European Marine Surveys

Marine & Yacht Surveyors & Marine Consultants

Motor Cruiser Pre- Purchase Survey

Notes: Engineering Inspections

Engine(s) visual only inspections are carried out on yachts and power boats

As surveyors (not technical engineers) we visually inspect engines and generator installations during our inspections, and where possible the engine is run up to access its general running characteristics, vibration levels, etc – see list. No dismantling of the engine or associated equipment is carried out within the scope of a condition survey so no detailed comment upon the internal parts is possible.

As we are unable to comment on the internal condition of the engine(s). It is therefore always strongly recommended that the engines(s) are examined and further tested by a competent marine engineer familiar with the make and type of machinery installed.

We will comment upon the following significant areas and observations…….

- Engine maintenance
- Exhaust system maintenance
- Fuel system maintenance
- Air system maintenance
- Cooling system maintenance
- As applicable: Smoke
  Misfiring
  Temperature / Overheating

On larger power vessels the engine represents a large part of the vessels value and is fundamental to safety. The above visual examinations will be carried out where possible but we will probably recommend a full sea trial to put the engine through its paces.

On larger engines, oil analysis * may be a worth while investment as it can tell a trained marine engineer a lot about the engines internal condition. At approximately £ 100 per engine (subject to confirmation), it represents very good value compared with the cost of rectifying damaged engines

We will if requested recommend qualified marine engineers to undertake a more in depth engineering report

- A static (visual inspection) is part in the pre-purchase survey, static / underway sea trials would carry an additional hourly charge.

** See below for further information covering Lubricating Oil Analysis*

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Lubricating Oil Analysis

Good lubrication, that is, the prevention of metal to metal contact, is an essential part of the modern high performance combustion engine. Preventing excessive wear and aiding in cooling, the lubricating oil within an engine should be considered as one of its most important components. Unfortunately, as with most precision parts, there are many factors which can effect smooth operation and lead to degraded performance and a shorter working life, both for the oil itself and for other major parts, leading to greater running expenses and maintenance costs.

There is therefore great benefit in a method of investigating the internal state of a main engine, gearbox or hydraulic system which obviates the necessity of physically opening the system and removing components for inspection. Lubricating oil analysis can provide this benefit. This procedure involves an analysis of the various properties of a sample of lubricating oil with testing for water, fuel and other impurities. The analysis involves the following tests:

VISCOSITY

This is a measurement of the thickness of the oil or its 'resistance to flow'. By maintaining the oil at its correct viscosity level, friction and wear are prevented whilst avoiding overheating or drag in the machinery.

FLASHPOINT

Changes in the flash point or ignition temperature of the oil can indicate dilution by another fluid, usually fuel, and may indicate potentially serious internal leakages.

WATER

The presence of water within the lubricating oil can be indicative of component failure or wear and can lead to serious failure if not checked.

TBN (Total Base Number)

The TBN indicates the alkalinity of the oil and its ability to neutralise acidic compounds (usually the products of combustion).

INSOLUBLES

These insoluble particles (e.g. carbon) are usually products of combustion and can be indicative of engine wear and combustion efficiency.

ACIDITY

A test of how much oil has deteriorated in service due to the detection of the weak organic acids which form over time as the oil oxidises. More commonly used for units which do not have combustion products, such as hydraulics, turbines, compressors and gearboxes.

INITIAL PH

Linked to the TBN and/or acidity it is a measure of the acidity or alkali concentration of the oil.

SPECTROGRAPHIC ANALYSIS

The accurate measure of elements which are virtually soluble in oil. This can determine if there has been oil contamination, or when monitoring for trends, can indicate component wear by identifying the metals involved and the most likely source of origin.

Common elements which may be identified by sampling and the possible sources of their contamination from within the machinery.

Aluminium -pistons, bearings, gears, housings and fuel
Carbon - fuel and cylinder liners
Chromium - piston rings, hydraulic actuator cylinders and piston rods
Copper - bearings and oil coolers
Iron - cylinders, piston rings, rotating shafts and gears
Lead - bearings
Manganese - cylinders
Molybdenum - piston rings
Nickel - bearings, valves, gear plating and fuel
Silicon - dirt, fuel and oil additive
Silver - bearings
Sodium - Salt water, antifreeze additive and fuel
Tin - bearings
Vanadium – Fuel

In assessing engine condition for a survey from a single oil sample, it is the spectrographic test that will reveal the most information. Many of the other tests are only of interest when sampling is done regularly and trends plotted from the results.

NB: Testing of the oil is not done where the oil to be sampled has recently been changed. The date of the last change of oil and filters should be ascertained before requesting an analysis.

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Notes: Diesel Engine Smoke

Diesel engine exhausts should be clear with the possible exceptions of:

> Sudden acceleration or extra loading. The engine may give off a little black smoke for a second or two until it settles down.
>
> Idling or running under low loads. The fuel pump may have problems metering out the minute quantities of fuel needed, resulting in an uneven idle and a little smoke. *Diesels should not be idled or run at low loads for prolonged periods, as they tend to carbon up.* If the engine must be used for battery charging, calorifier heating at anchor or dockside, buy a high-output alternator to keep the time to a minimum and, if possible, switch in other loads (e.g. refrigeration) or put the engine in gear. Give the engine some work to do.

Generally, any other smoke is a sure sign of problems. The colour of the smoke is a useful guide to the source of the trouble.

Black Smoke

Black smoke results from inadequate combustion of the injected diesel. This can arise from a restricted air flow through the engine. (plugged air filter, defective turbocharger, or blocked exhaust);too much fuel injected (generally due to overloading-the governor responds by opening up the fuel rack and pumping in more fuel). Or improper fuel injection (an injector fails to atomise the fuel correctly, dribbles fuel into a cylinder after the main injection pulse, or injects to late).

Check the air filter first. If the engine has a turbocharger, check all the ducting for air tightness. Remove an inspection cover and check the compressor assembly for carbon build up. If you find build up, clean the assembly, making sure it spins freely with no binding. Open up the exhaust line for any kinks or other restrictions.

If the air flow is deemed adequate, what about overloading? Is a line wrapped around the propeller? Are you powering hard into a head wind. Has any extra load been placed on the engine recently, such as belt driven auxiliaries equipment, a high output alternator, or a new propeller?

In the case of faulty fuel injection, remove the defective injectors and send them in for servicing. *Make no attempt to work on the injectors yourself.*

Blue Smoke.

Blue smoke comes from burning oil. There are only a few paths by which oil can find its way into the combustion chambers-up past the piston rings; down valve stems; through defective turbocharger seals; and out of crankcase ventilators, where there is high crank case pressure as a result of defective piston rings.

White Smoke

White smoke is indicative of one or more cylinders misfiring, water or air in the fuel, or water in the cylinders (most likely from a blown head gasket or cracked cylinder head). If the smoke occurs on start up and at light loads but clears when the engine warms, it maybe due to condensation or water vapour formed in combustion and is acceptable, but then again one or more cylinders also may have a compression problem and be failing to reach ignition temperatures until the engine warms up. If the smoke develops during normal operating, generally accompanied by erratic misfiring, the engine is running out of diesel or has water in the fuel.