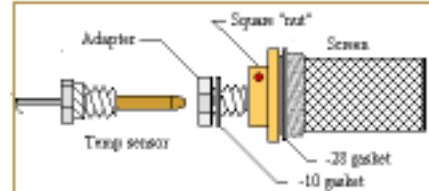


Oil Temperature Assembly for the Continentals

October '02, Scott acknowledges and “cures” the faults. See page 7 for the update Service Information Letter (SIL) and status!!

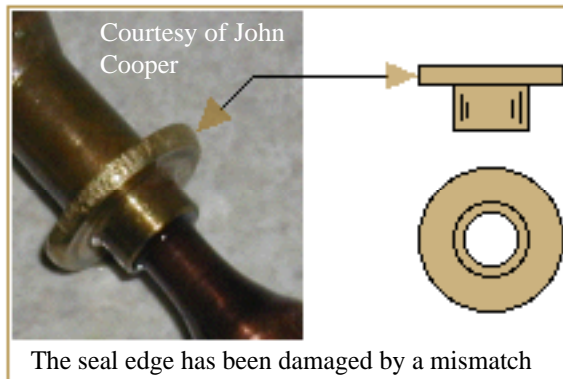
Mis-Matched Scott Oil Temp Assemblies The Path to Here:

Shortly after the story about the Oil Screen Assembly was submitted, two of the Cessna140.com members wrote emails noting that they had failures of the oil temp probe because of a part mismatch and poor quality of the new parts. The two both had to replace their brand new oil temp assemblies by Scott when they could not stop the leaks. Both found that there are two adapters, one with a flat surface to mate with the sensor to provide a seal and the other with a conical taper for the same purpose, but each type of adapter needs to be matched with the correspondingly-shaped sensor. The small figure shows the adapter, the all-important component which internally provides a sealing surface for the matching oil temp assembly. Mismatch the adapter and sensor assembly and the results vary from an unstoppable leak or destruction of the brand-new capillary units. It took one of the members one new assembly and three assemblies for the other to get a combination of parts that would work, some of the time. Each will require one more combination to make it all work properly. Getting tired of the job is an understatement and many are now apprehensive about taking the sensor out at each oil change in order to check for debris on the screen.



Failure Modes:

One member elected to use an existing adapter (prettier) that came with a replacement screen assembly; he re-installed the plane's old sensor capillary unit without realizing that the interior sealing surface did not match the shape of the surface on the oldie. The existing adapter had the conical surface whereas the old capillary unit had the flat sealing surface. The result is indicated in this segment of the superb picture he took of the destroyed sensor. The force of the nut on this flat type seal was such as to try to make it conform to the conical surface; the leak never stopped, the seal was damaged, and an annular portion of the seal disc was sheared. He purchased a replacement gauge assembly (with the tapered seal surface) and said this: "...the unit I got came with the correct adapter, and does not leak. Considerable damage to my pride and wallet, and, as I said, the new one is unreliable. I have flown for as much as 1.5 hours without the gauge registering. No amount of tapping on the glass will free it. It seems that given an opportunity to cool down partially, it always starts working again".



At the time of writing this, “Jim” was using the third set of parts, each set suffering from poor workmanship. He bought new Scott units and thought the new parts should work together, installed them and found they did not. He received a mismatch of adapter/sensor and then another set where the adapter has undulations in the conical sealing surface. The pictures don't do the chatter marks justice so you have to look closely. Chatter marks at the bottom of the hole don't matter, usually, but they matter a lot when that surface is required to be flat, not wavy, in order to seal with the sensor flange under pressure. Note the light/dark patterns which correspond to the high and

low points of the chatter surface. View with “thousands of colors” on the monitor if possible.

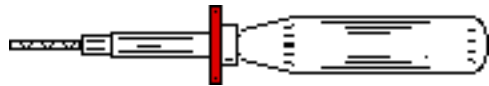


Jim contacted Scott via a group conference call and summarizes the telecon thusly:

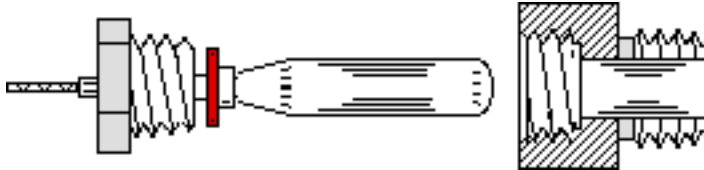
“Neal: Finally, I talked to Scott's tech reps. They were aware of some problem, but not exactly sure what was going on. They were very glad to hear from me and said it clarified the situation. They changed vendors and didn't realize there were incompatibility problems. Any gauge currently on a distributor's shelves may be a mismatch. The fix is that they have redesigned it again, (the reps thought that the engineers had gone back with the flat-shouldered probe and non-flared adapter, but they weren't sure). Unfortunately, it will be a few weeks before they are in production. They will send me ANOTHER new-design gauge, when they are available, for free. I think the only thing we can say for certain in your article at this time is to make sure that the design of the probe matches the design of the adapter, since any combination may be encountered.....”.

Flat:

This is the type which will be referred to as the “flat” kind. Most recall this as “the original” design. The annular disc-shaped red section is highlighted for reference; the left side will be forced by the mating surface of the nut to apply pressure on the disc so the right side of that red piece is pressed against a flat surface tight enough to make



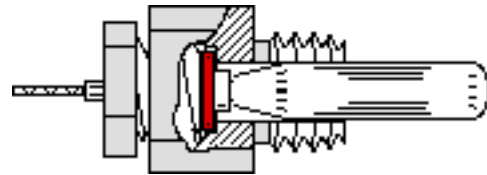
a leakfree oil seal.



This left figure shows the pieces of the assembly: note how the sensor assembly has a hex-headed, threaded part (a nut) which, when screwed into the adapter (at the right)

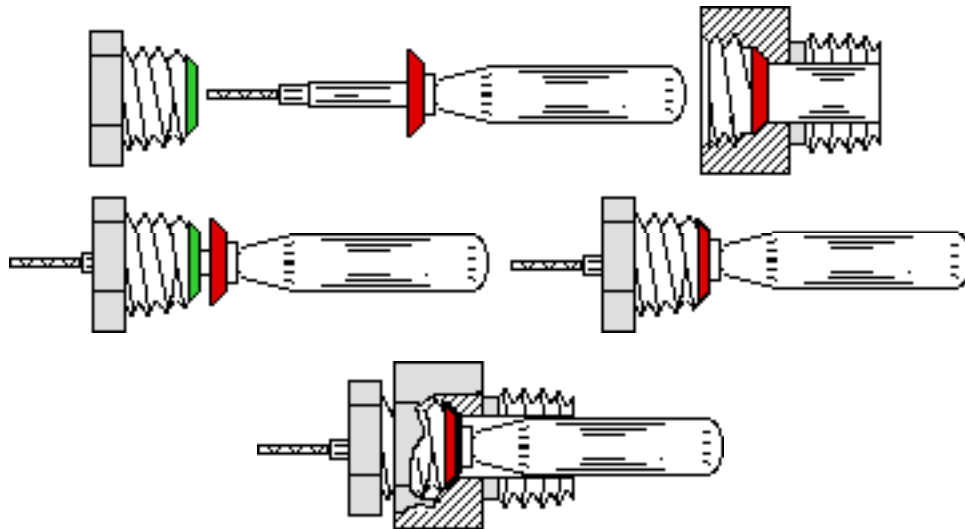
will force the red sealing portion against the flat surface in the adapter to make the seal.

With a little artistic license, the full assembly as it would go into the screen assembly is indicated, but this time the cutaway shows how the pieces fit together if all the mating surfaces are flat. The contact face of the hex-headed nut is bearing on the flat annulus shown in red and the other face of the sealing portion is pressed hard against the matching flat surface in the adapter. If done this way, the unit will usually last 30 or 40 years with no trouble.



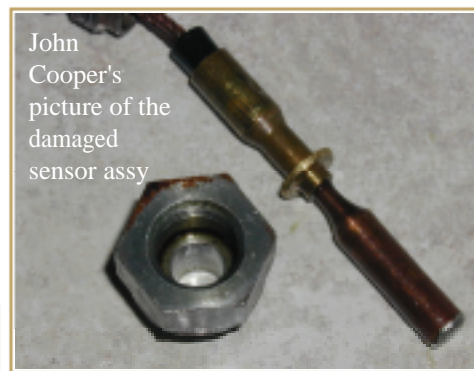
Conical mating surfaces:

This time, backing up a step to show the sensor inner parts “without clothes” allows a greater detail of the shape of the sealing surfaces, no longer the flat annulus and the flat seat, but with matching inner and outer cone shapes for the seal. To work, the “nut” of the oil temp assembly must have a conical nose, the inner and outer shapes of the sealing portion must match the angles of the nose, and the seat in the adapter must be conical at the same angle as well. The top figures show this relationship. In the middle is the assembly combination nesting. At the bottom, the combination of the oil temp assembly and the adapter, showing how, when the nut is tight, the four conical surfaces will provide the leak-free seal, again for 30 or 40 years.



Pictures:

This is a drastically reduced image of the superb picture John Cooper sent of his damaged, original sensor, along with what would have been the correct (flat seal surface) adapter. Not realizing the need to observe and match sealing surfaces in the adapter and the capillary sensor, he replaced the correct adapter with an incorrect adapter having the conical seal surface and reinstalled the sensor, causing a leak and damaging the sensor.



Pictures of the two adapters, with the conical sealing surface on the left and the flat sealing surface on the right. An illusion suggests that the conical surface is larger in diameter, but both surfaces are the same diameter and are the same as the peaks of the threads. Note, too, the difference in surface finish quality. Items from Jim Williams.

The left figure shows the dual adapter set sent to me by Jim to see the two types he had received with two orders, one with the flat internal sealing surface (on the right) and one with the conical sealing surface. It allowed me to confirm what he had said about the poor workmanship which leads to a non-stoppable leak because the sealing surface of the unit on the left undulates because the machinist allowed the tool to chatter. Scott is believed to be checking with their vendor and the design to find out why the wrong combinations and why the poor workmanship. In his discussion with them, it was not established whether the fault lay with a poor spec (the surface flatness not called out) or print, or poor workmanship.

Confusion Reigns:

Originally, the planes were issued with oil temperature assemblies made by Rochester. A split resulted in the present different companies of Scott and Rochester. Many buy their replacements via the aviation parts catalogs, and the listings in all of them are incorrect. In Aircraft Spruce's catalog, the Rochester lists the

mounting hole (correct at 2-1/16"), but states that the unit comes with a "1/2" NPT adapter nut". Below on that page, the optional adapters are listed, one with 5/8-18 internal and external threads (Continental) and the other with 1/2 NPT and 5/8-18 threads (Lycoming?), with you left to guess which threads are internal and which external. The adapter for our engines requires the 5/8-18 internal and external type. The Scott listing leaves off the size of hole the unit will fit, but does list the female capillary adapter fitting as 5/16-18 (yes, five sixteenths, a diameter/thread combination that does not exist and would fit nothing). On a previous page, the correct adapter is listed, with its use to "shorten long capillary tubes". Its threads are correct, though the interior sealing surface, conical or flat, is not noted, nor is that feature noted in any of the catalogs. In the Wag-Aero catalog.....well, let's skip the details and state that it has like errors and omissions. The message? Take care when you order and make sure you have an adapter which will work with the shape of the new gage/sensor set.



It will happen:

The capillary bulb of the sensor and tiny tube leading from it to the gauge is filled with a gas. When heated by the hot oil passing over the bulb, the gas expands and that pressure appears in the tube and in the Bourdon tube in the gauge. An increase in pressure causes the curved Bourdon tube to change shape and that movement is coupled to the needle of the meter. One molecule of gas at a time, all the sensors will fail eventually, so pay attention if it seems your engine is running cooler than last year....it isn't, but the first symptom of a progressive failure of the gage/probe is this one.

I have never seen a specification listing the expected accuracy of the meter, so don't expect much better than a plus or minus two percent when checking the unit in boiling water (212 at sea level....compensate at higher altitudes). And, always check the system, even just out of the box!!

Where To Get Them:

Oil Pressure Gage for the 120/140/140A Cessnas

The Scott RN 2100 is made for 2-1/16 to 2-18 panel holes, the size that are in the panels of our planes, comes with five feet of capillary tubing, a mounting bracket, attaching nuts, and washers. Its temperature range covers the 100 to 250 °F span. The most common has no lighting provisions.

Stewart-Warner has 2-1/16 dia case (but that means it won't go in 2-1/16 hole), comes with mounting brackets, and six feet of tubing. It covers 140 to 325 degrees F.

From Univair, the Scott is shipped with the AN 900-10 gasket, a bulb adapter with 5/8-18 NF thread (correct for Continental), and the Scott 2677 panel hole adapters. See below.

Univair: the Stewart-Warner is furnished with a 1/2 inch (sic) adapter nut (wrong size, suspect they mean 1/2 NPT for Lycoming), and a lighting kit and mounting brackets.

Wag Aero: the Scott is shipped with bracket and bulb adapter (wrong type for Continental, being 1/2 NPT, for Lycoming)

Van Dusen: the Scott is shipped with the correct 5/8-18 NF bulb adapter and mounting bracket, but does not come with the AN 900-10 gasket.

Aircraft Spruce of Corona CA: the Scott is shipped with the correct 5/8-18 NF bulb adapter and the mounting bracket.

The AN 900-10 gasket and 5/8-18 NF bulb adapter are available independently from Aircraft Spruce of Corona CA. The adapter is usually on a different page.

The Scott 2677 kit, consisting of two annular adapters, convert the unit to fit in holes 2-1/8 to 2-3/4 dia. Univair ships this kit with Scott RN 2100 meter"

Oil Temp Gage

Scott RN 2100, about \$35 (1992), \$66 in 2000, is the one that fits.

5/8-18 Female x 5/8-18 Male for the Continental

Wagaero has 5/8 x 1/2-NPT for the Franklin and Lycoming

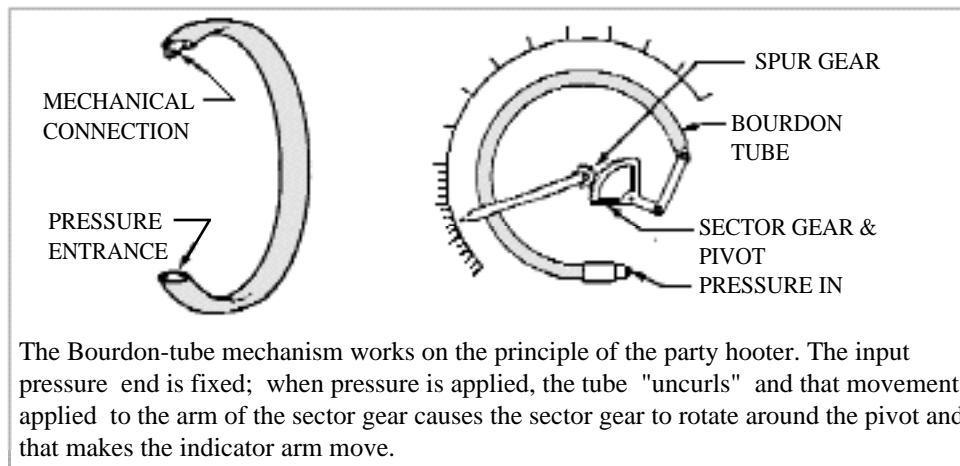
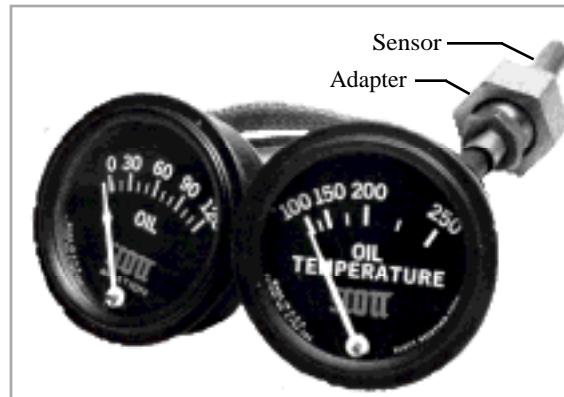
The adapter is required. The nut on the capillary end of the assembly screws into the adapter. Inside the adapter, there is a surface against which the flange of the capillary bulb is pressed to make the seal. Although the 5/8-18 threads of the capillary end nut will screw directly into the oil screen housing, there is no surface within against which the capillary end flange can be pressed to make a seal. You can jam the nut into the housing, but to do so is to violate the assembly per Cessna.

Beware. There are capillary flanges which are "flat"----the surface perpendicular to the centerline of the bulb and there are flanges which are conical. Whatever the flange shape, the adapter surface which mates with it must be the same shape or damage will result, as will leaks.

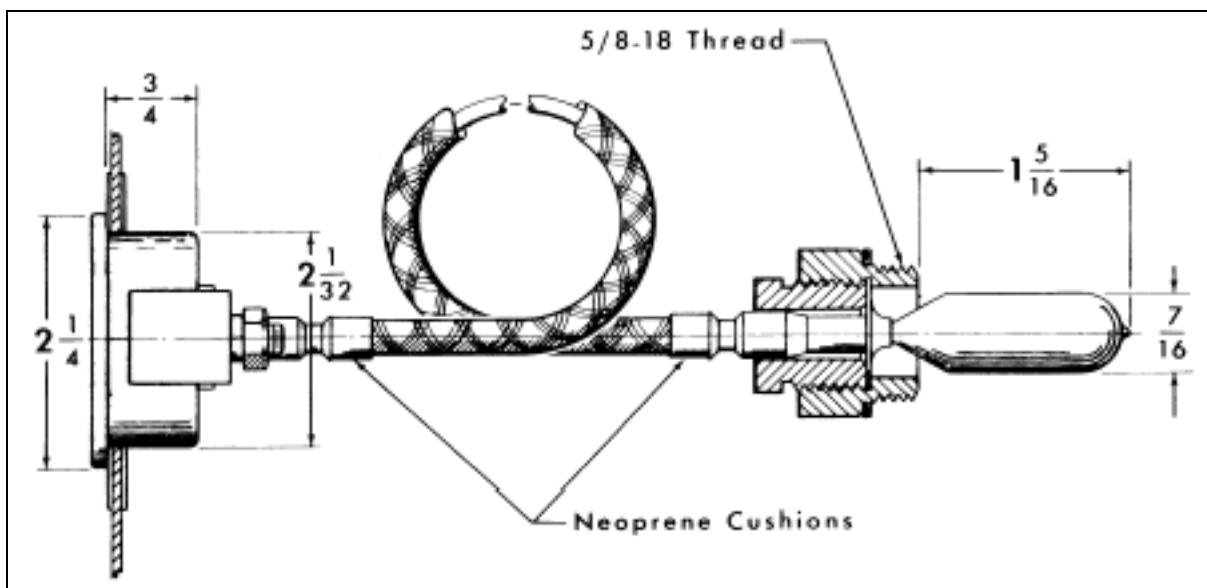
The AN 900-10 is a crush washer which provides the seal between the adapter and the oil screen housing.

POST CURE:

Every vendor should be shipping the Kit noted in the Scott service letter which follows in this article. No one should accept piece parts as was the normal listing and procurement noted earlier on this page. When you get the kit, use all of the parts, and discard the old adapter and the sensor and gauge.



This figure is better than most of Scott's and it comes from the newest Avial parts CD. Note the flat surface areas for sealing between the adapter and the sensor. This is the only figure I know of which has the dimensions, but is incorrect in that the 5/8-18 internal threads and the 5/8-18 external threads should have the same diameters. Sigh. I present it here because of the dimensions, especially that of the meter body diameter, a number often misleading in the catalogs.



The “Cure” by Scott:

In September of 2002, Scott finally got all the signatures and agreements from the FAA and the distributors and the maker (Citabria) needed to release the correction data about the oil temp sensor faults. It took 22 months from the time Jim and John started the feedback to Scott, ignored as usual, because Scott would not believe that errors had been made and did not look in their bin of returns to verify, though the proof was there.

There were two faults; 1) the sealing surface of the adapter was wavy, instead of being flat, a feature caused by poor workmanship at the making vendor and poor or no QC at Scott for that feature; 2) the sealing surface was changed by the vendor on the oil temp sensor but it was not documented by Scott nor the repercussions of real usage assessed.

Scott gave “unofficial” permission to their vendor to change the design of the sealing surface of the sensor to the adapter for the small Continental engines; C-75/85/90, and O-200 (the adapter is needed on all the small Continental and Lycoming engines, though different adapters for each).

Although Scott never nailed down the culprit act, it developed that someone at Scott had given permission to the vendor, but neither the vendor or Scott had written it down so it was, in effect, a bootleg, unauthorized change which Scott initially and continuously denied existed because they had no record, and because they refused in the first months of our input to go look at the product.

When I got involved, one of the first calls I made was to “customer service” at Scott, and from the abrupt and uncaring lady there, hear: “oh, that’s not our problem, that is Engineering’s problem”. Customer Service; right. So efficient was she, that I had to call back in because she would not hook me up to Engineering. To prove her point, no one from “customer service” ever got involved and that department is most likely still ignorant of the changes and cures.

The engineering manager with whom I interfaced all those months refused to believe there was anything wrong for too many months, and so had not looked at the product being returned from the field nor had anyone gone downstairs and looked at the new product still being shipped to see if there was anything wrong. He kept insisting: “we fixed that problem two years ago” but what he was talking about and what we were talking about was different. He ignored the inputs about faults from Jim and John.

To get some attention, I created a report which was developed around pictures and the actual parts from John and Jim, and submitted that to the engineering chief, after which (after a few goadings over many weeks, actually) he started to get some faith and changed from “impossible” to “maybe these people actually know something”. Then, he started looking. And, he found.

If anyone has the fortitude to read the notes I made along the way, not vetted....let me know...more than twenty pages.

The only one who offered assistance along the way was Clark of the Cessna140 web site; I was afraid to get him involved because he might get a tender of ad from Scott someday and any help would have blackballed him and the site forevermore.

The Scott philosophy is disturbing; note that none of us, not me, not John or Jim, were reimbursed for the cost of this correction, though all who hear of it instantly recognize the jeopardy Scott would have been in if one of the oil leaks of their incorrect parts would have caused an accident or loss of a plane or owner. As has proved true on other cases, the leaks probably did cause downings which were assessed by the NTSB as “carb heat”, the only reason they seem to sign off on.

Scott did not even say thanks to any who might have saved their corporate skins. If there is yet a loss, they are still on the hook with all those bad parts in the distribution system and the lack of awareness by the buyers of the hazards.

Although the faults could affect all the thousands of Continental engines, the “correction” went to just the Scott distributors, with 10 copies of the Service Information Letter to each, so no club, no organization, no company such as Continental will ever see a copy nor will any of the plane magazines ever see it.

Like a land mine, the problem and hazard will lie there....

The actual cure:

The following is the Service Information Letter issued by Scott and available on their web site.



SERVICE INFORMATION LETTER

Scott Aviation, 225 Erie Street, Lancaster NY 14086-9502 USA
Tel: 716-683-5100 • Fax: 716-681-1089 • Vendor Code: 53855

ENGINE INDICATING - ATA SYSTEM 77

P/N 13340-00 OIL TEMPERATURE GAUGE (FORMERLY REFERRED TO AS RN-2100 OIL TEMPERATURE GAUGE)

REPLACEMENT PROCEDURES

1. BACKGROUND

This Service Information Letter (SIL) contains important information about the oil temperature gauge and its replacement. It is important to read this SIL. Scott Aviation has received reports of oil leakage from the oil temperature gauge connection to the engine. This leakage is believed to be the result of the replacement of only part of the gauge assembly during maintenance. This SIL gives guidance on the installation of replacement oil temperature gauge assemblies.

You are authorized to make copies of this SIL and give them to other persons. If you copy this SIL, you must copy all of the SIL.

2. EFFECTIVITY

A. Aircraft

This SIL applies to all makes and models of aircraft that have a Scott P/N 13340-00 Oil Temperature Gauge installed. A Scott oil temperature gauge can be approved for installation in an aircraft in one of the two ways that follow:

- (1) Scott Aviation holds Parts Manufacturer Approval (PMA) to manufacture and sell the P/N 13340-00 oil temperature gauge for installation on American Champion Aircraft types 7ECA, 7GCAA, 7KCAB, 7GCBC, 8KCAB, & 8GCBC.
- (2) The Scott P/N 13340-00 oil temperature gauge may be installed on other aircraft where such installation has been approved by the cognizant airworthiness authority through a procedure acceptable to the cognizant airworthiness authority (FAA Form 337, Supplemental Type Certificate (STC), etc.).

B. Oil Temperature Gauge

This SIL applies to all Scott P/N 13340-00 oil temperature gauges. A typical oil temperature gauge is illustrated in Figure 1.

3. WARNINGS AND CAUTIONS

WARNING: FAILURE TO FOLLOW THE INSTRUCTIONS IN THIS SIL CAN CAUSE DAMAGE TO THE GAUGE, LOSS OF ENGINE LUBRICATION, AND RESULT IN LOSS OF AIRCRAFT AND INJURY OR DEATH TO PERSONS.

CAUTION: DO NOT DISASSEMBLE THE GAUGE. DISASSEMBLY OF THE GAUGE WILL CAUSE DAMAGE TO THE GAUGE.

4. DESCRIPTION

This SIL identifies a potential problem that can be caused by improper replacement of Scott Aviation Oil Temperature Gauges P/N 13340-00. Scott has learned of occurrences where the gauge sensor was damaged and engine oil leaked due to the incorrect installation of the gauge.

Rev: none
20020801

SIL-77-01
Page 1 of 4

4. DESCRIPTION (Continued)

A. BACKGROUND

Two different types of oil temperature sensors have been supplied on the 13340-00 gauge. The earlier type, manufactured before 1998, had a flat flange at right angles to the sensor as shown in Figure 2. The current type, manufactured during 1998 and later, has a conical shaped flange on the sensor as shown in Figure 3.

The sealing operation is accomplished by three parts: a steel compression nut that is captive on the capillary assembly, the copper flange of the sensor, and the steel adapter that is connected to the engine. The soft copper of the sensor bulb flange is squeezed between the hard steel of the compression nut and the adapter and conforms to the surfaces to provide a positive metal to metal seal against oil leakage. For the connection to seal, the surfaces of the three parts must mate.

B. PROBLEM

The current design of the gauge has conical mating surfaces as shown in Figure 3. The compression nut and the sensor are assembled at the time of manufacture and cannot be separated. The adapter must be a separate part to accomplish the installation.

If the wrong adapter is installed, the mating surfaces may not seal. For example, if a new gauge is purchased, but the already installed flat-faced adapter is not removed and replaced by the new adapter, then the conical mating surface of the sensor and the compression nut will not seal with the old flat-faced adapter. Installation of a new gauge with a conical flange and compression nut into an old adapter with a flat surface can result in damage to the sensor and loss of engine oil.

5. RECOMMENDATION

When installing a replacement gauge, it is critical that the compression nut, sensor bulb and adapter making up the complete oil temperature gauge be installed together. Make sure to remove the existing adapter from the engine, then install all three new parts.

Refer to the engine manufacturer's manual or maintenance instructions for the correct gasket if a gasket is required. If you find an oil leak at the adapter to compression nut joint and a mismatch is suspected, replace the entire gauge assembly (including the adapter).

Rev: none
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SIL-77-01

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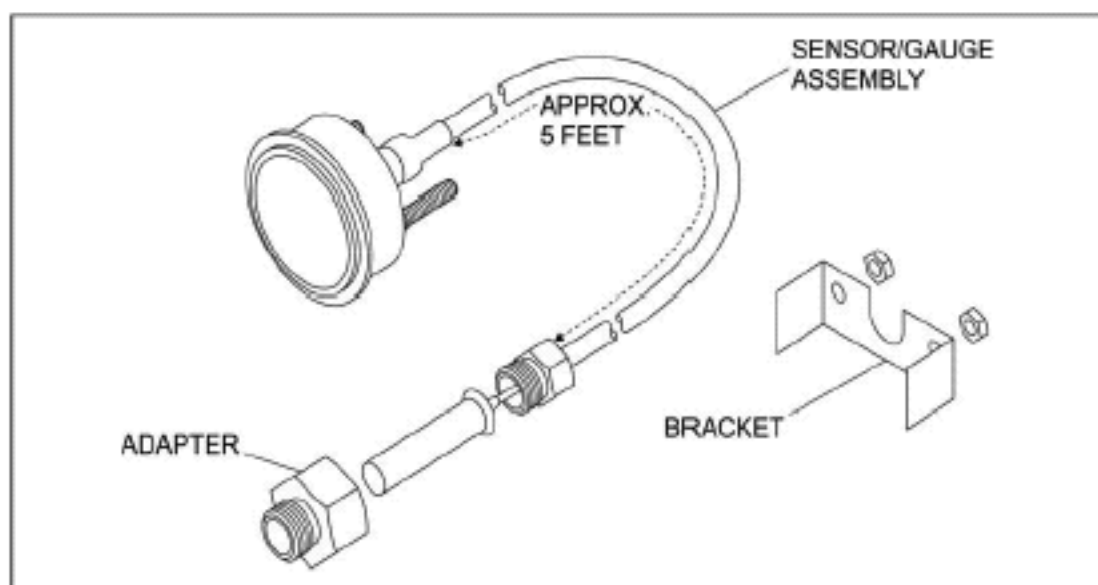


Figure 1
Complete Scott Oil Temperature Gauge

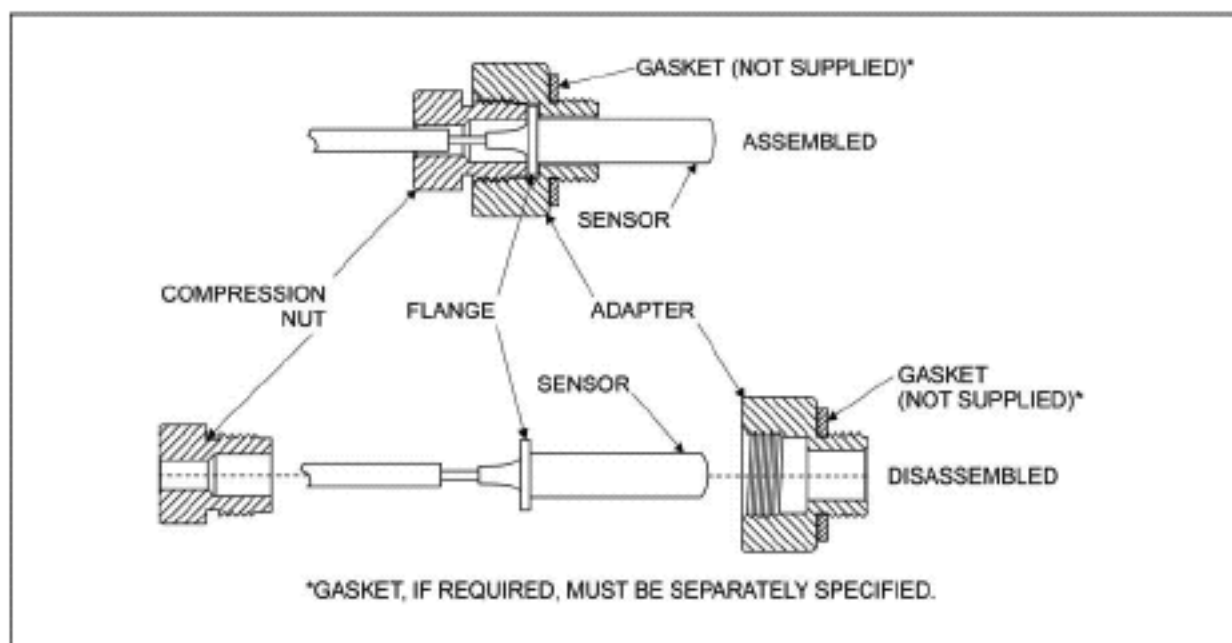


Figure 2
Square Type Flange

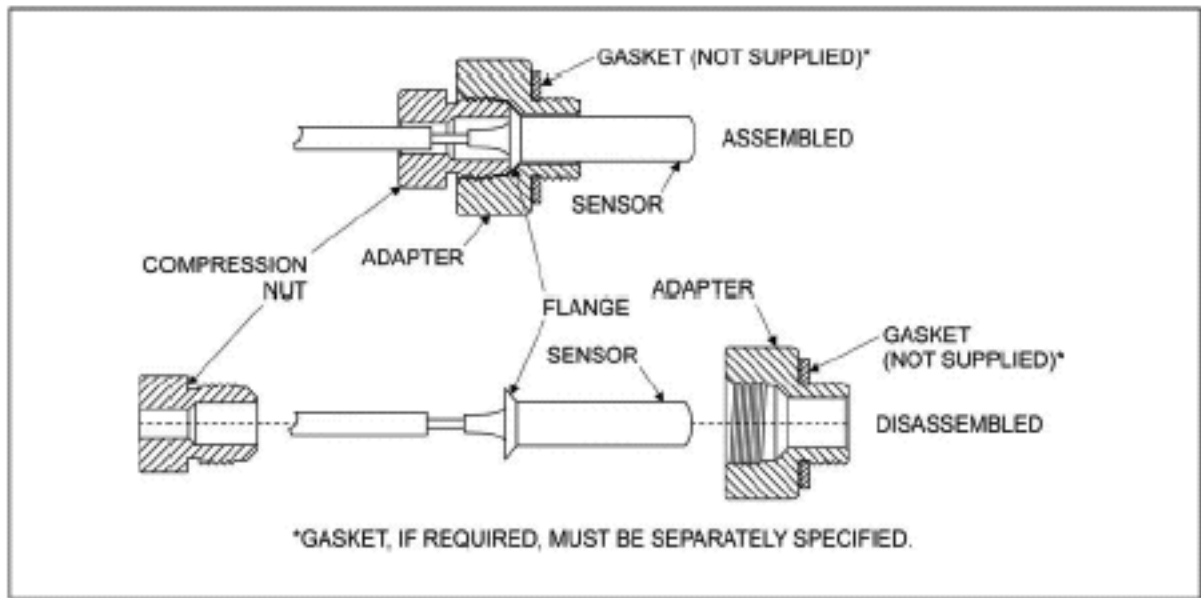


Figure 3
Current Conical-Type Flange

Rev: none

20020801

SIL-77-01

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C. To get a copy of SIL 77-01 or the revision status of a publication, contact the Scott Technical Publications Department.

- Telephone: 1-716-683-5100
- Fax: 1-716-681-1089
- E-mail: techpubs@tycoint.com
- Publications Index: log onto www.scottaviation.com; click on Aviation/Government Products, click on Aviation Product Information, click on Technical Product Information

Instruction Sheet in the Kit:

The next figure is the “instruction sheet” which is now packaged in each kit for the oil temp sensor assembly. Miss the admonition about never leaving the existing adapter in place when changing the oil temp sensor and you leave yourself open to a possible leak.



Scott Aviation
A Tyco Company
225 Erie Street
Lancaster, NY, USA 14086
Telephone: (716) 683-5100
Fax: (716) 681-1089

INSTRUCTION SHEET

REPLACEMENT OF 13340-00 OIL TEMPERATURE GAUGE

This Instruction Sheet applies to the installation of replacement Scott P/N 13340-00 Oil Temperature Gauges. This Instruction Sheet supplements, but does not replace the aircraft and/or engine manufacturer's instructions.

WARNING: FAILURE TO INSTALL THE GAUGE SENSOR AS INSTRUCTED HEREIN MAY RESULT IN DAMAGE TO THE GAUGE ASSEMBLY AND/OR LEAKAGE OF OIL WHICH COULD RESULT IN INJURY OR DEATH TO PERSONS.

When removing the existing oil temperature gauge and installing a new replacement Scott oil temperature gauge, consult and follow the applicable engine manufacturer's instructions or aircraft manufacturer's instructions.

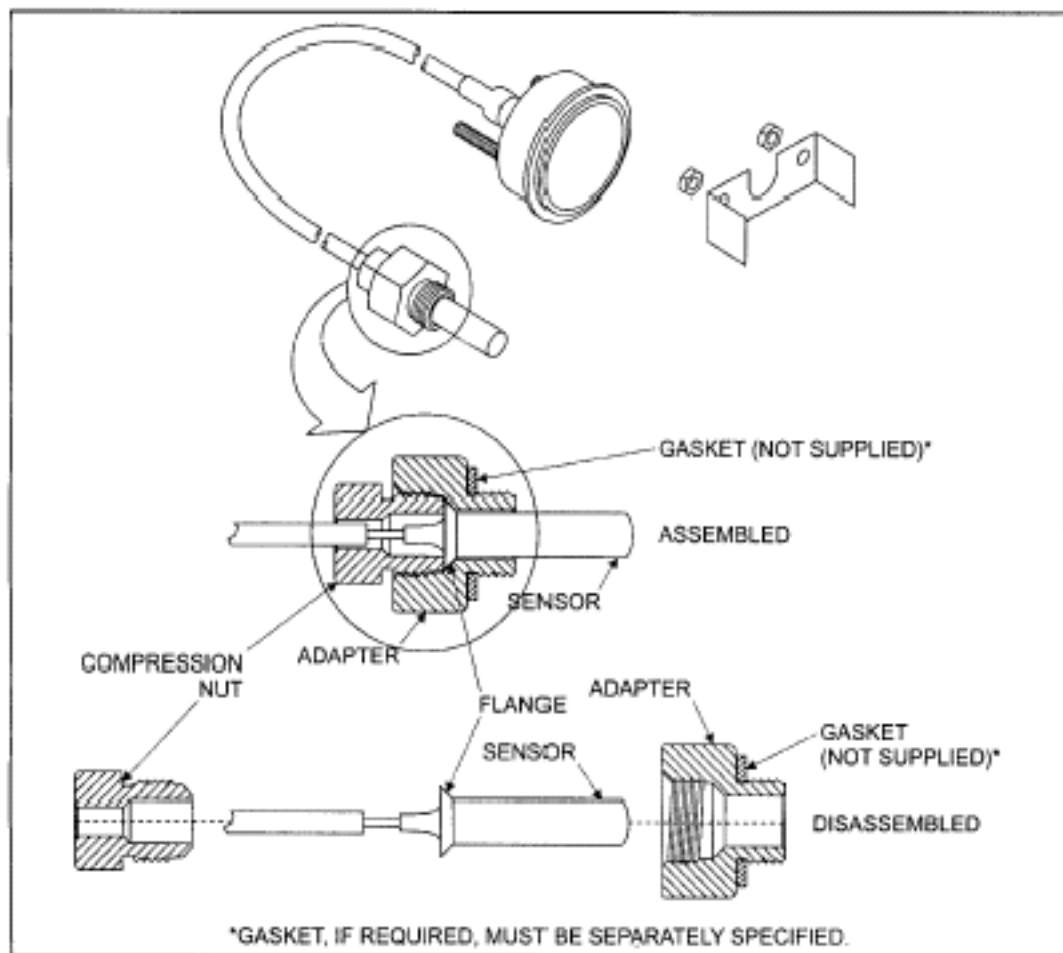
Make sure that all the components of the new replacement Scott P/N 13340-00 gauge are present. Refer to the figure below.

When installing a replacement gauge, it is critical that all the components of the original gauge be replaced. Make sure to remove the existing adapter. When installing the replacement adapter, refer to the aircraft/engine maintenance instructions for the appropriate gasket if required. Torque the new adapter to the engine/aircraft manufacturer's specifications, but not less than 12 to 15 lb ft (16.3 to 20.3 N•m).

Carefully insert the oil temperature bulb into the adapter. After insertion of the bulb, torque the compression nut to the engine/aircraft manufacturer's specifications, but not less than 12 to 15 lb ft (16.3 to 20.3 N•m).

Never attempt to install the sensor directly into an engine without the adapter.

Never attempt to install the sensor directly into an engine without the adapter.



08/01/02

89515-01

Neal

Filed as: Oil Temperature Assy Scott July '05 Revised July 27, 2005

Neal F. Wright

COUGARNFW@AOL.COM