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MANDATORY SERVICE BULLETIN

DATE: May 25, 2017

Service Bulletin No. 480F
(Supersedes Service Bulletin No. 480E)
Engineering Aspects are
FAA Approved

SUBJECT: Oil Servicing, Metallic Solids Identification After Oil Servicing, and Associated Corrective Action

MODELS AFFECTED: All Lycoming direct drive and TIGO-541 piston engines

TIME OF COMPLIANCE: As per the schedule in Table 1

REASON FOR REVISION: Added detailed information, tables and figures, procedures on oil servicing, progressive inspection of metallic solids from filtered oil, guidelines for possible sources of metallic solids, and recommended corrective action

NOTICE: Incomplete review of all the information in this document can cause errors. Read the entire Service Bulletin to make sure you have a complete understanding of the requirements.

This Service Bulletin contains a schedule (Table 1) and instructions for oil and oil filter changes as well as oil pressure screen and oil suction screen cleaning.

For correct operation, an engine must have clean filtered oil of the correct grade and viscosity for in-flight ambient temperatures to lubricate all of its moving parts. Oil must be changed at regular intervals.

Engines can have either a full flow oil filter (Figure 1) or an oil pressure screen (Figure 2) to filter engine oil. An oil suction screen (Figures 3 and 4) also is installed in the oil sump to provide additional filtration of the engine oil.

NOTICE: Canister-type oil filters and elements are no longer available through Lycoming Engines.

Neither the oil pressure screen nor the oil suction screen are disposable. They must be removed, examined, cleaned, and reinstalled with a new gasket during oil changes. If either screen is damaged, replace the screen and install it with a new gasket.

NOTICE: While compliance with the oil change schedule and inspections in Table 1 of this Service Bulletin is mandatory, in special circumstances, the oil change intervals in Table 1 can be extended by not more than 5 hours while en route to a place where the oil change can be done (on engines using aviation fuel).

If the engine is transitioned to continuous use of an approved unleaded fuel identified in the latest revision of Service Instruction No. SI-1070, the oil change interval can be extended per the latest revision of Service Letter No. L270.

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Table 1
Oil Servicing Schedule

Task	Frequency
Initial oil change of any new, rebuilt or overhauled engine, or engine returned to service after storage*	After the first 25 hours of operation after initial start-up or in 4 months (whichever occurs first*)
Routine oil change and oil filter replacement (after initial 25-hour oil change and oil filter replacement) on engines with an oil filter (except TIO-540-AF1A and -AF1B) and On oil sump - Oil suction screen cleaning/inspection	After every 50 hours of engine operation or every 4 months (whichever occurs first**)
	After replacement of any engine cylinder
Routine oil change and oil filter replacement (after initial 25-hour oil change and oil filter replacement) on TIO-540-AF1A and -AF1B engines and On oil sump - Oil suction screen cleaning/inspection	After every 25 hours of operation or every 4 months (whichever occurs first**)
	After replacement of any engine cylinder
Oil suction screen cleaning on the inverted oil system on any aerobatic engine***	After every 25 hours of operation or every 4 months (whichever occurs first**)
Routine oil change and oil pressure screen cleaning/inspection	After every 25 hours of operation or every 4 months (whichever occurs first**)
	After replacement of any engine cylinder

* When a new, overhauled, rebuilt, or stored engine is put into service, drain the preservative oil and add fresh oil. Be sure to pre-oil the engine. Refer to instructions in the applicable Lycoming Engines' Installation and Operation Manual and Maintenance Manual.

Oil must be drained from the oil sump and replaced with preservative fluid when preparing the engine for storage and preservation. Refer to the latest revision of Service Letter No. L180.

** Oil change intervals must not exceed 4 months if the aircraft has not been flown for at least 25 hours in a 4-month period. More frequent oil changes are recommended if the engine has been exposed to volcanic ash, particulate, sand, dust debris, extreme weather conditions, or salt spray in coastal environments.

*** For AEIO-360-A1B6, -A1E, and -H1B Lycoming engine models, refer to the latest revision of Service Bulletin No. SB-564 to ensure the correct length oil suction screen is installed.

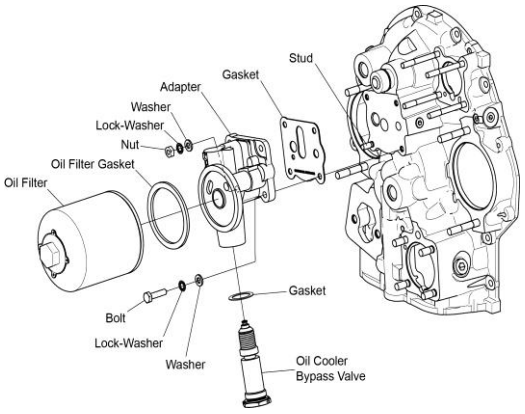

Figure 1
Example of a Full Flow Oil Filter

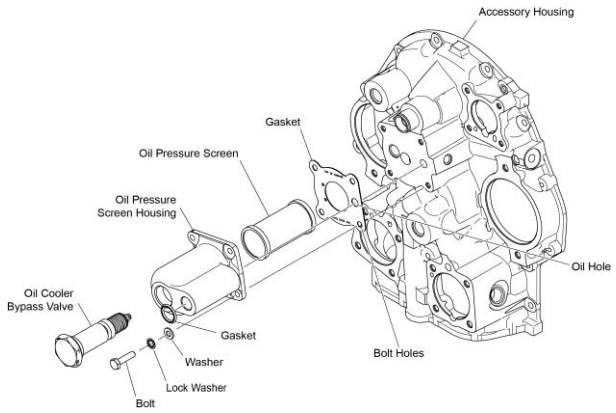

Figure 2
Example of an Oil Pressure Screen

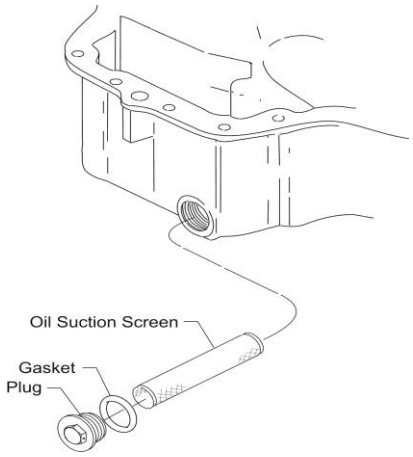

Figure 3
Example of an Oil Suction Screen

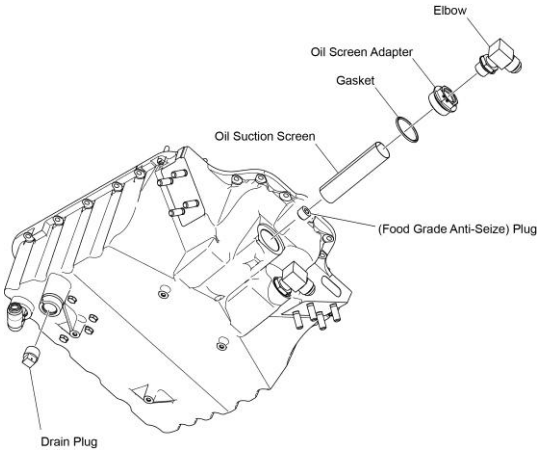

Figure 4
Example of an Oil Drain Plug and Oil Suction Screen on AEIO (Aerobatic Engines)

NOTICE: Figures 1 to 4 are example configurations for illustrative purposes. The configuration on your engine could be different.

Oil Change Procedure

1. Operate the engine until the oil temperature stabilizes and then shut down the engine.
2. Wait at least 15 minutes after engine shutdown. Drain oil from the engine as follows:
   A. Put a 15-quart (14-liter) capacity container under the drain plug(s) of the oil sump.
   B. Remove the safety wire/cable from one (or both) of the oil sump drain plug(s).
   C. Remove one (or both) oil sump drain plugs.
   D. Connect an oil drain hose if available.

NOTICE: As a best practice, Lycoming Engines recommends that spectrographic oil analysis be completed on an oil sample collected at each oil change to identify trends in engine wear as part of a comprehensive maintenance program. Refer to the latest revision of Service Letter L171 for more information.

   E. Collect an oil sample per your spectrographic laboratory's oil collection procedure. Be sure to collect the sample within 30 minutes after engine shutdown.
   F. Let the remainder of the oil drain from the engine.

3. Dispose of the oil in the container in accordance with environmental safety laws.
4. Clean the threads of the drain plug(s) and the threads in the oil sump with mineral spirits, MIL-PRF-680 or equivalent degreasing solvent.
5. Apply one to two drops of Loctite® 564™ or equivalent to the threads of each oil sump drain plug and install the oil sump drain plug(s) in the oil sump. Torque the drain plug(s) in accordance with the Standard Torque Tables in the latest revision of the ***Service Table of Limits - SSP-1776***.

⚠ **CAUTION:** MAKE SURE THAT EACH OIL SUMP DRAIN PLUG IS INSTALLED TIGHTLY PER THE CORRECT TORQUE TO PREVENT OIL LEAKAGE WHICH CAN CAUSE ENGINE FAILURE.

6. Safety cable/wire the oil sump drain plug(s), suction screen plug, and oil filter (if applicable) in accordance with the standard practices per the latest revision of AC43.13-1B or the latest revision of Service Instruction No. SI-1566.
7. During every oil change, either replace the oil filter or clean the oil pressure screen (whichever is on your engine) and clean the oil suction screen. Refer to respective procedures in this Service Bulletin.
8. Add new oil. Refer to the "Add Oil to the Engine" procedure in this Service Bulletin.

NOTICE: On certain engine models, the anti-scuffing agent oil additive (P/N LW-16702) to decrease engine wear is to be added to the oil sump during an oil change – except for installations that use a friction-type clutch and common engine oil system for the transmission and clutch assembly. Ask the airframe manufacturer what to use in those installations. Refer to the latest revision of Service Instruction No. SI-1409 for the general use of LW-16702 and AD 80-04-03R2 for engine models that require the use of oil additive LW-16702.

9. After adding oil, complete an oil level check and add more oil as necessary.
10. Refer to the Pilot's Operating Handbook (POH) to start the engine, complete the pre-flight run-up, stop the engine, and look for leaks in the oil system. Identify and correct the cause of any leaks before flight.

⚠ **CAUTION:** DO NOT RETURN THE ENGINE TO SERVICE UNLESS IT OPERATES CORRECTLY AND HAS NO OIL LEAK.

Add Oil to the Engine

NOTICE: Each time oil is added to the engine, record the quantity of oil added in the engine logbook for future reference to calculate oil consumption.

⚠ **CAUTION:** ADD OIL IN THE CORRECT QUANTITY AND OF THE CORRECT VISOCITY FOR THE CORRESPONDING AMBIENT TEMPERATURE TO THE ENGINE FOR CORRECT LUBRICATION ESSENTIAL TO ENGINE OPERATION PER THE APPROPRIATE LYCOMING ENGINE INSTALLATION AND OPERATION MANUAL.

NOTICE: On new or rebuilt engines, during the first 50 hours of engine operation, operate normally aspirated engines with mineral oil until oil consumption has stabilized. Operate turbocharged engines with ashless dispersant oil during the first 50 hours until oil consumption has stabilized. After the first 50 hours of engine operation, refer to the applicable Lycoming Installation and Operation Manual, to identify oil of the correct viscosity for the corresponding ambient temperature.

Add Oil to Wet Sump Engines (All Engine Models Except AIO and AEIO):

1. Pull out the oil port cap/dipstick from the oil fill tube.
2. Add new clean specified oil of the correct quantity and viscosity for the ambient temperature to the oil sump through the oil fill tube.
3. Measure the oil level using the dipstick. Add more oil as necessary until the oil level in the engine is sufficient.
4. Record the amount of oil added for future reference to calculate oil consumption.
5. Install the oil port cap/dipstick into the oil fill tube securely.

Add Oil to Dry Sump Engines (AIO Engine Models):

Refer to the aircraft manufacturer's instruction for adding oil to a dry sump aerobatic engine.

Add Oil to the Inverted Oil System on an Aerobatic Engine (AEIO Engine Models):

Add oil to the inverted oil system (Figure 5) on an aerobatic engine under any of the following circumstances:

- The initial engine fill with oil
- During an oil change
- After the oil valve of the inverted oil system has been removed or replaced.
- After one or more hoses in the inverted oil system have been disconnected and the oil has been drained.

The oil fill procedure for an aerobatic engine has an additional step after adding oil to the engine through the oil fill tube. After the oil level check shows that there is sufficient oil in the oil sump, add oil through the inverted oil pick-up hose (Figure 5) of the inverted oil system.

Because the configuration of the inverted oil system can be different depending on the engine model and installation, refer to the applicable Lycoming Engines' manual and the manufacturer's instructions when adding oil to the inverted oil system.

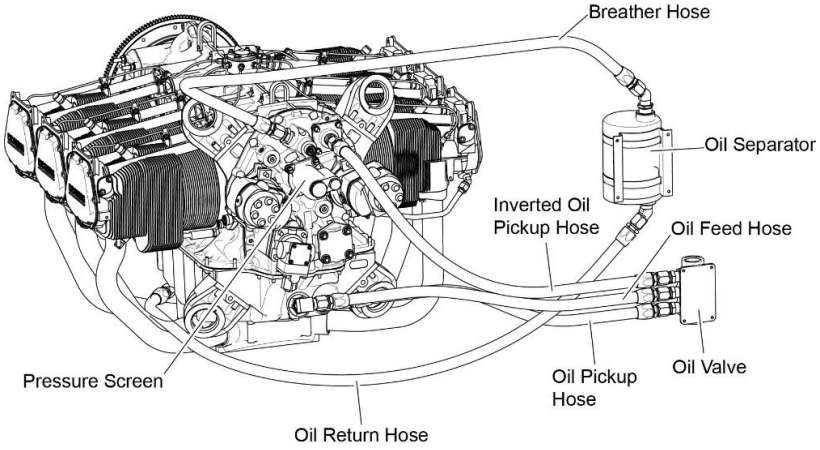

Figure 5
Example of an Inverted Oil System

⚠ **CAUTION:** DO NOT OVERFILL THE ENGINE WITH OIL. IT CAN CAUSE ENGINE DAMAGE.

Oil must be flowing to all engine parts that require lubrication at all times and in all attitudes to ensure correct engine operation.

Record the total amount of oil added to oil sump and the inverted oil system for future reference to calculate oil consumption after engine flights to identify oil usage and trends.

Oil Consumption

NOTICE: To ensure accurate calculation of oil consumption, each time oil is added to the engine, record the amount of oil added in the engine logbook.

1. Use the following formula to calculate the maximum allowable oil consumption limits for this engine and record the value in the engine logbook. Compare this oil consumption value to past oil consumption values.

$$0.006 \times BHP \times 4 \div 7.4 = Qt./Hr.$$

⚠WARNING: ONCE BREAK-IN IS COMPLETE, IF OIL CONSUMPTION IS MORE THAN THE CONSUMPTION RATES, DO NOT CONTINUE FURTHER FLIGHT. EXCESSIVE OIL CONSUMPTION IS AN INDICATION OF A SERIOUS PROBLEM THAT REQUIRES IMMEDIATE ATTENTION.

2. If engine oil servicing is consistently frequent or oil consumption has increased or is excessive, review the possible causes and associated corrective action below before further flight.

Possible Causes of Excessive Oil Consumption	**Corrective Action (per applicable Lycoming Engines' manual)**
New piston rings are not completely seated	As part of engine break-in, operate the engine at not less than 65% power for the first 50 hours to seat new piston rings.
Piston rings are worn, broken, or incorrectly installed OR Cylinder barrels are glazed or worn too much	1. Complete the Cylinder Compression Check. 2. Complete the Cylinder Borescope Inspection to determine if further corrective action is necessary **NOTICE:** Listen for a hissing sound at the breather of the crankcase which is an indication of air leaks around the rings. 3. Remove the cylinders, hone the cylinder barrels, replace the piston rings, and re-install the cylinders as per the following sections: • Cylinder Removal • Piston Removal • Piston Inspection • Piston Ring Replacement • Barrel Glaze and Varnish Removal from Interior Cylinder Barrel • Piston Installation • Cylinder Installation
Worn valve guides	Measure the valve guides for wear as per the Exhaust Valve and Guide Inspection. Replace worn valve guides.
Oil leaks	Examine the external area of the engine for leaks, identify and correct the cause of any leak.
Oil siphoned from engine during flight	Make sure the oil port cap/dipstick is secure and the oil access door closes correctly. Make sure that the breather hose is accurately cut and installed to prevent siphoning.
Oil level too high	Do not fill above the maximum oil sump capacity. Drain some oil (start of "Oil Change Procedure").

Oil Filter Replacement

After the initial 25-hour oil filter replacement and oil change, replace the oil filter after every 50 hours of engine operation during an oil change, unless otherwise directed (per the latest revision of Service Letter No. L270). During initiation of an engine, if oil consumption has not stabilized, repeat this procedure after the next 25 hours of engine operation. If oil consumption continues to be excessive, identify and correct the cause and repeat the oil change and oil filter replacement after every 25 hours of engine operation until oil consumption stabilizes.

1. Drain the oil from the oil sump per "Oil Change Procedure" in this Service Bulletin.
2. Remove the safety wire/cable from the oil filter (Figure 1). Discard the safety wire/cable.
3. Remove the oil filter from the engine.
4. Carefully remove the oil filter element from the oil filter. Refer to the "Oil Filter Element Inspection" procedure herein.
5. Apply Dow Corning® 4 or engine oil to the oil filter gasket on the new oil filter.
6. Apply Food Grade AA Anti-Seize to the oil filter threads.
7. Install the new oil filter on the oil filter base.

NOTICE: If installing an AC Canister and Element Type Oil Filter, torque the oil filter bolt to 25 ft.-lb. (34 Nm).

8. Torque the oil filter to 17 ft.-lb (23 Nm) or per the oil filter manufacturer's instructions.
9. Install new safety wire/cable (0.032 inch stainless steel) on the oil filter to keep it securely in place per the latest revision of Service Instruction No. SI-1566.
10. Record the oil filter replacement in the engine logbook.

Oil Filter Element Inspection

1. Cut open the removed oil filter element with an approved tool (e.g., for full-flow filters, use Champion Tool CT-470) per the tool manufacturer's instructions.
2. Remove the paper element from the oil filter.
3. Carefully unfold the paper element to prevent loss of collected particles which can compromise the integrity of this inspection.
4. Examine the material trapped in the filter. Look for shiny metallic particles/residue, shavings or flakes. Refer to the sections: "Identification of Metallic Solids After Oil Servicing" and "Visual Inspection of the Oil Filter Element, Oil Pressure Screen, and Oil Suction Screen" in this Service Bulletin.
5. Record all inspection findings and any corrective action in the engine logbook.

Oil Pressure Screen Inspection & Cleaning

1. Drain the oil from the oil sump per "Oil Change Procedure" in this Service Bulletin.
2. Remove the four bolts, lock washers, and washers from the oil pressure screen housing (Figure 2). Discard the lock washers.
3. Remove the oil pressure screen housing.
4. Remove the oil pressure screen and gasket. Discard the gasket.

5. Before cleaning, examine the oil pressure screen (Figure 2) for distortion, deformation or openings in the mesh and/or metallic particles. Refer to the sections: "Identification of Metallic Solids After Oil Servicing" and "Visual Inspection of the Oil Filter Element, Oil Pressure Screen, and Oil Suction Screen" in this Service Bulletin.
6. Examine and keep any material trapped in the oil pressure screen. Examine the condition of the oil and particles on the oil pressure screen. Look for shining, metallic residue which is an indication of a high concentration of metal.
7. Clean the oil pressure screen with mineral spirits or equivalent solvent.
8. Install the oil pressure screen (Figure 2) with a new gasket in the oil pressure screen housing flush with the base of the oil pressure screen housing.
9. Install the oil pressure screen housing assembly with the new gasket on the pad of the accessory housing aligned with the bolt holes and oil hole on the pad of the accessory housing using the four bolts, each with a washer and a new lock washer as shown in Figure 2.
10. Torque the four bolts as per the latest revision of the ***Service Table of Limits - SSP-1776***.
11. After all maintenance is complete, refer to the Pilot's Operating Handbook (POH) to start the engine, complete the pre-flight run-up, stop the engine, and look for oil leaks. Identify and correct the cause of any oil leak.

⚠ **CAUTION:** DO NOT RETURN THE ENGINE TO SERVICE UNLESS IT OPERATES CORRECTLY AND HAS NO OIL LEAK.

12. Record all oil pressure screen cleaning, inspection findings, and any corrective action in the engine logbook.

Oil Suction Screen Inspection & Cleaning

NOTICE: Some inverted oil systems (on aerobatic engines) have a second drain at the lower port for access to the oil suction screen.

1. Remove and discard the safety/cable wire/cable from the suction screen plug (Figure 3) and oil drain plug(s) on the oil sump.
2. Put a suitable collection container with a minimum 15-quart (14-liter) capacity under the drain plug(s) of the oil sump.
3. Remove the oil drain plug(s) and drain the oil from the engine.
4. Remove the oil suction screen plug and oil suction screen from the oil sump.
5. Remove and discard the gasket from the screen plug.
6. Before cleaning the oil suction screen (Figures 3 and 4), examine the oil suction screen for:
   A. Deformation or openings in the mesh.
   B. Metal particles, shavings or flakes trapped in the oil suction screen. Refer to the sections: "Identification of Metallic Solids After Oil Servicing" and "Visual Inspection of the Oil Filter Element, Oil Pressure Screen, and Oil Suction Screen" in this Service Bulletin.
7. Clean the oil suction screen with mineral spirits or equivalent solvent.
8. Apply Food Grade Anti-Seize to the threads of the oil suction screen plug.
9. Install the oil suction screen (do not flare the ends of the suction screen) in the oil sump with a new gasket, and the oil suction screen plug.

10. Tighten the oil suction screen plug until the sealing surfaces are in contact and then tighten the oil suction screen plug an additional 135°.

⚠ **CAUTION:** MAKE SURE THAT THE OIL SUCTION SCREEN PLUG IS INSTALLED TIGHTLY TO PREVENT OIL LEAKAGE.

11. Apply one to two drops of Loctite® 564™ or equivalent to the threads of the oil sump drain plugs and install the oil sump drain plug(s) in the oil sump. Torque the drain plug(s) in accordance with the latest revision of the ***Service Table of Limits - SSP-1776.***

12. Safety cable/wire the oil sump drain plug(s) and the oil suction screen plug in accordance with the standard practices per the latest revision of AC43.13-1B or the latest revision of Service Instruction No. SI-1566.

13. Complete the "Add Oil to the Engine" procedure.

14. After all maintenance is complete, refer to the Pilot's Operating Handbook (POH) to start the engine, complete the pre-flight run-up, stop the engine, and look for oil leaks. Identify and correct the cause of any oil leak.

⚠ **CAUTION:** DO NOT RETURN THE ENGINE TO SERVICE UNLESS IT OPERATES CORRECTLY AND HAS NO OIL LEAK.

15. Record all oil suction screen cleaning, inspection findings, and any corrective action in the engine logbook.

Identification of Metallic Solids After Oil Servicing

Identification of the nature of the metallic particles found in an oil filter element, oil suction screen, or oil pressure screen during an oil change is helpful as a diagnostic method. The metallic particles can be an early indication of wear or damage to engine components such as cylinders, bushings, piston pins, etc. ("Metallic particles" herein include metal particulates and/or chunks, chips, flake, hair-like strands, shavings, etc.)

Identification of the metallic particles is a progressive approach that begins with a visual inspection that can be followed with basic chemical analysis or more in-depth analysis or directly with component examination and subsequent corrective action.

Visual Inspection of the Oil Filter Element, Oil Pressure Screen, and Oil Suction Screen

When metallic particles are found on a filter element or screen, a visual inspection of the metallic particles on the filter element or screen is to be done to help identify and narrow the root source of affected engine components subject to wear or damage. The visual inspection includes four attributes:

Size - "Chunks" are metallic particles larger than 3/16-inch in size; chips are smaller than chunks. Chunks and chips require immediate analysis. Yet metallic particles can be small dust-size particulates - that is where quantity becomes more of the issue in this case.

Quantity – If more than five small particulates are on almost every panel in the oil filter element or if there is a 1/4 teaspoon full of metallic particles from an oil pressure screen or oil suction screen, these metallic particles require immediate analysis because they can be an indication of an engine component being worn or damaged.

Color – Metallic particles can vary in color: black, shiny silver or gray metal, bronze or brass – all of which can be an indicator toward the affected engine component.

Magnetic/Not Magnetic – Most ferrous alloy materials can be picked up by a magnet. However, some stainless steel and non-ferrous materials such as aluminum, magnesium, tin, cadmium, zinc, etc. cannot be picked up with a magnet.

The visual inspection procedure is slightly different for oil filter elements and screens:

Visual inspection for oil filter element:	**Visual inspection for oil pressure screen and oil suction screen:**
Remove the oil filter element from the oil filter canister.	Drain all fluid oil through a strainer cloth or paper to remove oil from either the oil pressure screen or oil suction screen as much as possible to enable better visibility of the metallic particles and prevent loss of metallic particles. Since quantity matters, try not to lose particles. Loss of metallic particles can compromise the integrity of this inspection.
Drain all fluid oil through a strainer cloth or paper to remove oil from the oil filter as much as possible to enable better visibility of the metallic particles and prevent loss of metallic particles. Since quantity matters, try not to lose particles. Loss of metallic particles can compromise the integrity of this inspection.	Scrape all of the remaining metallic particles onto a clean teaspoon, paper or cloth.
Open up and unravel the oil filter element on a clean sheet of white paper or cloth.	Look at metallic particles for any shiny metallic solids.
Use bright light illumination to look at the panels and folds on the filter element for any shiny metallic solids.	Look for any copper-colored metallic particles.
Look for any copper-colored metallic particles.	Use non-metallic tweezers or a pick to sort chunks, chips, and particles that look different.
Estimate the size and number of metallic particles.	Estimate the size and number of metallic particles.

It is important to know if this is the initial oil change of a new, rebuilt, or overhauled engine. Typically, small metallic particles, chips, and chunks on either the oil filter element or oil pressure screen or oil suction screen during the first oil change of a new, rebuilt, or overhauled engine, are acceptable. After an initial break-in period, metal content is likely to decrease rapidly to a level that remains essentially constant.

However, on subsequent oil changes, an increased quantity of chunks, chips, and/or small metal particles in the oil can be evidence of engine part wear. This wear can increase over a period of time until premature loss of form, fit, or function occurs.

NOTICE: If the engine has been operated in dust, sand storms, volcanic ash, wildfires, etc. more particulates could be found.

Table 2 identifies field tests and guidelines for identifying types of metals as well as possible sources and the next step in the process.

Table 3 identifies the size and amount of material and the recommended corrective action.

Table 4 identifies specific corrective action for the various findings.

The type of material (Table 2), regardless of quantity, and/or the quantity and size of metallic particles (Table 3) can help determine the corrective action (Table 4) to be taken.

NOTICE: Table 2 only applies to engines that use genuine Lycoming Parts.

Table 2
Guidelines for Identification of Metal Particulates and Chips & Corrective Action

Metals/ Alloys	Tests & Characteristics	Possible Source of Origin on Lycoming Engine	Next Step
Steel or cast iron	Picked up by magnet or, will move when a magnet is placed on the opposite surface of the filter element or strainer cloth – which will prevent chips from sticking to the magnet	Camshaft lobes Gears Tappets Push rods Rockers Shafts Impellers Piston rings Cylinder barrels	Refer to Table 3 for the quantity and size of the particles
Bronze	When placed in nitric acid, turns bright green	Connecting rod bushings Rocker bushings Crankshaft bearings Intake valve guide Piston pin plug Idler gear bushing	Refer to Table 3 for the quantity and size of the particles
Nickel	Not picked up by magnet	Exhaust flange V-band coupling Gasket	Refer to Table 3 for the quantity and size of the particles
Stainless steel		Valves Exhaust components Valve seats Oil bypass valve spring Safety wire	Refer to Table 3 for the quantity and size of the particles
Chrome		Piston rings Exhaust valve stems	Refer to Table 3 for the quantity and size of the particles
Copper	When placed in nitric acid, turns bright green	Platings	Refer to Table 3 for the quantity and size of the particles

Table 2 (Continued)
Guidelines for Identification of Metal Particulates and Chips & Corrective Action

Metals/ Alloys	Tests & Characteristics	Possible Source of Origin on Lycoming Engine	Next Step
Brass	When placed in nitric acid, turns bright green	Oil suction screen Pressure relief valve spacer	Refer to Table 3 for the quantity and size of the particles
Lead		Bearings	If lead chips, chunks, or balls are found, complete Corrective Action 4 in Table 4.
Aluminum flakes	When placed in 50% solution of nitric acid and muriatic acid (approximately 30% hydrochloric acid and water), or a sodium hydroxide solution, the aluminum particles bubble and fizz and form a black residue	Crankcase Accessory housing Oil pump body Cylinder head Pistons Piston pin plugs Oil sump baffle Turbocharger inlet housing Sleeve bearings	Refer to Table 3 for the quantity and size of the particles
Magnesium		Oil sump	Refer to Table 3 for the quantity and size of the particles
Tin	Soft, malleable Not picked up by magnet When dropped onto a hot (500◦F) soldering iron, tin particle will melt and fuse with 50/50 solder	Tin-plated parts	Refer to Table 3 for the quantity and size of the particles
Cadmium		Plating	Refer to Table 3 for the quantity and size of the particles
Zinc		Plating	Refer to Table 3 for the quantity and size of the particles

Table 3
Guidelines for Particle Quantity and Size on Oil Filter, Oil Pressure Screen, or Oil Suction Screen

Condition	Corrective Action (Table 4)
1 to 9 pieces of metal (1/16 in. (1.2 mm)) diameter or less)	Continue to operate the engine until the next scheduled oil change
10 to 20 pieces of shiny flake-like, non-magnetic metal (1/16 in. (1.2 mm)) diameter or less)	Corrective Action 1
10 or fewer short hair-like pieces of magnetic metal	Corrective Action 1
20 to 40 pieces of shiny flake-like non-magnetic metal	Corrective Action 2
45 to 60 small pieces of shiny flake-like, nonmagnetic metal	Corrective Action 3
Pieces of metal that are chunks, greater than 3/16 in. (4.8 mm) or chips smaller than chunks **NOTICE:** A mixture of magnetic and nonmagnetic material can indicate valve or ring and piston failure. **NOTICE:** Remove the bottom spark plugs to identify a non-conforming cylinder.	Corrective Action 4
1/4 teaspoonful or more of nonmagnetic plating with or without a copper tint, could vary in sizes	Corrective Action 2
1/4 teaspoonful or more of nonmagnetic plating with or without a copper tint, 1/16-inch or larger size could indicate bearing damage	Corrective Action 4
Pieces of shiny flake-like, nonmagnetic metal (larger than 1/16 inch in diameter) with no copper tint. (Possible indication of incorrect propeller operation.)	Corrective Action 4
1/4 teaspoonful of nonmagnetic brass or copper colored metal that appears coarse like sand	Corrective Action 4
1/2 teaspoonful of more of metal	Corrective Action 4
NOTICE: On six-cylinder engine models, if solids are found in the small screen molded within the propeller governor gasket, refer to the "Oil Contamination Check" section in this Service Bulletin.	

Table 3 (Continued)
Guidelines for Particle Quantity and Size on Oil Filter, Oil Pressure Screen, or Oil Suction Screen

Condition	Source of Particles	Corrective Action (Table 4)
Chunks (3/16-inch or larger) in oil suction screen	Valve Tappet Ring Piston Bearing Machining chips	Corrective Action 3 and contact Lycoming Product Support
Bronze chips in the oil suction screen	Connecting rod bushing	Corrective Action 6
More than five bronze chips found in the oil filter, oil pressure screen, or oil suction screen	Connecting rod bushing	Corrective Action 6
More than three bronze chips AND more than three aluminum chips found in the oil filter, oil pressure screen, or oil suction screen	Connecting rod bushing and piston	Corrective Action 7
1/4 teaspoon or more of metallic particles and metal has gotten past the oil filter or oil pressure screen	Cylinders Bearings Piston Piston pin plugs	Corrective Action 4
1/4 teaspoon or more of metallic particles and metal has **not** gotten past the oil filter or oil pressure screen	Possibly only one engine cylinder is damaged or spark plug is worn or damaged	Corrective Action 5

If the cause of the metal contamination cannot be identified, speak with the Lycoming Engines Product Support.

If there is unusual aluminum, bronze, or iron contamination in the oil, make sure you have a full description of the engine model, serial number, history, oil temperatures, oil pressure, unusual performance, and properties of the metal contamination (color, size, metallic/nonmetallic, shape, etc.). This information will help Product Support identify the cause of the contamination.

Coordinate with an appropriate oil analysis laboratory to have the material analyzed. For factory new, factory rebuilt or factory overhauled Lycoming engines within their hourly or 12 year required TBO cycle, if directed, send the oil filter element and metallic material to Lycoming Engines for analyses.

A change in the usual wear rate of a part is not necessarily an indication of imminent failure. It is an indication that a borescope examination, cylinder compression pressure check, etc. are necessary to identify the cause for unusual wear.

Recommended Corrective Action Options

Table 4
Recommended Corrective Action Options
(Refer to the applicable Lycoming Engine manual for procedures)

1	a. Complete an oil change. b. Replace the oil filter or clean the oil pressure screen. c. Clean the oil suction screen. d. Operate the engine in flight for 25 hours. e. Complete an oil change again. f. Remove and examine the oil filter or pressure screen. g. If either the oil filter or oil pressure screen is clean, resume the routine oil servicing schedule. If chunks or more than 45 metallic particles are found, ground the aircraft and proceed to Corrective Action 3.
2	a. Complete an oil change. b. Replace the oil filter or clean the oil pressure screen. c. Clean the oil suction screen. d. Operate the engine **on the ground** for 20 to 30 minutes. Refer to the aircraft POH. e. Remove and examine the oil filter or oil pressure screen. f. If either the oil filter or oil pressure screen is clean, install a new oil filter or re-install the oil pressure screen and operate the engine in flight for 10 hours. g. Remove the oil filter or pressure screen. h. If either the oil filter or oil pressure screen is clean, resume the routine oil servicing schedule. If chunks or more than 45 metallic particles are found, ground the aircraft and proceed to Corrective Action 3.
3	a. If one or more chunks are found, remove the oil sump and look for chunks and metallic particles in the oil sump. b. If one or more chunks are found in the oil sump, examine the valves, pistons, and rings.
4	Remove the engine or send the engine to Lycoming Engines or an FAA authorized repair facility for customized evaluation. Or Disassemble the engine per the applicable Lycoming maintenance or overhaul manual to identify and correct the cause.
5	Remove and examine the spark plugs. Complete a Cylinder Borescope Inspection on the cylinders. Remove the propeller governor to determine if metallic particles have spread to other parts of the engine. If the contamination has spread to other parts of the engine, proceed to Corrective Action 4.
6	a. Remove cylinders and pistons. b. Examine the connecting rod bushing per the latest revision of Service Bulletin No. SB-630.
7	a. Remove cylinders and pistons. b. Examine the connecting rod bushing per the latest revision of Service Bulletin No. SB-630. c. Examine the pistons for wear or damage.

Oil Contamination Check

On many six-cylinder Lycoming engine models, there is a small screen molded within the propeller governor gasket. Remove this gasket and look for metallic particles on the screen.

If less than 10 metallic particles are found on this screen:

A. Replace the propeller governor gasket.

B. Complete an oil change.

C. Replace the oil filter or remove, clean, and re-install the oil pressure screen.

D. Complete a 20 to 30-minute engine operational ground test. Refer to the aircraft POH.

E. Remove the oil filter and oil filter element.

F. Examine the oil filter element. If the quantity of metallic particles has increased, send the metallic particles for analysis and proceed to Corrective Action 5 in Table 4. If there are no metallic particles, continue with routine engine operation and maintenance.

If 10 or more metallic particles or flakes or slivers of metal are found on this screen:

A. It is likely that the particles have bypassed the oil filter or oil pressure screen and have circulated to other parts of the engine.

B. In this case, the particles could now be in the close-tolerance gaps between the crankshaft main bearings and crankshaft. The crankshaft could be scored or has heat damage due to decreased oil flow.

C. **Do not continue further flight.**

D. Proceed to Corrective Action 4 in Table 4.