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# Re: question about oil filter examination

*John,*

*I have read your knowledge base post on oil filter examination and wondered if the author (or other knowledgable person) could answer a quesion for me.*
*I routinely open my filters. Under casual observation nothing much is evident. The last couple of times I looked a little closer than usual and in bright sunlight. In the bright light I can see scattered microscopic shiny bits. They are so tiny you wouldn't see them other than by their reflection. I have been told that this represents an inconsequential finding, possibly microscopic bits from plating - normal wear finding. Would you agree?*

*I also find little bits of debri here and there, non-metallic in appearance and non-magnetic. It has the appearance of a tiny quantitiy of sand which may be just what it is.*

*I have not found anything large, magnetic, or otherwise scary looking.*

*Ultimately my question I suppose is; Should anything at all be visible on the pleats? I would imagine that filtering oil through there for 40-50 hours your gonna find something. That's what it's there for, right?*

*Thanks*
*Steve*

On my other web site I mention how to use sunlight to see microscopic particles in the oil: http://www.cancutter.com/how_to_inspect.htm. These might be small bits of bearing material.

Often with mechanics I don't agree with their theory but I do agree with their actions because often it is based on years of practical experience.

It is not normal for parts in an engine to shed metal particles. Possibly during initial break-pin (when you have surfaces getting to know one another) you can have a small amount of particles. From then on normal wear on surfaces does not generate particles. So much for theory. Now what do you do about it?

If the particles are very small and not many then typically the answer is to keep checking and make sure it doesn't get worse.

For your stuff that looks like sand. Try to squish the particles between two pieces of glass or your finger nails. Sand will not squish and will scratch the glass or your finger nail.

By examining the pleats you aren't going to find cam lobe or cam follower material in the early stages of failure. Better to rinse the pleats with solvent and a toothbrush. Drain the liquid through a coffee filter land let dry. Place a magnet under the coffee filter and move all of the iron to one side. If there is enough fuzz sticking to your magnet to cover the end of a stick magnet then inspect the cam lobe and follower. You will get a much better idea as to the amount of stuff that is in your filter using this method.

## Re: question about oil filter examination

*Thanks very much for your help John.*

*Here's an update:*

*In advance of reading your response I actually rinsed off a few pleats into a glass container with solvent.*
*Note that I picked pleats where small visible accumulations had gathered which I suspect relates to oil flow patterns through the filter.*
*I then dried the material which consisted of a few very tiny particles of varying color - tan, brown, gray.*

*None of it is magnetic.*

*I then took it out and squished it between my fingernails. It all mashes up effortlessly into a fine powder.*
*My feeling as therefore that this represent tiny bits of carbon or combustion products.*
*I think the shiny things I'm looking at are microscopic gray carbon bits.*

*Steve,*

Black and gray particles that you can squish between your fingernails are pieces of carbon, sludge and lead oxides and are normal.

Small shiny bits you can spread them onto a microscopic slide and and add a drop of Drano mixed with water. Look carefully under the microscope. If it is aluminum it will start to fiz and dissolve.

## Prop strike teardown recommendation

To answer the question "should the engine have been torn down for a more complete inspection"?

My recommendation has always been to do a tear down inspection for the following reasons:

1. After a prop strike there is rightful concern about the airworthiness of the engine. This concern can only be answered by inspection and not by hope, prayer, or opinion.

2. Having a shop that has performed approximately 1 prop strike inspection each month for some 20 years, I still cannot tell you which prop strikes cause damage and which ones don't without an inspection. This has taught me that the preceived "severity" of the propeller strike is not a criteria for deciding which engines should be inspected and which ones need no inspection.

3. I personally didn't tear down my engine after I hit the towbar with the propeller and sent it flying across the airport. But then we did one on a Navajo that hit a plastic caution cone that had damage -

4. Engine mounts can also be damaged. That said, my opinion is based on my personal experience and others have views that conflict with mine based on their experience and judgement. I could be wrong.

I have spend many year pondering how to inspect the engine without tearing it down and I have never come up with an adequate method. Your question as to signs to look for - I don't know.

## Removing magnetism from Austenitic Stainless steel

*I bought some 304 stainless steel tubing for building a fuel cell and found that even though it was touted as being austenitic, it had a magnetic field down the welded seam (nowhere else). I had tested the tubes with a neodymium magnet and saw where the field was. Will your degausser remove the magnetic field?*

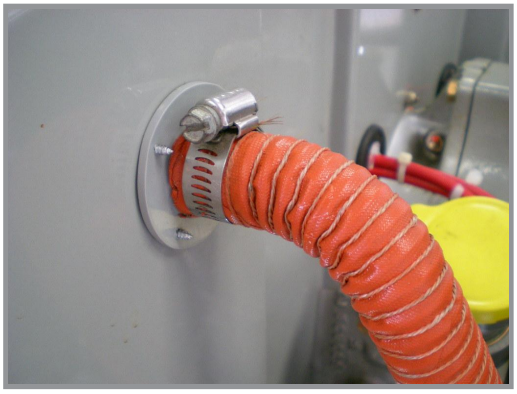
The degausser will not prevent the austenitic stainless from being magnetic. It will remove magnetic fields excepting the earth's magnetic field.

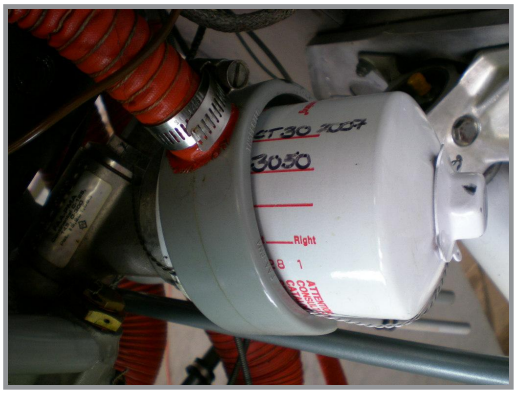
Austenitic is slightly magnetic when cold worked. In the fully annealed condition it is non-magnetic.

Any austenitic (300 series) stainless steel which is magnetic can be returned to non-magnetic condition by stress relieving to 700-800 degrees C. It then reverts back to its fully annealed condition and is softer and weaker. There may be other issues with annealing so the best thing to do would be to engage a metallurgist.

The degausser will remove an artificial magnetic field from a iron object, leaving just the earth's magnetic field. By testing with a magnet you have probably slightly magnetiized the weld area (stressed area).

# High oil temperature in Lycoming and Continental engines





*Hi John,*
*Here are the photos of my home made oil cooler for the Continental O-300. It actually takes about 15 degrees out of the oil on these hot summer Texas days.*

Take a close look. This is a Rapco vacuum pump cooling shroud!

This customer installed the Rapco vacuum pump cooling shrould around his oil filter. Neat idea and it reduced oil temperature by 15 degrees!

# Bendix D3000 magneto redundancy

*John, I purchased and read your magneto book, which I found informative and interesting. After reading the book, I do have two questions I'm wondering if you could answer given your experience with magnetos.*

*1. Our Cardinal has the dual magneto, although I am considering a conversion to a non-D at the upcoming overhaul. My question regards redundancy: what internal elements are common to the two magnetos within the D housing?*

*Do they only share a common drive shaft (and gear), or are any other electromechanical components shared - e.g., cam, magnets, etc.? Do you know of any source where I could see internal photos or mechanical or cutaway drawings of the D3000 magneto so I could better understand its design?*

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Yes, the maintenance/overhaul manual for this magneto. About the only parts that are truly redundant is the coil, points, and capacitor.

The D3000 magneto is a good magneto, easy to work on and reliable. Like any device it has its limitations. Follow the maintenance/overhaul manual, service bulletins and airworthiness directives.

The following three areas should be well understood, respected and maintained, as all have caused fatal aircraft accidents:

- Impulse coupling spring (part number 10-51324)
- Hold-down clamps
- Cam retaining screw

**Impulse Coupling Spring:** Magneto Impulse coupling spring

Breakage retards timing causing complete loss of engine power. Cessna 172N N738BC ditched at sea with 2 fatalities. On any magneto the impulse area sometimes gets rusty from condensation. The impulse spring gets tiny rust pits that create stress corrosion cracking. There is no warning - it just breaks. With two magnetos you lose timing but you can turn the bad magneto off; with the D3000 magneto the broken spring retards the timing on **both** magnetos and you lose power.

Follow TCM's instructions and recommendations to the letter in regards to inspecting and replacing the impulse spring. Personally, if I lived in a corrosive area I would replace it every year.

**Hold-down Clamps:**
See my article at http://www.sacskyranch.com/eng410.htm

**Cam Retaining Screw:** *"Everything hangs on this connection"*

Here is a copy of an email I received some time ago from Germany:

*A pilot came to an aircraft workshop with the problem,that the engine did not start well and did not reach more the 2200 RPM. (Cessna 170 N engine Lyc.O-320-H2AD SNR L-8408-76T)*

*The workshop made -a test run on ground:*

*the engine rpm drop was 120-130 rpm.-*
*The different pressure in the cylinders was 1.)80/78; 2.)80/79; 3.)80/78; 4.)80/77.-*
*The intake tube of the Cylinder No 3 was leaky -it was renewed.-*
*The timing of the ignitions examined and adjusted.-*
*The air intake filter was dirty and cleaned -*
*The following ground check did show no problems: rpm drop 70-80 rpm max rpm 2320 rpm.*

***After this the aircraft made a take off and crashed immediately in the ground, as the engine lost power.***

*The investigation did show, that the screw (Fig 1-14 D-3000 Magneto manual ) was loose and so the cam breaker could turn on the cone.*

Magneto cam retaining screw D-2000, D-3000 points and cam

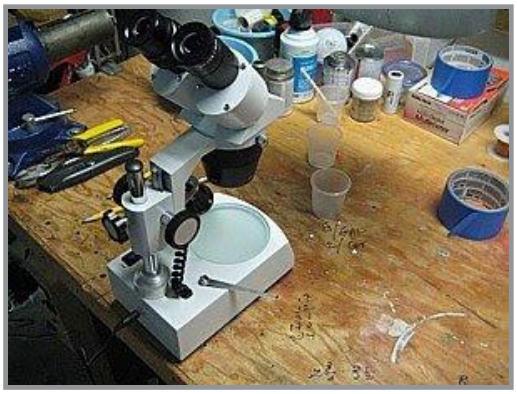
The problem here is that the mechanic did not order a new cam screw and re-used the old one. You loosen this screw when you adjust internal timing. This screw is a self-locking screw that uses a nylon patch on the threads. The locking effectiveness is poor if re-used. Continental says to replace it with a new one. Follow the factory instructions - accept no deviation or alternative methods of compliance.

Continental (Bendix) has addressed each one of these areas in their maintenance manual. Personally, if the mechanic did not have the maintenance manual for the D3000 in hand I would not let him touch the magneto.

There is an interesting discussion of this screw and the problems associated with installing it that I highly recommend be read by anyone working on this magneto. http://www.aaib.dft.gov.uk/cms_resources/Mooney%20Aircraft%20Corporation%20M20J,%20G-EKMW%2011-06.pdf

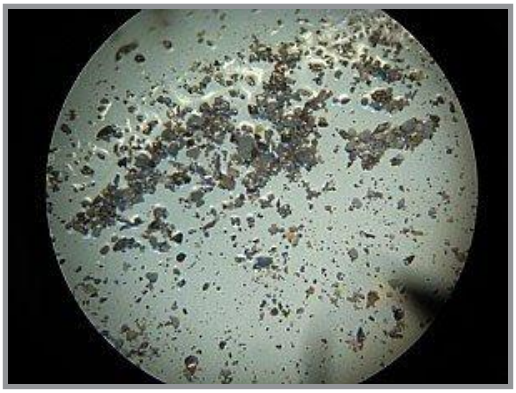
# Oil Filter Examination - continued

John,
So, being a reformed lab-rat myself, I set up a little scope and had a look at my filter washings. Here's a little show if you have a minute to view and comment. I realize there are services that will do this and I will likely send the next filter to them to see what they say but I thought you might like to see what I came up with...Incidentally, under magnification, most of the tiny reflectivity's I was seeing on the filter in the sun represented light reflecting off of oil dampened flat surfaces of a variety of tiny non-metallic looking debris. My stereo scope:



I washed one half of the total available oil filter, after cutting it out, with solvent into a cup.For reference, the cup's base diameter is about 1.5 inches.Here's all that I got in washing:

Under magnification it looks like this (20-40X)



I threw in a hair (ouch!) for reference: