UL 154

STANDARD FOR SAFETY

Carbon-Dioxide Fire Extinguishers

UL Standard for Safety for Carbon-Dioxide Fire Extinguishers, UL 154

Ninth Edition, Dated February 28, 2005

Summary of Topics

This revision to ANSI/UL 154 dated March 9, 2021 includes a Nameplate Abrasion Test Update; 44.2 and 44.3

Text that has been changed in any manner or impacted by UL's electronic publishing system is marked with a vertical line in the margin.

The revised requirements are substantially in accordance with Proposal(s) on this subject dated August 21, 2020.

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ULC Standards
Normes ULC

ULC Standards
CAN/ULC-S503-05-REV1
Fourth Edition

Underwriters Laboratories Inc.
ANSI/UL 154
Ninth Edition

Carbon-Dioxide Fire Extinguishers

February 28, 2005

(Title Page Reprinted: March 9, 2021)

Approved American National Standard
ANSI

ANSI/UL 154-2021

NATIONAL STANDARD OF CANADA
STANDARDS COUNCIL OF CANADA
CONSEIL CANADIEN DES NORMES
NORME NATIONALE DU CANADA

Commitment for Amendments

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This ANSI/UL Standard for Safety consists of the Ninth Edition including revisions through March 9, 2021.

The most recent designation of ANSI/UL 154 as an American National Standard (ANSI) occurred on March 9, 2021. ANSI approval for a standard does not include the Cover Page, Transmittal Pages, Title Page (front and back), or the Preface.

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Preface

This is the common UL and ULC Standard for Carbon-Dioxide Fire Extinguishers. It is the Fourth edition of CAN/ULC-S503, and the Ninth edition of ANSI/UL 154.

This Joint Standard was prepared by Underwriters Laboratories Inc., ULC Standards, and the UL/ ULC Extinguisher Technical Harmonization Committee The efforts and support of the Harmonization Technical Committee are gratefully acknowledged.

Only metric SI units of measurement are used in this Standard. If a value for measurement is followed by a value in other units in parentheses, the second value may be approximate. The first stated value is the requirement.

In Canada, there are two official languages, English and French. All safety warnings must be in French and English. Attention is drawn to the possibility that some Canadian authorities may require additional markings and/or installation instructions to be in both official languages.

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 is published as an identical standard between UL and ULC Standards. 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.

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INTRODUCTION

1 Scope

1.1 These requirements cover the construction and performance, exclusive of performance during fire tests, of portable carbon-dioxide fire extinguishers. Carbon-dioxide fire extinguishers are intended to be utilized in accordance with the Standard for Portable Fire Extinguishers, NFPA 10 and the National Fire Code of Canada.

1.2 The requirements for performance during fire testing of carbon-dioxide fire extinguishers are specified in the Binational Standard for Rating and Fire Testing of Fire Extinguishers, ANSI/UL 711 CAN/ULC-S508.

1.3 As used in these requirements, the term "extinguisher" refers to all extinguishers or any part thereof covered by these requirements, unless specifically noted otherwise.

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 Components

4.1 Except as indicated in 4.2, a component of a product covered by this standard shall comply with the requirements for that component. A component shall comply with both the Underwriters Laboratories Inc. and the Underwriters' Laboratories of Canada standards for the component.

4.2 A component is not required to comply with a specific requirement that:

a) Involves a feature or characteristic not required in the application of the component in the product covered by this standard, or

b) Is superseded by a requirement in this standard.

4.3 A component shall be used in accordance with its rating established for the intended conditions of use.

4.4 Specific components are incomplete in construction features or restricted in performance capabilities. Such components are intended for use only under limited conditions, such as certain temperatures not exceeding specified limits, and shall be used only under those specific conditions.

5 Glossary

5.1 For the purpose of this standard, the following definitions apply.

5.2 DISPOSABLE (NONRECHARGEABLE) FIRE EXTINGUISHER – A fire extinguisher not capable of nor intended to undergo complete maintenance including internal inspection of cylinder, replacement of parts and seals and hydrostatic testing.

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

5.4 GALVANIC COMPATIBILITY – Fire extinguisher cylinder and component parts, which are not susceptible to 10-day, stress corrosion cracking nor corrosion from combination of dissimilar materials.

5.5 GAS POINT – The point in time when the combined snow and gas discharge changes into a purely gaseous condition.

5.6 PORTABLE FIRE EXTINGUISHER – A fire extinguisher carried or on wheels and operated by hand.

5.7 RECHARGEABLE (REFILLABLE) FIRE EXTINGUISHER – A fire extinguisher capable of undergoing complete maintenance including internal inspection of cylinder, replacement of parts and seals and hydrostatic testing.

CONSTRUCTION

6 General

6.1 The construction of an extinguisher shall be such that the method of operation is obvious after observing the operating instructions.

6.2 The construction of an extinguisher shall be such that after discharge of the agent is initiated, the operator of the extinguisher is not required to take further manual actions to maintain the maximum possible flow of agent, other than holding the operating device in the fully opened position. The extinguisher shall be usable by one operator, without assistance from a second individual.

6.3 An extinguisher having a capacity of 2.3 kg (5 lb) mass or more of carbon dioxide shall stand in the upright position without support.

6.4 A material for an extinguisher part, the deterioration of which causes the extinguisher to become inoperable or results in the risk of injury to persons, shall not be susceptible to stress corrosion.

6.5 A polymeric or other nonmetallic part, other than an "O" ring or gasket, shall be evaluated on the basis of:

a) Mechanical strength, including resistance to impact, see Handle and Mounting Device Test, Clause 24; Hydrostatic Pressure Test, Clause 30; Vibration Test, Clause 33; Roadability and Rough Usage Tests, Clause 34; Nameplate Exposure Tests, Clause 42;

b) Moisture absorption; see Salt Spray Corrosion Test, Clause 39; One-Year Time Leakage Test, Clause 41, Nameplate Exposure Tests, Clause 42;

c) Flammability, see 6.6;

d) Resistance to deterioration due to aging, see Aging Tests – Polymeric Materials, Clause 37; One-Year Time Leakage Test, Clause 41; Nameplate Exposure Tests, Clause 42;

e) Exposure to light and water, see 37.3 and Nameplate Exposure Tests, Clause 42.

6.6 With reference to flammability, polymeric materials shall be classified as HB, V-0, V-1, V-2, 5VA, or 5VB, when tested in accordance with the Standard for Tests for Flammability of Plastic Materials for Parts in Devices and Appliances, UL 94. Other nonmetallic materials shall have equivalent characteristics.

6.7 An extinguisher shall operate as intended from the minimum storage temperature to 49°C (120°F), inclusive.

6.7.1 The minimum storage and use temperature shall not be higher than minus 30°C (minus 22°F). Temperatures lower than minus 30°C (minus 22°F) shall be permitted only for low temperature charges. See Clause 21.1(c).

6.8 The edges and surfaces of a valve, cap, closure, hose, cylinder, handle, mounting device, and similar items, shall not be sufficiently sharp to constitute a risk of injury to persons in intended maintenance and use.

6.9 Whenever reference measurements are necessary to determine that a part as described in 6.8 is not sufficiently sharp to constitute a risk of injury to persons, the method described in the Standard for Test for Sharpness of Edges on Equipment, UL 1439, is to be employed.

6.10 A hand portable extinguisher shall have a gross weight not exceeding 27 kg (60 lb).

7 Cylinders

7.1 The requirements in this Clause do not apply to a cylinder marked as complying with U. S. Department of Transportation (DOT), or Canada Transportation of Dangerous Goods Regulations (TDGR).

7.2 An extinguisher cylinder under the jurisdiction of the DOT or TDGR shall comply with the appropriate DOT or TDGR specifications for shipping containers.

7.3 A cylinder shall be threaded at the valve opening to accommodate a discharge valve.

7.4 The thread strength of the valve opening shall withstand not less than ten times the maximum rating of the pressure-relief mechanism. See 11.1.

7.5 The capacity of a cylinder shall be such that, when charged with the extinguisher's rated capacity plus the allowable tolerance of carbon dioxide, the weight of carbon dioxide does not exceed 68 percent of the water capacity, by weight, of the cylinder.

8 Discharge Valves

8.1 A cylinder of a hand-portable extinguisher shall be fitted with a manually opened, self-closing type valve. A cylinder for a wheeled extinguisher, shall be fitted with a manually opened valve having a manually or automatically operated locking mechanism, or other means, to maintain the valve in the open position throughout the effective duration of the extinguisher discharge.

8.2 A cylinder-mounted valve shall be constructed of a material that is compatible with the material of the cylinder with respect to the galvanic corrosion thread wear, or galling.

8.3 An extinguisher having a capacity greater that 9.1 kg (20 lb) or a wheeled extinguisher, shall be fitted with a self-closing type discharge valve at the discharge end of the hose.

8.4 A discharge valve shall be gas tight when closed, shall form a gastight connection with the components of the fire extinguisher to which it is intended to be attached, and shall operate as intended in atmospheric temperature as high as 49°C (120°F).

8.5 The construction of a cylinder-mounted discharge valve shall be such that the extinguisher is rechargeable as intended after use.

8.6 Operating parts of a discharge valve (valve stem, plunger pin, springs, bushings, and the like) shall be made of nonferrous metal or stainless steel resistant to corrosive influences encountered during intended use. See Salt Spray Corrosion Test, Clause 39.

9 Gaskets and "O" Rings

9.1 A gasket or an "O" ring shall be retained in a recess or the equivalent, in the cylinder or valve. A gasket or an "O" ring of a rubber-like material shall be of thickness to provide a compression-type seal and shall fit snugly against the cylinder or valve. See Elastomeric Parts Test, Clause 38.

10 Antirecoil Devices

10.1 An antirecoil device shall be provided to reduce risk of personal injury from recoil at the point where the horn or the hose-and-horn assembly is detached for recharging.

11 Pressure Relief

11.1 A cylinder-mounted discharge valve shall be fitted with a pressure relief that complies with the DOT or TDGR specifications, and be constructed or placed to reduce risk of injury to persons from recoil when the gas contents are vented.

12 Tamper Indicators and Locking Devices

12.1 The operating mechanism(s) of an extinguisher shall be provided with a locking pin or other device to reduce the risk of unintentional discharge. A locking device shall be made of corrosion-resistant material. See Salt Spray Corrosion Test, Clause 39.

12.2 The locking pin or other device shall be visible from the front of the extinguisher when the extinguisher is mounted on a wall in its bracket or on its mounting hook. However, the locking pin is able to be on the backside when pictographic operating instructions on the front illustrate the intended means of operation.

12.3 When the locking device is attached to the valve with a chain or similar device, the chain shall be attached so that it does not interfere with the discharge stream.

12.4 A tamper indicator such as a seal or the equivalent shall be made of a corrosion resistant material and shall be provided to retain the locking device and to indicate tampering with or use of the extinguisher. See 23.1.

12.5 The tamper indicator shall be constructed so that it is required to be broken to operate the extinguisher.

13 Hose

13.1 An extinguisher having a capacity of more than 2.7 kg (6 lb)-mass of carbon dioxide shall be equipped with a discharge hose. A hose shall be flexible and of a length not less than 600 mm (24 in) such that the horn points in any direction.

13.2 A hose shall contain a metal wire braid and shall have either an outer wrapping of tightly woven high-grade yarn or a cover of natural or synthetic rubber. It shall be equipped with couplings of ferrous metal coated to resist corrosion, nonferrous metal, or stainless steel threaded to accept the discharge fitting of the valve and the connector of the discharge horn. The hose shall be electrically conductive from the inlet coupling to the outlet coupling. The hose shall be capable of being removed and replaced.

14 Couplings

14.1 A hose coupling shall be made of corrosion-resistant material. See Salt Spray Corrosion Test, Clause 39. The coupling shall be threaded or provided with equivalent means for its attachment to the outlet of the discharge valve. When the hose coupling incorporates a nozzle orifice, the threads or attachment means shall prevent the outlet end of the hose from being connected to the outlet of the discharge valve.

14.2 Continued use of the hose shall not cause loosening or detachment of the coupling, and there shall be no projections to catch on objects or otherwise interfere with pulling of the hose.

15 Siphon Tubes

15.1 A siphon tube shall be constructed of a material that is resistant to the corrosive effects of the extinguishing agent.

15.2 The siphon tube shall be notched, scarfed, or otherwise prevented from restricting discharge in an unintended manner when the tip of the siphon tube is resting on the bottom of the cylinder.

16 Discharge Tubes

16.1 When a hand-portable extinguisher is provided with a discharge tube, the tube shall be fastened to the discharge valve by a swivel joint and sealed against leakage. The swivel shall be movable with sufficient friction to maintain the discharge tube in the same fixed position with respect to the assembly when the extinguisher is held in any position.

16.2 The discharge end of the tube shall be equipped with an antirecoil device and shall be threaded to accept the discharge horn, unless the antirecoil device is an integral part of the valve and the swivel assembly is intended to be detached for recharging purposes.

16.3 The combined length of the discharge tube and the horn shall be such that when rotated to the vertical-down position, the outer end of the discharge horn shall not extend beyond the plane formed by the extinguisher bottom.

17 Discharge Horns

17.1 An extinguisher shall be equipped with a discharge horn fabricated of electrically nonconductive material.

17.2 An extinguisher equipped with a flexible hose shall be provided with a horn handle made of an insulating material not less than 130 mm (5 in) long. All surfaces of wooden handles shall be coated with a water-resistant paint or similar coating.

17.3 An extinguisher equipped with a flexible hose shall be provided with a retainer to hold the discharge horn when not in use. The retainer shall securely hold the horn, and the horn shall be able to be readily disengaged for use.

18 Handle and Mounting Devices

18.1 A hand-portable extinguisher having a gross weight of 1.4 kg (3 lb) or more and having a cylinder diameter of 75 mm (3 in) or more, shall have a carrying handle and a means for mounting on a wall. A handle shall be made of nonferrous metal, austenitic stainless steel, carbon steel protected against corrosion see Salt Spray Corrosion Test, Clause 39, or a polymeric material complying with the Aging Tests – Polymeric Materials, Clause 37. The mounting means shall hold the extinguisher firmly in place.

18.2 A side handle or hanger loop shall be located so that the operating instructions face outward when the extinguisher is supported by the mounting means.

18.3 A handle shall be a minimum 90 mm (3-1/2 in) long for an extinguisher of 6.8 kg (15 lb) or more gross weight and a minimum 75 mm (3 in) long for an extinguisher of less than 6.8 kg (15 lb) gross weight.

18.4 There shall be a minimum 25 mm (1 in) clearance between the dome and the carrying handle when the handle is in the carrying position.

18.5 A mounting bracket shall not permit the extinguisher to drop to the floor when the strap is opened. The clamp releasing device shall be of a color contrasting with that of the immediate background and shall be visible, and the method of release shall be obvious when viewing the front of the extinguisher.

18.6 A wall mounting hook shall require both a horizontal and a minimum 6 mm (1/4 in) vertical motion to remove the extinguisher from the wall.

Exception: A minimum vertical motion of 3 mm (1/8 in) is able to be used for an extinguisher having a gross weight of 5.4 kg (12 lb) or less.

18.7 When a bracket requires force to open, the force shall not exceed 65 N (15 lb-f) for finger actuated assemblies, and 130 N (30 lb-f) for hand actuated assemblies. See 24.3 and 24.4.

19 Hose Retainers – Wheeled Extinguishers

19.1 A hose retainer shall retain the hose and horn on the extinguisher so that neither the hose nor the horn strikes or rubs the wheels or the ground. The retainer shall permit the hose to be installed and withdrawn as intended when the extinguisher is placed in operation.

20 Running Gear – Wheeled Extinguishers

20.1 The cylinder shall be secured to the running gear, consisting of the wheels, axle, cylinder bands, and the handle for hauling and manipulating the extinguisher.

21 Carbon-Dioxide Charges

21.1 An extinguisher shall be charged with one of the following before being shipped:

a) Standard Charge – A commercial grade of carbon dioxide. The vapor phase shall be not less than 99.5 percent carbon dioxide. The water content shall be not more than 60 parts per million (ppm) by weight at minus 47°C (minus 52°F) dew point. Oil content shall be not more than 10 ppm by weight.

b) High-Temperature Charge – A charge that is 90 percent of the standard charge. This charge shall be used in an extinguisher intended for high-temperature exposure [approximately 55° C (130°F) maximum], and the nameplate instructions shall correspond with this condition of charging.

c) Low-Temperature Charge – A special charge for use at temperatures below minus 30°C (minus 22°F) that is provided when intended for low temperature applications and includes pressurization with nitrogen. The nameplate instructions on the extinguisher shall correspond with this condition of charging.

PERFORMANCE

22 Fire Tests

22.1 Carbon-dioxide type fire extinguishers shall comply with the Binational Standard for Rating and Fire Testing of Fire Extinguishers, ANSI/UL 711 CAN/ULC-S508.

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

23 Tamper Indicators and Locking Device Tests

23.1 The tamper indicator shall break when subjected to a force of 65 N (15 lb-f) or less.

Exception: When the tamper indicator is broken by the action required to start discharge of the extinguisher, or when an internal load is continuously applied to the release mechanism, the force, applied as intended and required to accomplish discharge shall not exceed 130 N (30 lb-f). See 23.4.

23.2 The force required to extract or dislodge a locking device as intended along its axis shall not exceed 130 N (30 lb-f) after the locking device is subjected to the tests specified in 23.3 and 23.4.

23.3 A locking device shall not shear when a force of 220 N (50 lb-f) is exerted upon the operating mechanism for 30 seconds, and the extinguisher then shall be capable of being operated in its intended manner. An extinguisher, with its locking device and tamper indicator attached as intended, is to be secured on the floor in a vertical position and 220 N (50 lb-f) is to be exerted 13 mm (1/2 in) from the end of the operating lever.

23.4 The extinguisher then is to be secured in a test fixture in a vertical position. The locking device is to be pulled with 130 N (30 lb-f) for 30 seconds at an angle of 45 degrees in an upward direction from the horizontal, and then pulled for 30 seconds at a horizontally rotational angle of 45 degrees. The device shall either:

a) Be capable of extraction at the 45 degree angle; or

b) Not be damaged or the mechanism jammed to the extent that prevents intended extraction of the locking device directly outward along its axis, when 130 N (30 lb-f) is applied for 30 seconds.

23.5 The 130 N (30 lb-f) force exerted on the locking device both at the 45 degree angle and along the axis of the device is to be achieved by increasing the force from zero to 130 N (30 lb-f) at a rate of 260 N (60 lb-f) per minute.

24 Handle and Mounting Device Test

24.1 The method of attachment of the handle and hanger loop of a hand-portable extinguisher weighing 1.4 kg (3 lb) or more, and having a cylinder diameter greater than 75 mm (3 in), shall support a static load of five times the fully charged weight of the extinguisher, or a minimum 45 kg (100 lb) applied downward through the vertical axis of the extinguisher for 5 minutes.

24.2 A hand-portable extinguisher charged with its rated capacity is to be placed in the bracket or mounting hook provided with the extinguisher after the bracket or mounting hook has been secured to a wood board. The board is to be secured in a vertical position, and the static load then is to be applied to the top of the extinguisher.

24.3 For a bracket mounting device, the force required to open the bracket shall not exceed 65 N (15 lb-f) for finger actuated assemblies and 130 N (30 lb-f) for hand actuated assemblies measured at the end of the bracket opening device.

24.4 A hand-portable extinguisher, charged with its rated capacity, is to be placed in the bracket provided with the extinguisher after the bracket is secured in the vertical position to a wood board. Using a spring scale, or a similar device, a gradually increasing force is to be applied to the tip of the clasp or lever of the bracket strap or band, at a 90 degree angle to the extinguisher, at a rate of 0.45 kg/s (1 lb/s) and until the band releases the bracket. For hand actuated assemblies, when there is an indent or gripping location, the force is to be applied to the center of that actuating area.

25 Discharge Capacity and Duration Test

25.1 An extinguisher shall discharge a minimum of 97 percent of its contents, without freezing , and shall have a duration of discharge to the gas point of not less than 8 seconds when charged with its rated capacity and conditioned at a temperature of 21 ±3°C (70 ±5°F).

25.2 An extinguisher charged with its rated capacity of carbon dioxide is to be discharged with the discharge assembly held horizontally at a height of 0.9 m (3 ft) from the floor or ground.

26 Rate of Flow Test

26.1 An extinguisher shall be discharged to determine the rate of flow at 21 ±3°C (70 ±5°F) and shall be consistent, as evidenced by the results of three consecutive tests not varying more than 10 percent from their mean value.

26.2 An extinguisher charged with its rated capacity is to be discharged for a period of two-thirds of its average discharge duration at 21 ±3°C (70 ±5°F), rounded to the nearest second, with the horn held in a horizontal position. The rate of flow is to be calculated from the loss in weight during discharge. This test is to be used for identification and countercheck purposes with the rate of flow established as ±10 percent of the mean of the three tests conducted.

27 Intermittent Discharge Test

27.1 An extinguisher charged with its rated capacity shall discharge a minimum 75 percent (by mass) when conditioned at its minimum storage and use temperature, 21 ±3°C (70 ±5°F) and at 49 ±3°C (120 ±5° F), and shall operate in such a manner that not more than 1 second elapses from the time the discharge valve is opened until the agent starts to discharge.

27.2 An extinguisher charged with its rated capacity and conditioned at each of the temperatures specified in 28.1 for a minimum of 16 hours is to be operated intermittently by opening and closing the

discharge valve in cycles of 2 seconds "open" and 2 seconds "closed" until the gas point is reached. For a wheeled extinguisher, the cycles are to be 5 seconds "open" and 5 seconds "closed."

28 Operating Temperature Limits Test

28.1 An extinguisher conditioned for a minimum of 16 hours at the minimum storage and use temperature and at 49 ±3°C (120 ±5°F) shall discharge a quantity of carbon dioxide without freezing, equal to or greater than 95 percent of the quantity discharged when conditioned at 21.2° C (70° F). For an extinguisher operated at the minimum storage and use temperature stoppage of the discharge by freeze-up is able to occur after no less that 95 percent of the carbon dioxide has been discharged.

29 Temperature Cycling Test

29.1 An extinguisher shall discharge a minimum 90 percent (by mass) of its rated capacity of carbon dioxide when alternately conditioned at the minimum storage and use temperature and at 49 ±3° C (120 ±5°F).

29.2 An extinguisher charged with its rated capacity is to be conditioned at the minimum storage and use temperature for 24 hours, then conditioned at 49 ±3° C (120 ±5° F) for 24 hours, and then again at the minimum storage and use temperature for 24 hours. The extinguisher is then to be conditioned at 21 ±3°C (70 ±5°F) for 24 hours, after which it is to be discharged and the amount of carbon dioxide discharged is to be calculated.

30 Hydrostatic Pressure Test

30.1 Discharge valves

30.1.1 A discharge valve shall withstand an internal pressure of 34,500 kPa (5000 psig) for 1 minute without leakage or deformation.

30.2 Hose assemblies

30.2.1 A hose assembly shall withstand for 1 minute, without leakage, a hydrostatic pressure of 27,600 kPa (4000 psig).

30.3 Test method

30.3.1 The apparatus for these tests is to consist of a hand- or motor-operated hydraulic pump that produces the required test pressure, a test cage that contains the extinguisher and its parts in the event that parts are thrown off, required valves and fittings for attachment to the test sample, and the required valves, fittings, and similar devices, for regulating and maintaining the specified test pressure.

30.3.2 The pressure is to be increased at a rate of approximately 2000 kPa (300 psig) per minute until the test pressure is obtained. This pressure then is to be held for the time specified.

31 Valve Cycling Test

31.1 A self-closing discharge valve of an extinguisher shall operate as intended after 500 cycles of operation.

31.2 A self-closing discharge valve assembly is to be connected to a source of carbon dioxide and subjected to 500 cycles of opening and closing the valve. The discharge valve then shall comply with the requirements of the Intermittent Discharge Test, Clause 27 [at 21 ±3°C (70 ±5°F)].

32 Pressure Relief Test

32.1 A frangible disc or an equivalent pressure-relief disc shall function at a pressure of not less than 18,300 kPa (2650 psig) and not higher than five-thirds of the service pressure of the cylinder [20,700 kPa (3000 psig) for an 12,400 kPa (1800 psig) cylinder].

32.2 Twelve frangible discs are to be mounted in 12 different valves and subjected to a burst test in which the test pressure is increased rapidly to 85 percent, and thereafter raised at a rate not in excess of 689 kPa (100 psig) per minute, until burst.

33 Vibration Test

33.1 General

33.1.1 A hand-portable extinguisher charged with its rated capacity and mounted in its bracket or in a standard mounting fixture shall withstand the variable frequency and endurance tests specified in 33.1.3 – 33.5.1 without:

a) Becoming inoperable;

b) Causing a risk of injury to persons;

c) Dislodgment of the siphon tube; and

d) Incurring damage to the side handle, hanger loop, or means of attachment that impairs their intended use.

33.1.2 Physical deterioration of components that requires repair or replacement of the extinguisher, components, or bracket before they are able to be returned to service does not meet the intent of the requirement. For example, broken welds in the cylinder, malfunctions of operating parts, or abrading or scoring of the cylinder in excess of 10 percent of the minimum calculated wall thickness do not meet the intent of the requirement.

33.1.3 Following the vibration test, the extinguisher shall comply with the requirements of 28.1 [at 21 ± 3° C (70 ±5° F)]. When there are visible signs of damage or deterioration of the valve or cylinder, the extinguisher shall be subjected to and comply with the requirements of 30.1.1 and 30.2.1.

33.1.4 For these tests, amplitude is defined as the maximum displacement of sinusoidal motion from position of rest or one-half of the total table displacement. Resonance is defined as the maximum magnification of the applied vibration.

33.2 Mounting of test sample

33.2.1 A representative sample extinguisher charged with its rated capacity is to be mounted in a standard mounting fixture, and secured to the test fixture of the vibration test apparatus in a vertical position. When the extinguisher is for marine type use, the extinguisher is to be mounted using the bracket specified for use with the extinguisher. When a standard mounting fixture or a non marine bracket is used, the hose and horn assembly is to be removed.

33.3 Test orientation

33.3.1 The extinguisher is to be subjected to variable frequency and endurance tests in each of the three rectilinear orientation axes, horizontal, lateral, and vertical. Both variable frequency and endurance tests are to be completed in one plane of vibration before the sample is tested in another plane.

33.4 Variable frequency test

33.4.1 The extinguisher is to be vibrated from 10 to 60 hertz in discrete frequency intervals of 2 hertz at the table displacement indicated in Table 1. The vibration at each frequency is to be maintained for 5 minutes.

33.5 Endurance test

33.5.1 The extinguisher is to be vibrated for 2 hours at the frequency that produced maximum resonance as determined in the variable frequency test or, when no resonance is observed in the variable frequency test, at a frequency of 60 hertz. The table displacement is to be as specified in Table 1.

34 Roadability and Rough Usage Tests

34.1 Roadability

34.1.1 After being towed for 8 km (5 mi) at the rate of 8 to 13 km/h (5 to 7 mph) over concrete, macadam, or gravel roads or a combination thereof, a wheeled extinguisher shall comply with the following:

a) A minimum of 90 percent (by mass) of its rated capacity of the extinguisher shall be discharged;

b) The wheels, axles, and carriage assembly shall not be damaged to the extent of impairing mobility by one person;

c) No weld shall be broken; and

d) The siphon tube shall not become dislodged.

34.1.2 After being dropped three times onto a concrete surface from a 305 mm (12 in) high platform so as to land on the wheels; pulled at 8 km/h (5 mph) during which one wheel strikes a vertical wall of concrete, steel, or brick; and pushed over so as to land on the bumper, a wheeled extinguisher shall comply with the following:

a) The extinguisher shall not be damaged;

b) No weld shall be broken;

c) The mobility of the extinguisher shall not be impaired; and

d) The siphon tube shall not become dislodged.

34.1.3 The horn of a wheeled extinguisher, as attached to the hose, shall function as intended after being dropped three times onto a concrete surface from a height of 1 m (3 ft). The assembly is to be dropped in a random manner so that no effort results in any part of the horn, such as the tip or handle, to initially strike the concrete surface.

34.2 Rough usage

34.2.1 A hand-portable extinguisher shall comply with the requirements specified in (a) and (b) below after being dropped three times onto a concrete surface as specified in 34.2.2:

a) The extinguisher shall not rupture.

b) The extinguisher shall withstand, without leakage, a hydrostatic pressure of 12400 kPa (1800 psi) for 1 minute.

34.2.2 Sample hand-portable extinguishers are to be filled with a medium equal to the charge weight. A sample is to be tested with the locking device disengaged, and another sample is to be tested with the locking device engaged. When polymeric materials are to be tested, sample extinguishers are to be conditioned to the minimum storage and use temperature and to 49°C (120°F) for 24 hours immediately prior to the test. The distance of the drop is to be measured from the concrete surface to the bottommost part of the extinguisher. For extinguishers having an overall height of 609 mm (2 ft) or less, the drop distance is to be 1 m (3 ft). For extinguishers having an overall height of more than 609 mm (2 ft), the drop distance is to be 609 mm (2 ft). For the first test, each extinguisher is to be held in the upright position and dropped. For the second test, each extinguisher is to be held in the horizontal position and dropped. The orientation of the extinguisher is dependent on the extinguisher design. Each extinguisher is to be positioned to impact on the weakest point. For the third test, each extinguisher is to be held upside down and dropped.

34.3 Rough usage – operation

34.3.1 A hand-portable extinguisher shall comply with (a), (b), and (c) below after being dropped once onto a concrete surface as specified in 34.3.2. After the drop test:

a) The locking device shall disengage when subjected to a force not exceeding 178 N (40 lb-f);

b) The extinguisher shall actuate as intended to accomplish discharge; and

c) Parts of the extinguisher shall not be damaged to the extent that impairs intended use.

34.3.2 Sample hand-portable extinguishers are to be filled with a medium equal to the charge weight. The test procedure is to be similar to that described in 34.2.2, except that the inverted drop test is to be omitted and the locking device is to be engaged. When polymeric materials are to be tested, sample extinguishers including any polymeric parts are to be conditioned to the minimum storage and use temperature and to 49° C (120° F) for 24 hours immediately prior to the test. Conditioning is to be conducted after air oven aging and after light and water exposure. Each sample is to be subjected to only one drop, and a different sample is to be used for each test. After each drop, the locking device of the extinguisher is to be removed. Each extinguisher, after conditioning, shall be charged with its rated capacity and subjected to the Discharge Capacity and Duration Test, Clause 25.

35 Horn Impact Test

35.1 General

35.1.1 A horn used on an extinguisher equipped with a hose shall not crack or shatter at the low temperature resulting after discharge when the horn, in a horizontal position and loaded to a total weight of 2.3 kg (5 lb), is subjected to four free falls onto an anvil from a height of 850 mm (33-1/2 in). See 35.2.1.

35.1.2 A horn attached to an extinguisher through a swivel connection or in a fixed position shall not crack or shatter at the low temperature resulting after discharge when the horn, in a horizontal position, is impacted four times by a movable anvil of 1.1 kg (2-1/2 lb)-mass falling from a height of 572 mm (22-1/2 in). See 35.3.1.

35.1.3 Six sample horn assemblies of each type and size are to be subjected to the impact test.

35.1.4 The apparatus is to consist of a frame, two pivot arms (A and B), and an adjustable impact point or anvil (K) constructed as illustrated in Figure 1.

35.1.5 Pivot Arm "A" is to be made of angle iron upon which are to be attached an adjustable weight (G) and a clamping device for the horn (Detail X). This arm is to be used for horns utilized on carbon-dioxide extinguishers which use a hose.

35.1.6 Pivot Arm "B" is to be made of angle iron upon which are attached an adjustable weight (G) and a length of pipe (B). This apparatus is to be used to test horns on extinguishers without a hose.

35.1.7 Impact Point "K" (Anvil) is a 50 mm (2 in) outside diameter pipe welded upon an adjustable angle-iron carriage (J).

35.2 Method of test using "A" arm

35.2.1 The horn to be tested is to be first clamped in place on the movable arm, and then attached to the extinguisher, using the hose intended to be furnished. The distance from the pivot point to the line of impact is to be 914 mm (36 in). The point of impact on the horn is to be 100 mm (4 in) from the handle. A spring scale is to be attached to the arm at the point of impact and the sliding weight (G) adjusted to 2.3 kg (5 lb) force. The arm then is to be raised until the point of impact on the horn is 850 mm (33-1/2 in) above the impact point (K) on the fixture, measured vertically. The extinguisher is to be discharged to the gas point. When the gas point is reached, the arm is to fall, striking (K). This is to be conducted four times within 30 seconds after total discharge.

35.3 Method of test using "B" arm (swivel-type horn)

35.3.1 The horn to be tested is to be attached to the extinguisher, using the swivel connection intended to be furnished. The length of the arm from the pivot point to the point of impact is to be 584 mm (23 in). The discharge end of the horn is to be supported on its underside on the fixed anvil (K) in a horizontal plane positioned for impact from the movable anvil (B) on the end of the arm. The seam of the horn is to be located horizontal to the point of impact. The point of impact on the horn is to be 51 mm (2 in) from the discharge end. A spring scale is to be attached at the point of impact (on the arm) and the weight adjusted to 1.1 kg (2-1/2 lb)-force. The arm then is to be raised until the point of the impact on the arm is 572 mm (22-1/2 in) above the point of impact on the horn, measured vertically. The extinguisher is to be discharged to the gas point. When the gas point is reached, the arm is to fall, striking the horn. This is to be conducted four times within 30 seconds after total discharge.

36 Discharge Horn Resistance Test

36.1 A discharge horn shall have an over-surface resistance of not less than 25 megohms after exposure for 72 hours to moist air having a relative humidity of 85 ±5 percent at a temperature of 32 ±2°C (90 ±4°F).

36.2 Sample horns are to be supported over water in a closed container placed in an oven at 32 ±2°C (90 ±4°F). The nozzle orifice shall be attached to the horn by an antistatic wire looped around the orifice and attached to a 13 mm (1/2 in) pipe coupling connected to a length of 13 mm (1/2 in) pipe. The surface of the discharge end of the horn is to be sanded to remove any glazed surface and covered with a layer of metal foil. One lead of the Megohm bridge is to be clamped to the metal foil and the other lead attached to the end of the pipe, which in turn is connected to the nozzle orifice and antistatic wire. The Megohm bridge is to be connected to a 115 V 60 Hz power supply.

37 Aging Tests – Polymeric Materials

37.1 General

37.1.1 There shall be no cracking of a polymeric valve parts, discharge hose assembly, or bracket after air-oven aging for 180 days at 100 ±3°C (212 ±5°F). Aged samples shall perform as intended, when tested in accordance with: the Handle and Mounting Device Test, Clause 24; the Hydrostatic Pressure Test, Clause 30; the Vibration Test, Clause 33; and the Roadability and Rough Usage Test, Clause 34, as applicable.

37.1.2 There shall be no cracking of a polymeric siphon tube after air-oven aging for 90 days at 100 ±3°C (212 ±5° F). Aged samples of the siphon tube shall perform as intended, when installed in test extinguishers and tested in accordance with 34.3.1. Ring samples cut from the aged tube shall not exhibit a degradation in excess of 40 percent of the original tensile or ring crushing strength values. See 37.1.5.

37.1.3 When polymeric parts are attached to other polymeric or nonpolymeric parts or assemblies, the securement of the parts shall remain as intended after air-oven aging.

37.1.4 To determine the degradation of a polymeric material used in a siphon tube, ring samples 13 mm (1/2 in) wide are to be cut from the tube and subjected to air-oven aging. See 37.1.6. The ring samples then are to be subjected to a crush test between parallel flat plates using a machine capable of applying a compression load at a uniform rate of 5 mm (0.2 in) per minute and recording the load applied as a function of the deflection. The test is also to be conducted on as-received parts of identical size for comparative purposes. When the nature of the material is such that meaningful test results are not obtained, other tests, such as tension tests of the rings are to be conducted.

37.1.5 The polymeric valve, valve parts including discharge hose assembly and nozzle, bracket, and siphon tube samples to be aged are to be supported in a full-draft, circulating-air oven that has been preheated at full draft to 100 ±1°C (212 ±2°F). Samples are not to touch one another or the sides of the oven. The samples of the polymeric valve, valve parts including discharge hose assembly and nozzle, and the bracket are to be aged for 180 days and the siphon tube is aged for 90 days.

37.1.6 As an alternate to the air-oven aging tests specified in 37.1.1 and 37.1.2, an air-oven aging test at a lower temperature for a longer period of time is able to be used. The equivalent time-temperature for 180 days at 100 ±3°C (212 ±5°F) is to be 430 days at 87 ±3°C (189 ±5°F). The equivalent time-temperature for 90 days at 100 ±3°C (212 ±5°F) is to be 210 days at 87 ±3°C (189 ±5°F).

37.2 Exposure to extinguishing agent test

37.2.1 Polymeric siphon tubes that have been partially immersed in carbon dioxide for 210 days at 49°C (120°F) shall perform as intended, when installed in test extinguishers that are then subjected to the test described in 34.3.1. Ring samples cut from the tube, and completely immersed in carbon dioxide for 210 days at 49°C (120°F), shall not exhibit degradation in excess of 40 percent of the original tensile or ring crushing strength values. See 37.2.2.

37.2.2 Complete siphon tubes are to be partially immersed in carbon dioxide, and ring samples, 13 mm (1/2 in) wide, cut from as-received siphon tubes are to be totally immersed in carbon dioxide. The container of carbon dioxide, with the samples in place, is to be placed in a preheated oven at 49 ±3°C (120 ±5°F) for 210 days. After the test exposure, the samples are to cool in air at 21 ±2°C (70 ±4°F) for at least 24 hours before any tests or dimensional measurements are conducted. The ring samples then are to be subjected to a crush test between two parallel flat plates using a testing machine capable of applying a compressive load at a uniform rate of 5 mm (0.2 in) per minute and recording the load versus the deflection. When the nature of the material is such that meaningful test results are not able to be obtained, other tests, such as tensile tests, are to be conducted.

37.3 Light and water test

37.3.1 There shall be no cracking of a polymeric part, or bracket following exposure to ultraviolet light and water for 720 hours. Aged samples of the part or bracket shall perform as intended when tested as specified in: the Handle and Mounting Device Test, Clause 24; the Vibration Test, Clause 33; and the Roadability and Rough Usage Test, Clause 34.

37.3.2 The ultraviolet light is to be obtained from two stationary enclosed carbon-arc lamps. The arc of each lamp is to be formed between two vertical carbon electrodes, 12.7 mm (1/2 in) in diameter, located at

the center of a revolvable vertical metal cylinder, 787 mm (31 in) in diameter and 450 mm (17-3/4 in) in height. Each arc is to be enclosed with a No. 9200-PX clear Pyrex glass globe. The samples are to be mounted vertically on the inside of the revolvable cylinder, facing the lamps, and the cylinder continuously revolved around the stationary lamps at one revolution per minute. A system of nozzles is to be provided so that each sample, in turn, is sprayed with water as the cylinder revolves. During each operating cycle (total of 20 minutes) each sample is to be exposed to the light and water spray for 3 minutes and to the light only for 17 minutes. The air temperature within the revolving cylinder of the apparatus during operation is to be 63 ±5°C (145 ±9°F).

37.3.3 An alternate ultraviolet light exposure is obtainable in accordance with ASTM D2565, Standard Practice for Operating Xenon Arc-Type (Water-Cooled) Light-Exposure apparatus with and without Water for Exposure of Plastics. The source of radiation is to be a 6500 Watt, water-cooled xenon-arc lamp with borosilicate inner and outer optical filters. The wattage to the lamp is automatically controlled to provide spectral irradiance of 0.35 W/m^2 at 340 nm. The samples are mounted vertically on the inside of a 97 cm (38 in) diameter cylinder, facing the arc, and the cylinder is rotated about the arc at one revolution per minute. During each operating cycle of 120 minutes, each sample is exposed to light for 102 minutes and to light and water spray for 18 minutes. The black-panel temperature during the dry portion of the light-on cycle is regulated to 63 ±5°C (145 ±9°F).

38 Elastomeric Parts Test

38.1 An elastomeric part used to provide a seal shall have the following properties when tested as specified in the Standard for Gaskets and Seals, UL 157:

a) For silicone rubber (having poly-organo-siloxane as its constituent characteristic), a minimum tensile strength of 3400 kPa (500 psi) and a minimum ultimate elongation of 100 percent;

b) For fluoroelastomers, a minimum tensile strength of 6900 kPa (1000 psi) and a minimum ultimate elongation of 150 percent;

c) For natural rubber and synthetic rubber other than silicone rubber or fluoroelastomers, a minimum tensile strength of 8300 kPa (1200 psi) and minimum ultimate elongation of 150 percent; and

d) Those properties relating to maximum tensile set; minimum tensile strength and elongation after oven aging; and hardness after oven aging, as specified in UL 157. The maximum service temperature used to determine the oven time and temperature for oven aging is considered to be 60°C (140°F).

38.2 The Standard for Gaskets and Seals, UL 157, provides for the testing of either finished elastomeric parts or sheet or slab material. Sheet or slab material is to be tested when the elastomeric parts are O-rings having diameter of less than 25 mm (1 in). The material tested is to be the same as that used in the product, regardless of whether finished elastomeric parts or sheet or slab material is used.

39 Salt Spray Corrosion Test

39.1 All parts of an extinguisher, including the finishes on coated or painted parts, the assemblies of moving parts, the nameplates as secured in place, and brackets or mounting hooks, when provided, shall be subjected to a 240 hour salt spray exposure as described in 39.3 and 39.4, and after exposure shall comply with the following:

a) The extinguisher shall operate and recharge as intended.

b) Any corrosion-resistant coating (such as paint) shall remain intact and shall adhere to the surface so as not to be removable (when such removal exposes a material subject to corrosion) by such action as washing or rubbing with a thumb or fingernail.

c) Dissimilar metals in contact or close proximity with one another shall be provided with a corrosion protection system, so that there is no evidence of galvanic corrosion.

d) The extinguisher and its bracket or mounting hook shall not show pitting, flaking, chipping, spalling or similar evidence of destruction of metal surfaces.

39.2 Extinguishers with stainless steel cylinders, intended for USCG approval, shall comply with the requirements in 39.1 and be subjected to a duration of 1,000 hour salt spray exposure.

39.3 The test samples are to be supported vertically and exposed to salt spray (fog) as specified by the Standard Practice for Operating Salt Spray (Fog) Testing Apparatus, ASTM B117. The apparatus used for salt spray exposure is to consist of a fog chamber of a size and shape that results in the atomization and quantity of collected solution within the limits of ASTM B117, having a salt solution reservoir, a supply of conditioned compressed air, a dispersing tower for producing a salt fog, specimen supports, provision for heating the chamber, and means of control. The dispersion tower is to be located in the center of the chamber and is to be supplied with salt solution and with warmed, humidified air at a pressure of 120 to 130 kPa (17 to 19 psi), to disperse the salt solution in the form of a fine mist or fog throughout the interior of the chamber. The temperature within the chamber is to be maintained between 33 and 36°C (92 and 97°F). Condensate accumulation on the cover of the chamber shall not drop on the test specimens, and drops of the solution that fall from the specimens are not to be recirculated and are to be removed through a drain located in the floor of the chamber.

39.4 The salt solution is to consist of 20 percent (by mass) of common salt (sodium chloride) and distilled water. The pH value of this solution as collected after spraying in the test apparatus is to be between 6.5 and 7.2, and the specific gravity between 1.126 and 1.157 at 35°C (95°F).

40 10-Day Moist Ammonia Air Stress Cracking Test

40.1 After being subjected to the conditions described in 40.2 – 40.4, a brass part containing more than 15 percent zinc shall show no evidence of cracking when examined using 25X magnification.

Exception: Cracking is not prohibited when the cracking does not impact the ability of the product to comply with the requirements of this standard.

40.2 Each test sample is to be subjected to the physical stresses normally imposed on or within a part as the result of assembly with other components. Such stresses are to be applied to the sample prior to and maintained during the test. Samples with threads, intended to be used for installing the product in the field, are to have the threads engaged and tightened to the torque specified in Table 2. Teflon tape or pipe compound are not to be used on the threads.

40.3 Three samples are to be degreased and then continuously exposed in a set position for ten days to a moist ammonia-air mixture maintained in a glass chamber approximately 300 by 300 by 300 mm (12 by 12 by 12 in) having a glass cover.

40.4 Approximately 600 mL (0.12 gal) of aqueous ammonia having a specific gravity of 0.94 is to be maintained at the bottom of the glass chamber below the samples. The samples are to be positioned 38 mm (1-1/2 in) above the aqueous ammonia solution and supported by an inert tray. The moist ammonia-air mixture in the chamber is to be maintained at atmospheric pressure and at a temperature of 34 ±2°C (93 ±4°F).

41 One-Year Time Leakage Test

41.1 An extinguisher shall retain its charge without (a loss in weight of) leakage in excess of 28 g (1 oz) for 1 year at a temperature of 21 ±1°C (70 ±2°F).

41.2 Twelve sample extinguishers charged with their rated capacity are to be tested with six samples in a vertical position and six samples in a horizontal position and their weight checked after 1, 3, 6, and 12 months. Any loss in weight is an indication of leakage. At least half of the samples are to be discharged and recharged at the 3 month and 6 month points during the 1-year test period.

42 Nameplate Exposure Tests

42.1 After being subjected to the exposures specified in 42.2 (b) – (f), when compared to the conditioned sample in 42.2(a), a nameplate shall remain intact, readable, and legible, and shall not exhibit cracking or curling at the edges.

42.2 Prior to the exposures specified in (a) – (f), sample pressure-sensitive type nameplates are to be applied to test surfaces representative of the surface employed in the intended application. Curvature of this surface is to have the minimum radius anticipated in application. Each of the exposures specified in (b) – (f) is to be preceded by that specified in (a).

a) 72 hours at 23 ±2°C (73 ±4°F) and 50 ±5 percent relative humidity.

b) 24 hours at minus 54 ±2°C (minus 65 ±4°F) or minus 40 ±2°C (minus 40 ±4°F), depending on intended use.

c) 6 weeks at 60 ±2°C (140 ±4°F) and 97 ±3 percent relative humidity.

d) 90 days air-oven aging (mechanical convection) at 87 ±1°C (189 ±2°F).

e) 720 hours in ultraviolet light and water. See 37.3.1.

f) 48 hours immersion in distilled water 23 ±2°C (73 ±4°F).

43 Nameplate Adhesion Test

43.1 A pressure-sensitive nameplate containing the model number and extinguisher classification shall have an average adhesion after a 72-hour exposure to air at 23 ±2°C (73 ±4°F) and 50 ±5 percent relative humidity of a minimum 0.18 N/mm (1 lb-f/in) of nameplate width. Following the exposures specified in 42.2 (c) – (f), the average adhesion shall be a minimum 0.09 N/mm (1/2 lb-f/in) of nameplate width. The nameplate shall not be removable intact, showing signs of tearing, deformation or destruction of printed information when removal is attempted by hand following exposure specified in 42.2(a).

43.2 Sample nameplates are to be affixed to test surfaces representative of the surface employed in the intended application. The surface is to have a curvature with the minimum radius anticipated in application. The samples then are to be subjected to each of the exposures specified in 42.2 (a) – (e). After the exposure, the samples are to be conditioned for not less than 24 hours at 23 ±2°C (73 ±4°F) and 50 ±5 percent relative humidity and the nameplate is to be pulled from the surface at an angle of 90 degrees to the surface and at a constant speed of 50 mm/min (2 in/min) by means of an Instron testing machine. The force to remove the nameplate is to be recorded. The results obtained from a minimum three samples subjected to each exposure are to be averaged.

44 Nameplate Abrasion Test

44.1 After being subjected to the exposure specified in 42.2 (a), a nameplate shall remain intact, readable, and legible after being subjected to 500 strokes of emery cloth and to 500 strokes of a cloth covered with household detergents or cleansers.

Exception: Overlaminated or subsurface printed nameplates are not required to be subjected to the 500 strokes of a cloth covered with household detergents or cleansers requirement.

44.2 The apparatus for this test is to consist of common household detergents and cleaners and grade, 100 grit emery cloth.

44.3 The extinguisher is to be laid on its side and a strip of medium emery cloth, 25 mm (1 in) wide and long enough to cover half of the circumference of the extinguisher plus 150 mm (6 in), is to be draped over the nameplate. Weights of 0.45 kg (1 lb) each are to be attached vertically to the ends of the emery cloth. The weights are to be alternately unbalanced by quickly lifting one, 125 m (5 in), then the other. One stroke shall be performed as a single unidirectional movement that occurs after the balance force on one weight is removed until balance is restored and movement stops. The tests using detergent and cleanser, with a cloth, are to be conducted similarly but with the following exceptions. The weights, 0.45 kg (1 lb) each, are to be attached to a belt, 50 mm (2 in) wide, and the belt is to be placed over a cloth folded to form a pad, 50 mm (2 in) wide by 200 mm (8 in) long. The pad is to be wetted, squeezed by one hand to a damp condition, the powdered cleanser is to be applied liberally, and any excess powder shaken off. The powdering procedure is to be repeated for each series of 25 strokes for the duration of the test.

PACKAGING

45 General

45.1 Each hand-portable charged extinguisher shall be packaged. An extinguisher equipped with a flexible hose is able to be packaged with the hose and horn assembly detached from the extinguisher, and the hose and horn assembly shall be included in the same package with the extinguisher.

45.2 A bracket or mounting hook shall be packaged with each extinguisher.

Exception: An extinguisher weighing less than 1.4 kg (3 lb) and having a cylinder diameter of 76.2 mm (3 in) or less is not required to be supplied with either a mounting hook or bracket.

45.3 The package of an extinguisher with a USCG marine type classification shall state:

a) That the marine approval is valid only when the extinguisher is equipped with an approved marine type bracket; and

b) Whether or not the marine type bracket is included.

45.4 The hose assembly for a wheeled extinguisher may be packaged separately.

MANUFACTURING AND PRODUCTION TESTS

46 General

46.1 The manufacturer shall provide the necessary production control, inspection, and tests.

46.2 Pressure gauges used are to be calibrated at least once each month.

47 Hydrostatic Pressure Test – Hoses and Couplings

47.1 There shall be no leakage or permanent movement of a coupling when the extinguisher hose assembly is subjected for 1 minute to a pressure of 8620 kPa (1250 psi).

48 Leakage Test

48.1 Each extinguisher charged to its intended filling weight, without the horn or horn-and-hose assembly attached, shall not leak when tested as follows: The assembly is to be submerged in water or other equivalent test liquid maintained at a temperature of 21°C (70°F) to 43°C (110°F) for not less than one hour. Transparent covers are to be placed over the valve to collect and disclose the presence of escaping gas. The test is to be extended for the full 1-hour period after all air bubbles initially appearing in the covers have been removed.

48.2 The test method employed to determine leakage is water immersion, or other equally sensitive methods employing special leak detectors.

MARKING

***Advisory Note**: In Canada, there are two official languages, English and French. The Annex B lists acceptable French translations of the markings specified in this standard. All markings required by this standard may have to be in other languages to conform with the language requirements where the product is to be used.*

49 General

49.1 The operating, recharging, and inspection instructions shall be in the form of an etched or embossed metal nameplate, band, or a pressure-sensitive nameplate attached to the side of the cylinder, or in the form of silk-screening of paint directly on the cylinder. The nameplate shall identify the extinguisher as a carbon-dioxide fire extinguisher, and shall include the rating of the fire extinguisher. See ANSI/UL 711/CAN/ULC-S508.

49.2 The manufacturer's name or the equivalent designation and the model number shall be permanently marked on each embossed metal nameplate, band or pressure sensitive nameplate.

49.3 The year of manufacture, or the last two digits of the calendar year, and the factory test pressure in kilopascals, psi, or bar shall be permanently marked on the extinguisher. Extinguishers manufactured in the last 3 months of a calendar year are able to be marked with the following year as the date of manufacture, and extinguishers manufactured in the first 3 months of a calendar year are able to be marked with the previous year as the date of manufacture.

49.4 When a manufacturer produces extinguishers at more than one factory, each extinguisher shall have a distinctive marking to identify it as the product of a particular factory.

49.5 An extinguisher nameplate shall include a reference to the range of temperatures at which the extinguisher is usable such as "Intended for Use at Temperatures from..... to....." or the equivalent.

49.6 The nameplate shall include a statement that the extinguisher is to be installed, inspected, maintained, and tested in accordance in the United States with the Standard for Portable Fire Extinguishers, NFPA 10 and in Canada with the National Fire Code of Canada.

49.7 An extinguisher that contains at least 1.8 kg (4 lb) of agent, that has a gross weight of 25 kg (55 lb) or less, that, with the applicable bracket, has complied with the requirements specified in the Salt Spray Corrosion Test, Clause 39, and the Vibration Tests, Clause 33, and has attained a rating of at least 5-B:C is able to be marked with an appropriate "Marine Type" designation. This marking, when used, shall appear directly below the classification of the extinguisher, and shall include the statement: "USCG Approval Number_____Valid Only With Bracket Number_____." The U. S. Coast Guard bracket identification number shall be marked on both the bracket and the extinguisher.

49.8 The following applicable statement or the equivalent shall be included on the nameplate:

a) For rechargeable extinguishers – "Recharge immediately after any use."

b) For disposable extinguishers – "Discard immediately after any use."

49.9 A nameplate or the valve of each extinguisher shall be marked with its:

a) Exact gross weight; or

b) Minimum and maximum gross weight, which may be expressed as a tolerance.

The gross weight shall include the weight of the charged extinguisher and discharge assembly unless marked to indicate that the gross weight does not include the discharge assembly.

49.10 When an extinguisher incorporates a 3HT type cylinder, the extinguisher shall carry the wording "For Inside Use on Aircraft Only," and the maintenance instructions shall require a hydrostatic pressure test every three years and a warning to retire the unit after not more than 15 years of service.

49.11 The discharge horn shall be marked with the model or type designation of the extinguisher with which it is intended to be used. The marking shall be molded in the horn, stamped in the edge of the discharge end or applied by means of a decalcomania transfer or other form of printed adhesive tape.

50 Operating Instructions

50.1 Operating instructions for the purpose of applying the requirements of this clause are defined as those required to accomplish intended discharge of the extinguishing agent.

50.2 The operating instructions shall face outward and cover not more than a 120-degree arc on the extinguisher body. The marking required by 50.3 and 51.1 shall together occupy a minimum area of 77.4 cm^2 (12 in^2) for an extinguisher having a diameter greater than 82.5 mm (3-1/4 in) and 51.6 cm^2 (8 in^2) for an extinguisher having a diameter of 82.5 mm (3-1/4 in) or less.

50.3 The operating instructions shall be arranged as follows:

a) The word "INSTRUCTIONS" shall be at the top of the nameplate. The minimum letter height shall be:

1) 6.4 mm (1/4 in) for an extinguisher having a diameter greater than 82.5 mm (3-1/4 in); and

2) 4.8 mm (3/16 in) for an extinguisher having a diameter of 82.5 mm (3-1/4 in) or less.

b) The operating instructions shall be in the form of numerically sequenced pictographs. A single pictograph is able to include two written instructions.

c) The sequence of pictographs shall illustrate the recommended actions necessary for intended operation of the extinguisher. The sequence shall be as follows:

1) Readying the extinguisher by disengaging the locking device, tamper seal, or both.

2) Aiming the extinguisher at the base of the fire, including the recommended distance from the fire at which to begin discharge, and indicating the intended operating attitude of the extinguisher.

3) Taking whatever action necessary to initiate intended discharge of the extinguisher.

4) Describing the intended method of applying the extinguisher agent on the fire.

50.4 See Figure 2 and Figure 3 for examples of pictographs that meet the requirements specified in 50.3.

50.5 Words are able to be used with pictographs. The height of the words used in the pictographs shall be at least 3.2 mm (1/8 in) high.

50.6 A wheeled extinguisher is not required to have pictographic operating instructions when the same information is conveyed by words having a height of a minimum 12.7 mm (1/2 in).

51 Use Code Symbols

51.1 Use code symbols for the ratings achieved shall be positioned directly below the operating instructions. A description for the applicable Class B and C use code symbols shall be included as part of the use code in letters having a minimum height of 1.2 mm (3/64 in). Examples of the use code symbols are illustrated in Figure 4.

51.2 The use code symbols shall have dimensions a minimum 16 by 16 mm (5/8 by 5/8 in) and not more than 32 by 32 mm (1-1/4 by 1-1/4 in), excluding the borders.

51.3 A blue or black background shall be used for the use code symbols. Picture symbol objects and background borders shall be a color that contrasts with the blue or black background such as white, silver, or light gray. The words above the picture symbol objects shall be blue or black.

51.4 When the manufacturer's name or trade name is placed below the use code symbols, it shall not contain any other information that distracts attention from the operating instructions.

52 Recharging Instructions

52.1 The recharging instructions on the nameplate of a rechargeable extinguisher shall specify the weight of carbon dioxide.

52.2 Reference shall be made to the manufacturer's servicing instructions for the intended equipment and technique to be used in recharging the extinguisher. However, in lieu of detailing recharging instructions, the nameplate on the extinguisher shall instruct the user to return the extinguisher to the dealer or manufacturer for recharging, using the following words or the equivalent: "Return to an authorized recharger for recharging in accordance with Service Manual No._____." See 56.2.

53 Identification of Contents

53.1 An extinguisher shall have attached to it in the form of a label, tag, stencil or similar manner the following information concerning its contents:

a) Contents product name as it appears on the manufacturer's Material Safety Data Sheet (MSDS).

b) A listing of the hazardous material identification in accordance with the National Paint and Coatings Association, Hazardous Materials Identification Systems (HMIS) [a] or Workplace Hazardous Materials Information System (WHMIS)[b].

c) A list of any hazardous materials that are in excess of 1.0 percent of the contents.

d) A list of each chemical in excess of 5.0 percent of the contents.

e) Information as to what is hazardous about the agent in accordance with the MSDS.

f) The contents manufacturer's name, mailing address and phone number as shown on the MSDS.

[a] Information on the HMIS system may be obtained from Label Master Inc., Chicago, Illinois or from the National Paint Coatings Association, Washington, D.C.

[b] Information on the WHMIS system may be obtained from Health Canada, Ottawa, Canada.

54 Inspection Instructions

54.1 The inspection instructions on the nameplate shall state that:

a) The extinguisher shall be inspected monthly, or at more frequent intervals when circumstances require;

b) The hose, when supplied, and horn shall be examined to ascertain that they are unobstructed and undamaged; and

c) The tamper indicator shall be intact.

RECORD TAGS AND MANUALS

55 Record Tag

55.1 An extinguisher shall be provided with a record tag for recording the date on which the extinguisher was last inspected and the name or initials of the person making the inspection in accordance with the Standard for Portable Fire Extinguishers, NFPA 10, and the National Fire Code of Canada.

56 Manuals

56.1 An instruction manual shall be provided with each extinguisher. This manual shall contain the necessary instructions, warnings, and cautions for the intended installation, operation, inspection, and maintenance of the extinguisher. For marine type extinguishers, a statement shall also be included that Marine approval is valid only when the extinguisher is equipped with an approved marine type bracket.

56.2 The manufacturer shall prepare a service manual for each model fire extinguisher. It shall be made available upon request and shall:

a) Contain:

1) Required instructions, warnings, and cautions;

2) A description of servicing equipment; and

3) A description of procedures for intended servicing.

b) Provide a list of part numbers of all replaceable parts.