CATERPILLAR®

MAINTENANCE SERVICES

Optimizing Oil Change Intervals

For All Diesel Engines Except On-Highway Truck Engines

Getting the Most from Your Oil and Your Engine

Maintaining your engine oil is a very important factor in maximizing the productive life of your Cat® engines. It begins when you demand the higher standard of protection available from Cat engine oil and filters. And it continues as you work with us to optimize the effective life of the oil. Cat engines have recommended oil change intervals determined through extensive testing and historical data. However, these intervals cannot take into account your specific operating conditions and other factors that may necessitate a different oil change schedule. Our S·O·S℠ fluid analysis program helps you understand the factors affecting your engine oil, so you can better manage the life cycles of your engines and reduce costs.

Consider these factors when evaluating your oil performance

To optimize oil change intervals, it is important to determine how well your oil will hold up under specific conditions. To do this, all factors affecting oil condition must be controlled and stabilized during evaluation. Everything that could have an impact on oil condition must be held constant during the evaluation period so you can monitor the effects of application and load on the oil.

Application The same load should be applied (relatively the same amount of fuel consumed per hour) in the same operating and climatic conditions.

Oil Filters The same filters (preferably Cat filters) should be used for all engines in the test group, and they should all be changed at the same interval. Use Cat filters to guarantee the highest quality filter available.

Air Filters Change only as required by the air restriction indicator. Again, use Cat air filters to assure the highest quality and longest life.

Cooling System Maintenance Cooling system problems contribute to more than 50% of all premature engine failures and problems. Initially, submit coolant samples for Level 2 S·O·S Coolant Analysis to assure the cooling systems on all test units are optimal. Assure that radiators are clean externally and internally. Proper coolant and conditioner levels should be maintained. Over-heating or over-cooling can increase oil oxidation and/or sulfur product formation. Use S·O·S Level 1 Coolant Analysis *at each oil change* to make sure your cooling system and coolant are up to par.

Operating Practices Operating techniques impact how an oil responds and holds up to an application. Excessive lugging, excessive idling and full throttle on/off will all affect sooting and oxidation of oil.

Optimally Tuned Engines Keep engines running according to specifications. Check boost, fuel settings, air/fuel ratio control and transmission shift points. Poorly tuned engines can lead to malfunctions or adversely affect operating temperatures, fuel consumption, or other parameters.

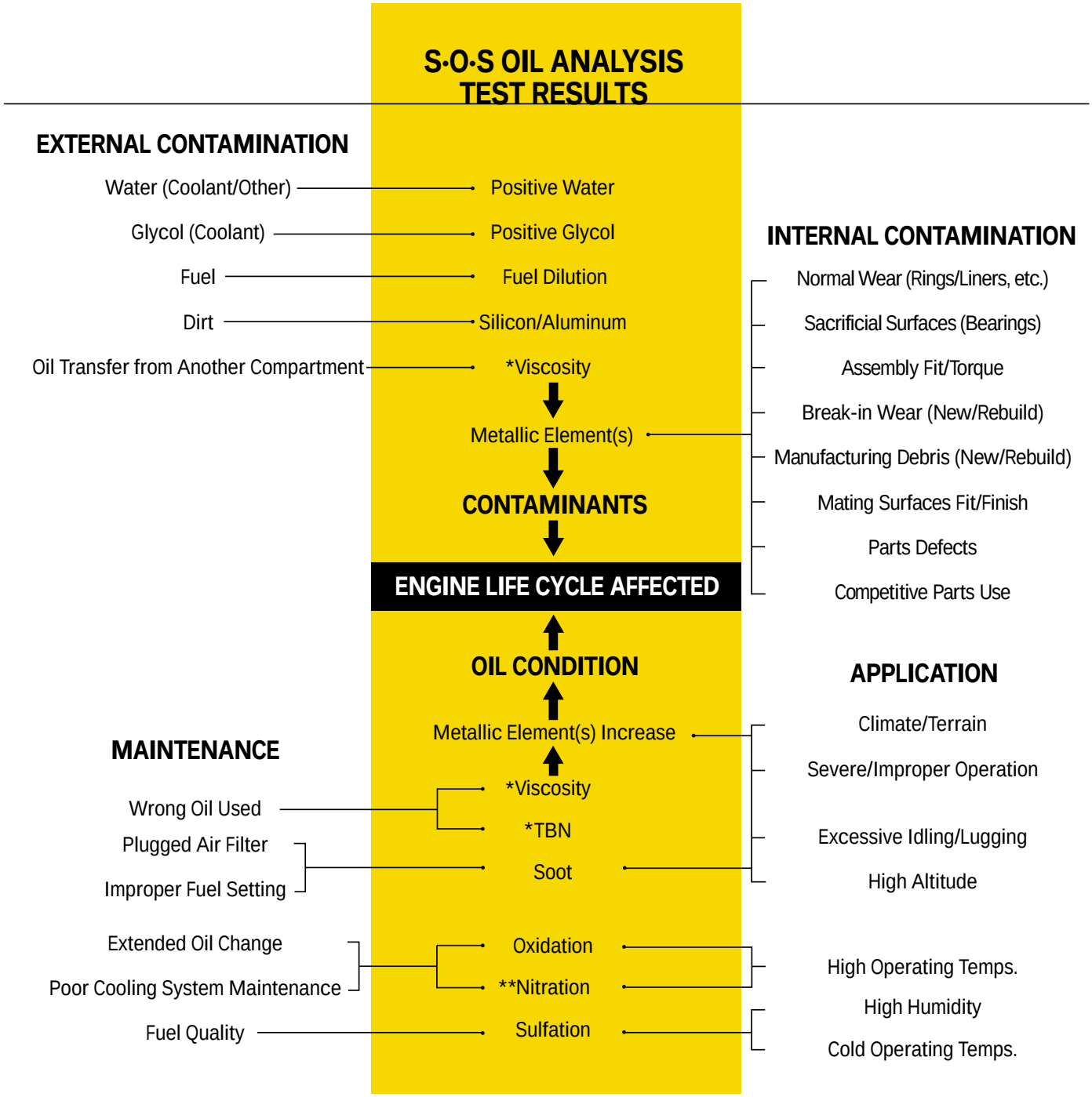
External Contamination Take a baseline oil sample from each engine in the test group at every oil change to make sure no external contaminants are introduced with new oil.

Selection of Test Engines Include engines with relatively low total operating hours and those never having grossly extended oil change intervals. Engines with higher hours have different wear and oil consumption rates than newer engines. Engines that have had grossly extended oil change intervals or that have used lower quality oils may already have irreversible oil-related problems at the start of the evaluation, i.e. lacquering, ring sticking and carbon build-up.

Provide complete S·O·S information

Be sure to correctly and completely fill out the S·O·S sample bottle card or label. This information is critical to assure accurate data from the lab tests and the interpretation of the data. In particular, it is essential to include the total hours (or odometer units) on the engine, the total hours/units on the oil, and the quantity of make-up oil added since the last oil change.

Understanding the Causes of Engine Wear



* TBN and Viscosity are optional tests within the S·O·S oil analysis program.
** Nitration is seldom a problem for diesel engines, but can be significant for natural gas engines.

Variable factors affecting lubrication and wear

There are a number of factors that operators and maintenance engineers can control to affect engine wear and costs. A general indication of how well a lubricant is performing during an oil change interval is the amount of wear metals generated during that time period. The rate and amount of wear occurring in an engine depends on four categories of causes (see chart, facing page). This chart provides a very simplified explanation of the causes of oil degradation and wear metal generation for diesel engines. The items shown in the "S·O·S Oil Analysis Test Results" column are those for which Caterpillar engineers have selected tests.

1. Maintenance Errors and omissions in routine preventive maintenance practices will affect oil condition, resulting in increased engine wear.

2. Application Environmental and operational factors that contribute directly to increased wear and/or oil condition degradation.

3. External Contamination Fuel, water, glycol or anything else getting into the engine lubricating system from the outside, accelerating wear.

4. Internal Contamination The causes of excessive internal contamination are usually misalignment of mating parts, improperly torqued bolts and nuts or defective parts. Internal contamination becomes a grinding agent which adds to internal debris produced by parts wearing together.

If S·O·S oil analysis indicates a problem in any of its tests, give consideration to each possible cause. Correct or alleviate the causes if possible. Be alert for changes in any of the Maintenance or Application factors which might lead to a problem. Doing this will help control and stabilize all the factors impacting oil conditions during the evaluation period.

Monitor oil consumption

Not shown on the chart (previous page) is the addition of make-up oil. If make-up oil is added, all the oil analysis results will be affected. It is very important to keep accurate records and report on each oil sample label the quantity of oil added.

The oil change interval balance

As with most business decisions, establishing an engine oil change interval beyond the manufacturer's recommendation has both risks and rewards. Perhaps the biggest potential reward is increased availability due to less maintenance downtime. But this increase can be quickly eroded if reduced engine life causes premature wear and repair downtime. Extending oil change intervals without a carefully planned and executed program is gambling with the life of your engines — and your cost of production.

ENGINE OIL CHANGE HOURS

REWARDS	RISKS
Decreased Oil and Filter Costs	Decreased Engine Life
Decreased Maintenance/Labor Costs	Increased Repair Downtime
Decreased Disposal	Increased Repair Costs
Increased Availability and Productivity	Decreased Availability and Productivity

At some oil change interval, there is a reasonable balance.

Determining Optimal Oil Change Intervals

We suggest you proceed beyond the manufacturer's recommended oil change period cautiously in incremental steps of 50 hours. First, determine that wear rates and oil condition are satisfactory at the 250 interval. Then, extend from the 250-hour recommended period to 300 hours. Stay with a 300-hour period for several changes and closely monitor the S·O·S results with samples taken as shown on the chart below.

Four types of oil samples

There are four categories of oil samples involved in evaluating an oil change interval:

1. Samples of New Oil
A sample of the new oil is needed as a test reference to the used oil. The new oil sample must be the exact same oil as the used oil being tested. Any time a new shipment of oil is received, a sample of that oil must be submitted as the reference.

2. Baseline Samples
After changing the oil and filter, run the engine until it reaches operating temperature (about 15 minutes) and take a sample. This determines wear metal carryover from any oil left in the pan from the previous interval. It also reveals if any external contaminants were introduced through the oil fill process. During the evaluation period, take a baseline sample after every oil change.

3. Samples at Shortened Intervals
Taking samples at less than the recommended oil change interval is essential to monitoring the oil degradation process. This will allow you to determine a trend line for wear accumulation and any external contamination entry. You must establish these rates for the recommended oil change interval before you begin an extended interval evaluation (see chart).

4. Samples at Oil Change
Test results from the samples taken at the time of each oil change will indicate the final levels of oil degradation and wear accumulation. These results, along with the shortened interval sample results, will be evaluated to establish the optimal oil change interval for your engine. Once the optimal interval has been established, submit a sample at each oil change.

Engine coolant samples

Because many engine problems are influenced by the cooling system, coolant samples should also be submitted. Level 2 Coolant Analysis should be performed at the beginning of the project and Level 1 tests at each oil change thereafter during the project.

SAMPLE PERIODS FOR ESTABLISHING OPTIMAL OIL CHANGE INTERVALS
(after two or three oil changes at the standard interval)

For engines with 250-hour recommended oil change intervals:

NEW OIL SAMPLE
BASELINE SAMPLE
(samples at shortened intervals) 75 HOURS
150 HOURS
250 HOURS (recommended change interval)
300 HOURS (first extended interval)
350 HOURS (second extended interval)
ETC.

Proceed with caution

We suggest that engines with a 500-hour recommended oil change interval should not be extended beyond that point. In some applications, it has been necessary to reduce the interval from 500 hours to a more frequent schedule.

Work with our experts

We will work with you to optimize the oil change periods for your Cat engines. Keep in mind, however, that the process of determining new oil change intervals is not simple. It requires that you work closely with our staff over a period of several months. Once new intervals are established, it will be more important than ever to carefully monitor oil performance and engine wear — using S·O·S analysis for both oil and coolant — to make sure there aren't any problems.

Use Cat Filters If you want to evaluate the possibility of oil change intervals other than those published by Caterpillar® for your engines, you must protect your engine with high-quality products. Cat filters are designed to do the job beyond the published oil change periods. This extra protection assures you can maintain the same filter change periods as your newly established oil change periods. Although there may be a small difference in price, it is well worth it to guarantee that your engines are protected.

And Use Cat Diesel Engine Oil If not Cat DEO, use a premium quality API CG-4 or CH-4 oil. Diesel engine oils that meet API specifications CG-4 and CH-4 contain the best additive package and base oil stock to help you achieve longer oil use and maximum engine life. But even with those API categories there can be wide variations in performance (which is reflected by the range of prices for CG-4 and CH-4 oil). Oil is viewed by some as a commodity, but as a rule, you get what you pay for — a higher quality add pack and base stock costs more than lower quality alternatives. To ensure you get the best oil for your money use Cat oil in your engines.*

**Caterpillar now offers a full synthetic diesel engine oil. This premium-priced lubricant is designed to achieve longer oil change intervals.*

Extend equipment life with quality Cat maintenance products.

Cat Fluids: Formulated to provide higher standards in performance and life.

Cat Fluid Filters: System engineered for optimal performance and protection.

S·O·S Analysis: The ultimate approach for assuring maximum productivity and achieving full design life for your equipment.

Maintenance Software: Trend Analysis Module (TAM) for S·O·S results, Maintenance Control System (MCS) for scheduling and record keeping and Preventive Maintenance Planner (PMP) for comprehensive maintenance checklists.

PEDP7035

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or visit our Web site at www.CAT.com

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