Notes to Part 6
Heating, Ventilating and Air-conditioning

A-6.2.1.1. Good Engineering Practice.

Building Pressurization

New buildings tend to be considerably more airtight than older ones. Consequently, these buildings may have a reduced pressurization requirement compared to the normal requirement in order to limit drafts and provide a reasonable level of comfort.

The humidification and relative pressurization of buildings and individual spaces in buildings can be significant factors in compromising the ongoing performance of the building envelope and other environmental separators.

In new construction, HVAC designers should take this issue into consideration and confer with those responsible for the design of the environmental separators so as to limit unintended effects on the environmental separators. In existing buildings, the ability of the environmental separators to resist or accommodate increases in pressure differential or moisture loading should be considered before changes are made to the HVAC system.

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HVAC designers should either develop a water management plan or complete a formal risk and hazard assessment to determine what measures are required for the control of legionella. The risk and hazard assessment should include inspections of the building and its surroundings to locate potential sources of legionella and to identify equipment or systems that could promote the growth and spread of legionella. The assessment should also evaluate the risk to building occupants that is associated with any identified equipment or systems, taking into account their design, location and operating conditions.

Further information on minimizing the growth and spread of legionella can be found in the following publications:

- ANSI/ASHRAE 188-2018, “Legionellosis: Risk Management for Building Water Systems,”
- “Developing a Water Management Program to Reduce Legionella Growth & Spread in Buildings” (U.S. Centers for Disease Control and Prevention, 2017),
- “Legionella and Legionnaires’ Disease: A Policy Overview” (European Agency for Safety and Health at Work, 2011),
- “Legionella and the Prevention of Legionellosis” (World Health Organization, 2007),
- “Legionnaires’ Disease: Technical Guidance: Part 1: The Control of Legionella Bacteria in Evaporative Cooling Systems, and Part 3: The Control of Legionella Bacteria in Other Risk Systems” (U.K. Health and Safety Executive, 2013), and
- “Recognition, Evaluation and Control of Legionella in Building Water Systems (Second Edition)” (American Industrial Hygiene Association, 2020). Rev. 12997

Radon Control

Measures may be necessary to reduce the radon concentration to a level below the guideline specified by Health Canada.

Further information on reducing the indoor concentration of radon can be found in the following Health Canada publications:

- “Guide for Radon Measurements in Public Buildings (Schools, Hospitals, Care Facilities, Detention Centres),” and
- “Radon: A Guide for Canadian Homeowners.”

A-6.2.1.2.(1) Outdoor Design Conditions. In the past, the practice of ventilating buildings with outdoor air assumed that the outdoor air was of better quality than the indoor air. It has become evident that the outdoor air in some areas of Canada may not be of an acceptable quality for ventilating buildings unless certain particles and gases are first removed or reduced. For particulate matter, the maximum acceptable level is the 98th percentile of the average 24 hour values; for ozone, the maximum acceptable level is the average of the average 8 hour values. A recent estimate suggests that many Canadians are exposed to contaminated outdoor air via buildings’ ventilation systems, which may lead to health problems such as cardiovascular and cerebral vascular diseases, respiratory irritation and illnesses, asthma, allergies, cancer, mucus membrane disorders and possibly death. Rev. 12630

In order to manage the air quality of a building’s indoor environment, thus reducing the potential for adverse effects on occupants’ health, the quality of outdoor air for building ventilation purposes must be addressed. The air pollutants for which standards have been developed are particulate matter and ground-level ozone. Health Canada sets limits on the maximum acceptable levels of these particles and gas that a building’s ventilation system should introduce directly to the indoor environment. These limits form part of the Canada-wide Standards for Particulate Matter (PM) and Ozone, which were established pursuant to the 1998 Canada-wide Accord on Environmental Harmonization of the Canadian Council of Ministers of the Environment (CCME) and its Canada-wide Environmental Standards Sub-Agreement. Information on related regulations is available from Environment Canada and the provincial/territorial ministries of the environment. A database of particle measurements for certain Canadian locations is available from the National Air Pollution Surveillance Network (NAPS), which is run by Environment Canada in conjunction with the provinces and territories. (See Subsection 1.3.2. for contact information for CCME, Environment Canada and NAPS.)

A-6.2.1.4. Structural Movement. This Article is intended to remind designers and installers of mechanical systems of one aspect of the "good engineering practice" referred to in Article 6.2.1.1.

In determining how to accommodate structural movement, there are two important principles to bear in mind:

- The prime concern of the Building By-law is the safety of people in and around the building, as opposed to protection of the mechanical systems and equipment.
- The nature of the accommodation will vary with the type of movement being considered, taking into account particularly how often the movement is likely to be encountered over the life of the building.

For example, a gas line supported on columns that also support a crane must be installed in such a way that the movement of the columns, which occurs many times daily, does not cause the lines to break, thus creating a hazard. Even if the gas line installation could somehow be designed to break in a non-hazardous manner, it would hardly be recognized as good engineering practice if movement that occurs so frequently could disrupt the operation of the mechanical system.

On the other hand, earthquakes occur far less frequently and it would not be surprising to have a non-critical mechanical system fail as a result of an earthquake. However, even in this situation, the failure must occur in a manner that does not create a hazard to building occupants. For example, heavy mechanical equipment should be properly anchored so that it does not topple on building occupants during an earthquake. The design of the anchors should take into account accelerations consistent with the seismic data given in Appendix C for the location of the building. Part 4 provides guidance on the calculation of the loads such equipment would exert on the building structure during an earthquake; these same loads can be used in designing the anchors.

Some mechanical equipment can be an important component of post-disaster life safety systems. In these cases, the measures needed to accommodate the movements caused by an earthquake become even more critical since failure of the equipment would not be acceptable.

Clearly, complying with this requirement will, in most cases, necessitate close coordination between the mechanical designer and the structural designer.

For additional information on the types of structural movement that may be encountered, see Article 4.1.3.5., Sentence 4.1.3.3.(2) and Subsection 4.1.8.

A-6.2.1.6.(1) Installation – General. Ducts or pipes without dampers or valves are generally not considered to constitute "equipment" and are therefore not subject to this requirement.

A-6.3.1.1.(4) Ventilation Air Supplied to Suites. The indirect supply of required outdoor ventilation air to normally occupied spaces through corridor pressurization or other indirect systems is not permitted.

A-6.3.1.2.(1) Ventilation and Venting of Crawl Spaces and Attic or Roof Spaces. The cross-reference to Part 5 pertains to unconditioned and unoccupied crawl spaces, and attic or roof spaces, which are effectively within the building envelope. That is, unconditioned and unoccupied attic or roof spaces are located between the roof deck and roofing above, and the insulation, air barrier system and vapour barrier below. Unconditioned and unoccupied crawl spaces are located between the ground cover below and the insulation, air barrier system and vapour barrier above. Venting of these spaces has implications for the performance of the building envelope rather than having direct effects on indoor conditions. The ventilation of conditioned or occupied crawl spaces and attic or roof spaces must comply with Part 6.

The requirements in Part 5 are stated in terms of loads that must be resisted rather than in terms of building elements. Thus, the By-law user will not find explicit references in Part 5 to crawl spaces, or attic or roof spaces. Part 5 makes reference to the need for venting environmental separators, i.e.,the dissipation of heat or moisture.

Sentence 6.3.1.2.(1) requires that crawl spaces be ventilated either by natural (above-grade only) or mechanical means. High moisture levels within the crawl space can lead to problems such as the formation of mould, lifting of flooring or long-term damage to structural components.

Crawl space ventilation cannot be expected to correct moisture-related problems caused by other factors like inadequate surface drainage from the foundation walls or improper protection against moisture from the ground. These conditions must be properly addressed so that crawl space ventilation can meet its intended objectives.

Several factors favour the use of mechanical ventilation rather than reliance on natural drafts. Local conditions, such as areas with high water tables, may dictate the need for mechanical ventilation to remove excessive moisture.

Crawl spaces should be maintained at a negative pressure relative to the conditioned area above to prevent the migration of moisture into occupied areas. This can be achieved through the use of an exhaust fan and relying on air transfer through floor penetrations, such as pipes.

A-6.3.1.4.(1) Storage Garages. Car dealership showrooms are not considered as storage garages.

A-6.3.1.4.(2) Ventilation of Storage Garages. Storage garages are ventilated to protect occupants from exposure to carbon monoxide and other vehicular exhaust fumes. In certain cases, such as small two- or three-bay storage garages that are used for occasional vehicle storage, and where occupants are not present, carbon monoxide or nitrogen dioxide monitoring devices may be omitted if the ventilation system is interlocked with a local light switch or other controls to ensure continuous system operation whenever the area is occupied. In any event, the ventilation system capacity must be designed to limit the concentrations of carbon monoxide or nitrogen dioxide at or below the prescribed values.

A-6.3.1.6. Indoor Air Contaminants.

Contaminants of Concern

Indoor air can contain complex mixtures of contaminants of concern such as formaldehyde, legionella, mould and emissions from building materials. While some contaminants may be knowingly introduced – as in the case of processing and manufacturing environments – others may be unintentionally released into indoor environments. “Industrial Ventilation: A Manual of Recommended Practice for Design,” published by the ACGIH, and the “Exposure Guidelines for Residential Indoor Air Quality,” published by Health Canada, are useful references on the control of contaminants in industrial workplace environments and residential settings, respectively. These and other guidelines and manuals should be interpreted while keeping in mind the settings and purposes for which they were developed compared to those to which they will be applied. Note that such documents do not necessarily consider the interactions between various contaminants.

Minimizing the Growth and Spread of Bio-contaminants

Bio-contaminants, such as bacteria, mould, mildew, fungi, viruses, and pollen, can thrive or be spread by sources like drain pans, spray-water air-washers, contaminated filters, poorly maintained cooling coils, water incursion into ductwork, high humidity and stagnant water, potentially causing a wide range of adverse health effects including respiratory allergic reactions, asthma, and diseases ranging from influenza to legionellosis. Rev. 12717

Some of the control measures are as follows:

a) Air-handling equipment should be accessible for the maintenance of filters, cooling coils and condensate drain pans located below the cooling coils. Access doors should be large and easy to open to facilitate thorough and regular maintenance.
b) If moisture is added to building ventilation air to maintain humidity levels in a designated range, humidifiers that inject steam or water vapour into central air-handling units or main supply ducts are normally used. Injection nozzles should not be located in air-handling unit plenums or ductwork that is insulated with internal fibrous lining. If the lining becomes wet, conditions conducive to the growth and spread of bio-contaminants will result.
c) HVAC systems that generate condensate or introduce liquid water into the airstream in the ducts require adequate drainage of excess water and, in some cases, a means of capturing air-entrained water droplets. These measures reduce the potential for bio-contaminants, including legionella, to proliferate in stagnant water and for water droplets containing bio-contaminants to be introduced into the airstream and contaminate the indoor environment. (See also Article 6.3.2.2.) Rev. 12717

The above only addresses features of an HVAC system that can help to minimize the growth and spread of bio-contaminants. Even more important than these features is a program of regular maintenance and cleaning of those portions of the system where such growth is likely to occur.

A-6.3.1.7.(2) Commercial Cooking Equipment. Refer to the City of Vancouver’s Kitchen Ventilation Guidelines for further information. Included is information on Design Considerations for Development Permit, Vancouver Coastal Health policy, checklists for inspections, and requirements for maintenance. This guideline is available on the City of Vancouver website.

A-6.3.1.7.(3) Commercial Cooking Equipment. The termination is also to be designed to the satisfaction of the Director of Planning. Where there is a canopy or awning, the discharge should be located above the canopy or awning. The exhaust and make-up air locations should be determined respectful of existing discharge, make-up air, operable window, and door locations of neighbouring properties.

In some cases, the Director of Planning may not approve exhaust or make-up air wall terminations on street frontages. Wall terminations should be located where they have the least impact on nearby properties, suites, amenity areas, the public realm, windows, and building design. Generally, roof terminations are preferred and wall terminations should be located in the lane.

A-6.3.1.7.(4) Ecologizers and Alternative Technologies. It is not the intention of the Article 6.3.1.7.(2) to prohibit technologies other than ecologizers. Other technologies that are capable of demonstrating an equivalent or better level of performance to devices listed to ULC-S647, "Standard for Exhaust Cleaning and Recirculation Assemblies for Commercial and Institutional Kitchen Exhaust Systems," may be permitted at the discretion of the Chief Building Official provided that an *acceptable* technical demonstration of performance has been provided as part of a building permit submission. Such devices must also comply with all applicable metro Vancouver regulations related to air emissions, odour, and low level ozone.

A-6.3.2.2. Stagnant Water in Drain Pans. It is important to eliminate stagnant water as it can promote the proliferation of disease-causing microorganisms, such as legionella. Rev. 12717

Of particular concern is the potential for legionella bacteria in water to become airborne in water droplets or mist that can be inhaled by humans or can contaminate other water sources or systems.

A-6.3.2.5. Duct Coverings and Linings. The TIAC "Mechanical Insulation Best Practices Guide" is a comprehensive source of information on the selection, installation and proper use of thermal insulation materials. (Note that Section 4 of this Guide is not included in the scope of this Note as it contains information on proprietary products, which are not within the mandate of the By-law.)

A-6.3.2.10.(5) and (6) Exhausting to Garages. A frequent practice in the design of ventilation systems serving buildings which have associated parking garages is to discharge exhaust air from the building to the garage in order to reduce the cost of heating the garage or reduce the length of the exhaust ducts. However, this practice entails a certain amount of risk since, when the exhaust system is not running, stack effect may turn the exhaust outlets into intakes and exhaust fumes (including carbon monoxide) can be drawn from the garage into the building. Incorporating a backdraft damper at the exhaust outlet provides some additional protection but backdraft dampers are generally not regarded as being very reliable. Therefore this practice is only permitted in very limited circumstances.

A-6.3.2.10.(6)(b) Air Contaminants. For the purpose of Clause 6.3.2.10.(6)(b), washroom exhaust air is not considered to contain contaminants that would adversely affect the air quality in the storage garage.

A-6.3.2.10.(7) and (8) Exhaust Ducts Connected to Laundry-Drying Equipment. Clothes dryers are a major cause of fires in buildings often due to a build-up of lint in the system, which then ignites or obstructs the venting or ventilation. Proper cleaning and regular maintenance of lint traps is directly proportional to the ease of access to the lint traps. It is therefore important to ensure that lint traps in multiple installations of laundry-drying equipment are installed in such a way as to allow easy access for inspection, maintenance, repair and cleaning.

A-6.3.2.10.(12)(b) Operation Diversity Factor. The operation diversity factor has to be assessed for each specific application. Good engineering practice (See Article 6.2.1.1.) design guidelines can provide information on the subject. Figure A-6.3.2.10.(12)(b), which originates from ASHRAE handbooks, provides an example of factors that can be used for general applications.

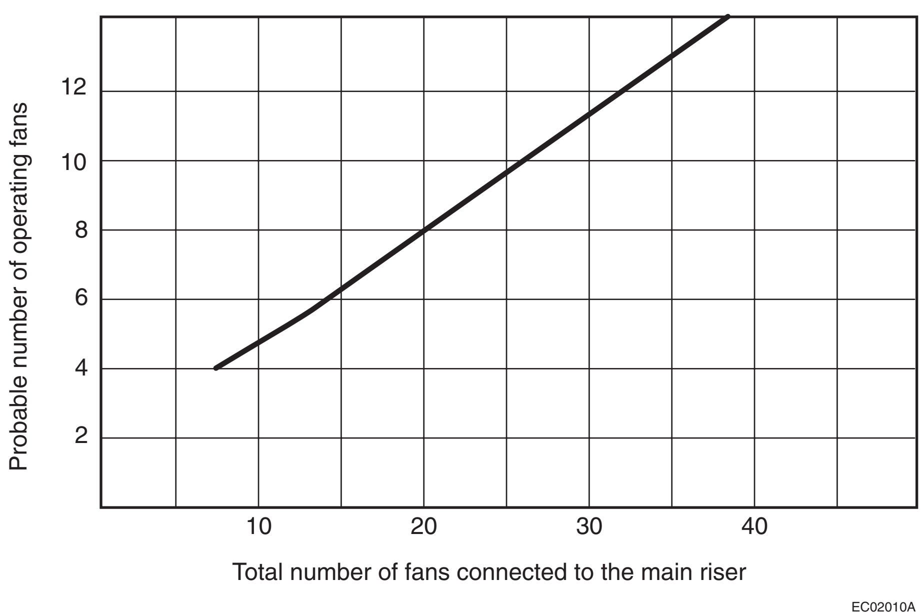

Figure A-6.3.2.10.(12)(b)
Operation diversity factor

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A-6.3.2.15.(6) and (7) Minimum Distances. Ensuring adequate distance between the air discharge locations of evaporative heat rejection systems and certain outdoor spaces and building components minimizes the potential for contamination of the air of occupiable spaces. For example, if a building's ventilation air intake were located too close to an air discharge location of an evaporative heat rejection system, warm discharge air and associated drift, which could contain biological contaminants, could be introduced to the indoor environment through the air intake.

The minimum distances stated in Sentences 6.3.2.15.(6) and (7) may need to be increased where warranted by local conditions such as prevailing winds, adjacent structures, or special processes being carried out, any of which would make further analysis necessary. (See also Sentence 6.3.3.1.(2).)

A-6.3.2.15.(11) Assessment of System and Make-up Water. The chemical characteristics of the water in the evaporative heat rejection system and of the make-up water should be assessed to select a suitable water treatment system.

A-6.3.2.16.(2) Prevention of Water Stagnation. Common strategies to prevent water stagnation include flushing, providing an inactivity drain, and periodic activation even with no load.

A-6.3.3.1.(2) Requirement for Venting. Sentence 6.3.3.1.(2) requires that vented products of combustion from appliances be discharged a minimum distance away from certain outdoor spaces and building components in cases where the vented products could contaminate the air of occupiable spaces. These minimum distances may need to be increased due to local conditions such as prevailing winds, adjacent structures, special processes being carried out, specific contaminants or effluent discharges, all of which would require further analysis.

"Occupiable outdoor spaces" refers to areas that could be occupied for a duration of more than fifteen minutes at any time, but does not include maintenance spaces. Occupiable outdoor spaces are located adjacent to an indoor space and are considered to be an extension of this indoor space: e.g. main entries, balconies, patios, decks, green roofs and other public assembly areas. Although sidewalks and driveways are mentioned in the provision, these areas are not considered as occupiable outdoor spaces since they are used as transport routes to and from the building, and people are not expected to remain there for extended periods of time.

The requirements of Sentence 6.3.3.1.(2) are not meant to override similar requirements found in the installation standards referenced in Article6.2.1.5. that address identical situations.

A-6.5.1.1.(3) Temperature of Exposed Piping. Normally piping carrying steam or high-temperature hot water at pressures above atmospheric (corresponding temperature 100°C or above) will be insulated to reduce heat losses as an economy measure. Abovea temperature of approximately 70°C, however, a bare pipe can cause a burn to human flesh coming in contact with the pipe. If pipes above this temperature are normally out of reach of all persons other than maintenance personnel or are properly guarded, it would be expected that no insulation would be needed for public safety.

A-6.9.1.2.(1) NFPA Publications Pertaining to the Heating, Ventilating and Air-Conditioning of Spaces Containing Hazardous Gases, Dusts or Liquids.

NFPA 30, "Flammable and Combustible Liquids Code"

NFPA 30A, "Motor Fuel Dispensing Facilities and Repair Garages"

NFPA 32, "Drycleaning Plants"

NFPA 33, "Spray Application Using Flammable or Combustible Materials"

NFPA 34, "Dipping, Coating, and Printing Processes Using Flammable or Combustible Liquids"

NFPA 35, "Manufacture of Organic Coatings"

NFPA 36, "Solvent Extraction Plants"

NFPA 40, "Storage and Handling of Cellulose Nitrate Film"

NFPA 51, "Design and Installation of Oxygen-Fuel Gas Systems for Welding, Cutting, and Allied Processes"

NFPA 51A, "Acetylene Cylinder Charging Plants"

NFPA 55, "Compressed Gases and Cryogenic Fluids Code"

NFPA 61, "Prevention of Fires and Dust Explosions in Agricultural and Food Processing Facilities"

NFPA 68, "Explosion Protection by Deflagration Venting"

NFPA 69, "Explosion Prevention Systems"

NFPA 85, "Boiler and Combustion Systems Hazards Code"

NFPA 86, “Ovens and Furnaces”

NFPA 88A, “Parking Structures”

NFPA 91, “Exhaust Systems for Air Conveying of Vapors, Gases, Mists, and Noncombustible Particulate Solids”

NFPA 96, “Ventilation Control and Fire Protection of Commercial Cooking Operations”

NFPA 204, “Smoke and Heat Venting”

NFPA 303, “Marinas and Boatyards”

NFPA 307, “Construction and Fire Protection of Marine Terminals, Piers, and Wharves”

NFPA 409, “Aircraft Hangars”

NFPA 415, “Airport Terminal Buildings, Fueling Ramp Drainage, and Loading Walkways”

NFPA 484, “Combustible Metals”

NFPA 654, “Prevention of Fire and Dust Explosions from the Manufacturing, Processing, and Handling of Combustible Particulate Solids”

NFPA 655, “Prevention of Sulfur Fires and Explosions”

NFPA 664, “Prevention of Fires and Explosions in Wood Processing and Woodworking Facilities”

NFPA “Fire Protection Guide to Hazardous Materials”

A-6.9.3.1.(2)(c) Carbon Monoxide Alarms. Battery-powered carbon monoxide alarms are acceptable provided that they are installed as recommended by the manufacturer. Rev. 12630

A-6.9.3.1.(6) Carbon Monoxide Devices. Although the scope of CAN/CSA-6.19, “Residential Carbon Monoxide Alarming Devices,” and UL 2034, “Standard for Single and Multiple Station Carbon Monoxide Alarms,” is limited to carbon monoxide alarms for residential applications, their use may be appropriate in some other locations where they are not subject to excessive contaminants or risk of damage, such as in classrooms and meeting spaces. The designer is also given the option to follow good engineering practice. For example, some carbon monoxide devices used in storage garages may be suitable for use in other applications.

A-6.9.3.1.(7) Spaces Served by a Fuel-Burning Appliance. Where a fuel-burning appliance such as a furnace circulates or distributes air to a space there is the potential for leakage of combustion products into the duct system which could then circulate combustion products including carbon monoxide (CO) to that space, so a CO alarm is required to protect occupants of that space. Fuel-burning appliances such as a boiler do not have the same potential of the system circulating or distributing CO to the spaces served via the piping system. In both examples of a fuel-burning furnace and a fuel-burning boiler, a CO alarm is required in the service room containing the appliances.

A-6.9.3.1.(8) Adjacent Suites. Suites that share a common attic or crawl space with a storage garage or service room, as well as suites that share a common wall or floor/ceiling assembly with a storage garage or service room are considered adjacent for the application of Sentence (8).