker - CLOSED.
6. Push the SYSTEM, START circuit breaker to CLOSE.
7. Perform engine operation test in accordance with Chapter 71 – *Power Plant* of this manual.
8. Inspect oil cooler and hoses for leaks.
9. Install upper and lower cowl in accordance with Chapter 71 – *Power Plant* of this manual.

This completes the Air/Oil Separator Installation procedure.
OIL FILTER ELEMENT REMOVAL

Perform this procedure to remove the oil filter.

1. Position the ALT and BAT master switches, the FADEC PWR A and B switches, and the ignition switch to OFF.

2. Pull the BAT1 (CB001) circuit breaker to OPEN.

3. Pull the SYSTEM, START circuit breaker to OPEN.

4. Remove upper and lower cownling in accordance with Chapter 71 – Power Plant of this manual.

5. Position container and/or absorbent material below oil filter element to accommodate unavoidable minor spillage.


**NOTE**

*It is recommended that filter element be opened (use oil filter cutter tool) and entire element be examined for metal or other foreign material.*

This completes the Oil Filter Element Removal procedure.
OIL FILTER ELEMENT INSTALLATION

Perform this procedure to install the oil filter.

1. Place a thin film of clean engine oil on gasket of replacement filter element.
2. Thread filter element onto adapter and torque to 192-216 in-lbs.
4. Push the BAT1 (CB001) circuit breaker - CLOSED
5. Push the SYSTEM, START circuit breaker to CLOSE
6. Perform engine operation test in accordance with Chapter 71 – Power Plant of this manual.
7. Inspect oil filter installation for leaks.
8. Install upper and lower cowling in accordance with Chapter 71 – Power Plant of this manual

This completes the Oil Filter Element Installation procedure.
ENGINE OIL DRAINING PROCEDURE

Perform this procedure to drain the engine oil.

1. Start engine and allow oil to reach normal operating temperature.
2. After shutdown, ensure all electrical switches are off.
3. Remove upper and lower engine cowling.
4. Position appropriate container under engine oil sump drain plug.
5. Cut and remove safety wire.
6. Remove drain plug and gasket, drain oil.
8. When draining is complete, reinstall oil drain plug with NEW gasket.
9. Torque drain plug to 190-210 in-lbs.
10. Secure with safety wire.
## Section 20-04  **Troubleshooting Guide**

Use Table 79-1 as an aid in troubleshooting issues with the oil system.

<table>
<thead>
<tr>
<th>Complaint</th>
<th>Possible Cause</th>
<th>Remedy</th>
</tr>
</thead>
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<tr>
<td>Oil separator flow obstructed</td>
<td>Oil residue</td>
<td>Clean with engine solvent</td>
</tr>
<tr>
<td>Oil leaking from filter seal</td>
<td>Filter seal damaged</td>
<td>Replace filter</td>
</tr>
<tr>
<td>Oil cooler lines leaking</td>
<td>Loose fittings</td>
<td>Tighten to spec IAW TCM Maintenance Manual M-22</td>
</tr>
<tr>
<td>Oil Cooler Element leaking</td>
<td>Remove and inspect if no</td>
<td>Tighten fittings</td>
</tr>
<tr>
<td></td>
<td>damage reinstall at correct</td>
<td>Replace oil cooler</td>
</tr>
<tr>
<td></td>
<td>torque.</td>
<td></td>
</tr>
</tbody>
</table>

**Table 79-1 Oil System Troubleshooting Guide**
Section 79-30 Indicating

An electronic oil temperature sensor is threaded into the oil cooler adapter. Information from this sensor is displayed on the VM1000FX Integrated Engine Instrument Display System.

An electronic oil pressure sensor is mounted on the firewall and plumbed to the oil pressure port on the oil cooler adapter. Information from this sensor is displayed on the VM1000FX Integrated Engine Instrument Display System.

Figure 79-6 VM1000FX Oil Temperature and Pressure Indicators

Section 30-01 Oil Indicating Procedures

This section contains the removal and installation procedures for the oil temperature and pressure sensors as shown in Figure 79-7. The sensors are electronic components. Care must be taken to avoid application of excess forces during procedures and to protect electrical connections from contamination or damage.

Figure 79-7 Oil Temperature and Pressure Sensors
OIL PRESSURE SENSOR REMOVAL

Perform this procedure to remove either of the oil pressure sensors. The oil pressure sensors mount to the firewall, below the level of the Electronic Control Units, ECU. There are two sensors at this location. See Figure 79-8. The sensor on top is for the Hobbs meter, the sensor on the side is for the Health Status Annunciator. As these sensors are co-located, the procedure is the same for both. Any differences are noted in the text of the procedure.

1. Pull circuit breaker BAT 1 (CB001) to OPEN.
2. Position the ALT and BAT master switches, the FADEC PWR A and B switches, and the ignition switch to OFF.
3. Remove the upper and lower engine cowling.
4. If the airplane is equipped with an air/oil separator mounted to the firewall between the Electronic Control Units (ECU), disconnect the air/oil separator and bracket from the Electronic Control Units.
5. Refer to the exploded view shown in Figure 79-9. Have someone hold a wrench on the nut from inside the cockpit.
6. Turn the bolt securing the mounting bracket to the firewall. Remove the bolt being careful to retain the flat washers and the sleeve spacer.
7. Remove the bracket securing the oil pressure sensor T-fitting to the firewall.

Figure 79-8 Location of the Oil Pressure Switch (Hobbs) and the Oil Pressure Sensor (HSA) (The Air/Oil Separator Not Shown)
8. Bring the oil pressure sensor assembly up enough to allow access to the electrical connections on the sensors.

9. If removing Hobbs oil pressure switch, go to step 13.

10. Remove the screw in the center of the connector.

11. Disconnect the cable going to pressure sensor.


13. Using a Phillips screwdriver, remove the two wires that connect to the top of the Hobbs oil pressure switch.

14. Wrap the T-fitting with a rag to catch any oil.

15. Use a 7/16-inch wrench to remove the oil pressure sensor.

16. If installation of a replacement sensor will happen at a later time, cap the open end of the T-fitting, and secure.

17. If an air/oil separator was removed, temporarily install the air/oil separator and secure.

This completes the Oil Pressure Sensor Removal procedure.
OIL PRESSURE SENSOR INSTALLATION

Perform this procedure to install the oil temperature sensor.

1. If installing a replacement sensor for the oil pressure immediately after removing the previous oil pressure sensor, then proceed to step 9 below.

2. Pull circuit breaker BAT 1 (CB001) to OPEN.

3. Position the ALT and BAT master switches, the FADEC PWR A and B switches, and the ignition switch to OFF.

4. Remove the upper and lower engine cowlings.

5. If the airplane is equipped with an air/oil separator mounted to the firewall between the Electronic Control Units (ECU), disconnect the air/oil separator and bracket from the Electronic Control Units.

6. Refer to the exploded view shown in Figure 79-9. Have someone hold a wrench on the nut from inside the cockpit.

7. Turn the bolt securing the mounting bracket to the firewall. Remove the bolt being careful to retain the flat washers and the sleeve spacer.

8. Remove the bracket securing the oil pressure sensor T-fitting to the firewall.

9. Install the oil pressure sensor to the T-fitting.

10. If installing Hobbs oil pressure switch, go to step 14.

11. Connect the cable going to pressure sensor.

12. Secure the connector with the screw in the center of the connector.


14. Using a Phillips screwdriver, secure the two wires to the top of the Hobbs oil pressure switch.

15. Check the connector or connections on the other oil pressure sensor to make sure the connections are secure.

16. Using Figure 79-9 as a guide, assemble the mounting bracket and hardware.

17. Push the bolt through the firewall blanket to the inside of the cockpit.

18. Have someone hold the bolt from the engine compartment. Assemble the hardware from the cockpit side as shown in Figure 79-9.

19. Tighten the nut to secure the hardware.

20. Remove any rags that were absorbing oil.

21. Clean oil spilled during this procedure.

This completes the Oil Pressure Sensor Installation procedure.
OIL TEMPERATURE SENSOR REMOVAL

Perform this procedure to remove the oil temperature sensor. The oil temperature sensor is located on the port side of the engine up next to the firewall. See Figure 79-10 for the location of the oil temperature sensor. The location makes it very difficult to remove and/or install. Before attempting to remove/install the sensor, check all of the wiring and connections. Make sure the fault is not in the wiring or connectors.

1. Pull circuit breaker BAT 1 (CB001) to OPEN.
2. Position the ALT and BAT master switches, the FADEC PWR A and B switches, and the ignition switch to OFF.
3. Remove the upper and lower engine cowlings.
4. Remove the top bracket 3/8-inch bolt and ¼-inch nut that secures the wire clamp to the L-bracket. Carefully remove the cable clamp from the wire bundle.
5. Loosen the side bracket bolt and nut that secures the wire clamp to the engine support tube.

Spraying the cable clamp with a small amount of alcohol will allow the cable clamp to slide easier on the support tubing.

6. Slide the wire clamp down the tube and out of the way.
7. Cut and remove the safety wire from the sensor.

8. Carefully remove any cable ties securing the bundle of wires above the sensor.


10. Position the wire bundle away from the top of the oil temperature sensor.

11. Pack the area of the around the sensor to catch any oil that may come out of the fitting.

12. Use a 7/8-inch open-ended wrench to remove the oil temperature sensor.

NOTE

With the two Adel wire clamps out of the way, there is just enough room to get the wrench on to the sensor and turn it just enough to break the threads free. Then bring the wrench straight down from the top and complete the removal of the sensor. See Figure 79-11 to see the correct positioning to complete the removal of the oil temperature sensor.

Figure 79-11 Positioning the Wrench to Remove the Oil Temperature Sensor

13. With the oil temperature sensor removed, remove the remainder of the safety wire from the sensor-mounting bracket. Install new safety wire in to the bracket to prepare for the installation of a replacement sensor.

NOTE

Liberty Aerospace, Inc. recommends to start the installation of the safety wire at this point, while the sensor is out of the engine.

14. If replacing the oil temperature sensor later, plug the open hole where the sensor goes, secure all wires and connectors, secure mounting hardware.

This completes the Oil Temperature Sensor Removal procedure.
OIL TEMPERATURE SENSOR INSTALLATION

Perform this procedure to install the oil temperature sensor.

1. Pull circuit breaker BAT 1 (CB001) to OPEN.

2. If installing replacement oil temperature sensor immediately after removing the previous oil temperature sensor, then proceed to step 6 below.

3. Position the ALT and BAT master switches, the FADEC PWR A and B switches, and the ignition switch to OFF.

4. If installed, remove the upper and lower engine cowling.

5. Reposition the cable mounting hardware associated with the cable above the oil temperature sensor.

6. Reposition the bundle of cables above the sensor.

7. Wrap the area with a rag to absorb and oil.

8. Remove any plug from the hole for the sensor.

9. If a new safety wire was not installed previously, insert a fresh safety wire and prepare it for the sensor.

10. Assemble the oil temperature sensor’s copper crush gasket onto the sensor.

11. Insert oil temperature sensor assembly into the hole for the oil temperature sensor. Use a 7/8-inch wrench as shown in Figure 79-11 to turn-in the oil temperature sensor.

12. Torque the sensor to 220 in-lbs.

13. Complete the installation of the safety wire.


15. Secure the cable bundle using wire ties.

16. Move the cable clamp back into position and tighten the side bracket bolt.

Figure 79-12 Oil Temperature Sensor Showing the Copper Compression Gasket

11. Insert oil temperature sensor assembly into the hole for the oil temperature sensor. Use a 7/8-inch wrench as shown in Figure 79-11 to turn-in the oil temperature sensor.

12. Torque the sensor to 220 in-lbs.

13. Complete the installation of the safety wire.


15. Secure the cable bundle using wire ties.

16. Move the cable clamp back into position and tighten the side bracket bolt.
17. Assemble the wire bundle cable clamp to the L-bracket. Secure the clamp to the L-bracket using the bolt and nut removed in step 4 in the Oil Temperature Sensor Removal procedure on page 23 of this chapter.

18. Remove any rags that were absorbing oil.

19. Clean oil spilled during this procedure.

This completes the Oil Temperature Sensor Installation procedure.
## Section 30-02 Troubleshooting Guide

Use Table 79-2 to aid in troubleshooting the oil sensors.

<table>
<thead>
<tr>
<th>Complaint</th>
<th>Possible Cause</th>
<th>Remedy</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Oil Temperature Sensor:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Temperature Intermittent</td>
<td>loose wiring or connector</td>
<td>Repair</td>
</tr>
<tr>
<td></td>
<td>Sensor bad</td>
<td>Replace</td>
</tr>
<tr>
<td>No indication</td>
<td>loose wiring or connector</td>
<td>Repair</td>
</tr>
<tr>
<td></td>
<td>Sensor bad</td>
<td>Replace</td>
</tr>
<tr>
<td><strong>Oil Pressure Sensor:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pressure Intermittent</td>
<td>loose wiring or connector</td>
<td>Repair</td>
</tr>
<tr>
<td></td>
<td>Sensor bad</td>
<td>Replace</td>
</tr>
<tr>
<td>No indication</td>
<td>loose wiring or connector</td>
<td>Repair</td>
</tr>
<tr>
<td></td>
<td>Sensor bad</td>
<td>Replace</td>
</tr>
</tbody>
</table>

Table 79-2 Troubleshooting Oil Sensors