TELEDYNE CONTINENTAL - AIRCRAFT ENGINE

Technical Brief

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Subject: **OIL ANALYSIS**

NOTE: SUPERSEDES TECHNICAL BRIEF T93-2.

Spectrographic oil analysis has become very popular with the owners and operators of general aviation piston powered aircraft. This process was developed over 35 years ago by the railroads as a method of identifying wear characteristics in large diesel engines. Eventually oil analysis was adopted by the military and then by commercial and general aviation.

Engines are designed and manufactured utilizing various materials and alloys. The engine lubrication system is designed to provide either pressure or splash oil to the areas of the engine that are subjected to frictional loading. These areas, in the course of normal operation, undergo minute,continuous wear. During operation submiroscopic material is released from these contact surfaces and are suspended in the lubricating oil.

Spectrographic oil analysis identifies these materials and the level of concentration.

There are two accepted methods of performing oil analysis, atomic absorption or atomic emissions. Either method, atomic absorption or atomic emission, will identify the presence of submicroscopic material that is suspended in the engine's oil. The

oil analysis report will identify the material suspended in the sample and the quantity of that material in parts per million (PPM).

Atomic absorption will identify suspended wear material that is 5 micron in size or smaller, while atomic emissions will identify suspended wear material that is 10 micron in size or smaller. Since engine oil analysis is used as a tool to establish an engine's wear trend and identify deviations from the established norm, either method is acceptable. However, it is important to realize that the oil analysis program must utilize the same laboratory for all sample analysis. Comparing an oil analysis report from a separate laboratory will have little meaning if each laboratory uses a different analysis method.

Spectrographic oil analysis is an additional tool which can, in some cases, assist in the identification of an internal engine problem. If samples are properly taken on a regular basis, it should provide the owner/operator and oil analysis technician with information relative to the normal or abnormal wear that occurs during the course of engine operation. Deviations from an established wear trend pattern should alert the owner/operator and oil analysis technician to the need for further investigation.

Spectrographic oil analysis must be accomplished according to a set protocol to provide any useful information. Even if done properly, spectrometric oil analysis will rarely provide any prior indication of a fatigue type failure. A single spectrographic oil sample will usually not provide a high level of useful information since there is no established wear trend
data on that specific engine for comparison. A proper spectrographic oil analysis program should begin with the first engine oil change. To establish a wear trend data base for an engine will require that at least 3 oil samples be analyzed. As the engine accumulates operating time and additional oil samples are analyzed a more definitive wear trend will be identified. Unexplained deviations from the engines normal wear trend pattern should be investigated

using accepted, conventional inspection methods.

LIMITATIONS

Variations in operation, utilization and maintenance may be reflected in the parts per million content reported. Deviations from standard or previously used sampling procedures may result in variations in the parts per million content of the sample report. Seasonal changes may also result in variations to the parts per million content in the sample report.

GENERAL PROCEDURES

To establish a data base for comparison and for the oil analysis reports to have any meaning the oil samples must be taken on a regular schedule using the same sampling technique and laboratory. The engine must have been operated long enough to obtain normal operational temperatures and the oil sample taken within 30 minutes after engine shut down. The tube or funnels used to drain the oil from the oil sump must be clean and free of any foreign material or residue. If the oil sample is taken from the oil as it drains from the sump, allow approximately 1/3 of the oil to drain prior to taking the sample. If the sample is taken via the oil filler or other location using a sampling tube it is critical that the sample not be taken from the bottom of the oil sump, but at a location 2 to 3 inches above the bottom of the sump. Under no circumstances should an oil sample be taken from the oil filter canister.