CANADIAN STANDARDS ASSOCIATION

C22.2 No. 187-09
(reaffirmed 2014)

Electrostatic air cleaners

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CANADIAN STANDARDS ASSOCIATION

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Note: *For information about the **Standards Update Service**, go to **shop.csa.ca** or e-mail **techsupport@csagroup.org**.*

Title: *Electrostatic air cleaners* — originally published March 2009

The following revisions have been formally approved and are marked by the symbol delta (Δ) in the margin on the attached replacement pages:

Revised	Clauses 2, 7.2.1, 7.4.2.4, 7.5, 7.5.1–7.5.3, 7.5.5, and 7.5.7
New	Clauses 1.1A, 7.2.1A, and 7.5.8 and Annexes A and B
Deleted	None

- Update your copy by inserting these revised pages.
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C22.2 No. 187-09
Electrostatic air cleaners

1 Scope

1.1
This Standard applies to
(a) electrostatic air cleaners intended to remove dust and dirt from the air and intended for general indoor residential and commercial use;
(b) air ionizer type air cleaners; and
(c) other similar ionizing equipment.

Δ **1.1A**
This Standard also applies to equipment for commercial use that intentionally produces ozone in temporarily unoccupied spaces incorporating an integral ozone detector.

1.2
This Standard does not apply to electrostatic air cleaners for use in hazardous locations or in atmospheres defined as hazardous by the *Canadian Electrical Code, Part I*.

1.3
This Standard does not apply to air cleaners designed to remove particles other than dust and dirt normally found in heating and ventilating systems.

1.4
The requirements of this Standard apply to cord-connected and permanently connected equipment operating at nominal supply voltages up to 600 V, single phase or polyphase, in accordance with the Rules of the *Canadian Electrical Code, Part I*.

1.5
This Standard does not specify requirements for the effectiveness of air cleaners with respect to the removal of airborne particles.

1.6
This Standard does not apply to electrostatic air cleaners intended for industrial use.

1.7
Air cleaners for household use that are designed to generate ozone intentionally are outside the scope of this Standard.

1.8
Ozone generators designed exclusively to be connected to air duct systems are outside the scope of this standard because the test procedures do not address this type of application.

1.9
In CSA Standards, "shall" is used to express a requirement, i.e., a provision that the user is obliged to satisfy in order to comply with the standard; "should" is used to express a recommendation or that which is advised but not required; "may" is used to express an option or that which is permissible within the limits of the standard; and "can" is used to express possibility or capability. Notes accompanying clauses

do not include requirements or alternative requirements; the purpose of a note accompanying a clause is to separate from the text explanatory or informative material. Notes to tables and figures are considered part of the table or figure and may be written as requirements. Annexes are designated normative (mandatory) or informative (non-mandatory) to define their application.

2 Reference publications

This Standard refers to the following publications, and where such reference is made, it shall be to the edition listed below, including all amendments published thereto.

CSA (Canadian Standards Association)

C22.1-09
Canadian Electrical Code, Part I

CAN/CSA-C22.2 No. 0-M91 (R2006)
General Requirements — Canadian Electrical Code, Part II

CAN/CSA-C22.2 No. 0.4-04
Bonding of electrical equipment

C22.2 No. 0.5-1982 (R2008)
Threaded conduit entries

C22.2 No. 0.8-M1986 (R2008)
Safety functions incorporating electronic technology

C22.2 No. 0.15-01 (R2006)
Adhesive labels

CAN/CSA-C22.2 No. 0.17-00 (R2004)
Evaluation of properties of polymeric materials

C22.2 No. 8-M1986 (R2004)
Electromagnetic interference (EMI) filters

CAN/CSA-C22.2 No. 18.1-04
Metallic outlet boxes

C22.2 No. 18.2-06
Nonmetallic outlet boxes

CAN/CSA-C22.2 No. 18.3-0
Conduit, tubing, and cable fittings

CAN/CSA-C22.2 No. 18.4-04
Hardware for the support of conduit, tubing, and cable

C22.2 No. 24-93 (R2008)
Temperature-indicating and -regulating equipment

C22.2 No. 66.1-06
Low voltage transformers — Part 1: General requirements

C22.2 No. 66.3-06
Low voltage transformers — Part 3: Class 2 and Class 3 transformers

C22.2 No. 77-95 (R2004)
Motors with inherent overheating protection

C22.2 No. 100-04
Motors and generators

C22.2 No. 127-99 (R2004)
Equipment and lead wires

Δ CAN/CSA-C22.2 No. 177-92 (R2012)
Clock-operated switches

Δ CAN/CSA-E730-2-7-94 (R2013)
Automatic electrical controls for household and similar use — Part 2: Particular requirements for timers and time switches

ASME (The American Society of Mechanical Engineers)
B18.6.3-2003 (R2008)
Machine Screws and Machine Screw Nuts

Δ **Health Canada**
Health Canada Guideline 2010
Residential Indoor Air Quality Guideline: Ozone

3 Definitions

The following definitions apply in this Standard:

Accessible part — a part located such that it can be contacted by a person either directly or using the probe specified in Figure 1, or a part that is not recessed the required distance behind an opening.

Air ionizer — an appliance that uses high voltage to ionize air molecules to remove dirt and dust from the air.

Commercial use — use of a product in a location other than a residential occupancy, where the same person does not occupy the space on a continual basis.
Note: *A factory is an example of a commercial occupancy.*

Duct-type air cleaner — an air cleaner intended for permanent installation in and at adjoining ducts of heating, air-conditioning, or ventilation systems.

Electrostatic air cleaner — an appliance intended to remove dust and dirt from the air.
Note: *A complete electrostatic air cleaner can consist of a high-voltage power supply, controls, an ionizer-collector cell, and other components.*

Exposed (as applied to non-current-carrying conductive parts) — the quality of parts that can be touched by the user in the normal use or adjustment of equipment, including those parts that can be touched accidentally.

Industrial establishment — a building or part of a building (other than office or exhibit space), or part of a premises outside a building, where persons are employed in manufacturing processes or in the handling of material, as distinguished from dwellings, offices, and similar occupancies.

Ionizer-collector cell — the component of an electrostatic air cleaner that is energized by the power supply and through which the air to be cleaned is passed.

Live part — a part that carries a current greater than 0.5 mA at a voltage exceeding 30 V rms or 42.4 V dc.

Occupied space — an area used or intended to be used by one or more persons on a full-time or part-time basis.

Ozone-level control system — a system designed to control the concentration of ozone generated by a product.

Ozone treatment technician — a person that has been trained to treat a temporarily unoccupied space with an ozone treatment unit.

Power supply — a unit consisting of a high-voltage transformer or other high-voltage generating circuitry and other electrical components.
Note: *The power supply can contain controls for the air cleaner.*

Residential use — use of a product in a residential occupancy.
Note: *Residential occupancies include homes, apartments, mobile homes, and boats.*

Voltage —

Extra-low voltage — a voltage less than or equal to 30 V rms.*

Low voltage — a voltage greater than 30 and less than or equal to 750 V rms*.

High voltage — a voltage greater than 750 V rms.*
**Unless otherwise specified, all voltages specified in this Standard are in rms values.*

4 General requirements

General requirements applicable to this Standard are given in CAN/CSA-C22.2 No. 0.

5 Construction

5.1 General

5.1.1

Electric components shall conform to the CSA C22.2 Standard covering such components, as applicable, and shall be suitable for the application.

5.1.2

Electrical components shall have enclosures of noncombustible absorption-resistant material that enclose all live parts except supply cords. Nonmetallic enclosures shall comply with the requirements of Clause 5.2.5.

5.1.3

Except as specified in Clause 5.1.4 and 5.1.5, the air-inlet and air-outlet openings of a duct-type air cleaner may be considered to be enclosed by the adjacent ductwork.

5.1.4

Line-voltage live parts shall not be considered to be enclosed by ductwork.

5.1.5

The air-inlet or air-outlet openings of a ceiling or wall-mounted duct-type air cleaner shall not be considered to be enclosed by ductwork.

5.1.6

Devices involving electronic control circuits shall be subject to investigation for safety and reliability.

5.1.7

An electronic or solid-state circuit in a limiting or other safety function shall comply with applicable tests and evaluation methods specified in CSA C22.2 No. 0.8.

6.8.8
The tests shall be conducted with Switch S2 (in Figure 2) in position A, and then repeated with Switch S2 in position B.

6.8.9
The probe shown in Figure 1 shall be metal. The probe shall be applied to any exterior metal part.

6.8.10
In the measurement of leakage current, for air cleaners having insulating material for the enclosure or a part of the enclosure, a test probe shall be in contact with metal foil measuring 10 × 20 cm, which shall be in contact with accessible areas of the insulating material. The foil shall not remain in place long enough to affect normal operation, drainage, and ventilation.

6.9 Strain relief
Strain relief shall be provided for power-supply cords and shall prevent transmission of strain to interior wiring, splices, and terminals when
(a) a steady force of 160 N is applied in any direction for 1 min;
(b) a torque of 0.25 N•m is applied in either direction for 1 min between the cord and the enclosure; and
(c) the cord is pushed in, in which case it shall be prevented from
    (i) contacting sharp edges, points, and moving parts; or
    (ii) being exposed to temperatures above the temperature rating of the cord insulation.

6.10 High-voltage insulating materials

6.10.1
Insulating materials other than glazed porcelain, glass, mica, or another material rated 0.17 V1 or better that come in contact with high-voltage live parts shall be subjected to the following test:
(a) A pair of tungsten electrodes, having a diameter of 2 mm and a minimum length of 30 mm and provided with a symmetrical conical point at one end, shall be mounted in a vertical plane at an angle of 45° to the surface of the insulating material to be evaluated in such a way that, during the test, the energized electrodes can be separated manually in a horizontal direction without changing the electrode angle.
(b) The high-voltage circuit in which the insulating material is to be used shall be connected to the electrodes and an arc shall be established.
(c) With the sample in place, the electrodes shall be manually separated slowly until the arc is extinguished. At this time, the space between the electrodes shall be reduced incrementally and the arc re-established.
(d) There shall be no ignition of the insulating material between the point of maximum arc length and the point where the electrodes touch each other.
(e) The test shall be continued with the arc operating continuously for 4 h.

6.10.2
Ignition shall be considered to have occurred if the material continues to burn or smoulder for more than 10 s after the arc is removed.

6.11 Strength of enclosures and grills
To determine whether the strength of enclosures or grills is adequate, a force of 50 N shall be applied to the surface. The spacings from uninsulated live parts to the enclosure or grill while the force is being applied shall be not less than those specified in Clause 5.15.

6.12 Access to moving parts

6.12.1
The probe illustrated in Figure 1 shall be applied to the guard at any angle, with an axial force of
(a) 14 N for openings in all fan guards, except as specified in Item (b); and
(b) 28 N for the openings in fan guards for other than household applications (i.e., commercial or industrial, and fans mounted on a pedestal whose overall height at the maximum extension exceeds 1.2 m above the supporting surface).

6.12.2
When applied as specified in Clause 6.12.1, the probe shall not make contact with moving parts.

6.13 Flame test for nonmetallic enclosures of live parts

6.13.1
Flame tests shall be conducted in accordance with CAN/CSA-C22.2 No. 0.17, Test B (flame test for combustion-resistant materials) except that no cotton shall be required for the tests.

6.13.2
Material shall be considered to comply with the requirements of Clause 5.2.5 when
(a) none of the specimens tested continues to burn for more than
  (i) 30 s after any of the first four applications of flame; or
  (ii) 1 min after the fifth application of the test flame; and
(b) after the fifth application of the test flame, there are no holes or other damage in any of the test specimens that prevents compliance with Clause 5.2.6.

6.14 Moisture-absorption test
The material shall be dried at a temperature of 105 ± 5 °C for 1 h before testing. The material shall then be weighed and immersed in water at 23 ± 5 °C for 24 h. The material shall not absorb more than 5% of the water by weight.

7 Ozone

7.1 General
Clause 7 applies to air cleaners and ionizers that have features designed to generate ozone for the stated purpose of air purification, that generate ozone as a by-product, or that have another stated similar purpose. Such products might or might not have a manual ozone-level control.

7.2 Requirements

Δ **7.2.1**
Products specified in Clause 7.1 shall not exceed an ozone concentration of 0.050 ppmv (parts per million by volume) at any time, when tested in accordance with the procedure specified in Clause 7.4.2.4(b).

Δ **7.2.1A**
The highest ozone level as measured in Clause 7.4.2.4(c) shall be posted on a label, both on the unit and the outer packaging. The 8-hour TWA (time-weighted average) ozone for this product shall be XX ppm when tested in a 30 m^3 chamber. Refer to safety instructions in manual for more information. The following shall be included in the manual under safety instructions:

> "This product complies with the maximum allowable concentration of ozone of 0.050 parts per million by volume (ppmv) in a 24-hour period. The Health Canada Guideline 2010

(ISBN 978-1-100-16288-1) recommends that the maximum exposure limit, based on an average time of 8 hours, is 0.020 ppmv or less when tested in a sealed, controlled room approximately 30 m^3."

Note: *"XX" is the highest calculated time-weighted average from Clause 7.4.2.4(c).*

7.2.2

The test procedures in Clause 7.4 are not applicable to products designed exclusively to be connected to air duct systems.

7.2.3

The ozone-level control system used to limit the concentration of ozone to that specified in Clause 7.2.1 shall be tested in accordance with Clause 7.4.3 for a minimum of 100 000 cycles of operation.

7.3 Markings

In addition to the marking requirements of Clause 8, the following shall be marked in a permanent and visible manner on air cleaners intended for commercial use and having ozone-generating features:

(a) CAUTION: HIGH LEVELS OF OZONE MAY BE INJURIOUS TO HEALTH. USE AS DIRECTED IN WELL-VENTILATED LOCATIONS*
**The equivalent French wording is ATTENTION : DES NIVEAUX ÉLEVÉS D'OZONE PEUVENT ÊTRE NOCIFS. RESPECTER LES CONSIGNES ET UTILISER DANS UN ENDROIT BIEN VENTILÉ.*

(b) FOR COMMERCIAL USE ONLY. NOT FOR RESIDENTIAL USE*
**The equivalent French wording is POUR USAGE COMMERCIAL UNIQUEMENT. NE CONVIENT PAS POUR USAGE DOMESTIQUE.*

(c) CERTIFIED FOR SHOCK AND ELECTRICAL FIRE HAZARD ONLY*
**The equivalent French wording is CERTIFIÉ UNIQUEMENT DU POINT DE VUE DE LA PROTECTION CONTRE LES CHOCS ET LES INCENDIES D'ORIGINE ÉLECTRIQUE.*

7.4 Tests

7.4.1 General

The product shall be operated in accordance with the operating manual supplied with the product.

7.4.2 Normal conditions

7.4.2.1

If the product is provided with an ozone-level control, the control shall be turned to a position that causes the equipment to produce the maximum ozone level. The fan shall be turned to its lowest speed. Other ozone-generating features provided with the electrostatic air-cleaning device shall be turned on.

7.4.2.2

The test shall be conducted in a room

(a) with a volume of 26.9 to 31.1 m^3;
(b) with a minimum side dimension of 2.5 m × 3.0 m;
(c) with a maximum height of 3.0 m; and
(d) without openings.

The test room walls shall be covered with a sheet of polyethylene to make the chamber substantially airtight.

7.4.2.3

During the test, the test room shall be maintained at a temperature of 23 ± 5 °C and relative humidity of 50 ± 5%. Prior to the start of testing, the ozone background level shall be measured with the product under test in the OFF position.

Δ **7.4.2.4**

The product shall be located in the centre of the test room floor, approximately 750 mm above the floor. The ozone monitor sampling tube shall be located 50 mm from the air outlet of the product, centred in the air stream, and pointed directly at the product. The removable filter shall be removed if the removal creates a more unfavourable condition.

The ozone measurements shall be conducted as follows:

(a) The emission of ozone shall be monitored for 24 h. The background level specified in Clause 7.4.2.3 shall be subtracted from the maximum measurement during the test.
(b) The ozone level shall not exceed the level specified in Clause 7.2.1.
(c) The 8-hour time-weighted average shall be calculated as follows:
    (i) 0–8 h;
    (ii) 8–16 h; and
    (iii) 16–24 h.
(d) The time-weighted average (TWA) shall be calculated using the following formula:

$$TWA = (C1T1 + C2T2 + C3T3 + \ldots + CnTn)/(8 \text{ hours})$$

where
C = concentration over the sampling period, ppmv
T = sampling period, hours
n = number of samples

Note: *See Annex A for a sample calculation.*

(e) The maximum time-weighted average shall be marked on the label described in Clause 7.2.1A.

7.4.2.5

If the product incorporates an ozone-level control system, the ozone level shall also be measured as close as possible to the sensor of the ozone-level control system. The ozone-sensing system shall be set to low, medium, and maximum positions, and measurements shall be taken at each position.

7.4.3 Endurance test

The dial of the ozone-level control system shall be set at the maximum position, and the unit shall be subjected to 100 000 cycles of operation by alternatively subjecting the unit to

(a) an ozone-rich atmosphere of the same concentration as measured in Clause 7.4.2.5, which turns the sensor ON; and
(b) an atmosphere with a low ozone level, which turns the sensor OFF.

At the completion of the test, the ozone generator shall be subjected to the test of Clause 7.4.2, and the concentration of ozone produced shall not exceed the concentration prior to that test by more than 25%.

Note: *The test may be performed on*

(a) the entire air cleaner; or
(b) the ozone control system removed from the air cleaner, tested as a component, and reinstalled in the unit.

7.4.4 Additional requirements

7.4.4.1

If the product is provided with an electronic ozone-sensing device, the sensing device shall meet the requirements of CSA C22.2 No. 0.8.

7.4.4.2

To demonstrate compliance with Clause 7.4.4.1, the unit under test shall

(a) stop generating ozone; or
(b) generate an ozone level less than 0.05 ppm.

Δ 7.5 Commercial ozone generators designed exclusively for use in temporarily unoccupied spaces

Δ 7.5.1
Clause 7.5 applies to ozone generators covered under the scope of Clause 7.1 that are intended for commercial use and designed exclusively for use in temporarily unoccupied spaces.

Δ 7.5.2
Commercial-use ozone generators as described in Clause 7.5.1 shall
(a) incorporate integral ozone sensing and detecting equipment;
(b) incorporate a timing device;
(c) be exclusively intended for use by trained technicians in accordance with the manufacturer's instructions in temporarily unoccupied spaces; and
(d) be provided with markings in accordance with Clause 7.5.4.

The tests specified in Clause 7.4 shall not apply to such ozone generators.

Δ 7.5.3
The instruction manual shall include, among other items, the following information to train technicians under the title, "Important Safety Instructions":
(a) the physiological effects of ozone on the human body;
(b) how to seal off the area in order to ensure that ozone does not migrate out of the area being treated;
(c) how to secure the area being treated with ozone to ensure that persons are impeded from entering the area and see the warning signs relative to the ozone treatment that is taking place;
(d) how to operate the equipment as intended:
  (i) enclosed spaces shall be dosed only once in a 24-hour period; and
  (ii) only one unit is to be operated at one time in a single unoccupied space;
(e) proper maintenance and care of ozone generating and detecting equipment;
(f) that no one is allowed to enter the designated area under test during this time even wearing personal protective equipment (PPE);
(g) first aid methods for accidental ozone exposure;
(h) a material safety data sheet (MSDS) for ozone; and
(i) that the checklist for ozone treatment technicians shall be used by a trained person.

Note: *See Annex B for a sample checklist.*

7.5.4
In addition to the markings specified in Clause 7.3, the following shall be marked on the product in a permanent manner and shall be visible during normal use:
CAUTION: NOT FOR USE IN OCCUPIED INDOOR SPACES; SUCH USE CAN BE INJURIOUS TO HEALTH. SEE MANUAL FOR USAGE INSTRUCTIONS*
**The equivalent French wording is ATTENTION : NE PAS UTILISER DANS UN ESPACE INTÉRIEUR OCCUPÉ. UNE TELLE UTILISATION POURRAIT ÊTRE NOCIVE. VOIR LA NOTICE D'UTILISATION.*

Δ 7.5.5
Installation and operating instructions for use shall be provided with each product.

7.5.6
Where special precautions are necessary, clear instructions regarding these precautions shall be provided.

Δ 7.5.7

7.5.7.1 Ozone sensor and detector

7.5.7.1.1
The ozone detector shall meet or exceed the following specifications:
(a) response time equal to or less than 60 s;

(b) accuracy the greater of 0.0020 ppmv or ±2% of the reading at 50% RH and 25 °C;
(c) linear range of 0 to 1 ppmv; and
(d) detection less than 0.050 ppmv.

7.5.7.1.2

The ozone detector shall include the following features:
(a) it shall stop the production of ozone at 0.80 ppmv;
(b) it shall have an alarming function with audio and visual (red light), as a warning signal, whenever the detected ozone level exceeds 0.050 ppmv;
(c) the ozone detector and alarming circuit shall be provided with a battery;
(d) the unit shall be provided with a low battery warning signal. The low battery signal shall start to activate at least when the battery can last for another 8-hour time duration. The 8-hour operation of the low battery condition shall be tested with all options of the unit switched on;
(e) the ozone generator shall not start until the ozone detecting equipment has achieved its steady state operating condition according to the manufacturer; and
(f) a monitoring function to detect and provide an alarm for any fault that can affect the safe operation shall be conducted when the unit is initially powered. The fault alarm shall be easy to distinguish from the ozone level alarm.

7.5.7.2 Timer

A timer shall be incorporated in the unit and shall:
(a) prevent the unit from operating beyond 1 h;
(b) be reset manually after the initial set time of 1 h maximum has elapsed;
(c) upon loss of the electrical supply and when the timing action is interrupted, resume at the point of interruption upon restoration of the electrical supply;
(d) stop the production of ozone after 1 h of operation; and
(e) meet the requirements of CAN/CSA-C22.2 No. 177 or CAN/CSA-E730-2-7.

7.5.7.3 Electronic circuits

Any electronic circuit associated with the safety functions in Clause 7.5.7, or performing any alarming function to indicate the safe ozone level for safe re-entry to the unoccupied space, shall be evaluated for functional safety in accordance with the requirements of CSA C22.2 No. 0.8.

Δ

7.5.8

7.5.8.1 Ozone detector test

The test shall be conducted with the timer described in Clause 7.5.7.2 bypassed.

7.5.8.2 Conditioning

The unit shall be conditioned at 50% RH and 25 °C for 24 h before commencing the tests specified in Clause 7.5.8.3.

7.5.8.3 Calibration test

7.5.8.3.1 Test conditions

The following test conditions shall be met:
(a) The test shall be conducted in a chamber approximately 3 to 5 times the size of the unit.
(b) The test shall be conducted at a temperature of 25 ± 2 °C, and humidity 50% RH ± 10%.
(c) The unit shall be located at the centre of the chamber.
(d) A reference ozone monitor sample line shall be placed 50 mm from the inlet of the ozone sensor being tested.

7.5.8.3.2 Test method

The test shall be conducted as follows:

(a) The device being tested shall be switched on and exposed to the test gas. The ozone level at which the alarm signal gets activated shall be recorded.
(b) The device being tested shall be continually energized until the maximum ozone limit is reached and the unit stops producing ozone. The ozone level at which the device stops producing ozone shall be recorded.
(c) The test chamber shall be vented in a safe manner to reduce the ozone concentration until the alarm deactivates. The ozone level at which the alarm deactivates shall recorded.
(d) The test method above shall be repeated 3 times on the same device.

7.5.8.3.3 Acceptance criteria

The acceptance criteria shall be as follows:

(a) The alarm shall activate at or below 0.052 ppmv.
(b) The device shall stop producing ozone at or below 0.816 ppmv.
(c) The alarm shall deactivate at no more than 0.052 ppmv.

Note: *Maximum allowable error has been incorporated [consistent with Clause 7.5.7.1.1(b)].*

7.5.8.4 Endurance test

The endurance test shall be conducted as follows:

(a) The unit shall be placed in the test chamber specified in Clause 7.5.8.3.1(a) with the vent open. The unit shall then be operated continuously for a period of 168 h. After this time period has elapsed, the vent shall be closed.
(b) The test method described in Clause 7.5.8.3.2 shall then be repeated.
(c) The acceptance criteria shall be as follows:
    (i) The alarm shall activate at or below 0.054 ppmv in the intended manner.
    (ii) The device shall stop producing ozone at or below 0.832 ppmv.
    (iii) The alarm shall deactivate at no more than 0.054 ppmv.

Note: *Double maximum allowable error has been incorporated [consistent with Clause 7.5.7.1.1(b)].*

8 Marking

8.1

Air cleaners shall be marked clearly and permanently with the following information:

(a) manufacturer's name, trademark, trade name, or other recognized symbol of identification;
(b) catalogue or type designation specifically identifying the air cleaner; and
(c) rated input voltage, current, frequency, and power or volt amperage.

8.2

Markings shall comply with the requirements of CAN/CSA-C22.2 No. 0.

8.3

Electrostatic air cleaners for use with copper and aluminum conductors shall be marked "CU-AL" or the equivalent.

8.4

Where required by Clause 5.19.5, air cleaners shall be marked with the following or equivalent wording:
CAUTION: DO NOT DEFEAT INTERLOCK*
**The equivalent French wording is ATTENTION : NE PAS NUIRE À L'ACTION DU VERROUILLAGE DE SÉCURITÉ.*

8.5
Where required by Clause 5.3.1, components requiring field assembly shall include a marking specifying proper assembly.

8.6

8.6.1
Where required by Clause 5.19.1, air cleaners shall be marked with the following or equivalent wording:
WARNING: DISCONNECT POWER SUPPLY BEFORE SERVICING*
**The equivalent French wording is AVERTISSEMENT : COUPER L'ALIMENTATION AVANT DE PROCÉDER AU DÉPANNAGE.*

8.6.2
If a time delay is required (see Clauses 5.19.2 and 6.7), air cleaners shall also be marked with the following or equivalent wording in addition to the marking specified in Clause 8.6.1:
WARNING: WAIT ... SECONDS BEFORE OPENING PANEL*
**The equivalent French wording is AVERTISSEMENT : ATTENDRE ... SECONDES AVANT D'OUVRIR LE PANNEAU.*

8.7
For duct-type systems in heating equipment, the following or equivalent wording shall appear on a temporary label or in the installation instructions:
THIS AIR CLEANER SHALL NOT BE INSTALLED ON THE HOT-AIR SIDE OF DUCT-TYPE SYSTEMS*
**The equivalent French wording is NE PAS INSTALLER CE FILTRE ÉLECTROSTATIQUE DANS LE COURANT D'AIR CHAUD D'UN APPAREIL DE CHAUFFAGE.*

8.8
Where required by Clause 5.20.3, cleaners shall be marked with the following or equivalent wording:
CAUTION: MOUNT WITH THE LOWEST MOVING PARTS AT LEAST 2.5 m ABOVE FLOOR OR GRADE LEVEL*
**The equivalent French wording is ATTENTION : INSTALLER DE SORTE QUE LES PIÈCES MOBILES INFÉRIEURES SOIENT À AU MOINS 2.5 m AU-DESSUS DU PLANCHER OU DU SOL.*

8.9
The month and year of manufacture, at minimum, shall be marked on each unit in a location that is accessible without the use of tools. Date coding, serial numbers, or equivalent means shall be used.

8.10
A removable ionizer-collector cell of an air cleaner that is intended for installation above floor level and that weighs more than 6.8 kg shall be marked with the following or equivalent wording:
CAUTION: THIS CELL WEIGHS ... kg. HANDLE WITH CARE WHEN REMOVING FOR CLEANING OR SERVICING*
**The equivalent French wording is ATTENTION : CE FILTRE PÈSE ... kg. ENLEVER AVEC SOIN POUR LE NETTOYAGE OU L'ENTRETIEN.*

8.11
All air cleaners shall be marked with the following or equivalent wording:
CAUTION: THIS EQUIPMENT SHOULD BE INSPECTED, AND COLLECTOR CELLS SHOULD BE CLEANED IN ACCORDANCE WITH MANUFACTURER'S INSTRUCTIONS, ON A REGULAR BASIS TO PREVENT EXCESSIVE ACCUMULATION OF DUST PARTICLES THAT CAN RESULT IN FLASHOVER OR A RISK OF FIRE*
**The equivalent French wording is ATTENTION : CET APPAREIL DEVRAIT FAIRE L'OBJET D'UNE INSPECTION ET LES FILTRES DEVRAIENT ÊTRE NETTOYÉS CONFORMÉMENT AUX INSTRUCTIONS DU FABRICANT, DE FAÇON RÉGULIÈRE, AFIN D'EMPÊCHER UNE ACCUMULATION EXCESSIVE DE POUSSIÈRE POUVANT PROVOQUER UN EMBRASEMENT ÉCLAIR OU CAUSER UN RISQUE D'INCENDIE.*

Δ *Annex A (informative)*
TWA sample calculation

Note: *This Annex is not a mandatory part of this Standard.*

A.1

The time-weighted average (TWA) sample calculation formula is as follows:

TWA = (C1T1 + C2T2 + C3T3 +…+ CnTn)/(8 hours)

where
C = concentration over the sampling period, ppmv

T = sampling period, hours

n = number of samples

Example
The ESP (electrostatic precipitator) device test was started at 8:12:15. The instrument in use provides 1-hour data values. In the first hour of sampling (between 8:12:15 and 9:12:15), the instrument reports a concentration of 0.017 ppmv. This is the first data value to use in the TWA calculation. Since it is an 8-hour TWA, 8 data values are needed to complete the calculation.

Time	O_3 (ppmv)
8:12:15	0.000
9:12:15	0.017
10:12:15	0.017
11:12:15	0.018
12:12:15	0.019
13:12:15	0.019
14:12:15	0.021
15:12:15	0.022
16:12:15	0.023

8-hour TWA =

$$\frac{(0.017 \times 1) + (0.017 \times 1) + (0.018 \times 1) + (0.019 \times 1) + (0.019 \times 1) + (0.021 \times 1) + (0.022 \times 1) + (0.023 \times 1)}{8}$$

= 0.0195 ppmv

Δ *Annex B (informative)*
Checklist for ozone treatment technicians

Note: *This Annex is not a mandatory part of this Standard.*

Table B.1
Checklist for ozone treatment technician operating the ozone generator for temporarily unoccupied spaces

Item	Activity to be conducted before operating the ozone generating unit	If activity accomplished, insert a check mark
1	Ensure training has been completed in the following: (a) the physiological effects of ozone on the human body; (b) how to seal off the area in order to ensure that ozone does not migrate out of the area being treated; and (c) how to secure the area being treated with ozone to ensure that persons are impeded from entering the area and see the warning signs relative to the ozone treatment that is taking place.	
2	Close all windows and doors in the area subjected to the treatment with ozone.	
3	Seal all return paths of the HVAC system so as not to allow ozone to enter into the building HVAC system.	
4	Place warning signs at all entrances leading to the unoccupied space, including entrances from other floors both above and below.	
5	Ensure warning signs contain the following: (a) a warning that the area is being treated with high levels of ozone; and (b) a warning that ozone could cause serious injury.	
6	Remove all pets from the area.	
7	Remove all plants and food from the area.	
8	Remove any electrical appliances from the area.	

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Preface

This is the third edition of CSA C22.2 No. 187, *Electrostatic air cleaners*, one of a series of Standards issued by the Canadian Standards Association under Part II of the *Canadian Electrical Code*. It supersedes the previous editions, published in 1986 and 1982.

This Standard applies to electrostatic air cleaners for use in nonhazardous locations and for installation in accordance with the *Canadian Electrical Code, Part I*.

The following Technical Information Letters (TILs) have been incorporated into this edition:

(a) TIL H13A: *Commercial Use Air Cleaners Designed to Produce Ozone*; and

(b) TIL H13B: *Commercial Use Air Cleaners Designated to Produce Ozone, Duct mount Air Cleaners using UV or Bacterial Lamps and Air Cleaners using High Voltage Negative Ion Generators*.

This Standard is considered suitable for use for conformity assessment within the stated scope of the Standard.

This Standard was prepared by the Subcommittee on Electrostatic Air Cleaners, under the jurisdiction of the Technical Committee on Consumer and Commercial Products and the Strategic Steering Committee on Requirements for Electrical Safety, and has been formally approved by the Technical Committee.

Interpretations: The Strategic Steering Committee on Requirements for Electrical Safety has provided the following direction for the interpretation of standards under its jurisdiction: "The literal text shall be used in judging compliance of products with the safety requirements of this Standard. When the literal text cannot be applied to the product, such as for new materials or construction, and when a relevant committee interpretation has not already been published, CSA's procedures for interpretation shall be followed to determine the intended safety principle".

March 2009

Notes:

(1) *Use of the singular does not exclude the plural (and vice versa) when the sense allows.*

(2) *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.*

(3) *This publication was developed by consensus, which is defined by* CSA Policy governing standardization — Code of good practice for standardization *as "substantial agreement. Consensus implies much more than a simple majority, but not necessarily unanimity". It is consistent with this definition that a member may be included in the Technical Committee list and yet not be in full agreement with all clauses of this publication.*

(4) *CSA Standards are subject to periodic review, and suggestions for their improvement will be referred to the appropriate committee.*

(5) *All enquiries regarding this Standard, including requests for interpretation, should be addressed to Canadian Standards Association, 5060 Spectrum Way, Suite 100, Mississauga, Ontario, Canada L4W 5N6.*

Requests for interpretation should

(a) define the problem, making reference to the specific clause, and, where appropriate, include an illustrative sketch;

(b) provide an explanation of circumstances surrounding the actual field condition; and

(c) be phrased where possible to permit a specific "yes" or "no" answer.

Committee interpretations are processed in accordance with the CSA Directives and guidelines governing standardization *and are published in CSA's periodical* Info Update*, which is available on the CSA Web site at www.csa.ca.*

C22.2 No. 187-09
Electrostatic air cleaners

1 Scope

1.1
This Standard applies to
(a) electrostatic air cleaners intended to remove dust and dirt from the air and intended for general indoor residential and commercial use;
(b) air ionizer type air cleaners; and
(c) other similar ionizing equipment.

1.2
This Standard does not apply to electrostatic air cleaners for use in hazardous locations or in atmospheres defined as hazardous by the *Canadian Electrical Code, Part I*.

1.3
This Standard does not apply to air cleaners designed to remove particles other than dust and dirt normally found in heating and ventilating systems.

1.4
The requirements of this Standard apply to cord-connected and permanently connected equipment operating at nominal supply voltages up to 600 V, single-phase or polyphase, in accordance with the Rules of the *Canadian Electrical Code, Part I*.

1.5
This Standard does not specify requirements for the effectiveness of air cleaners with respect to the removal of airborne particles.

1.6
This Standard does not apply to electrostatic air cleaners intended for industrial use.

1.7
Air cleaners for household use that are designed to generate ozone intentionally are outside the scope of this Standard.

1.8
Ozone generators designed exclusively to be connected to air duct systems are outside the scope of this standard because the test procedures do not address this type of application.

1.9
In CSA Standards, "shall" is used to express a requirement, i.e., a provision that the user is obliged to satisfy in order to comply with the standard; "should" is used to express a recommendation or that which is advised but not required; "may" is used to express an option or that which is permissible within the limits of the standard; and "can" is used to express possibility or capability. Notes accompanying clauses do not include requirements or alternative requirements; the purpose of a note accompanying a clause is