Approval Standard for Spark Resistant Tools

Class Number 7910

December 2007

Foreword

The FM Approvals certification mark is intended to verify that the products and services described will meet FM Approvals' stated conditions of performance, safety and quality useful to the ends of property conservation. The purpose of Approval Standards is to present the criteria for FM Approval of various types of products and services, as guidance for FM Approvals personnel, manufacturers, users and authorities having jurisdiction.

Products submitted for certification by FM Approvals shall demonstrate that they meet the intent of the Approval Standard, and that quality control in manufacturing shall ensure a consistently uniform and reliable product. Approval Standards strive to be performance-oriented. They are intended to facilitate technological development.

For examining equipment, materials and services, Approval Standards:

a) must be useful to the ends of property conservation by preventing, limiting or not causing damage under the conditions stated by the Approval listing; and

b) must be readily identifiable.

Continuance of Approval and listing depends on compliance with the Approval Agreement, satisfactory performance in the field, on successful re-examinations of equipment, materials, and services as appropriate, and on periodic follow-up audits of the manufacturing facility.

FM Approvals LLC reserves the right in its sole judgment to change or revise its standards, criteria, methods, or procedures.

TABLE OF CONTENTS

1 INTRODUCTION

1.1 Purpose

1.1.1 This standard states Approval requirements for Spark Resistant Tools. Spark Resistant Tools may be hand or machine operated hammers, wrenches, screw drivers, scrapers or other devices. Their purpose is to prevent the ignition of flammable materials, dusts, or vapors when used in environments where there is a risk of ignition of those materials resulting from a spark created by the use of tools slipping or striking a surface.

1.1.2 Approval criteria may include, but are not limited to, performance requirements, marking requirements, examination of manufacturing facilities, audit of quality assurance procedures, and a follow-up program.

1.2 Scope

1.2.1 This standard applies to any component intended for use as a Spark Resistant Tool or device. They may be hand or machine operated hammers, wrenches, screw drivers, scrapers or other operable devices. The standard assesses the potential of these tools or devices, or the material from which they can be made, to create a visible spark or to ignite a flammable materials under certain laboratory test conditions. It does not assess the practicality or suitability for purpose of the actual device but is limited to the determination of potential of igniting materials when in normal use.

1.2.2 This standard does not determine or assess the environments in which these tools are used. The types of environments where it is desirable or recommended to use spark resistant tools are described in FM Global Property Loss Prevention Data Sheets 6-9 and 7-43.

1.2.3 The standard does not address electrostatic discharge hazards, ignition by mechanical energy in the absence of a visible spark, environments that are oxygen enriched where ignition energy may be reduced relative to normal atmospheric oxygen concentrations, or environments rendered explosive as the result of hazardous concentrations of metal dusts or chemicals.

1.3 Basis for Requirements

1.3.1 The requirements of this standard are based on experience, research and testing. The advice of manufacturers, users, and loss control specialists was also considered.

1.3.2 The requirements of this standard reflect tests and practices used to examine characteristics of metallic alloys used to manufacture Spark Resistant Tools for the purpose of obtaining Approval. Spark Resistant Tools having characteristics not anticipated by this standard may be FM Approved if performance equal, or superior, to that required by this Standard is demonstrated, or if the intent of the standard is met. Alternatively, Spark Resistant Tools which meet all of the requirements identified in this Standard may not be FM Approved if other conditions which adversely affect performance exist or if the intent of this standard is not met.

1.4 Basis for Approval

Approval is based upon satisfactory evaluation of the product and the manufacturer in the following major areas:

1.4.1 Examination and tests on production samples shall be performed to evaluate

- the suitability of the product;
- the performance of the product as specified by the manufacturer and required by FM Approvals; and as far as practical,
- the durability and reliability of the product.

1.4.2 An examination of the manufacturing facilities and audit of quality control procedures is made to evaluate the manufacturer's ability to consistently produce the product which is examined and tested, and the marking procedures used to identify the product. These examinations may be repeated as part of FM Approvals' product follow-up program.

1.5 Basis for Continued Approval

Continued Approval is based upon:

- production or availability of the product as currently FM Approved;
- the continued use of acceptable quality assurance procedures;
- satisfactory field experience;
- compliance with the terms stipulated in the Approval report;
- satisfactory re-examination of production samples for continued conformity to requirements; and
- satisfactory Facilities and Procedures Audits (F&PAs) conducted as part of FM Approvals' product follow-up program.

Also, as a condition of maintaining Approval, manufacturers may not change a product or service without prior authorization by FM Approvals.

1.6 Effective Date

The effective date of an Approval standard mandates that all products tested for Approval after the effective date shall satisfy the requirements of that standard. Products FM Approved under a previous edition shall comply with the new version by the effective date or else forfeit Approval.

The effective date of this Standard is December 1, 2007 for compliance with all requirements.

1.7 System of Units

Units of measurement used in this Standard are United States (U.S.) customary units. These are followed by their arithmetic equivalents in International System (SI) units, enclosed in parentheses. The first value stated shall be regarded as the requirement. The converted equivalent value may be approximate. Appendix A lists the selected units and conversions to SI units for measures appearing in this standard. Conversion of U.S. customary units is in accordance with the American National Standards Institute (ANSI)/Institute of Electrical and Electronics Engineers (IEEE)/American Society for Testing Materials (ASTM) SI 10-97, ''Standard for Use of the International System of Units (SI): The Modern Metric System.''

1.8 Applicable Documents

The following standards, test methods, and practices are referenced in this standard:

FM Approvals/FM Global

FM Global Property Loss Prevention Data Sheet 6-9, *Industrial Ovens and Dryers* (September 2003)

FM Global Property Loss Prevention Data Sheet 7-43, *Loss Prevention in Chemical Plants* (January 2001)

1.9 Definitions

For purposes of this standard, the following terms apply:

Spark Resistant – A material that is not prone to generate impact sparks under conditions of use.

1.10 References

1. ''The Explosion Hazard in Mining'', US Department of Labor, Mine Safety and Health Administration, IR-1119 (1981)

2. ''Frictional Sparking'', Fire Prevention (January/February 1985)

2 GENERAL INFORMATION

2.1 Product Information

2.1.1 Spark Resistant Tools are used where it is important to prevent ignition of potentially flammable vapors, dusts, or liquids during any operation that requires the use of hand and machine operated tools for maintenance or production. Ferrous tools, when they slip or strike another hard surface during normal use can generate sparks that may ignite adjacent materials resulting in large fires or explosion. This hazard may be mitigated by the use of spark resistant tools.

2.1.2 Spark resistant tools are generally fabricated from non-ferrous alloys (typically Beryllium-Copper or Aluminum-Bronze) for use as hammers, screwdrivers, wrenches, scrapers, chisels, brushes, pliers and other items. They may also be used as latches and retention clips where they are moved against surfaces.

2.2 Approval Application Requirements

To apply for an Approval examination the manufacturer, or its authorized representative, should submit a request to

Materials Director
FM Approvals
1151 Boston-Providence Turnpike
PO Box 9102
Norwood, MA 02062 U.S.A.

The manufacturer shall provide the following preliminary information with any request for Approval consideration:

- a complete list of all models, types, sizes, and options for the products being submitted for Approval consideration;
- general assembly drawings, complete set of manufacturing drawings, materials list, anticipated marking format, brochures, sales literature, specification sheets, installation instructions,
- the number and location of manufacturing facilities.
- All documents shall identify the manufacturer's name, document number or other form of reference, title, date of last revision, and revision level. All documents shall be provided with English translation.

2.3 Requirements for Samples for Examination

2.3.1 Following authorization of an Approval examination, the manufacturer shall submit samples for examination and testing based on the following:

- Samples of all alloys from which tools and items shall be manufactured
- Sample requirements to be determined by FM Approvals following review of the preliminary information.

2.3.2 Requirements for samples may vary depending on design features, results of prior or similar testing, and results of any foregoing tests.

2.3.3 The manufacturer shall submit samples representative of production. Any decision to use data generated using prototypes is at the discretion of FM Approvals.

2.3.4 It is the manufacturer's responsibility to provide any necessary test fixtures, such as those which may be required to evaluate the devices manufactured from alloys for which FM Approval is requested.

2.4 Recognition

2.4.1 FM Approvals recognition and listing shall only be extended to spark resistant tool manufacturers who successfully meet all test performance criteria in addition to being under the FM Approvals' Facilities and Procedures Audit follow-up program.

2.4.2 Spark Resistant Tool manufacturers shall receive a listing in the Approval Guide as an FM Approved Spark Resistant Tool.

2.4.3 Recognition shall be limited to the tool design(s), specific alloy and manufacturing process used to manufacture the items evaluated in the test program.

3 GENERAL REQUIREMENTS

3.1 Review of Documentation

During the initial investigation and prior to physical testing, the manufacturer's specifications and details shall be reviewed to assess the ease and practicality of installation and use. The Approval investigation shall define the limits of the Approval.

3.2 Markings

3.2.1 Marking on the product or, if not possible due to size, on its packaging or label accompanying the product, shall include the following information:

- name and address of the manufacturer or marking traceable to the manufacturer;
- date of manufacture or code traceable to date of manufacture or lot identification;
- model number, size.

When hazard warnings are needed, the markings should be universally recognizable.

3.2.2 The model or type identification shall correspond with the manufacturer's catalog designation and shall uniquely identify the product as FM Approved. The manufacturer shall not place this model or type identification on any other product unless covered by a separate agreement.

3.2.3 The Approval Mark (see Appendix B) shall be displayed visibly and permanently on the product and/or packaging as appropriate. The manufacturer shall not use this Mark on any other product unless such product is covered by a separate report.

3.2.4 All markings shall be legible and durable.

3.3 Required Samples

All alloys or tools submitted for testing shall be representative of production run material. The need to monitor the manufacturer of the test specimens shall be at the discretion of FM Approvals.

3.4 Formulations

All FM Approved tools shall be manufactured with identical alloys, raw materials and additives as tested. The formulation shall be kept on file at FM Approvals.

3.5 Manufacturer's Installation and Operation Instructions

The manufacturer shall provide the user with

- instructions for the installation, maintenance, and operation of the product;
- facilities for repair of the product and supply replacement parts; and
- services to ensure proper installation, inspection, or maintenance for products of such nature that it would not be reasonable to expect the average user to be able to provide such installation, inspection, or maintenance.

3.6 Calibration

All examinations and tests performed in evaluation to this Standard shall use calibrated measuring instruments traceable and certified to acceptable national standards.

4 PERFORMANCE REQUIREMENTS

4.1 No-Spark on Impact

4.1.1 Requirement

The tools shall produce no visible sparks when struck on a variety of surfaces. This demonstrates a lack of capability of producing sparks and therefore a reduced risk of igniting surrounding materials or atmospheres when the tool is in use.

4.1.2 Test/Verification

No visible spark shall be created as determined by inspection of a video record of the impact of the alloy tested upon a variety of surfaces similar to those expected in service.

See Appendix C for the complete test procedure.

4.2 Test for Ignition of Flammable Chemicals

4.2.1 Requirement

Particles created by applying the test piece to a grinding wheel shall not ignite flammable vapors.

4.2.2 Tests/Verification

The alloy test piece is applied to a grinding wheel to produce particles of the material under test. The particles are cast upon cotton batting that has been soaked with a flammable chemical. The cotton batting with the flammable chemical shall not ignite.

See Appendix D for the complete test procedure.

4.3 Additional Tests

Additional tests may be required, at the discretion of FM Approvals, depending on design features and results of any foregoing tests.

A re-test following a failure shall be acceptable only at the discretion of FM Approvals and with a technical justification of the conditions or reasons for failure.

5 OPERATIONS REQUIREMENTS

A quality assurance program is required to assure that subsequent Spark Resistant Tools produced by the manufacturer shall present the same quality and reliability as the specific tools or alloys examined. Design quality, conformance to design, and performance are the areas of primary concern.

- Design quality is determined during the examination and tests, and is documented in the Approval Report.
- Continued conformance to this Standard is verified by the Facilities and Procedures Audit (F&PA).
- Quality of performance is determined by field performance and by periodic re-examination and testing.

5.1 Demonstrated Quality Control Program

5.1.1 The manufacturer shall demonstrate a quality assurance program which specifies controls for at least the following areas:

- existence of corporate quality assurance guidelines;
- incoming quality assurance, including testing;
- in-process quality assurance, including testing;
- final inspection and tests;
- equipment calibration;
- drawing and change control;
- packaging and shipping; and
- handling and disposition of non-conforming materials.

5.1.2 Documentation/Manual

There shall be an authoritative collection of procedures/policies. It shall provide an accurate description of the quality management system while serving as a permanent reference for implementation and maintenance of that system. The system shall require that sufficient records are maintained to demonstrate achievement of the required quality and verify operation of the quality system.

5.1.3 Records

To assure adequate traceability of materials and products, the manufacturer shall maintain a record of all quality assurance tests performed, for a minimum period of two years from the date of manufacture.

5.1.4 Drawing and Change Control

- The manufacturer shall establish a system of product configuration control that shall allow no unauthorized changes to the product. Changes to critical documents, identified in the Approval Report, must be reported to, and authorized by, FM Approvals prior to implementation for production.
- The manufacturer shall assign an appropriate person or group to be responsible for, and require that, proposed changes to FM Approved or Listed products be reported to FM Approvals before implementation. The manufacturer shall notify FM Approvals of changes in the product or of persons responsible for keeping FM Approvals advised by means of FM Approvals' Form 797, FM Approved Product/Specification-Tested Revision Report or Address/Main Contact Change Report.
- Records of all revisions to all FM Approved products shall be maintained.

5.2 Facilities and Procedures Audit (F&PA)

5.2.1 An audit of the manufacturing facility is part of the Approval investigation to verify implementation of the quality assurance program. Its purpose is to determine that the manufacturer's equipment, procedures, and quality program are maintained to insure a uniform product consistent with that which was tested and FM Approved.

5.2.2 These audits shall be conducted periodically but at least annually by FM Approvals or its representatives.

5.2.3 FM Approved products or services shall be produced or provided at or from the location(s) audited by FM Approvals and as specified in the Approval Report. Manufacture of products bearing the Approval Mark is not permitted at any other location without prior written authorization by FM Approvals.

5.3 Manufacturer's Responsibilities

The manufacturer shall notify FM Approvals of changes in product construction, components, raw materials, physical characteristics, coatings, component formulation or quality assurance procedures prior to implementation.

APPENDIX A

Units of Measurement

LENGTH:
in. - ‘‘inches’’; (mm - ‘‘millimeters’’)
mm = in. × 25.4
ft - ‘‘feet’’; (m - ‘‘meters’’)
m = ft × 0.3048

AREA:
in^2 - ‘‘square inches’’; (mm^2 - ‘‘square millimeters’’)
$mm^2 = in^2 \times 6.4516 \times 10^2$
ft^2 - ‘‘square feet’’; (m^2 - ‘‘square meters’’)
$m^2 = ft^2 \times 0.0929$

MASS:
lb - ‘‘pounds’’; (kg - ‘‘kilograms’’)
kg = lb × 0.454

PRESSURE:
psi - ‘‘pounds per square inch’’; (bar - ‘‘bar’’)
kPa = psi × 6.895
bar - ‘‘bar’’; (kPa - ‘‘kilopascals’’)
bar = kPa × 0.01
bar = psi × 0.06895

HEAT:
Btu - ‘‘British thermal units’’; (J - ‘‘joules’’)
$J = Btu \times 1.0551 \times 10^3$

HEAT RELEASE RATE:
Btu/min - ‘‘British thermal units per minute’’;
(kW - ‘‘kilowatts’’)
kW = Btu/min × 0.0176

TEMPERATURE:
°F - ‘‘degrees Fahrenheit’’; (°C - ‘‘degrees Celsius’’)
°C = (°F - 32) × 0.556

LIQUID:
gal - ‘‘gallons’’; (L - ‘‘liter’’)
L = gal × 3.785
L - ‘‘liter’’; (dm^3 - ‘‘cubic decimeters’’)
$L = dm^3$

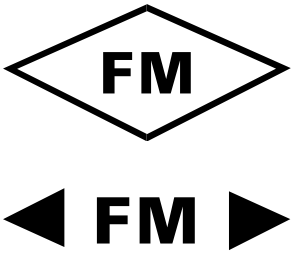
FLOW RATE:
gal/min - ‘‘gallon per minute’’;
(L/min - ‘‘liters per minute’’)
L/min = gal/min × 3.785

APPENDIX B

FM Approvals Certification Marks

FM Approvals certifications marks are to be used only in conjunction with products or services that have been Approved by FM Approvals and in adherence with usage guidelines.

FM APPROVED mark:
Authorized by FM Approvals as a certification mark for any product that has been FM Approved. There is no minimum size requirement for the mark, but it must be large enough to be readily identifiable. The mark should be produced in black on a light background, or in reverse on a dark background.



Cast-On FM Approvals marks:
Where reproduction of the FM Approved mark described above is impossible because of production restrictions, use these modified versions of the FM Approved mark. There is no minimum size requirement for the mark, but it must be large enough to be readily identifiable.

FM Approved Mark with "C" only:
Authorized by FM Approvals as a certification mark for any product that has been evaluated by FM Approvals in accordance with Canadian codes and standards. There is no minimum size requirement for the mark, but it must be large enough to be readily identifiable. The mark should be produced in black on a light background, or in reverse on a dark background.

FM Approved mark with "C" and "US":
Authorized by FM Approvals as a certification mark for any product that has been evaluated by FM Approvals in accordance with US and Canadian codes and standards. There is no minimum size requirement for the mark, but it must be large enough to be readily identifiable. The mark should be produced in black on a light background, or in reverse on a dark background.

FM Approvals Certification Marks Usage Guidelines

All FM Approvals certification marks are the sole property of FM Approvals LLC (‘‘FM Approvals’’) and are registered or the subject of applications for registration in the United States and many other countries. They are for use only according to these guidelines.

FM Approvals certification marks may be used only on FM Approved products and related product packaging, in advertising material, catalogs and news releases. Use of FM Approvals certification marks on such material is not a substitute for use of the complete FM Approvals certification mark on FM Approved products and/or product packaging.

No FM Approvals certification mark or aspect thereof may be incorporated as part of a business name, Internet domain name, or brand name/trademark for products/product lines. This includes both design aspects (the FM Approvals ‘‘diamond,’’ etc.) and word aspects (‘‘FM,’’ ‘‘Approved,’’ etc.). The use of any FM Approvals certification mark as a trademark is strictly prohibited.

The Approval Standard number or class number may not be incorporated as part of a business name, Internet domain name, or brand name/trademark for products/product lines. For example, a company may not say ‘‘ABC Company’s 4100 Fire Door is FM Approved’’; the proper terminology is, ‘‘ABC Company’s Fire Door is FM Approved per Approval Standard 4100.’’

FM Approvals certification marks, except for the FM Approvals Quality System Registration mark, may not be used on business stationery/cards/signage because this could mischaracterize the relationship with FM Approvals. Additionally, these items should not reference any FM Approvals certification mark.

Products or services may not be marketed under any mark or name similar to ‘‘FM Global,’’ ‘‘FM Approvals’’ or any of the FM Approvals certification marks. Further, products or services may not be marketed to imply a relationship beyond the scope of any Approval made by FM Approvals.

When an FM Approvals certification mark is used in advertising material or on product packaging, all material must reflect the specific circumstances under which the product was FM Approved. The material must clearly differentiate between products that are FM Approved and those that are not, and may not, in any way, imply a more substantial relationship with FM Approvals.

A company may not reference the intent to submit a product for Approval or the expectation that a company will have a certain product FM Approved in the future. For example, a company may not state, ‘‘Approval by FM Approvals pending’’ or ‘‘Approval by FM Approvals applied for.’’

FM Approvals certification marks should not be preceded or followed by a qualifier that indicates a degree of certification or acceptability. For example, ‘‘exceeds,’’ ‘‘first’’ or ‘‘only’’ may not be used to qualify any FM Approvals certification mark.

Only original artwork issued by FM Approvals should be used. The FM Approvals certification marks should not be altered in any way other than to resize the artwork proportionately. Unacceptable uses of the marks include, but are not limited to, adding/deleting wording or artwork, reducing the artwork to an illegible size, animation or distortion.

The text of the FM Approvals certification marks may not be translated into any language other than English.

FM Approvals certification marks must appear in a size and location that is readily identifiable, but less prominent than the name of the owner of the certification or the manufacturer/seller/distributor of the certified products.

APPENDIX C: Test Procedure for No Spark on Impact

C-1 Introduction

C-1.1 This test procedure is intended to show if an impactor made from the alloy used to produce spark resistant tools may generate a spark when falling on a number of different materials that may be encountered during use.

C-2 Test Apparatus and Arrangement

C-2.1 The description of the test apparatus is general in nature. Any equipment capable of performing the test procedure within the allowable tolerances is permitted. Only the major components are described.

C-2.2 Impactor – The impactor shall be a cast or machined solid bar with a weight of 5 lb ± 0.5 lb (2.3 ± 0.2 kg). It shall have a square cross section, a length/width ratio of no less than 3:1 and sharp edges at the end with the impacting face. A ⅛ in. (3 mm) hole shall be drilled across the width and centered in the width dimension ½ in. (13 mm) from the supported end. A length of string or small diameter wire shall be looped through the hole to allow attachment to the Quick Release Device.

C-2.3 Impacted Material – The impacted material shall be rough surface granite, rough surface cast concrete, and tool steel, minimum 18 in. × 18 in (0.5 m × 0.5 m) and thick enough not to be fractured as a result of the impact.

C-2.4 Test Frame – The test frame shall be fabricated from steel sections capable of supporting the material to be impacted at the appropriate location and angle and without excessive movement on impact.

C-2.5 Quick Release Device – A quick release device shall be used to release the impactor such that it can freely fall when released. The device shall be permitted to be attached to a rope or cable and a pulley system to aid raising the impactor to the proper height. The rope or cable shall not be attached in any way to the impactor as it is falling onto the sample.

C-3 Test Specimen

The test specimen shall be the impactor as described in C-2.2.

C-4 Test Procedure

C-4.1 The test specimen shall be attached to the Quick Release Device.

C-4.2 A suitable video recording device shall be positioned to record the specimen (impactor) striking the impacted material. Recording shall start no less than 10 seconds before release of the impactor and stop no more than 5 seconds after impact.

C-4.3 Each alloy under test shall be subjected to two (2) separate tests for each material used as the impacted surface. The point of impact shall be separated by no less than 2 in. (50 mm).

C-4.4 The impactor shall be raised to a height of 5 ft (1.5 m) over the midpoint of the material to be impacted. The impactor shall then be released such that it falls freely under gravity onto the surface of the impacted material.

C-5 Performance Requirements

The specimen shall be considered to meet the test criteria if upon review of the video record of each impact no spark can be detected.

APPENDIX D

DANGER: The chemical used in this test method is extremely flammable and a health hazard if not handled properly. Local exhaust ventilation shall be provided. All recommended personal protective equipment shall be worn when handling the test materials.

Read and follow all precautions specified in the MSDS's for this chemical.

Minimal chemical volumes shall be used to perform the test, local ventilation requirements must be determined and stated, personal protective equipment that must be worn shall be appropriate (chemically compatible gloves, respirator and cartridge types), proper disposal of test materials and surplus chemical storage requirements shall be followed.

D-1 Introduction

D-1.1 This test method is intended to evaluate the ability of particles cast from the test specimen during a grinding operation to ignite a flammable chemical vapor.

D-2 Test Apparatus and Arrangement

D-2.1 The description of the test apparatus is general in nature. Any equipment capable of performing the test procedure within the allowable tolerances is permitted. Only the major components are described.

D-2.2 Motor Driven Grinder and Grinding Wheel – The grinding wheel shall be 1 in. (13 mm) thick, 8 in. (200 mm) diameter, and consisting of bound ''medium'' aluminum oxide grit. It shall be driven by an electric motor operating at 3600 rpm. The guard/tool rest on the machine shall allow positioning of the test specimen as described in this procedure.

D-2.3 Sample Cup and Cotton Batting – The sample cup shall be constructed of metal, be square or round with side or diameter dimension between 3 in. (75 mm) and 4 in. (100 mm) with sides not to exceed 1 in. (25 mm) high. The cotton batting may be gauze or felt type and loosely fill the sample cup used but in no event be higher than the side.

D-2.4 Flammable Liquid – The flammable liquid shall be Carbon Disulfide (CAS# 75-15-0) of minimum 99% purity.

D-2.5 Steel test bar – The steel test bar shall be made from either tool steel, hot rolled, or cold rolled plate and have a cross section of 1 in (25 mm) by 0.25 in (6 mm).

D-3 Test Specimen

The specimen shall be made from the alloy under test with a minimum cross section of 1 in. (25 mm) by 0.25 in. (6 mm) and no greater than 1.5 in. (38 mm) by 1 in. (25 mm). The specimen may be machined or cast.

D-4 Test Procedure

D-4.1 The sample cup and cotton batting shall be placed directly beneath and between 3 in. (75 mm) and 4 in. (100 mm) from the point of contact of the grinding wheel and the test specimen.

D-4.2 Add 100 ml (3 oz.) of Carbon Disulfide to the sample cup.

D-4.3 The specimen shall be applied to the grinding wheel rotating at 3600 rpm so that the width of the specimen covers the width of the wheel and particles are cast upon the liquid soaked cotton batting for 30 seconds continuously. In the case of vapor ignition remove the specimen from the wheel and extinguish any flames. Record whether ignition occurs.

D-4.4 In the event that no ignition occurs with the test specimen, the steel test bar shall be immediately applied to the rotating wheel in the same fashion and for the same period of time that the sample was applied. Record when ignition occurs.

D-5 Performance Requirement

No ignition of flammable vapors shall occur when the specimen is applied to the grinding wheel.