Part 6
Heating, Ventilating and Air-Conditioning

Part 6
Heating, Ventilating and Air-Conditioning
(See Appendix A.)

Section 6.1. General

6.1.1. Application

6.1.1.1. Scope

(1) The scope of this Part shall be as described in Section 2.1.

(2) Where the method of operation of an existing heating, ventilating or *air-conditioning* system is altered, the repair, adjustment or component replacements that change the capacity or extent of safety of the system shall conform to this Code. (See Appendix A.)

6.1.1.2. Application

(1) This Part applies to systems and equipment for heating, ventilating and *air-conditioning* services.

6.1.2. Definitions

6.1.2.1. Reserved.

6.1.3. Plans and Specifications

6.1.3.1. Reserved.

Section 6.2. Design and Installation

6.2.1. General

6.2.1.1. Good Engineering Practice

(1) Heating, ventilating and *air-conditioning* systems, including related mechanical refrigeration systems, shall be designed, constructed and installed to conform to good engineering practice appropriate to the circumstances such as described in

(a) the ASHRAE Handbooks as follows:
  (i) 1993 Fundamentals,
  (ii) 1994 Refrigeration,
  (iii) 1995 HVAC Applications,
  (iv) 1996 HVAC Systems and Equipment, and
  (v) ASHRAE/IES 90.1-1989, "Energy Efficient Design of New Buildings Except Lowrise Residential Buildings". (See Article 2.1.1.11.)
(b) the CAN/CSA-F280-M90, "Determining the Required Capacity of Residential Space Heating and Cooling Appliances", and the outside winter design temperatures shall conform to Subsection 2.5.1. of this Code,
(c) the CAN/CSA-F326-M91, "Residential Mechanical Ventilation Requirements",
(d) the NFPA Fire Codes (1996 Publication),
(e) the HRAI Digest 2000,
(f) the Hydronics Institute Manuals,
(g) the SMACNA Manuals,
(h) the Industrial Ventilation Manual, 22nd Edition 1995, published by the American Conference of Governmental Industrial Hygienists,
(i) CAN/CSA-Z317.2, "Special Requirements for HVAC Systems in Health Care Facilities",
(j) the Unified Canadian Guideline for Integrated (Combined) Heating Systems, and
(k) the Model National Energy Code for Buildings, 1997. (See Article 2.1.1.11.)

6.2.1.2. Design Indoor Air Temperatures

(1) *Buildings* classified as Group B, Division 2 or 3 *occupancies* or Group C *residential occupancies* that are intended for use in the winter months on a continuing basis shall be insulated and be equipped with heating facilities that are capable of maintaining an indoor air temperature of 22°C (72°F) at the outside winter design temperature referred to in Article 6.2.1.8.

(2) All other *buildings* intended for occupancy in the winter months on a continuing basis should be insulated and shall be equipped with heating facilities to maintain a minimum indoor air temperature of 18°C (64°F) or

commensurate with the use of the *building* at the outside winter design temperature described in Article 6.2.1.8.

6.2.1.3. Reserved.

6.2.1.4. Structural Movement

(1) Mechanical systems and equipment shall be designed and installed to accommodate the maximum relative structural movement provided for in the *construction* of the *building*. (See Article 4.1.1.5., Subsection 4.1.9. and Article 4.1.10.4. for information on the types of structural movements that may be encountered.)

6.2.1.5. Installation Standards

(1) The installation of solid fuel-burning *appliances* for central heating systems shall comply with CAN/CSA-B365-M, "Installation Code for Solid Fuel-Burning Appliances and Equipment" and the manufacturer's installation instructions.

(2) The solid fuel-fired *appliances* in Sentence (1) shall conform to CAN/CSA-B366.1-M, "Solid Fuel-Fired Central Heating Appliances".

(3) The design and installation of ground and water source heat pumps shall conform to CAN/CSA-C445-M, "Design and Installation of Earth Energy Heat Pump Systems for Residential and Other Small Buildings" where

(a) the maximum standard rated output is 35 kW (119,000 Btu/h) per *dwelling unit* for residential applications, or
(b) small *building* applications serve a heated floor space area not greater than 1 400 m² (15,100 ft²).

(4) The design and installation of ground and water source heat pumps shall conform to CAN/CSA-C447-M, "Design and Installation of Earth Energy Heat Pump Systems for Commercial and Institutional Buildings" where the heated floor space is greater than 1400 m² (15,100 ft²).

(5) The design and installation of Solid fuel-burning *stoves*, *ranges* and *space heaters*, including the requirements for combustion air, shall conform to the requirements of CAN/CSA-B365-M, "Installation Code for Solid Fuel-Burning Appliances and Equipment" and the manufacturer's installation installation instructions.

6.2.1.6. Fireplaces

(1) Fireplaces shall conform to the requirements of Section 9.22.

6.2.1.7. Heat Recovery Ventilators

(1) Except as provided in Sentence (2), heat recovery ventilators with rated capacities of not less than 25 L/s (53 cfm) and not more than 200 L/s (424 cfm) shall be installed in accordance with Article 9.32.3.11.

(2) Where *electric space heating*, other than forced-air electric heating system, is provided in *buildings* of *residential occupancy* within the scope of Part 9, the mechanical ventilation system shall include heat recovery ventilators designed to provide the greater of

(a) the minimum rated efficiency required by the Ontario Energy Efficiency Act, or
(b) a minimum 55% sensible heat recovery efficiency when tested to the low temperature thermal and ventilation performance test method set out in CAN/CSA-C439-M, "Standard Methods of Test for Rating the Performance of Heat Recovery Ventilators", at a Station 1 test temperature of -25°C (-13°F) at an air flow not less than 30 L/s (64 cfm).

6.2.1.8. Outside Design Conditions

(1) The outside conditions to be used in designing heating, ventilating and *air-conditioning* systems shall be determined in conformance with Subsection 2.5.1.

6.2.1.9. Installation - General

(1) Equipment requiring periodic maintenance and forming part of a heating, ventilating or *air-conditioning* system shall be installed with provision for access for inspection, maintenance, repair and cleaning. (See Appendix A.)

(2) Mechanical equipment shall be protected with *guards* to prevent injury to the public or maintenance staff.

(3) Equipment forming part of a heating or *air-conditioning* system that may be adversely affected by freezing temperatures and that is located in an unheated area shall be protected from freezing.

6.2.1.10. Expansion, Contraction and System Pressure

(1) Heating and cooling systems shall be designed to allow for expansion and contraction of the heat transfer fluid and to maintain the system pressure within the rated working pressure limits of all components of the system.

6.2.1.11. Asbestos

(1) Asbestos shall not be used in air distribution systems or equipment in a form or in a location where asbestos fibres could enter the air supply or return systems.

6.2.1.12. Access Openings

(1) Any covering of an access opening through which a person could enter shall be openable from the inside without the use of keys where there is a possibility of the opening being accidentally closed while the system or equipment is being serviced.

6.2.1.13. Combustible Tubing

(1) *Combustible* tubing for pneumatic controls may be used in *buildings* required to be of *noncombustible construction* providing it has an outside diameter not exceeding 10 mm (⅜ in).

6.2.2. Ventilation

6.2.2.1. Required Ventilation

(1) Except as provided in Sentence (3), all rooms and spaces in *buildings* shall be ventilated in accordance with this Part.

(2) Except in *storage garages* and *repair garages* covered by Article 6.2.2.3., the rates at which outdoor air is supplied to rooms and spaces in *buildings* by ventilation systems shall be not less than the rates required by ASHRAE Standard 62, "Ventilation for Acceptable Indoor Air Quality". (See Appendix A.)

(3) Self-contained mechanical ventilation systems, serving only one *dwelling unit* which conform to the requirements of Subsection 9.32.3. shall be considered to satisfy the requirements of this Article. (See Appendix A.)

(4) *Live/work units* shall be mechanically ventilated in accordance with the requirement of Sentence (1).

6.2.2.2. Natural Ventilation

(1) The ventilation required by Article 6.2.2.1. shall be provided by mechanical ventilation except that it can be provided by natural ventilation or a combination of natural and mechanical ventilation in

(a) *buildings* of other than *residential occupancy* having an *occupant load* of not more than one person per 40 m^2 (431 ft^2) during normal use,
(b) *buildings* of *industrial occupancy* where the nature of the process contained therein permits or requires the use of large openings in the *building* envelope even during the winter, or
(c) seasonal *buildings* not intended to be occupied during the winter.

6.2.2.3. Ventilation of Storage and Repair Garages

(1) Except as provided in Sentences (4) and (6), an enclosed *storage garage* shall have a mechanical ventilation system designed to

(a) limit the concentration of carbon monoxide to not more than 100 parts per million of air when measured between 900 mm (2 ft 11 in) and 1 200 mm (3 ft 11 in) from the floor, or
(b) provide, during operating hours, a continuous supply of outdoor air at a rate of not less than 3.9 L/s (8.3 cfm) for each square metre of floor area. (See Sentences 3.3.1.19.(1) and 3.3.5.4.(4))

(2) Mechanical ventilation systems provided in accordance with Clause (1)(a) shall be controlled automatically by carbon monoxide monitoring devices, located so as to provide full protection throughout the *storage garage*.

(3) Mechanical ventilation systems provided in accordance with Sentence (1) shall be designed such that the pressure in the *storage garage* is less than the pressure in adjoining *buildings* of other *occupancy*, or in adjacent portions of the same *building* having a different *occupancy*.

(4) In *storage garages* subject to the requirements of Sentence (1), where motor vehicles are parked by mechanical means, the ventilation requirements may be reduced by one half.

(5) Except as provided in Sentence (6), ticket and attendant booths of *storage garages* shall be pressurized with a supply of outdoor air.

(6) The requirements of Sentences (1) to (5) shall not apply to *open-air storeys* in a *storage garage*.

(7) A *repair garage* shall have a mechanical ventilation system designed to limit the exposure of workers to carbon monoxide to below the time weighted average concentration of 35 parts per million for a normal 8 hour workday or 40 hour work week.

(8) In a *repair garage*, when a repair bay is not immediately adjacent to an outside garage door opening, a system capable of providing continuous general ventilation of not less than 700 L/s (1480 cfm) per internal bay shall be provided.

(9) The general ventilation system described in Sentence (8) shall be designed to

(a) operate continuously, or

(b) be controlled automatically by carbon monoxide monitoring devices, located so as to provide full protection throughout the *repair garage*.

(10) The general ventilation system described in Sentence (8) is not required when tail pipes of vehicles are directly connected to local mechanical exhaust systems that terminate outdoors.

6.2.2.4. Air Contaminants

(1) Air contaminants released within *buildings* shall be removed insofar as possible at their points of origin and shall not be permitted to accumulate in concentrations greater than permitted in the Industrial Ventilation Manual published by the American Conference of Governmental Industrial Hygienists. (See Appendix A.)

(2) Systems serving spaces that contain sources of contamination and systems serving other occupied parts of the *building* but located in or running through spaces that contain sources of contamination shall be designed in such a manner as to prevent spreading of such contamination to other occupied parts of the *building*. (See Appendix A.)

(3) Heating, ventilating and *air-conditioning* systems shall be designed to minimize growth of micro-organisms according to good engineering practice as described in 6.2.1.1.(1). (See Appendix A.)

(4) Mechanical rooms containing refrigeration equipment shall be ventilated in accordance with CSA B52-M, "Mechanical Refrigeration Code".

6.2.2.5. Hazardous Gases, Dusts or Liquids

(1) Systems serving spaces that contain hazardous gases, dusts or liquids shall be designed, constructed and installed in conformance with the provisions of the Ontario Fire Code made under the Fire Marshals Act, or in the absence of requirements pertinent to such systems in the Ontario Fire Code, to good engineering practice such as is described in the publications of the National Fire Protection Association and in the National Fire Code of Canada 1995. (See Appendix A.)

6.2.2.6. Commercial Cooking Equipment

(1) All commercial cooking equipment shall be provided with ventilation systems designed, constructed and installed to conform to NFPA 96, "Ventilation Control and Fire Protection of Commercial Cooking Operations", except as required by Sentence 3.6.3.1.(1) and Article 3.6.4.2. (See A-3.3.1.2.(2) in Appendix A.)

6.2.2.7. Crawl Spaces and Attic or Roof Spaces

(1) Every crawl space and every *attic or roof space* shall be ventilated by natural or mechanical means.

6.2.3. Air Duct Systems

6.2.3.1. Application

(1) Except as provided in Sentence (2), the design, construction and installation of air duct distribution systems serving heating, ventilating and *air-conditioning* systems shall conform to this Subsection.

(2) The requirements of Subsection 6.2.4. apply to individual *dwelling units* for the design, construction and installation of air duct distribution systems which serve ventilating or *air-conditioning* systems or which serve heating systems in which the rated heat input does not exceed 120 kW (410,000 Btu/h).

6.2.3.2. Materials in Air Duct Systems

(1) Except as provided in Sentences (2) to (4) and in Article 3.6.4.3., all ducts, duct connectors, associated fittings and *plenums* used in air duct systems shall be constructed of steel, aluminum alloy, copper, clay, asbestos-cement or similar *noncombustible* material.

(2) Ducts, associated fittings and *plenums* are permitted to contain *combustible* material provided they

(a) conform to the appropriate requirements for Class 1 duct materials in CAN/ULC-S110-M, "Standard Methods of Test for Air Ducts",

(b) conform to Article 3.1.5.14. in a *building* required to be of *noncombustible construction*,

(c) conform to Subsection 3.1.9.,

(d) are not used in horizontal runs in a *building* required to be of *noncombustible construction*,

(e) are not used in vertical runs serving more than 2 *storeys* in a *building* required to be of *noncombustible construction*, and
(f) are not used in air duct systems in which the air temperature may exceed 120°C (248°F).

(3) Duct sealants shall have a *flame-spread rating* of not more than 25 and a smoke developed classification of not more than 50.

(4) Duct connectors that contain *combustible* materials and that are used between ducts and air outlet units shall
(a) conform to the appropriate requirements for Class 1 air duct materials in CAN/ULC-S110-M, "Standard Methods of Test for Air Ducts",
(b) be limited to 4 m (13 ft 1 in) in length,
(c) be used only in horizontal runs, and
(d) not penetrate required *fire separations*.

(5) Materials in Sentences (1) to (4) which when used in a location where they may be subjected to excessive moisture shall have no appreciable loss of strength when wet and shall be corrosion-resistant.

6.2.3.3. Connections and Openings in Air Duct Systems

(1) Air duct systems shall have
(a) tight-fitting connections throughout, and
(b) no openings other than those required for proper operation, inspection and maintenance of the system.

(2) Except for systems that serve one *dwelling unit* only, access openings shall be provided in duct systems where lint, grease, debris, paper or other combustible material may accumulate in *plenums* and ducts.

6.2.3.4. Coverings, Linings, Adhesives and Insulation

(1) Coverings, linings and associated adhesives and insulation of air ducts, *plenums* and other parts of air duct systems shall be of *noncombustible* material when exposed to heated air or radiation from heat sources that would result in the exposed surface exceeding a temperature of 120°C (248°F).

(2) When *combustible* coverings and linings, including associated adhesives and insulation, are used, they shall have a *flame-spread rating* of not more than 25 on any exposed surface or any surface that would be exposed by cutting through the material in any direction, and a smoke developed classification of not more than 50, except that the outer covering of ducts, *plenums* and other parts of air duct systems used within an assembly of *combustible construction* may have an exposed surface *flame-spread rating* of not more than 75 and may have a smoke developed classification greater than 50.

(3) *Combustible* coverings and linings in Sentence (2) shall not flame, glow, smoulder or smoke when tested in accordance with the method of test in ASTM C411, "Hot-Surface Performance of High-Temperature Thermal Insulation" at the maximum temperature to which the coverings and linings are to be exposed in service.

(4) Except as provided in Sentence (5), foamed plastic insulation shall not be used as part of an air duct or for insulating an air duct.

(5) Foamed plastic insulation may be used in a ceiling space that acts as a return air *plenum* provided the foamed plastic insulation is protected from exposure to the *plenum* in accordance with Article 3.1.5.11.

(6) *Combustible* coverings and linings of ducts, including associated adhesives and insulation, shall be interrupted at the immediate area of operation of heat sources in a duct system, such as electric resistance heaters or fuel-burning heaters or *furnaces*, and where the duct penetrates a *fire separation*.

(7) Linings of ducts shall be installed so that they will not interfere with the operation of volume or balancing dampers, *fire dampers*, *fire stop flaps* and other *closures*.

6.2.3.5. Underground Ducts

(1) Underground ducts shall be constructed to provide interior drainage from and access to all low points and shall not be connected directly to a sewer.

6.2.3.6. Clearances

(1) The clearances from *combustible* material and supply *plenums*, *supply ducts*, boots and register boxes of heating systems shall conform to the requirements of Subsection 6.2.4.

6.2.3.7. Fire Dampers

(1) *Fire dampers* shall conform to the requirements of Article 3.1.8.9.

6.2.3.8. Smoke Detector Control

(1) Air handling systems shall incorporate *smoke detector* control where required by Article 3.2.4.13.

6.2.3.9. Exhaust Ducts and Outlets

(1) Except as provided in Sentence (2), *exhaust ducts* of nonmechanical ventilating systems serving separate rooms or spaces shall not be combined.

(2) *Exhaust ducts* of nonmechanical ventilating systems serving similar *occupancies* may be combined immediately below the point of final delivery to the outside, such as at the base of a roof ventilator.

(3) *Exhaust ducts* of ventilating systems shall have provision for the removal of condensation where this may be a problem.

(4) Exhaust outlets shall be designed to prevent back draft under wind conditions.

(5) Except as permitted in Sentence (6), exhaust systems shall discharge directly to the outdoors.

(6) Exhaust systems are permitted to exhaust into a *storage garage* provided such systems serve rooms which

(a) are accessible only from the *storage garage*, and

(b) are not served by duct systems serving other parts of the *building*.

(See Appendix A.)

(7) *Exhaust ducts* connected to laundry drying equipment shall be independent of other *exhaust ducts*.

(8) Except as provided in Sentence (10) and except for self-contained systems serving individual *dwelling units*, *exhaust ducts* serving rooms containing water closets, urinals, basins, showers or slop sinks shall be independent of other *exhaust ducts*.

(9) Except as provided in Sentence (10) and except for self-contained systems serving individual *dwelling units*, *exhaust ducts* serving rooms containing residential cooking equipment shall be independent of other *exhaust ducts*.

(10) Two or more exhaust systems described in Sentences (8) and (9) may be interconnected or connected with *exhaust ducts* serving other areas of the *building* provided

(a) the connections are made at the inlet of an exhaust fan, and

(b) all interconnected systems are equipped with suitable back pressure devices to prevent passage of odours from one system to another when the fan is not in operation.

(11) Where *exhaust ducts* containing air from heated spaces pass through or are adjacent to unheated spaces, the ducts shall be insulated to prevent moisture condensation in the ducts in accordance with Sentence 6.2.4.3.(10).

(12) Except for wash basins (lavatories), the exhaust air provided shall not be less than 24 L/s (50 cfm) for each sanitary fixture listed in Sentence (8).

(13) Except for wash basins (lavatories), sanitary facilities in a food premises shall be mechanically ventilated and shall be capable of exhausting air at the rate of not less than 24 L/s (50 cfm) for each sanitary fixture listed in Sentence (14).

(14) The mechanical ventilation described in Sentence (13) applies to rooms containing water closets, urinals, basins, showers or slop sinks.

6.2.3.10. Interconnection of Systems

(1) Except as provided in Sentence 6.2.3.9.(6), air duct systems serving *storage garages* shall not be interconnected with other parts of the *building*.

(2) In a *residential occupancy*, air from one *suite* shall not be circulated to any other *suite* nor to a *public corridor* or public stairway.

(3) Except for Sentence 3.3.1.4.(4) and Sentences (4) & (5), a *public corridor* or corridor serving the public shall not be used as a portion of a supply, return or exhaust air system serving adjoining areas, other than as part of a supply air system serving toilet rooms, bathrooms, shower rooms and similar auxiliary spaces opening directly to the *public corridor* or corridor used by the public.

(4) A *public corridor* may be used as part of an engineered smoke control system.

(5) Infiltration due to corridor pressurization is permitted into a *residential occupancy* from a *public corridor*.

6.2.3.11. Ducts in Exit Stairways

(1) Duct penetration of *fire separations* separating *exits* from the remainder of the *building* shall be in accordance with Article 3.4.4.4.

6.2.3.12. Make-up Air

(1) In ventilating systems that exhaust air to the outdoors, provision shall be made for the admission of a supply of make-up air in sufficient quantity so that the operation of the exhaust system and other exhaust equipment or combustion equipment is not adversely affected. (See Appendix A.)

6.2.3.13. Supply, Return, Intake and Exhaust Air Openings

(1) Supply, return and exhaust air openings in rooms or spaces in *buildings* when located less than 2 000 mm (6 ft 7 in) above the floor shall be protected by grilles having openings of a size that will not allow the passage of a 15 mm (5/8 in) diameter sphere.

(2) *Combustible* grilles, diffusers and other devices for supply, return and exhaust air openings in rooms shall conform to the *flame-spread rating* and smoke developed classification requirements for the interior finish of the surface on which they are installed.

(3) Outdoor air intakes and exhaust outlets at the *building* exterior shall be designed or located so that the air entering the *building* system will not contain more contaminants than the normal exterior air of the locality in which the *building* is situated.

(4) Exterior openings for outdoor air intakes and exhaust outlets shall be shielded from the entry of snow and rain and shall be fitted with corrosion-resistant screens of mesh having openings not larger than 15 mm (5/8 in), except where experience has shown that climatic conditions require larger openings to avoid icing over of the screen openings.

(5) Screens required in Sentence (4) shall be accessible for maintenance.

6.2.3.14. Filters and Odour Removal Equipment

(1) Air filters for air duct systems shall conform to the requirements for Class 2 air filter units as described in CAN4-S111, "Standard Method of Fire Tests For Air Filter Units".

(2) When electrostatic-type filters are used, they shall be installed so as to ensure that the electric circuit is automatically de-energized when filter access doors are opened and in *dwelling units* when the system circulating fan is not operating.

(3) When odour removal equipment of the adsorption type is used it shall be

(a) installed to provide access so that adsorption material can be reactivated or renewed, and
(b) protected from dust accumulation by air filters installed on the inlet side.

(4) Facilities for flushing and drainage shall be provided where filters are designed to be washed in place.

6.2.3.15. Air Washers and Evaporative Cooling Sections or Towers

(1) The filter and water evaporation medium of every air washer and evaporative cooling section enclosed within a *building* shall be made of *noncombustible* material.

(2) Sumps for air washer and evaporative cooling sections shall be constructed and installed so that they can be flushed and drained.

(3) Evaporative cooling sections or towers of *combustible* material located on or outside *buildings* shall have a clearance of not less than 12 m (39 ft 4 in) from sources of ignition such as *chimneys* or incinerators when the tower exterior construction is *noncombustible*, and a clearance of not less than 30 m (98 ft 5 in) when the tower exterior construction is *combustible*.

(4) Evaporative cooling sections or towers, the main structure of which exceeds a volume of 55 m^3 (1940 ft^3), shall comply with the requirements of NFPA 214, "Water-Cooling Towers".

6.2.3.16. Fans and Associated Air Handling Equipment

(1) Fans for heating, ventilating and *air-conditioning* systems shall be located and installed so that their operation

(a) does not adversely affect the draft required for proper operation of fuel-fired *appliances*, and
(b) does not allow the air in the air duct system to be contaminated by air or gases from the *boiler*-room or *furnace*-room.

(2) Fans and associated air handling equipment, such as air washers, filters and heating and cooling units, when installed on the roof or elsewhere outside the *building*, shall be of a type designed for outdoor use.

6.2.3.17. Construction and Installation of Ducts and Plenums

(1) Rectangular panels in *plenums* and ducts more than 300 mm (11¾ in) wide shall be shaped to provide sufficient stiffness.

(2) Where the installation of heating *supply ducts* in walls and floors creates a space between the duct and construction material, the space shall be fire stopped with *noncombustible* material at each end.

(3) Ducts shall be securely supported by metal hangers, straps, lugs or brackets, except that where zero clearance is permitted, wooden brackets may be used.

(4) All round duct joints shall be tight-fitting and lapped not less than 25 mm (1 in).

(5) Rectangular duct connections shall be made with S and drive cleats or equivalent mechanical connections.

(6) Trunk *supply ducts* shall not be nailed directly to wood members.

(7) Branch ducts shall be supported at suitable spacings to maintain alignment and prevent sagging.

(8) Ducts in or beneath concrete slabs-on-ground shall be watertight, corrosion-, decay- and mildew-resistant.

(9) Where a *supply* or *return duct* is not protected by an insulated exterior wall or where the duct is exposed to an unheated space it shall be insulated to prevent condensation.

6.2.3.18. Connectors

(1) Vibration isolation connectors in air duct systems shall be *noncombustible*, except that *combustible* fabric connectors are permitted provided they

(a) do not exceed 250 mm (9⅞ in) in length,
(b) comply with the flame-resistance requirements of CAN/ULC-S109, "Standard for Flame Tests of Flame-Resistant Fabrics and Films", and
(c) are not used in a location where they are exposed to heated air or radiation from heat sources that may cause the exposed surface to exceed a temperature of 120°C (248°F).

6.2.3.19. Tape

(1) Tape used for sealing joints in air ducts, *plenums* and other parts of air duct systems shall meet the flame-resistance requirements for fabric in CAN/ULC-S109, "Standard for Flame Tests of Flame-Resistant Fabrics and Films".

6.2.3.20. Return-Air System

(1) The return-air system shall be designed to handle the entire air supply.

(2) Where any part of a *return duct* will be exposed to radiation from the *furnace* heat exchanger or other radiating part within the *furnace*, such part of a *return duct* directly above or within 600 mm (23⅝ in) of the outside *furnace* casing shall be *noncombustible*.

(3) *Return ducts* serving solid fuel-fired *furnaces* shall be constructed of *noncombustible* material.

(4) Where *combustible return ducts* are permitted, they shall be lined with *noncombustible* material below floor registers, at the bottom of vertical ducts and under *furnaces* having a bottom return.

(5) The return-air system shall be designed so that the negative pressure from the circulating fan cannot affect the *furnace* combustion air supply nor draw combustion products from joints or openings in the *furnace* or *flue pipe*.

(6) Return-air inlets shall not be installed in an enclosed room or crawl space that provides combustion air to a fuel-fired *appliance*.

6.2.4. Air Ducts for Low Capacity Systems

6.2.4.1. Application

(1) Except as provided in Sentence (2), the design, construction and installation of air duct distribution systems serving heating, ventilating and *air-conditioning* systems shall conform to Subsection 6.2.3.

(2) The requirements of this Subsection apply to individual *dwelling units* for the design, construction and installation of air duct distribution systems which serve ventilating or *air-conditioning* systems or which serve heating systems in which the rated heat input does not exceed 120 kW (410,000 Btu/h).

6.2.4.2. Duct Design

(1) Materials in *supply ducts* shall conform to Article 6.2.3.2.

(2) Galvanized steel or aluminum *supply ducts* shall conform to Table 6.2.4.2.

(3) The design of fitting for ducts shall conform to SMACNA, "HVAC Duct Construction Standards - Metal and Flexible", except that metal thickness shall conform to Table 6.2.4.2.

Table 6.2.4.2.
Minimum Metal Thickness of Ducts
Forming Part of Sentence 6.2.4.2.(2)

Type of Duct	Maximum Diameter, mm (in)	Maximum Width or Depth, mm (in)	Minimum metal thickness, mm (in)	
			Duct Material	
			Galvanized Steel	Aluminum
Round ducts serving single *dwelling units*	125 (5) or less	---	0.254 (0.01)	0.30 (0.012)
Round	350 (13¾) over 350 (13¾)	--- ---	0.33 (0.013) 0.41(0.016)	0.30 (0.012) 0.41(0.016)
Rectangular, enclosed	--- ---	350 (13¾) over 350 (13¾)	0.33 (0.013) 0.41(0.016)	0.30 (0.012) 0.41(0.016)
Rectangular, not enclosed, for single *dwelling units*, with required clearance up to 12 mm (½ in)	--- ---	350 (13¾) over 350 (13¾)	0.33 (0.013) 0.41(0.016)	0.41(0.016) 0.48 (0.019)
Rectangular, not enclosed, with required clearance of more than 12 mm (½ in)	--- ---	350 (13¾) over 350 (13¾)	0.41(0.016) 0.48 (0.019)	0.41(0.016) 0.48 (0.019)
Column 1	2	3	4	5

6.2.4.3. Construction and Installation of Ducts and Plenums

(1) Rectangular panels in *plenums* and ducts more than 300 mm (11¾ in) wide shall be shaped to provide sufficient stiffness.

(2) Where the installation of heating *supply ducts* in walls and floors creates a space between the duct and construction material, the space shall be fire stopped with *noncombustible* material at each end.

(3) Ducts shall be securely supported by metal hangers, straps, lugs or brackets, except that where zero clearance is permitted, wooden brackets may be used.

(4) All round duct joints shall be tight-fitting and lapped not less than 25 mm (1 in).

(5) Rectangular duct connections shall be made with S and drive cleats or equivalent mechanical connections.

(6) Trunk *supply ducts* shall not be nailed directly to wood members.

(7) Branch ducts shall be supported at suitable spacings to maintain alignment and prevent sagging.

(8) *Combustible* ducts in concrete slabs-on-ground that are connected to a *furnace* supply *plenum* shall be located not closer than 600 mm (23⅝ in) to that *plenum* and not less than 600 mm (23⅝ in) from its connection to a riser or register.

(9) Ducts in or beneath concrete slabs-on-ground shall be watertight, corrosion-, decay- and mildew-resistant.

(10) Where a *supply* or *return duct* is not protected by an insulated exterior wall or where the duct is exposed to an unheated space it shall be insulated to provide a thermal resistance of not less than RSI 2.1 (R12).

6.2.4.4. Warm-Air Supply Outlets
(See Appendix A.)

(1) In a *dwelling unit*, a warm-air supply outlet shall be provided in each finished room which is located adjacent to unheated space, exterior air or exterior soil.

(2) Except as provided in Sentence (3), when a room described in Sentence (1) is located adjacent to exterior walls, such outlets shall be located so as to bathe not less than one exterior wall or window with warm air, except in bathrooms, utility rooms or kitchens, where this may not be practical.

(3) Where the heating system is also designed to provide ventilation air, ceiling outlets or outlets located high on interior walls may be installed provided the outlets are
(a) designed for this purpose, and
(b) installed with diffusers.

(4) Not less than one warm-air supply outlet shall be provided for each 40 m^2 (431 ft^2) of floor surface area in unfinished *basements* serving *dwelling units*, located so as to provide adequate distribution of warm air throughout the *basement*.

(5) Except for pipeless *furnaces* and floor *furnaces*, the capacity of warm-air supply outlets serving *dwelling units* shall be not less than the design heat loss from the area served and shall not exceed 3 kW (10,200 Btu/h) per outlet.

(6) In *basements* and heated crawl spaces, the calculated heat gain from the *supply ducts* and *plenum* surfaces may be considered in calculating the design heat loss.

(7) Warm-air supply outlets located in finished areas shall be provided with diffusers and adjustable openings and shall not be located on a *furnace plenum*.

(8) The temperature of supply air at the warm-air supply outlets shall not exceed 70°C (158°F).

(9) Air duct systems serving *storage garages* shall not be interconnected with other parts of the *building*.

6.2.4.5. Concrete Slabs-on-Ground

(1) Warm-air supply systems for *buildings* of *residential occupancy* built on concrete slabs-on-ground
(a) shall be installed in the slab, and
(b) shall be of the perimeter loop type or radial perimeter type.
(See Appendix A.)

6.2.4.6. Adjustable Dampers and Balance Stops

(1) All branch *supply ducts* for residential systems shall be equipped with volume control dampers at the boot to permit balancing or shall be fitted with a diffuser incorporating an adjustable and lockable volume control device which can be set in a fixed position.

6.2.4.7. Return-Air System

(1) The return-air system shall be designed to handle the entire air supply.

(2) Except as provided in Sentences (3) and (4), *return ducts* shall be constructed of material having a surface *flame-spread rating* of not more than 150.

(3) Where any part of a *return duct* will be exposed to radiation from the *furnace* heat exchanger or other radiating part within the *furnace*, such part of a *return duct* directly above or within 600 mm (23⅝ in) of the outside *furnace* casing shall be *noncombustible*.

(4) *Return ducts* serving solid fuel-fired *furnaces* shall be constructed of *noncombustible* material.

(5) *Combustible return ducts* shall be lined with *noncombustible* material below floor registers, at the bottom of vertical ducts and under *furnaces* having a bottom return.

(6) Spaces between studs and joists used as *return ducts* shall be separated from the unused portions of such spaces by tight-fitting metal stops or wood blocking.

(7) A vertical *return duct* shall have openings to return air on not more than 1 floor.

(8) A *public corridor* shall comply with Sentences 6.2.3.10.(3) and (4).

(9) The return-air system shall be designed so that the negative pressure from the circulating fan cannot affect the *furnace* combustion air supply nor draw combustion products from joints or openings in the *furnace* or *flue pipe*.

(10) Return-air from a *dwelling unit* shall not be recirculated to any other *dwelling unit*.

(11) Except for floor levels that are less than 900 mm (2 ft 11 in) above or below an adjacent floor level which is provided with a return-air inlet, at least one return-air inlet shall be provided in each floor level in a *dwelling unit*.

(12) Provision shall be made for the return of air from all rooms by leaving gaps beneath doors, using louvred doors or installing *return duct* inlets.

6.2.4.8. Coverings, Linings and Insulation

(1) Foamed plastic insulation may be used in a ceiling space that acts as a return air *plenum* provided the foamed plastic insulation is protected from exposure to the *plenum* in accordance with Article 3.1.5.11.

(2) Linings of ducts shall be installed so that they will not interfere with the operation of volume or balancing dampers.

6.2.4.9. Tape

(1) Tape used for sealing joints in air ducts, *plenums* and other parts of air duct systems shall meet the flame-resistance requirements for fabric in CAN/ULC-S109, "Standard for Flame Tests of Flame-Resistant Fabrics and Films".

6.2.4.10. Clearances of Ducts and Plenums (See Appendix A.)

(1) Where the *plenum* clearance is 75 mm (3 in) or less, the clearance between a *supply duct* and *combustible* material shall

(a) be equal to the required *plenum* clearance within 450 mm (17¾ in) of the *plenum*, and

(b) be not less than 12 mm (½ in) at a distance of 450 mm (17¾ in) or more from the *plenum*, except that this clearance may be reduced to zero beyond a bend or offset in the duct sufficiently large to shield the remainder of the duct from direct radiation from the *furnace* heat exchanger.

(2) Where the *plenum* clearance is more than 75 mm (3 in) but not more than 150 mm (5⅞ in), the clearance between a *supply duct* and *combustible* material shall

(a) be equal to the required *plenum* clearance within a horizontal distance of 1 800 mm (5 ft 11 in) of the *plenum*, and

(b) be not less than 12 mm (½ in) at a horizontal distance of 1 800 mm (5 ft 11 ft) or more from the *plenum*, except that this distance may be reduced to zero beyond a bend or offset in the duct sufficiently large to shield the remainder of the duct from direct radiation from the *furnace* heat exchanger.

(3) Where the *plenum* clearance is more than 150 mm (5⅞ in), the clearance between a *supply duct* and *combustible* material shall

(a) be equal to the required *plenum* clearance within a horizontal distance of 1 000 mm (3 ft 3 in) of the *plenum*,

(b) be not less than 150 mm (5⅞ in) within a horizontal distance between 1 000 mm (3 ft 3 in) and 1 800 mm (5 ft 11 in) from the *plenum*, and

(c) be not less than 25 mm (1 in) at a horizontal distance of 1 800 mm (5 ft 11 in) or more from the *plenum*, except that this distance may be reduced to 8 mm (5/16 in) beyond a bend or offset in the duct sufficiently large to shield the remainder of the *supply duct* from direct radiation from the *furnace* heat exchanger.

(4) Where a register is installed in a floor directly over a pipeless *furnace*, a double-walled register box with not less than 100 mm (4 in) between walls, or a register box with the warm-air passage completely surrounded by the cold-air passage, shall be permitted in lieu of the clearances listed in Sentences (1), (2) and (3).

6.2.4.11. Exhaust Ducts and Outlets

(1) Where an *exhaust duct* passes through or is adjacent to unheated space, the duct shall be insulated to prevent moisture or condensation in the duct.

(2) Exhaust outlets shall be designed to prevent back draft under wind conditions.

(3) *Exhaust ducts* directly connected to laundry drying equipment shall be independent of other *exhaust ducts*.

6.2.4.12. Make-up Air

(1) In ventilating systems that exhaust air to the outdoors, provision shall be made for the admission of a supply of make-up air in sufficient quantity so that the operation of the exhaust system and other exhaust equipment or combustion equipment is not adversely affected.

(2) Except as provided in Sentence (3), when electric resistance heating is used to temper make-up air required in Sentence (1) in *buildings* of *residential occupancy* within the scope of Part 9, the energy rating for windows and sliding glass doors shall conform to the requirements of Article 9.25.2.7. and the minimum thermal resistance of insulation to be installed shall conform to Column 4 of Table 9.25.2.7.

(3) Sentence (2) does not apply where
(a) *electric space heating* is provided, or
(b) a heat recovery ventilator meeting the minimum rating requirements of Article 6.2.1.7. is installed.

6.2.4.13. Supply, Return, Intake and Exhaust Air Openings

(1) Supply, return and exhaust air openings in rooms or spaces shall be protected by grilles having openings of a size that will not allow the passage of a 15 mm (5/8 in) diameter sphere.

(2) Outdoor air intakes and exhaust outlets at the *building* exterior shall be designed or located so that the air entering the *building* system will not contain more contaminants than the normal exterior air.

(3) Exterior openings for outdoor air intakes and exhaust outlets shall be shielded from the entry of snow and rain and shall be fitted with corrosion-resistant screens of mesh not larger than 15 mm (5/8 in), except where climatic conditions may require larger openings.

(4) Screens required in Sentence (3) shall be accessible for maintenance.

6.2.4.14. Air Filters and Equipment

(1) Air filters for air duct systems shall conform to the requirements for Class 2 air filter units as described in CAN4-S111-M, "Standard Method of Fire Tests For Air Filter Units".

(2) When electrostatic-type filters are used, they shall be installed so as to ensure that the electric circuit is automatically de-energized when filter access doors are opened or when the system circulating fan is not operating.

(3) When odour removal equipment of the adsorption type is used it shall be
(a) installed to provide access so that adsorption material can be reactivated or renewed, and
(b) protected from dust accumulation by air filters installed on the inlet side.

6.2.5. Heating Appliances, General

6.2.5.1. Location of Appliances

(1) Except for *appliances* installed in *dwelling units*, fuel-fired heating *appliances* shall be located, enclosed or separated from the remainder of the *building* in conformance with Section 3.6. (See Subsection 9.10.10.)

6.2.5.2. Appliances Installed Outside the Building

(1) Fuel-fired *appliances* installed on the roof of a *building* or otherwise outside the *building* shall be
(a) designed for outdoor use,
(b) installed not less than 1 200 mm (3 ft 11 in) from the property line, measured horizontally, and
(c) installed not less than 3 m (9 ft 10 in) from an adjacent wall of the same *building* when such wall contains an opening or openings within 3 *storeys* above and 5 m (16 ft 5 in) horizontally from the *appliance*, unless such openings are protected by a *closure* assembly having a 45 min *fire-protection rating* determined in conformance with Article 3.1.8.4., or by wired glass conforming to Article 3.1.8.14.

6.2.5A. Carbon Monoxide Detectors ○ (See Appendix A.)

6.2.5A.1. Application

(1) This Subsection applies to every *building* that
(a) contains a *residential occupancy*, and
(b) contains a fuel-burning *appliance* or a *storage garage*.

6.2.5A.2. Location of Carbon Monoxide Detectors

(1) Where a fuel-burning *appliance* is installed in a *suite* of *residential occupancy*, a carbon monoxide detector shall be installed adjacent to each sleeping area in the *suite*.

(2) Where a fuel-burning *appliance* is installed in a *service room* that is not in a *suite* of *residential occupancy*, a carbon monoxide detector shall be installed
(a) adjacent to each sleeping area in every *suite* of *residential occupancy* that is adjacent to the *service room*, and
(b) in the *service room*.

(3) Where a *storage garage* is located in a building containing a *residential occupancy*, a carbon monoxide detector shall be installed adjacent to each sleeping area in every *suite* of *residential occupancy* that is adjacent to the *storage garage*.

6.2.5A.3. Installation and Conformance to Standards

(1) The carbon monoxide detectors required by Article 6.2.5A.2. shall

(a) be permanently connected to an electrical circuit and shall have no disconnect switch between the overcurrent device and the carbon monoxide detector,

(b) be wired so that its activation will activate all carbon monoxide detectors within the *suite*, where located within a *suite* of *residential occupancy*,

(c) be equipped with an alarm that is audible within bedrooms when the intervening doors are closed, where located in a *suite* of *residential occupancy*, and

(d) conform to

(i) CAN/CGA-6.19, "Residential Carbon Monoxide Detectors",

(ii) CSA 6.19, "Residential Carbon Monoxide Alarming Devices", or

(iii) UL 2034, "Single and Multiple Station Carbon Monoxide Detectors".

6.2.6. Incinerators

6.2.6.1. Applicable Standard

(1) The design, construction, installation and *alteration* of every indoor incinerator shall conform to NFPA 82, "Incinerators, Waste and Linen Handling Systems and Equipment".

6.2.6.2. Venting

(1) Every incinerator shall be served by a *chimney flue* conforming to Section 6.3.

6.2.7. Unit Heaters

6.2.7.1. Clearances

(1) Every *unit heater* using either steam or hot water as the heating medium shall be installed with a clearance of not less than 25 mm (1 in) between the *appliance* and adjacent *combustible* material.

6.2.8. Radiators and Convectors

6.2.8.1. Lining or Backing

(1) Every steam or hot water radiator and convector located in a recess or concealed space or attached to the face of a wall of *combustible construction* shall be provided with a

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noncombustible lining or backing.

6.2.9. Piping for Heating and Cooling Systems

6.2.9.1. Piping Materials and Installation

(1) Piping shall be made from materials designed to withstand the effects of temperatures and pressures that may occur in the system. (See Articles 3.1.5.15., 3.1.9.1., 9.10.9.6. and 9.10.9.7. for fire safety requirements.)

(2) Every pipe used in a heating or *air-conditioning* system shall be installed to allow for expansion and contraction due to temperature changes.

(3) Supports and anchors for piping in a heating or *air-conditioning* system shall be designed and installed to ensure that undue stress is not placed on the supporting structure.

6.2.9.2. Insulation and Coverings

(1) Insulation and coverings on pipes shall be composed of material suitable for the operating temperature of the system to withstand deterioration from softening, melting, mildew and mould.

(2) Insulation and coverings on pipes in which the temperature of the fluid exceeds 120°C (158°F)

(a) shall be made of *noncombustible* material, or

(b) shall not flame, glow, smoulder or smoke when tested in accordance with the method of test ASTM C411, "Hot-Surface Performance of High-Temperature Thermal Insulation", at the maximum temperature to which such insulation or covering is to be exposed in service.

(3) Except as provided in Sentence (7), where *combustible* insulation is used on piping in a *horizontal* or *vertical service space*, the insulation and coverings on such pipes shall have a *flame-spread rating* throughout the material of not more than 25 in *buildings* of *noncombustible construction* and not more than 75 in *buildings* of *combustible construction*.

(4) Except as provided in Sentence (7), insulation and coverings on piping located in rooms and spaces other than the *service spaces* described in Sentence (3) shall have a *flame-spread rating* of not more than that required for the interior finish for the ceiling of the room or space.

(5) Except as provided in Sentence (7), where *combustible* insulation and covering is used on piping in *buildings* described in Subsection 3.2.6., they shall have a smoke developed classification of not more than 100.

(6) Pipes that are exposed to human contact shall be insulated so that the exposed surface does not exceed 70°C (158°F). (See Appendix A.)

(7) No *flame-spread rating* or smoke developed classification limitations are required where *combustible* insulation and coverings are used on piping when such piping is

(a) located within a concealed space in a wall,

(b) located in a floor slab, or

(c) enclosed in a *noncombustible* raceway or conduit.

6.2.9.3. Clearances

(1) Clearances between *combustible* material and bare pipes carrying steam or hot water shall conform to Table 6.2.9.3.

Table 6.2.9.3.
Clearance between Steam or Hot Water Pipes and Combustible Material
Forming Part of Sentence 6.2.9.3.(1)

Steam or Water Temperature °C (°F)	Minimum Clearance, mm (in)
up to 120 (248)	15 (5/8)
above 120 (248)	25 (1)
Column 1	2

6.2.9.4. Surface Temperature

(1) The exposed surface temperature of a steam or hot water radiator shall not exceed 70°C (158°F) unless precautions are taken to prevent human contact.

6.2.9.5. Protection

(1) Where a pipe carrying steam or hot water at a temperature above 120°C (248°F) passes through a *combustible* floor, ceiling or wall, the construction shall be protected by a sleeve of metal or other *noncombustible* material not less than 50 mm (2 in) larger in diameter than the pipe.

(2) Unprotected steam or hot water pipes that pass through a storage space shall be covered with not less than 25 mm (1 in) of *noncombustible* insulation to prevent direct contact with the material stored.

6.2.9.6. Piping in Shafts

(1) Where piping for heating or *air-conditioning* systems is enclosed in a shaft, the requirements of Article 3.6.3.1. for shafts shall apply.

6.2.10. Refrigerating Systems and Equipment for Air-Conditioning

6.2.10.1. Cooling Units

(1) Where a cooling unit is combined with a fuel-fired *furnace* in the same duct system, the cooling unit shall be installed

(a) in parallel with the heating *furnace*,
(b) upstream of the *furnace* provided the *furnace* is designed for such application, or
(c) downstream of the *furnace* provided the cooling unit is designed to prevent excessive temperature or pressure in the refrigeration system.

6.2.11. Storage Bins

6.2.11.1. Storage Bins

(1) Service pipes passing through a storage bin for solid fuel shall be protected or so located as to avoid damage to the pipes.

(2) Except for fuel-thawing pipes, every pipe designed to operate at a temperature of 50°C (122°F) or above shall be located where fuel cannot be stored in contact with it.

(3) A storage bin for solid fuel shall not be located above a sewer opening or drain opening.

(4) Storage bins for solid fuel shall be designed and constructed so that the air temperature in the bin or the surface temperature of any part of the floor or walls is below 50°C (122°F) .

6.2.11.2. Ash Storage Bins

(1) Every ash storage bin shall be constructed of *noncombustible* material and, where the bin is not covered, the ceiling of the room in which it is located shall be of *noncombustible* material.

(2) Every opening in an ash storage bin shall be protected by a tight-fitting metal door with metal frame securely fastened to the bin.

Section 6.3. Chimneys and Venting Equipment

6.3.1. General

6.3.1.1. Requirement for Venting

(1) Except as provided in Articles 6.3.1.2. and 6.3.1.3., the products of combustion from solid fuel-burning *appliances* shall be vented in conformance with the requirements in the applicable *appliance* installation standards listed in Article 6.2.1.5.

6.3.1.2. Masonry or Concrete Chimneys

(1) Rectangular *masonry or concrete chimneys* not more than 12 m in height shall conform to Part 9 if they serve *appliances* with a combined total rated heat output of 120 kW (410,000 Btu/h) or less, or that serve fireplaces.

(2) *Masonry or concrete chimneys* other than those described in Sentence (1) shall be designed and installed in conformance with the appropriate requirements in NFPA 211, "Standard for Chimneys, Fireplaces, Vents and Solid Fuel-Burning Appliances".

6.3.1.3. Metal Smoke Stacks

(1) Single wall metal smoke stacks shall be designed and installed in conformance with NFPA 211, "Standard for Chimneys, Fireplaces, Vents and Solid Fuel-Burning Appliances".

6.3.1.4. Reserved.

6.3.1.5. Access Ladders

(1) Access ladders for *chimneys*, when provided, shall consist of steel or bronze rungs, built into the walls of the *chimneys*.

(2) Rungs for external ladders shall begin at not less than 2 500 mm (8 ft 2 in) from ground level.