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**Determination of the anti-scuffing failure temperature of
lubricating oils - SRV type test machine method**

润滑油抗擦伤失效温度的测定 SRV型试验机法

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Foreword

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1. Structure and Drafting Rules of Standardization Documents". Drafting. Please note that some content in this document may involve patents. The issuing organization of this document assumes no responsibility for identifying patents. This document was proposed and is under the jurisdiction of the National Technical Committee on Standardization of Petroleum Products and Lubricants (SAC/TC280). This document was drafted by: Lubricating Oil Branch of China National Petroleum Corporation and Sinopec Research Institute of Petroleum Processing Co., Ltd. Company, Lanzhou Institute of Chemical Physics, Chinese Academy of Sciences, Taiyuan University of Technology, Fuchs Lubricants (China) Co., Ltd., Sinopec Lubricants Co., Ltd. The company's Synthetic Grease Branch, Dongfeng Commercial Vehicle Co., Ltd., Tsinghua University Tianjin Advanced Equipment Research Institute, and Puyang Xinye Special Lubricating Grease Limited Liability Company. The main drafters of this document are. Jin Zhiliang, Lei Ailian, Li Xiaogang, Zhai Guorong, Lü Huiying, Yang He, Su Huaigang, Zhang Xiaosheng, Zhou Chao, and Jin Lili. Wei Binbin, Wang Junming, Wang Yuling, Zhang Xuetao, Li Xu, Hao Lichun, Wang Yunxia, Tian Zhongli, Gao Qian, Zhu Yeyun, Dai Yuanjing, Zhang Guohui. Determination of the anti-scuffing failure temperature of lubricating oil SRV type testing machine method Warning

---The use of this document may involve certain hazardous materials, equipment, and operations. This document does not specify all possible safety precautions. Problem. Users are responsible for taking appropriate safety and health measures and ensuring compliance

with relevant national regulations.

1.Scope This document describes the determination of the anti-scuffing failure temperature of lubricating oil under high-frequency linear reciprocating motion conditions using an SRV-type friction and wear testing machine. The test method for degree. This document applies to the determination of the anti-scuffing failure temperature of engine oils, and also to the anti-scuffing properties of other lubricants used under high-temperature conditions. Determination of failure temperature.

Note. The failure temperature of a lubricating oil reflects its anti-scuffing performance (its ability to resist surface damage caused by seizing).

4.Principles This method uses an SRV-type testing machine to perform linear reciprocating motion between the test column and the test disc under lubricated oil conditions. The axis of the column is at a 90° angle to the direction of reciprocating motion (see Figure 1). The load, stroke, and frequency are fixed during the test, and the test temperature is 10°C. The incremental gradient increases, with each 10°C increase followed by 7-15 minutes of operation at a single temperature point, until engagement occurs or the temperature reaches 300°C, at which point judgment is made. It also reports the highest temperature at which no biting occurred, i.e., the temperature at which the anti-abrasion failure failed.

Note. The test frequency, test stroke, test load, and materials of the test column and disk may differ from those specified in this test method.

5 Instruments

5.1 SRV type testing machine. includes a linear vibration actuator, a test chamber, and a loading device with a servo motor and a weighing sensor. The instrument consists of a control device for reciprocating motion drive, a timer, load control, frequency control, stroke control, and a number of parameters for determining the coefficient of friction. The system consists of an amplifier, switches, and a controller for heating. An oscilloscope is used to monitor the data. Data is acquired via a computer. The data should be collected and recorded to determine the relationship between the friction coefficient, stroke, and test temperature and time. The control parameters of the testing machine should meet the following requirements.

---Test load. 10N~2000N, accuracy. $\pm 0.03\%$;

---Test stroke. 0.1mm~3.0mm, accuracy. $\pm 0.03\%$;

---Test temperature. room temperature to 350°C, maximum error less than 1%;

---Test frequency. 5Hz~70Hz, accuracy. $\pm 0.01\%$. The test column is mounted on the cage, and the longitudinal axis of the test column is at 90° with the direction of reciprocating motion, as shown in Figure 1. On a fixed base inside the test chamber, there is a piezoelectric device used to measure the frictional force (F_f) and calculate the coefficient of

friction (f) using software; The test pan's holder incorporates a temperature-controlled resistance heating element and a resistance thermometer for controlling and measuring the test pan's temperature; reciprocating... The motion drive rod is used to support the replaceable bracket of the test column and the loading rod of the loading device. The design of the test chamber base should ensure that it has an integrated cooling coil, or a cooling coil wound around it, so that the base can control its temperature. The temperature is maintained below 110°C. The test disc and test column are mounted in their respective cages. The test disc serves as the lower test specimen.

5.2 Syringe. Suitable for applying 120 μ L $\pm$ 10 μ L of test lubricating oil sample.

5.3 Torque wrench. Torque

0.5 N·m ~ 5 N·m.

5.4 Ultrasonic cleaner. suitable for cleaning test trays and test columns.

6.1 Cleaning solvent

6.1.1 Solvent oil. It shall meet the requirements of No. 2 solvent oil in GB 1922-2006.

Warning. Flammable and harmful to health.

6.1.2 Petroleum ether. boiling range 60°C~90°C, analytical grade. Warning. Flammable and harmful to health.

6.2 Materials

6.2.1 Test column. AISI 52100 steel or similar material, hardness (HRC) 60 $\pm$ 2, surface polished, Ra (CLA) 0.025 μ m $\pm$ 0.005 μ m, with dimensions of ϕ 15mm x22mm.

6.2.2 Test pan. High-carbon gray cast iron with a pearlitic matrix and flake graphite. Carbon content ranges from 3.65% to 3.85%; typical manganese content... The concentration of elemental molybdenum is 0.67%-0.75%; the typical concentration of molybdenum is 0.25%-0.32%. The Vickers hardness is 170 HV10. 220HV10 (Brinell hardness 160HBW~210HBW5/250). The morphology of the test disc is as follows: upper and lower surfaces polished, Ra(CLA). The range is 0.035 μ m~0.050 μ m, and the average unevenness height (Rz) ranges from 0.500 μ m to 0.650 μ m; the diameter is 24mm $\pm$ 0.5mm, thickness is 7.85mm $\pm$ 0.10mm. Note

1. Users of this method can use other gray cast iron or alloy cast iron test pans to simulate actual tests. Note

2. When evaluating gear oils, it is advisable to use a test disc made of 20CrMnTi or a similar material. Note

3. Rz is a parameter used to measure surface roughness, which is the sum of the average values of the five maximum profile peak heights and the five maximum profile valley depths

within the sampling length.

7 Experimental Preparation

7.1 Wearing solvent-resistant gloves, wipe the surface of the test column and test tray with a laboratory-grade degreased cotton cloth dampened with cleaning solvent oil, wiping repeatedly. Continue cleaning until no black residue remains on the degreased cotton cloth. Immerse the test column and test tray in a beaker containing cleaning solvent, and then clean them in an ultrasonic cleaner. Clean the test pieces with solvent oil and petroleum ether for 10 minutes each, then wipe the test column and test tray dry with a clean, degreased cotton cloth to ensure a smooth surface. No stripes.

7.2 Before starting the test, turn on the testing machine and the computer and preheat for 15 minutes.

7.3 Set the control parameters and create the corresponding configuration files in the SRV testing machine control software according to the test requirements. Test Parameter Settings See Table 1.

7.4 If occlusion occurs during the test, the following criteria shall be used to stop the test.

---The criterion for stopping the test when the coefficient of friction (f) increases for an extended period of time. the coefficient of friction is

0.3 and the duration is greater than 20 seconds;

---The standard for stopping the test when the coefficient of friction (f) increases once. the coefficient of friction is 0.35.

7.5 Data acquisition frequency of measurement channels related to results.

---Friction coefficient (f). not greater than 32 mS;

---Travel time. no more than 2 seconds;

---Load. Not exceeding 2 seconds;

---Frequency. No more than 2 seconds;

---Temperature. not more than 2 seconds.

8 Test Procedure

8.1 Ensure the testing machine is unloaded (see the relevant equipment operation manual for details).

8.2 Wearing dust gloves, install the cleaned test column onto the upper clamp and tighten the fixing screws. Then install the upper clamp onto the testing machine. The tightening torque of the clamp fixing screws on the cage is