MARINE DIESEL SPECIALISTS, INC
SURVEY REPORT

January 23, 2026

Lee Thomson
68 Upper Thames St.
London, U.K. EC4V3BJ

M/Y "ESCAPE OF LONDON" 1997 36.5M(120") TRIDENT ON#306019

MAIN ENGINES:
CAT 3508DITA 705 HP at 1200 RPM
Port Engine Number: 69Z00673 Hours: 11,216
Stbd. Engine Number: 69Z00672 Hours: 11,271
MARINE GEAR:
TWIN DISC Port: 3X3980 Stbd: 3X3979 Ratio: 3.13:1A

DESCRIPTION

The CAT 3508 is an eight-cylinder V configuration engine. The cylinder bore diameter is 170 mm (6.7") with a stroke of 215 mm (8.46"). The engine displacement is 4.88 liters per cylinder with a total displacement of 39.04 liters. The engine is of a four-cycle design with Woodward governor-controlled unit injection, two piece articulated piston design, closed circuit liquid cooling, charge air cooling and exhaust turbochargers. Single cylinder heads with two exhaust valves and two intake valves per cylinder are some of the design features of this engine.
Charge air cooling is accomplished through the large cooler that is mounted in the valley of the engine. Charge air cooling serves to make the combustion air more dense which enables the engine to efficiently burn more fuel and therefore, increasing the horsepower output when combined with exhaust gas driven turbochargers. The turbochargers are mounted at the end of each exhaust manifold, and they pressurize and deliver combustion air to the engine. The exhaust manifolds are dry systems with heat shields and blankets in the V of motor while the turbochargers utilize wet exhaust housings for cooling.
The engine cooling system consists of a tube bundle type heat exchangers which are supplied seawater by an engine mounted, gear driven raw water pump. The fuel injection system is mechanically controlled, and fuel is delivered via high pressure through the injectors and into the combustion chamber.
Engine starting is accomplished through two 24-volt Delco MT 50 starters. This engine application is typical for full displacement yachts, trawlers, towboats, crew and supply boats. Cruise speed should be approximately 1000 RPM according to Caterpillar.

M/Y "ESCAPE OF LONDON"

MAIN ENGINE PERFORMANCE

A sea trial was performed, and the engines were slowly brought up to 900 RPM in order to allow pressures and temperatures to stabilize. All temperatures and pressures were within normal parameters for this engine application at that speed. The engines were next brought up to 1000 and then 1200 RPM, again all temperatures and pressures were within manufacturers' specifications. The engines were then brought up to maximum RPM of 1245 on the port and 1203 on the starboard with all other readings being normal. Maximum full load RPM should be 1200. The engines reached full load RPM. It is necessary to bring the engines to maximum RPM on occasion in order to check performance and to check for problems that otherwise may not be evident at lower engine speeds.

FUEL SYSTEM

Fuel is supplied to the engines from the tanks through dual Racor model 1000 primary filter assemblies that act as primary filters and water separators. The fuel is routed from the primary filters to the engine supply pump then through engine mounted cartridge type secondary fuel filters and on to the mechanically controlled unit injector nozzles. The Racor fuel filter assemblies were in good condition with an air leak noted in port Racor bowl.

COOLING SYSTEM

The engine cooling system consists of a tube bundle type heat exchanger mounted off engine under the deck plates. Seawater is supplied to the heat exchangers through a bronze impeller gear driven pump mounted at the front of the engine. The aftercoolers are cooled with engine jacket water. Periodic inspection of sea strainers, water pump seals, and heat exchangers is recommended. There were no leaks noted from the cooling system at this time. The coolant temperatures and pressures were within specification during the sea trial.

MARINE TRANSMISSION TWIN DISC MG 530M

The marine transmissions are manufactured in America. The housing is made of a light aluminum alloy, and the internal parts include an input shaft, output shaft, gears, and forward and reverse clutch packs. The gear is hydraulically operated and is a reduction and a reversing unit. The selector valve serves to direct oil flow to provide neutral, forward or reverse. The transmissions operated normally during sea trials and there was no slippage noted during operation. The transmissions are equipped with a dual cartridge filter assembly and a seawater cooled oil cooler, both of which should be removed and cleaned periodically. The transmissions are flange mounted to the engine bellhousings and set up in a conventional propulsion configuration with shaft brakes installed. The transmissions have a reduction ratio of 3.13:1A.

M/Y "ESCAPE OF LONDON"

EXHAUST SYSTEM

The vessel is equipped with a marine exhaust system that connects to each turbocharger with a flexible compensator and a single riser per engine. The hot sections of the risers are shielded with a soft fiberglass insulation wrap. The exhaust stream enters a muffler mounted above and behind the engines that are heat shielded with soft fiberglass insulation wrap and then on to a collector and spray ring for cooling. The exhaust bypass exits the hull at the port and starboard hull sides at the waterline with an automatic shutoff valve. This is designed to prevent back pressure. The exhaust system appears to be in fair condition with minor leaks at the flanges after the mixing elbows, however there was no disassembly for pressure testing of the water-cooled risers at this time.

MOUNTS

The engines are resiliently mounted on LO_REZ Vibration Isolator Spring mounts. There are six mounts per engine/transmission. The mounts are bolted directly to the stringers. The mounts appear to be in good condition as there was no movement due to faulty mounts noted during sea trials or maneuvering.

PREHEATERS

There are preheaters installed on the engines. They are coolant circulation heaters that are 240V hooked in circuit. The heaters could not be tested due to engines already being to operating temperature.

STARTER / ALTERNATOR

The engines are equipped with 24-volt starters and no alternators. The engines have two Delco MT 50 starters per engine. Both the starters are functioning properly at this time.

CONTROLS

The vessel is equipped with Mathers pneumatic controls. The controls feature single lever control for port and starboard. The vessel is equipped with three control stations, a helm station, port wing station and a starboard wing station and throttle/shift control in the engine room. The control stations also feature push buttons for start and stop of the engines. All three control stations and the emergency backup throttles are functioning properly at this time.

AIR FILTRATION

The combustion air is supplied to the engines through CAT 3500 series paper air filters mounted directly to the air inlet elbow of the turbocharger. This application utilizes engine room air supply. The filters were in good condition at time of survey.

M/Y "ESCAPE OF LONDON"

MANUFACTURERS' RECOMMENDATIONS

CAT recommends that the engines be serviced at 250-hour intervals changing engine oil, filters, primary and secondary fuel filters. In addition, a maintenance service that includes additional items should be performed at 1000-hour intervals. Please refer to CAT maintenance manual.

DISCREPANCIES MAIN ENGINES

PORT

1. Pyrometers gauge alarm setpoint is not accurate.
2. Racor filter has air leak in bowl.
3. Monitoring system is not functioning.
4. Oil leak around coolant pump on the back of timing cover.
5. #8 valve cover is leaking
6. Breather is leaking oil.
7. Raw water pump is leaking oil at the seal.
8. Stabilizer pump mounting gasket is leaking oil.
9. Shift air lines are seeping.
10. Block heater/preheater coolant hose is cracked.
11. Gear cooler oil lines are cracking.
12. Fuel lines at the Racor are cracking.

STARBOARD

1. Pyrometers gauge alarm setpoint is not accurate.
2. Monitoring system is not functioning.
3. Right bank turbo drain line gasket is leaking oil.
4. Block heater/preheater coolant hose is cracked.
5. Coolant pump oil leak on back side of timing cover
6. Engine vibration from shaft bearing noted at higher RPM.

GENERAL COMMENTS

The main engines and gears were found to be in fair condition at this time. An external visual inspection was performed, and the outward appearance of the main engines and marine gears are satisfactory. The sea trial data shows that the engines are performing within the manufacturer's specifications. Top end overhaul is recommended by CAT at 11,000 hours of operation.
A maintenance schedule is included with this report

M/Y "ESCAPE OF LONDON"

GENERATORS: NORTHERN LIGHTS

PORT	STARBOARD
Model: M6680T/HE/50L	Model: M6680T/HE/50L
Serial: 6682-14507	Serial: 6682-14508
Hours: 13,019	Hours: 12,628
KW: 50	KW: 50
KVA: 62.5	KVA: 62.5
Volts: 120/240	Volts: 120/240
Amp: 150	Amp: 150
RPM: 1800	RPM: 1800
Freq: 60 HZ.	Freq: 60 HZ.
Oil pr: 50 psi	Oil pr: 50 psi
Temp: 181F	Temp: 1910 F
Batt. V: 24	Batt. V: 24

GENERATORS

The generators are resiliently mounted to their frames and all mounts appear to be in good condition. The generators are equipped with single Racor 500 primary fuel filter assembles. The port and starboard generators performed well and carried the vessels' electronic load.

GENERATOR DISCREPANCIES

PORT

1. Oil leaks on oil pan bolts
2. Coolant hose at oil cooler is cracking.
3. Fuel filter supply lines are cracking and need replacement.
4. Corrosion at raw water pump seal.
5. Corrosion around heat exchanger end caps.
6. Exhaust hose has rusty clamps
7. Coolant hoses need replacement.
8. Breather hose fitting leaking at valve cover.

STARBOARD

1. Exhaust stack drain hose is leaking.
2. Engine front cover is leaking from bolt
3. Oil drips noted at oil filter.
4. Oil level gauge line is leaking at front cover.
5. Fuel filter lock ring is cross threaded.

M/Y "ESCAPE OF LONDON"

6. Boost hoses are seeping oil.
7. Fuel supply lines are cracking and need replacement.
8. Fuel return lines need replacement.

OIL SAMPLE RESULTS

Oil samples were drawn from the main engines, transmissions, and generators. The results indicate that the starboard generator has abnormal levels of potassium. All other tested equipment falls within the normal wear limits.

NOTE:

The comments as stated in this report are based on engine inspections that were performed to the best of our ability and with as much attention to detail as possible. The results are believed to be an accurate evaluation as to the general condition of the engines at this time.

However, Marine Diesel Specialists, Inc. offers no warranty either express or implied on the engines of **M/Y "ESCAPE OF LONDON"**. Survey results are intended to represent the physical condition of the vessel only on the day of the survey, based on the facts presented and discovered, in the opinion of the surveyor. This report will not specify or imply any type of warranty of the vessel or the vessel's machinery.

This report is issued subject to the condition that it is understood and agreed that neither this office, nor any surveyor or employee thereof is under any circumstances whatsoever to be held responsible in any way for any error in judgment, default or negligence, nor for any inaccuracy, omission, misrepresentation or misstatement in this report, and that the use of this report shall be construed to be an acceptance of the foregoing conditions. This report is issued without prejudice to the rights of whom it may concern.

Thank you for the opportunity to be of service and if you have any questions, please call.

Sincerely,

Peter Angel
President

Marine Diesel Specialists

Sea Trial Data Port

BOAT NAME**: Escape of London**
ENGINE TYPE: **CAT 3508 DITA**
ENGINE NR: **69Z00673**
OPERATING HOURS: **11,216**

GEARBOX TYPE: **Twin Disc**
GEARBOXNR: **3X3980**
LOAD CONDITION: **50%**
LOCATION: **West Palm**

NAME: **THOMAS**
DATE: **Jan 23, 2026**
WEATHER: **P/C**
SEAS: **2-3**

Engine Speed	R P M	800	900	1000	1200
Eng. Speed Actual	R P M	770	877	972	1245
Outside Air	Deg F°	83	83	83	83
Air Before Turbo	Deg F°	105	107	105	104
Charge Air Temp	Deg F°	165	169	169	171
S.W. Aft. Pump	Deg F°	82	86	85	83
F.W. Temp	Deg F°	190	200	205	209
Exhaust Temp L	Deg F°	700	810	875	899
Exhaust Temp R	Deg F°	700	815	875	920
Engine Oil Temp	Deg F°	200	203	205	209
Engine Oil Press	PSI	59	59	60	59
Fuel Press	PSI	58	58	60	60
Gear Oil Press	PSI	190	190	190	190
Gear Oil Temp	Deg F°	110	110	115	115

Marine Diesel Specialists

Sea Trial Data Stbd

BOAT NAME**: Escape of London**
ENGINE TYPE: **CAT 3508 DITA**
ENGINE NR: **69Z00672**
OPERATING HOURS: **11,271**

GEARBOX TYPE: **Twin Disc**
GEARBOXNR: **3X3979**
LOAD CONDITION: **50%**
LOCATION: **West Palm**

NAME: **THOMAS**
DATE: **Jan 23, 2026**
WEATHER: **P/C**
SEAS: **2-3**

Engine Speed	RPM	800	900	1000	1200
Eng. Speed Actual	RPM	772	877	971	1205
Outside Air	Deg F°	83	83	83	83
Air Before Turbo	Deg F°	107	108	108	107
Charge Air Temp	Deg F°	171	179	180	185
S.W. Aft. Pump	Deg F°	82	86	88	86
F.W. Temp	Deg F°	190	200	203	205
Exhaust Temp L	Deg F°	625	725	800	875
Exhaust Temp R	Deg F°				
Engine Oil Temp	Deg F°	195	203	203	205
Engine Oil Press	PSI	60	60	60	62
Fuel Press	PSI	58	58	60	60
Gear Oil Press	PSI	195	199	199	199
Gear Oil Temp	Deg F°	115	120	115	115

MARINE DIESEL SPECIALIST

Phone:

Email:

Fax: ___-___-____

Machine ID: ESCAPE OF LONDON

Machine Year : NA

Component Description:

Component ID: 668214507

Component Make: NORTHERN LIGHTS

Component Model: M6680T

Component Year: NA

Component Type : DIESEL ENGINE

Component Location: PORT GENERATOR

Sump Capacity: 4 Gallons

M✓C

MOTORCHECK LAB

2000 N FLORIDA MANGO RD UNIT 104
WEST PALM BEACH FL 33409
561-684-7799

Sample ID	Date Taken	Hours on Component	Hours on Oil	Oil Weight	Oil Brand	Oil Type	Oil Changed	Date Analyzed	User Sample ID
7539	1/26/2026	13019	100	15W40	UNKNOWN	UNKNOWN	No	1/26/2026	
Comments	ALL ENGINE WEAR RATES NORMAL. SAMPLE APPEARS FREE OF EXTERNAL CONTAMINATION. ANALYSIS INDICATES PROPER PERFORMANCE OF THE LUBRICANT AND UNIT.								

	Wear Metals(ppm)							*Contaminant Metals (ppm)*			*Multi-Source Metals (ppm)*					*Additives (ppm)*				
Sample ID	Iron	Chromium	Aluminum	Copper	Lead	Tin	Vanadium	Silicon	Sodium	Potassium	Titanium	Molybdenum	Nickel	Manganese	Boron	Magnesium	Calcium	Barium	Phosphorus	Zinc
7539	5	7	<2	5	<2	<2	X	5	12	13	X	14	X	X	X	X	X	X	X	X

	Contaminants				*Physical Properties*								
Sample ID	Fuel	Soot	Water	Glycol	Nitration	TBN	Oxidation	V40C	V100C	VIndex	V40C Limit	V100C Limit	Visc Mode
7539	-	0.1	<0.1	-	<2.0	10.6	4.1	109	14.4	134	92 - 124	12.5 - 16.3	C

ABNORMAL | SEVERE | D = DETECTED | - = NOT DETECTED | X = NOT TESTED / NOT APPLICABLE | NA = NOT AVAILABLE | C = CALCULATED | M = MEASURED

MARINE DIESEL SPECIALIST **Phone:** **Email:** **Fax:** ___-___-____	**Machine ID:** ESCAPE OF LONDON **Machine Year :** NA **Component Description:**	**Component ID:** 668214508 **Component Make:** NORTHERN LIGHTS **Component Model:** M6680 **Component Year:** NA **Component Type :** DIESEL ENGINE **Component Location:** STARBOARD GENERATOR **Sump Capacity:** 4 Gallons	M✓C **MOTORCHECK LAB** **2000 N FLORIDA MANGO RD UNIT 104** **WEST PALM BEACH FL 33409** **561-684-7799**

Sample ID	Date Taken	Hours on Component	Hours on Oil	Oil Weight	Oil Brand	Oil Type	Oil Changed	Date Analyzed	User Sample ID
7540	1/26/2026	12628	100	15W40	UNKNOWN	UNKNOWN	No	1/26/2026	
Comments	ALL ENGINE WEAR RATES NORMAL. POTASSIUM LEVEL HIGHER THAN TYPICAL CHECK FOR SOURCE OF COOLANT LEAK.								

	Wear Metals(ppm)							*Contaminant Metals (ppm)*			*Multi-Source Metals (ppm)*					*Additives (ppm)*				
Sample ID	Iron	Chromium	Aluminum	Copper	Lead	Tin	Vanadium	Silicon	Sodium	Potassium	Titanium	Molybdenum	Nickel	Manganese	Boron	Magnesium	Calcium	Barium	Phosphorus	Zinc
7540	14	<2	<2	<2	<2	<2	X	5	<2	34	X	20	X	X	X	X	X	X	X	X

	Contaminants				*Physical Properties*								
Sample ID	Fuel	Soot	Water	Glycol	Nitration	TBN	Oxidation	V40C	V100C	VIndex	V40C Limit	V100C Limit	Visc Mode
7540	-	0.5	<0.1	-	2.5	9.8	4.8	110	14.4	134	92 - 124	12.5 - 16.3	C

ABNORMAL | SEVERE | D = DETECTED | - = NOT DETECTED | X = NOT TESTED / NOT APPLICABLE | NA = NOT AVAILABLE | C = CALCULATED | M = MEASURED

MARINE DIESEL SPECIALIST **Phone:** **Email:** **Fax:** ___-___-____	**Machine ID:** ESCAPE OF LONDON **Machine Year :** NA **Component Description:**	**Component ID:** 69Z00673 **Component Make:** CATERPILLAR **Component Model:** 3508 **Component Year:** NA **Component Type :** DIESEL ENGINE **Component Location:** PORT MAIN **Sump Capacity:** 45 Gallons	M✓C **MOTORCHECK LAB** **2000 N FLORIDA MANGO RD UNIT 104** **WEST PALM BEACH FL 33409** **561-684-7799**

Sample ID	Date Taken	Hours on Component	Hours on Oil	Oil Weight	Oil Brand	Oil Type	Oil Changed	Date Analyzed	User Sample ID
7542	1/26/2026	11216	100	15W40	UNKNOWN	UNKNOWN	No	1/26/2026	
Comments	ALL ENGINE WEAR RATES NORMAL. SAMPLE APPEARS FREE OF EXTERNAL CONTAMINATION. ANALYSIS INDICATES PROPER PERFORMANCE OF THE LUBRICANT AND UNIT.								

	Wear Metals(ppm)							*Contaminant Metals (ppm)*			*Multi-Source Metals (ppm)*					*Additives (ppm)*				
Sample ID	Iron	Chromium	Aluminum	Copper	Lead	Tin	Vanadium	Silicon	Sodium	Potassium	Titanium	Molybdenum	Nickel	Manganese	Boron	Magnesium	Calcium	Barium	Phosphorus	Zinc
7542	<2	5	<2	<2	<2	<2	X	3	<2	<2	X	<2	X	X	X	X	X	X	X	X

	Contaminants				*Physical Properties*								
Sample ID	Fuel	Soot	Water	Glycol	Nitration	TBN	Oxidation	V40C	V100C	VIndex	V40C Limit	V100C Limit	Visc Mode
7542	-	0.4	<0.1	-	<2.0	10.7	<2.0	108	14.4	136	92 - 124	12.5 - 16.3	C

ABNORMAL | SEVERE | D = DETECTED | - = NOT DETECTED | X = NOT TESTED / NOT APPLICABLE | NA = NOT AVAILABLE | C = CALCULATED | M = MEASURED

MARINE DIESEL SPECIALIST **Phone:** **Email:** **Fax:** ___-___-____	**Machine ID:** ESCAPE OF LONDON **Machine Year :** NA **Component Description:**	**Component ID:** 69Z00672 **Component Make:** CATERPILLAR **Component Model:** 3508 **Component Year:** NA **Component Type :** DIESEL ENGINE **Component Location:** STARBOARD MAIN **Sump Capacity:** 45 Gallons	M✓C **MOTORCHECK LAB** **2000 N FLORIDA MANGO RD UNIT 104** **WEST PALM BEACH FL 33409** **561-684-7799**

Sample ID	Date Taken	Hours on Component	Hours on Oil	Oil Weight	Oil Brand	Oil Type	Oil Changed	Date Analyzed	User Sample ID
7543	1/26/2026	11271	100	15W40	UNKNOWN	UNKNOWN	No	1/26/2026	
Comments	ALL ENGINE WEAR RATES NORMAL. SAMPLE APPEARS FREE OF EXTERNAL CONTAMINATION. ANALYSIS INDICATES PROPER PERFORMANCE OF THE LUBRICANT AND UNIT.								

	Wear Metals(ppm)							*Contaminant Metals (ppm)*			*Multi-Source Metals (ppm)*					*Additives (ppm)*				
Sample ID	Iron	Chromium	Aluminum	Copper	Lead	Tin	Vanadium	Silicon	Sodium	Potassium	Titanium	Molybdenum	Nickel	Manganese	Boron	Magnesium	Calcium	Barium	Phosphorus	Zinc
7543	<2	4	<2	<2	<2	<2	X	5	<2	<2	X	3	X	X	X	X	X	X	X	X

	Contaminants				*Physical Properties*								
Sample ID	Fuel	Soot	Water	Glycol	Nitration	TBN	Oxidation	V40C	V100C	VIndex	V40C Limit	V100C Limit	Visc Mode
7543	-	0.3	<0.1	-	<2.0	10.8	2.4	109	14.4	135	92 - 124	12.5 - 16.3	C

ABNORMAL | SEVERE | D = DETECTED | - = NOT DETECTED | X = NOT TESTED / NOT APPLICABLE | NA = NOT AVAILABLE | C = CALCULATED | M = MEASURED

MARINE DIESEL SPECIALIST **Phone:** **Email:** **Fax:** ___-___-____	**Machine ID:** ESCAPE OF LONDON **Machine Year :** NA **Component Description:**	**Component ID:** 3X3980 **Component Make:** TWIN DISC GEAR **Component Model:** MG530M **Component Year:** NA **Component Type :** GEARBOX **Component Location:** PORT **Sump Capacity:** 20 Gallons	M✓C **MOTORCHECK LAB** **2000 N FLORIDA MANGO RD UNIT 104** **WEST PALM BEACH FL 33409** **561-684-7799**

Sample ID	Date Taken	Hours on Component	Hours on Oil	Oil Weight	Oil Brand	Oil Type	Oil Changed	Date Analyzed	User Sample ID
7544	1/26/2026	11216	100	SAE 40	UNKNOWN	UNKNOWN	No	1/26/2026	
Comments	GEAR UNIT WEAR RATES NORMAL. SAMPLE APPEARS FREE OF EXTERNAL CONTAMINATION. ANALYSIS INDICATES PROPER PERFORMANCE OF THE LUBRICANT AND UNIT.								

	Wear Metals(ppm)							*Contaminant Metals (ppm)*			*Multi-Source Metals (ppm)*					*Additives (ppm)*				
Sample ID	Iron	Chromium	Aluminum	Copper	Lead	Tin	Vanadium	Silicon	Sodium	Potassium	Titanium	Molybdenum	Nickel	Manganese	Boron	Magnesium	Calcium	Barium	Phosphorus	Zinc
7544	6	<2	<2	11	<2	<2	X	6	<2	<2	X	22	X	X	X	X	X	X	X	X

	Contaminants				*Physical Properties*								
Sample ID	Fuel	Soot	Water	Glycol	Nitration	TBN	Oxidation	V40C	V100C	VIndex	V40C Limit	V100C Limit	Visc Mode
7544	X	X	<0.1	X	X	X	<2.0	157	14.4	88	133 - 181	12.5 - 16.3	C

ABNORMAL | SEVERE | D = DETECTED | - = NOT DETECTED | X = NOT TESTED / NOT APPLICABLE | NA = NOT AVAILABLE | C = CALCULATED | M = MEASURED

MARINE DIESEL SPECIALIST **Phone:** **Email:** **Fax:** ___-___-____	**Machine ID:** ESCAPE OF LONDON **Machine Year :** NA **Component Description:**	**Component ID:** 3X3979 **Component Make:** TWIN DISC GEAR **Component Model:** MG530M **Component Year:** NA **Component Type :** GEARBOX **Component Location:** STARBOARD **Sump Capacity:** 20 Gallons	M✓C **MOTORCHECK LAB** **2000 N FLORIDA MANGO RD UNIT 104** **WEST PALM BEACH FL 33409** **561-684-7799**

Sample ID	Date Taken	Hours on Component	Hours on Oil	Oil Weight	Oil Brand	Oil Type	Oil Changed	Date Analyzed	User Sample ID
7545	1/26/2026	11271	100	SAE 30	UNKNOWN	UNKNOWN	No	1/26/2026	
Comments	GEAR UNIT WEAR RATES NORMAL. SAMPLE APPEARS FREE OF EXTERNAL CONTAMINATION. ANALYSIS INDICATES PROPER PERFORMANCE OF THE LUBRICANT AND UNIT.								

	Wear Metals(ppm)							*Contaminant Metals (ppm)*			*Multi-Source Metals (ppm)*					*Additives (ppm)*				
Sample ID	Iron	Chromium	Aluminum	Copper	Lead	Tin	Vanadium	Silicon	Sodium	Potassium	Titanium	Molybdenum	Nickel	Manganese	Boron	Magnesium	Calcium	Barium	Phosphorus	Zinc
7545	3	3	<2	15	<2	<2	X	5	<2	<2	X	28	X	X	X	X	X	X	X	X

	Contaminants				*Physical Properties*								
Sample ID	Fuel	Soot	Water	Glycol	Nitration	TBN	Oxidation	V40C	V100C	VIndex	V40C Limit	V100C Limit	Visc Mode
7545	X	X	<0.1	X	X	X	<2.0	101	10.9	91	86 - 116	9.3 - 12.5	C

ABNORMAL | SEVERE | D = DETECTED | - = NOT DETECTED | X = NOT TESTED / NOT APPLICABLE | NA = NOT AVAILABLE | C = CALCULATED | M = MEASURED

M✓C™ *UNDERSTANDING YOUR REPORT*

	ENGINES	TRANSMISSIONS
ALUMINUM:	PISTONS, BEARINGS, HOUSINGS, THRUST WASHERS, BUSHINGS	TORQUE CONVERTER, THE CASE, THRUST WASHERS, HOUSINGS, GEAR AND VANE PUMPS
CHROMIUM:	COMPRESSION RINGS, LOW FRICTION BEARINGS, LINERS, CHROMATE COOLING SYSTEM	BALL AND ROLLER BEARINGS, ALLOY OF STEEL PARTS
COPPER:	BEARINGS, BUSHINGS, THRUST WASHERS, OIL COOLER, CLUTCHES, AND AN OIL ADDITIVE IN SOME GASOLINE ENGINE OILS.	CLUTCH PLATES, BRONZE BUSHINGS, OIL COOLER OXIDES, BRASS FITTINGS
IRON:	CRANKSHAFT, CYLINDERS, PISTONS, LINERS, BEARINGS, VALVE TRAIN	GEARS, BEARINGS, SHAFTS, SOME CASES, CLUTCH PLATES
LEAD:	BEARINGS, CONTAMINATION FROM LEADED GASOLINE	GEARS
TIN:	PISTON SKIRTS, BEARINGS, AND BUSHINGS.	SOME BEARING CAGES
SILICON:	AIRBORN DIRT, SEAL MATERIAL, GASKETS, USED IN SOME OIL ADDITIVES, SPRAY LUBRICANTS, WHEN FOUND WITH POTASSIUM INDICATES GLYCOL ISSUE	AIRBORN DIRT, SEALERS, GASKETS, USED IN SOME OIL ADDITIVES, SPRAY LUBRICANTS, WHEN FOUND WITH POTASSIUM INDICATES GLYCOL ISSUE, SAND-CASTED PARTS
POTASSIUM:	INDICATION OF GLYCOL OR SALTWATER INTRUSION, ADDITIVE IN SOME OILS	INDICATION OF GLYCOL OR SALTWATER INTRUSION, ADDITIVE IN SOME OILS
SODIUM:	FOUND IN SOME OIL ADDITIVES, GLYCOL, ENVIRONMENTAL COMTAMINANT OR SALT WATER	FOUND IN SOME OIL ADDITIVES, GLYCOL, ENVIRONMENTAL COMTAMINANT OR SALT WATER
WATER:	MEASURED IN % VOLUME, CAN BE INDICATION OF CONDENSATION, COOLING SYSTEM LEAK, OR OUTSIDE CONTAMINATION	
GLYCOL:	MEASURED IN % VOLUME, IN THE FORMULATION OF MOST COMMERCIAL COOLANTS	
OXIDATION:	THIS IS THE RESULTS OF OXYGEN IN THE AIR REACTING WITH THE OIL AT ELEVATED TEMPERATURES. THIS IS A NORMAL PROCESS AS THE OIL AGES. IF AN ENGINE IS OPERATED CONTINUOUSLY AT A HIGH TEMPERATURE FOR EXTENDED PERIODS, OR IF DRAIN INTERVAL IS OVER EXTENDED, OIL CHANGE IS RECOMMENDED.	
NITRATION:	FORMED DURING COMBUSTION PROCESS, LEADS TO ACCELERATED OIL DETERIORATION.	
SOOT:	NORMAL COMBUSTION BY PRODUCT OF DIESEL FUEL AND APPEARS AS CONTAMINANT IN THE OIL CAUSING AN INCREASE IN VISCOSITY. INDICATE AN INPROPER AIR/FUEL RATIO, DEFECTIVE AIR INTAKE, FAULTY INJECTORS, OR BLOW-BY	
VISCOSITY:	CALCULATED MEASUREMENT OF THE OIL'S ABILITY TO FLOW AND LUBRICATE, INDICATES IF OIL IS TOO THICK OR THIN	
TBN:	MEASUREMENT OF OIL'S ALKALINE BASE RESERVE, ADDITIVE IN OIL CAPABLE OF NEUTRALIZING ACIDIC CONTAMINANTS, WHEN TBN IS BELOW 3, IT IS AN INDICATION THE OIL IS NO LONGER SERVICEABLE	
FUEL DILUTION:	MEASURED IN % VOLUME, CAN INDICATE FAULTY COMBUSTION, RICH AIR/FUEL MIXTURE WHEN PRESENT BETWEEN 2%-5%. INJECTOR PROPBLEM OR INTERNAL FUEL LINE LEAK IS TYPICALLY INDICATED WHEN FUEL IS DETECTED AT HIGH LEVELS	

Terminology Used in Maintenance Schedules

Adjust – to conform and correspond to specifications.

Check – to observe for satisfactory conditions, accuracy, safety or performance.

Exchange – to trade a worn or failing component for a remanufactured or rebuilt component.

Inspect – to examine closely, in critical appraisal, while testing or evaluating components or systems.

Inspect/Rebuild or Exchange – to examine closely; then making the decision on repair option (Rebuild or Exchange).

Lubricate – to apply a lubricant (oil, grease, etc.) as specified for reducing friction, heat and wear between solid surfaces.

Protective Devices – indicators such as gauges, lights, emergency shutoffs, etc., that alert an operator that a potential problem may exist. Failure to respond to these indicators in a timely manner could result in serious engine damage.

Rebuild – to repair a worn or failing component with new parts, components and/or remanufactured components.

Replace – to install something new, remanufactured or rebuilt in place of an existing worn or failing component.

Service Hours (Electrical) – records the time (clock hours) the engine is actually running but does not reflect variations in speed, load, etc.

NOTE: The Maintenance Schedules are developed for calendar time, clock hours or fuel consumption. Service Hours are expressed in clock hours, not service meter units (unless the service meter is a clock hour device). Hours of operation include only the time that the engine is running. An electric clock device should be connected so it is OFF when the engine is not running. Caterpillar recommends that fuel consumption be used as the preferred method of establishing intervals rather than time or clock hours.

Maintenance Intervals

The Maintenance Schedule requires all previous interval maintenance items to be performed first. For instance, if the Every 250 Service Hour maintenance is being done, then the Daily maintenance items must be completed BEFORE performing the Every 250 Service Hour maintenance.

Engines may be equipped with various optional components and the Schedule may recommend maintenance for items not installed on your engine. Simply disregard reference to any unrelated items. If unsure of any item, consult your Caterpillar dealer.

Top End Interval

One interval for some engines is labeled **Top End** because it involves removal, inspection, and rework of the cylinder head components. This interval is dependent on load-sensitive items/total amount of fuel consumed.

Overhaul Interval

The last interval in each chart lists the components inspected, rebuilt, exchanged or replaced at overhaul. **Overhaul** is defined as the interval at which the major wear items in the engine should be replaced. The intervals represent maintenance of a non-failed engine. In other words, the engine is being rebuilt with certain new parts replacing worn parts such as piston rings, engine rod and main bearings, valves and valve seats., etc.

Incidental to the replacement of these relatively few parts is the complete inspection of all other parts that are visible during the overhaul of the engine. The disassembly required to do an overhaul means that disturbed seals and gaskets, etc., will be replaced, and the internal passages of the engine and block be cleaned.

- The Overhaul interval assumes that regular maintenance recommendations in the rest of the chart have been carefully followed.
- Some users may obtain significantly longer or shorter life than the chart recommends between overhauls, but if the recommended intervals are followed, Overhauls will occur BEFORE actual FAILURE, and the total COST of operation will be minimized.

Although most users will obtain more life between overhauls than the chart recommends, Caterpillar has determined that these limits are the best (least cost) for the vast majority of our engine users. Extend the intervals to overhaul ONLY if your experience shows strong evidence that the intervals are too short for your application and maintenance practices.

The most important criteria for Top End and Overhaul is Fuel Consumption. The service hours criteria is mainly for reference. To obtain a better estimate of Hours to overhaul, use the following formula:

Overhaul Interval (Hours) equals Total Fuel Consumption divided by *Actual Average Fuel Consumption per Hour.

*Use actual fuel records or estimate load factor. Actual will be less than the specification sheet, because an engine does not run at 100 percent load factor 100 percent of the time.

Maintenance Options

Rebuild with New Parts – Genuine Caterpillar parts are constantly tested and modified to incorporate the latest design advancements. Your Caterpillar dealer can rebuild or provide the parts needed for overhauling your engine. Your benefit; long lasting replacement parts at competitive prices.

New Components – Replace worn or failing components with new components.

Repair Kits – These useful kits can be obtained from your Caterpillar dealer. These kits include all the necessary parts and instructions to repair the components, in either the owner's maintenance shop or at a Caterpillar servicing dealer's facility. Repair kits simplify parts ordering, help speed repairs and reduce parts cost.

Exchange – This cost-cutting service permits you to exchange worn engine components for quality Caterpillar Remanufactured or Caterpillar dealer rebuilt components on an over-the-counter basis. When you need them, these parts are ready for a substantial savings in both time and money.

NOTE: If there is a component you need, contact your Caterpillar dealer to see if it is offered under his Dealer Exchange Component Program.

Caterpillar Factory Remanufactured Components – The latest remanufacturing techniques and procedures are used to restore components to Caterpillar's original functional specifications. Usually Caterpillar Remanufactured Components have a warranty identical to that of a new part. Remanufactured parts may not be available in your area. If there is a component you need, contact your Caterpillar dealer to see if it is offered under his Dealer Exchange Component Program. Contact your Caterpillar dealer for information.

To minimize downtime, Caterpillar recommends that the use of Remanufactured components (subject to availability) is the most cost effective option. Before deciding which method is best, make sure all of the options and costs associated with repair have been considered. Some considerations are:

- The costs associated with using separate parts from inventory versus the cost of a repair kit.
- Downtime costs while the product is being rebuilt or repaired.
- Total parts and labor costs for repairs versus the actual Remanufactured cost.
- Remanufactured components from Caterpillar (if available) are covered by a standard, factory warranty.

The following is a list of (R) Remanufactured components currently being offered by Caterpillar* in many countries:

- Cylinder head – bare
- Cylinder head – assembly and group
- Crankshaft – undersized
- Crankshaft – upgrade to new
- Complete turbocharger
- Turbocharger cartridges
- Water pumps
- Oil pump
- Connecting rods
- Air Compressor
- Alternator
- Electric starting motor

NOTE: If the component you need is not listed here, contact your Caterpillar dealer to see if it is offered under a dealer exchange component program (* X).

* The current parts book will asterisk a part number when a (R) Remanufactured unit is offered by Caterpillar.

3500 Marine Engine Maintenance Schedule

Use quantity of fuel used, service hours, or time interval, whichever occurs first. Refer to the Terminology topic in the Information Section of this manual for information relating to Top End and Overhaul.

Daily

Every 50 Service Hours*

Every 250 Service Hours*

Every 1000 Service Hours*

Every 2000 Service Hours*

Every 3000 Service Hours or Two Years*

Every 4000 Service Hours*

Every 6000 Service Hours*

Top End

To minimize downtime and provide you with the lowest cost and highest value, Caterpillar recommends that the engine be overhauled before failure by scheduling an overhaul with your Caterpillar dealer. Refer to the Top End Overhaul section in this manual on page 125

Cylinder Heads – Inspect 126
Injectors – Test 127

Overhaul

To minimize downtime and provide you with the lowest cost and highest value, Caterpillar recommends that the engine be overhauled before failure by scheduling an overhaul with your Caterpillar dealer. Refer to the Overhaul section in this manual on page 128

Cylinder Heads, Connecting Rods, Cylinder Liners, Pistons, Turbochargers, Cam Followers, Fuel Transfer Pump, Prelube Pump, Injectors, Governor, Wrist Pins and Main Oil Pump – Inspect/Rebuild or Exchange if necessary
Piston Rings, Main Bearings, Rod Bearings, Valve Rotators and Crankshaft Seals – Install new
Crankshaft, Camshaft, Cam Bearings, Damper, Fuel System Linkage, Gear Train, Gear Train Bushings, Spacer Plates and Driven Unit Alignment – Inspect
Coolant Analysis – Obtain
Oil Cooler – Clean/Test 129
Aftercooler Core – Clean/Test 129

*First Perform Previous Service Hour Items

**For larger optional sump capacity of 224 liters (59 gallons), these items occur at 500 Service Hours. For larger optional sump capacity of 425 liters (112 gallons), these items occur at 1000 Service Hours.

Maintenance Schedule Intervals

3508 SERVICE HOURS/FUEL CONSUMPTION			
Service Hours	**Rated Up to 1300 rpm**	**Rated 1301 to 1600 rpm**	**Rated 1601 to 1800 rpm**
Every 50 Service Hours or	4,550 liter (1,200 U.S. gallon) of Fuel	5,450 liter (1,440 U.S. gallon) of Fuel	6,400 liter (1,650 U.S. gallon) of Fuel
Every 250 Service Hours or	22,700 liter (6,000 U.S. gallon) of Fuel	27,200 liter (7,200 U.S. gallon) of Fuel	32,000 liter (8,500 U.S. gallon) of Fuel
Every 1000 Service Hours or	89,000 liter (23,500 U.S. gallon) of Fuel	109,000 liter (28,800 U.S. gallon) of Fuel	128,500 liter (34,000 U.S. gallon) of Fuel
Every 2000 Service Hours or	178,000 liter (47,000 U.S. gallon) of Fuel	218,000 liter (57,600 U.S. gallon) of Fuel	257,000 liter (68,000 U.S. gallon) of Fuel
Every 3000 Service Hours or Two Years or	267,000 liter (70,500 U.S. gallon) of Fuel	327,500 liter (86,400 U.S. gallon) of Fuel	386,500 liter (102,000 U.S. gallon) of Fuel
Every 4000 Service Hours or	356,000 liter (94,000 U.S. gallon) of Fuel	436,000 liter (115,200 U.S. gallon) of Fuel	514,000 liter (136,000 U.S. gallon) of Fuel
Every 6000 Service Hours or	535,000 liter (141,000 U.S. gallon) of Fuel	654,000 liter (172,800 U.S. gallon) of Fuel	771,000 liter (204,000 U.S. gallon) of Fuel
Top End @ 976,000 liter (257,500 U.S. gallon) of Fuel or	Every 11,000 Service Hours	Every 9000 Service Hours	Every 7500 Service Hours
Overhaul @ 1,952,000 liter (515,000 U.S. gallon) of Fuel or	Every 22,000 Service Hours	Every 18,000 Service Hours	Every 15,000 Service Hours
3512 SERVICE HOURS/FUEL CONSUMPTION			
Service Hours	**Rated Up to 1300 rpm**	**Rated 1301 to 1600 rpm**	**Rated 1601 to 1800 rpm**
Every 50 Service Hours or	6,670 liter (1,760 U.S. gallon) of Fuel	8,200 liter (2,160 U.S. gallon) of Fuel	9,700 liter (2,560 U.S. gallon) of Fuel
Every 250 Service Hours or	33,400 liter (8,800 U.S. gallon) of Fuel	41,000 liter (10,800 U.S. gallon) of Fuel	48,500 liter (12,800 U.S. gallon) of Fuel
Every 1000 Service Hours or	133,500 liter (35,000 U.S. gallon) of Fuel	164,000 liter (43,200 U.S. gallon) of Fuel	194,000 liter (51,200 U.S. gallon) of Fuel
Every 2000 Service Hours or	267,000 liter (70,000 U.S. gallon) of Fuel	328,000 liter (86,400 U.S. gallon) of Fuel	388,000 liter (102,400 U.S. gallon) of Fuel
Every 3000 Service Hours or Every Two Years or	398,000 liter (105,000 U.S. gallon) of Fuel	491,000 liter (129,600 U.S. gallon) of Fuel	582,000 liter (153,600 U.S. gallon) of Fuel
Every 4000 Service Hours or	534,000 liter (140,000 U.S. gallon) of Fuel	654,000 liter (172,800 U.S. gallon) of Fuel	776,000 liter (204,800 U.S. gallon) of Fuel
Every 6000 Service Hours or	796,000 liter (210,000 U.S. gallon) of Fuel	982,000 liter (259,200 U.S. gallon) of Fuel	1,164,000 liter (307,200 U.S. gallon) of Fuel
Top End @ 1,460,000 liter (385,000 U.S. gallon) of Fuel or	Every 11,000 Service Hours	Every 9000 Service Hours	Every 7500 Service Hours
Overhaul @ 2,920,000 liter (770,000 U.S. gallon) of Fuel or	Every 22,000 Service Hours	Every 18,000 Service Hours	Every 15,000 Service Hours
3516 SERVICE HOURS/FUEL CONSUMPTION			
Service Hours	**Rated Up to 1300 rpm**	**Rated 1301 to 1600 rpm**	**Rated 1601 to 1800 rpm**
Every 50 Service Hours or	8,800 liter (2,300 U.S. gallon) of Fuel	10,600 liter (2,800 U.S. gallon) of Fuel	12,900 liter (3,400 U.S. gallon) of Fuel
Every 250 Service Hours or	44,000 liter (11,600 U.S. gallon) of Fuel	53,000 liter (14,000 U.S. gallon) of Fuel	64,500 liter (17,000 U.S. gallon) of Fuel
Every 1000 Service Hours or	176,000 liter (46,500 U.S. gallon) of Fuel	212,000 liter (56,000 U.S. gallon) of Fuel	258,000 liter (68,000 U.S. gallon) of Fuel
Every 2000 Service Hours or	352,000 liter (93,000 U.S. gallon) of Fuel	424,000 liter (112,000 U.S. gallon) of Fuel	516,000 liter (136,000 U.S. gallon) of Fuel
Every 3000 Service Hours or Every Two Years or	528,700 liter (139,500 U.S. gallon) of Fuel	636,700 liter (68,000 U.S. gallon) of Fuel	773,000 liter (204,000 U.S. gallon) of Fuel
Every 4000 Service Hours or	704,000 liter (186,000 U.S. gallon) of Fuel	848,000 liter (168,000 U.S. gallon) of Fuel	1,032,000 liter (272,000 U.S. gallon) of Fuel
Every 6000 Service Hours or	1,056,000 liter (279,000 U.S. gallon) of Fuel	1,272,000 liter (336,000 U.S. gallon) of Fuel	1,548,000 liter (408,000 U.S. gallon) of Fuel
Top End @ 1,942,000 liter (512,500 U.S. gallon) of Fuel or	Every 11,000 Service Hours	Every 9000 Service Hours	Every 7500 Service Hours
Overhaul @ 3,884,000 liter (1,025,000 U.S. gallon) of Fuel or	Every 22,000 Service Hours	Every 18,000 Service Hours	Every 15,000 Service Hours