CONTAMINATION CONTROL

It Makes a Difference You Can See

CATERPILLAR®

KEEPING MACHINE FLUIDS FREE FROM OUTSIDE CONTAMINANTS SAVES MONEY, REDUCES DOWNTIME AND HELPS MAINTAIN PRODUCTIVITY.

KEEP IT CLEAN

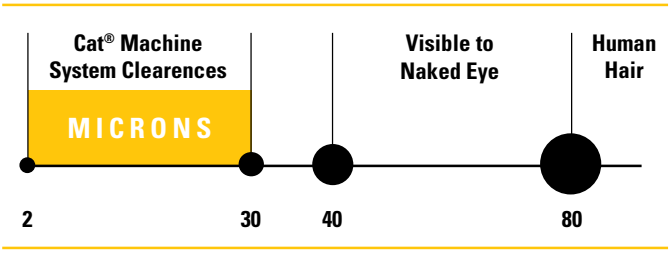
As big and rugged as most earthmoving machines are, it is surprising how much they can be damaged by particles that are too small to be seen without a microscope.

Dirt, sand, grit and even the finest dust can cause problems when they find their way into engine oils, vehicle fluid powered systems, hydraulic fluids and coolants. When they do, parts wear faster, need more servicing and can require shorter replacement intervals. They are also more prone to failure, which can shut a machine down suddenly and unexpectedly. This adds up to higher maintenance and operating costs.

TIGHTER TOLERANCE

Today's machines are required to do more work in less time on less fuel than ever before. This means their systems and components must work at higher pressures and within tighter tolerances (between 2 and 30 microns) than older equipment.

Even particles too small to see with the naked eye — which means even contaminants half the size of a human hair (about 40 microns) — can cause premature wear and other problems.



PERFORMANCE LOSS

Along with higher service costs, premature wear can also cause a loss of performance that may go undetected for a long time. Tests show that a hydraulic system can lose 20% of its rated performance, or one day per week, before an operator notices the difference. This means the machine is less productive than it could be.

FOUR SOURCES OF CONTAMINATION

There are four ways contamination can get into machine systems:

1) **Contaminants can be built in during manufacturing and assembly operations.** Dust, paint, weld splatter, metal shavings and other debris can be detected even in new components if they haven't been properly protected.

   At Caterpillar, all of our production facilities take precautions to ensure machines and components ship to a strict cleanliness rollout standard.

2) **Contaminants can enter during servicing and maintenance procedures.** Every time a system is open, airborne particles can adhere to filler caps, funnels and replacement parts. The longer the system is open, the greater the chance of contaminant entry.

3) **Contaminants can enter with new fluid.** Even fresh, "clean" fluids may be full of contamination picked up during transfer, transport or improper storage.

4) **Contaminants can enter during operation through pitted rods, broken breathers, worn seals and other trouble spots.**

Fortunately, there are steps you can take to prevent or correct fluid contamination from each of these sources.

FOUR WAYS TO CONTROL CONTAMINATION

Just as contamination itself is the result of the accumulation of tiny particles from a number of sources, an effective contamination control program is made up of many small steps that help maintain fluid cleanliness and reduce opportunities for contaminants to get into machine systems. Caterpillar recommends a four-part contamination control program. This consists of practices for the shop and field that result in:

1. CLEAN FLUIDS

2. CLEAN COMPONENTS

3. CLEAN FACILITIES

4. CLEAN SHOP REPAIR PROCESSES

Following the steps outlined here (and in informational and training materials available from your Cat® Dealer), you'll be better prepared to control contamination, reduce overall operating costs and keep your Cat equipment performing at its best.

1. CLEAN FLUIDS

The easiest way for contaminants to enter a system is to enter through "clean" fluids as they go into the machine. Proper fluid handling and clean, tightly sealed containers help prevent this source of potential contamination.

STORE FLUIDS PROPERLY

Keep oil barrels indoors where they won't get rusty or dirty, and protect them with Cat Oil Drum Covers. Drums stored outside without covers collect rain and dust that can enter the drum when the cap is removed. Contaminants may also work their way past the cap as the drum expands and contracts with temperature changes.

Protect all fluid containers—jugs, cans, etc.— from dust and dirt. Make a practice of wiping off container lids and caps with a clean shop towel before opening.

FILTER ALL INCOMING FLUIDS

Oils should be clean when they leave the refinery, but they may pick up contaminants during transfers and transport. By the time they arrive, they may no longer meet Cat cleanliness specifications.

Filter all fluids before they go into your equipment.

Use a tank with a kidney-loop capability to clean used oil to new specifications.

Never prefill lube oil or fuel systems filters—always use a priming pump or crank the engine to prime new filters. Prefilling introduces potentially dirty fluid directly into the system by missing the final filtering process. Even the small amount of contamination introduced each time a filter is prefilled can accumulate enough contaminants over time to do significant damage.

Optional Advanced or Ultra High Efficiency (UHE) filters should be used to clean up hydraulic and power train systems after servicing. It is also recommended to use them on an ongoing basis to maintain cleaner systems at all times. Your Cat Dealer can advise you on which Advanced or UHE filters to use in your applications.

2. CLEAN COMPONENTS

Replacement parts and components, including brand new ones, can introduce contaminants into the systems on which they are installed. Rebuilt and repaired components come with an even higher risk of contamination.

Even the cleanest parts can pick up contaminants if they're improperly stored or handled. It's vital to take steps to keep parts and components clean and protected until they are installed.

CLEAN AND PROTECT HOSES

Carefully clean out hoses using a high-pressure device (such as the Cat Hose Cleaner) to remove the debris created when the hose is cut.

Protect hoses with end plugs and caps. Stock an assortment of the proper sizes of end caps and plugs to protect hoses until they are installed.

PROTECT PARTS IN STORAGE

Keep parts in their original packaging until the moment they are installed.

Keep parts in drawers or cabinets or otherwise protected from dust and other contaminants.

CLEAN COMPONENTS BEFORE INSTALLATION

Use a filtered Cat wash stand or wash cabinet to ensure that parts are as clean as possible when installed.

3. CLEAN FACILITIES

Setting up your shop to minimize contamination sources makes overall contamination control easier. A clean shop means there is less dirt, dust and grit to get onto components, or transferred into fluids.

CONCRETE IS CLEANER THAN DIRT

A concrete apron around shop doors and crushed stone drive paths between facilities reduces the amount of dirt and mud machines, vehicles and people will track into the shop. Closable shop doors help keep blown-in dirt and dust to a minimum on windy days.

WASH FACILITIES FOR MACHINES AND COMPONENTS ARE VITAL

Wash all machines and components before entering the shop for disassembly, preferably with a high pressure, hot water wash system, to keep dirt and grease out of the shop.

MAINTAIN CLEAN, WELL-ORGANIZED WORK AREAS

Dirty floors and cluttered work areas contribute to contamination. Clean, sealed floors and well-organized work areas create an atmosphere of professionalism and encourage shop personnel to make contamination control a priority.

CLEAN UP OIL SPILLS PROMPTLY

Use absorbent pads, mops and scrubbers to immediately clean up oil spills.

Avoid using granular materials to absorb spills. Materials like saw dust or other granular absorbents can produce dust that adheres to containers, parts, machines and hands.

4. CLEAN SHOP REPAIR PROCESSES

Formalized processes work together with clean facilities to make contamination control a part of everyday shop life. A little care, taken at each step in a repair or service process, can make a big difference in keeping contaminants out of machine systems.

ASSIGN A CHAMPION

Make ongoing contamination control an assigned responsibility, with a contamination control team and team leader. The team leader should look for trouble spots, delegate solutions and reward progress on contamination control issues.

KEEP IT CLEAN

Protect parts and components before and during installation.

Wipe off boxes, jugs, cans, spouts, etc. before opening. Also, clean funnels, filler caps and orifices on the machine or component before opening or using them.

Look for areas above and "upstream" of an orifice for dirt, mud or dust that can fall into the orifice or onto a work area.

CLEAN PARTS

PROTECT WHILE YOU WORK

Any opening into a machine or component—an open filter head, an open filler tube, the open end of a hydraulic cylinder—is prone to contamination and should be protected.

Protect work in progress by storing all components under a roof and plastic wrap.

Keep orifices capped, with rustproofing if required.

TAKE FLUID SAMPLES

Regular fluid sampling is the best way to monitor fluid conditions and cleanliness. Particle Count results, in particular, can sound an early warning on abnormal component wear and contaminant congestions.

See the next page for more information on engine oil, hydraulic fluid and coolant sampling as practiced in the Caterpillar® S•O•S℠ Services program.

S•O•S℠ SERVICES IS A COMPREHENSIVE FLUID SAMPLING PROGRAM THAT ANALYZES A RANGE OF DATA AND OFFERS PROACTIVE RECOMMENDATIONS TO ENHANCE OVERALL MACHINE MAINTENANCE

S•O•S SERVICES

Regular fluid sampling and analysis helps you spot trouble from fluid contamination before it becomes a major problem. It can help you avoid downtime and make more informed decisions about maintenance routines and operating practices.

Fluid analysis is not just for engines and hydraulics systems anymore. Today's analysis tools provide detailed information about all kinds of fluids — from engine lube and hydraulic oils to final drive fluids and coolants.

FOUR TYPES OF S•O•S SERVICES ANALYSIS

The Caterpillar program includes four basic tests for engine and hydraulic oils:

Wear Rate Analysis assesses the amount and type of metal elements present in the oil, which can warn of accelerated component wear. It also detects silicon and other elements that indicate the entry of dirt into the system from dirty containers, dirty add oil or other sources.

Oil Cleanliness Analysis detects both metallic and nonmetallic debris generated by wear. That is important because materials from something like a friction disc are nonmetallic and won't show up on Wear Rate Analysis test equipment.

Oil Condition Analysis determines the extent to which oil has deteriorated during use by measuring levels of soot, oxidation and sulfation. Oil Condition Analysis also verifies that the oil is performing up to specification.

Oil Contamination Analysis detects external contaminants such as fuel, water or glycol. Viscosity measurement is important in this type of testing. Although today's oils maintain viscosity very well under severe conditions, some contaminants can cause potentially damaging viscosity changes.

Many Cat Dealers offer additional, more specialized services along with the basics included in S•O•S Services. Availability varies, so ask your local Cat Dealer about the specifics in your area.

COOLANT ANALYSIS

Coolant analysis is a more recent addition to scheduled fluid sampling practices. Caterpillar offers a two-level coolant analysis program:

Level 1: Basic Coolants Maintenance Check looks at how the coolant is being maintained and checks to see if there are enough nitrites in the coolant to protect the iron surfaces in today's diesel engines. Plus, it can indicate other problems that may need further analysis in Level 2.

Level 2: Comprehensive Cooling System Analysis is recommended at least once a year or after any major cooling system work. Level 2 provides an extensive chemical evaluation of the coolant and its overall effects on the cooling system. It identifies corrosion rates, additive depletion, external contaminants due to poor water quality and other issues.

Over 50% of engine failures are related to cooling system problems, so Coolant Analysis is an important addition to your preventive maintenance routines.

ALONG WITH HELPING CUSTOMERS CONTROL FLUID CONTAMINATION, CATERPILLAR AND CAT DEALERS ARE COMMITTED TO A HIGH LEVEL OF CONTAMINATION CONTROL IN OUR OWN FACILITIES AND PRACTICES.

LEADING THE WAY

Each Cat Dealer facility is rated on a wide range of factors that minimize potential contamination—including wash facilities, shop cleanliness and organization, parts and fluid storage and much more.

When you bring a machine to your Cat Dealer for servicing, you can be sure they are practicing the contamination control processes recommended to all Cat customers.

AVAILABLE TRAINING MATERIALS

Your Cat Dealer offers a range of materials to help you institute comprehensive contamination control programs in your facilities. These include informational brochures, training materials and products such as the Cat Oil Drum Covers and the Cat Hose Cleaner.

Your Cat Dealer can help you get more from your equipment investment by keeping systems cleaner — and help you make the case for contamination control with your operators, shop personnel and entire organization.

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For more complete information on Cat products, dealer services, and industry solutions, visit us on the web at **www.cat.com**

Materials and specifications are subject to change without notice. Featured machines in photos may include additional equipment. See your Cat dealer for available options.

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