UL 711

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Rating and Fire Testing of Fire Extinguishers

Underwriters Laboratories Inc. (UL)
333 Pfingsten Road
Northbrook, IL 60062-2096

UL Standard for Safety for Rating and Fire Testing of Fire Extinguishers, UL 711

Seventh Edition, Dated December 17, 2004

Revisions: This Standard contains revisions through and including June 1, 2007.

Summary of Topics

This revision to ANSI/UL 711 includes a revision to the wood crib fire tests for Class A extinguishers.

The revised requirements are substantially in accordance with UL's Proposal(s) on this subject dated August 11, 2006.

The revisions dated June 1, 2007 include a reprinted title page (page1) for this Standard.

As indicated on the title page (page 1), this UL Standard for Safety is an American National Standard. Attention is directed to the note on the title page of this Standard outlining the procedures to be followed to retain the approved text of this ANSI/UL Standard.

As indicated on the title page (page1), this UL Standard for Safety has been adopted by the Department of Defense.

The UL Foreword is no longer located within the UL Standard. For information concerning the use and application of the requirements contained in this Standard, the current version of the UL Foreword is located on ULStandardsInfoNet at: http://ulstandardsinfonet.ul.com/ulforeword.html

The master for this Standard at UL's Northbrook Office is the official document insofar as it relates to a UL service and the compliance of a product with respect to the requirements for that product and service, or if there are questions regarding the accuracy of this Standard.

Revisions of UL Standards for Safety are issued from time to time. A UL Standard for Safety is current only if it incorporates the most recently adopted revisions.

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The requirements in this Standard are now in effect, except for those paragraphs, sections, tables, figures, and/or other elements of the Standard having future effective dates as indicated in the preface. The prior text for requirements that have been revised and that have a future effective date are located after the Standard, and are preceded by a ″SUPERSEDED REQUIREMENTS″ notice.

New product submittals made prior to a specified future effective date will be judged under all of the requirements in this Standard including those requirements with a specified future effective date, unless the applicant specifically requests that the product be judged under the current requirements. However, if the applicant elects this option, it should be noted that compliance with all the requirements in this Standard will be required as a condition of continued Recognition and Follow-Up Services after the effective date, and understanding of this should be signified in writing.

This Standard consists of pages dated as shown in the following checklist:

Page	Date
1-2	June 1, 2007
3	December 17, 2004
4	June 1, 2007
5-6	December 17, 2004
7	June 1, 2007
8-28	December 17, 2004

No Text on This Page

Underwriters' Laboratories of Canada
CAN/ULC-S508
Fourth Edition

Underwriters Laboratories Inc.
ANSI/UL 711
Seventh Edition

Rating and Fire Testing of Fire Extinguishers

December 17, 2004

(Title Page Reprinted: June 1, 2007)

This common standard has been jointly revised on June 1, 2007. For this purpose, ULC and UL are issuing amendment pages dated June 1, 2007.

Approved by Standards Council of Canada

ANSI/UL 711-2007

Commitment for Amendments

This Standard is issued jointly by Underwriters Laboratories Inc. (UL) and Underwriters' Laboratories of Canada (ULC). Amendments to this Standard will be made only after processing according to the Standards writing procedures by UL and ULC.

UL and ULC are separate and independent entities and each is solely responsible for its operations and business activities. The UL trade names and trademarks depicted in this document are the sole property of Underwriters Laboratories Inc. The ULC trade names and trademarks depicted in this document are the sole property of Underwriters' Laboratories of Canada.

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Revisions of this Standard will be made by issuing revised or additional pages bearing their date of issue. A UL Standard is current only if it incorporates the most recently adopted revisions, all of which are itemized on the transmittal notice that accompanies the latest set of revised requirements. Comments or proposals for revisions on any part of the Standard may be submitted to UL at any time. Proposals should be submitted via a Proposal Request in UL's On-Line Collaborative Standards Development System (CSDS) at http://csds.ul.com.

The most recent designation of ANSI/UL 711 as an American National Standard (ANSI) occurred on June 1, 2007.

This ANSI/UL Standard for Safety, which consists of the Seventh Edition with revisions through June 1, 2007, is under continuous maintenance, whereby each revision is ANSI approved upon publication.

The Department of Defense (DoD) has adopted UL 711 on July 2, 1990. The publication of revised pages or a new edition of this Standard will not invalidate the DoD adoption.

CONTENTS

Preface

This is the common UL and ULC Standard for Rating and Fire Testing of Fire Extinguishers. It is the fourth edition of CAN/ULC-S508, including Amendment 2, and the seventh edition of UL 711. This common standard has been jointly revised on June 1, 2007. For this purpose, UL and ULC are issuing amendment pages dated June 1, 2007.

This common Standard was prepared by Underwriters Laboratories Inc., Underwriters' Laboratories of Canada and the manufacturing industry. The efforts and support of the Extinguisher Technical Harmonization Committee are gratefully acknowledged.

This Standard was formally approved by the ULC Committee on Portable Fire Extinguishers.

The Annexes in this Standard are for information purposes only.

Note: Although the intended primary application of this Standard is stated in its Scope, it is important to note that it remains the responsibility of the users of the Standard to judge its suitability for their particular purpose.

Level of harmonization

This standard used an ISO format, but is not based on, nor shall it be considered equivalent to, an ISO standard. This standard is published as an identical standard.

An identical standard is a standard that is the same in technical content except for conflicts in Codes and Governmental Regulations. Presentation shall be word for word except for editorial changes.

Interpretations

The interpretation by the SDO of an identical or equivalent standard shall be based on the literal text to determine compliance with the standard in accordance with the procedural rules of the SDO. If more than one interpretation of the literal text has been identified, a revision shall be proposed as soon as possible to each of the SDOs to more accurately reflect the intent.

UL Effective Date

As of August 14, 2007 all products Listed or Recognized by UL must comply with the requirements in this Standard.

A UL effective date is one established by Underwriters Laboratories Inc. and is not part of the ANSI approved Standard.

INTRODUCTION

1 Scope

1.1 These requirements cover rating, and performance during fire tests, of fire extinguishers intended for use in attacking Class A, B, C, D, and K fires as defined herein. These requirements also cover performance during fire tests of fire extinguishing agents for application on Class D fires. The ultimate rating of an extinguisher or the prescribed use of an extinguisher or fire extinguishing agent is based on its fire-extinguishing potential as determined by fire tests and presupposes installation and use in accordance in the United States with the Standard for Portable Fire Extinguishers, NFPA 10, and with the National Fire Code of Canada.

1.2 Fire extinguishers, fire extinguishing agents, or both shall also comply with the requirements for construction and performance as applicable to specific types, designs, sizes, and arrangements. Such additional requirements are not within the scope of these requirements.

2 Units of measurement

2.1 The metric unit shall be designated as the official unit for purposes of this standard. Where values of measurement are specified in both SI and English units, either unit is used. In cases of dispute, the metric unit shall be used.

3 Reference publications

3.1 See Annex A for a list of publications referenced in this standard. Any undated reference to a code or standard appearing in the requirements of this standard shall be interpreted as referring to the latest edition of that code or standard. When the latest edition of a standard is not applicable, the appropriate edition is indicated accordingly in Annex A.

4 Glossary

4.1 For the purpose of this standard the following definitions apply.

4.2 AFFF – Aqueous film-forming foam.

4.3 AUTOIGNITION TEMPERATURE – The temperature at which the test fuel ignites automatically.

4.4 CONTROL – A reduction in fire intensity of approximately 90 percent.

4.5 EFFECTIVE DISCHARGE – The time of discharge of extinguishing agent from the extinguisher until gas point.

4.6 FFFP – Film-forming fluoroprotein.

4.7 GAS POINT – The point in time when the discharge changes from the extinguishing agent alone to a gas and extinguishing agent combination.

4.8 LETTER DESIGNATIONS – The letter designates the general class of fire for which the extinguisher or agent is acceptable:

Class A Fires – Fires that involve ordinary combustible materials such as wood, cloth, paper, rubber, and many plastics.

Class B Fires – Fires that involve flammable liquids, oils, petroleum greases, tars, oil-base paints, solvents, lacquers, alcohols, and flammable gases.

Class C Fires – Fires that involve energized electrical equipment where the electrical nonconductivity of the fire extinguishing agent as discharged is of importance. (When electrical equipment is de-energized, extinguishers rated for Class A or B fires are used.)

Class D Fires – Fires that involve combustible metals, such as magnesium, titanium, zirconium, sodium, lithium, and potassium.

Class K Fires – Fires that involve cooking appliances with flammable cooking oils and fats, vegetable or animal.

4.9 NUMERAL DESIGNATIONS – The numeral that indicates the extinguishing potential of a fire extinguisher.

4.10 UNBURNED WOOD – The minimum clear, uncharred area where the thickness is measured across the smallest dimension of the test member following a fire test.

5 Ratings

5.1 Extinguishers are classed and rated according to their fire extinguishing potential which is indicated by numeral and letter designations.

5.2 The numerical portion of Class A ratings of extinguishers is developed on the basis of comparative fire tests using various sizes of wood-crib and wood-panel.

5.3 The numerical portion of Class A ratings of large sizes of extinguishers (usually wheeled) is developed on the basis of wood-crib fires only.

5.4 The numerical portion of Class B ratings of extinguishers is developed on the basis of fire tests using square steel pans in specific size increments and a flammable liquid test fuel similar to commercial grade heptane. The fire extinguishing classification is equivalent to 40 percent of the area of fire consistently extinguished by an expert operator. The numeral thus derived is an approximate indication of the relative fire extinguishing potential of the extinguisher.

5.5 There are no numerical components for Class C ratings of extinguishers, as only the electrical nonconducting characteristics of the agent when being discharged are significant, and no effort is made to indicate the extinguishing potential for fires that involve electrical equipment.

5.6 There are no numerical components for Class D ratings of extinguishers. Extinguishers and agents for use on Class D (combustible metals) fires are rated for the amount of agent and the method of application needed to control fire involving a particular quantity and type of metal.

5.7 There are no numerical components for Class K ratings of extinguishers, as the fire extinguishing characteristics of the extinguisher have only been determined for a single size fire source.

5.8 Extinguishing agents are classed according to the general class of fire for which the agent is acceptable, expressed by letter designation, where applicable. They are also rated for relative extinguishing effectiveness according to the amount of fire, of a given class, repeatedly extinguished.

PERFORMANCE

6 General

6.1 Wood crib fire tests for Rating-Class up to and including 10-A, wood panel fire tests and flammable liquid fire tests for Rating-Class up to and including 20-B are to be conducted in an essentially draft-free room having a volume large enough to assure a supply of oxygen and visibility for the duration of the test. A room having a ceiling height of approximately 7.5 m (24 ft), a volume of at least 1600 m^3(57,000 ft^3), and a total vent area of at least 4.5 m^2(50 ft^2) meets the intent of this requirement. The room is to have a smoothly finished concrete floor. For a Rating-Class 20-A and larger, the tests are to be conducted outdoors under conditions of essentially still air [5 km/h (3 mph) or less] and no precipitation. Flammable-liquid fire tests for a Rating-Class up to and including 20-B are to be conducted in a large-volume, essentially draft-free room. For a Rating-Class exceeding 20-B the tests may be conducted outdoors. Outdoor fire tests are to be conducted under conditions of steady breeze [5 – 13 km/h (3 – 8 mph)] with gusts not greater that 16 km/h (10 mph) and no precipitation.

6.2 All fire tests are to be conducted by experienced personnel. The operator of the extinguisher is to be protected against heat by wearing a safety helmet with heat-resistant face guard, and heat resistant long coat and gloves. A self-contained breathing apparatus, or the equivalent, is recommended.

7 Class A extinguishers

7.1 General

7.1.1 A Class A fire extinguisher, under conditions of continuous discharge with all devices for controlling the flow of the extinguishing agent maintained in the position for maximum discharge, shall extinguish wood crib and wood panel test fires as designated in the following requirements for a given class and rating. A test fire is considered to be extinguished when it reaches a state that will not be subject to self-reignition or continued smoldering under the conditions of test.

7.1.2 For an extinguisher to become eligible for a given class and rating, two out of three test fires shall be extinguished for crib fires and two consecutive test fires shall be extinguished for panel fires. For any new classification and rating or new extinguishing agent, three consecutive test fires shall be extinguished. The total number of test fires shall not exceed six without any extinguisher modification that affects extinguisher performance, and each test shall be conducted starting with an extinguisher charged with its rated capacity.

7.1.3 The minimum effective discharge time shall be at least 13 seconds for an extinguisher intended for a 2-A or higher rating class.

7.1.4 The minimum effective discharge time is to be determined by an operation test of an extinguisher charged with its rated capacity at 21 ±3°C (70 ±5°F) while being held in its intended operating position.

7.1.5 The extinguishment of test fires for Class A water extinguishers is primarily a function of the amount of water and the duration and range of its discharge. Extinguishers up to and including 125 L (33 gal) water capacity and otherwise conforming to the appropriate requirements for discharge capacity, duration, and range are eligible for rating without fire testing. In such cases the class and rating is to be applied in accordance with Table 1.

7.1.6 Other fire extinguishing agents or water-type extinguishers utilizing improved application methods which develop greater Class A extinguishing potential provided for in Table 1 shall be subjected to fire tests to determine the Class A rating.

7.1.7 Class A extinguishers to be rated on the basis of tests for Rating-Class 1-A through 6-A shall be subjected to the appropriate wood crib and wood panel test fires. Class A extinguishers for Rating-Class 10-A or higher shall be rated on the basis of appropriate wood crib test fires only.

7.2 Wood crib fire test

7.2.1 A wood crib is to consist of layers of 38 by 38 mm trade size [2 by 2 (1-1/2 by 1-1/2 in)] or size 38 by 89 mm trade size [2 by 4 (1-1/2 by 3-1/2 in)] kiln-dried spruce or fir lumber having a moisture content of 9 to 13 percent as determined by the Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Base Materials, ASTM D4442, in which samples are dried to constant weight in an oven at a temperature of 103 ±2°C (217 ±3°F). A hand-held meter employed in accordance with the Standard Test Methods for Use and Calibration of Hand-Held Moisture Meters, ASTM D4444, is also used to provide a means of sampling moisture content prior to testing. The general configuration and support of a typical crib is illustrated by Figure 1. The alternate layers are to consist of specified sizes and lengths of lumber placed at right angles to one another. The individual wood members in each layer are to be evenly spaced in forming a square determined by the specified length of the wood members. The length, size, and number of individual wood members and their arrangement in the crib are to be as specified in Table 2.

7.2.2 The crib is to be on an angle iron frame, mounted on a weighing platform as shown in Figure 1, at a height of 400 mm (16 in) above the floor or grade level. The wood members forming the outside edges of the crib are to be stapled or nailed together to provide strength to resist forces exerted by the extinguisher discharge.

7.2.3 The net mass of the crib is to be determined prior to commencement of the test and a value equivalent to 55 percent of this mass is to be calculated.

7.2.4 Ignition of the crib is to be accomplished by the burning of commercial grade heptane, see 8.2.4, in a pan placed symmetrically under the vertical axis of the crib. The steel pans for all sizes are to be square. The dimensions of the pan and the amount of fuel to be burned are to be as specified in Table 3.

7.2.5 When supplementary operations are required to activate an extinguisher (such as puncturing of cartridges or opening of valves on expellant gas containers), they are to be performed at a time in advance of attack on the fire consistent with normal operating procedure for the extinguisher and to ensure that the extinguisher is operated at, and not in excess of its normal operating pressure.

7.2.6 The liquid fuel is to be ignited and burned out. The crib fire is to be attacked when its mass has been reduced to 55 ±1 percent of its original mass. The crib is to be attacked from the front from an initial distance of a minimum 1.8 m (6 ft). Then the operator is able to reduce the distance of attack and direct the discharge at the sides, top, and bottom of the crib. In no case is the discharge to be directed at the back of the crib. Discharge is to be continuous until the extinguisher is completely discharged.

7.2.7 During the test the following observations are to be made and recorded:

a) Burnout time of commercial grade heptane charge;

b) Application of extinguisher;

c) Fire under control or extinguished;

d) End of effective discharge; and

e) Wind velocities and weather conditions when tests are conducted outdoors.

7.2.8 When the fire is under control or extinguished, observations are to be made and recorded concerning the presence and location of any glowing embers and the increase or decrease of the intensity of such glowing combustion until the fire reignites or is completely extinguished within a period of 15 minutes after discharge of the extinguisher. In the event of reignition, the time is to be recorded.

7.2.9 At the end of the test, the amount of extinguishing agent used and the condition of the charred members of the crib are to be noted and recorded.

7.3 Wood panel fire test

7.3.1 The wood panel is to consist of a solid square wood-panel backing on which are applied two horizontal sections of furring strips spaced apart and away from the panel by vertical furring strips to provide for a large vertical surface area of wood subject to combustion. A typical panel is illustrated by Figure 2.

7.3.2 The panel size for a given Rating-Class is to be constructed as shown in Table 4.

7.3.3 Lumber used in constructing a panel is to be kiln-dried and is to have a moisture content of between 9 and 13 percent as determined by the Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Base Materials, ASTM D4442, in which samples are dried to constant weight in an oven at a temperature of 103 ±2°C (217 ±3°F). A hand-held meter employed in accordance with Standard Test Methods for Use and Calibration of Hand-Held Moisture Meters, ASTM D4444, is also to be used to provide means of sampling moisture content prior to testing. The solid square backing panel is to be made using 19 by 140 mm trade size [1 by 6 (3/4 by 5-1/2 in)] D&M sheathing of spruce or fir. This material is also to be used for cleats to be applied to the back of the solid section. The furring strips are to consist of 19 by 19 mm trade size (3/4 by 3/4 in) S4S clear fir. All lumber, whether for backing, cleats, or strips, is to be cut in exact lengths appropriate for the panel size.

7.3.4 The solid square backing panel is to be constructed with tight joints horizontal to the floor or bottom end and employing full-length vertical cleats on the back at each side formed by the board ends. Any large knots in the panel material are to be removed. No knots are to be present along the edges of the panel. Such openings and other holes are to be filled with putty to prevent the passage of flame. The 2.44 and 3.05 m (8 and 10 ft) square panels are to include a third cleat on the back at the vertical center line. The 3.66, 4.27, and 5.18 m (12, 14, and 17 ft) square panels are to include, respectively, four, five, and seven cleats, the cleats being equally spaced from one another.

7.3.5 Vertical furring strips on 610 mm (2 ft) centers are to be nailed to the front of the solid panel. Horizontal furring strips spaced 19 mm (3/4 in) apart [38 mm (1-1/2 in) centers] are to be nailed thereon. A second application of vertical and horizontal furring strips is to be made in the same pattern and manner over the first network of furring strips.

7.3.6 Nails or staples are to be selected to provide a strong assembly without causing splitting of wood members.

7.3.7 The quantity of excelsior specified in Table 4 is to be divided into four separate and equal windrows. The excelsior, of seasoned basswood, poplar, or aspen, is to be new and dry and is to be pulled apart and each windrow is to be equal in length to the width of the test panel. The first windrow is to be readied for placement directly against the base of the test panel. The three remaining windrows are to be held in reserve at a location approximately 3 m (10 ft) from the front of the test panel. A board having a length equal to the width of the windrows and provided with handles to manipulate and support the board on its edge is to be prepared for pushing reserve windrows into position.

7.3.8 The panel is to be secured in a vertical position approximately 4 m (13 ft) from the wall of the test room. The panel is to be supported by steel framework, hangers, or other means that do not obstruct or cover any part of the combustible material.

7.3.9 The fuel oil is to be uniformly applied to the panel using 9 L (2-1/2 gal) pressurized extinguishers. The fuel oil is to be Grade No. 2, as specified in the Standard Specifications for Fuel Oils, ASTM D396.

7.3.10 Any excess fuel oil accumulating on the concrete floor is to be removed, using a squeegee. Dry chemical is to be applied over fuel oil collecting on the floor at the sides or back of the panel. The first windrow of excelsior is to be placed into position.

7.3.11 When supplementary operations are required to activate an extinguisher (such as puncturing of cartridges or opening of valves on expellant gas containers), they are to be performed at a time in advance of attack on the fire consistent with intended operating procedure for the extinguisher and in order that the extinguisher is operated at, and not in excess of its intended operating pressure.

7.3.12 A fuse of commercial grade heptane [60 to 120 ml (2 to 4 ounces)] is to be made by quickly pouring a small stream on the floor along the front edge of the first windrow at the base of the test panel. The fuse is then to be lighted by match at the middle of the windrow, resulting in the ignition over the full length of the windrow.

7.3.13 Forty-five seconds after ignition of the first windrow, the second windrow is to be pushed up to the base of the test panel. The third and fourth windrows are to be similarly handled at 45 second intervals.

7.3.14 At 3 minutes 20 seconds after ignition all of the remaining excelsior is to be cleared away from the base of the test panel.

7.3.15 At this time the test panel burns vigorously. The horizontal furring strips at the lower portion of the test panel [150 to 760 mm (6 to 30 in)] above the floor are most damaged and usually begin to break between 4 minutes 15 seconds and 4 minutes 30 seconds after ignition.

7.3.16 The extinguisher is to be applied when the horizontal furring strips begin to break, and no longer than 4 minutes 30 seconds after ignition. The time of initial attack is to be recorded.

7.3.17 The operator is to attack the face of the test panel using horizontal, vertical, or diagonal sweeps across the panel until the extinguisher is completely discharged.

7.3.18 Devices controlling the flow of the extinguishing agent are to be maintained in position for maximum discharge for the duration of the test.

7.3.19 During the test the times at which the following events occur are to be recorded:

a) Application of extinguishing agent;

b) Fire in panel extinguished; and

c) End of effective discharge.

7.3.20 When the fire is under control or extinguished, observations are to be made and recorded concerning the presence and location of any glowing embers and the increase or decrease of the intensity of such glowing combustion until the fire reignites within a period of 15 minutes after the discharge of the extinguisher. In the event of reignition, the reignition time is to be recorded.

7.3.21 At the end of the test, the amount of the fire extinguishing agent used and the condition of charred furring strips and the back panel are to be noted and recorded. The test is to be considered to be as intended when there is present a core of unburned wood approximately 6 mm (1/4 in) in diameter remaining in the center of a sample of the 19 mm (3/4 in) furring strip taken from the panel at a height of 1 m (3 ft 6 in) above the floor.

8 Class B extinguishers

8.1 General

8.1.1 Class B fire extinguishers, under conditions of continuous discharge with all devices for controlling the flow of the extinguishing agent maintained in the position for maximum discharge, shall be capable of extinguishing flammable liquid test fires as designated in the following requirements for a given Rating-Class. A test fire is to be considered extinguished when it does not self-reignite under the conditions of test.

8.1.2 For an extinguisher to become eligible for a given class and rating, two consecutive test fires shall be extinguished, and for any new classification and rating or new extinguishing agent, three consecutive test fires shall be extinguished. The total number of test fires shall not exceed six without any extinguisher modification that affects extinguisher performance, and each test shall be conducted starting with an extinguisher charged with its rated capacity.

8.1.3 An extinguisher charged with its rated capacity and conditioned at its minimum storage and use temperature for 16 hours shall extinguish a Class B fire having an area numerically equal to 40 percent of the area of the pan used in the rating of the fire extinguisher.

8.1.4 Hand fire extinguishers tested for a Rating-Class greater than 20-B, established on the basis of outdoor fires, shall have been found eligible for a Rating-Class of 20-B established on the basis of an indoor [4.65 m^2 (50 ft^2)] test fire.

8.1.5 An extinguisher to be used in a fire test shall have been previously tested for minimum effective discharge time. The minimum effective discharge time shall be at least that specified in Table 5.

8.1.6 The minimum effective discharge time is to be determined by an operation test of an extinguisher charged with its rated capacity at 21 ±3°C (70 ±5°F) while being held in its intended operating position.

8.2 Flammable liquid fire test

8.2.1 The flammable liquid fire test is to be conducted using a steel pan, square in shape, and 200 to 305 mm (8 to 12 in) in depth, partially filled with water, when necessary, and a 50 mm (2 in) layer of commercial grade heptane. The pans are to be of steel a minimum 6 mm (1/4 in) thick, with liquid-tight welded joints and provided with a minimum 4.8 mm (3/16 in) thick angle to reinforce the upper edge. The reinforcing angle is to be continuous around the perimeter of the pan and is to form a turned-out edge flush with the top edge of the pan. The top edge surface so formed is to be 45 mm (1-3/4 in) in width. The reinforcing angle is to be continuously welded to the outside of the pan at the top edge and tack-welded at the edge of the lower leg of the angle. A typical pan arrangement is illustrated by Figure 3. The size of pan for a given classification and rating is to be as specified in Table 5.

8.2.2 The steel pan is to be located away from any walls or obstructions to enable attack or approach from any side. Test pans for indoor fires [4.65 m^2 (50 ft^2) maximum pan size] are to be placed directly on the floor of the room. Test pans for outdoor fires are to be placed in the ground so that the top edges of the pan are level with the ground surface for a distance of at least 1.9 m (6 ft) measured from the outside edge of the reinforcing angle. The area surrounding outdoor test pans shall be free of grass, weeds, and other combustible materials.

8.2.3 The test fuel is to consist of a minimum a 51 mm (2 in) layer of commercial grade heptane. The surface of the commercial grade heptane layer is to be located 152 ±6 mm (6 ±1/4 in) below the top edge of the pan. The 150 mm (6 in) freeboard over the top surface of the commercial grade heptane is to be established by adding a layer of water if necessary.

8.2.4 The flammable liquid used in the test is to be commercial grade heptane having the following characteristics:

a) Distillation –

   1) Initial Boiling Point ..... minimum 90°C (194°F)

   2) 50 Percent..... 94°C (201°F)

   3) Dry Point..... maximum 100°C (212°F)

b) Gravity ° API.....70.2 (not critical)

c) Specific Gravity 0.69 – 0.73 (60°F/60°F)

1) (15.56°C/15.56°C).....0.702 (not critical)

8.2.5 The following procedures are to be applied during ignition and attack.

a) When supplementary operations are required to activate an extinguisher (such as puncturing of cartridges or opening of valves on expellant gas containers), they are to be performed at a time in advance of attack on the fire consistent with normal operating procedure for the extinguisher and sufficient to ensure that the extinguisher is operated at, but not in excess of, its normal operating pressure.

b) After ignition, the test fuel is to burn for 60 seconds before attacking the fire with the extinguisher.

c) The techniques of attack are to be adapted to the discharge characteristics of the extinguisher. For example, a dry-chemical extinguisher requires a rapid side-to-side sweeping motion and moving in on the fire as the area is extinguished. However, an attack using a dry-chemical extinguisher is to be made from one side only. Similarly, a carbon-dioxide extinguisher horn is held in the fire area above the flammable liquid so as to obtain the best smothering possible. In this case, the operator attacks the fire from one side or from one corner of the pan. For AFFF, FFFP, and similar foaming or film-forming type extinguishers, the operator is able to attack the fires from the front edge of the pan and the adjacent sides of the pan. For any type extinguisher the operator shall not extend any part of his person past the edge of the test pan while fighting the fire.

8.2.6 During the tests the following observations are to be recorded:

a) Application of the extinguisher;

b) Duration of discharge of extinguisher;

c) Fire in pan extinguished; and

d) Wind velocities and weather conditions when tests are conducted outdoors.

8.2.7 After the fire test, the amount of fire extinguishing agent used is to be recorded.

9 Class C extinguishers

9.1 General

9.1.1 The discharge of an agent from an extinguisher charged with its rated capacity, as specified in the Electrical Conductivity Test, shall not show a visible breakdown between the electrically charged target and the discharging extinguisher and shall not increase the electrical conductivity of the extinguisher more than 1.0 milliampere as measured by a milliammeter.

9.1.2 The Class C designation is to be provided for an extinguisher only in conjunction with a rating previously established under the requirements for Class A, Class B, Class K, or any combination.

9.1.3 No tests for the fire-extinguishing ability of a Class C extinguisher on electrical fires are to be conducted. There are to be, therefore, no numerical components for Class C ratings as only the nonconducting characteristics of the agent as discharged are significant.

9.1.4 The test method for electrical conductivity of the discharge is:

a) To impress a high-voltage, 60 hertz, alternating current between an electrically insulated extinguisher and an electrically charged target; and

b) To measure the current flow, when any, through the path formed by the agent during the period it is being discharged towards the target.

9.2 Electrical conductivity test

9.2.1 The mounting for the extinguisher is to consist of an insulating platform made of four sheets of glass or Plexiglas measuring approximately 710 by 760 by 13 mm (28 by 30 by 1/2 in), each layer separated by three 50-mm (2-in) ceresin (wax) or Plexiglas blocks. See Figure 4. The bottom plate is to rest directly on a platform of dry lumber.

9.2.2 The extinguisher is to be supported in a wooden framework or scaffold by two well-shellacked dry wooden cross bars, bolted to clamp the cylinder. The ends of these bars are to rest in insulated bearings secured to the scaffold leg braces. Plates and blocks of phenolic composition are to furnish additional electrical insulation between the extinguisher and the clamp and scaffold members. The top of the scaffold, 1.5 m (5 ft) above the floor, is to be wood planked to form a 1.2 by 1.2 m (4 by 4 ft) working platform.

9.2.3 Operation of the extinguisher valve is to be provided by an extension rod of phenolic composition or other insulated means of remote control providing for safe handling.

9.2.4 A target of sheet copper, 300 by 300 mm (12 by 12 in), is to be constructed for receiving the discharge from the extinguisher. See Figure 4. The sheet is to be bent at 90 degrees (1.57 rads), to a radius of 12.7 mm (1/2 in), forming a V, each side of which measures 300 by 150 mm (12 by 6 in). The target is to be buffed to remove all sharp edges or burrs. The target is to be supported on a metal stem soldered to the inside of the target at the apex. The lower end of this stem is to be secured to a pedestal of phenolic composition approximately 50 mm (2 in) thick. The pedestal is to be supported on an insulating platform consisting of four 300 by 300 by 13 mm (12 by 12 by 1/2 in) glass or Plexiglas plates separated from each other by three 50 by 50 by 13 mm (2 by 2 by 1/2 in) ceresin or Plexiglas blocks between each plate. The bottom plate is to rest on a dry wood stand. The target assembly is to be adjusted for height to center the target plate opposite the open end of the extinguisher horn or discharge nozzle.

9.2.5 The extinguisher horn handle or nozzle handle in all tests is to be wrapped with metal foil which, in turn, is to make electrical contact with the extinguishing valve. A bare No. 8 AWG copper wire is to be strapped on the outside of the horn or nozzle and is to run from the foil to the discharge end, being bent at right angles across the mouth of the horn or nozzle to carry current to the point of discharge. The extinguisher is to be connected to the high side of the transformer as shown in Figure 5. The target, with its metallic supports, is to be connected to the grounded side of the test circuit.

9.2.6 The potential to be employed throughout the tests is to be derived from a transformer rated at 60 hertz, 5 kilovolt-ampere capacity, 125 to 100,000 volts, or the equivalent. The transformer primary circuit is to be energized from a 60 hertz line through an induction regulator which is to provide a continuously variable secondary voltage from 0 to 100,000 volts. The secondary potentials are to be measured through a potential transformer contained within the test transformer having ratios of 1 to 250 volts and 1 to 500 volts, respectively, in conjunction with a suitable voltmeter. A 125 mm sphere gap is to be connected across the secondary of the test transformer for protective purposes, the gap is to be opened such that the arc over does not occur at the potential being employed in the test. One leg of the test circuit is to be grounded at the sphere gap. See schematic diagram of wiring, Figure 5.

9.2.7 A thermocouple milliammeter calibrated to an accuracy of 0.5 percent, with thermocouple elements of 10, 3, and 1.5 milliamperes, is to be employed to measure the current flow between the extinguisher and the target. In using a meter of this type, the readings are apt to be influenced by radio frequency (RF) currents. Therefore, in the assembly of the apparatus, a capacitor rated 0.005 microfarads is to be connected across the meter terminals to shunt out these RF currents. The meter is to be installed in two box-like enclosures made of copper screen wire separated from each other by insulators. The outer screen enclosure is to be connected to the shield of the meter leads and to ground. The meter is to be connected in the grounded leg of the transformer at all times.

9.2.8 The reading indicating passage of current across the gap between the extinguisher and the target when no extinguishing agent is being discharged is to be called the meter-tare.

9.2.9 When thermocouple units are used in the tests, the current flow through the capacitor is to be calculated on the basis of a 60 hertz current. Since the 1.5 mA thermocouple unit requires approximately 1240 millivolts drop across the meter terminals to produce full-scale deflection, the current flow through the capacitor is to be calculated on the basis of this unit. The value of current shunted around the meter through the capacitor is negligible as compared with the current flow recorded by the meter.

9.2.10 The extinguisher is to be placed on the insulated platform and connected to the high side of the transformer. When more than one type of horn or nozzle is used on the extinguisher under test, the test is to be conducted using each type.

9.2.11 Each horn or nozzle is to be equipped with a No. 8 AWG wire. The target is to be placed at varying distances of 250 mm (10 in) and greater from the open end of the horn or nozzle to determine the minimum distance at which a potential of 100,000 volts is capable of being maintained without a flash over. The extinguisher is to be operated for 20 seconds, discharging the agent against the target with a potential of 100,000 volts impressed between the extinguisher and target, without visible effects. The condition is to be checked for an additional 15 seconds discharge.

9.2.12 The test is to be repeated, using each type horn or nozzle or other modification and also is to be conducted at least once with the target plate heated to an initial temperature of 370°C (700°F) prior to the discharge of the extinguisher.

10 Class D extinguishers and agents

10.1 General

10.1.1 Class D fire extinguishers, or an extinguishing agent arranged for manual handling, shall be capable of extinguishing combustible-metal test fires as designated for a given metal in the following, and of preventing the scattering of burning material beyond the test bed area during the conduct of the test. An extinguished test fire shall be in that state which is not subject to reignition under the conditions of test and shall contain enough unburned combustible metal to show extinguishment by the agent prior to burnout.

10.1.2 There are to be no numerical components for Class D ratings. The type of combustible metal for which the extinguisher or an agent is applicable and the area, depth, and other characteristics of the fires which are controlled and extinguished are to be as stated in any published advices and as described in the manufacturer's recommendations for use.

10.1.3 Prior to any demonstrations or fire tests, a review of the ingredients in the formulation of any agent is to be made. The review is to include study with respect to toxicity of the agent as prepared and offered for use, as well as fumes and products of combustion liberated when used in the attack on combustible metal fires for which the agent is recommended. The review is also to include study of the possible reactions which occur between the burning metals for which the agent is recommended and the various ingredients contained in the agent. Consideration is also to be given to the above factors as related to the possible misuse of the agent on combustible metal fires of a kind and type not included in the manufacturer's recommendations; particularly with reference to toxicity and safety hazard.

10.1.4 Fire tests are to include the tests outlined in 10.2 and 10.3 for the combustible metals specified. Additional tests are required to cover other fire conditions, where such conditions are different in nature than those specified.

10.2 Magnesium fire tests

10.2.1 Area fire tests are intended to represent fires occurring in magnesium chips and dust, both in the dry state and as mixed with cutting oils, as accumulated in depth over a specified area.

10.2.2 Magnesium chips are to consist of both the Grignard and Commercial grades. The Grignard grade chips are to be about 6 to 9 mm (1/4 to 3/8 in) long, 3 mm (1/8 in) wide, and 0.25 mm (0.010 in) thick. The Commercial grade chips and turnings are to be about 12 to 19 mm (1/2 to 3/4 in) long, 6 to 12 mm (1/4 to 1/2 in) wide, and average about 0.05 mm (0.002 in) thick. Magnesium dust is to consist of finely divided particles or grains. Oily chips and oily dust are to be prepared by adding 10 percent by weight of a petroleum base cutting oil having a specific gravity of approximately 33.6 API to the dry magnesium. The flash and fire points of the cutting oil, as determined by the Standard Test Method for Flash and Fire Points by Cleveland Open Cup (AASHTO T48)(DIN51376)(IP36/84), ASTM D92, are to be within ±5.6°C of 146°C and 154°C (±10°F of 295°F and 310°F), respectively.

10.2.3 The test fire beds are not to be disturbed during these tests. The area and depth of the test fire beds and weights of the combustible material are to be as specified in Table 6. An attack is to be made on each of the four test beds specified.

10.2.4 The test fire beds are to be arranged on a dry steel plate surface at a location permitting access from all sides.

10.2.5 Ignition is to be effected by directing a premixed gas and air flame to the surface of the fuel bed at the approximate center. The ignition device is to be adequate to cause prompt ignition, such as by a gas-oxygen torch or a large LP-Gas heating torch.

10.2.6 The application of the extinguishing agent is to begin when the fire has spread to approximately 50 percent of the surface of the test bed or when approximately 25 percent of the fuel is burning, whichever occurs first.

10.2.7 When the extinguishing agent is to be discharged from an extinguisher, one test is to be conducted using the dry chip test bed as specified in Table 6. In this test, application of the agent is to begin when the fire has involved approximately 50 percent of the test fuel. The extinguisher valve is to be fully opened at the start of the attack and for the entire discharge time. The attack is to be made with the discharge opening not more than 2.4 m (8 ft) from the edge of the test bed and not more than the distance recommended by the manufacturer.

10.2.8 After completion of the attacks on the six test beds specified in Table 6, one test is to be conducted using a test bed as specified in Table 6 for either the dry or oily chips. In the latter test the application of the extinguishing agent is to be delayed until the fire has spread to approximately 75 percent of the surface of the test bed.

10.2.9 Burning magnesium shall not be scattered beyond a one square meter area centered on the midpoint of the test bed area as the result of this method of attack.

10.2.10 The techniques involved in applying an extinguishing agent, including the quantities and depths of material required for extinguishing the test fires, are to be observed and recorded. The magnesium remaining in the unburned state is to be described and weighed. The techniques and other information, based on the most severe conditions encountered during the above tests, are to be used as a basis for the manufacturer's operating and use instructions and other published advices.

10.2.11 Pallet transfer fire tests are intended to represent fires occurring in magnesium chips as accumulated on wood flooring or other combustible surfaces, over an area and at a reasonable depth. This test is to be conducted using Grignard grade magnesium chips in the state (dry or oily) that resulted in the hottest and most difficult fire to extinguish during the Area Fire Tests described above.

10.2.12 Two wood pallets are to be prepared for use. Each pallet is to be constructed using two thicknesses of tongue and groove or shiplap, kiln-dried construction grade fir or pine, 19 mm (1 in) nominal thickness lumber nailed or stapled to form a platform at least 1100 by 1100 mm (42 by 42 in) square supported by nominal 38 by 89 mm (2 by 4 in) runners placed on edge. The two 19 mm (1 in) layers of lumber are to be placed at 90 degrees (1.57 rads) to one another. The pallets are to be stored in a dry location and are to be thoroughly air-dried prior to use. The moisture content of the lumber used is to be between 9 to 13 percent as determined by the Standard Test Methods for Direct Moisture Content and Measurement of Wood and Wood-Base Materials, ASTM D4442, in which samples are dried to constant weight in an oven at a temperature of 103 ±2°C (217 ±3°F). A hand-held meter employed in accordance with the Standard Test Methods for Use and Calibration of Hand-Held Moisture Meters, ASTM D 4444, is also used to provide a means of sampling moisture content prior to testing. The pallets are to be placed immediately adjoining one another on a dry surface at a location providing ample work area around the pallets.

10.2.13 One pallet is to be used to support the size and depth of fuel bed as specified in Table 6, the fuel being that described in 10.2.11. The second pallet is to be precoated over its surface with at least a 25 mm (1 in) thick layer of the extinguishing agent.

10.2.14 The test fire bed is to be ignited as described for the Area Fire Tests and is to burn until 50 to 75 percent of the area has become involved and the fire has become deep-seated.

10.2.15 The attack is to be made by two operators working with long-handled shovels. The material from the burning pile is to be roughly and quickly transferred from the pallet fire to the second pallet insulated with extinguishing agent. Care is to be exercised to provide mixing of the magnesium chips during transfer as by turning over the shovel load when placing the material on the second pallet.

10.2.16 After transfer has been completed, the fire is to be attacked with additional agent until under control and extinguished.

10.2.17 The above test is to be repeated, substituting Commercial magnesium chips and turnings for the Grignard grade material. This type test fuel is to be dry or oily so as to produce the most difficult test, the selection to be made on the basis of experience gained in previous tests.

10.2.18 The techniques involved in applying an extinguishing agent, including the quantities and depths of material required for protecting the surface of the first pallet, and for extinguishing the fire on the second pallet, are to be observed and recorded.

10.2.19 The wood surfaces of the second pallet shall not show evidence of charring beyond a depth of 1.5 mm (1/16 in) following the test.

10.2.20 Premix fire tests are intended to represent fires reoccurring in mixtures of magnesium chips or turnings and the extinguishing agent. This test is to be conducted using at least three batches of 4.5 kg (10 lb) of dry Grignard grade magnesium chips thoroughly mixed, respectively, with 4.5, 9.1, and 13.6 kg (10, 20, and 30 lb) of extinguishing agent.

10.2.21 Each batch is to be prepared for ignition by pouring the fuel into a conical pile on a dry steel plate at a location providing for access to all sides. A small fuse of uncoated magnesium chips is to be placed at the apex of the cone of mixed material.

10.2.22 Ignition is to be effected as for previous tests and the pile allowed to burn until the fire becomes deep-seated and intense.

10.2.23 The fire is to be attacked by manual transfer of the agent or by extinguisher discharge.

10.2.24 The above test is to be repeated using three similar batches consisting of mixtures of Commercial magnesium chips and turnings with the agent.

10.2.25 The specified mixture of agent and metal shall not burn at a rate greater than the chips alone.

10.2.26 The techniques involved in applying an extinguishing agent, including quantities and depths of material required for extinguishing the fire, are to be observed and recorded. The magnesium remaining in the unburned state is to be described and weighed.

10.2.27 Casting fire tests are intended to represent fires occurring in both horizontal and vertical surfaces of castings which would characteristically result in a pool of burning molten metal.

10.2.28 A magnesium casting or nest of castings is to be placed on a dry steel plate. The test fuel is to have a total weight of approximately 11.3 kg (25 lb).

10.2.29 Ignition of the castings is to be effected as for previous tests and the resulting fire allowed to burn until a pool of molten magnesium has been formed comprising the bulk of the original fuel.

10.2.30 The fire is to be attacked by manual transfer of the agent or by extinguisher discharge.

10.2.31 The techniques involved in applying an extinguishing agent, including the quantities and depths of material required for extinguishing the fire, are to be observed and recorded. The magnesium remaining in the unburned state is to be described and weighed.

10.3 Sodium, potassium, and sodium-potassium alloy fire tests

10.3.1 Fire tests based on these combustible metals having melting points approaching normal ambient temperatures are to be confined to attack on the metals in the liquid state. Liquid-state test fires assume the containment of the metal in a high-melting-point container or pan, or the spill from such container onto a noncombustible dry surface. In the latter case, the spill is to be confined for test purposes by pouring the flaming material into a container or pan of an area large enough to create a pool of molten metal having a depth of approximately 6 mm (1/4 in).

10.3.2 Such metals are ordinarily obtainable as bar stock. As such, the metals are to be handled in the form of lengths weighing 0.45 kg (1 lb) each.

10.3.3 The metals are melted in all cases in a covered heavy-gauge steel container having an area of approximately 0.2 m^2 (2-1/2 ft^2) and a depth of approximately 150 mm (6 in). The source of heat is to be such that no flames extend beyond the bottom of the container. The cover or lid is to be tight fitting.

10.3.4 The container used for melting and its cover are to be provided with side handles, legs, or other means to be tipped or removed by operators standing at distances of at least 1.2 m (4 ft) from the assembly.

10.3.5 The container used for melting is to be provided with means for measuring temperatures of molten metal above the bottom of the pan. This is accomplished by welding or otherwise securing a straight section of 15.8 mm (0.622 in) ID steel closed-end conduit through the side of the container so as to be approximately 1.6 mm (1/16 in) above the bottom. A chromel-alumel thermocouple is located within the conduit, having its junction at the approximate center of the container.

10.3.6 The charge of metal fuel in the solid state is to be inserted in the container, and the lid or cover is to be placed in position. The container is to be heated until the metal charge has reached a temperature of at least 510°C (950°F). The lid or cover is then to be removed. The combustible metal charge will ignite at this temperature in the presence of air.

10.3.7 Heating of the container and the surface burning of the metal fuel is to continue until the molten metal has reached a temperature of approximately 550 to 565°C (1025 to 1050°F). The programs outlined in the individual tests described below are then to be followed.

10.3.8 Metal fuel weighing 1.4 kg (3 lb) is to be melted and heated in the covered container as described above. The flaming charge is then to be poured into a steel pan having an area of 0.4 m^2 (4 ft^2) and a depth of at least 150 mm (6 in). The depth of fuel in the 0.4 m^2 (4 ft^2) pan will be approximately 6 mm (1/4 in).

10.3.9 The metal in the 0.4 m^2 (4 ft^2) pan is to burn until the entire surface area is flaming. The extinguishing agent is then to be applied by manual transfer of the agent or by extinguisher discharge.

10.3.10 The techniques involved in applying an extinguishing agent, including the quantities and depths of material required for extinguishing the fire, are to be observed and recorded.

10.3.11 Two pan fires are to be conducted, using the 0.23 m^2 (2-1/2 ft^2) container employed for previous tests. One fire is to employ a shallow pool of fuel, and the second fire is to be involved with a deep pool of molten metal.

10.3.12 The shallow-pool charge is to consist of 2.7 or 3.2 kg (6 or 7 lb) of combustible metal, resulting in depths of molten metal of less than 25 mm (1 in). The deep-pool charge is to consist of 15.9 kg (35 lb) of combustible metal, resulting in depths of molten metal of approximately 76 to 89 mm (3 to 3-1/2 in).

10.3.13 In this test other techniques are able to be introduced to afford practical control of deep-pool fires. One such technique is to employ a grating or other perforated surface installed above the bottom of the pan and located somewhat below the surface of molten metal, to assist in building a crust or covering surface formed by the extinguishing agent.

10.3.14 When the temperatures of approximately 550 to 565°C (1025 to 1050°F) are reached, the extinguishing agent is to be applied by manual transfer or extinguisher, whichever is applicable.

10.3.15 The techniques involved in applying an extinguishing agent, including the quantities and depths of material, are to be observed and recorded for the purposes outlined heretofore. The presence of unburned metal shall be evidence of extinguishment.

11 Class K extinguishers

11.1 General

11.1.1 Class K fire extinguishers under conditions of continuous discharge with all devices for controlling the flow of the extinguishing agent continuously maintained in the position for maximum discharge, shall:

a) Cause the fire in the fryer to be completely extinguished;

b) Not permit re-ignition of the vegetable oil for 20 minutes or until the temperature of the vegetable oil decreases to at least 33°C (60°F) below the autoignition temperature, whichever is longer, after discharge; and

c) Cause no splashing of flaming oil outside the fryer.

11.1.2 For an extinguisher to become eligible for a given class and rating, two consecutive fire tests test fires shall be extinguished, and for any new classification and rating or new extinguishing agent, three consecutive fires shall be extinguished. The total number of test fires shall not exceed six without any extinguisher modification that affects extinguisher performance, and each test shall be conducted starting with an extinguisher charged with its rated capacity.

11.1.3 Fire tests are to be conducted with the extinguisher charged with its rated capacity at 21 ±3°C (70 ±5°F). One additional test is to be conducted with the extinguisher charged with its rated capacity and conditioned for 16 h at its maximum operating temperature.

11.1.4 Each fire test is to be conducted in a draft-free room, having dimensions of at least 9 by 9 by 4 m (30 by 30 by 15 ft) high and an ambient temperature of a minimum 10°C (50°F).

11.2 Fryer fire test method

11.2.1 The test fire is to be conducted using a commercial deep fat fryer, natural gas or propane fired unit, having a nominal 36 kg (80 lb) capacity, approximately 460 mm (18 in) deep with a minimum 460 by 610 mm (18 by 24 in) surface area including a 150 mm (6 in) drip board. A depth of vegetable oil is to provide a 75 mm (3 in) freeboard from the top of the fryer to the top of the oil surface using a nominal 36 kg (80 lb) of oil. The vegetable oil is to have an autoignition temperature of a minimum 363°C (685°F). The oil temperature is to be measured with a thermocouple located 25 mm (1 in) below the fuel surface, and not closer than 75 mm (3 in) from the walls of the fryer.

11.2.2 The fryer shall demonstrate an average cooling rate of not more than 2.8°C (5°F) per minute. To determine the average cooling rate of the fryer, the oil described in 11.2.1 is to be heated in the uncovered fryer at its maximum energy input until the oil reaches at least 316°C (600°F), then the energy source is to be shut off and the cooling rate of the fuel source is to be determined as the oil cools from 316 to 260°C (600 to 500°F).

11.2.3 For the fire extinguisher test, the fryer is to be continually heated at its maximum energy input, and at a minimum rate of 6.7°C (12°F) temperature rise per minute as measured when heating the oil temperature from 260 to 316°C (500 to 600°F), until autoignition occurs.

11.2.4 At autoignition or when the temperature reaches 363°C (685°F), whichever occurs last, the fire is to burn freely with the energy source remaining on for 1 minute. After the 1 minute freeburn, the extinguisher is to be discharged onto the fryer continuously until the extinguisher is fully discharged. The energy source to the fryer is to remain on during discharge. The initial discharge of the extinguisher onto the fryer shall be at the distance specified in the manufacturer's instructions, and the extinguisher nozzle shall not extend over the front edge of the fryer during discharge.

TABLES

Table 1
Classification based on water capacity

Nominal extinguisher capacity		Rating-Class
Liters	(U.S. Gallons)	
4.5	1-1/4	1-A
9.0	2-1/2	2-A
14.0	4	3-A
18.0	5	4-A
36.0	10	6-A
64.0	17	10-A
125.0	33	20-A

Table 2
Wood-crib construction

Classification and rating	Number of wood members	Trade size and length of wood members		Arrangement of wood members in crib
		mm	(in)	
1-A	72	38 by 38 by 500	(2 by 2 by 20)	12 layers of 6
2-A	112	38 by 38 by 635	(2 by 2 by 25)	16 layers of 7
3-A	144	38 by 38 by 735	(2 by 2 by 29)	18 layers of 8
4-A	180	38 by 38 by 800	(2 by 2 by 32)	20 layers of 9
6-A	230	38 by 38 by 925	(2 by 2 by 36)	23 layers of 10
10-A	324	38 by 38 by 1100	(2 by 2 by 43)	27 layers of 12
20-A	256	38 by 89 by 1400	(2 by 2 by 55)	16 layers of 16 on edge 1 top layer of 10 flat
30-A	324	38 by 89 by 1625	(2 by 4 by 64)	18 layers of 18 on edge 1 top layer of 12 flat
40-A	400	38 by 89 by 1750	(2 by 4 by 69)	20 layers of 20 on edge 1 top layer of 14 flat

Table 3
Wood-crib ignition arrangement

Classification and rating	Flammable liquid pan size		Heptane charge, Liters
	mm	(in)	
1-A	400 by 400 by 100	(16 by 16 by 4)	1.1
2-A	535 by 535 by 100	(22 by 22 by 4)	2.0
3-A	635 by 635 by 100	(25 by 25 by 4)	2.8
4-A	700 by 700 by 100	(26 by 26 by 4)	3.4
6-A	825 by 825 by 100	(33 by 33 by 4)	4.8
10-A	1000 by 1000 by 100	(39 by 39 by 4)	7.0
20-A	1300 by 1300 by 100	(51 by 51 by 4)	11.8
30-A	1525 by 1525 by 100	(60 by 60 by 4)	16.3
40-A	1650 by 1650 by 100	(65 by 65 by 4)	19.0

Table 4
Wood-panel construction and arrangement

Rating – class	Test panel size		No. 2 fuel oil (ASTM D396) applied		Excelsior windrow material	
	m	(ft)	Liters	(U.S. Gallons)	kg	(lb)
1-A	2.45 by 2.45	(8 by 8)	3.80	(1)	4.55	(10)
2-A	3.05 by 3.05	(10 by 10)	7.55	(2)	9.05	(20)
3-A	3.65 by 3.65	(12 by 12)	11.35	(3)	13.60	(30)
4-A	4.25 by 4.25	(14 by 14)	15.15	(4)	18.15	(40)
6-A	5.20 by 5.20	(17 by 17)	22.70	(6)	27.20	(60)

Table 5
Flammable liquid fire test, pan size, materials, and arrangement

Rating – class	Minimum effective discharge time, seconds	Pan size, (inside)		Metal thickness		Reinforcing angle size (approximate)		Commercial grade heptane used, (approximate)[a]	
		m^2	(ft^2)	mm	(in)	mm	(in)	Liters	(U.S. gallons)
Indoor tests:									
1-B	8	0.23	(2-1/2)	6	(1/4)	38 by 38 by 4.8	(1-1/2 by 1-1/2 by 3/16)	11	(3-1/4)
2-B	8	0.47	(5)	6	(1/4)	38 by 38 by 4.8	(1-1/2 by 1-1/2 by 3/16)	23	(6-1/4)
5-B	8	1.16	(12-1/2)	6	(1/4)	38 by 38 by 4.8)	(1-1/2 by 1-1/2 by 3/16)	57	(15-1/2)
10-B	8	2.32	(25)	6	(1/4)	38 by 38 by 4.8	(1-1/2 by 1-1/2 by 3/16)	114	(31)
20-B	8	4.65	(50)	6	(1/4)	38 by 38 by 4.8	(1-1/2 by 1-1/2 by 3/16)	227	(65)
Outdoor tests:									
30-B	11	7.00	(75)	12	(1/2)	38 by 38 by 6	(1-1/2 by 1-1/2 by 1/4)	350	(95)
40-B	13	9.30	(100)	12	(1/2)	38 by 38 by 6	(1-1/2 by 1-1/2 by 1/4)	465	(125)
60-B	17	14.00	(150)	12	(1/2)	38 by 38 by 6	(1-1/2 by 1-1/2 by 1/4)	700	(190)
80-B	20	18.60	(200)	12	(1/2)	38 by 38 by 6	(1-1/2 by 1-1/2 by 1/4)	950	(250)
120-B	26	27.9	(300)	12	(1/2)	38 by 38 by 6	(1-1/2 by 1-1/2 by 1/4)	1400	(375)
160-B	31	37.2	(400)	12	(1/2)	38 by 38 by 6	(1-1/2 by 1-1/2 by 1/4)	1850	(500)
240-B	40	55.7	(600)	12	(1/2)	38 by 38 by 6	(1-1/2 by 1-1/2 by 1/4)	2800	(750)
320-B	48	74.3	(800)	12	(1/2)	38 by 38 by 6	(1-1/2 by 1-1/2 by 1/4)	3700	(1000)
480-B	63	112.0	(1200)	12	(1/2)	38 by 38 by 6	(1-1/2 by 1-1/2 by 1/4)	5600	(1500)
640-B	75	149.0	(1600)	12	(1/2)	38 by 38 by 6	(1-1/2 by 1-1/2 by 1/4)	7500	(2000)

Table 5 Continued on Next Page

Table 5 Continued

Rating – class	Minimum effective discharge time, seconds	Pan size, (inside)		Metal thickness		Reinforcing angle size (approximate)		Commercial grade heptane used, (approximate)[a]	
		m^2	(ft^2)	mm	(in)	mm	(in)	Liters	(U.S. gallons)

[a] The amount of commercial grade heptane to be used in each test is to be determined by the actual depth as measured in the pan and not by the volume indicated.

Table 6
Magnesium area fire arrangement

Type of fuel	State of fuel	Weight of fuel		Area of fuel bed		Depth of fuel bed	
		kg	(lb)	m^2	(ft^2)	mm	(in)
Grignard	Dry	18	(40)	0.4	(4)	115	(4-1/2)
Commercial	Dry	18	(40)	0.4	(4)	115	(4-1/2)
Grignard	Oily	18	(40)	0.4	(4)	115	(4-1/2)
Commercial	Oily	18	(40)	0.4	(4)	115	(4-1/2)
Dust	Dry	11.5	(25)	0.4	(4)	25	(1)
Dust	Oily	11.5	(25)	0.4	(4)	25	(1)

FIGURES

Figure 1
Wood crib

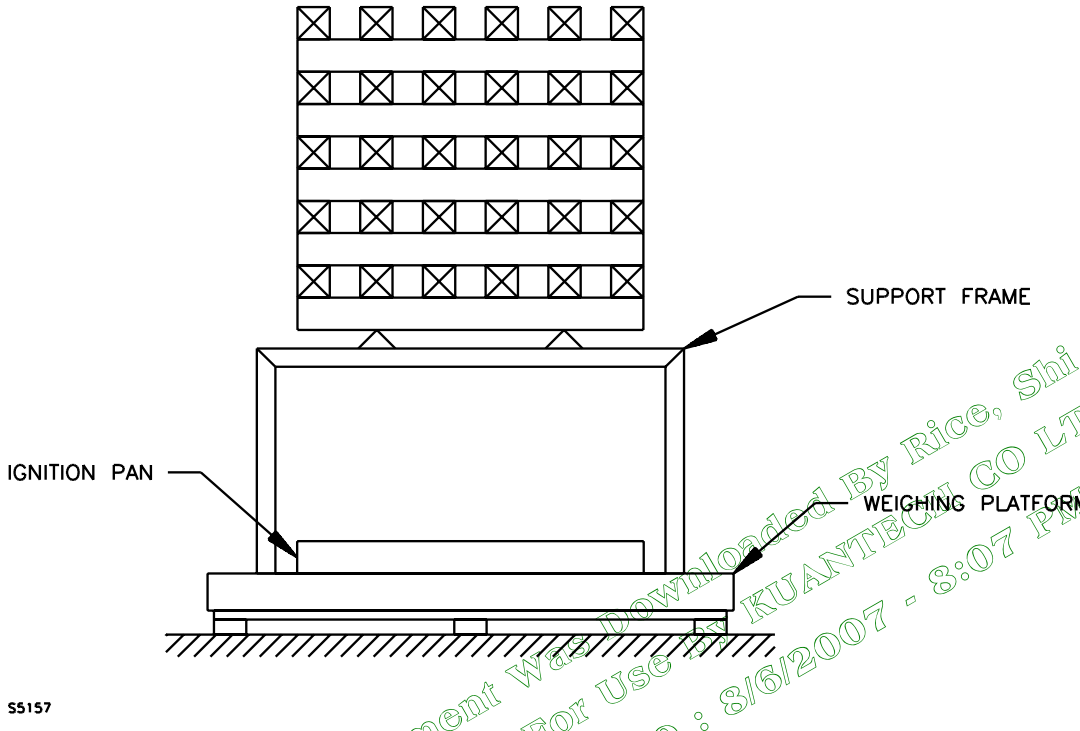
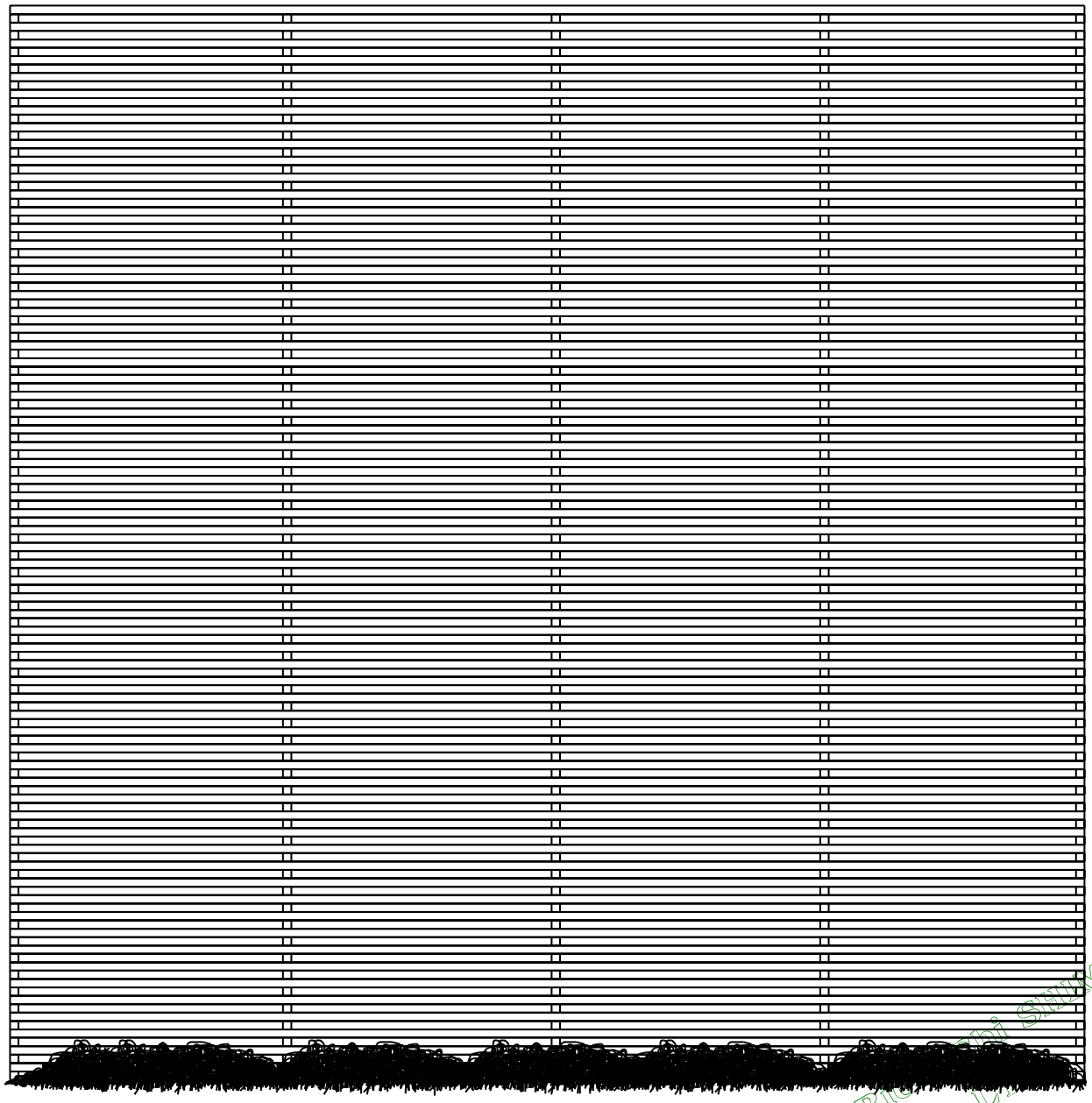
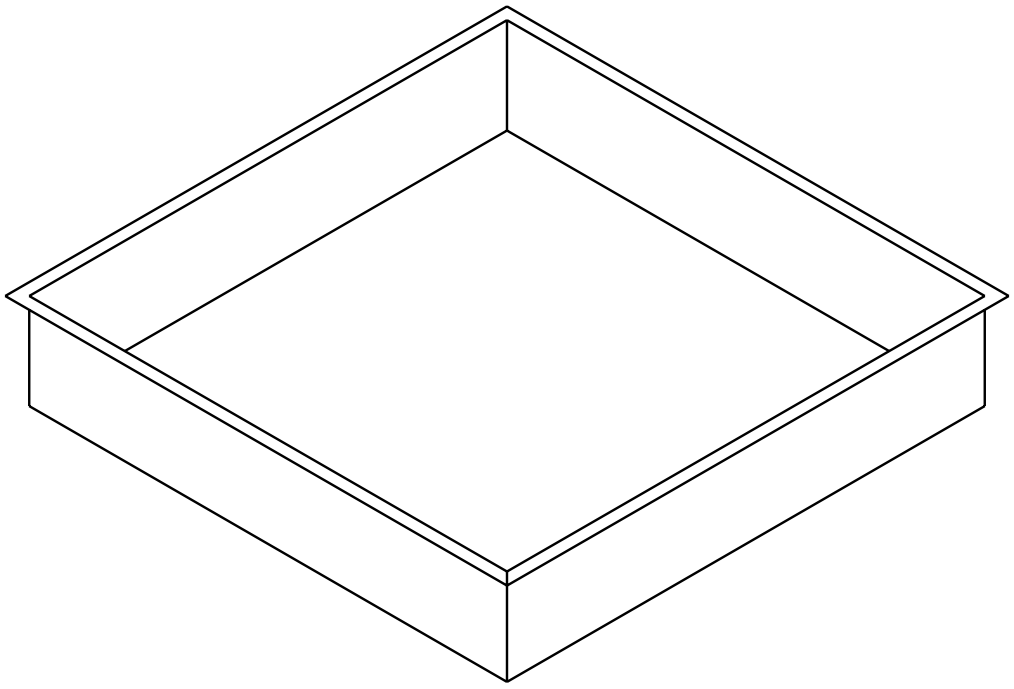


Figure 2
Wood panel



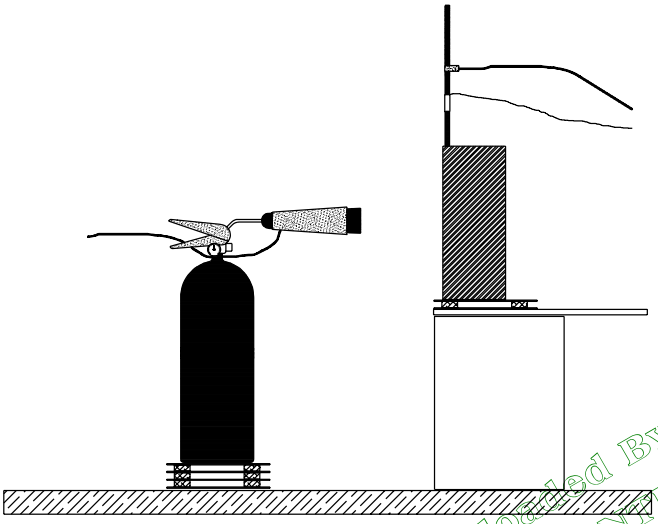
S4012

Figure 3
Flammable liquid fire test pan



S4013

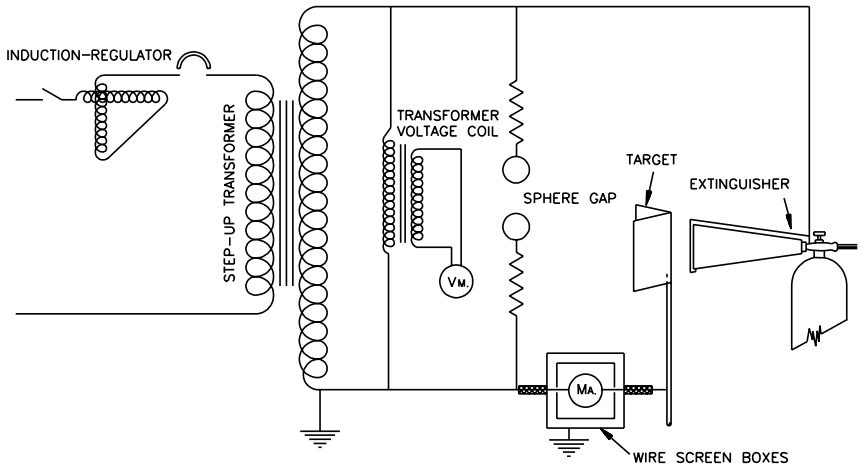
Figure 4
Extinguisher and target



S4014

Note: Figure shows insulating supports and wire on horn.

Figure 5
Test diagram



S2568

Note: Figure is a test diagram showing electrical connections and circuits.

ANNEX A

Reference Standards

ASTM[1] Standards

D396
Standard Specifications for Fuel Oils

D4442
Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Based Materials

D4444
Standard Test Methods for Use and Calibration of Hand-Held Moisture Meters

D92
Standard Test Method for Flash and Fire Points by Cleveland Open Cup (ASSHTO)(DIN51376)(IP36/84)

NFPA[2] Standards

NFPA 10
Portable Fire Extinguishers

Other Organizations

National Fire Code of Canada

[1]American Society for Testing and Materials.

[2]National Fire Protection Association.