

Preventing Engine Room Fires with an Oil Mist Detector

By Capt. Richard Kniffin

Fire!! This is probably the most dreaded word to hear aboard any vessel. Fires are deadly and destructive, can be difficult to put out, and could ultimately cause the loss of the vessel and/or loss of life. Even when extinguished, depending on the severity and longevity of the fire, much effort and expense will be spent in repair and cleanup, not to mention the vessel being out of service for some amount of time. Fires become exponentially more costly for every second they burn.

All crew members, especially deck and engineering officers, will spend much time and effort undergoing firefighting training multiple times during their careers and will participate in numerous fire drills on each vessel they serve on. Special training will be devoted to engine room fires since it is the place that most vessel fires originate. Emphasis will also be placed on fire prevention including good housekeeping practices and the removal of any one element of the fire triangle (fuel, heat and oxygen) that will cause a fire to go out or not start in the first place.

All yachts and ships built today are designed with fire prevention in mind and include fire bulkheads, non-flammable materials and will have systems and equipment to detect fires and extinguish them. There are many fire items aboard such as smoke detectors, heat detectors, fire suppression systems, fire extinguishers throughout the vessel, fire fighting clothing, gear and tools, fire pumps and plumbing, etc. There are fire safety plans, international rules and a host of measures designed to prevent fires, and if prevention is not successful, to extinguish fires.

Vessel fires, however, still occur on a regular basis. In fact, 2016 was a record year for large yacht fires, beginning with the destruction of the superyachts M/Y The One and M/Y Barbie in Marmaris, Turkey during the beginning days of January. It is obvious that, no matter how hard we try to deal with the prevention of vessel fires, they still occur.

Oil Mist Fires

A very important area of fire origination in engine rooms is oil mist. The International Maritime Organization (IMO) recognizes the extreme danger of oil mist fires in vessels:

ISO 16437:2012(en) "The majority of fires which have occurred in engine rooms are generally caused by a leak or fracture from a flammable liquid system. Most engine room fires begin as a result of the ignition of oil mist."

Many mariners are not even aware that oil mist is a fuel and can be present in the engine room without any warning. Oil mist is typically introduced to the engine room via a tiny perforation, fracture or leak of pressurized oil (fuel, lube or hydraulic) from injectors, fuel lines, high pressure pumps or high pressure oil lines which atomizes the fluid as it escapes. It is frequently undetectable by the naked eye.

Oil mist may also form when oil contacts a hot surface causing the oil to vaporize. Oil mist is quite small, with droplets in the 1-10 micron range and tends to disperse evenly in the surrounding air. It has a very large surface area and a low flash point temperature, making it very flammable when sufficient quantities are present. If the quantity of oil mist reaches the lower explosive level of 50 mg/liter and

comes into contact with a heat source of 200 degrees C, it can explode. Ignition can come from heat sources such as bearings, turbochargers, exhaust systems and electrical sources such as electric contacts, faulty wiring, motors and static electricity. Oil mist explosions in large engine crankcases have been recognized for many years and devices to detect this have been required for quite some time. More recently, attention has been given to oil mist in the ambient (surrounding) air in engine rooms, and oil mist detectors for this specific problem have been developed.

Oil Mist Detectors

There are basically two types of oil mist detectors for engine rooms.

The earlier “sniffer” systems have been around for a while. This type of system will extract engine room air into the unit and analyze it by nephelometry; the detection of oil mist due to light scatter. If oil mist is present an alarm will be generated. They do work well however there are some disadvantages to these: Multiple units are needed to effectively sample the various areas in the machinery space because each local point of the machinery space ventilation will require a separate unit. The units are pre-calibrated so no adjustments are possible. Each sampling unit is somewhat bulky and heavy. Most require AC power, so if the problem lies with the electrical generator, they stop functioning when the generator is shut down unless a UPS (uninterruptible power supply) is provided. There are moving parts (fans) which require periodic maintenance and some units have filters that must be changed. The nephelometric chamber which houses the light source transmitter, measuring receiver and compensating receiver, will need periodic cleaning. This type of oil mist detector system is typically found on large commercial vessels.

A more recent type of oil mist detector is the optical opacity meter. These were also developed for large commercial vessels but because of their small size, they are ideal for yacht installations. Initially infrared light was used but the most advanced systems now use a laser. The laser is transmitted from the transceiver to a reflector and back to the transceiver, a double pass detection method. The optical qualities of the laser are precisely known so any oil mist present will be detected by opacity of the laser light. There are a number of advantages to this type of system: They are much smaller, streamlined units. The transceiver and reflector can be mounted from 1 meter up to 15 meters (50 feet) apart providing a very large area of coverage. They are also fully programmable so that warnings and alarms can be adjusted to any opacity parameter. Generally two units will cover a large engine room and the main reason for the second unit is not only to provide more coverage, but to also provide redundancy. These systems integrate into the vessels current communications system using MODBUS TCP/IP protocol so they are quite easy to install. The only maintenance required, since they have no moving parts, is to periodically wipe clean the open transceiver and reflective lenses. They use DC power (typically 24 Volts), the same as most modern electronics, so are not affected if the vessels generator is taken off line. Another big difference is that these types of oil mist detectors will also detect the presence of smoke. Earlier versions of these had more false alarms because of the longer light path, but advances in the quality of the laser optical beam analysis and the ability to program the units have greatly reduced or eliminated this problem. Multiple transceivers can work off of a single PLC (Programmable Logic Controller). This is the type of oil mist detector that is now being installed into luxury yacht engine rooms.

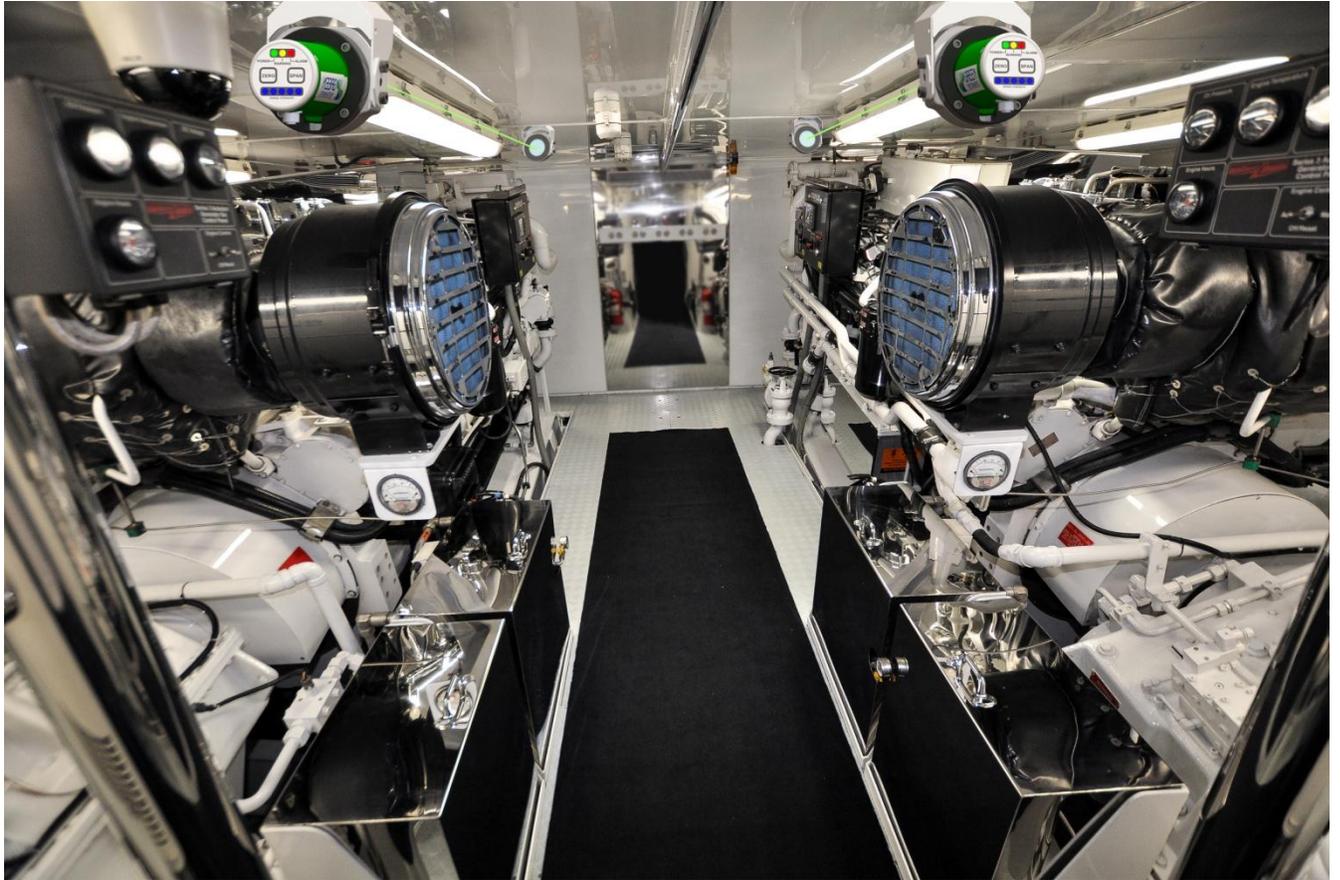
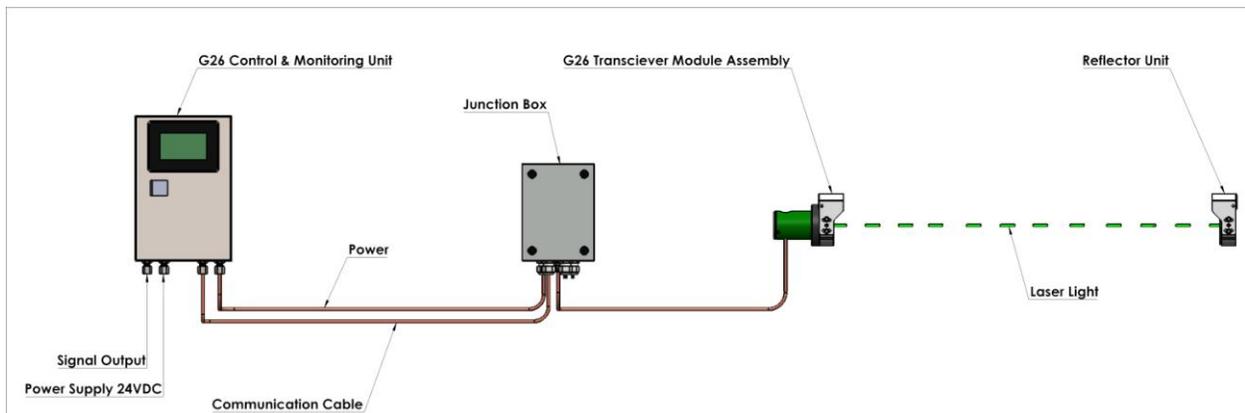


Photo Credit: J.K.Moller/Green Instruments USA

Example of a laser type oil mist detector two transceiver installation in a modern yacht engine room. The units are mounted to the overhead above the main engines and generators.



System diagram of laser type oil mist detector with a single transceiver unit. This is the Green Instruments G26 system.

Safety First

All yachts, large and small should consider installing the latest laser type oil mist detector. It is compact, robust, affordable and easily integrated into a modern yachts communication system. Additional transceiver units can be installed to protect other machinery spaces that have the potential for oil mist, such as generator rooms, hydraulic spaces (stabilizers and thrusters), and steering gear areas (lazarettas). Besides protecting from fire hazard, the early warning of oil mist presence will certainly pay dividends in keeping the yachts machinery spaces clean. The system is type classed and certified by DNV-GL, an important consideration for classed vessels. Most importantly, it gives the crew an early warning of a hazardous fire situation.

Marine insurance companies are still unaware, for the most part, that these systems now exist for yachts, but this is will change as more oil mist detectors are installed and fire casualties are reduced among vessels with this protection. This is already the case with commercial vessels, especially tankers and cruise ships.

Fire fighting and fire extinguishing are very important, but fire prevention is even more important. Preventing fires is really the safest and most cost effective method to avoid injury, damage and loss. The oil mist detector is an important step in preventing engine room fires.