



# Standard Test Method for Minimum Film Formation Temperature (MFFT) of Emulsion Vehicles<sup>1</sup>

This standard is issued under the fixed designation D2354; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

<sup>ε</sup><sup>1</sup> NOTE—Footnote 2 was corrected editorially in March 2013.

## 1. Scope

1.1 This test method covers the determination of the minimum temperature at which emulsion vehicles coalesce to form continuous films. The term “emulsion” in this test method includes latex vehicles.

1.2 This test method is limited to emulsions having minimum film formation temperatures below 90°C.

1.3 The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard.

1.4 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

## 2. Summary of Test Method

2.1 In this test method the minimum film formation temperature (MFFT) is determined by visual observation of cracking or whitening in films that have dried over a substrate having a controlled temperature gradient.

## 3. Significance and Use

3.1 The satisfactory film integrity of emulsion coatings requires that as the aqueous phase evaporates the resinous portion of the vehicle coalesces into a continuous film. Low temperature impairs the fluidity of the resin particle and thereby their ability to coalesce. Vehicles that can withstand low temperatures are therefore required, and MFFT is an important quality feature of emulsion vehicles.

<sup>1</sup> This test method is under the jurisdiction of ASTM Committee D01 on Paint and Related Coatings, Materials, and Applications and is the direct responsibility of Subcommittee D01.33 on Polymers and Resins.

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## 4. Apparatus

4.1 *Minimum Film Formation Temperature Bar*—An MFFT unit<sup>2</sup> such as is illustrated in Fig. 1. The bar represented in Fig. 1 is designed to be used with thermocouples. The thermocouple leads used with the assembly are iron-constantan with an external resistance of 10  $\Omega$ . Also included is a pyrometer (not shown in Fig. 1).

NOTE 1—Thermometers can be used as an alternative way of measuring temperature.<sup>3</sup> It is noted that larger holes ( $\frac{5}{32}$  in.) (4 mm) will have to be drilled in the bar to accommodate the thermometers. If thermometers are selected, all holes are drilled on the same side of the bar, as opposed to the system of alternate placement of holes when using thermocouples.

NOTE 2—A self-contained unit eliminating the need for any accessories, such as for sub-ambient cooling or temperature measurement, and requiring only an electrical outlet, piped water, and an air or nitrogen supply has been developed by ICI Paints Division.<sup>4</sup>

4.2 *Dry Air or Dry Nitrogen Supply*, with a regulating valve and flow meter.

4.3 *Film Caster*, having a 6-mil (150- $\mu$ m) clearance.

## 5. Reagents and Materials

5.1 *Dry Ice*.

5.2 *Isopropanol*, anhydrous.

<sup>2</sup> The sole source of supply of the MFFT bar, Model CS 188, known to the committee at this time is Dek-Tron Scientific Instrument Corp., 244 East 3rd Street, Plainfield, NJ 07060. If you are aware of alternative suppliers, please provide this information to ASTM International. Your comments will receive careful consideration at a meeting of the responsible technical committee,<sup>1</sup> which you may attend.

<sup>3</sup> The sole source of supply of the thermometer, Prince No. A-011044 known to the committee at this time is Princo Instruments Inc., 1020 Industrial Hwy., Southampton, PA 18966. If you are aware of alternative suppliers, please provide this information to ASTM International. Your comments will receive careful consideration at a meeting of the responsible technical committee,<sup>1</sup> which you may attend.

<sup>4</sup> The sole source of supply of the MFFTBAR units, Models MFFT-60, and MFFT-90, known to the committee at this time is Rhopoint Instrumentation Ltd., Beeching Rd., Bexhill-on-Sea, East Sussex, TN39 3LG, England. For the name of a local distributor, telephone them at 011-44-1-424-214291. Interested parties are invited to submit information regarding the identification of acceptable alternatives to the Committee on Standards, ASTM International. Your comments will receive careful consideration at a meeting of the responsible technical committee,<sup>1</sup> which you may attend.