Proper S•O•S℠ Services Sampling Techniques for Caterpillar Equipment

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S•O•S℠ Services Sampling Objectives

1. The **first** objective of sampling is to produce a sample that is representative of the material the system is producing and the contamination that has entered the system.
    1. Take a “hot” sample. Be sure the system has been exercised so that the entire system loop has been used. Usually 15 minutes of operation is sufficient.

S•O•S[SM] Services Sampling Objectives

- Utilize the sampling valve on the pressurized systems (Engine, transmission and hydraulic). It may be necessary to add a sampling valve following the Caterpillar Special Instruction SEHS9043.

S•O•S℠ Services Sampling Objectives

- Use the proper method when using the vacuum gun for sampling from non-pressurized systems. (Final drives, Differentials, etc.)

S•O•S^{SM} Services Sampling Objectives

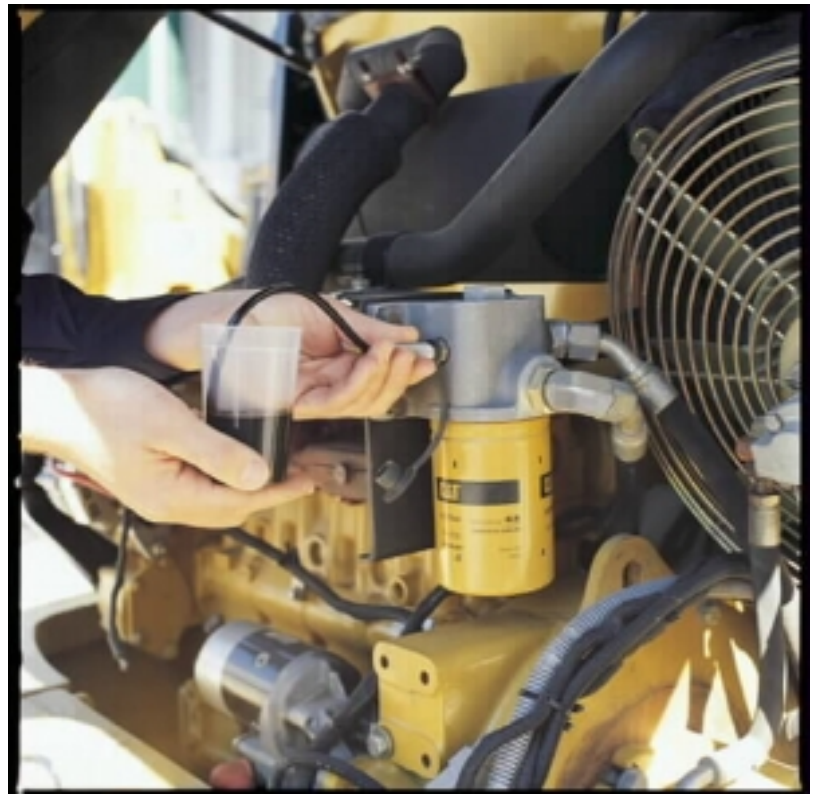
2. The **second** objective of sampling is to use the proper timing. S•O•S^{SM} Services sampling interval timing is a very important factor in problem detection and determination of the optimal time for intervention and/or repair. An accepted definition in the industry for the optimal sample interval for a component is “an interval short enough to provide at least two samples during the period between the start of an abnormal condition and the beginning of a critical failure mode.” Based on nearly 30 years of success with sampling mobile equipment, S•O•S^{SM} Services sampling intervals have been set at the following intervals:

   Engine…every 250 hours and at oil change time.
   All other compartments…every 500 hours and at oil change time.

   At a minimum, the above sampling intervals must be adhered to during any and all published oil and filter change intervals for any Caterpillar machine and compartment.

S•O•S℠ Services Sampling Objectives

3. The **third** objective is to prevent contamination of the sample during sampling.
   - Maintain the cleanliness of the bottle before sampling.
   - Be sure the sampling area is clean before taking a sample.
   - Remove a few milliliters(4oz.) of fluid into a waste container before taking the sample.
   - Never sample from the drain stream, a used filter or the bottom of a system pan.



General Guidelines for using the sampling valve method

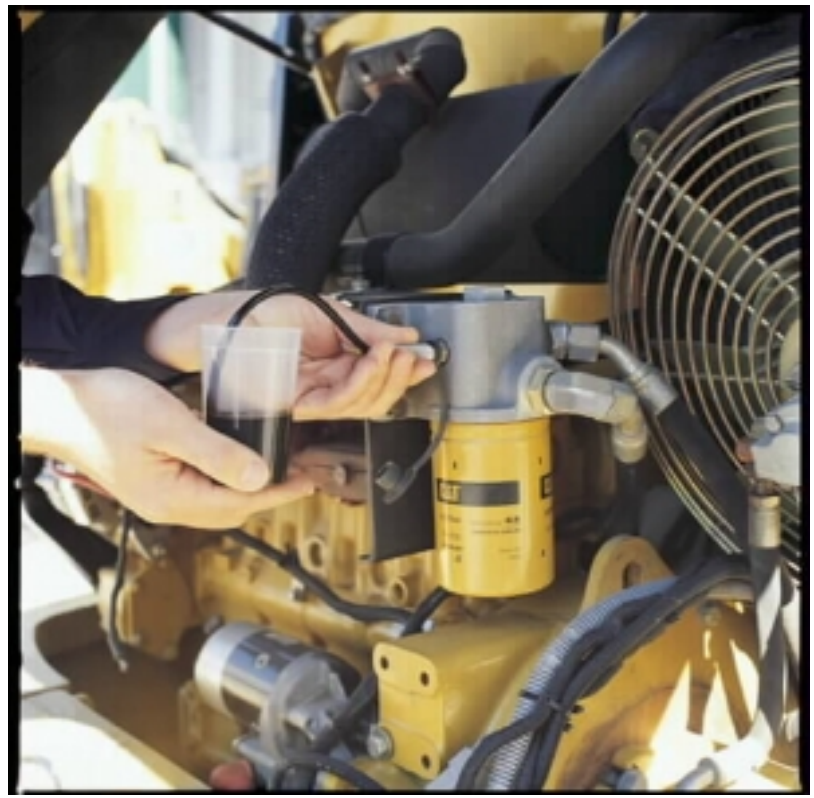
- This method will require a sampling bottle(169-8373), the sampling probe and tubing(177-9343) and the probe holder(162-8873).
- Always begin the sampling process with the cleanest system.(hydraulics, followed by transmission, engines and gear compartments).
- Use a new sampling probe and tubing for each compartment being sampled to prevent contamination.
- Fill out the label completely before starting the sampling process.

Sampling Valve method

1. After exercising the equipment for 15 minutes, set the engine at low idle and remove the dust cap from the valve of the compartment you are sampling. Clean around the sample valve and dust cap.

Sampling Valve method

2. Insert the probe into the valve and collect 100ml(4 fl oz) of oil into a waste container. If the oil flow is slow at low idle, it may be necessary to have someone accelerate the engine to high idle while extracting the sample. Dispose of the waste oil properly. (This process cleans the valve and helps ensure a representative sample.)



Sampling Valve method

3. Insert the probe into the valve again and fill the sample bottle three-quarters full—do not fill to the top. Do not allow any dirt to enter the bottle or cap.

Sampling Valve method

4. Withdraw the probe from the valve and secure the bottle cap. Then place the clean bottle with the completed label into the shipping cylinder. Return the dust cap to the sample valve.

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OIL ANALYSIS

Oil Analysis

Take sample when oil is hot

JAMES SMITH — Owner Name	MAY 11, 2000 — Date Sample Taken	2 — Oil Added (Qts/Liters)
E. SABULA — Job Site	2485 — Meter Reading	225 — Hrs./Miles/Km on Oil (circle which)
8KR01049 — Serial No.	D5 — Model	104 — Equipment No.

Application ☐ Light ☑ Medium ☐ Heavy

Oil (brand) CAT Type CH-4 Oil Wt (visc.) 30

Was oil changed at this sample time? ☑ *yes* ☐ *no*

Sample taken from:
- ☑ Engine
- ☐ Transmission
- ☐ Hydraulic system
- ☐ Right final drive
- ☐ Left final drive
- ☐ Front axle/diff.
- ☐ Rear axle/diff.
- ☐ _____

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General Guidelines for Vacuum Extraction method

1. The sampling method requires a Vacuum Pump(1U5718) and tubing (4C-4056). We recommend the Tube Cutter(1U7648), which allows you to make a quick clean cut of the tubing with just one hand.
2. Use this method for systems without sampling valves.
3. Use new tubing for each compartment being sampled to prevent contamination.
4. Use a separate Vacuum Pump for taking coolant samples.
5. Fill out the label completely before starting the sampling process.

Vacuum Extraction method

1. Turn the engine off. Measure and cut new tubing so that it reaches about halfway into the oil depth.

Vacuum Extraction method

2. Insert the tubing through the head of the vacuum pump and tighten the retaining nut. The tubing should extend about 4 cm (1in.) beyond the base of the vacuum pump head.

Vacuum Extraction method

3. Install a new sampling bottle onto the vacuum pump and insert the end of the tubing into the oil—do not allow the tubing to touch the bottom of the compartment.

Vacuum Extraction method

4. Pull the vacuum pump handle to create a vacuum. Hold the pump upright—if you turn it over, oil may contaminate the pump. If oil enters the pump, disassemble and clean it before taking the sample. Fill the bottle three-quarters full—do not fill to the top.

Vacuum Extraction method

5. Withdraw the tubing from the compartment. Remove the bottle from the vacuum pump and secure the cap on the bottle. Then place the clean bottle with the completed label into the shipping cylinder(4C-4600).

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OIL ANALYSIS

Oil Analysis

Take sample when oil is hot

JAMES SMITH — Owner Name	MAY 11, 2000 — Date Sample Taken	2 — Oil Added (Qts/Liters)
E. SABULA — Job Site	2485 — Meter Reading	225 — Hrs./Miles/Km on Oil (circle which)
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- ☐ Left final drive
- ☐ Front axle/diff.
- ☐ Rear axle/diff.
- ☐ _____

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Sampling Valve Locations

- Oil sampling valves
  1. Install an oil sampling valve for each pressurized oil system in an accessible, but safe location. Use of the valves requires that the engine be running.
  2. The oil sampling valves should be located away from any point of potential peril to the person taking samples (e.g. away from the fan, alternator/air conditioning drive belts, etc.) Ideally, the sampling should be done from ground level, in a standing position, outside the main frame of the machine.
  3. Each oil sampling valve should only be installed in a fluid carrier which contains fluid at a pressure between 50 psi and 500 psi, however, a range of 50 psi to 150 psi is preferred.
  4. The oil sampling valves should be installed in a "flowing" fluid carrier, not in a "dead end" which could be susceptible to debris accumulation. Sampling instructions advise that the valve should be flushed before taking a sample.
  5. Ideally, the valves should be placed before the filter and after the pump. In most instances, on the filter housing.

- Coolant sampling valves
  1. Install a coolant sampling valve for the engine cooling system in an accessible, but safe location. Use of the valve requires that the engine be running.
  2. The coolant sampling valve should be located away from any point of potential peril to the person taking a sample (e.g. away from the fan, alternator/alternator drive belts, etc.) Ideally, the sampling should be done from ground level, in a standing position, outside the main frame of the machine.
  3. The coolant sampling valve should be installed in a "flowing" fluid location, not in a "dead end" which could be susceptible to debris accumulation. In particular, it should not be installed in the radiator bottom tank because of the accumulation of debris there. Sampling instructions advise that the valve should be flushed before taking a sample.
  4. Ideally, the coolant sampling valve should be located at the point where the coolant leaves the water cooler and reenters the block, although any actively flowing location would be satisfactory.

S•O•S℠ Fluid Analysis Products

Latest generation sampling kits offer key improvements...

1.	169-8373	Bottle Group, 300 per box
2.	162-8873	Probe, Holder
3.	177-9343	Cap and Probe Group, 500 per box
4.	4C-4600	Mailer Container - reusable
5.	1U-8757	Tube - 6.35 mm (1/4 in) O.D. x 30.5 m (100ft) rolls, 5 rolls per box
6.	4C-4056	Tube - 7.9 mm (5/16 in) x 30.5 m (100 ft) rolls, 5 rolls per box
7.	169-7373	Clear Bottle, 71g (2 1/2 oz), 200 per box
8.	169-7372	Clear Bottle, 114g (4 oz), 200 per box
9.	1U-5718	Vacuum Pump
	1U-5719	Seal Kit for 1U-5718 Pump
10.	8T-9208	Probe, purging
11.	1U-7648	Tube Cutter
	1U-8589	Replacement Blades
12.	8C-8456	Sealed Cap (for temporary sealing of leaky sample valve)
13.	8C-3446	Oil Sampling Valve (7/16 inch-20 - ext. thread)
	3J-7354	O-Ring Seal for 8C-3446
14.	7X-3387	Oil Sampling Valve (1/4 inch-18 NPTF - ext. thread)
15.	8C-3345	Oil Sampling Valve (M10 x 1 - ext. thread)
	8T-7876	O-Ring Seal for 8C-3345
16.	8C-3445	Dust Cap (Engine)
	8C-3447	Dust Cap (Transmission)
	8C-3451	Dust Cap (Hydraulic)
	6V-0852	Dust Cap (Blank)
17.	4C-3602	Frosted Bottle, 57g (2 oz), 700 per box (not pictured)

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Tips

- Fill out the label information before you begin taking the samples to keep the label oil-free and easy to read.
- It may be more efficient to have the operator collect the samples at the fueling station. This also can help ensure that the machine has been “warmed up” before sampling.
- Keep the bottles stored in plastic bags.
- Minimize the amount of time the lid is off the bottle.

More tips…

- Put the filled bottle and label in the mailing cylinder immediately after taking the sample for contamination control.
- To avoid unrepresentative samples, do not **ever** take samples from the drain stream, a pan of drained oil or a used filter.
- It may be more efficient to collect the flush sample in a regular sample bottle. Then collect the true sample in a sample bottle. Both bottles can then be stored in a carrying case if the sample collection process is being done in the field and the samples need to be transported back to the main shop.