Designation: D 5402 – 93 (Reapproved 1999)

Standard Practice for Assessing the Solvent Resistance of Organic Coatings Using Solvent Rubs[1]

This standard is issued under the fixed designation D 5402; 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 (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This practice describes a solvent rub technique for assessing the solvent resistance of an organic coating that chemically changes during the curing process. This technique can be used in the laboratory, in the field, or in the fabricating shop. Test Method D 4752 is the preferred method for ethyl silicate zinc-rich primers.

1.2 This practice does not specify the solvent, number of double rubs, or expected test results.

1.3 The values stated in SI units are to be regarded as the standard. The values given in parentheses are for information only.

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.* Consult the supplier's Material Safety Data Sheet for specific hazard information relating to the solvent used.

2. Referenced Documents

2.1 *ASTM Standards:*

D 235 Specification for Mineral Spirits (Petroleum Spirits) (Hydrocarbon Dry Cleaning Solvent)[2]

D 523 Test Method for Specular Gloss[3]

D 740 Specification for Methyl Ethyl Ketone[2]

D 843 Specification for Nitration Grade Xylene[2]

D 1186 Test Methods for Nondestructive Measurement of Dry Film Thickness of Nonmagnetic Coatings Applied to a Ferrous Base[3]

D 1400 Test Method for Nondestructive Measurement of Dry Film Thickness of Nonconductive Coatings Applied to a Nonferrous Metal Base[3]

D 3363 Test Method for Film Hardness by Pencil Test[3]

D 4138 Test Method for Measurement of Dry Film Thickness of Protective Coating System by Destructive Means[4]

D 4752 Test Method for Measuring MEK Resistance of Ethyl Silicate (Inorganic) Zinc-Rich Primers by Solvent Rub[4]

3. Terminology

3.1 *Definitions of Terms Specific to This Standard:*

3.1.1 *double rub*—the act of rubbing a cloth in one complete forward and back motion over a coated surface.

4. Significance and Use

4.1 Coatings that chemically change during the curing process, such as epoxies, vinyl esters, polyesters, alkyds and urethanes, become more resistance to solvents as they cure. These coatings should reach specific levels of solvent resistance prior to being topcoated and prior to placing in service; the levels of solvent resistance necessary vary with the type of coating and the intended service. Rubbing with a cloth saturated with the appropriate solvent is one way to determine when a specific level of solvent resistance is reached. However, the level of solvent resistance by itself does not indicate full cure and some coatings become solvent resistant before they become sufficiently cured for service.

4.2 The time required to reach a specific level of solvent resistance can be influenced by temperature, film thickness, air movement and, for water-borne or water-reactive coatings, humidity.

4.3 The test solvent's effect upon the coating varies with coating type and solvent used. The coating manufacturer may specify the solvent, the number of double rubs, and the specific test results needed.

5. Materials and Equipment

5.1 *Solvent:*

5.1.1 *Methyl Ethyl Ketone (MEK)*, conforming to Specification D 740, or

5.1.2 *Mineral Spirits*, conforming to Specification D 235, or

5.1.3 *Xylene*, conforming to Specification D 843, or

5.1.4 *Other Solvents*, as specified by the coating manufacturer or user.

5.2 *Cheesecloth*, 100 % cotton mesh size grade 28 by 24,

[1] This practice is under the jurisdiction of ASTM D-1 on Paint and Related Coatings, Materials, and Applications and is the direct responsibility of Subcommittee D01.46 on Industrial Protective Coatings.

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[2] *Annual Book of ASTM Standards*, Vol 06.04.

[3] *Annual Book of ASTM Standards*, Vol 06.01.

[4] *Annual Book of ASTM Standards*, Vol 06.02.

approximately 300 by 300 mm (12 by 12 in.) and contrasting in color to the coating being evaluated, or other mutually agreed upon cloth.

5.3 *Proper Safety Equipment*, as determined from the solvent MSDS, for example, solvent resistant gloves, respirator.

6. Procedure

6.1 Select areas on the coated surface at least 150- mm (6-in.) long on which to run the tests. Clean the surface with tap water to remove any loose material and allow to dry.

6.2 Measure the dry-film thickness of the coating in the selected areas in accordance with Test Methods D 1186, D 1400 or D 4138. Mark a150- by 25-mm (6- by 1-in.) rectangular test area on the undamaged cleaned surface using a pencil or other suitable solvent resistant marker.

6.3 Fold the cotton cloth into a pad of double thickness and saturate it to a dripping wet condition with the specified solvent. Do not allow more than 10 s to elapse before preceeding to the next steps.

6.4 Place the properly protected index finger into the center of the pad while holding excess cloth with the thumb and remaining fingers of the same hand. With the index finger at a 45° angle to the test surface, rub the rectangular test area with moderate pressure first away from the operator and then back towards the operator. One forward and back motion is one double rub, and complete at the rate of approximately 1/s.

6.5 Continue rubbing the test area for a total of 25 double rubs. Take care to stay within the rectangular test area.

6.6 If additional solvent rubs are specified, reposition the finger on an unused clean portion of the cloth and resaturate the cloth with the selected solvent to a dripping wet condition. Do not allow more than 10 s to elapse before continuing the double rub procedure on the marked test area for an additional 25 double rubs. Repeat this step until reaching the specified test criteria.

6.7 Immediately inspect the middle 125 mm (5 in.) of the rubbed area, disregarding 13 mm (½in.) at each end, for fingernail hardness and visual changes in appearance, comparing the rubbed area with an adjacent unrubbed area. Gloss and hardness will tend to return to initial values as recovery time increases. If numerical values or ratings are desired, gloss may be measured in accordance with Test Method D 523 and pencil hardness with Test Method D 3363. Measure the film thickness of the rubbed area by the same method used in 6.3. Visually examine the cloth for indications of coating removal.

7. Report

7.1 Report, as a minimum, the following information:

7.1.1 Solvent used,

7.1.2 Number of double rubs,

7.1.3 Film thickness before rubbing and after rubbing, and

7.1.4 Results of visual examination of cloth for indication of coating removal.

7.2 Additional information, such as temperature, humidity, weather conditions, elaped time between coating applications and conducting the test can affect test results and should be reported whenever possible.

7.3 Appendix X1 contains a “Solvent Double Rub Test” form that may be helpful in reporting test results.

8. Precision and Bias

8.1 *Precision*—The precision is being determined.

8.2 *Bias*—Since there is no accepted reference material, bias cannot be determined.

9. Keywords

9.1 coating; curing characteristics; double rub method; drying or curing; paint; recoat time; service time; solvent resistance; solvent rub method

APPENDIX

(Nonmandatory Information)

X1. SOLVENT DOUBLE RUB TEST

X1.1 *Solvent Double Rub Test Form:*

Coating Identification:
Generic type:
Manufacturer:
Number of components:

Application Information

Date Applied:[A]
Time applied:[A]
Substrate:
Area coated:

Surface temperature:
Temperature:[A]
Air movement:[A]
Humidity:[A]

Test Information

Date Tested:
Time tested:
Cure time:[A]
Solvent:
Cure conditions[A]
Number of double rubs specified:
Temperature:[A]
Humidity:[A]
Air movement:[A]

Results

Number of double rubs performed:

Results	*Before Rubbing*	*After Rubbing*	*Specified*
Dry-film thickness:			
Method used:			
Appearance:			
Hardness:			
Method used:			
Gloss:			
Condition of cloth:			
Tested by:			

[A] The temperature humidity, weather conditions, elapsed time between coating application, and conducting the test can impact test results and should be reported whenever possible.