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Standard Guide for Obtaining In-Service Samples of Turbine Operation Related Lubricating Fluid[1]

This standard is issued under the fixed designation D8112; 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.

INTRODUCTION

Oil analysis is one of widely accepted condition monitoring techniques by the modern industry. This technology, however, depends on obtaining a representative sample of the fluid from the operating system. Although some information on sampling procedure for condition monitoring is provided in a number of different standards, there is a lack of a clear reference addressing all related issues in one document. The intent of this standard is an attempt to provide all critical information related to fluid sampling for condition monitoring from steam and gas turbines as well as from other auxiliary equipment in power generating industry in one document.

1. Scope*

1.1 This guide is applicable for collecting representative fluid samples for the effective condition monitoring of steam and gas turbine lubrication and generator cooling gas sealing systems in the power generation industry. In addition, this guide is also applicable for collecting representative samples from power generation auxiliary equipment including hydraulic systems.

1.2 The fluid may be used for lubrication of turbine-generator bearings and gears, for sealing generator cooling gas as well as a hydraulic fluid for the control system. The fluid is typically supplied by dedicated pumps to different points in the system from a common or separate reservoirs. Some large steam turbine lubrication systems may also have a separate high pressure pump to allow generation of a hydrostatic fluid film for the most heavily loaded bearings prior to rotation. For some components, the lubricating fluid may be provided in the form of splashing formed by the system components moving through fluid surfaces at atmospheric pressure.

1.3 Turbine lubrication and hydraulic systems are primarily lubricated with petroleum based fluids but occasionally also use synthetic fluids.

1.4 For large lubrication and hydraulic turbine systems, it may be beneficial to extract multiple samples from different locations for determining the condition of a specific component.

1.5 The values stated in SI units are regarded as standard.

1.5.1 The values given in parentheses are for information only.

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, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.7 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

B117 Practice for Operating Salt Spray (Fog) Apparatus
D923 Practices for Sampling Electrical Insulating Liquids
D3326 Practice for Preparation of Samples for Identification of Waterborne Oils
D4057 Practice for Manual Sampling of Petroleum and Petroleum Products
D4175 Terminology Relating to Petroleum Products, Liquid Fuels, and Lubricants
D4289 Test Method for Elastomer Compatibility of Lubricating Greases and Fluids

[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.C0.01 on Turbine Oil Monitoring, Problems and Systems.

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[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.

***A Summary of Changes section appears at the end of this standard**

D4378 Practice for In-Service Monitoring of Mineral Turbine Oils for Steam, Gas, and Combined Cycle Turbines
D6224 Practice for In-Service Monitoring of Lubricating Oil for Auxiliary Power Plant Equipment
D7464 Practice for Manual Sampling of Liquid Fuels, Associated Materials and Fuel System Components for Microbiological Testing
D8506 Guide for Microbial Contamination and Biodeterioration in Turbine Oils and Turbine Oil Systems

2.2 *American National Standard Institute Standards:*[3]
B93.19 Method for Extraction Fluid Samples from the Lines of an Operating Hydraulic Fluid Power System (for Particulate Contamination Analysis)
B93.44 Method for Extracting Fluid Samples from the Reservoir of an Operating Hydraulic Fluid Power System

2.3 *ISO Standards:*[3]
ISO 3165 Sampling of chemical products for industrial use—Safety in sampling
ISO 3170 Petroleum Liquids—Manual Sampling
ISO 4406 Hydraulic fluid power—Fluids—Method for coding the level of contamination by solid particles

2.4 *Society of Automotive Engineers Standards:*[4]
SAE J517 Hydraulic Hose
SAE J1273 Recommended Practices for Hydraulic Hose Assemblies

3. Terminology

3.1 *Definitions:*

3.1.1 For definitions of terms used in this guide, refer to Terminology D4175.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *bulk oil tote, n*—any container for lubrication or control fluid with working volume of approximately 1000 L to 1300 L designed for fluid storage at atmospheric pressure.

3.2.2 *continuous sampling loop, n*—a limited flow of fluid from a point in a pressurized system to a point of lower pressure used to decrease required purge fluid and sample time during the sampling process.

3.2.3 *disposable sample tubing, n*—any single-use flexible plastic tubing used to transfer fluid during the sampling process.

3.2.4 *drain sampling, n*—a method of sampling used fluid for non-pressurized reservoirs or lines occurring when the lubricating fluid is being drained from the reservoir during a fluid change.

3.2.4.1 *Discussion*—As part of a fluid change, the drain plug is removed to allow the fluid to drain into an appropriate container under gravity. Mid way through the draining, a sample bottle is filled by placing it in the fluid stream and once filled immediately capped.

3.2.5 *drop tube sampling, n*—a method of sampling used fluid for non-pressurized reservoirs when sampling is completed by dropping an appropriate length of sampling tubing into the reservoir and using a vacuum generating device to extract the sample.

3.2.6 *permanent sample tube, n*—any tubing installed in a reservoir or pipe used to extract a sample from a specific location within the system.

3.2.7 *purge, v*—to remove the existing non-representative fluid and contaminants from the sample valve and tubing during the sampling process.

3.2.8 *reservoir, n*—any equipment-based container that holds a volume of fluid, usually under atmospheric condition, for use in the lubrication, sealing or control process.

3.2.9 *remote access hose, n*—any permanently installed metallic or elastomeric tube or hose used to transfer fluid from the system to a point outside the system to facilitate sampling.

3.2.10 *sample container, n*—a clean, fresh plastic bottle used for system fluid analysis (see section 6.1).

3.2.11 *sample valve, n*—a system consisting of a male and female component used specifically for the extraction of a fluid sample either by internal system pressure or by an externally generated vacuum.

3.2.11.1 *Discussion*—The male component, referred to as a probe, may be for one time use or permanently attached to the female component, referred to as a sample valve, is used by either threading the probe onto the valve or pushing the probe into the valve for the purpose of opening the valve and allowing fluid to flow out.

3.2.12 *sample valve sampling, v*—to obtain a sample from either pressurized or non pressurized lines or reservoirs.

3.2.12.1 *Discussion*—When sampling non-pressurized reservoirs this sampling method usually applies a vacuum generating device and sampling tubing to extract a sample into a sampling container from a strategically located sampling valve. When sampling pressurized reservoirs or lines, this sampling method is completed by using system pressure to force lubricating fluid into a sampling container through a sampling valve.

3.2.13 *vacuum generating device, n*—a pump used to create a low pressure in a sample container to cause fluid to move from a non-pressurized reservoir to the container through disposable tubing.

3.2.14 *weighted drop tube device, n*—a mass attached to a piece of steel or stainless steel tubing with a method to attach disposable sampling tubing to the steel or stainless steel tubing.

3.2.14.1 *Discussion*—This device is used during drop tube sampling.

4. Summary of Guide

4.1 This guide assists users in extracting representative in-service fluid samples from turbines and related lubrication and control systems primarily found in the power generation industry. This guide deals both with location of these sampling points and the method used to extract the sample.

4.2 There is great variation in the methods of sampling lubricating and control fluids in power generation turbines; however, most practices are based on the same principles. The

[3] Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036, http://www.ansi.org.

[4] Available from SAE International (SAE), 400 Commonwealth Dr., Warrendale, PA 15096, http://www.sae.org.