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SURFACE VEHICLE RECOMMENDED PRACTICE

SAE J243

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METHODS OF TESTS FOR AUTOMOTIVE-TYPE SEALERS, ADHESIVES, AND DEADENERS

Foreword—This Document has not changed other than to put it into the new SAE Technical Standards Board format.

1. Scope—This SAE Recommended Practice contains a series of test methods for use in measuring characteristics of automotive-type sealers, adhesives, and deadeners. The test methods which are contained in this document are as follows:

ADS-1—Methods of Determining Viscosity
ADS-2—Low Temperature Tests
ADS-3—Weld-Through Tests
ADS-4—Enamel, Lacquer, and Fabric Staining Test
ADS-5—Wash-Off Resistance Test
ADS-7—Solids Test
ADS-8—Flash Point Test
ADS-9—Sag and Bridging Tests
ADS-10—Flow Test

The intent of this document is to provide a series of test methods which can be used in testing the various qualities of sealers, adhesives, and deadener material. In later revisions of this document, attempts will be made to reduce the number of tests now presented. The specific temperatures and times at which some of these tests are to be conducted are not dictated in these test procedures, but they will be found in the material standards which govern each type of material to be tested.

2. References

2.1 Applicable Publications—The following publications form a part of this specification to the extent specified herein.

2.1.1 ASTM PUBLICATIONS—Available from ASTM, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959.

ASTM D 5—Test for Penetration of Bituminous Materials
ASTM D 93—Standard Method of Test for Flash Point by Pensky-Martin's Closed Tester
ASTM D 217—Test for Cone Penetration of Lubricating Grease
ASTM D 553—Standard Method of Test for Viscosity and Total Solids Content of Rubber Cements
ASTM D 1310—Standard Method of Test for Flash Point of Volatile Flammable Materials by Tag Open Cup Apparatus

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ASTM D 1582—Standard Method of Test of Non-Volatile Content of Phenol, Resorcinol and Melamine Adhesives

3. ADS-1—Methods of Determining Viscosity

3.1 Methods of Conditioning Test Materials Prior to Checking Viscosity

3.1.1 FOR VISCOSITY UNAGITATED

3.1.1.1 *Conditioning Method A*—Check the submitted sample as received. Test in the original container or transfer to the test vessel with minimum handling.

3.1.2 FOR VISCOSITY AGITATED

3.1.2.1 *Conditioning Method A*—Material shall be subject to the specified number of cycles in a standard mechanical greaseworker as outlined in ASTM D 217, Test for Cone Penetration of Lubricating Grease.

3.1.2.2 *Conditioning Method B*—Pass the sample once through the sealer cup using specified pressure and orifice.

3.1.2.3 *Conditioning Method C*—Stir a pint sample to 50 stirs with a 1 x 6 in steel-bladed spatula.

3.1.3 FOR VISCOSITY AGED—Conditioning (agitated or unagitated as specified):

a. Condition the sample in a sealed 1/2 pt can for 72 h in an oven at specified temperature.
b. Remove from the oven, condition the sample to 77 ± 2 F, and determine viscosity.

3.2 Viscosity Tests

3.2.1 VISCOSITY, PRESSURE FLOW METHOD

3.2.1.1 *Application*—This procedure is used to determine the viscosity of adhesives, sealers, and deadeners. The time required for a specified weight of the material to pass through a specified orifice under a given pressure indicates the viscosity of the material.

3.2.1.2 *Equipment Required*

3.2.1.2.1 Castor-Severs Rheometer or Pressure Flowmeter—The pressure flowmeter required for this test is detailed in Figure 1. The flowmeter is not available commercially but must be fabricated. For example:

	Sealer Cup Orifices							
	A	**B**	**C**	**D**	**E**	**F**	**G**	**H**
Diameter of Orifice, in	0.052	0.063	0.073	0.104	0.104	0.125	0.200	0.250
Lengths of Orifice, in	0.531	2.00	0.531	0.531	0.750	2.00	0.750	2.00

3.2.1.2.2 Ring stand and clamps for supporting pressure flowmeter.

3.2.1.2.3 Pressure gage, 100 lb maximum air gage, calibrated in 2 lb increments.

3.2.1.2.4 Pressure relief valve—This is an air cock which opens or closes at a single turn.

3.2.1.2.5 Shutoff valve—Same type as pressure relief valve.

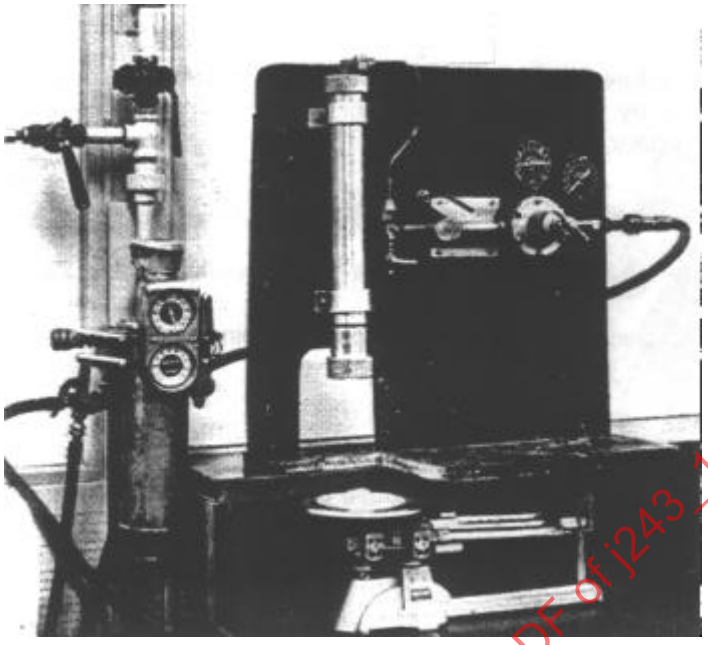

FIGURE 1—CASTOR-SEVERS RHEOMETER OR PRESSURE FLOWMETER (OR KEIL RHEOMETER)

3.2.1.2.6 Pressure regulator and extractor—This unit may be of any suitable type which will remove oil and water from the air and which will control the pressure of the air delivered to the pressure flowmeter. The regulator and extractor unit is assembled between the shutoff valve and an adequate air source.

3.2.1.2.7 Pipe cleaners suitable for cleaning orifice of flowmeter.

3.2.1.2.8 Stopwatch or other timing device calibrated in seconds.

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

3.2.1.2.10 Connections 0.25 in pipe and fittings with standard pipe threads as are necessary for assembling equipment, as shown in Figure 1.

3.2.1.2.11 Mechanical convection oven capable of maintaining a temperature of ±2 F.

3.2.1.3 Procedure

3.2.1.3.1 Fill the clean and dry sealer cup equipped with specified orifice with the test material, allowing room for the plunger disc, and assemble the apparatus. Care should be taken to avoid air entrapment.

NOTE—Test material and equipment shall be maintained at a temperature of 77 ± 2 F during the test.

3.2.1.3.2 Adjust the air line pressure to the flowmeter as designated by the material standard and bleed until free of air. This should be done while the test material is passing through the pressure flowmeter or Severs Rheometer.

3.2.1.3.3 Close air line valve, place a paper on the balance pan under the flowmeter and bring balance to equilibrium. Add specified weight.

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

3.2.1.3.5 When the specified weight of the sealer has accumulated on the balance pan, stop the timer, close the air line valve, and open the pressure relief valve.

3.2.1.3.6 Report the viscosity of the material as the number of seconds required for a specified amount of the material to pass through the orifice at the specified pressure. (Note: Take the average of three readings.)

3.2.2 BROOKFIELD METHOD

3.2.2.1 *Application*—This procedure is to determine the viscosity of adhesives, deadeners, and thin body sealers. The viscosity is indicated by the resistance produced upon a spindle rotating at a definite speed while immersed in the material under test.

3.2.2.2 *Equipment*—Commercially available Brookfield Viscometer[1] (Figure 2).

FIGURE 2—BROOKFIELD VISCOMETER

3.2.2.3 *Procedure*—Test material and equipment shall be maintained at a temperature of 77 ± 2 F during the test.

3.2.2.3.1 Insert the specified spindle in a pint of test material, keeping the fluid's level below the immersion groove cut in the spindle shaft.

3.2.2.3.2 Attach spindle to the lower shaft.

3.2.2.3.3 Lower viscometer so that the groove cut in spindle shaft is flush with the fluid's level.

1. Available from Brookfield Engineering Laboratories, 240 Cushing St., Stoughton, Mass.

3.2.2.3.4 Level the viscometer and set viscometer speed at specified rpm.

3.2.2.3.5 Depress the clutch and turn on the viscometer motor. Release clutch and allow dial to rotate for 1 min. Take reading at this position. If the pointer has not stabilized at a fixed position after 1 min, the reading shall not be taken until the pointer has stabilized. The time shall then be recorded.

3.2.2.3.6 Using conversion table, convert to centipoise.

3.2.2.3.7 When reporting viscosity, the spindle, rpm, and viscometer and model number shall be indicated. Average of three readings.

3.2.3 MACMICHAEL METHOD—Used for measuring the viscosity of both Newtonian and non-Newtonian liquids such as sealers, adhesives, and deadeners. The viscosity is given in degrees MacMichael (M).

3.2.3.1 Equipment Required—A commercially available Fisher-MacMichael Viscometer[2] with sample cups, plungers, and different gage wires (Figure 3).

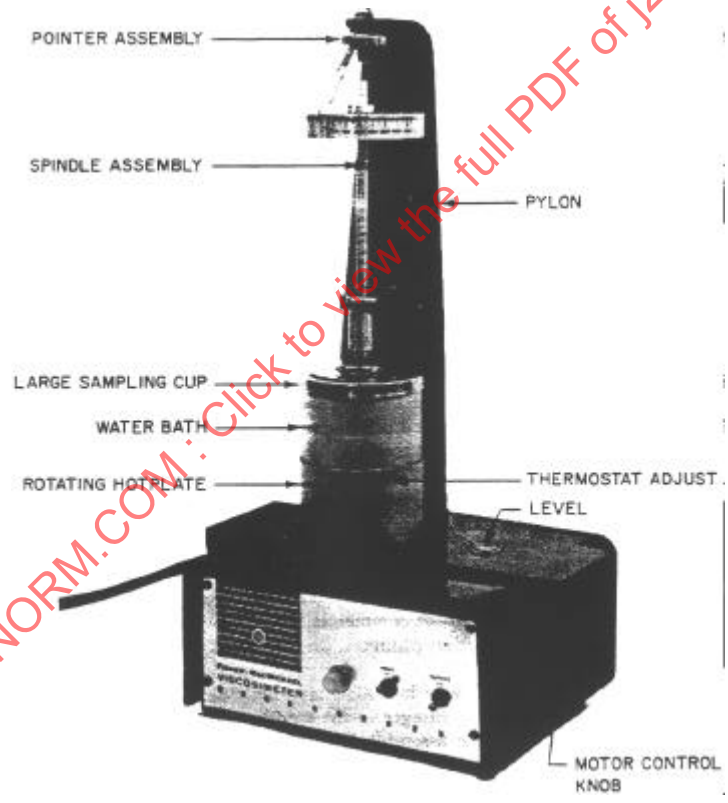

FIGURE 3—FISHER-MACMICHAEL VISCOMETER

2. Available from Fischer Scientific Co., 1458 N. Lamon Ave., Chicago, Illinois 60651.

3.2.3.2 Procedure

3.2.3.2.1 Insert specified wire in hollow spindle.

3.2.3.2.2 Attach specified plunger to the spindle.

3.2.3.2.3 Suspend spindle assembly from the pointer assembly support.

3.2.3.2.4 Level apparatus.

3.2.3.2.5 Zero the dial.

3.2.3.2.6 Lift spindle assembly off support.

3.2.3.2.7 Adjust hot plate rotation speed to rotational speed specified.

3.2.3.2.8 Adjust the sample temperature to temperature specified.

3.2.3.2.9 Fill specified clean sample cut (sample depth specified) and place on hot plate.

3.2.3.2.10 If test temperature is greater than 77 F, adjust thermostat to desired temperature.

3.2.3.2.11 Replace spindle.

3.2.3.2.12 Cover sample cup.

3.2.3.2.13 Check that sample is at desired temperature.

3.2.3.2.14 Take reading by turning on the rotate switch and read degrees M from the dial at point spindle becomes stationary or at specified time.

3.2.3.2.15 When reporting degrees M viscosity, the temperature of material, wire gage, plunger, hot plate rotational speed, sample cup size, and sample depth should be indicated.

3.2.4 FORD CUP METHOD—Particularly suited for measuring the viscosity of relatively thin adhesives, sealers, and deadeners. The viscosity is given in seconds and is the amount of time it takes for specific amounts of fluid material to pass through a known size orifice.

3.2.4.1 Equipment

3.2.4.1.1 Commercially available Ford Cups[3] (Figure 4).

3.2.4.1.2 Ring stand and ring for holding Ford Cup.

3.2.4.1.3 Timing device for measuring seconds.

3.2.4.2 Procedure—Test material and equipment shall be at a temperature of 77 ± 2 F during the test.

3.2.4.2.1 Holding finger over aperture, fill the specified clean cup and orifice with the material being tested.

3.2.4.2.2 Simultaneously remove finger from aperture and start timing device.

3. Available from Ford Viscosimeter Corp., 7730 W. Fort St., Detroit, Michigan 48209.

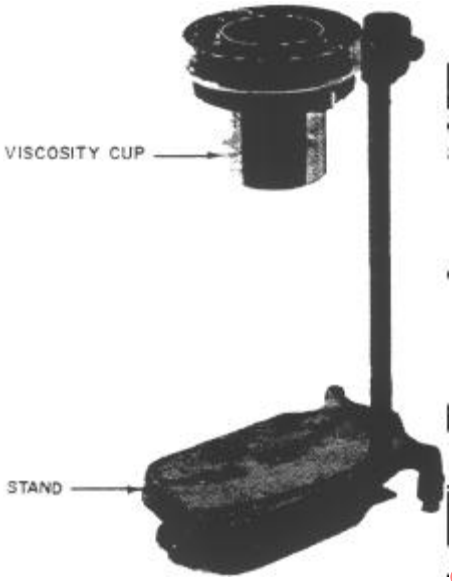

FIGURE 4—FORD CUP

3.2.4.2.3 When a break in the flow of material through the open aperture occurs or a specified amount of material has flowed, stop the timing device.

3.2.4.2.4 When reporting Ford viscosity, indicate the Ford Cup used.

3.2.5 PENETROMETER METHOD—This procedure is used to determine the viscosity of heavy bodied sealers and deadeners. Viscosity is a measure of depth of penetration of a cone or needle into a standard body of material.

3.2.5.1 Equipment Required

3.2.5.1.1 Commercially available universal penetrometer as described in ASTM D 217 or ASTM D 5, Test for Penetration of Bituminous Materials. (Figure 5).

3.2.5.1.2 Weights to place on loading bar.

3.2.5.1.3 Penetrating instrument (cone—ASTM D 217, needle—ASTM D 5).

3.2.5.1.4 Stopwatch.

3.2.5.1.5 Sample cup as specified.

3.2.5.2 Procedure—Test material and equipment shall be at 77 ± 2 F during the test.

3.2.5.2.1 Level penetrometer.

3.2.5.2.2 Insert specified penetrating instrument into chuck.

3.2.5.2.3 Set dial reading to zero.

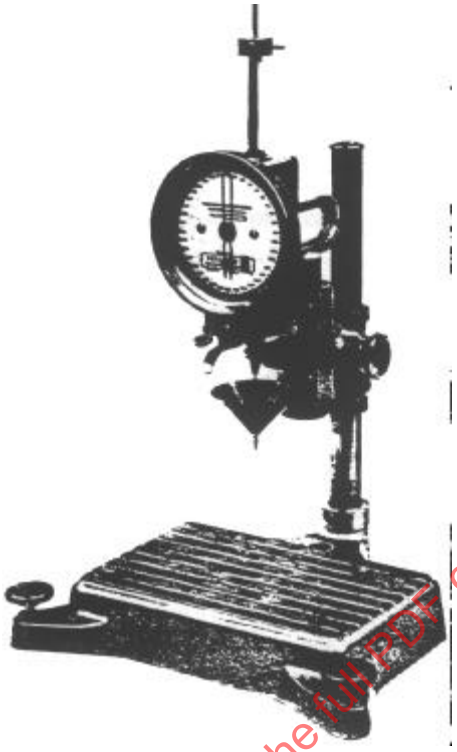

FIGURE 5—PENETROMETER

3.2.5.2.4 Add weights as required to loading bar to achieve specified load. (Load is the total weight of rod and penetrating instrument.)

3.2.5.2.5 Fill clean sample cup level full with test material, smooth surface, and place it in position centered under the penetrating instrument.

3.2.5.2.6 Adjust height so as to bring the point of the penetrating instrument exactly into contact with the smooth surface of the sample.

3.2.5.2.7 Release test rod by pushing the clutch trigger down and holding it down during specified time of the test.

3.2.5.2.8 At the end of the specified time, lock the test rod by releasing the clutch trigger.

3.2.5.2.9 Push down the depth gage rod as far as it will go and read the depth of penetration in tenths of millimeters.

3.2.5.2.10 When reporting penetrometer viscosity, indicate the load, penetration time, and cup size (average of three samples).

3.2.6 GARDNER MOBILOMETER METHOD—This method is used for determining the viscosity of adhesives and "thin" bodied sealers. Viscosity is expressed as the time in seconds for a standard plunger assembly (disc, piston rod, weight pan), loaded or unloaded, to fall through 10 cm of the test product.

3.2.6.1 Equipment

3.2.6.1.1 Commercially available regular Gardner Mobilometer[4] with 51-hole disc, solid disc, and 4-hole disc (Figure 6).

FIGURE 6—REGULAR GARDNER MOBILOMETER

3.2.6.1.2 Weights—Various gram amounts in 50 g increments.

3.2.6.1.3 Timing device for measuring seconds.

3.2.6.2 Procedure—Test material and equipment shall be maintained at a temperature of 77 ± 2 F during the test.

3.2.6.2.1 Fill clean cylinder to a depth of 20 cm with material to be tested.

3.2.6.2.2 Level instrument.

3.2.6.2.3 Attach collar bracket cylinder so top of collar bracket is 4 in down from top of cylinder.

3.2.6.2.4 Place piston rod through piston guide and attach specified disc to piston rod.

3.2.6.2.5 Lower disc into material until lowest mark on the piston rod is flush with the top of the piston guide. (If there is only two marks on piston rod, lower the piston rod into the material until the bottom mark is 1/2 in above the piston guide top.)

4. Gardner Laboratory, Inc., P.O. Box 5728, Bethesda, Maryland 20014.

3.2.6.2.6 If a load is called for, add weights to weight pan to give specified load. By definition, load shall be considered zero if there is no weights added to the weight pan.

3.2.6.2.7 Release piston rod and start timer when second lowest mark reaches top of piston guide. (If there is only two marks on piston rod, start timer when bottom mark reaches top of piston guide.)

3.2.6.2.8 Stop timer when the last mark reaches the top of the piston guide and report viscosity.

3.2.6.2.9 When reporting Gardner viscosity, indicate the disc used and the load applied.

4. ADS-2—Low Temperature Tests

4.1 Method A (Impact Test)—This procedure is used to determine the adhesion properties of sealers when subjected to an impact at a low temperature.

4.1.1 EQUIPMENT REQUIRED

4.1.1.1 Slam fixture capable of delivering a uniform impact to the test panel. See Figure 7.

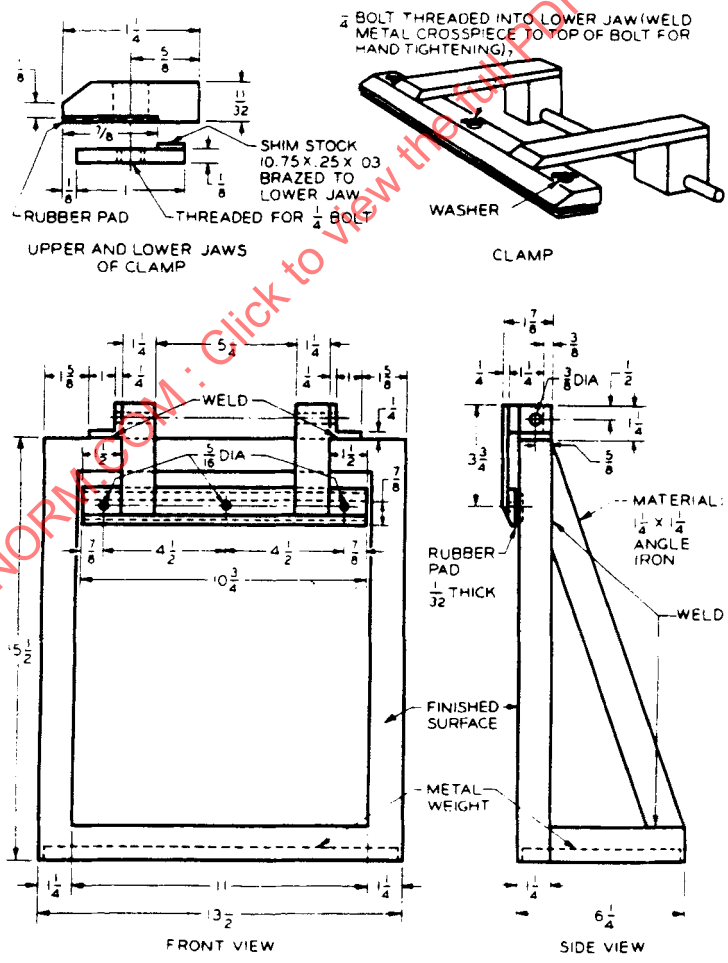

FIGURE 7—DETAILED VIEW OF SLAMMING FIXTURE FOR COLD ADHESION TEST

4.1.1.2 Cold box capable of maintaining a temperature of –40 ± 2 F.

4.1.1.3 Circulating air oven capable of maintaining temperatures up to 400 ± 2 F.

4.1.1.4 Analytical balance accurate to 1 mg.

4.1.1.5 *Metal panels*—12 x 12 x 0.036 in cold rolled, low carbon body stock steel, primed or painted as specified.

4.1.1.6 Draw down fixture with opening made to produce the bead size specified.

4.1.2 GENERAL PROCEDURE

4.1.2.1 Samples shall be mixed or otherwise treated as specified before applying.

4.1.2.2 Weigh panel and prepare as specified and record weight.

4.1.2.3 A size bead or ribbon of metal as specified shall be applied to the panel.

4.1.2.4 The applied bead or ribbon of material shall be conditioned, that is, air dried or baked for the time and temperature specified.

4.1.2.5 Weigh test panel and cured material and record weight.

4.1.2.6 Place the panels and specified slam fixture in the cold box for the time and temperature specified.

4.1.2.7 Insert the test panel in the slam fixture with sealer facing out and in the vertical position. Raise panel to a horizontal position. Release panel and allow it to slam against the test fixture. The number of slams to be as specified.

4.1.2.8 Inspect for loss of adhesion and remove loose material; calculate weight of material loss and record results as percent loss of adhesion.

4.2 Method B (Bend Test)—This procedure is used to determine the adhesion properties of seals when bent around a mandrel.

4.2.1 EQUIPMENT REQUIRED

4.2.1.1 Steel mandrel of size diameter as specified.

4.2.1.2 Aluminum foil 0.001–0.003 in thick.

4.2.1.3 Cold box capable of maintaining a temperature of –40 ± 2 F.

4.2.1.4 Circulating air oven capable of maintaining temperatures up to 400 ± 2 F.

4.2.1.5 Draw down fixture with opening made to produce the bead size specified.

4.2.2 GENERAL PROCEDURE

4.2.2.1 Samples shall be mixed or treated as specified.

4.2.2.2 Aluminum foil shall be prepared as specified.

4.2.2.3 A size bead or ribbon of material as specified shall be applied to the aluminum foil.

4.2.2.4 The applied bead or ribbon of material shall be conditioned, that is, air dried or baked for the time and temperature specified.

4.2.2.5 Place the aluminum foil and the mandrel in the cold box for the time and temperature specified.

4.2.2.6 While at the test temperature, wrap the aluminum foil 180 deg around the mandrel.

4.2.2.7 Inspect for cracking and loss of adhesion. Record number and size of cracks and loss of adhesion.

5. ADS-3—Weld-Through Tests

5.1 Scope—These tests are used to determine acceptability of weld-through sealers.

5.2 Method A

5.2.1 EQUIPMENT AND SUPPLIES

5.2.1.1 Single point spot welder with low inertia head, transformer tap setting of 4.5 V.

5.2.1.2 Two WA 2510 spot welding electrodes with 1/4 in diameter face and a 45 deg truncated cone.

5.2.1.3 A galvanometer-type oscillograph for recording sine wave of the secondary current.

5.2.1.4 A mechanical convection oven capable of maintaining 130 ± 2 F.

5.2.1.5 Test coupons 1 x 3 x 0.036 in cold rolled, low carbon, open hearth steel, free from burrs or ragged edges that might provide a shunt path for welding current.

5.2.2 WELDING SCHEDULE

5.2.2.1 Electrode force: 550 lb.

5.2.2.2 Weld time: 9 cycles.

5.2.2.3 Secondary amperes: 11,000 A.

5.2.2.4 Secondary current time: Full sine wave starting at 0 deg point on first half cycle.

5.2.3 PROCEDURE—Weld-through characteristics shall be tested in two groups. Each group shall be tested using 25 sets of test coupons with sealer. Bare test coupons shall be welded at the start and finish of the test.

5.2.3.1 Prepare 50 coupon assemblies with 1 x 0.093 ± 0.015 in of sealer, as shown in Figure 8.

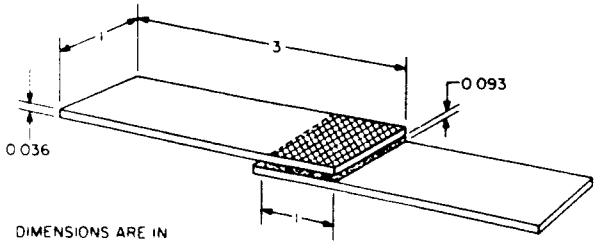

FIGURE 8—COUPON ASSEMBLIES WITH SEALER

5.2.3.2 Age 25 of the assemblies for 30 d at 72 ± 5 F (group 1).

5.2.3.3 Condition 25 assemblies for 72 h at 130 ± 2 F in a mechanical convection oven (group 2).

5.2.3.4 Verify the above specified weld schedule on a set of bare coupons.

5.2.3.5 Make 25 successive welds on the oven-aged coupons (group 2), one weld for each set of coupons through a bead of sealer. Exercise care to assure that the weld is directly through the sealer material. After each weld, examine the sine wave trace. Acceptable materials must show 90% of full welding current on or before the second half cycle of all welds. The height of the sine wave obtained in welding bare steel of the same thickness shall indicate full welding current.

5.2.3.6 Repeat the welding test on the 25 sets of coupons which were aged for 30 d (group 1), and examine the sine wave trace. Acceptable materials must show 90% of full welding current on or before the second half cycle of all welds.

5.2.3.7 During the above welding tests, the sealer shall show no tendency to ignite. There shall be no fouling of the spot welder points if the sealer is in direct contact.

5.2.3.8 Repeat the verification of the specified weld schedule on a set of bare coupons.

5.2.3.9 All welds must tear the metal when the "sealer-prepared" and "bare" welded panels are pulled in a tensile shear testing machine.

5.2.3.10 Measure the diameter of the weld buttons on the destructed shear strength panels after separating them with a chisel.

5.2.3.11 The material shall flow back around the weld to form a complete seal. Test method: Drill the spot welds from five panels of each of the two groups tested and visually observe for flowback.

5.3 Method B

5.3.1 EQUIPMENT AND SUPPLIES

5.3.1.1 A press type stationary spot welder.

5.3.1.2 Two water-cooled electrodes with 5/8 in diameter shank having a 45 deg truncated cone with a 1/4 in diameter welding face.

5.3.1.3 Test coupons of flat, cold rolled steel free from edge burrs and rust. Size 1 x 4 x 0.035 in and 4 x 24 x 0.035 in

5.3.1.4 Suitable tensile test machine.

5.3.1.5 Locating fixture (Figures 9A and 9B).

5.3.1.6 Notched spreader bar to give 1/32 in effective film thickness.

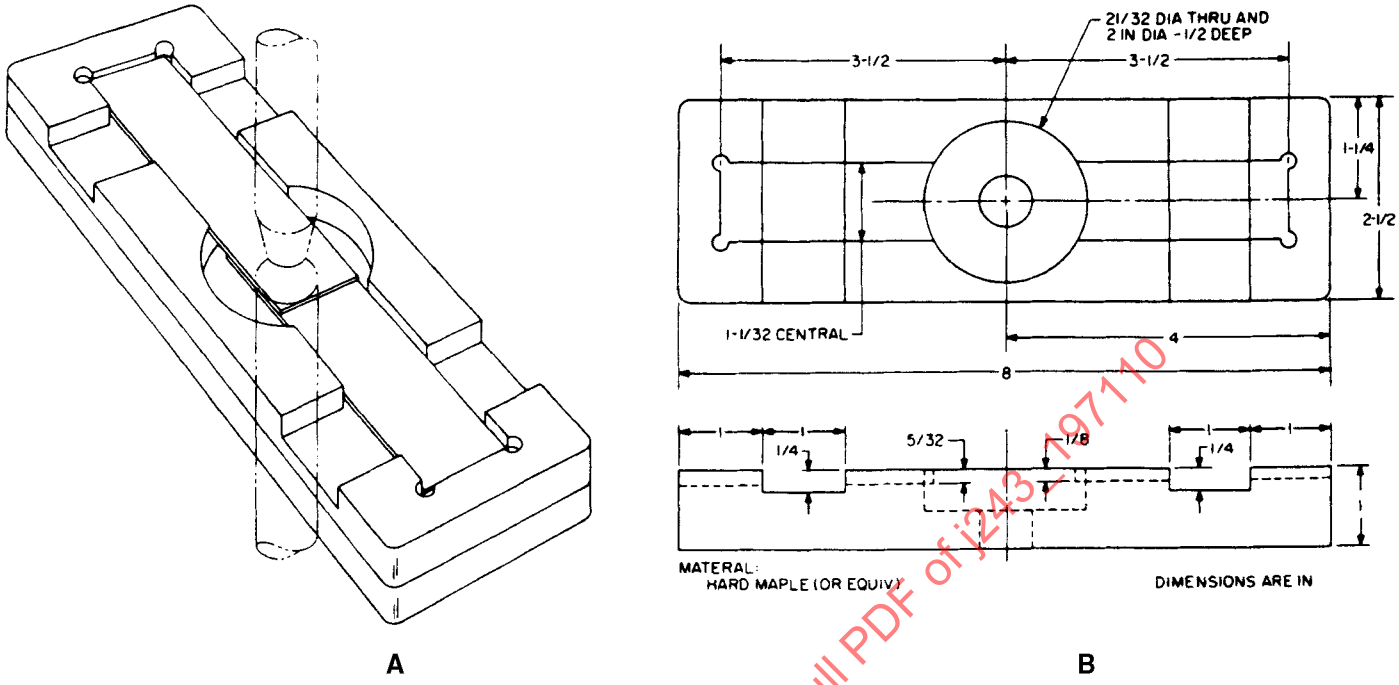

FIGURE 9—LOCATING FIXTURE

5.3.2 WELDING SCHEDULE

5.3.2.1 Electrode force: 500 lb.

5.3.2.2 Weld time: 5 cycles.

5.3.2.3 Weld current: 9500–10,500 A.

5.3.3 PROCEDURE

5.3.3.1 Flat weld 1 x 4 x 0.035 in coupons without sealer to determine if proper weld is being obtained. Pull in tensile tester to check tensile shear.

5.3.3.2 *Weldability At Various Drying Times*—Condition sealer sample to 77 ± 2 F before testing.

Using 1 x 4 in cold rolled steel test panels (Figure 10), apply the spot weld sealer with the notched spreader bar to only one coupon of the weld sample. Material will spread under pressure to form uniform coating of approximately 1/32 in thickness. Weld samples using the following drying times after application:

a. 0 h.
b. 24 h—If not weldable at this drying time, recheck to find limit of drying time relative to weldability.
c. 48 h.
d. 72 h.
e. 96 h.

Weld coupons so that the applied material is in the 1 in lap joint and with a single spot weld in the center of the lap area (Figure 10). Use the locating jig for locating coupons to insure accurate alignment. (See Figures 9A and 9B.) Three welding samples are required for each test.

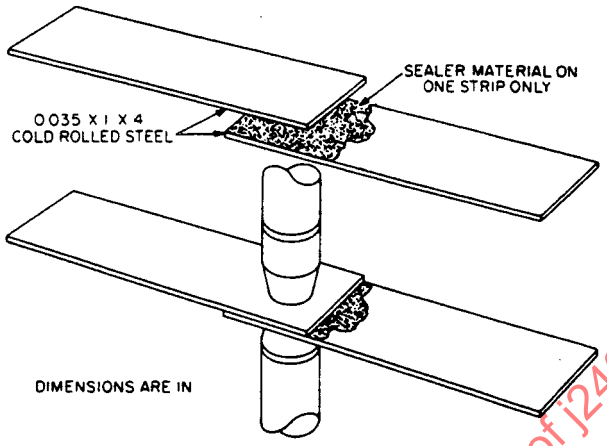

FIGURE 10—WELDABILITY TEST

Weld samples are to be pulled on a tensile test machine. Samples should yield a plug-type failure and a minimum tensile strength of 650 lb.

5.3.3.3 *Effect of Material Upon Weldability and Electrode Life*—Use same equipment as listed in paragraph 5.3.1.

5.3.3.3.1 Application of Materials—Use same procedure as outlined in paragraph 5.3.3.2.

Weld a strip sample 4 x 24 in immediately after application so that the material, applied to only one strip of the sample, contacts the movable electrode (Figure 11) and note:

a. Flashing.
b. Effect on electrode life.
c. Amount of electrode pickup.
d. Effect of electrode pickup on weldability.

Welds should be at a 1/2 in (approximately) spot spacing. Speed of operation: 100 spots/min, repetitive welds to a minimum of 800 welds.

Chisel test the welded strip and examine the sample for weld quality.

Note burn-out condition of material around weld nugget.

Do not redress the electrodes during this test. This test is to be continued until additional welding is considered impractical because of one of the four factors listed above.

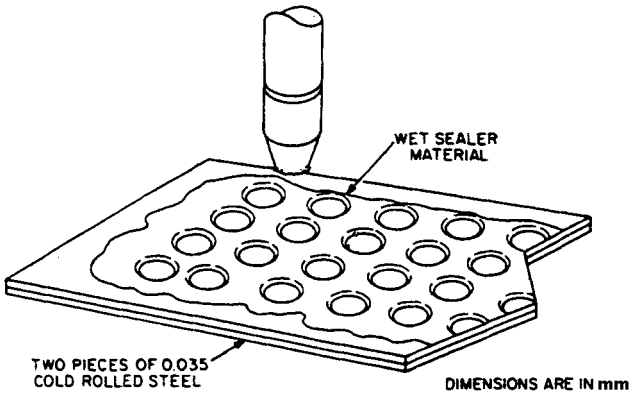

FIGURE 11—TIP FOULING TEST

Additional welding is considered impractical when any one of these factors exists to such a degree that:

a. Flashing is an operator hazard.
b. The electrode sticks to the work.
c. An insulating coating forms on the electrode face prohibiting the flow of welding current.
d. The tensile strength of the welds falls below the 650 lb minimum.

Several trials should be made in order to permit a more accurate evaluation of results.

5.3.3.4 *Reported Results*—Figure 12 shows a suggested report form.

5.4 Method C

5.4.1 EQUIPMENT AND SUPPLIES

5.4.1.1 150 KVA gun type spot welder.

5.4.1.2 Two water-cooled 5/8 in diameter electrodes with 45 deg truncated cone and 1/4 in diameter welding tip.

5.4.1.3 Panels, 1.5 x 36 x 0.035 in and 4 x 12 x 0.035 in clean, flat, cold rolled steel free from all edge burrs.

5.4.1.4 Spreader bar to coat film 1.25 in wide and 1/32 in thick.

5.4.2 WELDING SCHEDULE

5.4.2.1 Electrode force: 600 lb.

5.4.2.2 Weld time: 8 cycles.

5.4.2.3 Weld current: 9500–12,000 A.

5.4.3 PROCEDURE

5.4.3.1 *Weld-through Performance*

5.4.3.1.1 Make a test weld through two pieces of 0.035 in thick steel with no sealer.

WELD TEST DATA SHEET FOR PRIMERS, SEALERS, AND COATED STEELS

MANUFACTURER'S NAME _____ NO. _____
TYPE OF MATERIAL _____
FISHER SPECIFICATION NO. _____ DATE _____
DEPARTMENTAL IDENTIFYING NO. _____

CURRENT: 9500 - 10,500 A
WELD TIME: 5 CYCLES
STOCK SIZE: 20 GAGE (0.035)

ELECTRODE FORCE - 500 LB
ELECTRODE TIP DIA - 1/4 IN - FLAT (UPPER AND LOWER)

TEST 1 - WELDABILITY AT VARIOUS DRYING TIMES WITH MATERIAL APPLIED BETWEEN WELD JOINT.						
SAMPLE NUMBER	TYPE OF FAILURE		SHEAR STRENGTH, LB	PLUG DIA	DRYING TIME, H	REMARKS
	PLUG	SHEAR				
1-0					0	
2-0					0	
3-0					0	
1-24					24	
2-24					24	
3-24					24	
1-48					48	
2-48					48	
3-48					48	
1-72					72	
2-72					72	
3-72					72	
1-96					96	
2-96					96	
3-96					96	
COMPARISON SAMPLES - UNCOATED METAL						
1	X				--	
2	X				--	
3	X				--	

TEST 2 - EFFECT OF MATERIAL UPON WELDABILITY AND ELECTRODE LIFE WHEN APPLIED TO THE OUTER SURFACE OF A SAMPLE IN CONTACT WITH MOVABLE ELECTRODE. SPEED OF OPERATION - 100-200 SPOTS/MIN				
TRIAL NUMBER	FLASHING	EFFECT ON ELECTRODE	NUMBER OF CONTINUOUS SPOT WELDS	REMARKS
1				
2				
3				
4				
5				

COMMENTS:

FIGURE 12—WELD TEST DATA SHEET FOR PRIMERS, SEALERS, AND COATED STEELS

5.4.3.1.2 Mix sealer sample thoroughly prior to application.

5.4.3.1.3 Apply 1/8 in diameter x 8 in long bead along center of 4 x 12 in panel.

5.4.3.1.4 Within 1 h cover bead with a second 4 x 12 in panel.

5.4.3.1.5 Immediately spot weld the assembly directly through the sealer.

5.4.3.1.6 Weld nugget should be 0.16 in in diameter. Make a sharp 45 deg angle bend at the weld. If failure occurs, a hole at least equal to the diameter of the weld must be pulled from one of the sheets.

5.4.3.1.7 Repeat steps 5.4.3.1.4–5.4.3.1.6 after aging prepared panel samples 1 week at room temperature (78 ± 2 F).

5.4.3.2 Electrode Fouling

5.4.3.2.1 Use the spreader bar to apply a film 1.25 in wide and 1/32 in thick the entire length of two 1.5 x 36 in strips.

5.4.3.2.2 Place a second 1.5 x 36 in strip in back of each of the coated strips leaving the sealer exposed.

5.4.3.2.3 Within 1 h after coating, weld the strips together, bringing one electrode in direct contact with the sealer.

5.4.3.2.4 Place 2 rows of welds on the strips, 50 in each row on the constructions, for a total of 200 welds. Do not adjust or dress the electrodes during this test.

5.4.3.2.5 Weld at the rate of 60 welds/min with a 30 s cooling period between each group of 25 welds.

5.4.3.2.6 During this test observe any electrode sticking, corrosion, or excessive degraded sealer building up on the electrode face. This buildup will act as an insulator, resulting in extreme deterioration or complete stoppage of the weld.

5.4.3.2.7 Welds should pass the test outlined in paragraph 5.4.3.1.6.

6. ADS-4—Enamel, Lacquer, And Fabric Staining Test

6.1 Application—The methods A and B outlined in this section are the two general procedures used for determining the staining effects of sealers and adhesives materials on or under painted finishes or fabrics. The equipment suggested in paragraph 6.2.2 are examples of that most generally used by the industry. The procedure and equipment used for this test are predicated on the application and are subject to agreement by the supplier and user.

6.2 Equipment and Materials Required

6.2.1 Phosphatized, primed, enameled, lacquered panels or plastics or specified fabrics.

6.2.2 Groven Fluorescent (F-20) UV Cabinet, S-1 Sunlamp Cabinet, Standard Weather-Ometer, or Fade-Ometer.

6.3 Procedure

6.3.1 METHOD A—ADHESIVE OR SEALANT APPLIED PRIOR TO PAINT BAKE CYCLE

6.3.1.1 Apply a specified amount of the material under test onto the specified test sample or panel.

6.3.1.2 Condition test assembly at specified time and temperature before exposure.

6.3.1.3 Paint and bake the assembly according to the user's regular paint operation using a light-colored, currently released production enamel or lacquer.

6.3.1.4 Expose the test panel assembly or fabric in a Groven Fluorescent UV Cabinet, S-1 Sunlamp Cabinet, Standard Weather-Ometer, or Fade-Ometer at a specified distance from the light source and at a specified temperature and cycle for a length of time, as indicated on the engineering drawing and/or material specification.

6.3.1.5 Examine for contact and/or migration stains.

6.3.2 METHOD B—ADHESIVE OR SEALANT APPLIED AFTER PAINT BAKE CYCLE

6.3.2.1 Paint and bake test assembly according to the user's regular paint operation using a light-colored, currently released production enamel or lacquer.

6.3.2.2 Apply a specified amount of the material under test onto the specified test sample or panel.

6.3.2.3 Condition test assembly at specified time and temperature before exposure.

6.3.2.4 Expose the test panel assembly or fabric in a Groven Fluorescent UV Cabinet, S-1 Sunlamp Cabinet, Standard Weather-Ometer, or Fade-Ometer at a specified distance from the light source and at a specified temperature and cycle for a length of time, as indicated on the engineering drawing and/or material specification.

6.3.2.5 Examine for contact and/or migration stains.

7. ADS-5—Wash-off Resistance Test

7.1 Application—This procedure is used to determine the resistance of automotive sealer, deadeners, and adhesives to wash-off during rinsing and phosphatizing operations.

7.1.1 EQUIPMENT REQUIRED—See Figure 13.

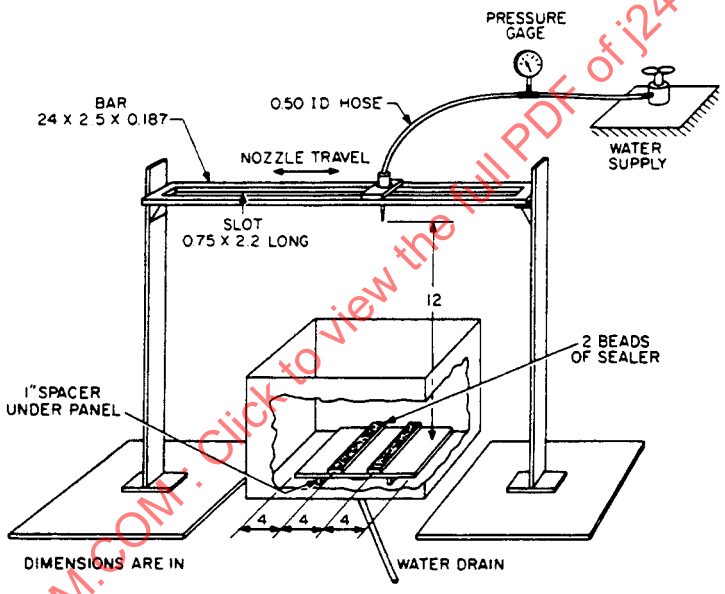

FIGURE 13—WASH-OFF RESISTANCE TEST

7.1.1.1 Cold rolled, low carbon steel body stock panels 12 x 12 in,in 20 gage.

7.1.1.2 Light paraffinic oil having the following properties:

Viscosity SUS at 100 F: 70–100 s
Flash COC: 300 F min.
Pour point: 30 F min.

7.1.1.3 *Nozzle*—Spraying System No. 1/2 GG-25 full jet or as specified on material standard.

7.1.1.4 Water supply capable of maintaining 160 F and a pressure of 20 psi.

7.1.1.5 Burette graduated in 0.1 cc.

7.1.1.6 Rubber hose 1/2 in ID of adequate lengths to connect water supply outlet with nozzle.

7.1.1.7 Pressure gage with minimum dial diameter of 3.5 in graduated in 1 lb increments and having a 60 psi range.

7.1.1.8 Metal bar 24 x 2.5 x 0.187 in with opening of 0.750 x 22.0 in cut out of center. This is used for a guide for the nozzle during testing.

7.1.2 PROCEDURE: A HORIZONTAL WASH

7.1.2.1 Clean the panels by washing with aliphatic hydrocarbon solvent having a boiling range between 200 and 300 F. (Solvents commonly known as VM&P meet this requirement.) Dry the panels with a lint-free cloth.

7.1.2.2 From a burette apply 0.5 cc of oil to a clean test panel and distribute evenly over the surface by rubbing with two finger tips.

7.1.2.3 Apply two equally spaced beads or ribbons of material to the panel, using the size of bead or ribbon specified in the material standard.

7.1.2.4 Air dry for the period of time specified on the material standards.

7.1.2.5 Refer to Figure 13. Assemble the hose, nozzle, and gage and connect to the water supply. Adjust the water temperature to 135 ± 5 F and the throughput for 1 gal per 20 s or as specified on material standard. Record the pressure required for the desired throughput. Subsequent tests using this equipment can be run at this pressure setting without rechecking volume of flow.

7.1.2.6 Place the panel horizontal with a minimum clearance of 1.0 in between the panel and the bottom of the sink or reservoir to allow the spray water to drain out without accumulating over the panel and giving erroneous test results.

7.1.2.7 Position the nozzle guide directly above the center of the panel so that the nozzle tip is 12.0 in above the test panel and so that the long axis of the guide is at a 90 deg angle with the long axis of the ribbon or bead of material.

7.1.2.8 Place the nozzle on top of the guide so that the spray of water is through the cutout section of the guide and move the nozzle back and forth across the guide in such a manner that the spray of water crosses the panel each 2 s.

7.1.2.9 Visually examine the material for wash-off and displacement. Record the results.

8. ADS-7—Solids Test

8.1 Method A (Fixed Time)—This procedure is used for determining the solid content of adhesives, sealers, and deadeners containing organic solvents.

8.1.1 EQUIPMENT REQUIRED

8.1.1.1 Low form weighing bottle, Fisher Model 3-420 or equivalent.

8.1.1.2 Circulating air oven capable of maintaining temperatures between 70–150 C ± 2% (158–302 F ± 2%).

8.1.1.3 Desiccator, with drying agent and tray.

8.1.1.4 Analytical balance, accurate to 1 mg.

8.1.1.5 Spatula, square-tipped blade.

8.1.2 PROCEDURE

8.1.2.1 Weigh bottle and cover to nearest milligram. Record weight.

8.1.2.2 Mix sample thoroughly using square-tipped spatula. Care should be taken to avoid entrapment of air and/or loss of solids.

8.1.2.3 Transfer 5–10 g (or other specified weight) of the material into the tared bottle, cover and weigh to nearest milligram. Record weight.

8.1.2.4 Place cover and uncovered bottle containing the sample in the oven at 215 ± 5 F for 3 h unless otherwise specified.

8.1.2.5 Remove bottle containing the residue and cover from the oven and immediately place in the desiccator. Allow to cool at room temperature for 3 h minimum.

8.1.2.6 Weigh the covered bottle with the residue to nearest milligram. Record weight.

8.1.2.7 Subtract the weight of bottle and cover as determined in step 8.1.2.1 from the weight recorded in steps 8.1.2.3 and 8.1.2.6.

8.1.2.8 Calculate percent solids, and record the results.

$$\frac{\text{Weight (step 8.1.2.6)} - \text{Weight (step 8.1.2.1)}}{\text{Weight (step 8.1.2.3)} - \text{Weight (step 8.1.2.1)}} \times 100 = \%\ \text{solids} \qquad \text{(Eq. 1)}$$

8.2 Method B (Solids to Constant Weight)—This procedure is used to determine the solid content of adhesives, sealers, and deadeners containing organic solvents. Reference: ASTM D 553, Standard Method of Test for Viscosity and Total Solids Content of Rubber Cements.

8.2.1 EQUIPMENT REQUIRED

8.2.1.1 Low form weighing bottle, Fisher Model 3-402 or equivalent.

8.2.1.2 Circulating air oven capable of maintaining temperatures between 70–150 C ± 2% (158–302 F ± 2%).

8.2.1.3 Desiccator, with drying agent and tray.

8.2.1.4 Analytical balance, accurate to 1 mg.

8.2.1.5 Spatula, square-tipped blade.

8.2.2 PROCEDURE

8.2.2.1 Weigh bottle and cover to nearest milligram. Record weight.

8.2.2.2 Mix sample thoroughly using square-tipped spatula.

8.2.2.3 Transfer 5–10 g or other specified weights of the material into the tared bottle, cover and weigh to nearest milligram. Record weight.

8.2.2.4 Place cover and uncovered bottle containing the sample in the oven at 215 ± 5 F for 3 h unless otherwise specified.

8.2.2.5 Remove bottle containing the residue and cover from the oven and immediately place in the desiccator. Allow to cool to room temperature for 3 h minimum at 73–78 F.

8.2.2.6 Weigh the covered bottle with the residue to nearest milligram. Record weight.

8.2.2.7 Repeat steps 8.2.2.4, 8.2.2.5, and 8.2.2.6 until a constant weight is obtained.

8.2.2.8 Subtract the weight of bottle and cover as determined in step 8.2.2.1 from the weights recorded in steps 8.2.2.3 and 8.2.2.7.

8.2.2.9 Calculate percent solids:

$$\frac{\text{Weight (step 8.2.2.7)} - \text{Weight (step 8.2.2.1)}}{\text{Weight (step 8.2.2.3)} - \text{Weight (step 8.2.2.1)}} \times 100 = \% \text{ solids} \qquad \text{(Eq. 2)}$$

8.3 Method C (ASTM D 1582)—This method is suitable for determining the nonvolatile content phenol, resorcinol, and melamine adhesives, with or without hardener and containing high boiling and low boiling volatile organic solvents and water, or both.

Procedure reference: ASTM D 1582, Standard Method of Test of Non-Volatile Content of Phenol, Resorcinol and Melamine Adhesives.

9. ADS-8—Flash Point Test

9.1 Method A (Pensky Marten's Closed Cup Method)—This procedure is used to determine the flash point of fuel oils as well as viscous materials and suspensions of solids.

Reference: ASTM D 93, Standard Method of Test for Flash Point by Pensky-Martin's Closed Tester. (See note in paragraph 7 of this test for use with materials having solids in suspension.)

9.2 Method B (Tag Open Cup Method)—This method covers procedures for the determination of flash points of liquids having flash points between O and 235 F. This method, when applied to paints and resin solutions which tend to skin over or which are very viscous, gives less reproducible results than when applied to solvents.

Reference: ASTM D 1310, Standard Method of Test for Flash Point of Volatile Flammable Materials by Tag Open Cup Apparatus.

10. ADS-9—Sag And Bridging Tests

10.1 Application—These tests are used to determine the ability of the material to remain in position and bridge gaps.

10.1.1 EQUIPMENT REQUIRED

10.1.1.1 Circulating air oven capable of maintaining temperatures up to 400 ± 5 F.

10.1.1.2 50 ml burette graduated in 1 ml.

10.1.1.3 Light paraffine oil having the following properties:

Viscosity SUS at 100 F: 70–100 s
Flash COC: 300 F minimum
Pour point: 30 F minimum

10.1.1.4 Metal panels 12 x 12 in, 20 gage cold rolled, low carbon steel.

10.1.1.4.1 Phosphatized panels[5] as specified.

10.1.1.4.2 Oiled panels. Clean the panels by first wiping with VM&P naphtha and then dry with a lint-free cloth. Apply 0.5 cc of oil from the burette and distribute it evenly on the surface by rubbing with two finger tips.

10.1.1.4.3 Painted panels to be prepared as specified by customer.

10.1.1.5 Draw down fixture. These are made in a "U" configuration as shown on Figure 14 (flow type), part A with the opening made to give the bead size specified.

10.1.2 GENERAL PROCEDURE—Samples shall be mixed or otherwise treated as specified by the customer before applying.

10.2 Sag Tests

10.2.1 METHOD A (INVERTED BRAKE TEST)

10.2.1.1 Apply a prescribed size bead or ribbon of material to a panel treated as specified.

10.2.1.2 Invert panel and air dry at room temperature (material on under side of panel) for 15 min or as specified. Examine at the end of the exposure period and record the results.

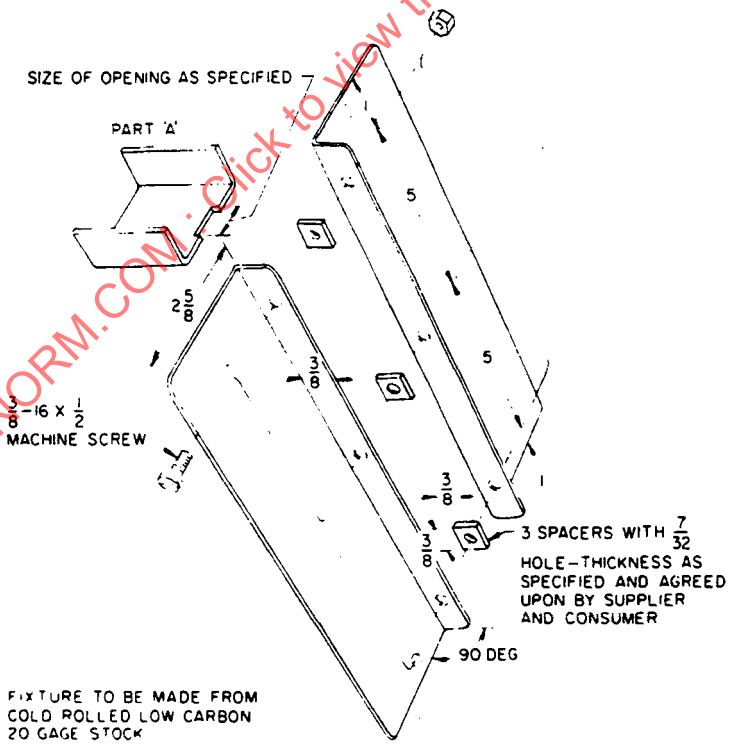

FIGURE 14—DRAW DOWN FIXTURE (FLOW-TYPE MATERIALS)

5. Phosphatized panels are commercially available from: Q-Panel Co., 15610 Industrial Parkway, Cleveland, Ohio; or Parker Rust Proof Co., Division of Hooker Chemical Corp., 2177 E. Milwaukee Avenue, Detroit, Michigan 48211.

10.2.1.3 Bake in the inverted position for specified time and temperature.

10.2.1.4 Cool to room temperature and examine and record the results.

10.2.2 METHOD B (HORIZONTAL AND VERTICAL BAKE TEST)

10.2.2.1 Apply two prescribed size ribbons or beads of material, equally spaced on two panels. The panels are to be of the size and surface treatment as specified.

10.2.2.2 Mark the position of the ribbons or beads.

10.2.2.3 Place one panel in a vertical position, with the ribbon(s) or bead(s) horizontal. Place one panel in a vertical position with the ribbon(s) or bead(s) vertical.

10.2.2.4 Air dry at 73–78 F for 15 min or as specified.

10.2.2.5 Heat cure panels at specified time and temperature, in above position and protect from direct air flow if specified.

10.2.2.6 Remove from oven and measure the amount of sag or slump by measuring from the bottom of the curved material to the marked bottom edge of the original bead or ribbon. Record the results.

10.3 Bridging Tests

10.3.1 EQUIPMENT—See Figure 14.

10.3.2 METHOD C (COACH JOINT TEST)

10.3.2.1 Clamp the two steel panels together to form a coach joint.

10.3.2.2 Drill three 1/4 in diameter aligning holes in the flanges.

10.3.2.3 Assemble the panels to form a coach joint, using the three spacers to give the opening specified. See Figure 14.

10.3.2.4 Apply a uniform ribbon or bead of material over the gap of the assembled coach joint. The ribbon or bead shall be of the size specified.

10.3.2.5 Keep the assembly and material horizontal for the specified time at room temperature.

10.3.2.6 Measure the depth to which the material has slumped and record. The measurement from the top of the material bead or ribbon at the time of application.

10.3.2.7 Place the assembly, in a horizontal position, in the oven for the specified time(s) and temperature(s).

10.3.2.8 Cool to room temperature.

10.3.2.9 Measure the depth the sealer has slumped and record.

10.3.3 METHOD D (METAL PERFORATION)

10.3.3.1 Extrude a 1/2 in diameter bead of material lengthwise over the centerline of the holes of the specified bridging test fixture, as shown in Figures 15 and 16.