



Evaluating Brittleness of Painted Plastics by Means of a Mandrel

1 Introduction

Note: Nothing in this standard supercedes applicable laws and regulations.

Note: In the event of conflict between the English and domestic language, the English language shall take precedence.

1.1 Purpose. This standard describes the method to evaluate the amount of cracking that takes place when a painted plastic material is flexed around a designated mandrel at a designated temperature.

1.2 Applicability. This test is a requirement during primer, paint and plastic developments for “paint on plastic” systems that are typically used on exterior parts. Typically for this test, flexible plastics are defined as having a flexural modulus of 800 MPa or less, and moderately flexible plastics are defined as having a flexural modulus between 801 MPa and 2000 MPa.

1.3 Remarks. Not applicable.

2 References

Note: Only the latest approved standards are applicable unless otherwise specified.

2.1 External Standards/Specifications.

None

2.2 GM Standards/Specifications.

None

2.3 Additional References. None.

3 Resources

3.1 Facilities.

3.1.1 Calibration. The test facilities and equipment shall be in good working order and shall have a valid calibration label.

3.1.2 Alternatives. Alternative test facilities and equipment may also be used. However, all measuring variables as specified in this standard shall be determined correctly with respect to their physical definition.

3.2 Equipment.

3.2.1 Mandrel fixture capable of accommodating the specified mandrel.

3.2.2 Environmental chamber capable of maintaining the specified test temperatures.

3.3 Test Vehicle/Test Piece. The test pieces wherever possible shall be the finished part. If size, shape, etc., of the finished part is not practical, tests shall be conducted on specially prepared coated test panels.

3.4 Test Time.

Calendar time: 1 d

Test time: < 1 h (not including pre-conditioning)

Coordination time: Varies

3.5 Test Required Information. Not applicable.

3.6 Personnel/Skills. Personnel performing this test shall have received training for this test procedure.

4 Procedure

4.1 Preparation. Not applicable.

4.2 Conditions.

4.2.1 Environmental Conditions. Not applicable.

4.2.2 Test Conditions. Deviations from the requirements of this standard shall have been agreed upon. Such requirements shall be specified on component drawings, test certificates, reports, etc.

4.3 Instructions.

4.3.1 When specifically stated, this procedure can be used to evaluate the cracking that occurs using combinations of temperature and mandrel diameter that are different from those defined for class M1, M2, or M3 (see Table 1).

4.3.2 Unless otherwise specified, painted samples shall be subjected to a minimum aging period of 72 h following the baking or drying cycle prior to sample preparation or start of testing. A shorter aging period may be used provided it is recognized that this represents a more severe condition of test and that results obtained at different aging times under 72 h are not a good basis for comparing the relative performance characteristics of paint finishes.

4.3.3 Cut or stamp a 150 mm long by minimum 25 mm wide test sample from the part or plaque to be evaluated (150 mm × 75 mm sample size is preferred if part size permits). The sample shall be carefully cut or stamped down through the show surface to avoid any nicks in the edges of the sample which would cause an unnatural stress concentration and consequently premature failure. If using a die cutter, check the die to make sure it is sharp, straight and free of edge nicks. Check cut side edges of samples to make sure the cut side edges of the samples are smooth and continuous. Sanding the edges of the samples is allowed if needed to eliminate roughness.

4.3.4 Expose the test samples and mandrel fixture to the specified test temperatures for a minimum of 4 h. The mandrel fixture shall be rigidly attached within the environment to allow both hands of the operator to be free to perform the test.

4.3.5 Quickly wrap the conditioned sample 180 degrees or as far as possible around the mandrel so that the width of the sample is parallel to the axis of the mandrel. The wrapping action shall take no more than 2 s. Painted samples shall be wrapped so that the painted surface is in tension. The operator shall wear gloves when testing the samples at sub ambient temperatures to avoid warming the surface of the sample.

Table 1: Test Condition for Class M1, M2 and M3

Class	Test Temperature	Mandrel Diameter ^{Note 1}
M1	23 °C ± 2 °C	13.2 mm ± 0.7 mm
M2 ^{Note 2}	23 °C ± 2 °C	13.2 mm ± 0.7 mm
	-15 °C +0 °C/-3 °C	26.0 mm ± 0.7 mm
	-30 °C +0 °C/-5 °C	62.0 mm ± 0.7 mm
M3	23 °C ± 2 °C	62.0 mm ± 1.7 mm

Note 1: Mandrel diameters and tolerances are based on American National Standards Institute (ANSI) Schedule 40 welded and seamless wrought steel pipes with nominal Inner Diameters of ¼ in, ¾ in and 2 in and/or standard tubing of ½ in, 1 in and 2 ½ in.

Note 2: Suffix M2 requires tests to be made at all three (3) of the conditions shown.