

KLEENOIL

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Kleenoil Onboard Oil Recycling Systems

Go GREEN! - Keep it KLEEN

KLEENOIL 

Equipment Efficiency Challenges

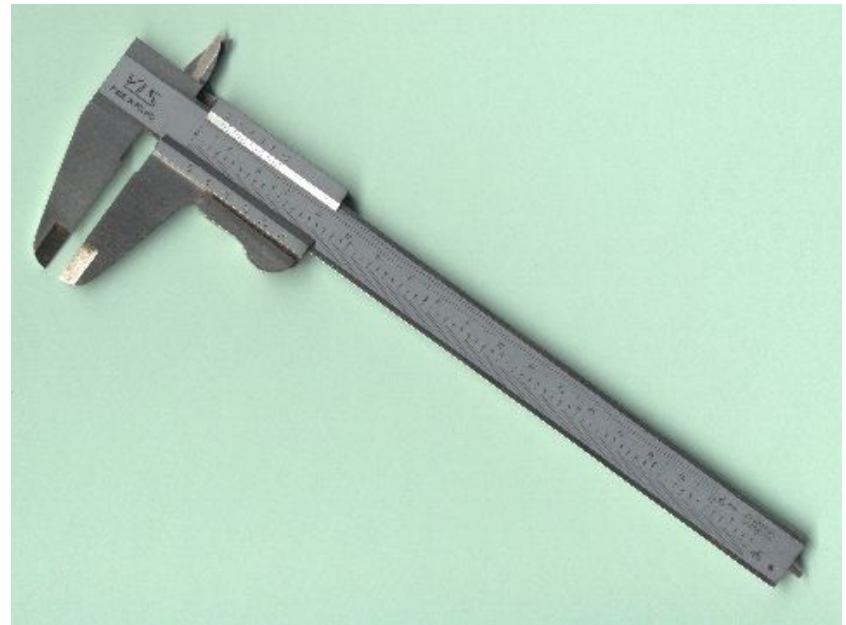
- ◎ Reduced sump capacities
- ◎ Tighter tolerances
- ◎ Increased PSI's
- ◎ Stronger materials
- ◎ Higher cycle temperatures will invariably pose tribological problems of the top ring, piston, valve seats, and valve guides



Tighter Tolerances

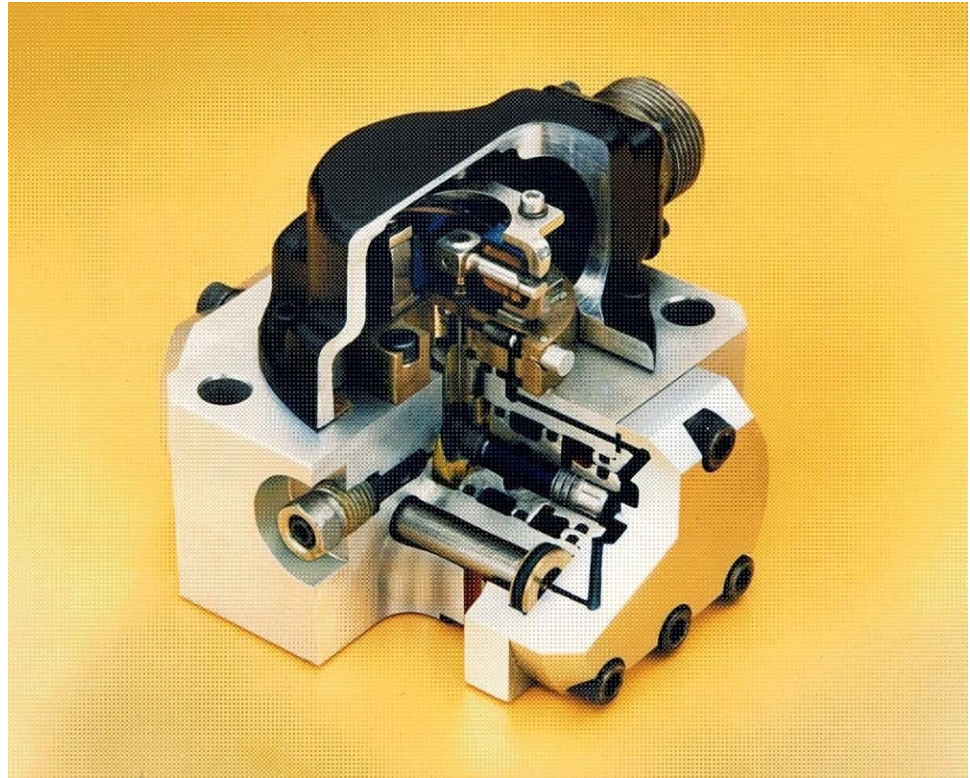
- In engineering, we've grown accustomed to machines and their component parts becoming stronger, lighter, cheaper, smaller, more powerful and more efficient.

Brendan Casey, "Heating Things Up: What's Next in Hydraulics?".
Machinery Lubrication Magazine. March 2009



2 Micron Tolerances

- Servo Valve
 - Also
- Fuel Injectors



Heat can be your biggest enemy of a hydraulic system

- ◎ It's bigger than particle and water contamination these days due to the widespread understanding and adoption of modern filtration technologies.
- ◎ According to Arrhenius' Law, for every 10°C increase in temperature, the rate of reaction doubles. The chemical reactions we're concerned with – in so far as hydraulic oil life is concerned – are oxidation (due to the presence of air) and hydrolysis (due to the presence of water). So the hotter the oil, the faster the rate of these reactions – and exponentially so.



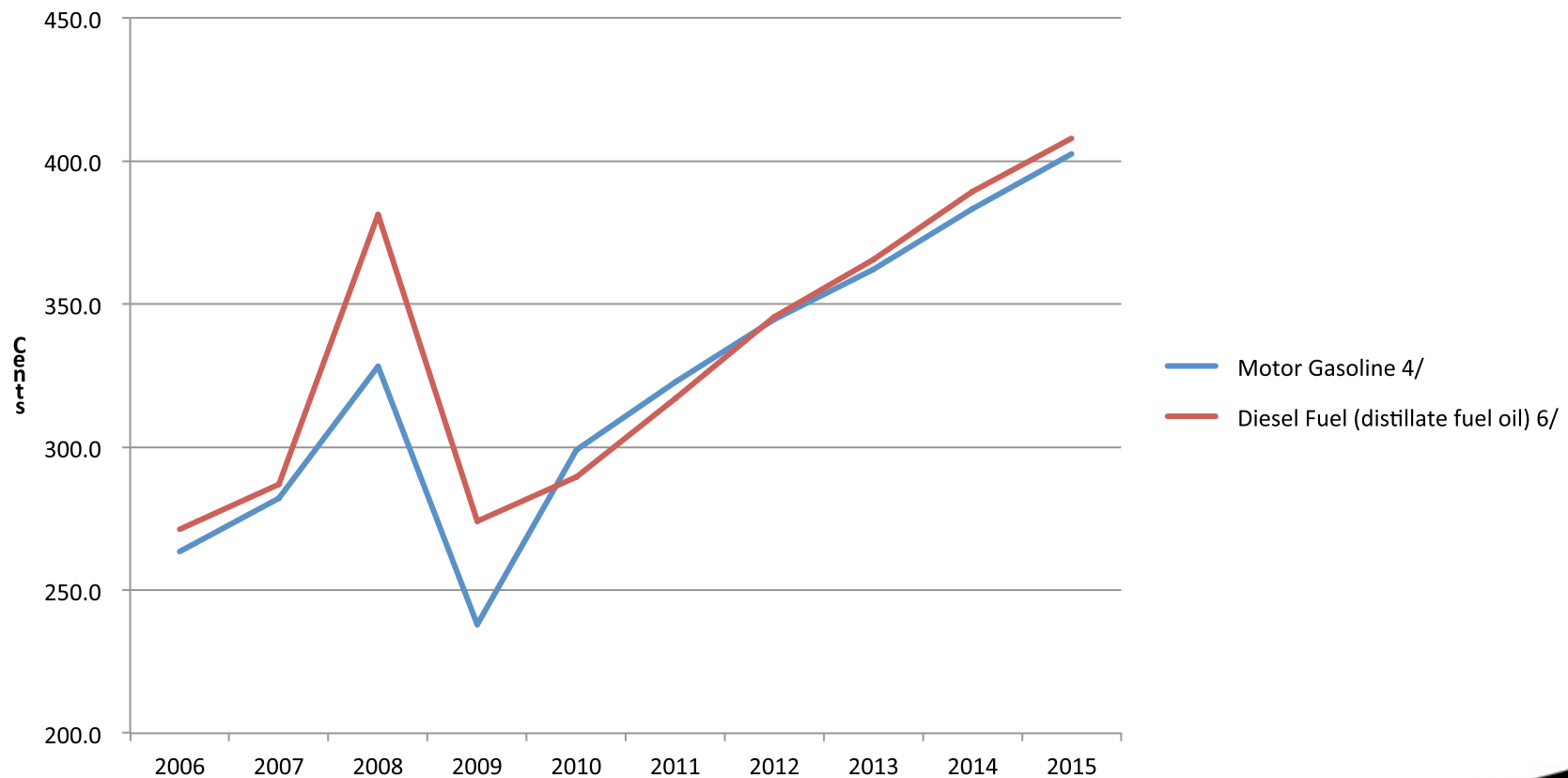
Long-Term Crude Oil Projections

Energy Information Administration



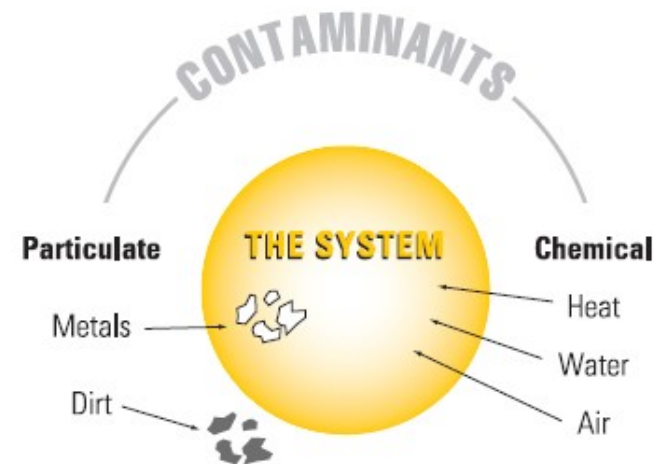
Long-Term Projected Fuel Cost

EIA: Release Date 11/08

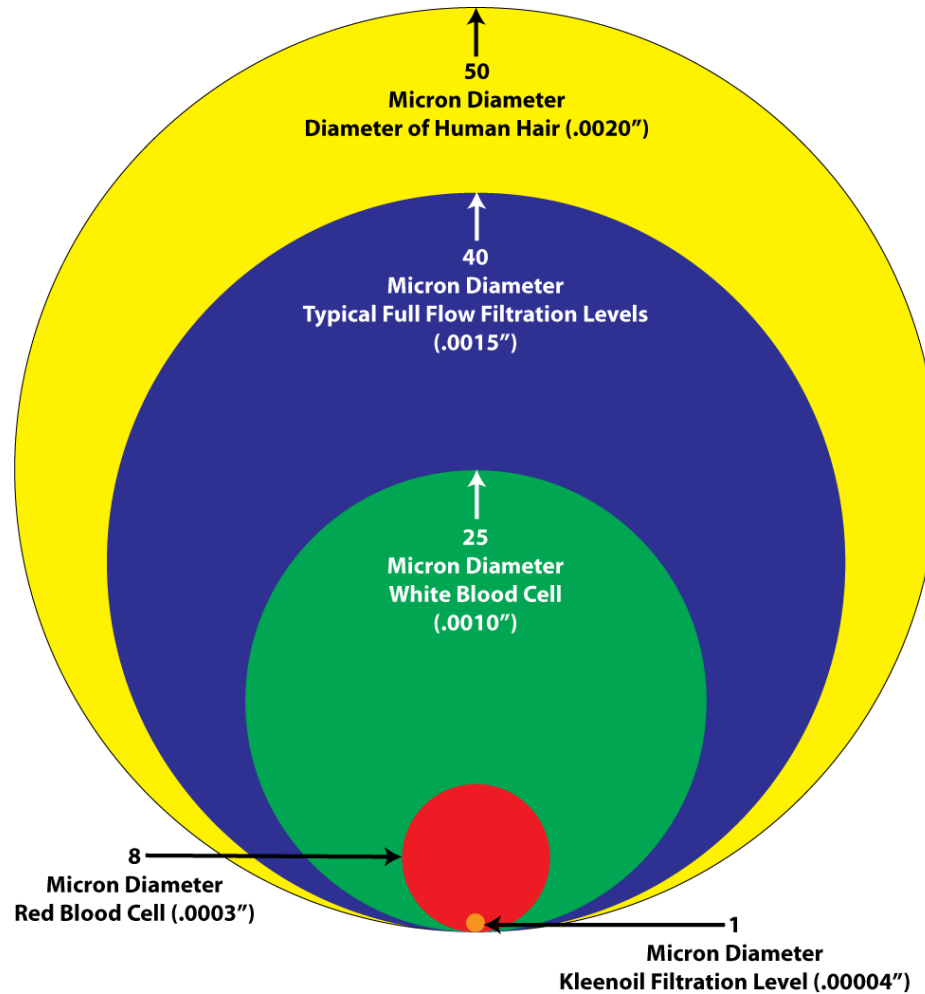


Contamination

- “Any material not contained in the lubricant's formulation”



How Big is a Micron



ISO Code 4406 & 4406:99

- ◎ The International Organization for Standardization (ISO) has developed a code system called ISO Cleanliness codes, a universal standard for measuring and reporting particulate contamination levels in fluids.



International
Organization for
Standardization

ISO Cleanliness Code Rating

More Than (p/ml)	Up To and Including (p/ml)	ISO Code
80,000	160,000	24
40,000	80,000	23
20,000	40,000	22
10,000	20,000	21
5,000	10,000	20
2,500	5,000	19
1,300	2,500	18
640	1,300	17
320	640	16
160	320	15
80	160	14
40	80	13
20	40	12
10	20	11
5	10	10
2.5	5	9
1.3	2.5	8

Each code represents a range of solid particles present in a lubricant.

15 MICRONS

NUMBER OF PARTICLES LESS THAN

Generally Don't Filter Below 25 Microns



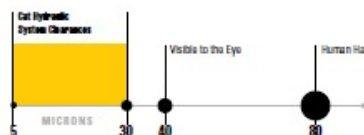
Irreversibly damages bearing surfaces



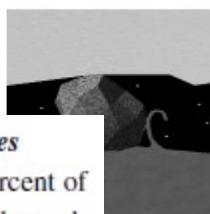
Know the effects of contamination

Fluid contamination damages a hydraulic system in two ways. First, it **reduces system efficiency**. Machine productivity and efficient hydraulics go hand in hand. If a hydraulic system isn't performing at peak efficiency, it's robbing the machine of performance. Efficiency losses usually occur slowly and can reach 16 to 20 percent before the operator detects a loss in performance. These "invisible" efficiency losses also can increase fuel consumption.

Contamination also **accelerates component wear**. 75 to 85 percent of hydraulic pump, motor, cylinder and valve failures can be traced to contamination. Due to the extremely small clearances in today's hydraulic systems, even particles you cannot see can damage pumps, motors, cylinders and valves in the form of abrasive, adhesive and fatigue wear.

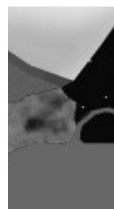


Typical metal-to-metal clearances in Cat hydraulic systems are 5-30 microns (one micron is one millionth of a meter). Therefore, even particles too small to see can do big damage.



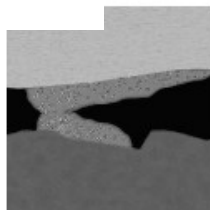
Abrasive wear

Abrasive particles scrape metal from hydraulic components. Wear metal is created, multiplies and travels to other parts of the system to do more damage.



Fatigue wear

Repeated high-pressure stress loads cause metal to chip or break from components and contaminate the hydraulic system.



Silting

Small particles build up on metal surfaces and clog the flow of fluids. The result is jamming and sticking of valves and reduced system efficiency.



Volume 18 Number 1

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Pocker Guide**
Cat® Skid Steer Loaders
& Multi Terrain Loaders.
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ON YOUR OWN

COVER STORY

New! Cat® B-Series Skid Steer
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Page 6

FIELD REPORT

AccuGrade® Laser Grade
Control System in Operation
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FIELD REPORT

Cat Wheel Excavator
Handles Precious Loads
Page 24

**Louisiana
Machinery**



PRODUCT SUPPORT

KEEP IT CLEAN

Minute contaminants can be your machine fluid systems' biggest enemy.

Contaminants can sometimes be introduced during assembly. Other times, it enters while the machine is working or being serviced. Whenever contaminants invade a system, they impair machine performance and reduce component life.

Equipment owners are demanding increased performance, improved efficiency and longer life from their equipment. As a result, Cat has designed products with an electro-hydraulic component high-pressure fluid systems. hydraulic systems operate at 1 of 6,000 psi and higher. Fuel pressures can reach nearly 40. To achieve these pressure Caterpillar designs must incorporate extremely tight tolerances. They are especially vulnerable to contamination that cannot be detected by the human eye.

Too Small to See

Contaminants are measured in microns. One micron is one-millionth of a meter. A grain of salt is about 100 microns in diameter. A human hair, around 80 microns. Particles smaller than 40 microns can damage engine and hydraulic systems.

Most manufacturers assess the cleanliness of

It's Never Too Late

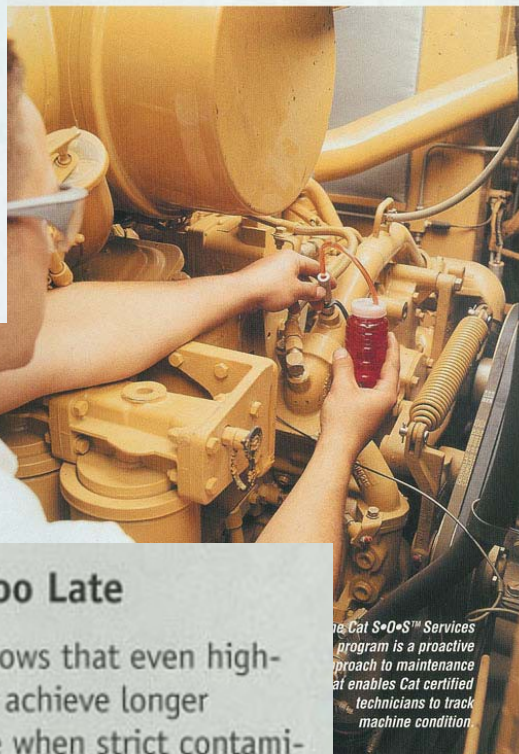
Research shows that even high-hour machines achieve longer component life when strict contamination control procedures are applied.

One of the best things you can do to minimize contamination during operation and maintenance.

Take advantage of your dealer's oil analysis services.

Cat S•O•S™ Services program is a proactive approach to maintenance that enables Cat certified technicians to track machine condition.

Systems by counting and measuring the number of particles present in the oil. The results are reported to an International Organization for Standardization (ISO) contaminant code. The first digit refers to the number of larger particles in a sample. The second digit refers to the number of 15-micron and larger particles in that same sample. A rating of 21/17 rating, for example, means that 1 millimeter of oil contains up to 221





(about 2 million) particles 5 microns and larger, as well

oil sample that earns a 21/17 rating is equivalent to a 55-gallon drum

In fact, if your machine meets the 21/17 standard – and the hydraulic pumps operate at 32 gallons per minute, 8 hours a day, 200 days per

improving cleanliness to ISO 18/15, you can reduce the amount of dirt in your system to about 80 pounds per year. Achieve a 16/13 rating, and the number drops to 20 pounds

- Productivity declines, often without your knowledge. As particulates build up on metal surfaces and impede hydraulic flow, system efficiency erodes. But even a skilled

- Component life suffers. A three-year independent study of hydraulic systems found that some hydraulics components lasted up to 10 times longer with proper contamination control.

- The odds of a catastrophic failure increase. Left unchecked, severe contamination leads to unplanned failures, unscheduled downtime and higher repair costs. ■

Controlling Contamination: Factory to Field

Manufacturers, dealers and owners can work together to maximize contamination control. Their united efforts keep earthmoving clean over their entire life cycle.

Manufacturer

Manufacturer is primarily responsible for designing and building clean equipment.

Work with suppliers to improve cleanliness of purchased parts and components. Educate employees about the role they play in contamination control.

Design work stations to enhance cleanliness.

Invest in advanced cleaning technologies.

Provide covers and doors for storage areas.

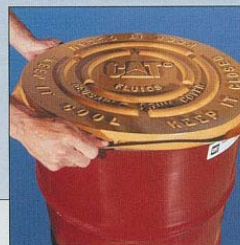
Use foam and plastic packaging rather than cardboard, to reduce paper contamination.

Test oil repeatedly prior to installing new machine systems. Use particle counting technology to verify cleanliness before operating.

Dealer

Here's how your local dealer must control contamination:

- Manage oil storage and transfer systems effectively.
- Maintain a clean work environment in all service areas.
- Train employees to use proper maintenance and repair processes in the field, as well as in the service shop.
- Invest in tools and technology that enhance contamination control efforts.
- Advise customers on ways to control contamination.



Owner's job to reduce the

contamination during operation and maintenance.

Control operating temperature to reduce internal wear.

Check for leaks immediately. If oil is leaking out, particles are getting in. Replace worn seals without delay. A bad seal makes a perfect entry point for dirt.

Change old filters carefully. They hold sludge that can fall back into the system.

Use new filters packaged until they're ready for installation.

Drain oil when it's warm and agitated. And make sure to drain the fluid as thoroughly as possible.

Use a filtered fluid transfer cart to add new oil.

Enroll in an oil-analysis program.

Determining Optimal Oil Change Intervals

Work with our experts

We will work with you to optimize the oil change intervals for your Cat engines. Keep in mind, the process of determining new oil change intervals is not simple. It requires that you work closely with your dealer 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. Use S•O•S Services for both oil and coolant analysis, to make sure there are not any problems.

Extend oil drain intervals



We suggest you proceed beyond the manufacturer's recommended oil change period cautiously. First, determine that wear rate and oil condition are satisfactory at the recommended interval. Then, extend to the recommended interval plus 50 hours. Stay with the new interval for several changes and closely monitor the S•O•S results. If wear results remain acceptable, proceed again to a plus 100 hour interval.



take a sample to monitor the characteristics and cleanliness.

• 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.

• 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.

• 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.

Proceed with caution

We suggest that when evaluating engines with a 500-hour recommended oil change that you move forward cautiously. Some applications and conditions may allow for oil drain interval extensions, but some extreme applications and conditions may require more frequent oil changes.

What is a Kleenoil Bypass Filter?

- It is an on-board recycling system
- Removes all particles to 1 micron in size
- Removes 99.95% of all water
- Maximizes component life



Kleenoil Filter Cartridge

This Is The Technological Difference!



- ◎ It uses a cellulose filter medium that not only filters particles down to the size of 1 micron or less, but it also filters 100% of any water that may accumulate through condensation, or through the combustion process itself.
- ◎ This eliminates the possibility of corrosion and hydro cracking. Water contamination in lubricants can cut bearing life by as much as 80%.

Comparison

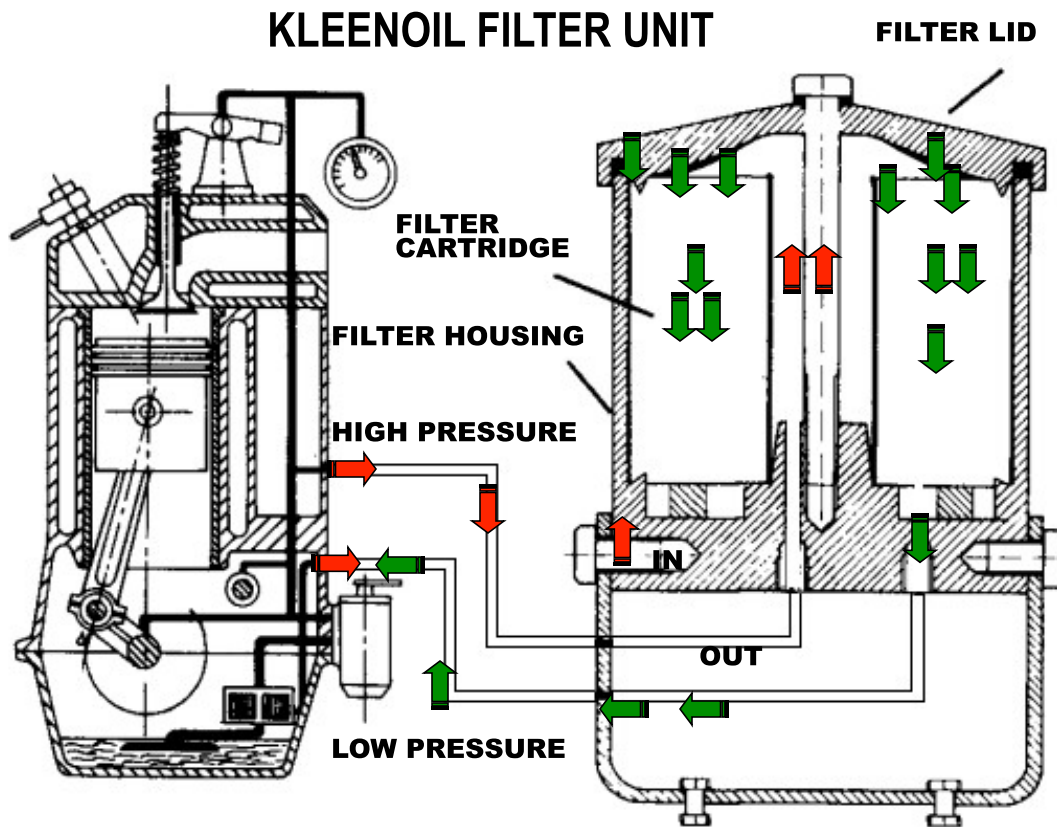
Full Flow Engine Oil Filter

- 30 to 40 quarts per minute
- Models differ but generally capture particles no less than 25 to 40 microns
- No water retention

Kleenoil Bypass Filter

- 3 to 4 quarts per minute
- Captures particles as small as 1 micron (3 micron absolute)
- Absorbs water

How Does It Work?



Quick Review

- Product with lifetime warranty
- Easy installation
- No moving or electrical parts
- Reduces maintenance
- Extends equipment life
- Reduces consumption of oil
- Reduces carbon footprint – **Going Green**

Empire Mesa Hydraulic Service Department





MOBILE OIL ANALYSIS REPORT

CONTAMINATION	NORMAL
OIL CONDITION	NORMAL
WEAR	NORMAL

BULK TANK - Hydraulic System

Unit Make : {n/a} Serial No : {n/a} Date Rec'd : Mar 17, 2006
 Unit Model : {n/a} Cust. Ref No. : {n/a} Sample Date : Mar 13, 2006
 Comp Make : {n/a} Stub No. : KL-M085769 Diagnostician : Doug Bogart
 Comp Model : {n/a}

RECOMMENDATION		Sample Date	02/03/06	02/09/06	02/20/06	Current	UOM
		Time on Unit	0	0	0	0	hrs
Sample Date		02/03/06	02/09/06	02/20/06	Current		
Silicon		3.9	1.0	1.6	0.9		
Potassium		4.1	0.0	0.0	0.0		
Water (%)		<0.1	<0.1	<0.1	<0.1		
>4µm(c)		18222	229	364	340		
>6µm(c)		7926	59	84	100		
>14µm(c)		351	7	13	12		
>21µm(c)		5	1	2	3		
>38µm(c)		0	0	0	0		
>70µm(c)		0	0	0	0		
ISO 4406(c)		20/16	13/10	14/11	14/11		
		visc@100°C	---	---	---	---	0.5
		TAN	1.56	1.61	1.56	1.64	
WEAR		Sample Date	02/03/06	02/09/06	02/20/06	Current	Abn
		PQ	---	---	---	---	
		Iron	1.3	1.1	1.2	1.4	
		Nickel	0.0	0.0	0.1	0.0	
		Chromium	0.0	0.0	0.1	0.1	
		Titanium	0.1	0.0	0.1	0.1	
		Copper	0.1	0.1	0.1	0.0	
		Aluminum	1.0	1.0	0.6	0.0	
		Tin	0.0	0.0	0.0	0.0	
		Lead	0.0	0.0	0.0	0.0	
		Silver	0.0	0.0	0.0	0.0	

All component wear rates are normal.

Bucyrus 49RII



KLENOIL

Bucyrus 49 R Drill

PREVIOUS SAMPLE TAKEN
8/09/2010
ISO 23/23/21

COMPANY NAME: [REDACTED]
CUSTOMER EQUIP NUM: RMDR15
COMPARTMENT NAME: HYDRAULIC SYSTEM
SERIAL NUMBER: [REDACTED]
MANUFACTURER: UNKNOWN
MODEL: UNK_UNKNOWN
JOB SITE:
EXT WARR NUMBER:

SHOP JOB NUM:
COMP SERIAL NUM:
COMPARTMENT MODEL:
COMP MANUFACTURER:
SAMPLE LABEL NUM:
FLUID BRAND / WEIGHT: / 10W
FLUID TYPE:
EXT WARR EXPIRE DATE:

SECOND SAMPLE TAKEN AFTER
16 HOURS ON KLENOIL FILTER
ISO 16/14/11



LAB CONTROL NUMBER	SAMPLE DATE	PROCESS DATE	EQUIPMENT METER	METER ON FLUID	FLUID CHANGED	MAKE UP FLUID	MAKE UP FLUID UNITS	FILTER CHANGED
[REDACTED]	10/29/2010	11/02/2010	21981.1	21981.1	No			No
	NO PROBLEMS PRESENTLY ASSOCIATED WITH THIS SAMPLE. CONTINUE SAMPLING AT THE NORMAL INTERVAL.							
	08/09/2010	08/11/2010	21062	21062	No			No
	VISIBLE DIRT IN SAMPLE. LPC (LARGE PARTICLE COUNT) READING EXCEEDS RECOMMENDED CLEANLINESS LEVEL. POSSIBLY DUE TO CONTAMINATION WHEN SAMPLE COLLECTED. INSPECT. RECOMMEND RESAMPLE ASAP TO CONFIRM ANALYSIS. MONITOR COMPARTMENT.							
	09/30/2009	10/02/2009	17882	17882	No			No
	NO PROBLEMS PRESENTLY ASSOCIATED WITH THIS SAMPLE. CONTINUE SAMPLING AT THE NORMAL INTERVAL.							
[REDACTED]	12/12/2008	12/16/2008	16498	16498	Unknown			Unknown
	LPC (LARGE PARTICLE COUNT) READING EXCEEDS RECOMMENDED CLEANLINESS LEVEL. PARTICLES >10 MICRONS ASSOCIATED WITH HIGH RISK. FAILURE ARE UNDETECTABLE BY SPECTROANALYSIS ... INSPECT FILTER (S). SUGGEST EITHER CHANGING OIL OR FILTERING OUT DEBRIS. MONITOR COMPARTMENT.							

→ Kleenoil Installed

Wear Metals (ppm)	Al	Ba	B	Ca	Cr	Cu	Fe	Pb	Mg	Mo	Ni	P	K	Si	Ag	Na	Sn	Ti	V	Zn
[REDACTED]	0	1	0	25	0	2	0	0	4	0	0	326	0	0	0	1	1	0	0	415
[REDACTED]	0	0	0	35	0	1	1	0	4	0	0	318	2	0	0	1	0	0	0	399
[REDACTED]	1	1	0	26	0	1	0	2	3	0	0	327	22	0	1	4	2	0	0	413
[REDACTED]	0	0	0	23	0	0	1	0	4	0	0	321	0	0	0	0	0	0	0	421

Fluid Condition / Particle Count (ct/ml)	W	A	V100	ISO	Debris	4μ	6μ	10μ	14μ	18μ	21μ	38μ	70μ	PVI
[REDACTED]	N	N	9.1	16/14/11	N	431	102	27	12	6	5	1	0	0.08
	N	N	9.1	23/23/21	N	62478	47955	27314	13908	5624	2884	142	3	45.78
	N	N	9.0	18/15/12	N	2402	304	66	28	18	14		1	0.31
	N	N	9.1	22/21/18	N	29377	10743	3229	1345	671	394		5	4.94

→ 16 hours of Kleenoil Filtration

KLENOIL

The Extension by Reducing ISO Codes

		New Cleanliness Level (ISO Code)																					
		20/17		19/16		18/15		17/14		16/13		15/12		14/11		13/10		12/9		11/8		10/7	
Current Machine Cleanliness (ISO Code)	26/23	5	3	7	3.5	9	4	>10	5	>10	6	>10	7.5	>10	9	>10	>10	>10	>10	>10	>10	>10	>10
		4	2.5	4.5	3	6	3.5	6.5	4	7.5	5	8.5	6.5	10	7	>10	9	>10	10	>10	>10	>10	>10
	25/22	4	2.5	5	3	7	3.5	9	4	>10	5	>10	6	>10	7	>10	9	>10	>10	>10	>10	>10	>10
		3	2	3.5	2.5	4.5	3	5	3.5	6.5	4	8	5	9	6	10	7.5	>10	9	>10	>10	>10	>10
	24/21	3	2	4	2.5	6	3	7	4	9	5	>10	6	>10	7	>10	8	>10	10	>10	>10	>10	>10
		2.5	1.5	3	2	4	2.5	5	3	6.5	4	7.5	5	8.5	6	9.5	7	>10	8	>10	10	>10	>10
	23/20	2	1.5	3	2	4	2.5	5	3	7	3.5	9	4	>10	5	>10	6	>10	8	>10	9	>10	>10
		1.7	1.3	2.3	1.5	3	2	3.7	2.5	5	3	6	3.5	7	4	8	5	10	6.5	>10	8.5	>10	10
	22/19	1.6	1.3	2	1.6	3	2	4	2.5	5	3	7	3.5	8	4	>10	5	>10	6	>10	7	>10	>10
		1.4	1.1	1.8	1.3	2.3	1.7	3	2	3.5	2.5	4.5	3	5.5	3.5	7	4	8	5	10	5.5	>10	8.5
21/18	1.3	1.2	1.5	1.5	2	1.7	3	2	4	2.5	5	3	7	3.5	9	4	>10	5	>10	7	>10	10	
	1.2	1.1	1.5	1.3	1.8	1.4	2.2	1.6	3	2	3.5	2.5	4.5	3	5	3.5	7	4	9	5.5	10	8	
20/17			1.3	1.2	1.6	1.5	2	1.7	3	2	4	2.5	5	3	7	4	9	5	>10	7	>10	9	
			1.2	1.05	1.5	1.3	1.8	1.4	2.3	1.7	3	2	3.5	2.5	5	3	6	4	8	5.5	10	7	
19/16					1.3	1.2	1.6	1.5	2	1.7	3	2	4	2.5	5	3	7	4	9	6	>10	8	
					1.2	1.1	1.5	1.3	1.8	1.5	2.2	1.7	3	2	3.5	2.5	5	3.5	7	4.5	9	6	
18/15							1.3	1.2	1.6	1.5	2	1.7	3	2	4	2.5	5	3	7	4.5	>10	6	
							1.2	1.1	1.5	1.3	1.8	1.5	2.3	1.7	3	2	3.5	2.5	5.5	3.7	8	5	
17/14									1.3	1.2	1.6	1.5	2	1.7	3	2	4	2.5	6	3	8	5	
									1.2	1.1	1.5	1.3	1.8	1.5	2.3	1.7	3	2	4	2.5	6	3.5	
16/13												1.3	1.2	1.6	1.5	2	1.7	3	2	4	3.5	6	4
												1.2	1.1	1.5	1.3	1.8	1.5	2.3	1.8	3.7	3	4.5	3.5
15/12														1.3	1.2	1.6	1.5	2	1.7	3	2	4	2.5
														1.2	1.1	1.5	1.4	1.8	1.5	2.3	1.8	3	2.2
14/11																1.3	1.3	1.6	1.6	2	1.8	3	2
																1.3	1.2	1.6	1.4	1.9	1.5	2.3	1.8
13/10																		1.4	1.2	1.8	1.5	2.5	1.8
																		1.2	1.1	1.6	1.3	2	1.6

Based on ISO 4406:99 - 4 Million range number has been omitted.

KLEENOIL

Bucyrus 49R Drill

COMPANY NAME: [REDACTED]
CUSTOMER EQUIP NUM: RMDR19
COMPARTMENT NAME: HYDRAULIC SYSTEM
SERIAL NUMBER: [REDACTED]
MANUFACTURER: UNKNOWN
MODEL: UNK_UNKNOWN
JOB SITE:
EXT WARR NUMBER:

SHOP JOB NUM:
COMP SERIAL NUM:
COMPARTMENT MODEL:
COMP MANUFACTURER:
SAMPLE LABEL NUM:
FLUID BRAND / WEIGHT: / 10W
FLUID TYPE:
EXT WARR EXPIRE DATE:

INITIAL SAMPLE TAKEN FROM OLD OIL
THAT WAS DRAINED
ISO 19/18/16

SECOND SAMPLE TAKEN OF NEW OIL
ISO 19/18/16

THIRD SAMPLE TAKEN AFTER 15 HOURS
ON KLEENOIL
ISO 17/15/12



LAB CONTROL NUMBER	SAMPLE DATE	PROCESS DATE	EQUIPMENT METER	METER ON FLUID	FLUID CHANGED	MAKE UP FLUID	MAKE UP FLUID UNITS	FILTER CHANG
[REDACTED]	10/28/2010	11/02/2010	28375	15	No			No
[REDACTED]	NO PROBLEMS PRESENTLY ASSOCIATED WITH THIS SAMPLE. CONTINUE SAMPLING AT THE NORMAL INTERVAL.							
[REDACTED]	10/27/2010	11/02/2010	28360	28360	Yes			Yes
[REDACTED]	NO PROBLEMS PRESENTLY ASSOCIATED WITH THIS SAMPLE. CONTINUE SAMPLING AT THE NORMAL INTERVAL.							
[REDACTED]	10/27/2010	11/02/2010	28361	28361	No			Unknown
[REDACTED]	NO PROBLEMS PRESENTLY ASSOCIATED WITH THIS SAMPLE. CONTINUE SAMPLING AT THE NORMAL INTERVAL.							
[REDACTED]	08/12/2010	08/16/2010			No			No
[REDACTED]	NO PROBLEMS PRESENTLY ASSOCIATED WITH THIS SAMPLE. CONTINUE SAMPLING AT THE NORMAL INTERVAL.							

KLEENOIL Installed

Wear Metals (ppm)	Al	Ba	B	Ca	Cr	Cu	Fe	Pb	Mg	Mo	Ni	P	K	Si	Ag	Na	Sn	Ti	V	Zn
[REDACTED]	1	1	0	21	0	1	0	1	4	0	0	321	5	0	0	3	2	0	0	397
[REDACTED]	0	0	1	18	0	1	0	0	3	0	0	333	2	0	0	2	1	0	0	406
[REDACTED]	0	0	0	21	0	0	0	1	4	0	0	320	4	0	0	2	1	0	0	400
[REDACTED]	0	0	2	17	0	1	0	0	3	0	0	318	0	0	0	0	0	0	0	383

Fluid Condition / Particle Count (ct/ml)	W	A	V100	ISO	Debris	4μ	6μ	10μ	14μ	18μ	21μ	38μ	70μ	PVI
[REDACTED]	N	N	9.0	17/15/12	N	692	174	47	21	13	10	4	2	0.49
[REDACTED]	N	N	9.3	19/18/16	N	4359	2076	759	332	175	111	12	1	1.76
[REDACTED]	N	N	8.9	19/18/16	N	4717	1987	798	410	214	132	10	1	1.90
[REDACTED]	N	N	9.3	21/19/15	N	12419	4980	1168	268	69	36	5	2	2.04

15 hours of
Kleenoil Filtration

KLEENOIL

Cat D10R Installation



Unit 522 Cat D10R Hydraulics

COMPANY NAME: [REDACTED]
 CUSTOMER EQUIP NUM: 522
 COMPARTMENT NAME: HYDRAULIC SYSTEM
 SERIAL NUMBER: 3KR00727
 MANUFACTURER: CAT
 MODEL: D10R_CAT
 JOB SITE:
 EXT WARR NUMBER:

SHOP JOB NUM:
 COMP SERIAL NUM:
 COMPARTMENT MODEL:
 COMP MANUFACTURER:
 SAMPLE LABEL NUM:
 FLUID BRAND / WEIGHT:
 FLUID TYPE:
 EXT WARR EXPIRE DATE:



LAB CONTROL NUMBER	SAMPLE DATE	PROCESS DATE	EQUIPMENT METER	METER ON FLUID	FLUID CHANGED	MAKE UP FLUID	MAKE UP FLUID UNITS	FILTER CHANGED
H160-41087-0203	03/24/2011	03/28/2011	50443	50443	No			No
NAR	NO PROBLEMS PRESENTLY ASSOCIATED WITH THIS SAMPLE. CONTINUE SAMPLING AT THE NORMAL INTERVAL.							
H160-41087-0208	03/22/2011	03/28/2011	27389	27389	No			No
AR	SILICON / ALUMINUM ARE HIGH INDICATING DIRT ENTRY. DIRT ENTRY IS CAUSING EXCESSIVE WEAR. INSPECT POSSIBLE SOURCES OF DIRTY ENTRY. ACTION REQUIRED. INSPECT CYLINDER WIPER SEALS. COPPER IS ELEVATED. IRON IS ELEVATED. CHROME IS ELEVATED. POSSIBLE PUMP / CYLINDER WEAR. INSPECT. ACTION REQUIRED.							
H160-41041-0037	02/08/2011	02/10/2011	26903	26903	No			No
AR	SILICON / ALUMINUM ARE HIGH INDICATING DIRT ENTRY. DIRT ENTRY IS CAUSING EXCESSIVE WEAR. INSPECT POSSIBLE SOURCES OF DIRTY ENTRY. ACTION REQUIRED. INSPECT CYLINDER WIPER SEALS. IRON HAS INCREASED. CHROMIUM HAS INCREASED. POSSIBLE PUMP / CYLINDER WEAR. PARTICLE COUNT CONTINUES TO BE ABOVE THE RECOMMENDED ISO CODE LEVEL FOR THIS SYSTEM. INSPECT. ACTION REQUIRED.							
H160-40328-0164	11/19/2010	11/24/2010	26115	26115	No			No
AR	SILICON / ALUMINUM ARE HIGH INDICATING DIRT ENTRY. DIRT ENTRY IS CAUSING EXCESSIVE WEAR. INSPECT POSSIBLE SOURCES OF DIRTY ENTRY. ACTION REQUIRED. INSPECT CYLINDER WIPER SEALS. IRON HAS INCREASED. CHROMIUM HAS INCREASED. POSSIBLE PUMP / CYLINDER WEAR. LPC (LARGE PARTICLE COUNT) READING EXCEEDS RECOMMENDED CLEANLINESS LEVEL. INSPECT. ACTION REQUIRED.							

Fluid Condition / Particle Count (ct/ml)	W	A	V100	ISO	Debris	4μ	6μ	10μ	14μ	18μ	21μ	38μ	70μ	PVI
H160-41087-0203	N	N	10.3	18/16/13	N	2261	511	91	41	20	12	2	0	0.28
H160-41087-0208	N	N	9.4	23/18/13	N	45736	1374	144	75	42	28	3	1	2.02
H160-41041-0037	N	N	9.9	23/20/15	N	62389	9752	411	203	127	92	23	2	4.24
H160-40328-0164	N	N	10.2	23/20/16	N	56608	7056	1303	583	316	208	34	6	5.85

Unit 522Cat D10R Transmission

COMPANY NAME: [REDACTED]
 CUSTOMER EQUIP NUM: 522
 COMPARTMENT NAME: TRANSMISSION POWER SHIFT
 SERIAL NUMBER: 3KR00727
 MANUFACTURER: CAT
 MODEL: D10R_CAT
 JOB SITE:
 EXT WARR NUMBER:

SHOP JOB NUM:
 COMP SERIAL NUM:
 COMPARTMENT MODEL:
 COMP MANUFACTURER:
 SAMPLE LABEL NUM:
 FLUID BRAND / WEIGHT:
 FLUID TYPE:
 EXT WARR EXPIRE DATE:



LAB CONTROL NUMBER	SAMPLE DATE	PROCESS DATE	EQUIPMENT METER	METER ON FLUID	FLUID CHANGED	MAKE UP FLUID	MAKE UP FLUID UNITS	FILTER CHANGED
H160-41087-0209	03/22/2011	03/28/2011	27389	27389	No			No
NAR	NO PROBLEMS PRESENTLY ASSOCIATED WITH THIS SAMPLE. CONTINUE SAMPLING AT THE NORMAL INTERVAL.							
H160-41062-0045	02/28/2011	03/03/2011	27224	27224	No			Yes
NAR	PARTICLE COUNT IS ELEVATED. PLEASE CONFIRM OIL HOURS / MILES. OIL HOURS / MILES CAN AFFECT SAMPLE INTERPRETATION.							
H160-41041-0038	02/08/2011	02/10/2011	28903	28903	No			No
NAR	PARTICLE COUNT IS ELEVATED. MAY BE NORMAL FOR MACHINE APPLICATION. NO ACTION REQUIRED.							
H160-40328-0165	11/19/2010	11/24/2010	28115	28115	No			No
MC	PARTICLE COUNT CONTINUES TO BE ABOVE THE RECOMMENDED ISO CODE LEVEL FOR THIS SYSTEM. MONITOR COMPARTMENT.							

Fluid Condition / Particle Count (ct/ml)	W	A	V100	ISO	Debris	4μ	6μ	10μ	14μ	18μ	21μ	38μ	70μ	PVI
H160-41087-0209	N	N	18.1	19/16/13	N	4360	465	111	57	32	21	5	1	0.61
H160-41062-0045	N	N	17.7	23/21/18	N	43173	19499	5473	2464	1228	748	82	12	13.93
H160-41041-0038	N	N	17.6	22/20/17	N	24626	6274	1918	880	493	324	36	2	5.21
H160-40328-0165	N	N	17.5	22/20/17	N	39520	7907	2530	1288	757	509	77	5	8.50

Unit 523 Cat D10R Hydraulics

COMPANY NAME: [REDACTED]
 CUSTOMER EQUIP NUM: 523
 COMPARTMENT NAME: HYDRAULIC SYSTEM
 SERIAL NUMBER: 3KR00808
 MANUFACTURER: CAT
 MODEL: D10R_CAT
 JOB SITE:
 EXT WARR NUMBER:

SHOP JOB NUM:
 COMP SERIAL NUM:
 COMPARTMENT MODEL:
 COMP MANUFACTURER:
 SAMPLE LABEL NUM:
 FLUID BRAND / WEIGHT:
 FLUID TYPE:
 EXT WARR EXPIRE DATE:



LAB CONTROL NUMBER	SAMPLE DATE	PROCESS DATE	EQUIPMENT METER	METER ON FLUID	FLUID CHANGED	MAKE UP FLUID	MAKE UP FLUID UNITS	FILTER CHANGED
H160-41130-0064	05/05/2011	05/10/2011	33922	33922	No			No
NAR	NO PROBLEMS PRESENTLY ASSOCIATED WITH THIS SAMPLE. CONTINUE SAMPLING AT THE NORMAL INTERVAL.							
H160-41116-0095	04/22/2011	04/28/2011	33699	33699	No			Yes
AR	VISIBLE LARGE PARTICLES IN SAMPLE. LPC (LARGE PARTICLE COUNT) READING EXCEEDS RECOMMENDED CLEANLINESS LEVEL. INSPECT. RECOMMEND RESAMPLE ASAP TO CONFIRM ANALYSIS. ACTION REQUIRED.							
H160-41074-0345	03/10/2011	03/15/2011	33198	33198	No			No
AR	SILICON / ALUMINUM ARE HIGH INDICATING DIRT ENTRY. DIRT ENTRY IS CAUSING EXCESSIVE WEAR. INSPECT POSSIBLE SOURCES OF DIRTY ENTRY. ACTION REQUIRED. INSPECT CYLINDER WIPER SEALS. CHROME IS ELEVATED. POSSIBLE PUMP WEAR. LPC (LARGE PARTICLE COUNT) READING EXCEEDS RECOMMENDED CLEANLINESS LEVEL. INSPECT. ACTION REQUIRED.							
H160-41067-0021	03/04/2011	03/08/2011	33105	33105	No			No
AR	SILICON / ALUMINUM ARE HIGH INDICATING DIRT ENTRY. DIRT ENTRY IS CAUSING EXCESSIVE WEAR. INSPECT POSSIBLE SOURCES OF DIRTY ENTRY. ACTION REQUIRED. INSPECT CYLINDER WIPER SEALS. IRON IS ELEVATED. CHROME IS ELEVATED. POSSIBLE PUMP / CYLINDER WEAR. LPC (LARGE PARTICLE COUNT) READING EXCEEDS RECOMMENDED CLEANLINESS LEVEL. INSPECT. RECOMMEND CHANGING OIL (AND FILTER(S), IF APPLICABLE). ACTION REQUIRED.							

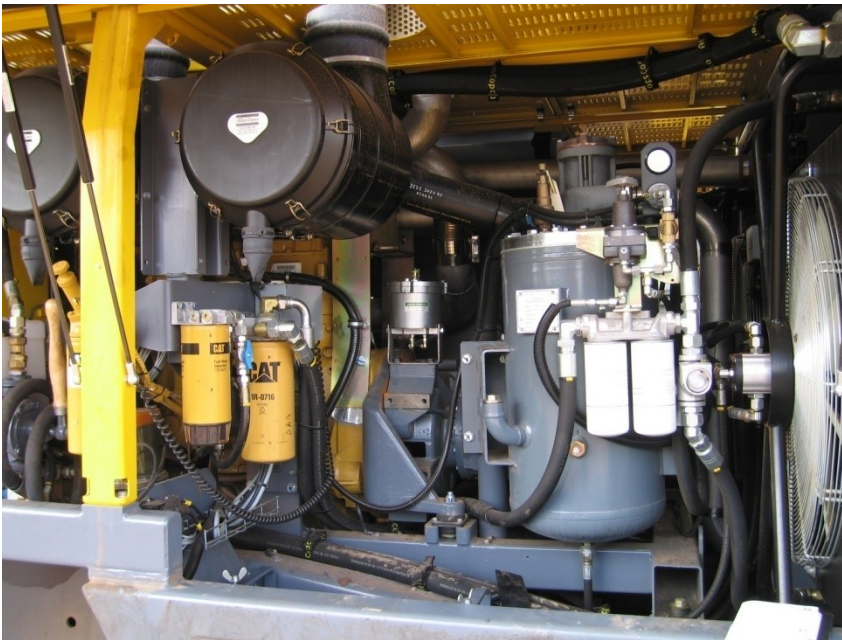
Wear Metals (ppm)	Al	Ba	B	Ca	Cr	Cu	Fe	Pb	Mg	Mo	Ni	P	K	Si	Ag	Na	Sn	Ti	V	Zn
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Fluid Condition / Particle Count (ct/ml)	W	A	TAN	V100	ISO	Debris	4μ	6μ	10μ	14μ	18μ	21μ	38μ	70μ	PVI
H160-41130-0064	N	N		12.0	20/19/16	N	8971	3386	1115	585	309	192	27	3	3.35
H160-41116-0095	N	N		11.6	23/22/21	N	60390	39964	18135	11053	6578	4428	710	41	61.56
H160-41074-0345	N	N	0.40	10.1	23/20/18	N	48567	9120	2615	1372	744	485	85	9	9.68
H160-41067-0021	N	N		10.2	23/22/16	N	75010	36552	1794	359	154	91	11	2	7.13

Bulk Tanks



Fuel Lines



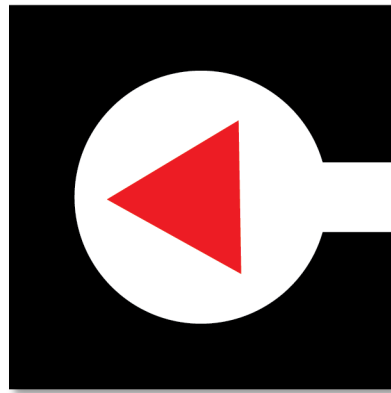
Coal Mine - Texas



522 Dozer

- Kleenoil filter was installed on 3/3/06 with 50464 HRS on dozer. Hydraulic oil had 557 hrs on it when system installed.
- On 12/21/06 dozer had 56366 on it. Hydraulic oil had 6459 hrs on it.
- Cost of oil, if changed as scheduled during this test period \$538.
- Kleenoil filter is changed on a 500 hr PM cycle.
- 2006 budgeted hydraulic system repairs **\$2.79/hr**, actual cost for 2006 was **\$0.86/hr**.
- **Reduced cost of hydraulic system repairs in 2006 by \$14,152**

KLEENOIL



**ENERGY
DRILLING
COMPANY**

KLEENOIL 

Energy Drilling – Company Bio

Energy Drilling Company is a privately owned, land drilling contractor based in Natchez, MS. Formed in March of 1979, Energy Drilling Company has been in business for over 30 years and currently operates nine drilling rigs in North and South Louisiana, East Texas, Mississippi, Arkansas and Alabama. We pride ourselves in understanding the needs of our customer and offer a complete package, from engineering to operations. We drill wells on turnkey, footage and day work basis and specialize in drilling for independent operators. We build long lasting relationships with our customers through stellar performance and an emphasis on safety.



Energy Drilling – Company Bio

Energy Drilling Company has a fleet of nine drilling rigs – three 1000 HP box on box substructure rigs and 6 trailer mounted rigs. Our trailer mounted rigs have the same peripheral equipment as our 1000 HP rigs in the form of our mud pumps, generator sets, solids control equipment, kelly and pipe spinners, mud tank systems, etc. These accessories really make our trailer mounted rigs very versatile with regard to drilling 5000'-12,500' wells.



Energy Drilling – Kleenoil Case Study



Energy Drilling – Kleenoil Case Study



Energy Drilling – Kleenoil Case Study

Puckett

Puckett Machinery Company
3263 Highway 80 West
Post Office Box 3170
Jackson, Mississippi 39207-3170

PROFORMA

Jackson (601) 969-6000
Gulfport (228) 832-1711
Natchez (601) 442-1633
Meridian (601) 483-4511
Harrisburg (601) 268-2000
Brookhaven (601) 833-5115

CUSTOMER

CASH SALES NATCHEZ
PO BOX 3170
JACKSON MS 39207-3170

SHIP TO

PAID

9681

PAID

REFU

CHECK #2089

INVOICE NUMBER	INVOICE DATE	CUSTOMER NO.	CUSTOMER PURCHASE ORDER NUMBER	STORE	DIV	SALESMAN	TERMS	PAGE
NT21373	03-01-11	1966000		02	E		4	1
PSO/NO.	DOC. DATE	PC	LC	MC	SHIP VIA		INVOICE SEQ. NO.	
NT21373	02-25-11	10	10	10				1
MAKE	MODEL	SERIAL NUMBER	EQUIPMENT NUMBER	METER READING	MACH. ID NO.			

TROUBLESHOOT BEARINGS

CUSTOMER WANTED TO KNOW THE EXTENT OF BEARING WEAR DUE TO HIGH HOURS ON ENGINE FINDINGS;

1. ALL BEARINGS WERE MEASURED WITH A BROWN & SHARPE, TYPE 300 RED, ELECTRONIC CALIPER
2. THIS ENGINE IS ONE OF TWO FLOOR MOTORS ON A DRILLING RIG. THE OTHER C-13 S/N LGK04501 HAD 24,114 HOURS AND THE BEARINGS WERE IN THE SAME CONDITION. CAT RECOMMENDS AN OVERHAUL @ 12,000 HOURS.
3. AS SHOWN ON THE ATTACHED SPREAD SHEET, LITTLE OR NO WEAR IS EVIDENCED BY THE MEASUREMENTS.

TOTAL LABOR SEG. A1 87.00 *

SEGMENT A1 TOTAL 87.00 T

***** NOT RETURNABLE *****

TERMS NET CASH 10TH OF MONTH FOLLOWING INVOICE DATE. PRICES SUBJECT TO CHANGE WITHOUT NOTICE.

ACCOUNTS WHICH ARE NOT PAID IN THE MONTH FOLLOWING THE DATE OF STATEMENT ON WHICH A CHARGE FIRST APPEARS WILL BE ASSESSED A DELINQUENCY CHARGE AT THE RATE OF 1.5% PER MONTH. (OPEN ACCOUNTS WILL BE CLOSED WHEN THEY BECOME 90 DAYS OLD)

THIS INVOICE IS SUBJECT TO THE CONDITIONS SHOWN ON THE REVERSE HEREOF. SEE PRICE CERTIFICATION TO COUNTRIES, CITIES, AND TOWNS ON THE REVERSE HEREOF.

PROFORMAPS

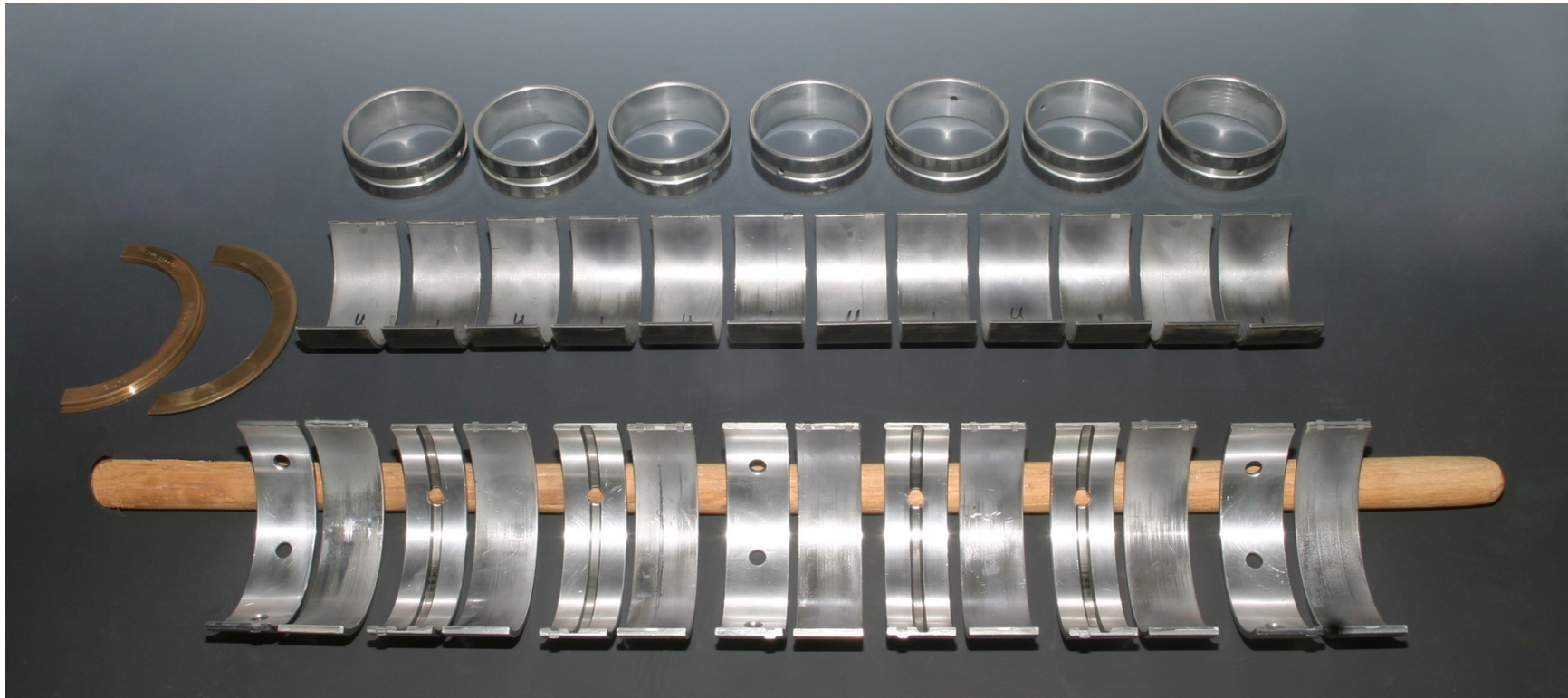
MISSISSIPPI LICENSE NO. 01949
(SENATE BILL 2718, LAWS OF 1995)

PROFORMA AMOUNT

CONT'D

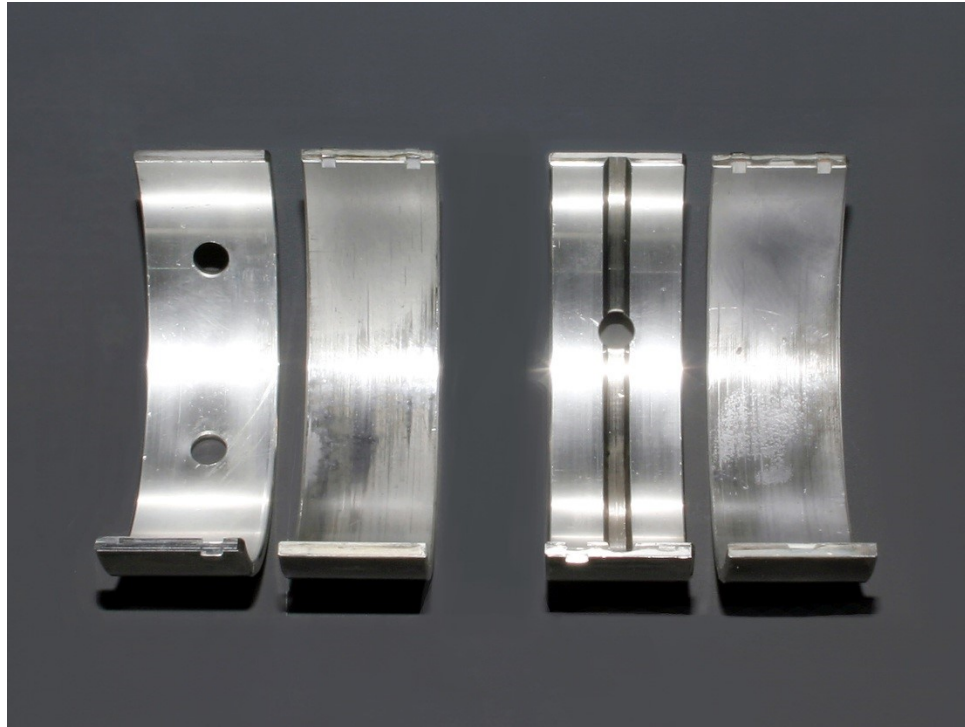
CUSTOMER'S FIRST

Energy Drilling – Kleenoil Case Study



Main Bearings		Specs Lower: +/- 0.004mm						
	Spec.	1	2	3	4	5	6	7
Upper	3.950	3.940	3.940	3.930	3.930	3.930	3.940	3.940
Lower	3.946	3.930	3.930	3.930	3.920	3.920	3.930	3.930

Energy Drilling – Kleenoil Case Study



		Specs Upper: +/- 0.008mm						
Main Bearings		Specs Lower: +/- 0.004mm						
	Spec.	1	2	3	4	5	6	7
Upper	3.950	3.940	3.940	3.930	3.930	3.930	3.940	3.940
Lower	3.946	3.930	3.930	3.930	3.920	3.920	3.930	3.930

Energy Drilling – Kleenoil Case Study

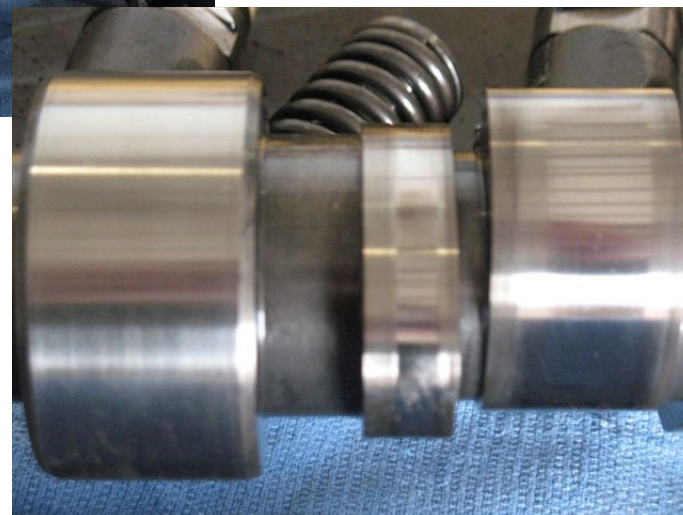
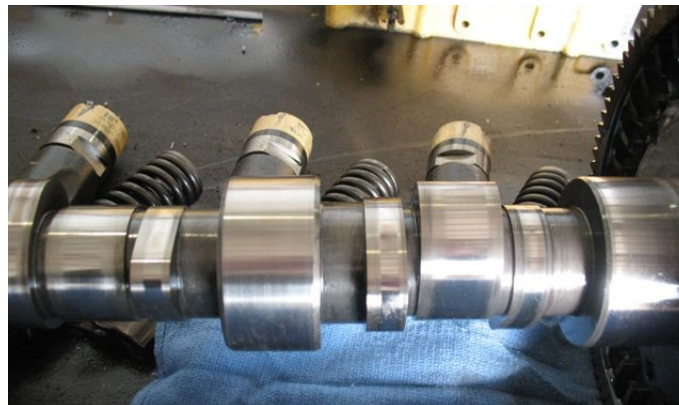


Energy Drilling – Kleenoil Case Study



Rod Bearings		Specs Upper & Lower: +/- 0.008mm					
	Spec.	1	2	3	4	5	6
Upper	2.359	2.350	2.350	2.350	2.350	2.350	2.350
Lower	2.359	2.350	2.350	2.350	2.350	2.350	2.350

Energy Drilling – Kleenoil Case Study



Energy Drilling – Kleenoil Case Study



Camshaft Bearings		Specs : +/- 0.020mm					
Spec.	1	2	3	4	5	6	7
3.510	3.510	3.510	3.510	3.510	3.510	3.510	3.510

Energy Drilling – Kleenoil Case Study



Camshaft Bearings			Specs : +/- 0.020mm					
Spec.	1	2	3	4	5	6	7	
3.510	3.510	3.510	3.510	3.510	3.510	3.510	3.510	

Energy Drilling – Kleenoil Case Study



Thrust Plate		Specs: 6.350mm +/- 0.040mm			
Left	6.210				
Right	6.220				

KLEENOIL

Select Kleenoil USA Inc. Customers

Randalls



Tom Thumb



NASA

NUCOR
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Schlumberger



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Select Kleenoil and Power Up OEM's

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th no special tools.

Boeing Helicopter



Kalmar Industries



Toro Equipment

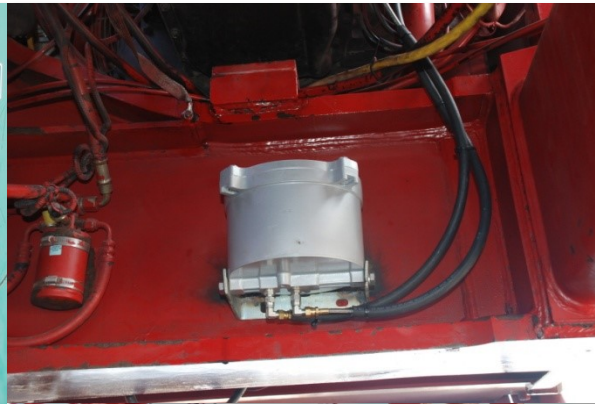


Toro Equipment



KLEENOIL

Companies Using Kleenoil – Bechtel



KLEENOIL



KLEENOIL





MOBILE OIL ANALYSIS REPORT

CONTAMINATION
OIL CONDITION
WEAR

NORMAL
NORMAL
NORMAL

4JIC-6500-04-04 - Diesel Engine

Unit Make : MANITOWOE
Unit Model : 888
Comp Make : CUMMINS
Comp Model : M11

Serial No : 4JIC-6500-04-04
Cust. Ref No. : {n/a}
Stub No. : KL-M2209422

Date Rec'd : Nov 16, 2009
Sample Date : Nov 6, 2009
Diagnostician : Doug Bogart

RECOMMENDATION

Resample at the next service interval to monitor.

Sample Date	09/22/09	10/06/09	Current	UOM
Time on Unit	3954	4063	4396	hrs
Time on Oil	150	309	642	hrs
Time on Fltr	150	309	0	hrs
Oil Maint.	not chg	not chg	not chg	---
Filter Maint.	not chg	not chg	not chg	---

CONTAMINATION

There is no indication of any contamination in the component. The amount and size of particulates present in the system is acceptable.

Sample Date	09/22/09	10/06/09	Current	Abn
Silicon	4.7	4.5	4.0	
Fuel (%)	<2.0	<2.0	<2.0	
Glycol	---	---	---	
Water (%)	<0.1	<0.1	<0.1	
Soot (%)	0	0	0	
>4µm(c)	320	269	141	
>6µm(c)	174	146	76	
>14µm(c)	29	24	13	
>21µm(c)	10	8	4	
>38µm(c)	1	1	0	
>70µm(c)	0	0	0	
ISO 4406(c)	15/12	14/12	13/11	

OIL CONDITION

Oil Type: 9 GAL of CHEVRON DELO 400 MULTIGRADE 15W40
The condition of oil is suitable for further service.

Sample Date	09/22/09	10/06/09	Current	Base
Potassium	1.6	0.0	7.6	
Boron	2.5	2.1	1.7	
Barium	0.2	0.6	0.3	
Calcium	3820	3450	2624	
Magnesium	138	184	299	
Molybdenum	5.5	8.3	14	
Sodium	1.4	1.6	1.3	
Phosphorus	1215	1110	1012	
Sulfur	6898	6282	5251	
Zinc	1302	1245	1163	
Visc@100°C	14.2	14.11	14.2	14.4
TBN	12.0	11.6	10.7	

WEAR

All component wear rates are normal.

Sample Date	09/22/09	10/06/09	Current	Abn
Iron	3.3	3.6	4.3	---
Nickel	0.0	0.0	0.0	---
Chromium	0.0	0.3	0.4	---
Titanium	0.1	0.4	0.7	---
Copper	3.1	4.0	3.9	---
Aluminum	1.6	1.8	1.8	---
Tin	0.0	0.0	0.0	---
Lead	4.3	4.0	5.5	---
Silver	1.0	0.2	0.0	---





MOBILE OIL ANALYSIS REPORT

CONTAMINATION
OIL CONDITION
WEAR

NORMAL
NORMAL
NORMAL

868 - Hydraulic System

Unit Make : CUMMINS
Unit Model : M-11
Comp Make : CUMMINS
Comp Model : {n/a}

Serial No : 4JIC-6500-04-04
Cust. Ref No. : {n/a}
Stub No. : KL-M2215034

Date Rec'd : Nov 16, 2009
Sample Date : Nov 6, 2009
Diagnostician : Doug Bogart

RECOMMENDATION

Resample at the next service interval to monitor.

Sample Date	09/22/09	10/06/09	Current	UOM
Time on Unit	3754	4063	4396	hrs
Time on Oil	150	309	642	hrs
Time on Fltr	150	309	0	hrs
Oil Maint.	not chg	not chg	not chg	---
Filter Maint.	not chg	not chg	not chg	---

CONTAMINATION

There is no indication of any contamination in the component. The amount and size of particulates present in the system is acceptable.

Sample Date	09/22/09	10/06/09	Current	Abn
Silicon	3.4	3.3	3.5	---
Potassium	0.0	7.2	9.4	---
Water (%)	<0.1	<0.1	<0.1	---
>4µm(c)	1932	789	3415	---
>6µm(c)	331	94	223	1300
>14µm(c)	57	12	21	160
>21µm(c)	12	3	5	---
>38µm(c)	1	1	1	---
>70µm(c)	0	0	0	---
ISO 4406(c)	16/13	14/11	15/12	17/14

OIL CONDITION

Oil Type: 120 GAL of CHEVRON HYDRAULIC OIL AW ISO 46
The condition of oil is suitable for further service.

Sample Date	09/22/09	10/06/09	Current	Base
Boron	0.9	2.0	0.9	---
Barium	0.3	0.8	0.1	---
Calcium	185	173	161	---
Magnesium	8.0	8.1	7.4	---
Molybdenum	0.4	0.8	0.2	---
Phosphorus	350	344	336	---
Sulfur	1448	1437	1423	---
Zinc	425	416	409	---
Visc@40°C	40.57	39.43	41.23	46.0
Visc@100°C	---	---	---	6.7
TAN	0.827	0.630	0.672	---

WEAR

All component wear rates are normal.

Sample Date	09/22/09	10/06/09	Current	Abn
Iron	3.4	3.2	3.6	---
Nickel	0.1	0.0	0.0	---
Chromium	0.0	0.1	0.0	---
Titanium	0.0	0.0	0.0	---
Copper	2.8	2.9	3.6	---
Aluminum	0.0	0.2	0.0	---
Tin	3.7	0.0	0.0	---
Lead	1.9	1.0	0.6	---
Silver	0.0	1.4	0.1	---





MOBILE OIL ANALYSIS REPORT

CONTAMINATION
OIL CONDITION
WEAR

NORMAL
NORMAL
NORMAL

533060E - Diesel Engine

Unit Make : CUMMINS

Unit Model : 5.9L

Comp Make : {n/a}

Comp Model : {n/a}

Serial No : {n/a}

Cust. Ref No. : {n/a}

Stub No. : KL-M2219360

Date Rec'd : Nov 16, 2009

Sample Date : Oct 30, 2009

Diagnostician : Doug Bogart

RECOMMENDATION

Resample at the next service interval to monitor.

Sample Date	10/01/09	10/26/09	Current	UOM
Time on Unit	2414	2578	2604	hrs
Time on Oil	901	1065	1091	hrs
Time on Fltr	0	0	0	hrs
Oil Maint.	n/a	not chg	not chg	---
Filter Maint.	changed	not chg	not chg	---

CONTAMINATION

There is no indication of any contamination in the component. The amount and size of particulates present in the system is acceptable.

Sample Date	10/01/09	10/26/09	Current	Abn
Silicon	5.5	6.7	6.6	
Fuel (%)	<2.0	<2.0	<2.0	
Glycol	---	---	---	
Water (%)	<0.1	<0.1	<0.1	
Soot (%)	0.1	0.1	0.1	
>4µm(c)	333	397	217	
>6µm(c)	181	216	118	
>14µm(c)	30	36	20	
>21µm(c)	10	12	6	
>38µm(c)	1	1	1	
>70µm(c)	0	0	0	
ISO 4406(c)	15/12	15/12	14/11	

OIL CONDITION

Oil Type: 3 GAL of CHEVRON DELO 400 MULTIGRADE 15W40

The condition of oil is suitable for further service.

Sample Date	10/01/09	10/26/09	Current	Base
Potassium	0.0	0.0	12	
Boron	41	24	27	
Barium	0.1	0.3	0.4	
Calcium	3567	3172	3050	
Magnesium	77	66	66	
Molybdenum	14	16	14	
Sodium	1.2	2.5	2.7	
Phosphorus	1118	918	891	
Sulfur	6739	5870	5604	
Zinc	1190	1040	1059	
Visc@100°C	15.77	14.5	14.42	14.4
TBN	10.2	8.15	7.91	

WEAR

All component wear rates are normal.

Sample Date	10/01/09	10/26/09	Current	Abn
Iron	9.4	13	14	---
Nickel	0.0	0.9	0.1	---
Chromium	0.3	0.8	0.7	---
Titanium	0.4	0.3	0.4	---
Copper	0.7	3.2	3.5	---
Aluminum	2.1	2.0	2.7	---
Tin	0.0	0.0	0.0	---
Lead	4.9	2.1	3.7	---
Silver	0.0	0.0	0.0	---



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Danne Pearn – Head of Maintenance
817-266-0050

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Unit LL054
Caterpillar 980C
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Unit CR003
Gomaco GP3000
Engine and Hydraulics

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Duinick Brothers
Unit LL610
Caterpillar 980H
Engine, Transmission and Hydraulics

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Unit RS605
Ingersoll-Rand DD136
Engine and Hydraulics

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From: Hemmings Jim [mailto:james.hemmings@volvo.com]
Sent: Friday, November 13, 2009 2:00 PM
To: VonKaitz Rollie; Wolf Steven; Phil Kennedy; John Impson
Cc: Drzewiecki Dave; Bogdanoff Roberto
Subject: By-pass filtration.

Gentlemen,

The filtration method I would recommend for machine L180E, serial # 9009, is more commonly called by-pass filtration. This system is fitted into a lower flow portion of the hydraulic circuit i.e. servo or cooler return, and filters the oil over a longer time frame but to a finer level. During this filtration period the machine can be operated as normal and, in fact, the more functions that are operated the cleaner the system hydraulic oil becomes. This method has no effect on machine operation and requires no external power or pumps.

As we discussed, anyone who owns, rents or uses Volvo equipment can use the contact information below. I would prefer any other equipment owners/users to use:
jhemmings11@comcast.net

Best regards,

Jim Hemmings
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One Volvo Drive
Asheville, North Carolina 28803

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