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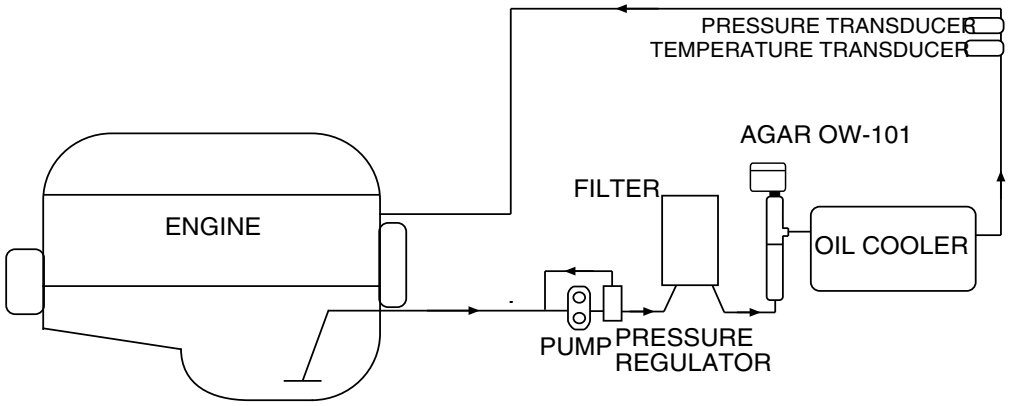
APPLICATION NOTE

AGAR OW-SERIES OIL/WATER MONITORS CONTAMINANT DETECTION IN LUBRICATION SYSTEMS

Industrial lubrication systems require close monitoring of the lubricating fluid to detect contaminants and prevent the resultant degradation of the fluid. Contaminants such as water and metallic fines are commonly monitored manually, requiring routine sampling and laboratory analysis. *AGAR OW-Series Oil/Water Monitors* can be installed to automatically and continuously monitor the quality of lubricating fluids, providing real time contaminant measurement and alarms without operator involvement.

The most common use of lubricant monitoring can be found in large-scale motors and engines and other reciprocating equipment utilizing closed loop oils for lubrication or cooling. These industries include:

- Marine Transportation
- Power Generation
- Rail Transportation
- Refining
- Pumping/Compressor Stations
- Steel Manufacturing



Engines and machines have a multitude of bearing surfaces that depend on the oil to form a very thin film. This micron thick layer of oil is the only thing that prevents direct metal to metal contact and reduces friction to a level that allows for years of service.

The oil is forced into the bearings under pressure to keep the layer of oil replenished, and to carry off heat and metal particles that wear off the bearing surfaces. The oil is collected by a pump from the oil pan or sump, and forced through a filter to remove the metal particles. It is then fed through a cooler and recirculated through the engine.

After a period of operation, the oil must be replaced because it is contaminated with metal particles,dirt, water, process fluid and residues resulting from fuel combustion.

Most of the heat generated by engines is carried off by a coolant. The most common coolant is a combination of water and glycol. As engines operate at a range of different temperatures, dilation and contraction of the engine's metal parts are a common cause of leaks. Corrosion, gasket failure, overheating and uneven head bolt torque are some of the other common causes of leaks.

Equipment is supplied with several systems designed to detect abnormal operating conditions. A pressure transducer monitors the oil pressure, and temperature transducers monitor both the oil and coolant. These are often tied in with alarms or shut down devices that stop the machine before damage is done.

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If a large amount of coolant is lost due to a leak, a temperature transducer detects it. However, if coolant is slowly leaking into the lubrication oil, it will usually remain undetected by the on-line temperature and pressure instruments. Usually it takes a catastrophic failure for these instruments to detect a water leak or contamination. This is because oil pressure or temperature instruments will not detect the lubricating oil contamination because not enough coolant has leaked out to affect the coolant or oil temperatures. Also, the lubricant system pressure is not significantly affected by low levels of contamination that is still sufficient to adversely affect lubrication.

Water in the lubrication oil system causes a thin ragged layer of oil on bearings instead of the thin uniform layer that is needed. This ragged film does not adequately protect against metal to metal friction. Metal to metal friction causes heat to build up and rapid wear of the main rod bearings and the crankshaft.

The *OW-101 Oil/Water Monitor* works on the principle of absorption of electromagnetic waves. The unit contains an antenna that transmits a high frequency signal. The lubrication oil circulates over this antenna and absorbs a part of this signal. The changed signal is received by the antenna and these changes are measured to determine the water content and/or other containments

Oil has very low absorption properties, while water, on the other hand, has higher absorption. If a small quantity of water is entrained with the oil, the instrument would detect the difference in absorption and trigger an alarm. Metal particles, with absorption properties much higher than water, are also detected and indicate that the lubricant should be replaced.

The *OW-101* is ranged 0 to 10% water in oil for this application, and is repeatable to within ± 0.1%. The *OW-101* can be supplied with an adjustable set point relay, indicating lights, a pneumatic solenoid valve and or an analog 4 to 20 mA linear output that corresponds to the water content. Any combination of these outputs is available, including digital display, and in 0 to 10% water in oil or other ranges.

The power supply and signal conditioner unit can be supplied in NEMA 4 (weatherproof) or NEMA 7 (explosion proof), or CENELEC (flame proof) enclosures.

The Agar OW-101Oil in Water Monitor measures percentage water through measurement of certain electrical properties of the hydrocarbon/water mixture. There are other constituents in such oil/water mixtures (such as sulfur, iron sulfide/oxide, etc.) that absorb electromagnetic energy at a rate that is equal to or even greater than that of water. When these interfering constituents are present and their content varies, the resultant change in composition of the oil/water mixture can cause a baseline shift in the energy absorption. The shift will be seen as variations in the measured percent water. This shift can be corrected with automatic instrumentation/algorithm (e.g., densitometer or sulfur analyzer) input or by manual adjustment of the OW-101's zero setting. In either case, prior knowledge of the interfering parameters and their variation will allow for most accurate measurement.

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