

STAFFORD DIESEL ENGINE CO.,INC.
MARINE ENGINE SURVEYORS
13294 Lakeside Ter.
Cooper City, FL 33330
(954) 252-0707 Fax (954) 252-9333

ENGINE SURVEY REPORT

TO: Your Private Yacht
612 Organ Trail
Aspen, CO 81611

REQUESTED BY: Mr. Craig Morris

FILE NUMBER: JS6686
VESSEL: "ALTITUDE ADJUSTMENT"

DATE: March 7, 2019
HULL NUMBER: BWD00553H506

ENGINE SPECIFICATIONS:

Engine Manufacturer
Engine Model
Engine Serial No.
Engine Hours
Transmission Manufacturer
Transmission Model
Transmission Serial No.

PORT

Caterpillar
C30
CLX00660
5063 Posted
Z.F.
2050
50013219

STARBOARD

Caterpillar
C30
CLX00659
5055 Posted
Z.F.
2050
50013218

TRIAL RUN DATA:

Engine RPM'S
Engine Water Temp.
Engine Oil Temp.
Drive Oil Temp.
Engine Oil Pressure
Drive Oil Pressure
Fuel Pressure
Crankcase Pressure
Turbo Boost

2317 RPM'S
189 Degrees
208 Degrees
138 Degrees
54 PSI
246 PSI
56 PSI
555 CFPH
33 PSI

2318 RPM'S
187 Degrees
205 Degrees
106 Degrees
52 PSI
253 PSI
55 PSI
575 CFPH
31 PSI

COOLING SYSTEMS:

Fresh Water System
Caps
Pump
Hoses
Hose Clamps
Heat Exchanger
Raw Water System
Pump
Zincs
Hoses
Hose Clamps

Clean
Held pressure
No leaks
Serviceable
Serviceable
See note
Operational
No leaks
Deteriorating
Serviceable
Serviceable

Clean
Held pressure
No leaks
Serviceable
Serviceable
No leaks
Operational
No leaks
Deteriorating
Serviceable
Serviceable

ELECTRICAL:

Electronic Monitoring Unit
Computerized Monitoring System
Engine Monitoring System
Electronic Control Modulator
Alarms-Ignition Test
Alternator Output

Serviceable
Serviceable
Operational
Operational
Operational
Normal

Serviceable
Serviceable
Operational
Operational
Operational
Normal

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FILTERS:

	PORT	STARBOARD
Engine Oil Filters	<u>Serviceable</u>	<u>Serviceable</u>
Primary Fuel Filters	<u>Serviceable</u>	<u>Serviceable</u>
Secondary Fuel Filters	<u>Serviceable</u>	<u>Serviceable</u>
Transmission Oil Filter	<u>Serviceable</u>	<u>Serviceable</u>

OIL/FUEL LINES:

Turbo Oil Lines	<u>Serviceable</u>	<u>Serviceable</u>
Engine Oil Lines	<u>Serviceable</u>	<u>Serviceable</u>
Engine Fuel Lines	<u>Serviceable</u>	<u>Serviceable</u>
Transmission Oil Lines	<u>Serviceable</u>	<u>Serviceable</u>

AIR SYSTEM:

Turbos	<u>Operational</u>	<u>Operational</u>
Airseps	<u>Serviceable</u>	<u>Serviceable</u>
Air Filters	<u>Clean</u>	<u>Clean</u>
Aftercoolers	<u>Check Core</u>	<u>Check Core</u>

EXHAUST SYSTEM:

Hoses	<u>Serviceable</u>	<u>Serviceable</u>
Risers	<u>Monitor</u>	<u>Monitor</u>
Elbows	<u>Serviceable</u>	<u>Serviceable</u>
Mufflers	<u>Serviceable</u>	<u>Serviceable</u>
Manifolds	<u>Serviceable</u>	<u>Serviceable</u>
Crossover	<u>Exhaust leaks</u>	<u>Exhaust leaks</u>
Turbo Sweep	<u>Serviceable</u>	<u>Serviceable</u>
Hose Clamps	<u>See note</u>	<u>Serviceable</u>

MISCELLANEOUS:

Engine Mounts	<u>Firm</u>	<u>Firm</u>
Engine Paint	<u>Serviceable</u>	<u>Serviceable</u>
Vibration Dampener	<u>Serviceable</u>	<u>Serviceable</u>
Engine Oil Level	<u>Full</u>	<u>Full</u>
Engine Oil Condition	<u>See oil sample</u>	<u>See oil sample</u>
Transmission Oil Level	<u>Full</u>	<u>Full</u>
Transmission Oil Condition	<u>See oil sample</u>	<u>See oil sample</u>
Generator Oil Level	<u>Full</u>	<u>Full</u>
Generator Oil Condition	<u>See oil sample</u>	<u>See oil sample</u>

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This is to certify that the undersigned diesel engine surveyor did, at the request of, Mr. Craig Morris perform an engine and generator survey to the above captioned vessel while afloat and during the sea trial on March 7, 2019. Survey performed in order to ascertain the general condition for pre-purchase consideration.

All observations and conditions contained in this Diesel Evaluation were derived from "external inspections", no internal inspections were ordered or performed but are recommended. The findings are the results of facts and conditions presented before and during the trial run, with no guarantees or warranties specified or implied by Stafford Diesel, Inc., any employee, surveyor, representative or agent of the corporation.

ENGINE TYPE:

The main engines are Caterpillar C30 high performance diesels, which are, V-12 cylinder four stroke turbocharged aftercooled electronic controlled diesels with fresh waster cooling.

TRANSMISSION TYPE:

The transmissions are Z.F. 2050 gears with 2.032:1 ratios.

EXHAUST SYSTEMS:

The exhaust risers are manufactured of stainless steel. The exhaust elbows are manufactured of stainless steel. The exhaust mufflers are manufactured of fiberglass. Normal life (safe) expectancy for risers is five to seven years. This life expectancy would be subject to the operating conditions to which the vessel was subjected. The only positive means of attesting to the internal condition of the risers is to have them removed and pressure tested. Exhaust soot was noted coming from under the exhaust blankets port and starboard sides.

The exhaust hoses were inspected and appear to be in serviceable condition.

The exhaust hose clamps were inspected and appear to be in serviceable condition. A few of the clamps were not installed properly.

The exhaust risers were inspected externally and appear to be in serviceable condition.

The exhaust manifolds were inspected and appear to be in serviceable condition.

The exhaust elbows were inspected and appear to be in serviceable condition.

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FUEL SYSTEMS:

The fuel systems consist of Racor 1000 water/fuel separators, primary filters and spin-on secondary filters. A sample of the fuel showed the fuel to contain some bacteria and sediment. The fuel lines were inspected and appear to be in serviceable condition.

AIR INTAKE SYSTEM:

The air filters were inspected and found to be in serviceable condition.

FRESH WATER SYSTEMS:

The fresh water systems were pressure checked with a Stant Pressure Tester at operational pressure.

The port system showed coolant leak bottom side of the heat exchanger. The starboard system showed no leaks. The fresh water caps held pressure port and starboard. The fresh water pumps showed no leakage during pressure testing port or starboard. The fresh water hoses appear to be in serviceable condition. The fresh water hose clamps appear to be in serviceable condition. The systems were clean and had antifreeze protection. Port coolant level alarm was active during the trial run.

RAW WATER SYSTEMS:

The raw water systems were visually inspected before and during the trial run. The heat exchangers were inspected, coolant leakage was noted port bottom side. Starboard showed no leakage. The raw water pumps showed no leakage during the trial run. The raw water hoses were inspected and a few were found to be in deteriorating condition and have chafe damage. The raw water hose clamps were inspected and appear to be in serviceable condition.

ALARM SYSTEMS IGNITION TEST:

The engine alarm systems were tested and found to be operational. Engine overheat and/or low oil pressure testing of the alarm systems cannot be performed.

HOOR METERS:

Hour meters were found to be operational during the trial run. Note:, hours posted cannot be guaranteed accurate by the undersigned engine surveyor. Internal inspection would be needed to confirm hours posted. No internal inspections were ordered or performed.

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AFTERCOOLERS:

Aftercooler cores could not be visually inspected. Note:, aftercooler cores should be replaced every six years according to factory specifications. No documentation was provided to prove cores were replaced. Renew the cores if proof of replacement is not provided.

TURBOS:

The turbos were inspected intake sides and appear to be in serviceable condition. Note:, exhaust sides of the turbos cannot be inspected. Exhaust pipes would need to be removed.

TURBO OIL LINES:

The turbo oil lines were inspected and appear to be in serviceable condition.

ENGINE OIL LINES:

The engine oil lines were inspected and appear to be in serviceable condition.

ENGINE/TRANSMISSION MOUNTS:

The engine-transmission mounts were visually inspected and found to be firm. The mounts were inspected under sea trial conditions by shifting from forward to reverse, while watching the mounts for movement (Back Down Test).

ENGINE/TRANSMISSION ALIGNMENT:

During the trial run, some engine/transmission movement and vibration was noted. Some amount of movement and vibration is considered normal.

TRANSMISSIONS:

The gear sumps were probed via magnet and found to have a slight trace of metal. A small trace of metal is considered normal. The transmission oil lines were inspected and appear to be in serviceable condition. Raw water leakage was noted at the oil cooler end caps.

OIL ANALYSIS:

Oil sample results will follow in a few days. Note:, the accurate interpretation of the chemical analysis of crankcase oil and/or transmission oil is generally possible only when samples have been taken and analyzed periodically. Only in that way can benchmarks and a usable pattern be established. Without that history, someone is just guessing as to the real significance of various oil contaminant levels. It is also important to understand that oil analysis will not predict a sudden, catastrophic failure-for example, the fracturing of a connecting rod. The reason is this type of failure is not usually the result of ongoing wear.

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TRIAL RUN DATA:

Engine and transmission RPM'S were measured at full throttle with the use of a Caterpillar program and laptop computer. The port engine turned 2317 RPM'S, while the starboard engine turned 2318 RPM'S. The port transmission showed no slippage. The starboard transmission showed no slippage.

The following conditions were found during the trial run, using state of the art test equipment (readings were taken at full throttle sustained).

The port engine fresh water temperature was 189 degrees and starboard was 187 degrees. The port engine oil pressure was 54 PSI and starboard was 52 PSI. The port transmission oil pressure was 246 PSI and the starboard was 253 PSI. Engine fresh water temperatures, engine oil pressures and transmission oil pressures were found to be normal during the trial run.

The exhaust was clear with no sign of irregular oil consumption or fuel distribution. Some amount of smoke was noted during the cold start-up, which is normal.

The exhaust stack temperatures were uniformed port and starboard, showing a good balance between compression and fuel distribution.

The port engine oil sump temperature was 208 degrees and starboard was 205 degrees, which is normal.

The port engine transmission oil temperature was 138 degrees and starboard was 106 degrees, which is normal.

ENGINE INTERNAL INSPECTIONS:

No internal inspections were ordered or performed but are recommended. Condition of the internal parts (rods, liners, pistons, crankshaft and etc.) is unknown. Caterpillar engines cannot be internally inspected without dismantling the engines (injectors, cylinder heads, oil pan and etc...) If internal inspection of the engines is requested, it will be conducted at a later date at an agreed upon rate at which time an addendum to this report will be issued.

CYLINDER COMPRESSION TEST:

To best determine cylinder condition, (rings and liners) a cylinder compression test would have to be performed. Cylinder compression test are recommended but performed only if requested. This test is not included in this survey and cost extra.

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BLOW BY TEST:

A crankcase blow by test was performed using a Caterpillar Computerized Blow By Indicator. Port engine showed 555 CFPH and the starboard engine showed 575 CFPH. This test shows cylinder pressures are most likely but not definitely being controlled by the pistons, rings and cylinder liners at this time. Internal inspections is the only definitive way to determine cylinder condition.

MAINTENANCE INTERVAL SCHEDULE:

Caterpillar provides, with each type engine, a "Maintenance Interval Schedule", which can be found in the "Operation and Maintenance Manual". Proper operation and maintenance are key factors in obtaining the maximum life and economy of the engines. If the directions in the Operation and Maintenance Manual are followed, cost can be minimized and engine life can be maximized. **Note:, No proof was provided showing time since last factory recommended engine maintenance. If no documentation is provided to prove maintenance was performed, then it is imperative to perform all factory recommended service at this time for engine hours posted and age of the engines.**

The diesel evaluation results were derived via non disassembly type testing procedures. No internal inspections were ordered or performed but are recommended. Marine engines are subjected to a corrosive environment, which makes forecasting engine life difficult (especially inactive machinery). Diesel engines require frequent maintenance to maintain full RPM potential and safe operation. Continuous operation should not exceed 80%, while full throttle should be avoided to obtain maximum life and minimize fuel consumption. Operation at continuous full throttle will shorten engine life. Remaining engine life is unknown. Speculation of remaining engine life is not warranted. Internal inspections would be needed to estimate remaining engine life and to determine if internal defects are present.

Remarks and recommendations pertaining to the port and starboard engines and transmissions are repairs which require attention, due to their immediate effect on safe and proper operation. Reinspection of repairs by STAFFORD DIESEL, INC. and/or a qualified diesel mechanic should be conducted.

This report is issued to the condition that it is understood and agreed that neither this office nor any surveyor or any employee is under any circumstances whatsoever to be held responsible in any way for any error in judgement, default or negligence nor for any inaccuracy, omission or misrepresentation in this report, and that the use of this report shall be construed to be an acceptance of the foregoing conditions.

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PORT REMARKS AND RECOMMENDATIONS:

1. Aftercooler core should be replaced every six years according to factory specifications. No documentation was provided to prove core was replaced. Renew the core if proof of replacement is not provided.
2. Several above average engine oil leaks were noted (oil pan, rocker housings, valve covers and etc.). Service the above average engine oil leaks as needed.
3. A few of the raw water hoses were found to be in deteriorating condition and some chafe damage has occurred. Renew the hoses as needed, install chafe guard where needed.
4. One of the exhaust hose clamps was not installed properly. Service the clamp as needed.
5. The factory recommended cylinder head service is due at this time. Perform cylinder head valve job as good preventive maintenance.
6. Coolant leakage was noted bottom inboard side at the heat exchanger cooling plate seals. Renew the heat exchanger cooling plate seals.
7. The low coolant alarm was active during the trial run (coolant level was found to be normal). Service the alarm as needed.
8. Exhaust soot was noted coming from under the exhaust flange heat shield. Remove the heat shield, determine origin of exhaust leak(s) and service as needed.
9. Corrosion showing signs of raw water leakage was noted at the transmission oil cooler end caps. Renew the end cap seals.
10. Raw water leakage was noted at the exhaust muffler to thru-hull exhaust pipe seal. Renew the seal.

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STARBOARD REMARKS AND RECOMMENDATIONS:

1. Aftercooler core should be replaced every six years according to factory specifications. No documentation was provided to prove core was replaced. Renew the core if proof of replacement is not provided.
2. Several above average engine oil leaks were noted (oil pan, rocker housings, valve covers, rear main crankshaft oil seal and etc.). Service the above average engine oil leaks as needed.
3. A few of the raw water hoses were found to be in deteriorating condition and some chafe damage has occurred. Renew the hoses as needed, install chafe guard where needed.
4. One of the exhaust hose clamps was not installed properly. Service the clamp as needed.
5. The factory recommended cylinder head service is due at this time. Perform cylinder head valve job as good preventive maintenance.
6. Exhaust soot was noted coming from under the exhaust heat shield near the A-Bank turbo. Remove the heat shield, determine origin of exhaust leak(s) and service as needed.
7. Corrosion showing signs of raw water leakage was noted at the transmission oil cooler end caps. Renew the end cap seals.
8. Raw water leakage was noted at the exhaust muffler to thru-hull exhaust pipe seal. Renew the seal.
9. A-Bank exhaust manifold forward cooling pipe support bracket bolt was found to be loose. Service the bolt as needed.

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PORT GENERATOR:

MODEL:40.0BED
SERIAL:1021097
HOURS:7587 Posted

The Westerbeke generator is a fresh water unit. The fresh water system was tested using a Stant pressure tester at operational pressure. The system showed no leaks. The fresh water cap held normal pressure. The system was clean and had antifreeze protection. Water temperature was tested and found to be normal. Engine oil pressure was tested and found to be normal. The fuel system is protected by a water/fuel separator and spin on secondary fuel filter. The generator was run under full load during the trial run, maintaining good voltage and phase. The exhaust showed little sign of oil or improper fuel atomization. Service to the following recommendations should be performed.

1. Minor corrosion at the unit was noted.
2. Due to the hours posted, factory recommended cylinder head valve job should be performed at this time.
3. Exhaust hose chafe damage was noted at the PTO mount.
4. A few above average engine oil leaks were noted.

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STARBOARD GENERATOR:

MODEL:40.0BED
SERIAL:Not Observed
HOURS:8819 Posted

The Westerbeke generator is a fresh water unit. The fresh water system was tested using a Stant pressure tester at operational pressure. Coolant leak was noted at the thermostat coolant hose. The system showed no leaks. The fresh water cap held normal pressure. The system was clean and had antifreeze protection. Water temperature was tested and found to be normal. Engine oil pressure was tested and found to be normal. The fuel system is protected by a water/fuel separator and spin on secondary fuel filter. The generator was run under full load during the trial run, maintaining good voltage and phase. The exhaust showed little sign of oil or improper fuel atomization. Service to the following recommendations should be performed.

1. Minor corrosion at the unit was noted.
2. Due to the hours posted, factory recommended cylinder head valve job should be performed at this time.
3. Coolant leak was noted at the thermostat housing hose.
4. Intermittent raw water leakage was noted at the raw water pump.

Signed without prejudice,

Joe Stafford, Sr.

JOE STAFFORD, Sr. for the corporation.