

**RHEOLOGICAL TESTING FOR DETERMINING THE VISCOSITY OF ADHESIVES AND SEALERS****Application**

This method is used to evaluate the viscosity of adhesives and sealers as a function of shear rate. Such properties help to optimize the processing of these materials throughout the manufacturing process, particularly in the flow of these materials through the dispensing system, from the pump to the nozzle.

Apparatus Required**Rheometer**

An extrusion rheometer, equipped with an orifice of 0.32 cm diameter and at least 3.2 cm length. The rheometer should be capable of determining the rheological properties of substances that will flow at room temperature with the application of pressure from 0 to 100 psi, in a viscosity range of 1 to 1 million centipoises.

For example, Burrell Severs Model A120 Rheometer equipped with an orifice of 0.32 cm inner diameter and 5 cm length, and a sample cylinder of 4 cm inner diameter and 29.5 cm length. (Figure 1)

Temperature Control Devices

- (a) An oven capable of achieving a temperature range of 100 – 125 °F +/- 2 °F
- (b) A refrigerator or freezer capable of achieving a temperature of 54 °F +/- 2 °F

Miscellaneous

- (a) Balance to make weight measurements
- (b) Thermocouple or similar device to make temperature measurements. For example, Omega Thermocouple Probe machined into rheometer sample cylinder, to measure material temperature (Figure 1)
- (c) Paper cups
- (d) Stopwatch

Materials Required**Adhesive/Sealer**

Adhesives and sealers (Ford specifications WSB-M4G60-B4, WSB-M4G348-A/A2, WSS-M4G348-A3/A4 and WSB-M2G388-A) will be tested according to this test method.

Conditioning and Test Conditions

All test values indicated herein are based on material conditioned in a controlled atmosphere of 23 +/- 2 °C and 50 +/- 5% relative humidity for not less than 24 h prior to testing. Materials will be tested at 23 °C unless otherwise stated.

Date	Action	Revisions
2005 03 08	Activated	

**Procedure**

1. Load material into rheometer and attach orifice of 0.32 cm diameter. Fill the orifice with material by applying a small amount of pressure.
2. Three different tests should be run under the following conditions:
 - a. Test One: Room Temperature Testing -- 23 – 25 °C (73 – 77 °F)
 1. Extrude material through orifice into a paper cup, for 1 minute, at the following pressures:
 - a. 5 psi
 - b. 10 psi
 - c. 20 psi
 - d. 30 psi
 - e. 50 psi
 - f. 70 psi
 - g. 90 psi
 2. For each pressure, record the weight of material extruded in 1 minute.
 3. Run three replicates per pressure.
 - b. Test Two: Elevated Temperature Testing -- 43 – 46 °C (110 – 115 °F)
 1. Condition the rheometer sample cylinder in an oven for 30 minutes at 52 °C (125 °F). Remove sample cylinder from oven and run test listed in Step 2 below, while maintaining a material temperature of 43 – 46 °C (110 – 115 °F). Material temperature should be monitored throughout the experiment using a thermocouple probe or similar device. Generally, two pressures can be run at one time; then sample cylinder should be re-conditioned in an oven for an additional 30 minutes at 52 °C (125 °F).
 2. Extrude adhesive through orifice into a paper cup, for 30 seconds, at the following pressures:
 - a. 5 psi
 - b. 10 psi
 - c. 20 psi
 - d. 30 psi
 - e. 50 psi
 - f. 70 psi
 - g. 90 psi
 3. For each pressure, record the weight of material extruded in 30 seconds.
 4. Run three replicates per pressure.
 - c. Test Three: Cold Temperature Testing -- 12 – 13 °C (54 – 56 °F)
 1. Condition the rheometer sample cylinder in a refrigerator or freezer until the material reaches a temperature of 12 °C (54 °F). Remove sample cylinder from refrigerator/freezer and run test listed in Step 2 below, while maintaining a material temperature of 12 – 13 °C (54 – 56 °F). Material temperature should be monitored throughout the experiment using a thermocouple probe or similar device. Generally, two pressures can be run at one time; then sample cylinder should be re-conditioned in refrigerator / freezer until material reaches a temperature of 12 °C (54 °F).
 2. Extrude adhesive through orifice into a paper cup, for 1 minute, at the following pressures:
 - a. 10 psi
 - b. 20 psi
 - c. 30 psi
 - d. 50 psi
 - e. 70 psi
 - f. 90 psi
 - g. 95 psi
 2. For each pressure, record the weight of material extruded in 1 minute.
 3. Run three replicates per pressure.

