



Designation: D4174 – 23

Standard Practice for Cleaning, Flushing, and Purification of Petroleum Fluid Hydraulic Systems¹

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1. Scope*

1.1 This practice covers aid for the equipment manufacturer, the installer, the oil supplier and the operator in coordinating their efforts towards obtaining and maintaining clean petroleum fluid hydraulic systems. Of necessity, this practice is generalized due to variations in the type of equipment, builder's practices, and operating conditions. Constant vigilance is required throughout all phases of design, fabrication, installation, flushing, testing, and operation of hydraulic systems to minimize and reduce the presence of contaminants and to obtain optimum system reliability.

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¹ This practice is under the jurisdiction of ASTM Committee D02 on Petroleum Products, Liquid Fuels, and Lubricants and is the direct responsibility of D02.N0 on Hydraulic Fluids.

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1.3 The values stated in SI units are to be regarded as the standard. The values given in parentheses are for information only.

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

1.4 *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.*

1.5 *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

D445 Test Method for Kinematic Viscosity of Transparent and Opaque Liquids (and Calculation of Dynamic Viscosity)

D664 Test Method for Acid Number of Petroleum Products by Potentiometric Titration

D974 Test Method for Acid and Base Number by Color-Indicator Titration

D1744 Test Method for Determination of Water in Liquid Petroleum Products by Karl Fischer Reagent (Withdrawn 2016)³

D2709 Test Method for Water and Sediment in Middle Distillate Fuels by Centrifuge

D4006 Test Method for Water in Crude Oil by Distillation

D4175 Terminology Relating to Petroleum Products, Liquid Fuels, and Lubricants

D7042 Test Method for Dynamic Viscosity and Density of Liquids by Stabinger Viscometer (and the Calculation of Kinematic Viscosity)

D7546 Test Method for Determination of Moisture in New and In-Service Lubricating Oils and Additives by Relative Humidity Sensor

D7647 Test Method for Automatic Particle Counting of Lubricating and Hydraulic Fluids Using Dilution Techniques to Eliminate the Contribution of Water and Interfering Soft Particles by Light Extinction

F311 Practice for Processing Aerospace Liquid Samples for Particulate Contamination Analysis Using Membrane Filters

F312 Test Methods for Microscopical Sizing and Counting Particles from Aerospace Fluids on Membrane Filters

F313 Test Method for Insoluble Contamination of Hydraulic Fluids by Gravimetric Analysis (Withdrawn 1988)³

2.2 ANSI Standards:

B93.2 Glossary of Terms for Fluid Power⁴

B93.19 Method for Extracting Fluid Samples from the Lines of an Operating Hydraulic Fluid Power System (for

Particulate Contamination Analysis)⁴

3. Terminology

3.1 Definitions:

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

3.2 Definitions of Terms Specific to This Standard:

3.2.1 *nominal filtration rating, n*—an arbitrary micrometre value indicated by a filter manufacturer. Due to lack of reproducibility this rating is deprecated. (ANSI B93.2)

4. Significance and Use

4.1 Proper fluid condition is essential for the satisfactory performance and long life of the equipment. Prerequisites for proper lubrication and component performance are: (1) a well-designed hydraulic system, (2) the use of a suitable fluid, and (3) a maintenance program including proper filtration methods to ensure that the fluid is free of contaminants. These prerequisites are meaningless unless the hydraulic system is initially cleaned to a level that will prevent component damage on initial start up or when debris may be dislodged by any system upset.

4.2 The cleaning and flushing of both new and used systems are accomplished by essentially the same procedure. In new systems, the emphasis is on the removal of contaminants introduced during the manufacture, storage, field fabrication, and installation. In used systems, the emphasis is on the removal of contaminants that are generated during operations, from failures that occur during operation; or contaminants introduced during overhaul. Both new and used systems may benefit from high velocity flushing to remove materials that can collect in hard to drain pockets or normally non-wetted surfaces.

4.3 While the flushing and cleaning philosophies stated in this practice are applicable to all primary and servo hydraulic systems, the equipment specified herein does not apply to compact systems that use relatively small volumes of fluid unless they are servo systems where it is economically justified.

4.4 It should be emphasized that the established procedures to be followed for flushing and cleaning the hydraulic systems should be accomplished through the cooperative efforts and agreement of the equipment manufacturer, the installer, the flushing service vendor, the operator, and the fluid supplier. No phase of these procedures should be undertaken without a thorough understanding of the possible effects of improper system preparation. The installation and cleaning and flushing of the equipment should not be entrusted to persons lacking in experience.

5. Types of Contamination

5.1 *General*—Hydraulic systems can become contaminated from a variety of sources. Generally, there are five categories of contamination: (1) water, (2) fluid soluble material, (3) fluid insoluble material, (4) erroneous fluid additions, and (5) hydraulic fluid deterioration. Properly designed systems can normally control water and insoluble contaminants; however,

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.

³ The last approved version of this historical standard is referenced on www.astm.org.

⁴ Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036.