Designation: D7874 – 13

Standard Guide for Applying Failure Mode and Effect Analysis (FMEA) to In-Service Lubricant Testing[1]

This standard is issued under the fixed designation D7874; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This guide describes a methodology to select tests to be used for in-service lubricant analysis. The selection of fluid tests for monitoring failure mode progression in industrial applications applies the principles of failure mode and effect analysis (FMEA).

1.2 Although typical FMEA addresses all possible product failure modes, the focus of this guide is not intended to address failures that have a very high probability of unsafe operation as these should immediately be addressed by other means.

1.3 This guide is limited to components selected for condition-monitoring programs by providing a methodology to choose fluid tests associated with specific failure modes for the purpose of identifying their earliest developing stage and monitoring fault progression. The scope of this guide is also focused on those failure modes and their consequences that can effectively be detected and monitored by fluid analysis techniques.

1.4 This guide pertains to a process to be used to ensure an appropriate amount of condition monitoring is performed with the objective of improving equipment reliability, reducing maintenance costs, and enhancing fluid analysis monitoring of industrial machinery. This guide can also be used to select the monitoring frequencies needed to make the failure determinations and provide an assessment of the strengths and weaknesses of a current condition-monitoring program.

1.5 This guide does not eliminate the programmatic requirements for appropriate assembly, operational, and maintenance practices.

1.6 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

D7684 Guide for Microscopic Characterization of Particles from In-Service Lubricants

D7720 Guide for Statistically Evaluating Measurand Alarm Limits when Using Oil Analysis to Monitor Equipment and Oil for Fitness and Contamination

2.2 *IEC Standard:*

IEC 60812 Analysis Techniques for System Reliability—Procedure for Failure Mode and Effects Analysis (FMEA), 2006

3. Terminology

3.1 *Definitions:*

3.1.1 *cause(s) of failure, n*—underlying source(s) for each potential failure mode that can be identified and described by analytical testing.

3.1.2 *component incipient failure, n*—moment a component begins to deteriorate or undergo changes that will eventually lead to the loss of its design function.

3.1.2.1 *Discussion*—This moment may not be easily detectable because of sensitivity limitations of monitoring instrumentation or a lack of measurable change in performance characteristics or both.

3.1.3 *criticality number, C, n*—product of the severity (*S*) and occurrence (*O*) numbers for a given failure mode's causes and effects.

3.1.4 *design function, n*—function or task that the system or component should perform.

3.1.5 *detection ability number, D, n*—ranking number that describes the ability of a specific fluid test to successfully detect a failure mode's causes or effects. A scale is used to grade detection ability numbers; see an example in 6.4.7.

3.1.6 *effect(s) of failure, n*—potential outcome(s) of each failure mode on the system or component.

[1] This guide is under the jurisdiction of ASTM Committee D02 on Petroleum Products, Liquid Fuels, and Lubricants and is the direct responsibility of Subcommittee D02.96.04 on Guidelines for In-Services Lubricants Analysis.

Current edition approved Oct. 1, 2013. Published October 2013. DOI: 10.1520/D7874-13.

[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

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