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Method of Viscosity Test for Automotive Type Adhesives, Sealers, and Deadeners

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METHOD OF VISCOSITY TEST FOR AUTOMOTIVE TYPE ADHESIVES, SEALERS, AND DEADENERS—SAE J1524 JUN85

SAE Recommended Practice

Report of the Nonmetallic Materials Committee, approved June 1985. Originated in the Adhesives and Body Sealers Subcommittee.

1. Scope—This SAE Recommended Practice contains a series of test methods for use in measuring the viscosity of automotive-type adhesives, sealers, and deadeners.

The test methods which are contained in this document are as follows:

VIS-1 Brookfield Method
VIS-2 Castor-Severs Rheometer or Pressure Flowmeter
VIS-3 Penetrometer

2. Principle of Methods—The viscosity of a material is a measurement of the internal friction that must be overcome before a change of form can be accomplished. For the purpose of this test method, however, viscosity refers to a finished product parameter that is quantified in various ways and used by the automotive industry as a means of identifying and assigning a minimum and maximum value for the application characteristics of a material.

The use of these values should be tempered by the knowledge that the numbers generated are quality control aids and may not fully address the plant-to-plant variations encountered in application systems.

Each piece of equipment is suited to a particular viscosity range, although there are no sharp viscosity demarcations between the various viscometers. Generally, a Brookfield is used for low viscosity materials in the 25 to 500 000 cps range. The Pressure Flowmeter is used for materials with viscosities exceeding 200 000 cps and which are not so "heavy" that they cannot be extruded within 2 min at 275 kPa (40 psi) through a 3.18 mm (0.125 in) orifice. The Penetrometer, with its needle, various cones, and weights, is used for very high viscosity materials, such as putties and highly gelled compounds.

3. Sample Temperature Conditioning—Prior to the actual viscosity measurement, the sample to be tested must be conditioned thermally.

3.1 As Received Viscosity—Unless specified otherwise, as received viscosity shall refer to material stored at "room temperature" and tested at 25 ± 1°C (77 ± 2°F).

3.2 Aged Viscosity—Aged viscosity refers to a value obtained by subjecting a sample prior to testing to a specified temperature for 72 h. The sample is then conditioned to 25 ± 1°C and the viscosity is measured. The size of the sample to be tested should be 500 mL (1 pt). Samples smaller than this conditioned at elevated temperatures may give different results.

4. Sample Mechanical Conditioning—Prior to the actual viscosity measurement, the sample to be tested must be conditioned mechanically.

4.1 Conditioning Method A—Unagitated—Unagitated testing refers to the transfer of materials from the shipping container to the testing apparatus with the minimum amount of agitation. This viscosity is supposed to be indicative of a compound in its shipping container prior to use.

The tester should be aware that the very act of removing a sample for test can affect the rheology of thixotropic materials and, in so doing, may substantially alter the value measured.

4.2 Conditioning Method B—Moderate Agitation—Moderate agitation of a sample is achieved by stirring a 500 mL sample 50 stirs in 60 s with a 25 × 150 mm (1.000 × 6.000 in) steel bladed spatula. This agitation can also be used to assure the uniform 25°C necessary for testing.

4.3 Conditioning Method C—Grease Working—Grease working refers to subjecting a sample to 150 cycles, unless otherwise specified, in a standard mechanical grease-worker, as outlined in ASTM D217.

5. Brookfield Method

5.1 Application—This procedure is used to determine the viscosity of adhesives, deadeners, and thin-body sealers. The values obtained are expressed in centipoise (cps) and are a measure of the resistance a rotating spindle encounters with immersed in the compound to be tested.

5.2 Equipment—Commercially available Brookfield Viscometer (see Fig. 1).

5.3 Procedure—Test equipment and sample shall be maintained at 25 ± 1°C.

5.3.1 Set viscometer at specified rpm.

5.3.2 Attach specified spindle.

5.3.3 Lower viscometer into 500 mL of test material so that the groove cut in the spindle is flush with the fluid's level.

5.3.4 Level the viscometer.

5.3.5 Depress the clutch, turn on the viscometer, and release the clutch. Take the reading and record the times after the indicator has stabilized or after a specified time, typically 60 s. (When measuring thixotropic materials at specific times, other than stable readings, it will be necessary to test separate samples in order to obtain reproducible values.)

5.3.6 Use conversion table to convert to centipoise.

5.3.7 Take the average of three readings and report the viscosity spindle, rpm, time of recording, and the model of the viscometer used.

6. Castor—Severs Method/Pressure Flowmeter Method

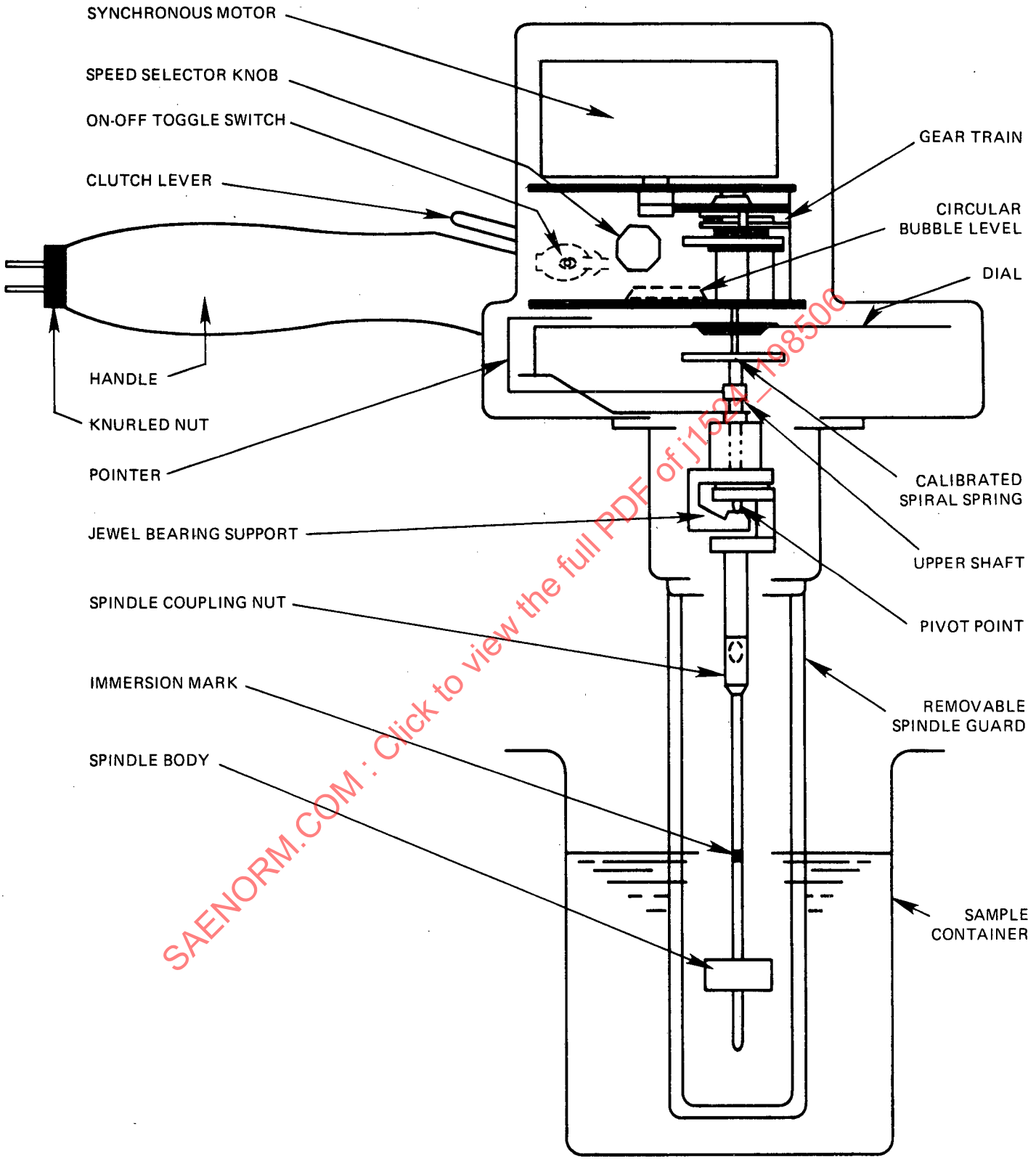
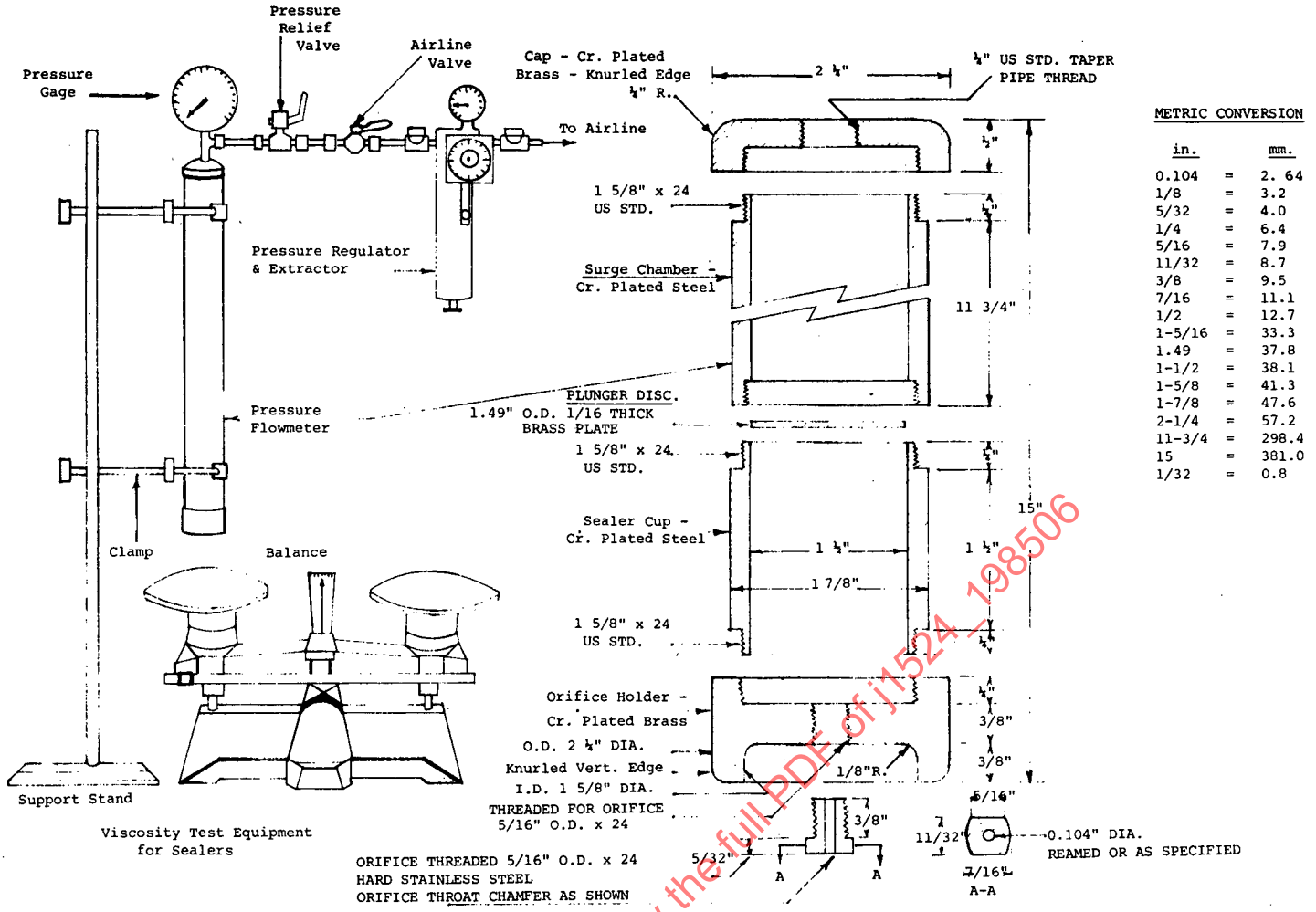


FIG. 1—SCHEMATIC DRAWING OF THE BROOKFIELD SYNCHROLECTRIC VISCOMETER



METRIC CONVERSION

in.		mm.
0.104	=	2. 64
1/8	=	3.2
5/32	=	4.0
1/4	=	6.4
5/16	=	7.9
11/32	=	8.7
3/8	=	9.5
7/16	=	11.1
1/2	=	12.7
1-5/16	=	33.3
1.49	=	37.8
1-1/2	=	38.1
1-5/8	=	41.3
1-7/8	=	47.6
2-1/4	=	57.2
11-3/4	=	298.4
15	=	381.0
1/32	=	0.8

FIG. 2

6.1 Application—This procedure is used to determine the viscosity of adhesives, sealers, and deadeners. The values obtained are expressed in seconds and are a measurement of the time needed to extrude a specified mass through a specified orifice at a specified pressure.

6.2 Equipment

6.2.1 Rheometer as shown in Fig. 2.

6.2.2 Orifices as follows:

No.	Diameter mm (in)	Length mm (in)	Typical Use	Limits
1	1.32 (0.052)	13.5 (0.531)	Sprayable	Readings less than 10 s, use Brookfield Method
2	2.64 (0.014)	13.5 (0.531)	Pumpable	Readings less than 10 s, use orifice No. 1
3	3.18 (0.125)	51 (2.0000)	Deadeners	Readings less than 10 s, use orifice No. 2

6.2.3 Air supply, 700 kPa (100 psi).

6.2.4 Pressure gauge, 700 kPa (100 psi).

6.2.5 Pressure regulator and air line water and oil extractor.

6.2.6 Pipe cleaners for cleaning the orifice.

6.2.7 Stop watch or other timing device calibrated in seconds.

6.2.8 Balance, double beam type or equivalent, sensitivity to 0.01 g.

6.2.9 Mechanical convection oven capable of maintaining a temperature of ±1°C (±2°F).

6.3 Procedure

6.3.1 Fill the clean, dry, sealer cup equipped with the specified orifice with the material to be tested. The material should be at 25 ± 1°C unless otherwise specified. Care should be taken to avoid air entrapment and to allow enough room for the plunger.

6.3.2 Adjust line pressure to 275 kPa (40 psi), unless otherwise specified. Open air valve and extrude material through orifice until entrapped air is evacuated, shut air valve.

6.3.3 Place a paper on the balance, tare and add specified weight.

6.3.4 Open air valve and start timer when the material touches the paper on the weighing pan.

6.3.5 When 20 g of sealer has accumulated on the balance pan, stop the timer, close the air valve, and open the pressure relief valve.

6.3.6 Take the average of three readings and report the number of seconds, pressure, and orifice diameter.

7. Penetration Method

7.1 Application—This procedure is used to determine the viscosity of heavy bodied sealers and deadeners. In this method, viscosity is a measurement of the depth of penetration by a cone or needle into the material tested and is expressed in 0.1 mm of penetration.

7.2 Equipment

7.2.1 Commercially available penetrometer (Fig. 3), as described below:

No.	Penetrometer	Typical Use	Limits
1	Cone ASTM D217	Deadeners	Readings less than 5 mm use Penetrometer No. 2
2	Needle ASTM D5	Thumbable Materials	Readings less than 5 mm use Durometer hardness ASTM D2240

7.2.2 Stop watch.

7.2.3 Weights to place on loading bar.

7.2.4 Penetration instruments (cone ASTM D217 and needle ASTM D5).