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Public Works and Government Services Canada

MD 15000 – 2012

Mechanical Environmental Standard for Federal Office Buildings

Standard for Building Owners, Design Professionals and Maintenance Personnel

December 2012



Mechanical and Electrical Engineering

Advisory and Practices (Professional Services) Directorate
Professional and Technical Service Management
Real Property Branch
Public Works and Government Services Canada
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Public Information

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Public Works and Government Services, Canada is pleased to present the Mechanical Design Standard document *MD 15000 – 2012 Mechanical Environmental Standard for Federal Office Buildings*. This is a revision of the earlier document *MD15000 Environmental Standard for Office Accommodation*, which was published in November 1994.

The objective of this document is to provide the minimum mechanical design and operating requirements related to temperature, relative humidity, ventilation, and acoustics for new and existing Crown-owned federal office buildings. This standard does not apply to leased buildings.

The document was developed by Mechanical and Electrical Engineering, Advisory and Practices (Professional Services) (APPS) Directorate, Professional and Technical Service Management (PTSM), Real Property Branch (RPB), Public Works and Government Services Canada (PWGSC), in consultation with specialists and engineering professionals in the regions.

Clients, building owners, property managers, design professionals, engineers and maintenance personnel must become familiar with this document and apply this standard in a consistent manner for federal projects throughout Canada.

This document is available in electronic format from the PWGSC RPB Publication's website at www.tpsgc-pwgsc.gc.ca/biens-property/publications-eng.html.

Le ministère des Travaux publics et Services gouvernementaux Canada a le plaisir de vous présenter la norme de conception mécanique *IM 15000 – Norme environnementale de mécanique concernant les immeubles à bureaux fédéraux* (2012). Il s'agit d'une révision du document *IM 15000 – Norme sur l'environnement intérieur des locaux à bureaux*, publié en novembre 1994.

Le présent document a pour objectif de fournir les exigences minimales de conception mécanique et d'exploitation relatives à la température, à l'humidité relative, à la ventilation et à l'acoustique pour les immeubles à bureaux fédéraux neufs et existants. La présente norme ne s'applique pas aux immeubles loués.

Ce document a été élaboré par le Groupe du Génie mécanique et électrique, Conseils et pratiques (Services professionnels) [CPSP], la Gestion des services professionnels et techniques (GSPT), la Direction générale des biens immobiliers (DGBI) et Travaux publics et Services gouvernementaux Canada (TPSGC), avec la collaboration des spécialistes et des ingénieurs des régions.

Les clients, les propriétaires de bâtiments, les gestionnaires immobiliers, les professionnels de la conception, les ingénieurs et le personnel d'entretien doivent bien connaître ce document et être en mesure d'appliquer cette norme de manière uniforme pour les projets fédéraux au Canada.

Le présent document est disponible sur le site de publications de la DGBI de TPSGC à l'adresse www.tpsgc-pwgsc.gc.ca/biens-property/publications-fra.html.

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Preface

General

This document has been developed by the Mechanical and Electrical Engineering (M&E) group within Advisory and Practices (Professional Services) (APPS), Professional and Technical Service Management (PTSM), Real Property Branch (RPB), Public Works and Government Services Canada (PWGSC) in consultation with engineers and technical specialists from the regions.

Intended Audience

Clients, building owners, property managers, design professionals, engineers and maintenance personnel must become familiar with this document and apply this standard in a consistent manner for federal projects throughout Canada.

Feedback

Comments, additional information and suggestions for changes, corrections or recommendations that will improve this document are invited. For this purpose the attached form entitled “Request for Changes” may be used and sent by e- mail, regular mail or by fax to the address shown.

Conflicts

Any conflict between this document and the Terms of Reference, Project Brief, Request for Proposal (RFP) or other project documents shall be brought to the attention of the project manager for clarification, as soon as it is noted.

Background

MD 15000 was first published by the former Public Works Canada (now PWGSC) in 1977. Its first edition reflected many of the requirements of American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) Standard 62-1973 *Ventilation for Acceptable Indoor Air Quality*.

It was revised in 1984 to include requirements from ASHRAE Standard 55-1981 *Thermal Environmental Conditions for Human Occupancy*. An explanatory supplement (MD 15000S) was issued in 1985 which also included a glossary of terms used in the standard.

It was revised in 1994 to include updated requirements from ASHRAE Standard 55-1992 *Thermal Environmental Conditions for Human Occupancy* and ASHRAE Standard 62-1989 *Ventilation for Acceptable Indoor Air Quality*. The revised edition also combined documents MD 15000 and MD 15000S into one document.

With the current edition of MD 15000, the title of the document has changed to “Mechanical Environmental Standard for Federal Office Buildings,” and technical changes within the document reflect the updated requirements of the following American National Standards Institute (ANSI)/ASHRAE standards:

- ANSI/ASHRAE Standard 62-2001 *Ventilation for Acceptable Indoor Air Quality*
- ANSI/ASHRAE Standard 62.1-2010 *Ventilation for Acceptable Indoor Air Quality*
- ANSI/ASHRAE Standard 55-2010 *Thermal Environmental Conditions for Human Occupancy*

Acknowledgments

We acknowledge the valuable inputs from technical professionals from the national Headquarters and from the Regions of the Real Property Branch, who took time to review and comment on this document.

MD 15000 – 2012
Mechanical Environmental Standard for Federal Office Buildings
REQUEST FOR CHANGES

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Table of Contents

Chapter 1: Introduction	10
1.1. Purpose	10
1.2. Scope	10
1.3. Definitions	12
1.4. Acronyms and Abbreviations	13
Chapter 2: Temperature	15
2.1. Design and Operation for Occupant Comfort	15
2.2. Operating Temperature Range	15
2.3. Outdoor Design Temperature	15
2.4. Indoor Design Temperature	16
2.5. Areas That Do Not Require Cooling	16
Chapter 3: Relative Humidity	17
3.1. Building Relative Humidity Operating Limits	17
3.2. Building Relative Humidity Modulation	17
3.3. Areas Requiring Special Relative Humidity Consideration	17
Chapter 4: Ventilation	19
4.1. Minimum Outdoor Air Ventilation Rate	19
4.2. Demand Controlled Ventilation	19
4.3. Outdoor Air Volume in Excess of Minimum Requirements	19
4.4. Outdoor Air Intakes and Exhausts	19
4.5. Measurement of Outdoor Air Flow Rate	20
4.6. Building Flushing	20
4.7. Quality of Outside Air	20
4.8. Filtration	21
4.9. Indoor Air Contaminant Control	21
Chapter 5: Acoustics	22
5.1. Acceptable Acoustical Environment	22
5.2. Acoustic Testing	22
5.3. Vibration Isolation	23
Appendix A: Impact of Glazing Type on Maximum Building Relative Humidity	A-1
Appendix B: Quality of Indoor Air	B-1
Appendix C: Mechanical Design Criteria Form	C-1

Bibliography

List of Tables

Table 1-1: Applicability of Sections	11
Table 2-1: Indoor Design Temperatures	16
Table 2-2: Areas That Do Not Require Cooling	16
Table 3-1: Building Relative Humidity Limits	17
Table 3-2: Areas That Require Special Relative Humidity Consideration	17
Table 4-1: Minimum Filtration Requirements	21
Table 5-1: Maximum Mechanical Noise	22
Table 5-2: Human Comfort Vibration Criteria	23

Chapter 1: Introduction

1.1. Purpose

This document provides the minimum mechanical design and operating requirements related to mechanical environmental conditions in Public Works and Government Services Canada (PWGSC) federal office buildings. It sets out the mechanical requirements for temperature, *relative humidity*, *ventilation*, and acoustics. This standard is intended for use in new and existing Crown-owned federal office buildings; and it does not apply to leased buildings.

1.2. Scope

The target audiences for this document are property managers, engineers, designers, installers, maintenance personnel, and property owners.

This document supports the Project Brief and/or the Request for Proposal (RFP), if available, as these are the primary reference documents for each project.

In this document, the word “shall” is used to express a requirement that the user must satisfy in order to comply with this standard, and the word “should” is used to express a recommendation that is advised for the designer but is not a requirement for compliance with this standard.

Unless noted otherwise in this document, the ventilation system(s) within federal office buildings shall be designed, constructed, and operated in accordance with the requirements of the latest versions of the following documents:

- ASHRAE Standard 62.1 *Ventilation for Acceptable Indoor Air Quality*
- ASHRAE Standard 55 *Thermal Environmental Conditions for Human Occupancy*
- National Building Code of Canada
- National Joint Council *Occupational Health and Safety Directive*
- Treasury Board of Canada *Occupational Safety and Health Policy*

Where this standard conflicts with the requirements of applicable legislation or regulations, the most stringent requirement shall take precedence.

The “Mechanical Design Criteria” form found in Appendix C shall be completed, submitted, and approved during the conceptual design phase of the project and again at the completion of design. The final version of the form shall also be included in the operation and maintenance manuals upon the completion of the project.

Refer to Table 1-1 for the applicability of each section of this standard for your project.

Table 1-1: Applicability of Sections

Section Number	Section Name	New Buildings	Existing Buildings		
			Major Renovation	Minor Renovation	No Renovation
2.1	Design and Operation for Occupant Comfort	M	M	G	G
2.2	Operating Temperature Range	M	M	M	M
2.3	Outdoor Design Temperature	M	M	G	G
2.4	Indoor Design Temperature	M	M	G	G
2.5	Areas That Do Not Require Cooling	M	M	G	G
3.1	Building Relative Humidity Operating Limits	M	M	M	M
3.2	Building Relative Humidity Modulation	M	M	M	M
3.3	Areas Requiring Special Relative Humidity Consideration	M	M	M	M
4.1	Minimum Outdoor Air Ventilation Rate	M	M	G	G
4.2	Demand-Controlled Ventilation	M	M	G	G
4.3	Outdoor Air Volume in Excess of Minimum Requirements	M	M	G	G
4.4	Outdoor Air Intakes and Exhausts	M	M	G	G
4.5	Measurement of Outside Air Flow Rate	M	M	G	G
4.6	Building Flushing	M	M	M	M
4.7	Quality of Outside Air	M	M	G	G
4.8	Filtration	M	M	M	M
4.9	Indoor Air Contaminant Control	M	M	G	G
5.1	Acceptable Acoustical Environment	M	M	G	G
5.2	Acoustic Testing	G	G	G	G
5.3	Vibration Isolation	M	M	G	G
Appendix A	Impact of Glazing Type on Maximum Building Relative Humidity	G	G	G	G
Appendix B	Quality of Indoor Air	G	G	G	G
Appendix C	Mechanical Design Criteria Form	M	M	M	G

Notes:

M – Mandatory: Required for compliance to MD-150000-2012.

G – Guideline: Required for compliance to MD-15000-2012 when there is no additional cost to implement, and the performance of the building is not adversely affected, or when the section relates to a component being replaced by a renovation. Otherwise section compliance is optional.

Major Renovation: Includes the following: Major mechanical equipment replacement or refurbishment; Change in use of the space.

Minor Renovation: Includes the following: No change in use of the space; Major mechanical equipment are not affected or replaced. Existing space level mechanical equipment is primarily re-used.

1.3. Definitions

<u>Air Speed:</u>	The rate of air movement at a point, without regard to direction.
<u>Breathing Zone:</u>	The region within an <i>occupied space</i> between planes 75mm and 1,800 mm above the floor and more than 600 mm from the walls or fixed air-conditioning equipment.
<u>Concentration:</u>	The quantity of one constituent dispersed in a defined amount of another.
<u>Contaminant:</u>	An unwanted airborne constituent that may reduce acceptability of the air.
<u>Demand-Controlled Ventilation:</u>	Any means by which the <i>breathing zone outdoor air</i> flow can be varied to the <i>occupied space</i> or spaces based on the actual or estimated number of occupants and/or <i>ventilation</i> requirements of the occupied zone.
<u>Exfiltration:</u>	Uncontrolled outward air leakage from conditioned spaces, through unintentional openings in ceilings, floors, and walls, to unconditioned spaces or the outdoors, caused by pressure differences across these openings due to wind, inside-outside temperature differences (stack effect), and imbalances between supply and exhaust airflow rates
<u>Filters:</u>	A device used to remove suspended particles from an air stream.
<u>Indoor Air:</u>	The air in an enclosed occupiable space.
<u>Indoor Design Temperature:</u>	The indoor dry bulb space set point temperature used for the sizing and selection of mechanical equipment.
<u>Infiltration:</u>	Uncontrolled inward air leakage from unconditioned spaces or the outdoors to conditioned spaces through unintentional openings in ceilings, floors, and walls, caused by the same pressure differences that induce <i>exfiltration</i> .
<u>Mechanical Ventilation:</u>	<i>Ventilation</i> provided by mechanically powered equipment, such as motor-driven fans and blowers, but not by devices such as wind-driven turbine ventilators and mechanically operated windows.
<u>Natural Ventilation:</u>	<i>Ventilation</i> provided by thermal, wind, or diffusion effects through doors, windows, or other intentional openings in a building.
<u>Normal Operating Conditions:</u>	The time period during which a building's mechanical systems are functional and the building is not subjected to

	outdoor weather conditions in excess of the temperatures prescribed by Section 2.2.
<u>Operating Temperature Range:</u>	The dry bulb temperature range in which an indoor space is allowed to fluctuate within a federal office building.
<u>Occupied Space:</u>	An enclosed space intended for human activities, excluding those spaces that are intended primarily for other purposes, such as storage rooms and equipment rooms that are only occupied occasionally, and for short periods of time.
<u>Operative Temperature:</u>	The uniform temperature of an imaginary black enclosure in which an occupant would exchange the same amount of heat by radiation plus convection as in the actual non-uniform environment.
<u>Outdoor Air:</u>	Ambient air that enters a building through a ventilation system, either through intentional openings for <i>natural ventilation</i> or by <i>infiltration</i> .
<u>Relative Humidity:</u>	The ratio of the partial pressure (or density) of water vapour in the air to the saturation pressure (or density) of water vapour at the same temperature and the same total pressure.
<u>Ventilation:</u>	The process of supplying air to or removing air from a space for the purpose of controlling air <i>contaminant</i> levels, humidity, or temperature within a space.

1.4. Acronyms and Abbreviations

μg	<i>Micrograms</i>
AFD	<i>Alternate Form of Delivery</i>
AMCA	<i>Air Movement and Control Association International</i>
ANSI	<i>American National Standards Institute</i>
APPS	<i>Advisory and Practices Professional Services</i>
ASHRAE	<i>American Society of Heating, Refrigerating and Air Conditioning Engineers</i>
Bq	<i>Becquerel</i>
CO	<i>Carbon Monoxide</i>
CEPA	<i>Canadian Environmental Protection Act</i>
DB	<i>Dry Bulb</i>
HVAC	<i>Heating, Ventilation and Air-Conditioning</i>
L	<i>Litres</i>

<i>NAAQO</i>	<i>National Ambient Air Quality Objectives</i>
<i>NBC</i>	<i>National Building Code</i>
<i>NC</i>	<i>Noise Criteria</i>
<i>NJC</i>	<i>National Joint Council</i>
<i>NO</i>	<i>Nitrogen oxide</i>
<i>m</i>	<i>Meter</i>
<i>MERV</i>	<i>Minimum Efficiency Reporting Value</i>
<i>mg</i>	<i>Milligrams</i>
<i>PM</i>	<i>Particulate Mater</i>
<i>PPM</i>	<i>Parts per Million</i>
<i>PTSM</i>	<i>Professional and Technical Service Management</i>
<i>PWGSC</i>	<i>Public Works and Government Services Canada</i>
<i>RC</i>	<i>Room Criteria</i>
<i>RH</i>	<i>Relative Humidity</i>
<i>RFP</i>	<i>Request for Proposal</i>
<i>RPB</i>	<i>Real Property Branch</i>
<i>s</i>	<i>Seconds</i>
<i>TVOC</i>	<i>Total Volatile Organic Compounds</i>
<i>VOC</i>	<i>Volatile Organic Compounds</i>
<i>WB</i>	<i>Wet bulb</i>

Chapter 2: Temperature

2.1. Design and Operation for Occupant Comfort

Federal office buildings shall be designed and operated to meet the requirements of ANSI/ASHRAE Standard 55- *Thermal Environmental Conditions for Human Occupancy*.

2.2. Operating Temperature Range

The *operating temperature range* for normally occupied areas in federal office buildings shall respect the requirements of the National Joint Council *Occupation Health and Safety Directive*.

1. The *operating temperature range* should be a dry bulb temperature between 20 °C and 26 °C as measured at the desktop level where the majority of normal duties are carried out.
2. Operation of *occupied spaces* outside of the acceptable *operating temperature range* shall only be permitted:
 - a. In circumstances outside the direct control of building operations, such as:
 - i. Weather extremes.
 - ii. Equipment failure.

2.3. Outdoor Design Temperature

The minimum outdoor design criteria shall be based on either the weather data tabulated in the latest editions of the National Building Code and its supplements, or in the ASHRAE Handbook—Fundamentals volume, whichever is more stringent. Regional building codes that have more stringent requirements should be followed where appropriate.

1. When using ASHRAE:
 - a. Winter design conditions shall be, at a maximum, based on the 99.6% column dry bulb temperature.
 - b. Summer design conditions for sensible heat load calculation shall be, at a minimum, based on the 0.4% dry bulb temperature with its mean coincident wet bulb temperature.
2. When using the National Building Code:
 - a. Winter design conditions shall be, at a maximum, based on the 2.5% column temperature.
 - b. Summer design conditions for sensible heat load calculations shall be, at a minimum, based on the 2.5% dry bulb temperature.
3. Take into account local conditions, which may differ from the conditions at the nearest weather reporting station.

2.4. Indoor Design Temperature

The *indoor design temperatures* for spaces in federal office buildings shall be in accordance with the set point temperature requirements specified in Table 2-1 and are to be maintained from 150 mm to 1,800 mm above the floor.

Table 2-1: Indoor Design Temperatures

Area	Summer DB ² (°C)	Winter DB ² (°C)
Office Space ¹ (Occupied) (Unoccupied)	24 System OFF	22 18
Conference Room ¹	24	22
Corridor ¹	24	22
Lobby ¹	24	22
Cafeteria ¹	24	22
Auditorium ¹	24	22
Washroom	24	22
Entry Vestibule	-	18
Stairwell	-	18
Storage Room	30 (maximum)	18
Loading Area	-	10 (minimum)
Mechanical Room	35 (maximum)	12 (minimum)
Electrical Room	26	13
Server Room	Shall meet the requirements of MD 15116 - <i>Computer Room Air-conditioning Systems</i>	Shall meet the requirements of MD 15116 - <i>Computer Room Air-conditioning Systems</i>

Notes:

1. The set point temperatures listed refer to dry bulb (DB) temperatures when the *air speed* is less than 0.2 m/s and the thermal radiant and convective exchange between the occupants and surrounding environment is negligible. Otherwise, the set point temperatures listed refer to *operative temperatures*.
2. Spaces shall be maintained within +2 /-1°C (summer) and +1 /-2°C (winter) of the temperature listed in Table 2-1

2.5. Areas That Do Not Require Cooling

The areas within federal office buildings specified in Table 2-2 do not require cooling unless they are normally occupied, or if the Project Brief and/or RFP specifically state a requirement for cooling:

Table 2-2: Areas That Do Not Require Cooling

Areas		
Entry vestibule	Loading areas	Maintenance/workshop areas
Washrooms	Mechanical rooms	Shipping/receiving areas
Storage areas	Parking garages	Service entrances and exits

Chapter 3: Relative Humidity

3.1. Building Relative Humidity Operating Limits

The summer and winter *relative humidity* limits for federal office buildings are specified in Table 3-1.

Table 3-1: Building Relative Humidity Limits

Season	Acceptable Relative Humidity (RH) Limit
Summer	Maximum 60%
Winter	30% ± 5%

1. A building shall normally be operated at a *relative humidity* between 25% and 60%. When a building cannot be operated within this *relative humidity* range:
 - a. The client representative for the building occupants shall be notified of:
 - i. The deficiency.
 - ii. The possible health consequences associated with occupying a space outside of this range.
2. Under *normal operating conditions*,
 - a. A building shall not be permitted to operate at a *relative humidity* that causes condensation on or within any component of the building's envelope, unless:
 - i. A building envelope component is specifically designed to manage condensation.

3.2. Building Relative Humidity Modulation

The *relative humidity* set point inside a federal office building shall be modulated throughout the year to meet the requirements specified in Section 3.1.

3.3. Areas Requiring Special Relative Humidity Consideration

Spaces and elements within federal office buildings that require special consideration with respect to *relative humidity* include, but are not limited to those specified in Table 3-2.

Table 3-2: Areas That Require Special Relative Humidity Consideration

Areas		
Computer rooms	Printing rooms	Heritage elements
Kitchens	Special storage areas	Artwork

1. The *relative humidity* in these spaces shall be maintained in accordance with their specific requirements.

-
2. If a building contains artwork, generally the *relative humidity* range specified in Section 3.1 shall be acceptable. However, the *relative humidity* requirements for specific pieces of artwork may fall outside this range. In these cases:
 - a. The acceptable *relative humidity* range for the artwork must be determined:
 - i. At the outset of a project.
 - ii. Considered during design and operation.
 - b. Special enclosures and equipment may be required to maintain acceptable humidity levels.
 3. Consult the Project Brief and/or RFP for any specified areas in addition to those specified in Table 3-2 that require special consideration with respect to *relative humidity*. The humidity requirements for these additional spaces shall be in accordance with:
 - a. The Project Brief and/or RFP.
 - b. Accepted industry standards and best practices.

Chapter 4: Ventilation

4.1. Minimum Outdoor Air Ventilation Rate

The minimum *outdoor air ventilation* rate required for each space within a federal office building shall be calculated based on one of the following procedures from ANSI/ASHRAE Standard 62.1 *Ventilation for Acceptable Indoor Air Quality*:

1. Ventilation Rate Procedure, but at a rate not less than 10 L/s per occupant.
2. Indoor Air Quality Procedure.
3. Natural Ventilation Procedure.

4.2. Demand Controlled Ventilation

A *demand-controlled ventilation* system shall be implemented wherever possible.

4.3. Outdoor Air Volume in Excess of Minimum Requirements

1. The amount of *outdoor air* introduced into a building may exceed the minimum value calculated in Section 4.1 under the following circumstances.
 - a. *Outdoor air* introduced for zone or building pressurization.
 - b. *Outdoor air* introduced to offset stack effect, *infiltration*, and *exfiltration*.
 - c. *Outdoor air* introduced for LEED® projects seeking to provide increased *ventilation*.
2. If the rate of *outdoor air ventilation* exceeds the minimum level required as set out in Section 4.1:
 - a. The reason shall be documented in:
 - i. The project design brief.
 - ii. The operation and maintenance manuals.

4.4. Outdoor Air Intakes and Exhausts

1. *Outdoor air* intakes and exhausts shall be designed in accordance with the requirements of ANSI/ASHRAE Standard 62.1 *Ventilation for Acceptable Indoor Air Quality*.
2. A threat assessment shall be done to establish the risks of contamination to air intakes.
 - a. Protection measures shall be located and provided for *outdoor air* intakes to address any issues identified in the threat assessment.

4.5. Measurement of Outdoor Air Flow Rate

Continuous measurement shall be undertaken of *outdoor air* flow rates introduced into the building.

1. The device(s) used to measure the *outdoor air* flow rate shall be:
 - a. Certified by the Air Movement and Control Association International (AMCA).
 - b. Located to provide consistent and accurate measurements.
 - c. Located to facilitate maintenance access.

4.6. Building Flushing

All buildings shall have *mechanical ventilation* systems capable of providing *outdoor air* to flush out all or part of the building.

1. The flush-out duration shall be based on:
 - a. The volume of *outdoor air* delivered to the space by the mechanical systems.
 - b. The volume of the space being flushed out.
 - c. The reason for the flush-out.
2. The flush-out shall be scheduled and staged such that:
 - a. The indoor temperature does not fall outside the acceptable range listed in Section 2.2.

4.7. Quality of Outside Air

Outdoor air is considered acceptable for introduction into a federal office building if it meets all requirements set out in ANSI/ASHRAE Standard 62.1 *Ventilation for Acceptable Indoor Air Quality* based on the evaluation methods defined in that standard. In addition:

1. The regional air quality shall be reviewed in relation to the National Ambient Air Quality Objectives (NAAQOs) developed by Environment Canada under the *Canadian Environmental Protection Act* (CEPA).
 - a. Form MD15000-F1 (in Appendix C of this document) shall be completed and submitted at:
 - i. The project's conceptual design stage.
 - ii. Design completion.
 - b. Additional analysis of the *outdoor air* shall be performed if:
 - i. Necessary or;
 - ii. Requested in the Project Brief and/or RFP.
2. If the *outdoor air* quality at a building location does not meet the minimum requirements set out in ANSI/ASHRAE 62.1, then corrective measures must be employed to improve the *outdoor air* quality to comply with that standard prior to introducing the *outdoor air* into the building.

4.8. Filtration

Filtration shall be provided in *mechanical ventilation* equipment that meets or exceeds the Minimum Efficiency Reporting Value (MERV) ratings specified in Table 4-1.

Table 4-1: Minimum Filtration Requirements

Building Type	Minimum Filtration Requirements
Existing Buildings	Lower-rated MERV <i>filters</i> should be changed to MERV 13 during routine maintenance whenever it is possible to do so without physical changes to the air handling unit layout, or changes to the fan motors/drives in order to accommodate the higher pressure drop across the new <i>filters</i> .
Existing Rooftop Units, Heat pumps, Terminal Units	Minimum MERV 8. MERV 8 <i>filters</i> should be changed to MERV 11 during routine maintenance whenever it is possible to do so without physical changes to the rooftop unit or changes to the fan motors/drives in order to accommodate the higher pressure drop across the new <i>filters</i> .
New Buildings Air Handling Units	MERV 8 pre <i>filters</i> MERV 13 final <i>filters</i>
New Rooftop Units	MERV 11
Computer Rooms (Not Normally Occupied)	Refer to MD 15116

4.9. Indoor Air Contaminant Control

Indoor air contaminants shall be controlled using the following steps:

1. Source Control:
 - a. Eliminate sources of contamination.
 - b. Reduce indoor emissions.
2. Ventilation:
 - a. Use a local exhaust ventilation system to:
 - i. Capture *contaminants* at or near the source.
 - ii. Exhaust *contaminants* outside.
 - b. Provide a supply of uncontaminated *outdoor air* to:
 - i. Reduce the *concentration* of *contaminants* in the *indoor air*.

Chapter 5: Acoustics

5.1. Acceptable Acoustical Environment

The maximum ambient noise permitted from mechanical equipment in federal office building spaces shall not exceed the more stringent of the following:

1. The Room Criteria (RC) and Noise Criteria (NC) ratings listed in Table 5-1.
2. The *ASHRAE Handbook— HVAC Applications volume*
3. Criteria listed in the Project Brief and/or RFP.

Table 5-1: Maximum Mechanical Noise

Space Usage	Maximum Mechanical Noise NC / RC(N)
Executive Office	25–30
Private Office	30–35
Open Plan Office	35–40
Conference, Meeting Room	25–30
Data Processing Facility	40–45
Training Room	25–30
Library	30–35
Hall, Corridor	35–40
Locker Room, Washroom	40–45
Cafeteria	40–45

Notes:

1. This table does not apply to noise generated by the occupants, equipment under the occupant's control, and/or the occupant's operations.

5.2. Acoustic Testing

Acoustic measurements of the space should be performed prior to occupancy to establish the RC rating of the space once the heating, ventilation, and air conditioning (HVAC) systems are operational and the space is fully furnished.

1. When performing acoustic measurements:
 - a. Use the RC method (ANSI Standard S12.2 *Criteria for Evaluating Room Noise*) to evaluate the background-noise acoustic profile of a space once construction is completed.

5.3. Vibration Isolation

Mechanical equipment, pipes and ducts shall be vibration-isolated as recommended by the *ASHRAE Handbook – HVAC Applications volume*.

1. The minimum acceptable criteria for vibration in a building structure due to the mechanical equipment shall be the curve listed in Table 5-2.

Table 5-2: Human Comfort Vibration Criteria

Areas	Time of Day	8 to 80Hz Curve (mm/s)
Office areas	All	0.406

Appendix A: Impact of Glazing Type on Maximum Building Relative Humidity

The type of glazing, or window, has an impact on the maximum *relative humidity* permissible in a building to avoid condensation on the glazing.

For a building operating at an indoor dry bulb temperature of 21 °C, the table below specifies the maximum *relative humidity* values permissible to avoid condensation on the glazing based on outdoor temperature, single-pane windows or double-pane sealed windows, and wind conditions.

This table should only be used as a general guideline. It is the responsibility of the designer and facility operator to verify the maximum *relative humidity* permissible to avoid condensation on a building's glazing.

Outdoor Temperature (°C)	Maximum Relative Humidity to Avoid Condensation on Glazing for a Building Operating at 21 °C Indoor Dry Bulb Temperature (%)			
	Single-Pane Windows		Double-Pane Sealed Windows	
	Wind	No Wind	Wind	No Wind
+20	24	41	53	61
0	12	27	41	49
-20	6	17	32	39
-40	2	10	23	31

Appendix B: Quality of Indoor Air

The table below sets out the guideline limits for a number of common sources of *indoor air contaminants*, and these limits should not be exceeded. For other *contaminants* where there are no available guidelines indicating guideline limits, all efforts should be made to avoid the *contaminants* and mitigate potential exposure. Where it is impossible to avoid the *contaminant*, it is advisable to keep *concentrations* as low as possible. Consult with the PWGSC Indoor Environmental Health Unit for specific *indoor air quality contaminant* limits, testing requirements and remedial action requirements.

Contaminant	Description / Sources	Guideline Limit
Particulates	Pollen, dust, smoke	PM_{10} – 150 $\mu\text{g}/\text{m}^3$, 24-hour average
		$PM_{2.5}$ – 35 $\mu\text{g}/\text{m}^3$, 24-hour average
Microbial Matter	Mould, bacteria	Less in quantity than and similar in species type to outdoor air sample
Carbon Dioxide	Respiration	800 ppm
Combustion By-products	Carbon monoxide, nitrogen oxides (NOx)	CO: 10 ppm, 24-hour average
		NO: 2.5 ppm NO ₂ : 0.3 ppm
Formaldehyde	Construction materials, furnishings, etc.	123 $\mu\text{g}/\text{m}^3$, 1-hour average
Volatile Organic Compounds (VOCs)	New building materials and furnishings, consumable products, maintenance materials	Total VOC (TVOC) – Action Limit: 5 mg/m^3 Target Value: 1 mg/m^3
Ozone	Photocopiers, air cleaners	40 $\mu\text{g}/\text{m}^3$, 8-hour average
Radon	Soil gas	200 Bq/m ²

Appendix C: Mechanical Design Criteria Form

1. The Prime Consultant/Designer shall provide the following forms:
 - a. A completed preliminary form MD15000-F1 at the design concept stage of the project.
 - b. A completed final form MD15000-F1 at the completion of design.
 - c. A copy of the completed final form to the contractor for inclusion in the operation and maintenance manual.
2. The completed forms are to be reviewed and signed by the following individuals:
 - a. Client representative.
 - b. PWGSC Project Manager.
 - c. AFD Project Manager (where applicable).
3. *Outdoor air* testing shall be performed to establish compliance with the guideline levels of the NAAQOs under one or both of the following conditions
 - a. *Outdoor air* testing is identified in the project RFP.
 - b. Section 2 (Outdoor Air Quality Observations) of the form MD15000-F1 concludes that there are risks associated with the quality of the *outdoor air* at the project location and recommends further air testing.

Mechanical Design Criteria		Form: MD15000-F1
Critères de conception mécanique		Formulaire: IM 15000-F1
		Page 1 of/de 4
Section 1: Project Information / Données sur le projet		
Project Title / Titre du projet:		
Project Location / Emplacement du projet:		
Project Description / Description du projet:		
Section 2: Outdoor Air Quality Observations / Observations de la qualité de l'air extérieur		
(Attach supplemental sheet(s) as required / Joindre des feuilles supplémentaires au besoin: Qty / nombre : ____)		
Regional Air Quality Meets NAAQO La qualité de l'air dans la région respecte les ONQAA:	YES / OUI NO / NON	If No, List Contaminants of Concern: / Si non, indiquer les contaminants préoccupants :
Site Description / Description de l'emplacement: (Include facilities on-site and adjoining properties / Inclut les installations de l'emplacement et des propriétés rattachées.)		
Date of Observation / Date de l'observation:		
Time of Observation / Heure de l'observation:		

Section 2 continued / suite		Form: MD15000-F1	
		Formulaire: IM 15000-F1	
		Page 2 of/de 4	
(Attach supplemental sheet(s) as required / Joindre des feuilles supplémentaires au besoin: Qty / nombre : ____)			
Observation of Contaminants On-Site and Adjoining Properties / Contaminants observés à l'emplacement et sur les propriétés rattachées:			
Odours / Odeurs:			
Irritants / Irritants:			
Visible Plumes / Panaches visibles:			
Visible Air Contaminants / Contaminants de l'air visibles:			
Vehicle Exhaust / Gaz d'échappement des véhicules :			
Other Potential Contaminants / Autres contaminants potentiels:			
Conclusions: (Acceptability of outdoor air for introduction into the building based on consideration of information from investigation / acceptabilité de l'air extérieur à introduire dans le bâtiment selon l'information provenant de l'enquête)			
Additional Outdoor Air Testing Recommended / Autres analyses de l'air extérieur recommandées:	YES/OUI	NO/NON	
Observations Taken By / Observations par:			
Company Name / Entreprise			
Name / Nom (Please print / caractères d'imprimerie)			
Signature			
Date			

Section 3: Mechanical Design Criteria / Critères de conception mécanique Form: MD15000-F1 Formulaire: IM 15000-F1 Page 3 of/de 4 (Attach supplemental sheet(s) as required / Joindre des feuilles supplémentaires au besoin: Qty / nombre :)						
Outdoor Design Conditions / Conditions extérieures nominales: <div style="text-align: right;"> Summer / Été Winter / Hiver </div>		db / BS (°C) db / BS (°C)		wb / BH (°C) wb / BH (°C)		rh / HR (%) rh / HR (%)
Indoor Design Conditions / Conditions intérieures nominales: <div style="text-align: right;"> Summer Occupied / Été (occupé) Summer Unoccupied / Été (inoccupé) Winter Occupied / Hiver (occupé) Winter Unoccupied / Hiver (inoccupé) </div>		db / BS (°C) db / BS (°C) db / BS (°C) db / BS (°C)		wb / BH (°C) wb / BH (°C) wb / BH (°C) wb / BH (°C)		rh / HR (%) rh / HR (%) rh / HR (%) rh / HR (%)
Mechanical System Designed to Comply With ANSI/ASHRAE Standard 55 / Le système mécanique a été conçu pour respecter la norme ANSI/ASHRAE 55: (Confirm conformance / Confirmer la conformité)	YES / OUI NO / NON		Comments / Commentaires:			
Mechanical System Designed to Comply With MD15000 Section 4.1 and ANSI/ASHRAE Standard 62.1 / Le système mécanique a été conçu pour respecter l'article 4.1 de la norme IM 15000 et la norme ANSI/ASHRAE 62.1: (Confirm conformance / Confirmer la conformité)	YES / OUI NO / NON		Comments / Commentaires:			
Method Used for Determining Minimum Outdoor Air Ventilation Rates / Procédure utilisée pour calculer les débits de ventilation d'air extérieur minimaux: (Circle method used / Encercler la méthode employée)	4.1 a) Ventilation Rate Procedure / Procédure sur le débit de ventilation	4.1 b) IAQ Procedure / Procédure sur la qualité de l'air intérieur	4.1 c) Natural Ventilation Procedure / Procédure sur la ventilation naturelle			
Outdoor Air Design Ventilation Rates/ Débits de ventilation d'air extérieur nominaux:	Space Category / Catégorie de local	(L/s/Occupant)	(L/s/m ²)			

Section 3: continued / suite		Form: MD15000-F1 Formulaire: IM 15000-F1 Page 4 of/de 4	
(Attach supplemental sheet(s) as required / Joindre des feuilles supplémentaires au besoin: Qty / nombre : _____)			
Filtration Media / Filtres:	System Type / Type de système	Filter MERV Rating / Cote MERV des filtres	
Mechanical Design Complies With Requirements of MD-15000 / La conception mécanique respecte les exigences de la norme IM 15000 (Confirm conformance / Confirmer la conformité)	YES / OUI	Comments / Commentaires:	
	NO / NON		
Mechanical Design Completed By / Conception mécanique par:			
Company / Entreprise			
Name / Nom (Please print / caractères d'imprimerie)			
Signature			
Date			
Section 4: Stakeholder Approval / Approbation des parties prenantes			
	Client Representative / Représentant du client	PWGSC Project Manager / Gestionnaire de projets de TPSGC	AFD Project Manager / Gestionnaire de projets AFPS (where applicable / le cas échéant)
Name / Nom (Please print / caractères d'imprimerie)			
Signature			
Date			

Bibliography

The reader shall review and coordinate with the requirements contained in the following related documents:

1. American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE). *ANSI/ASHRAE Standard 55 Thermal Environmental Conditions for Human Occupancy*. For more information: <http://www.ashrae.org/>
2. American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE). *ANSI/ASHRAE Standard 62.1 Ventilation for Acceptable Indoor Air Quality*. For more information: <http://www.ashrae.org>
3. American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE). *ANSI/ASHRAE Standard 62.1 User's Manual*. For more information: <http://www.ashrae.org/>
4. American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE). *ASHRAE Handbook—Fundamentals*. For more information: <http://www.ashrae.org/>
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6. Canadian Centre for Occupational Health and Safety. *Indoor Air Quality Health and Safety Guide*. 2nd ed., revised. 2004. For more information: <http://www.ccohs.ca>
7. Canadian Standards Association/CSA International. *CAN/CSA Z204-94 (R1999) Guideline for Managing Indoor Air Quality in Office Buildings*. 1994. Available online: <http://www.csa.ca/cm/ca/en/home>
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9. Department of Justice Canada. *Canada Labour Code, Part II Occupational Health and Safety*. Available online: <http://laws-lois.justice.gc.ca/eng/acts/L-2/>
10. Department of Justice Canada. *Canada Occupational Health and Safety Regulations*. Available online: <http://laws-lois.justice.gc.ca/eng/regulations/SOR-86-304/index.html>
11. Environment Canada. *Canadian Environmental Protection Act (CEPA)*. Available online: <http://www.ec.gc.ca/lcpe-cepa/default.asp?lang=En&n=26A03BFA-1>
12. Environment Canada. *National Ambient Air Quality Objectives (NAAQO)*. Available online: <http://www.ec.gc.ca/rnsps-naps/default.asp?lang=En&n=24441DC4-1>

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13. National Joint Council. *Occupation Health and Safety Directive Part II – Permanent Structures and Safe Occupancy of the Workplace (Use and Occupancy of Buildings)*. Available online: <http://www.njc-cnm.gc.ca/directive/index.php?sid=252&hl=1&lang=eng>
 14. National Research Council Canada. *Humidity in Canadian Buildings*. CBD-1. 1960. Available online: <http://www.nrc-cnrc.gc.ca/eng/ibp/irc/cbd/building-digest-1.html>
 15. National Research Council Canada. *Indoor Air Quality and Thermal Comfort in Open-Plan Offices*. Construction Technology Update No. 64. 2005. Available online <http://archive.nrc-cnrc.gc.ca/eng/ibp/irc/cbd/building-digest-1.html>
 16. National Research Council Canada. *Indoor Air Quality Guidelines and Standards*. 2005. Available online: <http://archive.nrc-cnrc.gc.ca/obj/irc/doc/pubs/rr/rr204/rr204.pdf>
 17. National Research Council Canada. National Building Code of Canada. Available Online: <http://www.nationalcodes.nrc.gc.ca/eng/nbc/index.shtml>

Unless a specific version of the document is listed, the most current version of the document should be consulted.