Note: It is permissible for this marking to appear on the installation wiring diagram rather than on the detector as described.

m) An indication that the device shall not be installed in locations where the normal ambient temperature exceeds 37.8 °C (100°F), unless the detector has been determined to be permissible for installation in a higher ambient temperature.

n) The following or equivalent notice shall be on the outer surface of the enclosure. The letters shall not be less than 3.2 mm (1/8 inch) high and shall be located to be readily visible after the detector is mounted in its intended manner.

1) In Canada: "DO NOT PAINT" and "NE PAS PEINTURER" and/or symbol indicated below;

2) In the United States: "DO NOT PAINT" and/or symbol indicated below.

The symbol shall be min 12.7 mm (1/2 in) diameter.

o) For a detector that employs a radioactive material the following information shall be indicated directly on the detector exterior (such as the back of detector):

In the United States:

i) The statement, "CONTAINS RADIOACTIVE MATERIAL";

ii) Name of Radionuclide and quantity (no abbreviations); and

iii) The statement, "U.S. NRC License No. XXX " (XXX – No. of License) or the name of the Licensee.

In Canada:

i) Radiation warning symbol and the following caution notice: " RAYONNEMENT – DANGER – RADIATION"; and

ii) Name, quantity, date of measurement and form of the nuclear substance in the detector.

Note: The markings in i) and ii) are in accordance with "Radiation Protection Regulations", published in the "Nuclear Safety and Control Act" by the Department of Justice Canada at the time of publication of this edition of the Standard. Manufacturers should consult the Regulations for any updates or changes to this marking.

p) A separable mounting base that is employed with two or more detector heads shall be marked with the name of the manufacturer, model number, and the following or equivalent marking: "FOR USE WITH MODELS xxx DETECTOR HEADS" (xxx is the appropriate model number(s))

Note: It is permissible for this marking to appear on the installation wiring diagram rather than on the detector as described.no

q) In the United States, a detector intended only for connection to a household system control unit shall be marked with the following (or equivalent) information: "For Household Use Only".

r) Sealed units intended to be returned to the manufacturer for servicing shall be marked as follows on the outside of the detector: "RETURN TO xxx FOR SERVICING", or equivalent. It is permissible for units on which the cover is removable, and that are also intended to be returned to the manufacturer for servicing, to have the marking on the inside of the detector. (xxx is the name and address of the manufacturer or supplier.)

s) Temperature rating of supplementary heat detector or supplementary heat sensor, when provided, in degrees Fahrenheit and Celsius.

t) In the United States, the following or equivalent qualifying statement on a battery-operated detector when battery operation, under other than normal room temperature conditions during the long term battery tests (see the Battery Tests, Section 72), is less than 1 year: "CONSTANT EXPOSURES TO HIGH OR LOW TEMPERATURES OR HIGH HUMIDITY MAY REDUCE BATTERY LIFE". Applicable wording is to be used.

u) The end-of-life marking requirements shall apply as follows;

1) Smoke Detectors with *Specified Lifetime*(i.e. limited life components) – Shall be marked with the following or equivalent, “Replace after X years”. X = Lifetime of the product when the *end-of-life signal* will be initiated based on manufacturers recommended end-of-life not to exceed 10 years.

81.2 When a false alarm occurs under the test condition specified in 40.1 (b) or (c), the following marking shall be provided on the detector in 3.2 mm (1/8 inch) high letters:

"NOT SUITABLE FOR INSTALLATION IN AREAS WHERE AIR VELOCITIES EXCEED + METERS PER MINUTE (# FPM)"

+ - Insert equivalent meter value (91 or 300).

- Insert 300 or 1000, whichever is applicable.

81.3 Information required to appear directly on the detector shall be readily visible after installation. Except for the marking specified in 82.1(n), the removal or opening of an enclosure cover or the removal of not more than two securing screws of a cover, or an equivalent arrangement to view a marking, complies with the requirement of this paragraph.

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

81.5 Additional marking requirements are specified by 10.6.4.

81.6 Detector guard shall be permanently marked with the following information in a contrasting color, finish, or equivalent:

a) Name or identifying symbol of the manufacturer or private labeler,

b) Model number, and

c) A statement indicating that the guard is only to be used with detectors specified in the manufacturer's published instructions of the guard, or detector.

Unless the letter height is specified all markings shall be at least 1.2 mm (3/64 inch) high.

82 Packaging marking (United States Only)

82.1 The smallest point-of-sale carton in which a smoke detector employing a radionuclide is packaged shall be permanently marked on the exterior with the following information. Each letter shall be at least 1.2

mm (3/64 inch) high and shall be in a contrasting color or finish with respect to the background, or the equivalent:

a) Name of radionuclide and quantity (no abbreviations).

b) The statement, "U.S. NRC License No. XXX " (XXX – No. of License) or the name of the Licensee.

c) The following or equivalent statement:

"THIS DETECTOR CONTAINS RADIOACTIVE MATERIAL AND HAS BEEN MANUFACTURED IN COMPLIANCE WITH U.S. NRC SAFETY CRITERIA IN 10 CFR 32.27. THE PURCHASER IS EXEMPT FROM ANY REGULATORY REQUIREMENT."

INSTRUCTIONS

83 Installation Instructions – Wiring Diagram

83.1 All detectors

83.1.1 Installation instructions (part of the *manufacturer's published instructions*), including an installation wiring diagram, shall be packaged with each detector (head with integral base) illustrating the field connections to be made. For detectors that consist of separable heads and bases, the instructions and diagram shall be packaged with the base. It is permissible for the instructions to be attached to the detector (head with integral base) or separable base. When not attached, the instructions shall be referenced in the detector (head with integral base) or base marking. Where devices are packaged in bulk (multiple devices in one single package) and not intended for individual resale, a minimum of one set installation instructions and drawings shall be provided.

83.1.2 The installation wiring diagram shall show a pictorial view of the installation terminals or leads to which field connections shall be made as specified in (a) – (c):

a) Monitored connections (identified incoming and outgoing leads) to the initiating device circuit of a control unit and power supply circuit. See Figure 37 for examples.

b) The terminal numbers or position (if distinctive) on the detector (head with integral base) or separable base shall agree with the numbers or position on the drawing.

c) When duplicate terminals are not provided to facilitate monitoring of the installation wiring connections, and there is no provision to prevent looping an unbroken wire around or under a terminal, the word "CAUTION" "«MISE EN GARDE» and the following or equivalent text in letters not less than 2.38 mm (3/32 inch) high shall be included on the installation drawing: "FOR SYSTEM MONITORING – FOR TERMINALS ___ AND ___, DO NOT USE LOOPED WIRE UNDER TERMINALS. BREAK WIRE RUN TO PROVIDE MONITORING OF CONNECTIONS." The blanks shall contain the applicable terminal identification.

d) For a detector intended only for releasing device service, a typical connection shall be shown.

e) Initiating Device Circuit – For open area detectors intended to be connected only to the initiating device circuit of a fire alarm system control unit, at least two detectors shall be shown connected to a typical initiating device circuit.

Note: In Canada, there are two official languages, French and English. Attention is drawn to the fact that some Canadian authorities may require markings to be in both official languages. Annex G lists acceptable French translations of the markings specified in this standard.

83.1.3 Instructions (diagram) not attached to the detector (head with integral base) or separable base shall be marked with the name or identifying symbol of the manufacturer or private labeler, detector or separable base model number, issue number and/or date, or equivalent.

83.1.4 Installation instructions for a separable base shall include reference to all detector heads with which it is employed by name of manufacturer and model number, or equivalent and/or include a note to reference the installation instructions for the compatible detector heads.

83.1.5 When a technical bulletin or engineering drawing is separate from the installation instructions, the instructions shall reference where to obtain the latest copy of the technical bulletin.

83.1.6 When other technical literature is required for installation or determination of compatibility between equipment, the instructions shall reference and identify the technical literature and its source. A copy of such literature shall be provided for review.

83.1.7 The instructions shall include the following statement: "Smoke detectors are not to be used with detector guards unless the combination has been evaluated and found suitable for that purpose."

83.1.8 The instructions for projected beam type smoke detectors shall include an indication that the light beam path of the units shall be kept free of blockage.

83.2 Four-wire detectors

83.2.1 The marking information specified in (a) and (b) shall appear on the installation wiring diagram for the applicable circuit to which field connections are made:

a) Supply Circuit – Voltage, current or watts, and frequency.

b) Supplementary Circuits – Voltage, current or watts.

83.2.2 Units rated in minimum and maximum voltage (or current) limits shall be marked with those ratings.

83.3 Two-wire detectors

83.3.1 The instructions for two-wire detectors shall either include or provide reference to other identifiable literature and its source that contains the following information:

a) Name of manufacturer, model number(s) of compatible control unit(s), and compatibility identification marker.

b) Name or model number of any plug-in zone module, zone card, or zone panel, when more than one is available.

c) Identification of any other part of the control unit, such as specific wiring terminal numbers, or reference to the control unit installation wiring diagram by issue number and date, or any other variables requiring programming which are a factor in determining compatibility.

d) The maximum number of detectors that are intended to be connected to each initiating device circuit of the control unit. This includes any detectors that employ an integral component, such as a relay or sounder, that consumes power during an alarm condition.

e) Minimum and maximum rated operating voltage.

f) Maximum rated normal standby current.

g) Minimum and maximum rated alarm current and impedance.

h) Minimum current and voltage required for intended operation of integral components, such as a relay or sounder.

83.4 Manufacturer's Published Instructions – RF Equipment

83.4.1 The manufacturer's published instructions shall include at least the following:

a) All information applicable to the interconnected equipment, such as a household (residential) control unit for fire, burglar alarm, health care, and the like;

b) Specific and detailed installation limitations for RF equipment, such as building construction, specification of procedures, installation aids, and test equipment (by manufacturer and model number or the equivalent) needed to install the system as intended, special receiver-to-transmitter orientations, and metallic bodies that are not visible on the outside;

c) The maximum separation (range) of the equipment, including indication that the manufacturer's specified range is for comparative purposes only and is not applicable when the equipment is installed in a typical home; and

d) Instructions to test the system for operation upon completion of installation.

83.5 Special Applications

83.5.1 Installation instructions for *special application* detectors shall include the following information relating to operating the detector in *special application* mode/configuration:

a) The statement: "Detectors [*Sampling ports*] set to the *special application* sensitivity are not suitable for use in areas where cooking appliances may be used. If cooking appliances are used within the protected space, a normal application detector or normal application mode or configuration must be used for that area."

b) A warning to users that the *special application* mode of operation is not for general use and may be more prone to false alarms if used in unsuitable environments.

c) A list of examples of suitable and unsuitable environments for the detector, consistent with the requirements in item (a).

d) A description of potential nuisance alarm sources.

e) A description of the method to configure the detector's *special application* sensitivity.

84 Technical bulletin

84.1 A technical bulletin, to be used as a reference by the installer, shall be available from the manufacturer Refer also to Section 83.1.5 and 83.1.6. The bulletin shall include the manufacturer's recommendations regarding typical detector locations. The information shall include guidelines on detector location, spacings, maintenance, servicing, tests, under various environmental conditions and physical configurations. Some conditions for which guidelines are required shall be: temperature; humidity; corrosive atmospheres; air movement (ventilating and air-conditioning systems); high ceilings; sloped ceilings; girder ceiling construction; small and large bays; open joist construction; high stock piling; and conditions produced by manufacturing processes. The information shall be in accordance with NFPA 72 and/or CAN/ULC-S524 depending on country of installation.

84.2 Information regarding locations where detectors are not to be installed shall also be provided to minimize the possibility of false alarms.

84.3 Detailed information shall be provided regarding the use of the *smoke sensitivity* level or test means provided on the detector. Typical information that shall be provided (when applicable) includes:

a) Nominal reading or setting under clear condition,

b) Nominal reading when close to alarm,

c) Nominal reading at alarm condition, and

d) Guidelines on instrument use and maintenance requirements as per *manufacturer's published instructions*.

84.4 Reference to the Bulletin number and date is required, either on the detector nameplate marking or on the installation drawing. When the installation drawing is included as part of the Technical Bulletin, reference to the Bulletin is to be indicated on the detector.

84.5 The Technical Bulletin, carton, or literature shipped with the detector shall not include manufacturer's claims on the operation of the detector that have not been substantiated by the performance tests included in Sections 29 – 74, or that are not covered:

a) In the United States, the ANSI/NFPA No. 72, National Fire Alarm and Signaling Code or other applicable Standards of the National Fire Protection Association;

b) In Canada, CAN/ULC-S524, Installation of Fire Alarm Systems, CAN/ULC-S536, Inspection and Testing of Fire Alarm Systems; and CAN/ULC-S537, Verification of Fire Alarm Systems

84.6 The Technical Bulletin for *multi-criteria smoke detectors* shall describe the method of *smoke detector sensitivity* level supervision.

Tables

Table 1
Cast metal enclosures

Use or dimensions of area involved	Minimum thickness			
	Die-cast metal,		Cast metal of other than the die-cast type,	
	mm	(inch)	mm	(inch)
Area of 155 cm^2 (24 square inches) or less and having no dimension greater than 152 mm (6 inches)	1.6	(1/16[a])	3.2	(1/8)
Area greater than 155 cm^2 (24 square inches) or having any dimension greater than 152 mm (6 inches)	2.4	(3/32)	3.2	(1/8)
At a threaded conduit hole	6.4	(1/4)	6.4	(1/4)
At an unthreaded conduit hole	3.2	(1/8)	3.2	(1/8)

[a] The area limitation for metal 1.6 mm (1/16 inch) thick is obtained by the provision of reinforcing ribs subdividing a larger area.

Table 2
Sheet metal enclosures

In the United States												
Maximum dimensions of enclosure				Minimum thickness of sheet metal								
Length or width,		Area,		Steel, zinc-coated,			Steel, uncoated,			Brass or aluminum,		
mm	(inches)	cm^2	$(inches)^2$	mm	(inch)	GSG	mm	(inch)	GSG	mm	(inch)	AWG
305	(12)	581	(90)	0.86	(0.034)	20	0.81	(0.032)	20	1.14	(0.045)	16
610	(24)	2322	(360)	1.14	(0.045)	18	1.07	(0.042)	18	1.47	(0.058)	14
1219	(48)	7742	(1200)	1.42	(0.056)	16	1.35	(0.053)	16	1.91	(0.075)	12
1524	(60)	9678	(1500)	1.78	(0.070)	14	1.70	(0.067)	14	2.41	(0.095)	10
1524	(Over Over 60)	9678	(Over 1500)	2.46	(0.097)	12	2.36	(0.093)	12	3.10	(0.122)	8

In Canada					
Maximum enclosure dimensions		Minimum thickness of sheet metal			
		Steel		Aluminum	Brass
Length or width (mm)	Area of any surface (cm^2)	Zinc-coated (mm)	Uncoated (mm)	(mm)	(mm)
305	580	1.0	1.0	1.2	1.2
610	2320	1.2	1.2	1.6	1.6
1220	7740	1.6	1.6	2.0	2.5
1524	9670	2.0	2.0	2.5	2.5
Over 1524	Over 9670	2.8	2.8	3.5	3.5

Table 3
Thickness of glass covers

Maximum size of opening				Minimum thickness,	
Length or width,		Area,			
mm	(inches)	cm^2	$(inches^2)$	mm	(inch)
102	(4)	103	(16)	1.6	(1/16)
305	(12)	929	(144)	3.2	(1/8)
Over 305	(Over 12)	Over 929	(Over 144)	see footnote a	see footnote a

[a] 3.2 mm (1/8 inch) or more, based upon the size, shape, and mounting of the glass panel. A glass panel for an opening having an area greater than 929 cm^2 (144 square inches), or having any dimension greater than 305 mm (12 inches), shall be supported by a continuous groove not less than 4.8 mm (3/16 inch) deep along all four edges of the panel.

Table 4
Thickness of flat sheets of insulating material

Maximum dimensions				Minimum thickness,[a]	
Length or width,		Area,			
mm	(inches)	cm^2	$(inches^2)$	mm	(inch)
152	(6)	232.4	(36)	1.6	(1/16)
305	(12)	928.8	(144)	3.2	(1/8)
610	(24)	2322	(360)	9.5	(3/8)
1219	(48)	7432	(1152)	12.7	(1/2)

Table 4 Continued on Next Page

Table 4 Continued

Maximum dimensions				Minimum thickness,[a]	
Length or width,		Area,			
mm	(inches)	cm^2	($inches^2$)	mm	(inch)
1219	(48)	11148	(1728)	15.9	(5/8)
Over 1219	(Over 48)	Over 11148	(Over 1728)	19.1	(3/4)

[a] Material less than the minimum thickness shown shall be used for a panel only when the panel is supported or reinforced to provide equivalent rigidity.

Table 5
Minimum spacings

Point of application	Voltage range[f]	Minimum spacings[a, b]			
		Through air,		Over surface,	
		mm	(inch)	mm	(inch)
To walls of enclosure					
Cast metal enclosures	0 – 300	6.4	(1/4)	6.4	(1/4)
Sheet metal enclosures	0 – 300	12.7	(1/2)	12.7	(1/2)
Installation wiring terminals					
With barriers	0 – 30	3.2	(1/8)	4.8	(3/16)
	31 – 150	3.2	(1/8)	6.4	(1/4)
	151 – 300	6.4	(1/4)	9.5	(3/8)
Without barriers	0 – 30	4.8	(3/16)	4.8	(3/16)
	31 – 150	6.4	(1/4)	6.4	(1/4)
	151 – 300	6.4	(1/4)	9.5	(3/8)
Rigidly clamped assemblies[c]					
100 volt-amperes maximum[d, e]	0 – 30	0.8	(1/32)	0.8	(1/32)
Over 100 volt-amperes[e]	0 – 30	1.2	(3/64)	1.2	(3/64)
	31 – 150	1.6	(1/16)	1.6	(1/16)
	151 – 300	2.4	(3/32)	2.4	(3/32)
Other parts	0 – 30	1.6	(1/16)	3.2	(1/8)
	31 – 150	3.2	(1/8)	6.4	(1/4)
	151 – 300	6.4	(1/4)	9.5	(3/8)

[a] An insulating liner or barrier of vulcanized fiber, varnished cloth, mica, phenolic composition, or similar material employed where spacings are otherwise insufficient shall not be less than 0.71 mm (0.028 inch) thick. When a liner or barrier is used which is less than 0.71 mm (0.028 inch), and not less than 0.33 mm (0.013 inch) thick, it shall be used in conjunction with an air spacing of not less than one-half of the through air spacing required. The liner shall be located so that it is not affected adversely by arcing. When insulating material having a thickness of less than that specified is used, it shall be found to be appropriate for the particular application.

[b] Measurements shall be made with solid wire of an ampacity that is intended for the applied load connected to each terminal. In no case is the wire to be smaller than 16 AWG (1.3 mm^2) in the United States, or 18 AWG (0.82 mm^2) in Canada.

[c] Rigidly clamped assemblies include such parts as contact springs on relays or cam switches and printed wiring boards.

[d] Spacings less than those indicated, and not less than 0.4 mm (1/64 inch), are permissible for the connection of integrated circuits and similar components where the spacing between adjacent connecting wires on the component is less than 0.8 mm (1/32 inch).

[e] When spacings between traces on a printed wiring board are less than the minimum specified the boards shall be covered with a *conformal coating*, and the combination shall be evaluated to the requirements in Conformal Coatings of Printed Wiring Boards, Section 73.

[f] RMS volts for sinusoidal waveform. The equivalent peak voltage should be used for non-sinusoidal waveforms.

Table 6 (Canada Only)
Minimum over surface spacings on printed wiring boards (see Table 5, footnote e)

Table deleted

Table 7
Test voltages

Nameplate voltage rating[a]	Test voltage[b]
110 to 120	120
220 to 240	240
Other	Marked nameplate rating

[a] The voltage rating shall be applied at the voltage waveform(s) specified in the markings. See 81.1(f).

[b] Detectors rated at frequencies other than 60 hertz shall be tested at their rated nameplate voltage and frequency.

Table 8
Detector tests and analysis

Test title	Applicable test (paragraphs, sections, subsection)	Single criteria	Multi-criteria / combination
Test units	28.1.1 – 28.1.2	X	X
Remote accessories	28.2		
Performance of single Sensor components of multi-criteria detector	28.3		X
Test voltages, Test samples and data Component reliability data Smoke Detector guards Test conditions Tests and analysis	28.4 – 28.9	X	X
Normal operation – General	29.1.1 – 29.1.3, 29.1.6 – 29.1.9	X	X
Normal operation – General	29.1.4 – 29.1.5		X
Standardized *alarm signal*, Sensitivity shift criteria	29.2 – 29.3	X	X
Electrical supervision – General, Component Failure, Photocell illuminating lamps and light emitting diodes (LEDs), Battery powered units, Smoke chamber monitoring End of life signal	30.1 – 30.6	X	X
Multi-criteria smoke detector with gas sensor	30.7		X
Sensitivity – General	31.1.1.1	X	
Sensitivity – General	31.1.1.2	X	X
Combustibles	31.1.2	X	X

Table 8 Continued on Next Page

Table 8 Continued

Test title	Applicable test (paragraphs, sections, subsection)	Single criteria	Multi-criteria / combination
Aerosol generation equipment (alternate method)	31.1.3	X	X
Test Equipment,	31.1.4	X	X
Test Method,	31.1.5	X	X
Uniformity of operation,	31.1.6	X	X
Smoke sensitivity test feature	31.1.7	X	X
Sensitivity test – gas sensor of a multi-criteria detector	31.2		X
Sensitivity test – heat sensor	31.3		X
Sensitivity test – sensors other than smoke, gas or heat	31.4		X
Automatic *drift compensation* for smoke sensing	32	X	X
Directionality Test	33	X	X
Smoke sensor	34.1	X	X
Multi-criteria detector with gas sensor	34.2	X	X
Smoke Entry (Stack Effect) Test	35	X	X
Lamp Interchangeability Test (Photoelectric)	36	X	X
Reduction in Light Output Test	37	X	X
Stability Test	38.1 – 38.8	X	X
Stability tests – multi-criteria detectors incorporating gas sensor(s)	39		X
Test for Effect of Air Velocity	40	X	X
Fire Tests	41	X	X
Smoldering Smoke Test	42	X	X
Selectivity Test – multi criteria smoke detectors incorporating gas sensors	44		X
Circuit Measure Tests	45	X	X
Overvoltage and Undervoltage Tests	46	X	X
Temperature Test	47	X	X
Vibration Test	48	X	X
Replacement Test, Head and Covers	49	X	X
Jarring Test	50	X	X
Operation in high and low ambients and Effect of shipping and storage	51.1 and 51.2	X	X
Effect of shipping and storage – Multi-criteria Detectors Incorporating Gas Sensor(s)	51.3		X
High Humidity, Humidity test	52.1	X	X
Low humidity [multi-criteria with gas sensor(s)]	52.2		X
Corrosion Tests Alternate Corrosion Test (21 day)	53, 54	X	X

Table 8 Continued on Next Page

Table 8 Continued

Test title	Applicable test (paragraphs, sections, subsection)	Single criteria	Multi-criteria / combination
Transient Tests	55	X	X
Static Discharge Test	56	X	X
Dust Test	57	X	X
Overload Test	58	X	X
Endurance Test	59	X	X
Audible Signaling Appliance	60		
Fire Test – Smoke Detector with Supplementary Heat Detection	61	X	
Abnormal Operation Test	62	X	X
Locked Rotor Test	63	X	X
Dielectric Voltage-Withstand Test	64	X	X
Polarity Reversal Test	65	X	X
Tests on Polymeric Materials	66	X	X
Strain Relief Test	67	X	X
Non-compulsory Fire and Smoldering Smoke Tests (United States only)	68	X	X
Survivability Test	69	X	X
Audibility Test	70	X	X
Field Service Test	71	X	X
Battery Tests	72	X	X
Conformal Coatings on Printed Wiring Boards	73	X	X
Air Duct Detectors (Canada only)	74	X	X

Table 9
Visible smoke obscuration limits (gray smoke/aerosol)

Percent per meter	Percent per foot	OD per meter	OD per foot
1.6	0.5	0.0072	0.0022
Note: Refer to Annex C for the calculation of obscuration and optical density			

Table 10
Measuring Ionization Chamber (MIC) measurement

United States	Canada
93 pA (maximum)	Smoke Density* (Relative Measuring Ionization Chamber Units[a]): 0.12 (maximum)
*NOTE: Smoke Density X is derived as follows: $X = (Io - I) / Io$ *Where:* Io is the quiescent chamber current in clean air in pA, and I is the reduced chamber current when smoke is present in pA. [a] See Annex A, Section A4 Refer to Annex C for the calculation of obscuration and optical density	