# Aviation Service Manual AV6-R

## Spark Plugs/Oil Filters

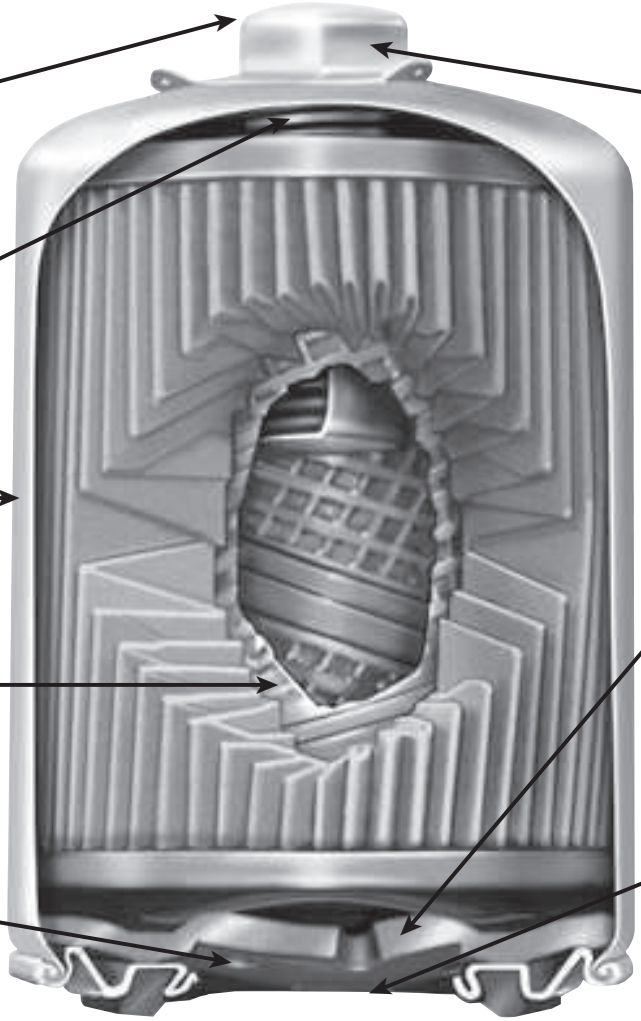
$3.00

CHAMPION AEROSPACE

Bringing Power To Flight®

Revised November 2004

# Oil Filters



**Shorter Installed Height**
Shortened can height by approximately 1/2", with no impact to the filter media's performance.

**Improved Spring**
Replaced old "leaf" spring with an improved coil spring design.

**Thicker-Walled Can**
Increased wall thickness for improved structural integrity.

**Stronger Center Tube**
Redesigned center tube for added strength, with collapse pressures more than double the current design.

**New Inlet Design**
Changed four-hole design to an eight-hole design for approximately 30% greater inlet flow area.

**New Improved Wrench Flats**
Provides: secure fit, proper torque, and easier removal.

**Increased Lid Thickness**
Increased thickness of seaming lid by approximately 35%, which subsequently provided for higher burst and impulse testing.

**Improved Baseplate Thread**
Replaced cut thread with an improved rolled thread, without affecting tolerances on the thread dimensions.

## Design Features

Champion Aerospace's full-pleat, resin-impregnated micronic filter media traps all harmful particles, including metallic chips which result from abnormal engine wear. Because the oil flows through many layers of locked-in fibers, there is no migration of fiber material to clog engine oil passages or affect bearing surfaces.

According to industry-approved tests, the Champion oil filter traps more dirt and harmful particles during its operating time than any other similar filter.

# Aircraft Engine Oil Filters

Champion oil filter elements and spin-on filters are manufactured to meet or exceed the specifications in ARP 1400 B. These specifications define uniform parameters for the design, manufacture and testing of filters for general aviation lubricating oil systems for aircraft-type reciprocating engines. In addition, Champion has been chosen as original equipment supplier to both Teledyne Continental Motors and Textron Lycoming for all their reciprocating oil filter requirements.

Specific operational, maintenance and inspection procedures for oil filters are contained in aircraft and engine manuals. We highly recommend their use to obtain specific details that apply to the requirements of any given model engine or aircraft. However, this service manual includes some cautionary notes and guidelines which should be taken into account when servicing reciprocating engines.

**Champion Full Flow Spin-On Oil Filters**


Lycoming
CH48103-1 CH48104-1


Continental
CH48108-1 CH48109-1
TCM No. 649922 TCM No. 649923


Lycoming and Continental
CH48110-1 CH48111-1

## Benefits of Efficient Engine Oil Filtration

For all general aviation piston engines, the basic purpose of an engine lube oil filter is to help supply a continuous flow of filter-clean oil to vital engine parts. Clean lube oil of a type approved by the engine manufacturer provides the best possible protection for engine parts during the service life of the engine.

For maximum engine protection, the best working companion to engine lube oil is an efficient oil filter, free of harmful contaminants and performing its multipurpose job of lubricating, sealing, cooling and cleaning. Engine lube oil performs all of these functions best with full-flow, filter-cleaned oil.

- Lubricating. By maintaining a protective film of lubrication between all frictional surfaces of vital engine parts under all operating conditions.
- Sealing. By providing a film of heat-resistant lubricant between piston rings, pistons and cylinder walls necessary to maintain proper compression and combustion pressures, as well as protection against harmful blow-by into crankcase sections.
- Cooling. Internal engine parts (pistons, rings, bearing surfaces) operating at high temperatures are an essential function of engine lube oil. Rapid transfer of heat away from these internal parts is increased by the aid of an externally mounted oil cooler.
- Cleaning. A major function of lube oil is to keep engine parts such as oil lines, galleys, squirt jets, piston ring lands and oil holes clean and open. Some approved engine lube oils even contain special ashless dispersants to aid in internal engine cleaning.

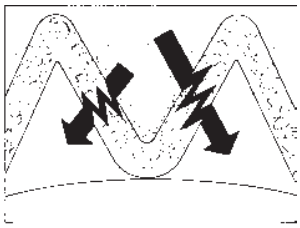
## Oil Filter and Replacement Element Design

Champion offers two types of oil filter cartridges to cover all existing aircraft piston engine lube oil system applications. Replacement elements service engine-mounted or line-installed filter systems incorporating a permanent housing assembly. And a modern spin-on oil filter contains the element incorporating the valve mechanisms of anti-drain back valves and the pressure relief valve, sealed in a disposable housing.

Champion replacement elements are manufactured to exact specifications required by the housing assembly system. Important design features of Champion aviation oil filters are described here.


## Filter Media

The filter media is a Champion exclusive high performance resin-impregnated cellulosic/glass fiber composite paper manufactured to rigid specifications to assure uniform density and porosity. Preforming, convoluting and high-temperature curing transform the basic structure into a durable filter medium that resists heat, shock and oil chemicals. The filter medium provides both surface and scientific depth filtration, because the oil flows through many layers of locked-in fibers. No migration of filter material is possible, so engine oil passages remain clear, and bearing surfaces are not affected.

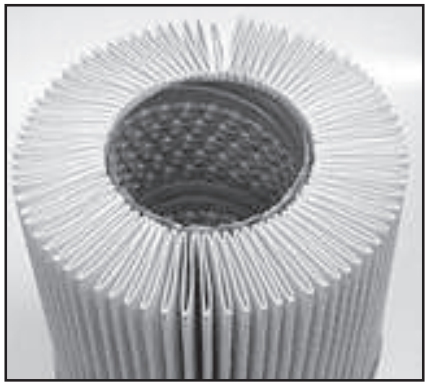


## Dirt-Holding Capability

Advancements in design and materials in aviation oil filter manufacturing have produced a superior filter element at Champion Aerospace. Our own laboratory-controlled comparative tests, conducted in accordance with established filter industry test procedures, have shown that the Champion oil filter traps and holds more contaminants during its normal operating life than other similar filters.

## Resistance to Collapse

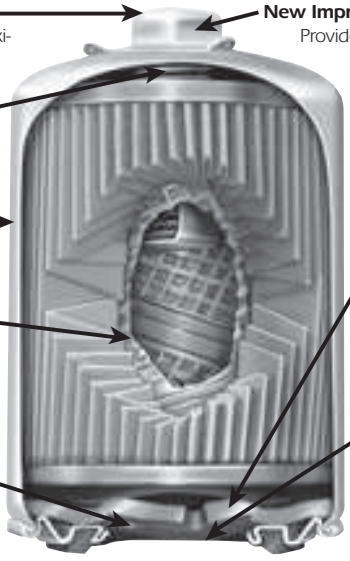
The Champion Aerospace design, with a corrugated, steel center tube supporting each convoluted pleat of the filter media, results in a collapse-pressure rating approximately twice that of other similar filters. Substantially higher, this rating offers a significant extra margin of protection from failure under cold-start conditions.



## Champion Spin-On Oil Filters

Champion spin-on oil filters contain the same high-quality high-performance element, without perforated wrapper, as our other oil filters – plus these design and performance features.

- Wrench pad with 1' hex, spot-welded to case, handles torque pressures far beyond normal removal or installaton requirements.
- Tough steel case provides exceptional strength to resist the high oil pressures which occur during cold engine starts. Meets or exceeds engine manufacturer specifications.
- High performance resin-impregnated cellulosic paper is manufactured to rigid specifications, assuring uniform density and porosity. The high quality media is preformed, convoluted and cured at a controlled temperature to form a durable, heat shock- and chemical-resistant filter medium. It provides both surface and scientific depth filtration because the oil flows through many layers of locked-in fibers. Filter material cannot migrate to clog engine oil passages or affect bearing surfaces.
- Heavy, corrugated steel center tube supports each convoluted pleat of the filter element and produces a substantially higher collapse-pressure rating, twice that of other similar filters.
- Maximum full-flow design, without interference from center-bolt oil filter assemblies, provides increased oil filtration each engine operating hour.
- Heavy-duty steel mounting plate is cemented, spot-welded and crimped to case. Even under abnormal oil temperatures and pressures, this primary, standard part of the filter assembly ensures freedom from troublesome oil leakage when the filter is installed according to the instructions printed on the case.

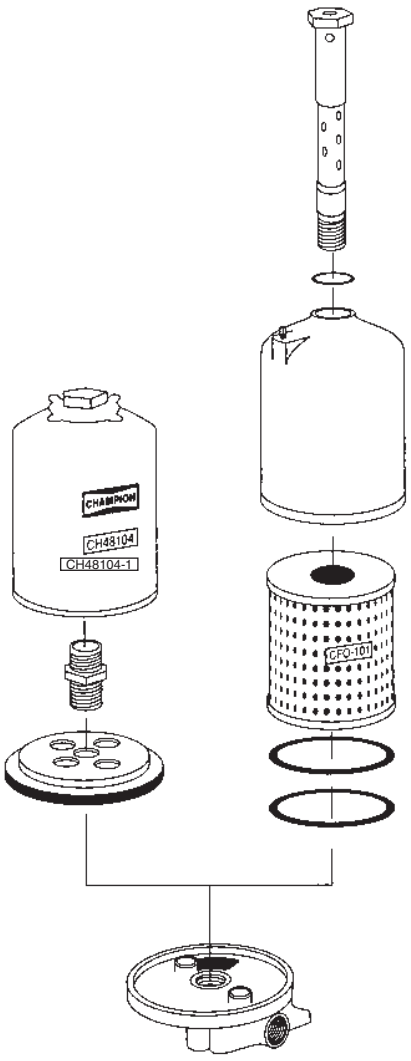


# Aviation Engine Oil Filters

## Lycoming Replacement Filters

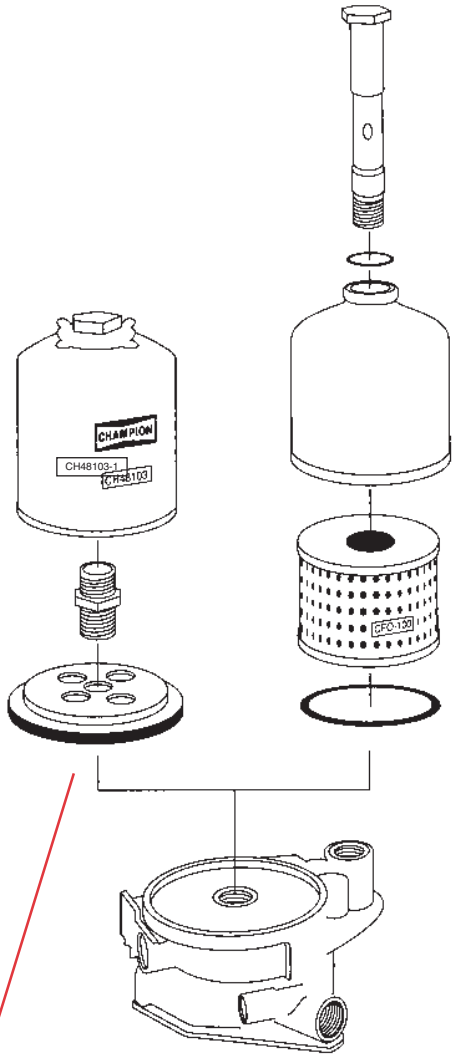
Champion spin-on oil filters, CH48103-1 and CH48104-1, are designed to replace oil filter element housing assemblies in Lycoming engine models TIO-541, TIGO-541 and direct-drive engines that have the die-cast accessory case with single-drive dual magneto. One exception is the 0-320-H2AD engine which uses Lycoming Filter Kit #LW-14969.

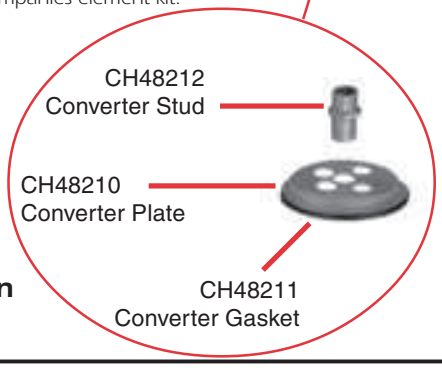
### Models TIO-541 and TIGO-541.




**NOTE:** Do not use flat gasket which accompanies element kit.

### Models with Single-Drive, Dual Magnetos.




**CH48922 (54E23093) Spin-On Oil Filter Converter Kit.**

**NOTE:** Replace gasket anytime converter plate is removed. Textron Lycoming now supplies the converter kit, formerly sold under Champion part no. CH48922. This kit is now available from your Lycoming distributor under part no. 54E23093.

# Aviation Engine Oil Filters

### Semi-Depth Type Filters

All Champion Aerospace oil filters are classified as semi-depth types. They incorporate exclusive construction design features to provide the advantages of a full-flow engine oil filtration system under all engine operating conditions.

A semi-depth type oil filter combines the filtration functions of surface- and depth-type filters. The most popular semi-depth type oil filter incorporates convoluted or pleated paper filter media. This filter media is manufactured within closely controlled specifications to ensure efficient performance and uniform product quality.

The filter media is usually resin-coated to impart special characteristics such as strength and resistance to water and temperature. Strength is especially important during cold engine starts. The filter element experiences literally thousands of pressure differential cycles during its life. During pressure pulsations of the lubrication system resin impregnation provides desirable pore structure rigidity to retain media pore size and maintain filtering efficiency through flow-fatigue resistance.

## Oil Filters Element Removal and Installation Instructions

### Housing Removal

- To remove filter housing from adapter, cut and remove safety wires, loosen the hex head screw (1) and turn the entire housing counterclockwise.
- Remove nylon nut (8) which secures coverplate (6).
- Remove coverplate (6) from case (3).
- Remove hex head screw (1) from case (3). Push on threaded end of screw and pull out on screwhead side.

**CAUTION:** Do not mar or damage threaded end of screw.

- Remove and discard used filter element (4).

**NOTE:** Old filter element may be inspected at this time by removing the outer body wrapper and observing the type of contaminant in the paper pleats like wear particles or metal chips. Such inspection may help define potential operating problems.

- Discard used rubber gaskets (5,7) and copper gasket (2).

**NOTE:** Do not reuse old gaskets. Replacement kit contains new gaskets.

### Cleaning and Lubrication

- Wipe clean all remaining filter housing parts and the aircraft adapter.
- Lightly oil rubber grommets in the new filter element (4), new copper gasket (2) and new rubber gaskets (5,7) with clean oil.

### Assembly

- Place new rubber gaskets (5,7) in the cover (6) and seat properly.
- Insert screw (1) through new copper gasket (2) into filter case (3) and stand upon screw head.
- Carefully push element (4) over screw (1) into case (3) until bottomed.
- Place cover (6) over case (3) and thread on the nylon nut (8) by hand.

**NOTE:** When the nylon nut is properly threaded onto the screw, it will not protrude above the metal surfaces of the cover. Do not use pliers or wrench.

## CT-921 Torque Wrench

### Oil Filter Installation and Removal

The one-inch ratchet can be used for installation of Spin On Champion Oil Filters. The CT-921 is also a torque wrench calibrated to the recommended installation torque of 17 foot-pounds. The torque wrench can be easily recalibrated.

# Aviation Oil Filters

**Assembly (con't)**

- Install housing on engine adapter by turning the entire housing clockwise until the gasket (7) seats against the adapter.
- Torque the screw (1) according to applicable values provided at right. Always use a torque wrench and tighten the screw to the specified torque.
- Check the gasket (7) for circular distribution around the edge of the adapter. If not properly distributed, the gasket may have become unseated during assembly and must be replaced.

**NOTE:** Do not use a gasket which has been unseated, since it is damaged and cannot be reused. A close check of the adaptor for warpage due to overtightening is a must.

- Check for leakage by starting and warming up the engine. Observe the areas around the gasket seal to the adapter and the screw seal to the housing. Turn off the engine and recheck the screw torque for required value as shown previously. The filter housing holds about one quart of oil. **Check oil level.**
- Complete assembly by safety-wiring the screw (1) to the case (3) and the case (3) to the adapter or engine.

| Filter Housing | Manufacturer | Torque Ft./Lb. | In./L.b |
|---|---|---|---|
| OF-71-A | AC | 20 to 25 | 240 to 300 |
| OF-7-A | AC | 15 to 18 | 180 to 216 |
| 1250406-1 | Cessna | 15 to 18 | 180 to 216 |
| OF-81-A | AC | 20 to 25 | 240 to 300 |
| OF-8-A | AC | 15 to 18 | 180 to 216 |
| OF-9-A | AC | 15 to 18 | 180 to 216 |
| C-294505 | Cessna | 20 to 25 | 240 to 300 |

| NOTE: | # of Turns | Approximately = # of Ft./Lb. of Screw |
|---|---|---|
| | 1-5/8 to 1-3/4 | 15 to 18 |
| | 1-3/4 to 1-7/8 | 20 to 25 |

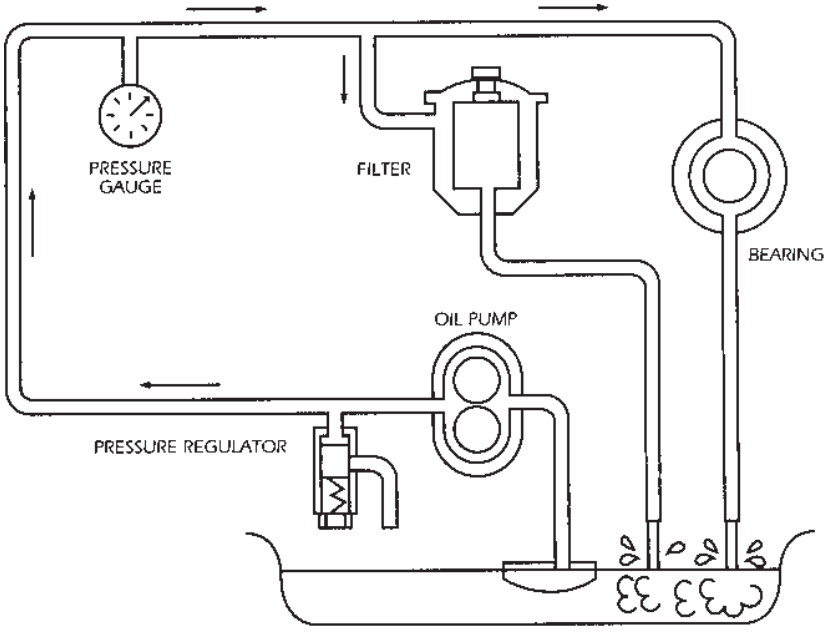
**NOTE:** If spare copper gaskets or rubber gaskets are required, they may be obtained by ordering Gasket Replacement Kit PN CFO-205, which includes:

| Description | Part No. |
|---|---|
| Copper Gasket (2) | CFO-240 |
| Flat Rubber Gasket (5) | CFO-203 |
| Square Rubber Gasket (70 | CFO-202 |

## Bypass Filter System

Most new aircraft engines are equipped with, or have provisions to accept, a full-flow type oil filter system. However, some older model engines do not have these provisions. Instead, they have a bypass system sometimes known as a partial-flow system.

The partial-flow bypass system filters only about 10% of the oil through the filtering element, returning the filtered oil directly to the sump. Therefore, as shown here, the oil passing through the engine bearing is not filtered oil.



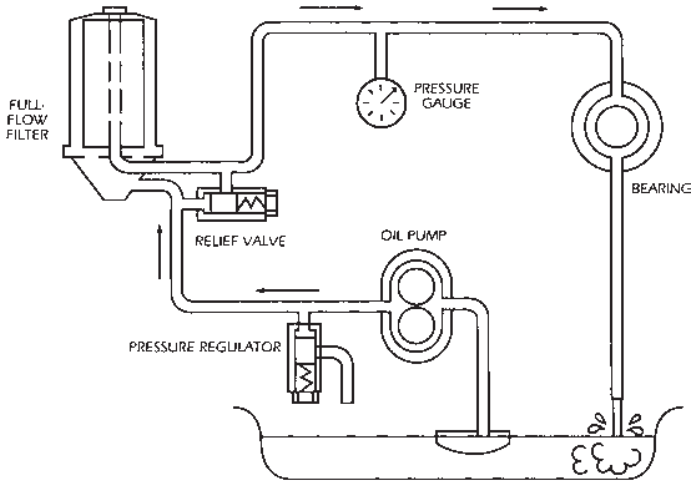

BYPASS FILTER SYSTEM

# Aviation Engine Oil Filters

## Full-Flow Filter System

Champion oil filters are designed for a full-flow oil system. This system positions the filter between the oil pump and the engine bearings, thereby filtering the contaminants from the circulated oil before it passes through the bearing surfaces.

All full-flow systems incorporate a pressure-relief valve, which opens at a predetermined differential oil pressure Therefore, should the filter become clogged, the relief valve will open, allowing the oil to bypass and prevent engine oil starvation.




FULL-FLOW FILTER SYSTEM

## Oil Filter Sludge Inspection

Inspection of engine sludge trapped in spin-on oil filters has been recommended practice for many years. Service engineers of engine manufacturers, oil companies and licensed aircraft mechanics recognize the valve of visual inspection to help determine if internal engine wear or malfunction has occurred through inspection for metal or other contaminants within the engine oil system.

### CT-923 Oil Filter Can Cutter

The Champion CT-923 Oil Filter Can Cutter is a useful tool for opening spin-on filters without introducing foreign material into the filter. Use the following recommended procedures to inspect full-flow oil filters.

- Remove the filter from the engine and place it on a drain tray. Allow oil to drain through a clean cloth to determine if foreign material drains from the filter.
- Using the Champion CT-923 Can Cutter, open the filter as shown here.
- Using a clean plastic bucket containing approximately one pint of clean Varsol, swish the filter element around in the Varsol to loosen entrapped metal or other contaminants.
- Using a clean magnet, work the magnet around in the Varsol. Ferrous metal particles in the solution should adhere to the magnet for inspection.

Slightly tighten cutter blade against filter and rotate 360°. Repeat operation until mounting plate section separates.

Lift mounting plate to expose complete filter media for inspection.

- After all ferrous metal particles have been retrieved with the magnet, pour the remaining Varsol through another clean shop rag, and any nonferrous metals should be detectable in bright light.

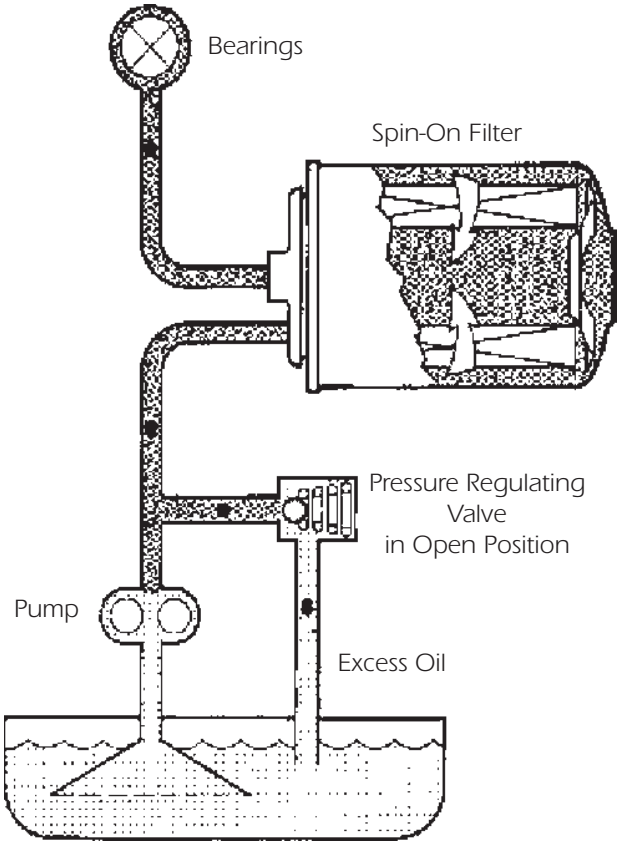
# Over Pressurized Lube Oil Filters

Have you ever had a filter that appears to be "BLOWN UP"? Looks like a balloon or the gasket is protruding from the base of the filter? Often the deformed filter is the only sign that a problem existed in the lube oil system.

The first thing you want to blame is the filter. However, if the pressure was sufficient to blow out the gasket or unroll the lockseam, the pilot may have experienced immediate and costly problems. This should be considered a non-airworthy condition.

A look at how a lube oil system functions will show that the oil pump creates oil pressure. A pressure-regulating valve controls the upper limit of this pressure, which is usually an integral part of the pump.

Figure 1 is a simplified diagram of the lube oil system showing the pump, regulating valve, filter and bearings.



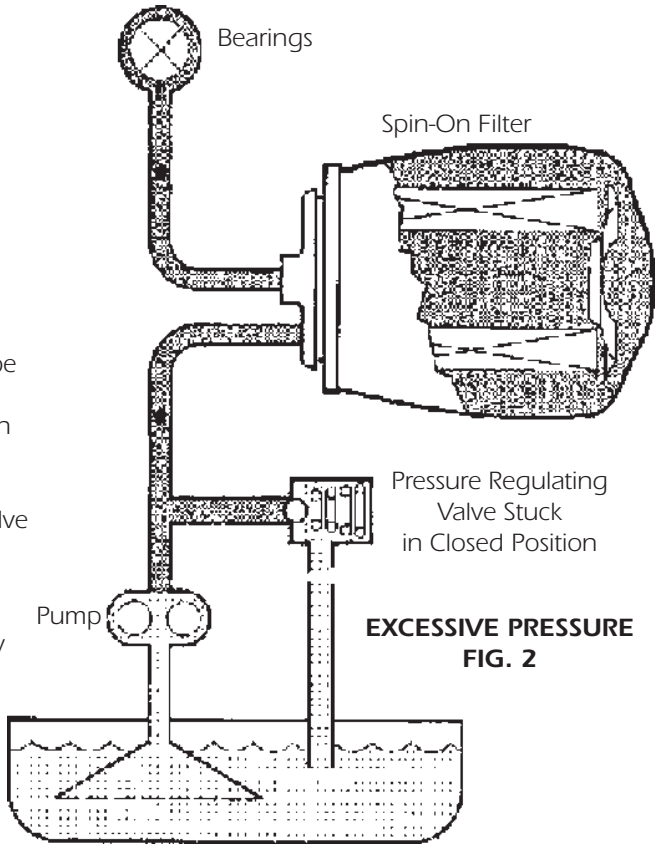

**NORMAL PRESSURE**
**FIG. 1**

The oil pump supplies sufficient flow to lubricate the bearings and other moving parts of the engine. This oil must be under pressure if it is to properly separate the highly loaded parts of an engine and prevent excessive wear. The purpose of the regulating valve is to provide a constant pressure for the system.

The regulating valve consists of a ball or plunger, which regulates pressure with the aid of a spring. The spring is calibrated so that the plunger will lift off its seat when the oil pressure reaches the desired setting. Once the valve is open, the pressure remains fairly constant with only small changes occurring as the engine rpm varies.

The filter and all other components in the oil system are subjected to the pressure established by the regulating valve. If this pressure is excessive, filter damage may occur. This is the point that many mechanics that are not familiar with lube systems fail to realize. Just remember any blockage in the system can also send the pressure beyond what the filter can stand which is rated at 400 psi. Burst.

Figure 2 shows the system operating with the regulating valve stuck in the shut position. Under this condition the pressure will build up in seconds and unless something happens to relieve the pressure the filter will become the victim and not the cause. With a high spike of pressure the gasket will blow out or the lockseam will unwind as the pressure increases.




**EXCESSIVE PRESSURE**
**FIG. 2**

In conclusion, if a filter distorts due to over pressure in the system, the fault might be the regulating valve **Not the filter**

Courtesy of Filter Manufacturers Council