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Standard Test Method for Evaluation of Fluids for Effects on Friction of Wet, Bronze-Faced, Friction Brakes¹

This standard is issued under the fixed designation D 4999; 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 test method evaluates fluids for effects on friction of oil cooled brakes with bronze friction material in combination with steel disks.

1.2 The values stated in SI units are to be regarded as standard.

1.3 *This standard may involve hazardous materials, operations, and equipment. This standard does not purport to address all of the safety problems 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.* For a specific hazard statement, see 7.4.

2. Referenced Document

2.1 ASTM Standard:

D 235 Specification for Mineral Spirits (Petroleum Spirits) (Hydrocarbon Dry Cleaning Solvent)²

3. Terminology

3.1 Description of Terms Specific to This Standard:

3.1.1 *capacity*—the amount of torque that a brake can absorb without slipping.

3.1.2 *chatter*—changing frictional characteristics that occur during the application of the brake measured by observing torque variation. These changing frictional characteristics result in an audible noise.

4. Summary of Test Method

4.1 A modified transmission/final drive unit containing fluid-wetted brakes is used as the test machine for this test method (see Figs. A1.1, A1.2, A1.3, and A1.4). Prior to starting a test, new brake facings (see A1.5) and a brake disk are measured. After installing the measured parts in the test machine, a break-in is run consisting of 1000 cycles of operation using a reference fluid. The brake parts are removed, measured, and re-installed. A 100-cycle flush procedure is performed using a fluid containing no additives. The test proceeds with 200 cycles of operation with new reference fluid, then a chatter test. The brake parts are removed, measured, and re-installed in the test machine. A 100-cycle flushing procedure is performed using a fluid containing no additives. Test fluid is introduced into the

system and a conditioning run of 200 cycles is performed prior to running a chatter/capacity test. After completion of the chatter/capacity test, the brake parts are again measured.

5. Significance and Use

5.1 This test method measures the chatter/capacity characteristics of fluids used in multi-purpose power transmission systems of on-off highway equipment.

5.2 This test method was developed for this purpose referencing John Deere Standards JDQ40 and JDQ41.³

6. Apparatus

6.1 *Test Machine Configuration*—This test method requires the use of a John Deere (JD) 4250 tractor.⁴

6.2 *External Fluid Control Systems*—External systems will be required to maintain proper operating conditions (see Figs. A1.6 and A1.7). In this system, use no brass or copper in components contacted by the test fluid.

6.3 *Monitoring and Control Equipment*—Speed, torque, pressure, and temperature monitoring/control instrumentation is required.

6.3.1 *Axle Restraint*, one side (see Fig. A1.8).

6.3.2 *Auxiliary Hydraulic System*, capable of providing 16.0 MPa pressure.

6.3.3 *Strain Gage* (see Figs. A1.9 and A1.10).

6.3.4 *Heater/Cooler System*, to maintain fixture fluid temperature.

6.3.5 *Electronic Slip Ring Assembly*.

6.3.6 *Reservoir*, 20-L capacity.

6.3.7 *Pressure Transducer*.

6.4 *Cycle Controls*—A timer and mechanism to control the brake engagement.

6.5 *Recording Equipment*—A means of recording pressure, temperature, and torque simultaneously with a minimum frequency response of 120 Hz.

6.6 *Measurement Equipment*—A device capable of measuring friction pad groove depth of 0.01 mm.

6.7 *Speed Measurement*—Any suitable speed measuring device capable of measuring axle speed within 0.5 r/min (with a range from 10 to 60 r/min).

7. Reagents and Materials

7.1 *Test Fluid*, approximately 20 L.

7.2 *Reference Fluid*, approximately 95 L.⁵

¹ This test method is under the jurisdiction of ASTM Committee D-2 on Petroleum Products and Lubricants and is the direct responsibility of Subcommittee D02.B on Automotive Fluids.

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² *Annual Book of ASTM Standards*, Vol 06.03.

³ Available from John Deere and Company, Corporate Standards, John Deere Road, Moline, IL 61265.

⁴ A product of John Deere and Company, John Deere Road, Moline, IL 61265.

⁵ Reference Fluid(s) available from Southwest Research Institute, 8500 Culebra Road, San Antonio, TX 78284.