possible from the vertical so that the tip of the blue cone touches the specimen. The test flame is to be applied to three different locations on each of the three samples tested. A supply of technical-grade methane gas is to be used with a regulator and meter for uniform gas flow.

EXCEPTION NO. 1: It is permissible that the flame be applied to the outside of an enclosure when the equipment is of the encapsulated type or of such size that the flame cannot be applied inside.

EXCEPTION NO. 2: Natural gas having a heat content of 37 MJ/m<sup>3</sup> (1000 Btu/ft<sup>3</sup>) at 23 °C (73°F) has been found to provide similar results and is permissible for use.

72.4.6 The flame is to be applied for 5 s and removed for 5 s. The operation is to be repeated until the specimen has been subjected to five applications of the test flame.

## 73 Strain Relief Test

### 73.1 General

73.1.1 A cord or lead that relies upon a thermoplastic enclosure or part for strain relief is to be subjected to the applicable tests specified in 73.2.1 - 73.3.1 following exposure to the temperature conditioning test described in 80.2.1.

### 73.2 Power-Supply Cord

73.2.1 When tested in accordance with 73.2.2, the strain relief means provided on the flexible cord shall withstand for 1 min, without displacement, a pull of 156 N (35 pounds-force) applied to the cord with the connections within the alarm disconnected.

73.2.2 A 15.9 kg (35 pound-mass) weight is to be suspended on the cord and supported by the alarm so that the strain relief means are stressed from any angle that the construction of the alarm permits. The strain relief does not comply when, at the point of disconnection of the conductors, there is such movement of the cord as to indicate that stress has resulted on the connections.

#### 73.3 Strain Relief (Special Field-Wiring Terminals)

73.3.1 To determine suitability as a field-wiring connection in compliance with 17.4.1 and 17.4.2, representative samples shall comply with all of the tests specified in 73.3.2 and 73.3.3.

73.3.2 A terminal connection shall withstand the application of a straight pull of 22.2 N (5 pounds), applied for 1 min to the wire in the direction which would most likely result in pullout, without separating from the terminal.

73.3.3 Six samples of the terminal are to be connected to the wire sizes with which they are intended to be used, in accordance with the manufacturer's instructions. When a special tool is required to assemble the connection, it is to be used. Each sample is to be subjected to a gradually increasing pull on the wire until the test pull of 22.2 N (5 pounds) is reached and maintained at 22.2 N (5 pounds) for 1 min.

### 74 Survivability Test

74.1 Two samples of the smoke alarm shall be exposed to a temperature of  $121 \pm 2 \text{ °C}$  ( $250 \pm 4 \text{ °F}$ ) for a period of 4 min. The units shall be removed from the test chamber and allowed to return to room temperature. The units are then to be subjected to the Audibility Test, Section 76, (when applicable) and the Sensitivity Test, Section 38.

74.2 Following conditioning, the samples shall be capable of producing an audible output (when applicable) of 85 dBA at 3.05 m (10 ft), and the sensitivity of each smoke alarm shall not vary by more than specified in 34.3, Sensitivity Shift Criteria.

## 75 Drop Test

75.1 This test is to be conducted only on smoke alarms intended for transient use, such as a travel alarm, and is not to be conducted on alarms intended for stationary installation.

75.2 An alarm shall withstand five drops from a height of 2.1 m (7 ft) onto a tiled concrete floor without exposure of internal high-voltage parts and without affecting its intended operation and sensitivity. The sample is to be held so that each impact with the floor is at a different location on the alarm. Dislodgement of parts is not prohibited when:

- a) The dislodged part does not affect operation or sensitivity of the unit,
- b) The dislodged part is replaceable (such as a cover),
- c) There are no high-voltage parts exposed, and
- d) The condition is visually obvious.

75.3 Each of two alarms is to be raised to a height of 2.1 m (7 ft) and permitted to drop five times onto a concrete floor covered with a 3.2 mm (1/8 in) thick uncushioned vinyl tile. Following the drops, the unit is to be examined for damage and tested for sensitivity. Sensitivity measurements, recorded after the drop test, shall vary not more than specified in 34.3.1.

### 76 Audibility Test

### 76.1 Sound Output Measurement

76.1.1 The signal format of a low frequency alarm shall conform to the description in 76.5.

76.1.2 A smoke alarm that incorporates an audible device shall be capable of providing an output of at least 85 dBA at 3 m after being subjected to the endurance test described in Section 63, while connected to a source of rated voltage and frequency and mounted on a wooden board described in 76.3.2 with the front of the smoke alarm at 90 degrees with the horizontal and facing the microphone. At least two samples shall be tested. Units intended additionally for multiple-station connection shall be tested in that configuration with the maximum line resistance as defined in 67.2.2 and the audibility measured on the smoke alarm subject to an abnormal smoke condition. For a battery-operated unit, the batteries shall be depleted to a point just above or at the smoke alarm trouble signal level. The measurement shall be made after 4 min of alarm operation.

76.1.3 The measurement shall be made in a free field condition to minimize the effect of reflected sound energy. The ambient noise level is to be at least 10 dB below the measured level produced by the signal appliance. Free field conditions may be simulated by mounting the device on a wood surface at least 125 by 150 mm not less than 3 m from the ground and with the microphone located 3 m from the smoke alarm and conducting the test outdoors on a clear day with a wind velocity of not more than 8 kph and an ambient temperature of 15 to 25°C.

76.1.4 Alternately, an anechoic chamber of not less than 28 m<sup>3</sup>, with no dimension less than 2 m, and with an absorption factor of 0.99 or greater from 100 Hz to 10 kHZ for all surfaces may be used for this measurement.

### 76.2 Alarm Duration Test

76.2.1 An alarm sounding appliance of an alarm powered by a primary or secondary battery that has been discharged to the trouble level condition shall provide the equivalent of 85 dbA minimum at 3.05 m (10 ft) for 1 min of continuous alarm operation and shall provide at least 82 dbA up to 4 min of alarm operation.

76.2.2 To determine compliance with 76.2.1, a measurement shall be made under the following conditions. The ambient noise level is to be at least 10 dB below the measured level produced by the signaling appliance. The alarm is to be mounted 302 mm (1 ft) from the microphone placed in a direct line with the alarm. The alarm is then to be energized in the alarm condition and the sound output is to be measured at 1 min intervals, using a sound level meterp employing the A weighting network. A maximum of 3 dB decrease from the original 1 min reading, after 4 min shall determine compliance for a battery operated alarm that is providing a trouble signal.

### 76.3 Supplementary Remote Sounding Appliances

76.3.1 The sound output of a supplementary remote sounding appliance, intended to be installed in the same room as a user (such as a bedroom), shall not be less than 85 dB unless the appliance is marked with the following, or equivalent, text to indicate the specific use:

"THIS UNIT IS TO BE INSTALLED IN A ROOM OCCUPIED FOR SLEEPING." and « CET AVERTISSEUR DOIT ÊTRE INSTALLÉ DANS UNE CHAMBRE À COUCHER. »

76.3.2 Under no circumstances is the sound output to be less than 75 dB. The alarm signal format shall also comply with the requirement in 76.4.

### 76.4 Low Frequency Alarm Signal Format

76.4.1 A low frequency alarm shall have a fundamental frequency of 520 (F1) Hz  $\pm$ 10%, with subsequent harmonic frequencies occurring at 1560 (F3), 2600 (F5) and 3640 (F7) Hz  $\pm$ 10% as determined by a Fast Fourier Transform (FFT) analysis of the audible alarm signal.

76.4.2 The spectral analyses shall be performed in a reverberant room per the test setup as described in 80.2.2. The FFT measurement shall be a 30 s spectrum averaging of a 12.8 (kHZ) frequency span of 2 (Hz) resolution, non-weighted.

76.4.3 The maximum sound pressure level (dB) of any frequency within the FFT measurement shall be at least 5 dB less than the F1 sound pressure level (dB). The minimum sound pressure level (dB) of the odd harmonics shall not be less than 20 dB for F3, 30 dB for F5 and 50 dB for F7 of the fundamental F1 level.

### 77 Field Service Tests (If Recommended By The Manufacturer)

### 77.1 Go/No-Go Field Test

#### 77.1.1 Go/No-Go Field Test (gas sensors used in multi-criteria smoke alarms)

77.1.1.1 Where the smoke and gas sensor can be tested independent of the other sensors, Section 61, Dust Test shall apply.

77.1.1.2 Two smoke alarms shall be energized with their rated voltage and operate at their intended signaling performance. The smoke alarms shall be subjected to X number of the manufacturer's recommended go/no-go field test. The number of go/no-go field tests is determined using the following calculation:

$$X = (A \times B)2.5$$

in which:

A = Sensor life (years based on shortest sensor lifespan) as stated by the manufacturer.

B = The number of tests the sensor is to be subject to annually (as recommended by the manufacturer).

X = Number of go/no-go test gas concentration exposures the product is to be subject to.

77.1.1.3 The samples shall indicate a successful gas entry into the sensing cell via a measurement means provided by the manufacturer. The smoke alarm shall be reset either mechanically, electrically, or by the smoke alarm remaining in fresh air for a period of time specified by the manufacturer. Following the reset period, this sequence of go/no-go field tests is to be repeated "X" number of trials. Following "X" number of go/no-go test gas exposures, the smoke alarms shall comply with Section 38.8 (Sensitivity Test – gas sensor of a multi-criteria smoke alarm) and Section 77.1.2 [Go/no-go field test (for the smoke sensor)].

#### 77.1.2 Go/No-Go Field Test (for the smoke sensor)

77.1.2.1 Two smoke alarms, one at maximum and one at minimum sensitivity, shall operate at their intended signaling performance, and each smoke alarm's sensitivity shall not shift by more than specified in 34.3, Sensitivity Shift Criteria after being subjected to 50 alarm and restoration cycles of the manufacturer's specified go/no-go field test method for smoke entry. The samples are to be energized with rated voltage and subjected to the go/no-go test at a rate of not more than one field test per 30 min.

Note: Where smoke entry into the smoke alarm is not applicable the manufacturer's specified test method shall be utilized.

77.1.2.2 Following the successful completion of the go/no-go field test these samples shall be subjected to the Dust Test, Section 61.

### 77.2 Maintenance (Cleaning)

77.2.1 For smoke alarms intended to be cleaned in the field, two smoke alarms, one at maximum and one at minimum sensitivity, shall operate for their intended signaling performance, and each smoke alarm's sensitivity shall not shift by more than specified in 34.3, Sensitivity Shift Criteria, after being subjected to 50 cycles of the manufacturer's specified field cleaning procedure.

### 77.3 Battery Tests – Primary Power Supply – Battery

77.3.1 Where a replaceable battery is employed as the main source of power of a smoke alarm, it shall provide power to the unit under intended ambient conditions for at least 1 year (or whatever longer period specified by the manufacturer) in the standby condition, including novelty and weekly alarm testing, and then operate the alarm for a minimum of 4 min of alarm, followed by 7 days of trouble signal. See 37.5. The alarm sound level shall be at least 85 dBA at the end of the 4 min alarm period when tested in accordance with the Audibility Test outlined in Section 76 and the Battery Trouble Voltage Determination outlined in Section 49.2.

77.3.2 Where a nonreplaceable battery is employed as the main source of power, it shall provide power to the unit under intended ambient conditions for at least 10 years in the standby condition, including novelty and weekly testing, and then operate the alarm for a minimum of 4 min of alarm, followed by 7 days of trouble signal.

77.3.3 Six samples of the battery, or sets of batteries when more than one battery is used for primary power, shall be tested under each of the following ambient conditions for a minimum of 1 year while connected to the smoke alarm or a simulated load to which the battery is to supply power:

- a) A room ambient temperature of 23 ±2 °C (73.4 ±3.6°F), 30 50 % relative humidity, and 760 mm Hg;
- b) High temperature of =  $(T_{HI} 38 \text{ °C}) + 45 \text{ °C}$  or  $(T_{HI} 100 \text{ °F}) + 113 \text{ °F}$
- c) Low temperature of =  $(T_{LO} 0 \ ^{\circ}C)$  or  $(T_{LO} 32 \ ^{\circ}F)$ , and
- d) Temperature =  $(T_{HI} 38 \text{ °C}) + 30 \text{ °C}$  or  $(T_{HI} 100^{\circ}\text{F}) + 86^{\circ}\text{F}$ , and 85 ±5 % relative humidity and;
- e) Where  $T_{LO}$  and  $T_{HI}$  are the respective low and high end operating temperatures.

77.3.4 For the test, either alarm samples or test loads simulating a maximum standby current drain are to be employed. The alarm load is to be the audible appliance intended to be used in the smoke alarm or an appropriate load simulating maximum alarm conditions. The batteries are to be tested in the mounting clips employed in the alarm.

77.3.5 Terminals or jacks are to be provided on each test means to facilitate measurement of battery voltage, standby, and alarm currents. The measuring means is to be separated from the battery test means by a wiring harness or equivalent at least 0.9 m (3 ft) long.

77.3.6 Prior to placing the battery test setups in the various ambient conditions, each battery is to be subjected to 25 cycles of alarm representing novelty testing. Each cycle is to consist of 5 s of alarm and at least 5 min between each application.

77.3.7 During the course of the test, the battery voltage and current in standby and alarm condition are to be recorded periodically. The alarm voltage is to be recorded 3 s after energization. The standby voltage and current are to be recorded prior to the alarm measurements. The smoke alarm is to be placed into an alarm condition weekly. The duration of the weekly alarm test signal is to be 3 s.

77.3.8 For batteries rated longer than one year, at the end of the specified test period, all batteries shall have a capacity capable of operating the alarm signal for a minimum of 4 min, followed by 7 days of trouble signal. To obtain the trouble signal level it is sometimes required to continue the test with the standby current drain for longer than the test period. Batteries shall be subjected to the conditions described in 81.1.3 (b), (c), and (d) for the test period unless the alarm is marked to indicate the battery limitations for the condition involved. In no case shall the length of conditioning be less than one year.

77.3.9 For batteries rated for one year only, at the end of the specified test period (1 year) all batteries shall have a capacity capable of operating the alarm signal for a minimum of 4 min, followed by 7 days of trouble signal. To obtain the trouble signal level it is sometimes required to continue the test with the standby current drain for longer than 1 year. Batteries shall be subjected to the conditions described in 81.1.3 (b), (c), and (d) for a minimum of 1 year unless the alarm is marked to indicate the battery limitations for the condition involved. In no case shall the length of conditioning be less than 6 months.

## 78 Conformal Coatings on Printed Wiring Boards

### 78.1 General

78.1.1 Conformal coatings are for use only on printed wiring boards where the acceptability of the combination has been investigared for flammability in accordance with CSA C22.2 No. 0.17, Evaluation of Properties of Polymeric Materials, and the dielectric property after environmental, humidity, and thermal conditioning in accordance with CSA C22.2 No. 0.17, Evaluation of Properties of Polymeric Materials.

### 78.2 Low Voltage Printed Wiring Boards

78.2.1 The following test program is to be utilized to determine the acceptability of a conformal coating in lieu of full electrical spacings for circuits at potential of 30 V rms or less.

78.2.2 Eight samples of the printed wiring board, without electrical components installed, and coated with the conformal coating, shall be subjected to this test. Test leads shall be attached to the printed wiring (prior to the application of the coating) so as to allow for convenient application of the specified test potential.

78.2.3 Four specimens shall be conditioned to room ambient by exposure to ambient air at a temperature of 23  $\pm$ 2 °C (73, minus 3, +4°F) and 50  $\pm$ 5 % relative humidity for not less than 24 h. Following the conditioning, the four samples shall be subjected to the Dielectric Voltage-Withstand Test, Section 70, for the 0 – 30 volt range. There shall be no indication of dielectric breakdown as a result of the test. All specimens shall be smooth, homogeneous, and free of heat deformation such as bubbles and pin holes, as determined by visual examination.

78.2.4 Four samples shall be exposed to ambient air at a temperature chosen from the applicable temperature index line shown in Figure 16 corresponding to the "in service" operating temperature of the coating. The aging temperature chosen from the index line shall correspond to not less than 1000 h of exposure. It is permissible for any value of temperature to be chosen when it corresponds to no fewer than 300 h of exposure. The samples are then to be subjected to the Dielectric Voltage-Withstand Test, Section 70. All specimens shall be smooth, homogeneous, and free of defects such as bubbles and pin holes, as determined by visual examination. There shall not be crazing, chipping, or other visual evidence of deterioration or separation of the coating from the board after conditioning. There shall not be indication of a dielectric breakdown.

78.2.5 As an option to the use of conformal coating for circuits at a potential of 30 V rms (42.4 V dc or ac peak) or less and less than 100 V•A, four samples of the printed wiring board shall be subjected to the following tests. The samples shall be conditioned in the environment described in the Humidity Test, Section 56. Following the conditioning, the four samples shall be subjected to the Dielectric Voltage-Withstand Test, Section 70, for the 0 - 30 volt range. There shall not be indication of dielectric breakdown as a result of the test.

### 78.3 High Voltage Printed Wiring Boards

78.3.1 The following test program is to be utilized to determine the acceptability of a conformal coating in lieu of full electrical spacing for circuits at potential greater than 30 V rms. The coating shall not be less than 0.2 mm (0.008 in) thick.

78.3.2 Three samples of the printed wiring board without electrical components installed, and coated with the conformal coating, shall be subjected to this test. Test leads shall be attached to the printed wiring (prior to the application of the coating) so as to allow for convenient application of the specified test potential. Each sample shall be subjected to a 5,000 V ac Dielectric Voltage-Withstand Test potential for one min:

- a) The test shall be performed between tracks on the printed wiring board;
- b) A 7-day heating-cooling cycling period, each cycle consisting of 4 h "on" at 105 ±2 °C (221 ±4°F) followed by 4 h "off" at 25 ±2 °C (77 ±4°F);
- c) A 7-day oven conditioning period of 100  $\pm$ 2 °C (212  $\pm$ 4°F);
- d) A 7-day oven conditioning period at 85 % relative humidity at 65 °C (149°F); and
- e) A Dielectric Voltage-Withstand Test potential at 2,500 V ac repeated 10 times.

There shall not be peeling or other deterioration of the coating material as a result of the conditioning.

78.3.3 A sample of the coated printed wiring board, equipped with test leads, without electrical components installed, shall be subjected to this test. The sample shall be subjected to an atmosphere having a relative humidity of 93  $\pm$ 2 % at a temperature of 32  $\pm$ 2 °C (89, minus 3, +4°F) for a period of 24 h followed by a 500 V Dielectric Voltage-Withstand Test with the sample maintained in the conditioning atmosphere. There shall be no indication of a dielectric breakdown.

## **79 Power Supply Tests**

#### 79.1 General

79.1.1 If a separate power supply, as described in Section 18 (Remote Power Supply) is used to provide energy to one or more smoke alarms, it shall be subjected to the tests of Clauses 79.2 and 79.3 and meet the requirements of the following test:

- a) Circuit Measurement Test, 49;
- b) Overvoltage and Undervoltage Test, 50;
- c) Temperature Test, 51;
- d) Jarring Test, 54;
- e) Variable Ambient Temperature and Humidty Test, 55;
- f) Transients Tests, 59;
- g) Overload Test, 62;
- h) Endurance Test, 63;
- i) Leakage Current Test, 66; and
- j) Tests on Polymeric Materials, 72.

### 79.2 VA Capacity

79.2.1 The VA output capacity of a power supply shall not exceed 100 VA and shall not be more than 30 V rms (42.4 V peak).

aenerai

79.2.2 To determine compliance with Clause 79.2.1, a variable resistive load shall be connected to the output circuit. With the sample connected to a rated source of supply, the load resistor is to be varied between open circuit to short circuit conditions in such a manner that the elapsed time is between 1.5 and 2.5 min. Voltage and current measurements are recorded over the range and the maximum VA is calculated. If an interchangeable type over-current protective device is provided, it shall be shunted out during the test.

### 79.3 Burnout Test

79.3.1 There shall be no damage to the enclosure, charring or burning of the cheesecloth, nor emission of flame or molten metal when a sample is operated under the conditions described in 79.3.2. While still hot from the burnout test, the power supply is to be subjected to and comply with the requirements of the Leakage Current Test, 66; and Dielectric Voltage-Withstand Test, 70.

79.3.2 With the output shorted, the supply circuit of the sample is to be connected to a rated source of voltage and frequency with the enclosure grounded and operated for a least 7 h or until burnout occurs. A single layer of mercerized cotton cheesecloth is to be loosely draped over the device during the test. If accessible, interchangeable type over-current protective devices are provided, they are to be shunted out, but inaccessible over-current protective devices are to remain in the circuit.

## 80 Smoke Alarms For Use In Recreational Vehicles (RV)

### 80.1 General

80.1.1 A single criteria smoke alarm intended for use in recreational vehicles shall comply with the requirements specified in Sections 80.1 - 80.6, in addition to the requirements specified in Sections 1 - 79 and 83 - 93, inclusive.

80.1.2 A multi-criteria smoke alarm with gas sensor intended for use in recreational vehicles shall comply with the requirements specified in Sections 1 - 79 and 83 - 93, inclusive.

80.1.3 All batteries included with smoke alarms intended for use in recreational vehicles shall at a minimum have a published operational specification range of minus 20° C to 60° C (minus 4°F to 140°F). Recommended replacement batteries shall also meet the temperature range.

### 80.2 Marking

80.2.1 In addition to the applicable requirements in Section 92, Markings, a single criteria or multi-criteria smoke alarm for use in a Recreational Vehicle shall be permanently and legibly marked with the following information. The markings shall be in contrasting color, finish or equivalent, in letters at least 1.2 mm (3/64 in) high. Items (f) and (g) shall be readily visible after installation:

- a) Manufacturer's or private labeler's name or identifying symbol;
- b) Model, type, or catalog designation;
- c) Date of manufacture (in code is not prohibited);
- d) Electrical rating in V and A;
- e) Reference to owner's manual;

- f) The type of product, such as "RV Smoke Alarm" « avertisseur de fumée pour VR »or "RV Multicriteria Smoke Alarm" « Avertisseur de fumée multicritères pour VR », or equivalent. It is not prohibited that this marking be incorporated in (g); and
- g) Identification of switches and light indicators.

#### 80.3 Variable Ambient Temperature and Humidity Test

80.3.1 There shall be no false alarms or adverse change in performance when two units, one at maximum and one at minimum sensitivity, are subjected, in turn, to each of the following conditions:

- a) Thirty days in air at 66  $\pm$ 3 °C (150  $\pm$ 6°F).
- b) At least 72 h at minus 40  $\pm$ 2 °C (minus 40  $\pm$ 4°F).
- c) Ten days in 93  $\pm$ 2 % humidity at 61  $\pm$ 2 °C (142  $\pm$ 4°F).

80.3.2 Sensitivity measurements, recorded in the environmental chamber smoke box, shall not vary more than specified in 34.3 Sensitivity Shift Criteria. During the sensitivity measurement, the environmental chamber is to be as close as possible to the test conditions specified in 80.2.1, condition (a) to be conducted at 49 °C, condition (b) to be conducted at 0 °C, and condition (c) to be conducted at 40 °C, 93 % relative humidity, respectively).

80.3.3 Gas sensitivity measurements, recorded in the environmental chamber, shall not vary more than specified in 38.7 Sensitivity test – gas sensor of a multi-criteria smoke alarm.

80.3.4 During each test condition, the alarm is to be connected to a source of rated voltage or battery.

80.3.5 The tests in 80.3.1 shall be done sequentially on the same two samples, and using the same battery samples for all three environments. The tests shall be conducted using each battery model specified in the marking or the installation instructions.

### 80.4 Corrosion (Salt Spray) Test

80.4.1 A smoke alarm shall operate as intended and shall not false alarm after exposure for 48 h to a salt spray in accordance with the procedure specified in the Standard for Salt Spray (Fog) Testing, ASTM B117-11.

80.4.2 Two alarms, one at maximum and one at minimum sensitivity, are to be subjected to the salt spray while in a de-energized condition. Following the exposure, the samples are to be removed, dried for at least 24 h in an air circulating oven or air dried for at least 48 h, and then subjected to the Sensitivity Test, Section 38.

80.4.3 It is not prohibited for sensitivity measurements following the exposure to vary by more than specified in 34.3 Sensitivity Shift Criteria in the direction of high sensitivity under the following conditions:

- a) The smoke alarm does not false alarm and
- b) The sensitivity does not vary more than specified in 34.4.1 in the direction of low sensitivity.

In any case, the sensitivity shall not exceed the limits specified in the Sensitivity Test, Section 38.

#### 80.5 Vibration Test

80.5.1 After vibration in accordance with 80.5.2, a smoke alarm shall not false alarm nor be adversely damaged. Sensitivity measurements shall not be greater than specified in 34.3 in the direction of low sensitivity, measurements greater than specified in 34.3 in the direction of high sensitivity are not prohibited. In no case shall the measurements exceed the limits specified in the Sensitivity Test, Section 38 for single criteria smoke alarms or Clause 33.2.2 for multicriteria smoke alarms.

80.5.2 Two smoke alarms, one at maximum and one at minimum sensitivity, are to be subjected to vibration for 120 h in accordance with the Vibration Test, Section 80.5. Sensitivity measurements are to be recorded before and after the test.

#### 80.6 Contamination Test (Cooking By-Products)

80.6.1 After exposure in accordance with 83.6.2 – 83.6.5, a smoke alarm shall not false alarm or otherwise be adversely affected. Sensitivity measurements following the exposure shall not be greater than specified in 34.3 in the direction of low sensitivity, (measurements greater than specified in 34.3 in the direction of high sensitivity are not prohibited). In no case shall measurements exceed the limits of the Sensitivity Test, Section 38 for single criteria smoke alarms or Clause 33.2.2 for multicriteria smoke alarms...

80.6.2 Two samples are to be subjected to the vaporization of a mixture of 50 grams of animal fat (lard), 50 grams of vegetable fat (Crisco), and 100 grams of beef gravy (Franco-American). The mixture is to be placed in an 203 mm (8 in) diameter aluminum plate that is heated on an 216 mm (8-1/2 in) diameter hotplate located on the bottom center of a galvanized sheet metal enclosure.

80.6.3 The enclosure is to measure 914 mm (3 ft) high, 406 mm (16 in) square and have an open top and a 406 mm square opening at the bottom of one side. A sheet metal cover, 457 mm (18 in) square, with 25 mm (1 in) flanges, is to be supported at the enclosure top by 20 mm (7/8 in) high standoffs. See Figure 19.

80.6.4 The alarm under test is to be supported on the end of a threaded 61 mm (1/4 in) steel rod positioned so that the exposed face of the alarm is 304 mm (12 in) below the enclosure cover and 406 mm (16 in) above the aluminum plate. The alarm is not to be energized during the test.

80.6.5 Each sample is to be subjected to five complete vaporization exposures. Following the fifth exposure, each sample is to be removed, permitted to cool for at least 3 h, and then tested for sensitivity as specified in the Sensitivity Test, Section 38 for single criteria smoke alarms or Clause 33.2.2 for multicriteria smoke alarms.

### 81 Smoke Alarms For Use On Recreational Boats

#### 81.1 General

81.1.1 A smoke alarm intended for use in recreational boats shall comply with requirements specified in 81.1 - 81.1.6, in addition to the requirements specified in 1 - 73 and 83 - 93, inclusive.

81.1.2 These requirements apply to the construction and performance characteristics for single station self contained battery operated alarms as well as alarms powered by the vessels installed dc system. These alarms may be used in stand alone operation or as part of an integrated multiple device system when installed.