Designation: E 1753 – 95

An American National Standard

Standard Practice for Use of Qualitative Chemical Spot Test Kits for Detection of Lead in Dry Paint Films[1]

This standard is issued under the fixed designation E 1753; 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 covers the use of commercial spot test kits based on either sulfide or rhodizonate for the qualitative determination of the presence of lead in dry paint films.

1.2 This practice may also be used as a qualitative procedure for other dry coating films such as varnishes.

1.3 This practice provides a list of the advantages and limitations of chemical spot test kits based on sulfide and rhodizonate to allow the user to choose the appropriate spot test for a given circumstance.

1.4 This practice contains notes which are explanatory and not part of mandatory requirements.

1.5 *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. Referenced Documents

2.1 *EPA Standards:*

EPA 600/R-93/085 Investigation of Test Kits for Detection of Lead in Paint, Dust and Soil[2]

EPA 600/R-93/129 Identification of Performance Parameters for Test Kit Measurement of Lead in Paint[2]

3. Terminology

3.1 *Definitions:*

3.1.1 *core sample*—a fragment of a dry paint film removed from the substrate with a coring tool which is designed to remove a specified area (that is, a square centimetre) of dry paint film.

3.1.2 *negative test*—the absence of the characteristic color change within a specified time limit, usually within a few minutes.

3.1.3 *paint chip sample*—a fragment of a dry paint film removed from the substrate.

3.1.4 *positive test*—the observation of the characteristic color change within a specified time limit, usually within 10 to 30 s.

3.1.5 *rhodizonate spot test method—for lead detection*, the use of a dilute solution of rhodizonate ion to test a painted surface or paint chip for the qualitative presence of lead **(1)**.[3] A color change from yellow/orange to pink or red indicates the presence of lead above the level of detection of the test kit.

3.1.6 *spot test*—the application of reagent solution to a prepared dry paint film sample, paint chip, paint powder, or painted surface and the subsequent observation for the presence or absence of the characteristic color change.

3.1.7 *sulfide spot test method—for lead detection*, the use of a dilute solution of sulfide ion to test a painted surface or paint chip for the qualitative presence of lead **(2)**. A color change from clear to grey or black indicates the presence of lead above the level of detection of the spot test.

3.1.8 *test kit*—equipment (for example, a cutting tool, adsorbent applicators, if necessary) and chemicals (for example, sulfide or rhodizonate spot test reagents and any extraction solutions needed) assembled for use during spot testing for lead.

4. Summary of Practice

4.1 A dry paint film sample (a painted surface, paint chip, ground paint powder, or core sample) is tested for lead qualitatively through the use of spot tests. Spot tests kits are based on the reaction of Lead II (Pb^{2+}) ion with either sulfide ion (S^{2-}) or rhodizonate ion [$C_6O_6^{2-}$] resulting in a visual color change from clear to grey or black for lead sulfide and from yellow/orange to pink or red for lead rhodizonate.

4.1.1 Prior to performing the spot test, first clean the dry paint film surface. Except for surface tests, the film is then prepared by either cutting a notch or an angular cut in situ or by removing a paint chip or core sample.

4.1.2 The test is performed by applying the spot test reagents (directly or with the use of an adsorbent applicator) to the prepared dry paint sample and observing the requisite color change after a specified time, usually within a few minutes.

4.1.3 An interpretation of the presence or absence of lead in the dry paint sample is made based on the observation of the presence or absence of the characteristic color change.

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[1] This practice is under the jurisdiction of ASTM Committee E-6 on Performance of Buildings and is the direct responsibility of Subcommittee E06.23 on Lead Paint Abatement.

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[2] Available from Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402.

[3] The boldface numbers in parentheses refer to a list of references at the end of this practice.

5. Significance and Use

5.1 This practice is intended for use as a qualitative procedure to check dry paint films for the presence of lead. The response of the spot test method varies depending on the extractability of lead from a paint matrix, which may differ depending on the test kit used, the paint type tested, and the form presented.

5.1.1 This technique is applicable to dry paint films and varnishes in a variety of forms including the intact dry paint film surface, a notched or other angular cut surface that exposes a cross section of all paint layers, a paint chip, and ground paint film or pellet.

5.2 The response of the spot test method varies depending on the extractability of lead from a coating matrix, which may differ depending on the test kit used, the coating type tested, and the form presented **(3)**.

5.3 In some situations, metals and other chemical species interfere with the spot tests causing false negative or false positive results (see Section 8).

5.4 This practice may be used in conjunction with quantitative analytical methods for lead such as portable X-ray fluorescence, anodic stripping voltometry, or laboratory analysis of paint chip samples.

5.5 Color blind individuals (protanomalous viewers) who are deficient in viewing red colors may have difficulty in discerning the pink or red color of a positive rhodizonate test.

6. Apparatus and Materials

6.1 *For Sulfide Spot Tests*:

6.1.1 *Sulfide Based Spot Test Kit* (usually consists of a 5 to 8 % solution of sodium sulfide in a dropper bottle).

6.1.2 *Disposable Plastic or Latex Gloves*.

6.2 *For Rhodizonate Spot Tests*:

6.2.1 *Rhodizonate Based Spot Test Kit* (usually consists of rhodizonate reagent and an extraction solution).

6.2.2 *Absorbent Applicators*, for applying spot test reagents or for extracting and collecting the lead from the painted surface. Absorbent applicators (that is, swabs, filter paper) may or may not be provided with a purchased test kit.

6.3 *For Both Sulfide and Rhodizonate Spot Tests*:

6.3.1 *Non-Abrasive Cleaning Solution*.

6.3.2 *Towels, Towelette, or Sponge*.

6.3.3 *Cutting Tool*, used to cut into the dry paint film. A cutting tool may or may not be provided with the kit. Acceptable cutting tools include a clean cutting knife with a fine, sharp edge, razor knife, thin scalpel blade, or coring tool.

6.3.4 *Mortar and Pestle*, for grinding paint chip sample, if necessary.

6.3.5 *Magnifying Glass* (at least 4× power).

6.3.6 *Flashlight*, to examine color change under incandescent light in unlit areas.

7. Reagents

7.1 *Reagents as Provided by the Spot Test Kit*—Reagents and materials kept beyond the preparer's expiration date or recommended shelf life shall be discarded. Store spot test kits at room temperature away from direct sunlight or room light. Freshly prepared rhodizonate reagents require storage in a refrigerator to retard the rate of hydrolysis of the rhodizonate dye.

8. Advantages and Disadvantages of Different Chemical Spot Tests

8.1 *Sulfide Test*—A clear solution of sodium sulfide reacts with lead in situ or on paint chips to produce a grey or black color (lead sulfide, PbS).

8.1.1 *Sulfide Test Advantages*:

8.1.1.1 Sulfide-based tests are rapid, easy, and relatively inexpensive to use.

8.1.1.2 Sodium sulfide reacts with most lead containing pigments in paint, including lead chromate pigments within 1 or 2 min.

8.1.2 *Sulfide Test Disadvantages*:

8.1.2.1 Sulfide solutions emit a toxic, potentially hazardous gas (H_2S) which has an unpleasant odor (rotten eggs). The generation of hazardous levels of H_2S in the field, however, can be minimized by good ventilation, by using low concentrations of sodium sulfide (not to exceed 5 to 8 %), by restricting the volume of sodium sulfide solution used per test to a drop, and by carrying only small amounts of sodium sulfide solutions (30 mL or less). Also, since acid conditions increase the release H_2S gas, do not use a strong acid or an acidic solution to clean the test location either before or after the sulfide test is performed. The user is cautioned to minimize breathing in the H_2S fumes. In addition, since sulfide solutions are alkaline, it is recommended that the user consider wearing gloves and eye protection. All solutions are to be kept out of the reach of children.

8.1.2.2 Sulfide based tests are not specific for lead. In addition to lead, sulfide ion reacts with several other metal ions to give a black color including iron, nickel, cobalt, copper, mercury, and molybdenum **(1, 4)**. Except for iron, the concentration of these metals in paint is usually less than 1 %, which is too low to be detected by a 5 to 8 % solution of sodium sulfide **(2)**. Iron-containing pigments, oxides, and iron blue are found in paints. Oxides are used primarily in exterior paints to provide deep earth-toned colors. Although sodium sulfide solution does not cause a color change with all iron oxide pigments, positive sulfide spot test results on deep earth-toned or blue colored paints are to be considered suspect. In these cases, the use of other test procedures for lead is recommended.

8.1.2.3 Testing paint directly on metal surfaces composed of iron, copper, or nickel (for example, pipes and radiators) is discouraged as it may lead to false positive results. An immediate dark color is formed on the surface of some treated steels, for example, phosphate treatment.

8.1.2.4 Metals other than lead and iron found in large quantities in paint include zinc, titanium, and barium, but none of these metals produces a black color with sulfide **(2)**. Zinc sulfides are colorless; titanium sulfides can be red or even grey, and barium sulfides are yellow/green **(1)**. However, these sulfides are rarely observed when testing paint with sodium sulfide spot tests because of the low solubility of the metal species in the sodium sulfide solution.

8.1.2.5 Sulfide can react with some non-lead containing paints used today to produce a grey color; however, most non-lead containing paints do not react with the 5 to 8 %