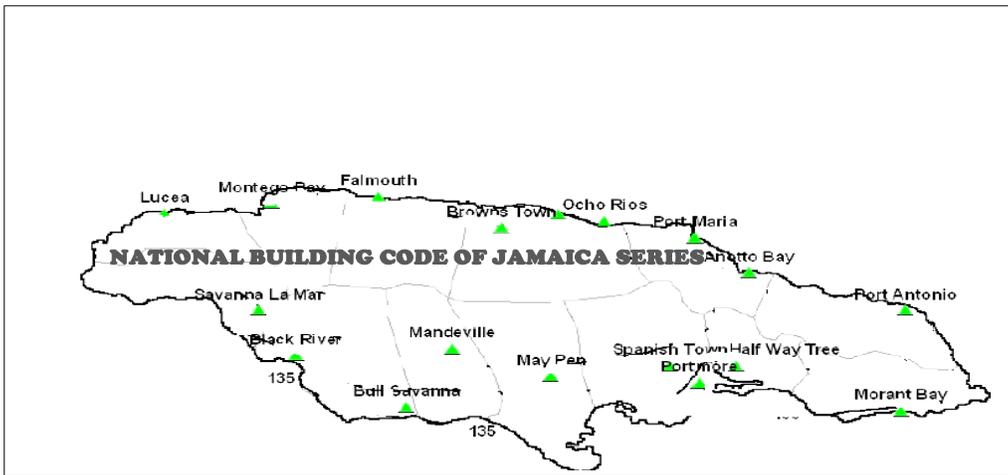




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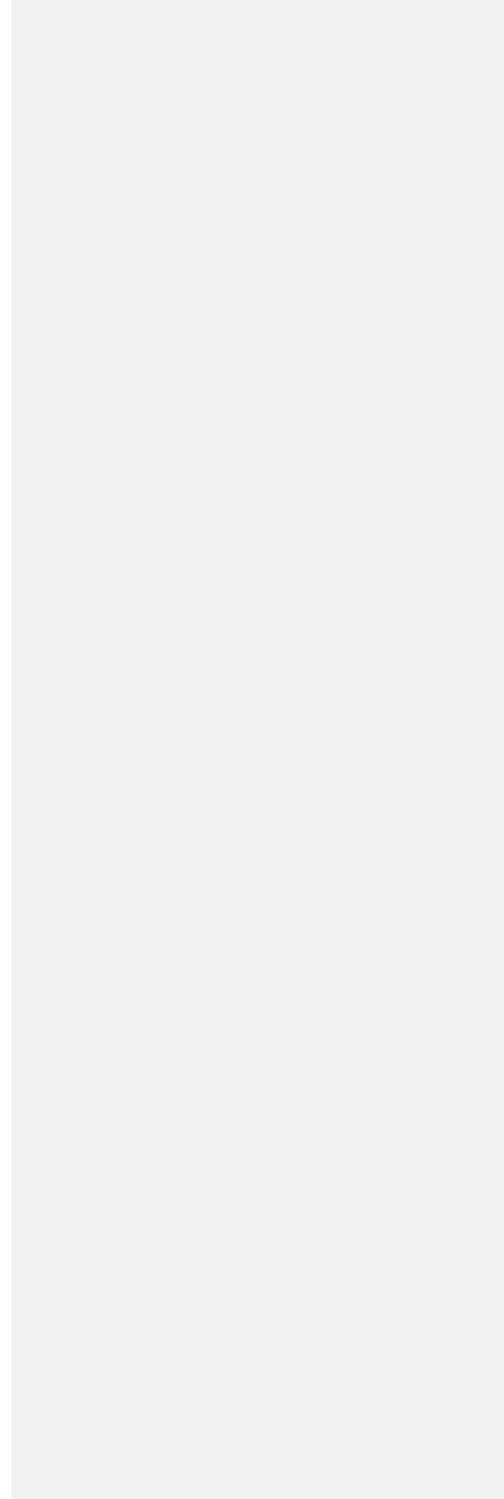
JAMAICA MECHANICAL CODE

the international Code Family.



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JAMAICA
MECHANICAL CODE®



2020 Jamaica Mechanical Code®

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BUREAU OF STANDARDS JAMAICA

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PREFACE

Introduction

The *Jamaica Mechanical Code*[®] (JMC[®]) establishes minimum requirements for mechanical systems using prescriptive and performance-related provisions. It is founded on broad-based principles that make possible the use of new materials and new mechanical designs. This 2020 edition is fully compatible with all of the *Jamaica Codes*[®] (J-Codes[®]) published by the International Code Council[®] (ICC[®]) and the Bureau of Standards Jamaica, including the *Jamaica Building Code*, *Jamaica Energy Conservation Code*, *Jamaica Existing Building Code*, *Jamaica Fire Code*, *Jamaica Fuel Gas Code*, *Jamaica Plumbing Code*, *Jamaica Private Sewage Disposal Code*, *Jamaica Property Maintenance Code* and *Jamaica Small Building/Residential Code*.[®]

The J-Codes, including this *Jamaica Mechanical Code*, may be used in a variety of ways in both the public and private sectors. Most building industry professionals are familiar with the I-Codes as the basis of laws and regulations in communities across the U.S. and in other countries. However, the impact of the J-Codes will extend well beyond the regulatory arena, as they may be used in a variety of nonregulatory settings, including:

- Voluntary compliance programs such as those promoting sustainability, energy efficiency and disaster resistance.
- The insurance industry, to estimate and manage risk, and as a tool in underwriting and rate decisions.
- Certification and credentialing of individuals involved in the fields of building design, construction and safety.
- Certification of building and construction-related products.
- Jamaica Government agencies, to guide construction in an array of government-owned properties.
- Facilities management.
- “Best practices” benchmarks for designers and builders, including those who are engaged in projects with a governmental enforcement mechanism.
- College, university and professional school textbooks and curricula.
- Reference works related to building design and construction.

In addition to the codes themselves, the code development process brings together building professionals on a regular basis. It provides a forum for discussion and deliberation about building design, construction methods, safety, performance requirements, technological advances and innovative products.

Development

This 2020 edition presents this code as issued by the ICC 2003 version, with changes reflected in the 2012 through 2018 editions and local changes approved by the BSJ Code Development Process through 2018. A new edition such as this is targeted for promulgation every 6 years.

This code is founded on principles intended to establish provisions consistent with the scope of a mechanical code that adequately protects public health, safety and welfare; provisions that do not unnecessarily increase construction costs; provisions that do not restrict the use of new materials, products or methods of construction; and provisions that do not give preferential treatment to particular types or classes of materials, products or methods of construction.

Maintenance

The *Jamaica Mechanical Code* is kept up to date through the BSJ review of proposed changes submitted by code consultants, code enforcement officials, industry representatives, design professionals and other interested parties. Proposed changes are carefully considered through an open code/standards development process in which all interested and affected parties may participate.

The ICC/BSJ Code Development Process reflects principles of openness, transparency, balance, due process and consensus and the principles embodied in OMB Circular A-119, which governs the US federal government's use of private-sector standards. The BSJ/ICC process is open to anyone; there is no cost to participate, and people can participate without travel cost through the BSJ's online meeting platforms⁸. A broad cross section of interests are represented in the BSJ/ICC Code Development Process. The codes, which are updated regularly, include safeguards that allow for emergency action when required for health and safety reasons.

In order to ensure that organizations with a direct and material interest in the codes have a voice in the process, the BSJ has developed partnerships with key industry segments that will be impacted by the use of the codes. Some code development committee members were nominated by the following industry partners and approved by the BSJ Council:

- Jamaica Institution of Engineers (JIE)
- Jamaica Institution of Architects (JIA)
- Construction Industry Council (CIC)

The code development committee evaluates and makes recommendations regarding proposed changes to the codes both from its expertise and from suggestions advanced by BSJ appointed consultants. **Their recommendations are then subject to public comment and alterations emanating therefrom, ICC's review, clarification and formatting of the proposed draft code and acceptance by the BSJ's Standards Council (Board of Directors).**

The contents of this work are subject to change through the code development cycles and by any governmental entity that enacts the code into law. For more information regarding the code development process, contact the Standards Division of the Bureau of Standards Jamaica.

While the J-Code development procedure is thorough and comprehensive, the BSJ, ICC, its members and those participating in the development of the codes disclaim any liability resulting from the publication or use of the J-Codes, or from compliance or noncompliance with their provisions. The BSJ does not have the power or authority to police or enforce compliance with the contents of this code.

Code Development Committee Responsibilities

In each code development cycle, consultants proposed changes to this code are considered at the BSJ's Building Code Committee meetings and its approved alterations constitute the recommendation to the Jamaican public for final proposed change. Code change proposals are further altered as warranted from the public comments and the draft document submitted to the ICC for their review, suggested clarifications and formatting. The draft document is then finally presented to the BSJ's Standards Council where reasons for significant section changes are given and approval sought. Any significant condition for approval is factored into the draft code by the BSJ's Building Code Committee before it is sent to the Ministry of Industry and Commerce to be declared and gazzetted as a national Jamaican code. **Marginal Markings**

In further editions of this code solid vertical lines in the margins within the body of the code will be used to indicate a technical change from the requirements of the 2020 edition. Deletion indicators in the form of an arrow (·) will be provided in the margin where an entire section, paragraph, exception or table has been deleted or an item in a list of items or a table has been deleted.

Coordination of the Jamaica Codes

The coordination of technical provisions is one of the strengths of the ICC/BSJ family of model codes.

The codes can be used as a complete set of complementary documents, which will provide users with full integration and coordination of technical provisions. Individual codes can also be used in subsets or as stand-alone documents. To make sure that each individual code is as complete as possible, some technical provisions that are relevant to more than one subject area are duplicated in some of the model codes. This allows users maximum flexibility in their application of the J-Codes.

Italicized Terms

Word and terms defined in Chapter 2, Definitions, are italicized where they appear in code text and the Chapter 2 definitions applies. Where such words and terms are not italicized, common-use definitions apply. The words and terms selected have code-specific definitions that the user should read carefully to facilitate better understanding of the code.

Adoption

The International Code Council and Bureau of Standards Jamaica maintains a copyright in all of J-codes and standards. Maintaining copyright allows the ICC and BSJ to fund its mission through sales of books, in both print and electronic formats. The ICC and BSJ welcome adoption of its codes by jurisdictions that recognize and acknowledge the ICC's and BSJ's copyright in the code, and further acknowledge the substantial shared value of the public/private partnership for code development between jurisdictions and the ICC/BSJ.

The ICC and BSJ also recognizes the need for jurisdictions to make laws available to the public. All I-Codes and I-Standards, along with the laws of many jurisdictions, are available for free in a nondownloadable form on the ICC's website. All J-Codes and J-Standards are available at a cost in a downloadable or hard copy form from the website and BSJ office respectively. Jamaican Laws and Regulations are available free of cost from the Government of Jamaica website at <https://Japarliament.gov.jm>. Jurisdictions should contact the ICC at adoptions@iccsafe.org or the BSJ at ----- to learn how to adopt and distribute laws based on the *Jamaica Mechanical Code* in a manner that provides necessary access, while maintaining the ICC's copyright.

EFFECTIVE USE OF THE JAMAICA MECHANICAL CODE

The *Jamaica Mechanical Code*[®] (JMC[®]) is a model code that regulates the design and installation of mechanical systems, appliances, appliance venting, duct and ventilation systems, combustion air provisions, hydronic systems and solar systems. The purpose of the code is to establish the minimum acceptable level of safety and to protect life and property from the potential dangers associated with the installation and operation of mechanical systems. The code also protects the personnel that install, maintain, service and replace the systems and appliances addressed by this code.

The JMC is primarily a prescriptive code with some performance requirements. The code relies heavily on product specifications and listings to provide much of the appliance and equipment installation requirements. The general Section 105.2 and the exception to Section 403.2 allow designs and installations to be performed by approved engineering methods as alternatives to the prescriptive methods in the code.

The format of the JMC allows each chapter to be devoted to a particular subject with the exception of Chapter 3, which contains general subject matters that are not extensive enough to warrant their own independent chapter.

Chapter 1 Scope and Administration. Chapter 1 establishes the limits of applicability of the code and describes how the code is to be applied and enforced. A mechanical code, like any other code, is intended to be adopted as a legally enforceable document and it cannot be effective without adequate provisions for its administration and enforcement. The provisions of Chapter 1 establish the authority and duties of the code official appointed by the jurisdiction having authority and also establish the rights and privileges of the design professional, contractor and property owner.

Chapter 2 Definitions. Chapter 2 is the repository of the definitions of terms used in the body of the code. Codes are technical documents and every word and term can impact the meaning of the code text and the intended results. The code often uses terms that have a unique meaning in the code and the code meaning can differ substantially from the ordinarily understood meaning of the term as used outside of the code.

The terms defined in Chapter 2 are deemed to be of prime importance in establishing the meaning and intent of the code text that uses the terms. The user of the code should be familiar with and consult this chapter because the definitions are essential to the correct interpretation of the code and because the user may not be aware that a term is defined.

Chapter 3 General Regulations. Chapter 3 contains broadly applicable requirements related to appliance location and installation, appliance and systems access, protection of structural elements, condensate disposal and clearances to combustibles, among others.

Chapter 4 Ventilation. Chapter 4 includes means for protecting building occupant health by controlling the quality of indoor air and protecting property from the effects of inadequate ventilation. Air changes per hour requirement for both natural and mechanical (forced) ventilation has been upgraded to a minimum of 5 to avoid rampant in-building transfer of COVID 19 and other viruses. In some cases, ventilation is required to prevent or reduce a health hazard by removing contaminants at their source.

Ventilation is both necessary and desirable for the control of air contaminants, moisture and temperature. Habitable and occupiable spaces are ventilated to promote a healthy and comfortable environment for the occupants. Uninhabited and unoccupied spaces are ventilated to protect the building structure from the harmful effects of excessive humidity and heat. Ventilation of specific occupancies is necessary to minimize the potential for toxic or otherwise harmful substances to reach dangerously high concentrations in air.

Chapter 5 Exhaust Systems. Chapter 5 provides guidelines for reasonable protection of life, property and health from the hazards associated with exhaust systems, air contaminants and smoke development in the event of a fire. In most cases, these hazards involve materials and gases that are flammable, explosive, toxic or otherwise hazardous. Where contaminants are known to be present in quantities that are irritating or harmful to the occupants' health or are hazardous in a fire, both naturally and mechanically ventilated spaces must be equipped with mechanical exhaust systems capable of collecting and removing the contaminants.

This chapter contains requirements for the installation of exhaust systems, with an emphasis on the structural integrity of the systems and equipment involved and the overall impact of the systems on the fire safety performance of the building. It includes requirements for the exhaust of commercial kitchen grease and smoke-laden air, hazardous fumes and toxic gases, clothes dryer moisture and heat and dust, stock and refuse materials.

Chapter 6 Duct Systems. Chapter 6 of the code regulates the materials and methods used for constructing and installing ducts, plenums, system controls, exhaust systems, fire protection systems and related components that affect the overall performance of a building's air distribution system and the reasonable protection of life and property from the hazards associated with air-moving equipment and systems. This chapter contains requirements for the installation of supply, return and exhaust air systems. Specific exhaust systems are also addressed in Chapter 5. Information on the design of duct systems is limited to that in Section 603.2. The code is very much concerned with the structural integrity of the systems and the overall impact of the systems on the fire safety and life safety performance of the building. Design considerations such as duct sizing, maximum efficiency, cost effectiveness, occupant comfort and convenience are the responsibility of the design professional. The provisions for the protection of duct penetrations of wall, floor, ceiling and roof assemblies are extracted from the *Jamaica Building Code*.

Chapter 7 Combustion Air. Complete combustion of solid and liquid fuel is essential for the proper operation of appliances, for control of harmful emissions and for achieving maximum fuel efficiency.

The specific combustion air requirements provided in previous editions of the code have been deleted in favor of a single section that directs the user to NFPA 31 for oil-fired appliance combustion air requirements and the manufacturer's installation instructions for solid-fuel burning appliances. For gas-fired appliances, the provisions of the *Jamaica Fuel Gas Code* are applicable.

Chapter 8 Chimneys and Vents. Chapter 8 is intended to regulate the design, construction, installation, maintenance, repair and approval of chimneys, vents and their connections to solid and liquid fuel-burning appliances. The requirements of this chapter are intended to achieve the complete removal of the products of combustion from fuel-burning appliances and equipment. This chapter includes regulations for the proper selection, design, construction and installation of a chimney or vent, along with appropriate measures to minimize the related potential fire hazards. A chimney or vent must be designed for the type of appliance or equipment it serves. Chimneys and vents are designed for specific applications depending on the flue gas temperatures and the type of fuel being burned in the appliance. Chimneys and vents for gas-fired appliances are covered in the *Jamaica Fuel Gas Code*.

Chapter 9 Specific Appliances, Fireplaces and Solid Fuel-burning Equipment. Chapter 9 sets minimum construction and performance criteria for fireplaces, appliances and equipment and provides for the safe installation of these items. It reflects the code's intent to specifically address all of the types of appliances that the code intends to regulate. Other regulations affecting the installation of solid fuel-burning fireplaces, appliances and accessory appliances are found in Chapters 3, 6, 7, 8, 10, 11, 12, 13 and 14.

Chapter 10 Boilers, Water Heaters and Pressure Vessels. Chapter 10 presents regulations for the proper installation of boilers, water heaters and pressure vessels to protect life and property from the hazards associated with those appliances and vessels. It applies to all types of boilers and pressure vessels, regardless of size, heat input, operating pressure or operating temperature.

Because pressure vessels are closed containers designed to contain liquids, gases or both under pressure, they must be designed and installed to prevent structural failures that can result in extremely hazardous situations. Certain safety features are therefore provided in Chapter 10 to reduce the potential for explosion hazards.

Chapter 11 Refrigeration. Chapter 11 contains regulations pertaining to the life safety of building occupants. These regulations establish minimum requirements to achieve the proper design, construction, installation and operation of refrigeration systems. Refrigeration systems are a combination of interconnected components and piping assembled to form a closed circuit in which a refrigerant is circulated. The system's function is to extract heat from a location or medium, and to reject that heat to a different location or medium. This chapter establishes reasonable safeguards for the occupants by defining and mandating practices that are consistent with the practices and experience of the industry.

Chapter 12 Hydronic Piping. Hydronic piping includes piping, fittings and valves used in building space conditioning systems. Applications include hot water, chilled water, steam, steam condensate, brines and water/antifreeze mixtures. Chapter 12 contains the provisions that govern the construction, installation, alteration and repair of all hydronic piping systems that affect reliability, serviceability, energy efficiency and safety.

Chapter 13 Fuel Oil Piping and Storage. Chapter 13 regulates the design and installation of fuel oil storage and piping systems. The regulations include reference to construction standards for above-ground and underground storage tanks, material standards for piping systems (both above-ground and underground) and extensive requirements for the proper assembly of system piping and components. The *Jamaica Fire Code (JFC)* covers subjects not addressed in detail here. The provisions in this chapter are intended to prevent fires, leaks and spills involving fuel oil storage and piping systems.

Chapter 14 Solar Thermal Systems. Chapter 14 establishes provisions for the safe installation, operation and repair of solar energy systems used for space heating or cooling, domestic hot water heating or processing. Although such systems use components similar to those of conventional mechanical equipment, many of these provisions are unique to solar energy systems.

Chapter 15 Referenced Standards. Chapter 15 lists all of the product and installation standards and codes that are referenced throughout Chapters 1 through 14. As stated in Section 102.8, these standards and codes become an enforceable part of the code (to the prescribed extent of the reference) as if printed in the body of the code. Chapter 15 provides the full title and edition year of the standards and codes in addition to the address of the promulgators and the section numbers in which the standards and codes are referenced.

Appendix A Chimney Connector Pass-throughs. Appendix A provides figures that illustrate various requirements in the body of the code. Figure A-1 illustrates the chimney connector clearance requirements of Table 803.10.4.

Appendix B Recommended Permit Fee Schedule. Appendix B provides a sample permit fee schedule for mechanical permits. The local jurisdiction may use this appendix and fill in the dollar amounts in the blank spaces to establish their official permit fee schedule. The ICC and BSI do not establish permit fees because this is the prerogative of the Local Government Ministry and/or Local Authorities or municipalities.

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CHAPTER 1

SCOPE AND ADMINISTRATION

User note:

About this chapter: Chapter 1 establishes the limits of applicability of the code and describes how the code is to be applied and enforced. Chapter 1 is in two parts: Part 1—Scope and Application and Part 2—Administration and Enforcement. Section 101 identifies what buildings, systems, appliances and equipment fall under its purview and references other J-Codes as applicable. Standards and codes are scoped to the extent referenced.

The code is a legally enforceable document and it cannot be effective without adequate provisions for its administration and enforcement. The provisions of Chapter 1 establish the authority and duties of the building official appointed by the Local Authority having jurisdiction and also establish the rights and privileges of the design professional, contractor and property owner.

PART 1— SCOPE AND APPLICATION SECTION 101 GENERAL

101.1 Title. These Regulations shall be cited as the 2020 Jamaica Mechanical Code (JMC) hereinafter referred to as “this code.”

101.1.1 Building laws of Jamaica. The Building Act, the Building Regulations, this Code and the codes referred to in regulation 101.4 constitute the “Building Laws of Jamaica”.

101.2 Scope. This code shall regulate the design, installation, maintenance, alteration and inspection of mechanical systems that are permanently installed and utilized to provide control of environmental conditions and related processes within buildings. This code shall also regulate those mechanical systems, system components, equipment and appliances specifically addressed herein. The installation of fuel gas distribution piping and equipment, fuel gas-fired appliances and fuel gas-fired appliance venting systems shall be regulated by the Jamaica Fuel Gas Code.

The provisions of this code shall apply to building work and the change of building use in Jamaica, unless exempted by or under the Building Act, any other regulations made under the Building Act or any other enactment for the regulation of buildings or building work. This code shall apply to the following building:

- (a) Buildings of all sizes in the occupancy classifications A, B, E, F, H, I, M, R-1, R-3, R-4, S and U;
- (b) Buildings in the occupancy classification R-2 > 300 m² total floor area;
- (c) Buildings in the occupancy classification R-2 ≤ 300 m² total floor area that have complex structures or services or locations.

Exception: Detached one- and two-family dwellings, small general purpose buildings and multiple single-family dwellings (townhouses) not more than three stories high with separate means of egress, total floor area of 300 m² or less and have no complex structure or services or location as well as accessory structures for these buildings shall comply with the Jamaica Small Building/Residential Code.

102.4 Additions, alterations or repairs. Additions, alterations,

101.2.1 Appendices. Provisions in the appendices

shall not apply unless specifically adopted. A headline statement specifying that the appendix is mandatory shall constitute satisfactory adoption.

101.3 Intent. The purpose of this code is to establish minimum standards to provide a reasonable level of safety, health, property protection and public welfare by regulating and controlling the design, construction, installation, quality of materials, location, operation and maintenance or use of mechanical systems.

101.4 Severability. If a section, subsection, sentence, clause or phrase of this code is, for any reason, held to be unconstitutional, such decision shall not affect the validity of the remaining portions of this code.

SECTION 102 APPLICABILITY

102.1 General. Where there is a conflict between a general requirement and a specific requirement of this code, the specific requirement shall govern. Where, in a specific case, different sections of this code specify different materials, methods of construction or other requirements, the most restrictive shall govern.**102.2 Existing installations.** Except as otherwise provided for in this chapter, a provision in this code shall not require the removal, alteration or abandonment of, nor prevent the continued utilization and maintenance of, a mechanical system lawfully in existence at the time of the adoption of this code.

102.2.1 Existing buildings. Additions, alterations, renovations or repairs related to building or structural issues shall be regulated by the Jamaica Existing Building Code.

102.3 Maintenance. Mechanical systems, both existing and new, and parts thereof shall be maintained in proper operating condition in accordance with the original design and in a safe and sanitary condition. Devices or safeguards that are required by this code shall be maintained in compliance with the edition of the code under which they were installed. The owner or the owner’s authorized agent shall be responsible for maintenance of mechanical systems. To determine compliance with this provision, the code official shall have the authority to require a mechanical system to be reinspected.

The inspection for maintenance of HVAC systems shall be performed in accordance with ASHRAE/ACCA/ANSI Standard 180.

renovations or repairs to a mechanical system shall conform to that

required for a new mechanical system without requiring the existing mechanical system to comply with all of the requirements of this code. Additions, alterations or repairs shall not cause an existing mechanical system to become unsafe, hazardous or overloaded.

Minor additions, alterations, renovations and repairs to existing mechanical systems shall meet the provisions for new construction, unless such work is done in the same manner and arrangement as was in the existing system, is not hazardous and is approved by the Building Official.

102.5 Change in building use. It shall be unlawful to make a change in the *building use* of any structure that will subject the structure to any special provision of this code applicable to the new *occupancy* without the approval of the building official. The building official shall certify that such structure meets the intent of the provisions of law governing building construction for the proposed new *change of building use* and that such change of *change of building use* does not result in any hazard to the public health, safety or welfare.

102.6 Historic buildings. The requirements of this code shall not be mandatory for existing buildings or structures identified and classified by the National Heritage Trust as historic buildings where such buildings or structures are judged by the building official not to constitute a threat to public health, safety and welfare. However, any necessary alteration, repair, enlargement, restoration, relocation or moving of such historic buildings or structures shall be carried out as close as possible to code requirements without doing injury to the historic integrity of the buildings or structures.

102.7 Moved buildings. Except as determined by Section 102.2, mechanical systems that are a part of buildings or structures moved into or within the jurisdiction shall comply with the provisions of this code for new installations.

102.8 Referenced codes and standards. The codes and standards referenced herein shall be those that are listed in Chapter 15 and such codes and standards shall be considered as part of the requirements of this code to the prescribed extent of each such reference and as further regulated in Sections 102.8.1 and 102.8.2.

Exception: Where enforcement of a code provision would violate the conditions of the listing of the *equipment* or *appliance*, the conditions of the listing and the manufacturer's installation instructions shall apply.

102.8.1 Conflicts. Where conflicts occur between provisions of this code and the referenced standards, the provisions of this code shall apply.

102.8.2 Provisions in referenced codes and standards. Where the extent of the reference to a referenced code or standard includes subject matter that is within the scope of this code, the provisions of this code, as applicable, shall take precedence over the provisions in the referenced code or standard.

102.9 Requirements not covered by this code. Requirements necessary for the strength, stability or proper operation of an existing or proposed mechanical system, or for the public safety, health and general welfare, not specifically covered by this code, shall be determined by the project registered mechanical or electrical engineer and approved by the building official.

102.10 Other acts (laws). The provisions of this code shall be regarded as in addition to, and not in derogation of, or in substitution of provisions of the following acts that may deal with similar subject matter:

(a) the Architects Registration Act.

(b) the Beach Control Act.

(c) the Endangered Species (Protection, Conservation and Regulation of Trade) Act.

(d) the Fire Brigade Act.

(e) the Housing Act.

(f) the Jamaica National Heritage Trust Act.

(g) the Land Surveyors Act.

(h) the Local Improvements Act.

(i) the Local Improvements (Community Amenities) Act.

(j) the National Housing Trust Act.

(k) the National Solid Waste Management Act.

(l) the Natural Resources Conservation Authority Act.

(m) the Professional Engineer Registration Act.

(n) the Standards Act.

(o) the Town and Country Planning Act.

(p) the Urban Development Corporation Act; or

(q) the Wildlife Protection Act.

102.10.2 Differences in similar requirement. Where a requirement of the Building Laws of Jamaica in regulating buildings or building works (whether generally or specifically for an area in a Local Authority), differs from a requirement in any other enactment that also regulates the same matter, then: –

(a) if the requirement of the other enactment is consistent with the Building Laws, it shall be complied with in addition to the Building Laws requirement; or

(b) if the requirement of the other enactment is inconsistent with the Building Laws, then: –

(i) so far as is practicable, the requirement of the other enactment shall be read so as to resolve the inconsistency; and

(ii) subject to subparagraph (i) immediately above and the extent of the inconsistency, the other enactment requirement shall cease to have effect, generally or within the specific area of a Local Authority, for the period that the Building Laws requirement is in force.

102.11 Application of references. Reference to chapter section numbers, or to provisions not specifically identified by number, shall be construed to refer to such chapter, section or provision of this code.

102.12 Regulation cease to have effect in a jurisdiction. A Local Authority shall publish, in a newspaper circulated generally in its area of jurisdiction, a notice of the fact that a regulation in the Building Laws has ceased to have effect in its area of jurisdiction.

PART 2--ADMINISTRATION AND ENFORCEMENT

SECTION 103 DEPARTMENT OF MECHANICAL INSPECTION

103.1 General. The Local Authority has overall responsibility for the enforcement of this Code. The Municipal Corporation for

each parish and every City Municipality is designated as the Local Authority for the respective area in which the Municipal Corporation or City Municipality has jurisdiction. The Building Act authorizes each Local Authority (formerly Parish Councils, Corporation and Municipality) to establish a department of building safety to enforce the Building Laws. The Chief Executive Officer otherwise known as the Building Official is responsible for the administration of the affairs of the Local Authority. The Chief Engineering Officer or Building Official of the Local Authority is the senior officer of the Local Authority who is responsible for engineering matters. The Local Authority appoints officers for the performance of its functions and designates officers of the Authority to undertake specified functions in respect of the administration and enforcement of building matters including mechanical. These officers undertake work for the Building Official.

103.2 Appointment. The position of building official of a Local Authority shall be classified and approved by the Ministry with responsibility for the Public Service after reviewing and accepting the Municipality's submitted documentation embodying justification for operation of the post, detailed job description and proposed salary scale. The approved position shall be advertised for applicants, suitable applicants shall be short listed, interviewed and a selection made and approved by the appointing authority of the jurisdiction.

103.3 Deputies. In accordance with the prescribed procedures for the appointment of officers and with the prior written approval of the Minister responsible for the Public Service the Local Authority may pursue the appointment of a deputy building official, other related technical officers, inspectors and other employees as well as acting appointees in all of these approved positions. Such employees shall have powers as delegated by the Building Official.

103.4 Liability. The building official, member of the board of appeals or employee charged with the enforcement of this code, while acting for the jurisdiction in good faith and without malice in the discharge of the duties required by this code or the Building Act or its Regulations, shall not thereby be civilly or criminally rendered liable personally. The Building Act of Jamaica relieves all officers from personal liability for any damage accruing to persons or property as a result of an act or by reason of an act or omission in the discharge of official duties.

that will impact the specific duties:-

- (a) Administer and enforce the Building Laws of Jamaica, within his area of jurisdiction;
- (b) accept and consider applications for building permission and make determinations on them, subject to any specified term or condition;
- (c) ensure that all building work within his area of jurisdiction is carried out in accordance with the Building Laws of Jamaica;
- (d) keep and maintain full, accurate and up-to-date records and make the information available to the public, subject to such guidelines as may be established;
- (e) issue compliance certificates of stages of construction and certificates of occupancy in respect of buildings and building work;
- (f) prescribe fees for services provided by or on behalf of the Local Authority;

103.4.1 Legal defense. Any suit or criminal complaint instituted against an officer or employee of the Local Authority because of an act performed by that officer or employee in the lawful discharge of duties and under the provisions of this code shall be defended by the legal representatives of the jurisdiction until the final termination of the proceedings. The building official or any subordinate shall not be liable for costs in any action, suit or proceeding that is instituted in pursuance of the provisions of this code.

Commented [RM1]: This procedure is incorrect. To be reviewed

SECTION 104 DUTIES AND POWERS OF THE BUILDING OFFICIAL

104.1 General. The building official is responsible for the functioning of the Local Authority's Building Department. The duties and powers in relation to this code includes enforcement of its provisions, render interpretations of its provisions, and adopt policies and procedures in order to clarify the application of its provisions. The interpretations, policies and procedures shall be in compliance with the intent and purpose of this code. The policies and procedures shall not have the effect of waiving requirements specifically provided for in this code. Notwithstanding these aforementioned specific duties the building official has the following general functions

- (g) ensure that designs submitted in respect of building applications are in compliance with the Building and that the design and supervisory aspects of building work are undertaken and executed by duly qualified persons;
- (h) engage persons under contract as it deems necessary for the proper performance of its functions in accordance with applicable laws and guidelines; and
- (i) perform such other functions as are necessary or expedient for, or in connection with, the proper performance of its functions under the Building Laws of Jamaica.

104.2 Applications and permits. The building official shall receive applications for permits, review construction documents and issue permits for the installation, replacement and alteration of mechanical systems, inspect the premises for which such permits have been issued and enforce compliance with the provisions of this code.

104.3 Inspections. The building official shall make all of the

inspections required by Sections 104, 105, 106, 107, 108 and 109, or shall accept reports of inspection by approved agencies or individuals. Reports of all in-house inspections shall be in writing and be certified by the responsible officer or in the case of approved external agency, by the responsible individual of that agency. The building official is authorized to engage external expert opinion as deemed necessary to report on unusual technical issues that arise, subject to the contracting guidelines of the appointing authority.

104.4 Right of entry. Where it is necessary to make an inspection to enforce the provisions of this code, or where the building official has reasonable cause to believe that there exists in a building or on any premises any conditions or violations of this code that make the building or premises unsafe, insanitary, dangerous or hazardous, the building official is authorized to enter the building or premises at all reasonable times to inspect or to perform the duties imposed on the building official by this code. If the building or premises is occupied, the building official shall present credentials to the occupant and entry requested. If the building or premises is unoccupied, the building official shall first make a reasonable effort to locate the owner, the owner's authorized agent or other person having charge or control of the building or premises and request entry. If entry is refused, the building official shall have recourse to every remedy provided by law to secure entry.

Where the building official has first obtained a proper inspection warrant or other remedy provided by law to secure entry, the owner, owner's authorized agent or occupant or person having charge, care or control of the building or premises shall not fail or neglect, after proper request is made as herein provided, to promptly permit entry therein by the building official for the purpose of inspection and examination pursuant to this code.

104.5 Identification. The building official shall carry proper identification when inspecting buildings or structures or premises in the performance of duties under this code.

104.6 Notices and orders. The building official shall issue all necessary notices or certificates or orders or other authorizations or approvals or make determinations to ensure compliance with this code.

104.7 Department records. The building official shall keep

A) 105.3 Required testing. Where there is insufficient evidence of compliance with the provisions of this code, or evidence that a material or installation method does not conform to the requirements of this code, or in order to substantiate claims for alternative materials or installation methods, the building official shall require tests as evidence of compliance to be made without expense to the jurisdiction.

105.3.1 Test methods. Test methods shall be as specified in this code or by other BSI or BSI recognized test standards. In the absence of BSI recognized and accepted test methods, the building official shall approve the testing procedures.

105.3.2 Testing agency. Tests shall be performed by the BSI or a BSI approved agency.

105.3.3 Test reports. A report shall be generated for all tests requested by the building official or submitted by a permit applicant of tests shall be retained by the code official for the

official records of applications received; permits and certificates issued; fees collected; reports of inspections made; notices, orders, other authorizations and approvals issued and determinations made. The records shall be retained in the official records for the period required for retention of public records.

SECTION 105 APPROVAL

105.1 Modifications. Where there are practical difficulties involved in carrying out the provisions of this code, the building official shall have the authority to grant modifications for individual cases upon application of the owner or owner's authorized agent, provided that the building official shall first find that special individual reason that makes the strict letter of this code impractical and the modification is in compliance with the intent and purpose of this code and does not lessen health, life and fire safety requirements. The details of action granting modifications shall be recorded and entered in the files of the department of building safety.

105.2 Alternative materials, design and methods of construction and equipment. The provisions of this code are not intended to prevent the installation of any material or to prohibit any design or method of construction not specifically prescribed by this code, provided that any such alternative has been approved. An alternative material, design or method of construction shall be approved where the building official finds that the proposed design is satisfactory and complies with the intent of the provisions of this code, and that the material, method or work offered is, for the purpose intended, not less than the equivalent of that prescribed in this code in quality, strength, effectiveness, fire resistance, durability and safety. Where the alternative material, design or method of construction is not approved, the building official shall respond in writing, stating the reasons why the alternative was not approved.

105.2.1 Research reports. Supporting data, where necessary to assist in the approval of materials or assemblies not specifically provided for in this code, shall consist of valid research reports from approved sources.

period required for retention of public records.

105.4 Approved materials and equipment. Only materials, equipment and devices approved by the BSI or a BSI recognized body shall be allowed to be incorporated in building works by the building official. The constructed and installed works shall be inspected to ensure that the materials, equipment and devices are in accordance with the approval.

105.5 Material, equipment and appliance reuse. Used materials, equipment, appliances and devices shall not be reused unless they have been reconditioned, tested and placed in good and proper working condition and approved by the building official.

SECTION 106 PERMITS

106.1 Where required. Any premises owner, owner's duly authorized agent or contractor who intends to erect, install, enlarge,

alter, repair, remove, convert or replace a mechanical system, the installation of which is regulated by this code, or to cause such work to be performed, shall first make application to the **Local Authority** and obtain the required permit for the work.

Exception: Where *equipment* and *appliance* replacements or repairs must be performed in an emergency situation, the permit application shall be submitted within the next working business day to the department of **building safety**.
106.1.1 Annual permit. Instead of an individual construction permit for each alteration to an already *approved* **mechanical** system or equipment or application installation, the **building** official is authorized to issue an annual permit upon application therefor to any person, firm or corporation regularly employing one or more qualified **and licensed** tradespersons in the building, structure or on the premises owned or operated by the applicant for the permit.

106.1.2 Annual permit records. The person to whom an annual permit is issued shall keep a detailed record of alterations made under such annual permit. The **building** offi-

necessary to determine compliance with this code.

cial shall have access to such records at all times or such records shall be filed with the building official as designated.

106.2 Installations for which permits are not required. Permits shall not be required for the installation of the following:

1. Portable heating appliances.
2. Portable ventilation appliances and *equipment*.
3. Portable cooling units.
4. Steam, hot water or chilled water piping within any heating or cooling *equipment* or appliances regulated by this code.
5. The replacement of any minor part that does not alter the approval of *equipment* or an *appliance* or make such *equipment* or *appliance* unsafe.
6. Portable evaporative coolers.
7. Self-contained refrigeration systems that contain 4.5 kg (10 pounds) or less of refrigerant, or that are actuated by motors of 0.75 kW (1 horsepower) or less.
8. Portable fuel cell appliances that are not connected to a fixed piping system and are not interconnected to a power grid.

Exemption from the permit requirements of this code shall not be deemed to grant authorization for work to be done in violation of the provisions of this code or the Building Act or its regulations.

106.3 Application for permit. To obtain a permit, the applicant shall first file an application therefor on the prescribed form furnished by the Local Authority having jurisdiction for the area in which the permit will be executed. The prescribed permit application form which may also be downloaded and filled in online, shall contain:

- i. A general description of the proposed work and its location.
- ii. The signature of the owner or the owner's authorized agent.
- iii. The proposed occupancy of all parts of the building.
- iv. That portion of the site or lot, if any, not covered by the building or structure.

v. Such other information required by the building official.

106.3.1 Construction documents. *Construction documents*, engineering calculations, diagrams and other data shall be submitted in the requisite number of sets and format (hard and soft copies) with each application for a permit. The building official shall require *construction documents*, computations and specifications to be prepared and submitted by a registered design building professional or where allowed by a licensed building practitioner. Where special conditions exist, the building official is authorized to require additional *construction documents* to be prepared by a registered design building professional. *Construction documents* shall be drawn to scale and shall be of sufficient clarity to indicate the location, nature and extent of the work proposed and show in detail that the work conforms to the provisions of this code. *Construction documents* for buildings more than two stories in height shall indicate where penetrations will be made in slabs or roofs for mechanical systems, and the materials and methods for maintaining required structural safety, fire-resistance rating and fire-blocking.

Exception: The building official shall have the authority to waive the submission of *construction documents*, calculations or other data if the nature of the work applied for is such that reviewing of *construction documents* is not

106.3.2 Preliminary inspection. Before a permit is issued, the **building official** is authorized to inspect and evaluate the systems, *equipment*, buildings, devices, premises and spaces or areas to be used.

106.3.3 Time limitation of application. An application for a permit for any proposed work shall be deemed to have been abandoned 180 days after the date of filing, unless **the** application has been pursued in good faith or a permit has been issued; except that the **building official** is authorized to grant one or more extensions of time for additional periods not exceeding 90 days each. The extension shall be requested in writing and justifiable cause demonstrated.

106.4 Actions for permit issuance. The application, *construction documents* and other data filed by an applicant for a permit **as well as requests for amending a permit already issued** shall be reviewed by the **building official**. If the application or the *construction documents* or other documents do not conform to the requirements of pertinent laws, the **building official** shall reject the application in writing, stating the reasons for the rejection. If the **building official** is satisfied that the proposed work conforms to the requirements of this code and all laws and **regulations** applicable thereto, and that the fees specified in Section 106.5 have been paid, a permit shall be issued to the applicant.

106.4.1 Approved construction documents. When the **building official** issues the permit where *construction documents* are required, the *construction documents* shall be endorsed in writing and stamped "APPROVED." Such *approved construction documents* shall not be changed, modified or altered without authorization from the **building official**. Work shall be done in accordance with the *approved construction documents*.

The **building official** shall have the authority to issue a permit for the construction of part of a mechanical system before the *construction documents* for the entire system have been submitted or *approved*, provided that adequate information and detailed statements have been filed complying with all pertinent requirements of this code. The holder of such permit shall proceed at his or her own risk without assurance that the permit for the entire mechanical system will be granted.

106.4.2 Validity of permit. A building permit shall be valid for the period specified in the permit. The issuance or **granting** of a permit or approval of *construction documents* shall not be construed to be a permit for, or an approval of, any violation of any of the provisions of this code or of **any laws or regulations governing** the jurisdiction. Permits presuming to give authority to violate or cancel the provisions of this code **or laws or other regulations** shall **not** be valid.

The issuance of a permit based on *construction documents* and other data shall not prevent the **building official** from thereafter requiring the correction of errors in said *construction documents* and other data or the **construction works**. The **building official** is authorized to prevent occupancy or use of a structure from being

carried on thereunder **that is** in violation of this code or of **any law governing the** jurisdiction.

106.4.3 Expiration. Every permit issued by the **Local Authority** under the provisions of this code shall expire by limitation and become null and void if the work authorized by such permit is not commenced within 180 days from the date of permit **issuance**, or if the work authorized by such permit is suspended or abandoned at any time after commencement for a period of 180 days **or more**. After permit expiration occurs work shall only recommence, if:

- a) **A** new permit shall be obtained.

- b) Any fee stipulated by regulation is paid.
- c) No changes have been made or will be made in the original *construction documents* for such work.
- d) The suspension or abandonment has not exceeded one year.

106.4.4 Extensions. A permittee holding an unexpired permit shall have the right to apply for an extension of the time within which the permittee will commence work under that permit where work is unable to be commenced within the time required by this section for good and satisfactory reasons. The building official may extend the time for action by the permittee for a period not exceeding 180 days if there is reasonable cause. A permit shall not be extended more than once. Any fee for an extension that is required by regulation shall be paid before a new permit is issued.

106.4.5 Suspension or revocation of permit. The building official is authorized to suspend or revoke a permit issued under the provisions of this code wherever the permit is issued in error or on the basis of incorrect, inaccurate or incomplete information, or in violation of the Building Act or Regulation or any of the provisions of this code.

106.4.6 Retention of construction documents. One set of approved construction documents in hard and/or soft copy format shall be retained by the building official for a period of not less than 180 days from date of completion of the permitted work, or as required by statutory requirement. One set of approved construction documents in hard and/or soft copy format shall be returned to the applicant, and one set in hard copy format shall be kept on the site of the building or job at all times during which the work authorized is in progress until completion.

106.4.7 Conditions where code changes do not impact approved permits. This code shall not require changes in the *construction documents*, construction works or designated *occupancy* of a structure for which a lawful permit has been heretofore issued or otherwise lawfully authorized, and the construction of which has been pursued in good faith within 180 days after the effective date of this code and has not been abandoned.

106.4.8 Posting of permit. The permit or a copy shall be kept on the site of the work until the completion of the project.

106.5 Payment of fees before permit issuance. A permit shall not be issued until the fees prescribed in Section 106.5.2 have been paid, nor shall an amendment to a permit be released until any additional fee required by regulation or due to an increase of the mechanical system construction estimate, has been paid.

106.5.1 Work commencing before permit issuance. Any person who commences work on a mechanical system before obtaining the necessary permits shall be subject to the penalty outlined in the Building Act and its Regulations.

106.5.2 Permit fee schedule. The fees for mechanical

works permits shall be those published in the Building Regulations and approved by the Ministry of Local Government and Community Development and the Local Authority. These fees are subject to periodic review and revision as needed.

106.5.3 Fee refunds. The *building official* shall authorize the refunding of any of the following fees required by regulation:

1. The full amount of any fee paid hereunder that was erroneously paid or collected.
2. The percentage of the permit fee paid which regulation makes refundable for work that has not been done under a permit issued in accordance with this code.
3. The percentage of any fee paid specifically for or allocated to plan review in an application for a permit for which a plan review is withdrawn or canceled before any plan review effort has been expended.

The *building official* shall not authorize the refunding of any fee paid, except upon written application filed by the original permittee not later than 180 days after the date of fee payment.

SECTION 107 INSPECTIONS AND TESTING

107.1 General. The *building official* is authorized to conduct such inspections as are deemed necessary to determine compliance with the provisions of this code. Construction or work for which a permit is required shall be subject to completion stage inspection by the *building official*, and such construction or work shall remain visible and able to be accessed for inspection purposes until approved. Approval as a result of an inspection shall not be construed to be an approval of a violation of the provisions of this code or of any other law governing the jurisdiction. Inspections presuming to give authority to violate or cancel the provisions of this code or of any other law governing the jurisdiction shall not be valid.

107.2 Required inspections and testing. The *building official*, upon notification from the permit holder or the permit holder's agent, shall make the construction stage inspections outlined below and other inspections as necessary, and shall either release that portion of the construction or shall notify the permit holder or the permit holder's agent of violations that must be corrected. The holder of the permit shall be responsible for scheduling the following inspections:

1. Underground inspection shall be made after trenches or ditches are excavated and bedded, piping installed, and before backfill is put in place. Where excavated soil contains rocks, broken concrete, wood peices and other rubble that may damage or break the piping or cause corrosive action or cause trench subsidence, cleaned backfill material shall be obtained by sifting or importation and placed on the job site prior to the inspection.
2. Rough-in inspection shall be made after the roof, framing, fireblocking and bracing are in place and all duct-ing and other components to be concealed are complete, and prior to the installation of wall or ceiling membranes.
3. Final inspection shall be made upon completion of the mechanical system.

Exception: Ground-source heat pump loop systems tested in accordance with Section 1210.10 shall be permitted to be backfilled prior to inspection.

The requirements of this section shall not be considered to prohibit the operation of any heating *equipment* or appliances installed to replace existing heating *equipment* or appliances serving an occupied portion of a structure provided that a request for inspection of such heating *equipment* or appliances has been filed with the department not more than 48 hours after such replacement work is completed, and before any portion of such *equipment* or appliances is concealed by any permanent portion of the structure.

107.2.1 Other inspections. In addition to the inspections specified in Section 107.2, the **building** official is authorized to make or require other inspections of any construction work to ascertain compliance with the provisions of this code and other laws **that govern the jurisdiction**.

107.2.2 Inspection requests. It shall be the duty of the holder of the permit or their duly authorized agent to notify the **building** official when work is ready for inspection. It shall be the duty of the permit holder to provide *access* to and means for inspections of such work that are required by this code.

107.2.3 Approval required. Work shall not be done beyond the point indicated in each successive inspection without first obtaining the approval of the **building** official. The **building** official, upon notification, shall make the requested inspections and shall either indicate in writing the portion of the construction that is satisfactory as completed, or notify **in writing** the permit holder or his or her agent the **section of the installation that fails to comply with this code**. Any portion **of an installation that does not comply with this code** shall be corrected and the portion shall not be covered or concealed until **reinspected and** authorized by the **building** official.

107.2.4 Approved inspection agencies. The **building** official is authorized to accept reports of *approved* agencies, provided that such agencies satisfy the requirements as to qualifications and reliability.

107.2.5 Evaluation and follow-up inspection services. Prior to the approval of a prefabricated construction assembly having concealed mechanical work and the issuance of a mechanical permit, the **building** official shall require the submittal of an evaluation report on each prefabricated construction assembly, indicating the complete details of the mechanical system, including a description of the system and its components, the basis on which the system is being evaluated, test results and similar information, and other data as necessary for the **building** official to determine conformance to this code.

107.2.5.1 Evaluation service. The **building** official shall designate the evaluation service of an *approved agency* as the evaluation agency, and review such agency's evaluation report for adequacy and conformance to this code.

107.2.5.2 Follow-up inspection. Except where ready access is provided to mechanical systems, service *equipment* and accessories for complete inspection at the site without disassembly or dismantling, the **building** official shall conduct the in-plant inspections as frequently as necessary to ensure conformance to the *approved* evaluation report or shall designate an independent, *approved* inspection agency to conduct such

inspections. The inspection agency shall furnish the **building** official with the follow-up inspection manual and a report of inspections on request, and the mechanical system shall have an identifying label permanently affixed to the system indicating that factory inspections have been performed.

107.2.5.3 Test and inspection records. Required test and inspection records shall be available to the **building** official at all times during the fabrication of the mechanical system and the erection of the building; or such records as the **building** official designates shall be filed.

107.3 Testing. Mechanical systems shall be tested as required in this code and in accordance with Sections 107.3.1 through 107.3.3. Tests shall be made by the permit holder and observed by the **building** official.

107.3.1 New, altered, extended or repaired systems. New mechanical systems and parts of existing systems, which have been altered, extended, renovated or repaired, shall be tested as prescribed herein to disclose leaks and defects.

107.3.2 Apparatus, material and labor for tests. Apparatus, material and labor required for testing a mechanical system or part thereof shall be furnished by the permit holder.

107.3.3 Reinspection and testing. Where any work or installation does not pass an initial test or inspection, the necessary corrections shall be made so as to achieve compliance with this code. The work or installation shall then be resubmitted to the **building** official for inspection and testing.

107.4 Approval. After the prescribed tests and inspections indicate that the work complies in all respects with this code, a notice of approval shall be issued by the **building** official.

107.4.1 Revocation. The **building** official is authorized to, in writing, suspend or revoke a notice of approval issued under the provisions of this code wherever the notice is issued in error, on the basis of incorrect information supplied, or where it is determined that the building or structure, premise or portion thereof is in violation of any **law** or regulation or any of the provisions of this code.

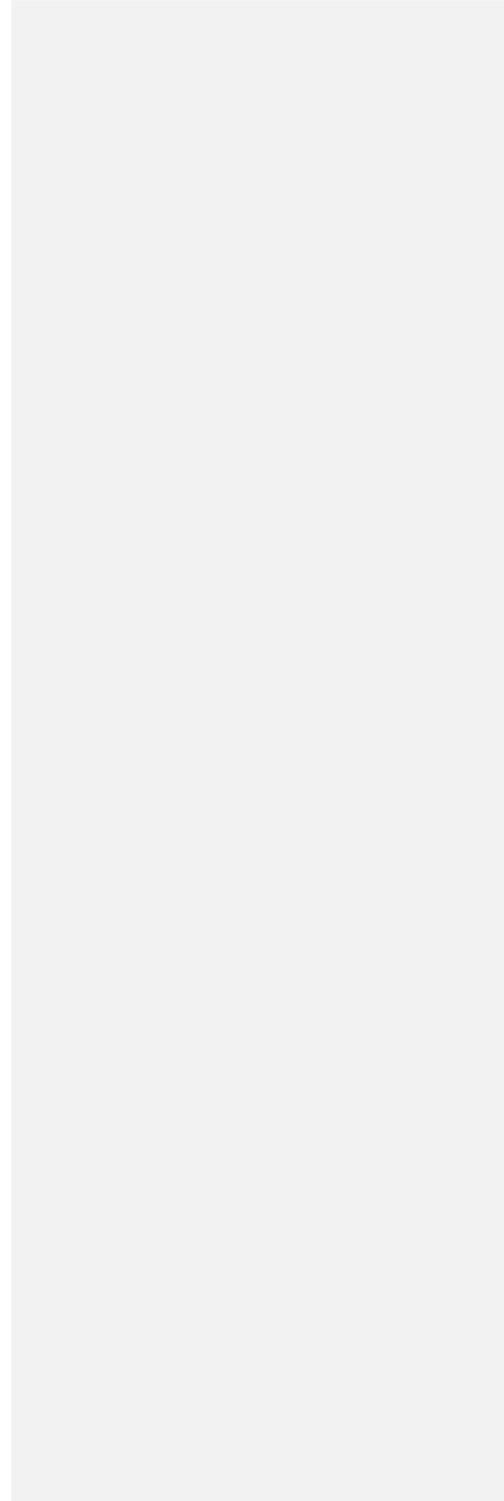
107.5 Temporary connection. The **building** official (**electrical inspector**) shall authorize the temporary connection to the sources of energy for the purpose of testing mechanical systems or for use under a temporary certificate of *occupancy*. **Systems to be temporarily connected to sources of energy shall first be certified as meeting the requisite code(s) and thereby pose no danger to the construction site workers.**

107.6 Connection of service utilities. A person shall not make connections from a utility, source of energy, fuel or power to any building or system that is regulated by this code for which a permit is required, until authorized by the **building (electrical inspector)** official.

SECTION 108

VIOLATIONS

108.1 Unlawful acts. It shall be unlawful for a person, firm or corporation to erect, construct, alter, repair, remove,



demolish or utilize a mechanical system, or cause same to be done, without first obtaining the required permit and ensuring that none of these actions are in conflict with or in violation of any of the provisions of this code.

108.2 Notice of violation. The building official shall serve a notice of violation or order to the person responsible for the erection, installation, alteration, extension, repair, removal or demolition of mechanical work that is in violation of the provisions of this code, or in violation of a building official directive or other authorization issued under the provision of this or another code, or the approved construction documents thereunder, or in violation of a permit or certificate issued under the provisions of this code. Such order shall direct the discontinuance of the illegal action or condition and the abatement of the violation.

108.3 Prosecution of violation. If the notice of violation is not complied with promptly, the building official is authorized to institute the appropriate proceeding at law or in equity to restrain, correct or abate the violation, or to require the removal or termination of the unlawful occupancy of the building or structure in violation of the provisions of this code or of the order or direction made pursuant to this code.

108.4 Violation penalties. Any persons who contravenes a provision of this code or who fails to comply with any of the requirements of this code or who erects, installs, alters or repairs mechanical work in violation of the approved construction documents or directive of the building official, or of a permit or certificate or other authorization issued under the provisions of this code, shall be subject to penalties as prescribed by the Building Laws.

108.5 Stop work orders. Where the building official has reasonable grounds to suspect that mechanical work is unauthorized or being performed in a manner either contrary to the provisions of this code or dangerous or unsafe, the building official is authorized to issue a stop notice requiring the responsible party to immediately cease the mechanical work. Mechanical work is unauthorized if it is being carried out in breach of a term or condition subject to which a permit was issued or is being carried out without obtaining a permit for the work. Where a violation has occurred, a stop notice shall be given in writing to the owner of the property, or to the owner's authorized agent, or to the person performing the work. The stop notice shall state the reason for the order and the conditions under which the cited work will be permitted to resume. The stop notice shall remain in effect until the cited mechanical work is completed to comply with the related enforcement notice is certified by the Local Authority as being completed. However, if the enforcement notice is not served before the end of fourteen days after service of the stop notice, the stop notice shall expire.

Where an emergency exists, the building official shall not be required to give a written stop notice prior to stopping the work. The written stop notice shall be served within 24 hours of stopping the work.

Any person who shall continue any work on the cited mechanical system after having been served with a stop notice, except such work as that person is directed to perform to remove a violation or unsafe condition, shall be subject to penalties as prescribed by the Building Laws.

108.6 Abatement of violation. The imposition of penalties prescribed elsewhere in law shall not preclude the Local Authority from instituting appropriate action to prevent unlawful construction or to restrain, correct or abate a violation, or to prevent illegal occupancy of a building, structure or premises, or to stop an illegal act, conduct, business or utilization of the mechanical system on or about any premises.

108.7 Unsafe mechanical systems. A mechanical system that is unsafe, constitutes a fire or health hazard, or is otherwise dangerous to human life, as regulated by this code, is hereby declared as an unsafe mechanical system. Use of a mechanical system regulated by this code constituting a haz-

ard to health, safety or welfare by reason of inadequate main-tenance, dilapidation, fire hazard, disaster, damage or abandonment is hereby declared an unsafe use. The unsafe equipment and appliances are hereby declared to be a public nuisance and shall be abated by repair, rehabilitation, demolition or removal or replacement.

108.7.1 Authority to condemn mechanical systems. Where the building official determines that any mechanical system, or portion thereof, regulated by this code has become hazardous to life, health, property, or has become insanitary, the building official shall order in writing that such system either be removed or restored to a safe condition. A time limit for compliance with such order shall be specified in the written notice. A person shall not use or maintain a defective mechanical system after receiving such notice.

Where such mechanical system is to be disconnected, written notice as prescribed in Section 108.2 shall be given. In cases of immediate danger to life or property, such disconnection shall be made immediately and without the written notice. However, the written notice shall be provided within 24 hours of the disconnection being made.

108.7.2 Authority to order disconnection of energy sources. The building official is authorized to order from building owners, building owners' authorized agents or building occupants or public utilities disconnection of energy sources supplied to a building, structure or mechanical system regulated by this code, where it is determined that the mechanical system or any portion thereof has become hazardous or unsafe. Written notice of such order to disconnect service and the causes therefor shall be given within 24 hours to the owner, the owner's authorized agent and occupant of such building, structure or premises, provided, however, that in cases of immediate danger to life or property, such disconnection shall be ordered and requested to be immediate and without written notice. Where energy sources are provided by a public utility, the building official shall immediately notify the serving utility in writing of the issuance of the order to disconnect and solicit their immediate attention.

108.7.3 Connection after order to disconnect. A person shall not make energy source connections to mechanical systems regulated by this code that have been disconnected or ordered to be disconnected by the building official, or the use of which has been ordered to be discontinued by the building official until the building official authorizes the reconnection and use of such mechanical systems.

Where a mechanical system is maintained in violation of this code, and in violation of a notice issued pursuant to the provisions of this section, the building official shall institute appropriate action to prevent, restrain, correct or abate the violation.

SECTION 109 MEANS OF APPEAL

109.1 Application for appeal. A person shall have the right to appeal a decision of the Local Authority to the Building Appeal Tribunal. A Building Appeal Tribunal shall be established by the Minister who is committed to establish other Tribunals in each county and some parishes depending on demand. An application for appeal shall be based on a claim that includes one or more of the following:

- a) The true intent of this code or the rules legally adopted under this code have been incorrectly interpreted;
- b) The provisions of this code do not fully apply to the cited violation on which the ruling was made; or
- c) An equally good or better form of construction is proposed.

The application for an appeal shall be filed on a form obtained from the Local Authority and lodged within 30 days of the relevant decision being notified to that person, or such longer period as the Appeal Tribunal may in its discretion allow.

109.1.1 Limitation of authority. The Building Appeal Tribunal shall not have authority relative to interpretation of the administration of this code nor shall the Tribunal be empowered to waive requirements of this code.

109.2 Membership of the Tribunal. The Building Appeal Tribunal shall consist of three members, a chairman and two other members, all appointed by the Minister of Local Government and Community Development. Members shall hold office for a period not exceeding 2 years as the Minister shall determine and shall be eligible for reappointment. The Minister may, if he thinks it expedient so to do, at any time revoke the appointment of any member of the Tribunal.

109.2.1 Qualifications. The Building Appeal Tribunal shall consist of three individuals, from the following professions or disciplines.

1. A chairman who in the Minister's judgement has the requisite qualification and experience to guide the Tribunal's business in a very efficient and effective manner that will result in the successful and just disposal of all appeals coming before the Tribunal.
2. A representative of the Construction Industry Council with Registered design building professional status in the engineering or architectural or surveying disciplines

with not less than 10 years' experience, 5 of which shall have been in responsible charge of work.

3. A Registered Attorney-at-law with not less than 10 years' experience, 5 of which shall have been in responsible charge of work.

The Members of the Tribunal shall not be employees of the Local Authority.

109.2.2 Temporary (Alternate) members. The Minister of Local Government and Community Development in the case of the absence or inability or temporary withdrawal of the chairman to carry out his duties, may appoint a person to act temporarily as chairman. In case of the absence or inability or temporary withdrawal of any of the other two members, the Minister may also appoint a person to act temporarily. Temporary members shall possess the qualifications required for Tribunal membership and shall serve until the member returns.

109.2.3 Chairman. The tenure of the chairman within the two year cycle for Tribunal members shall be dependent on the judgement of the Minister of Local Government and Community Development. Reappointment for additional 2-year cycles shall also depend on the judgement of the Minister.

109.2.4 Temporary withdrawal (Disqualification) of member. A member shall not hear an appeal in which that member has a personal, professional or financial interest.

109.2.5 Secretary. The chief administrative officer of any Local Authority hosting a Building Appeal Tribunal shall

designate a qualified clerk to serve as secretary to the Tribunal. The secretary shall file a detailed record of all proceedings in the office of the chief administrative officer of the Local Authority.

109.2.6 Compensation of members. Compensation of the Tribunal members shall be as determined by the Minister of Local Government and Community Development.

109.3 Notice of meeting. The Tribunal shall meet upon notice from the chairman, within 10 days of the filing of an appeal, or at stated periodic meetings.

109.4 Open hearing. Hearings before the Tribunal shall be open to the public. The appellant, the appellant's representative, the building official and any person whose interests are affected shall be given an opportunity to be heard.

109.4.1 Procedure. The Tribunal shall adopt and make available to the public through the secretary procedures under which a hearing will be conducted. The procedures shall not require compliance with strict rules of evidence, but shall mandate that only relevant information be received.

109.4.2 Performance objectives. The Tribunal shall endeavour to achieve the following objectives:

- a) Within 21 days of the date of lodging the appeal, receive, hear and examine the evidence and submissions relating to the appeal.
- b) Within 30 days of the date of hearing the appeal, issue a written decision with reason for the decision.

The Tribunal may extend the periods specified above to such longer period in each case, as extenuating circumstances may require.

109.5 Postponed hearing. When the three members are not present to hear an appeal, either the appellant or the appellant's representative shall have the right to request a postponement of the hearing.**109.6 Tribunal decision.** The Tribunal shall modify or reverse the decision of the Local Authority by a concurring vote of the majority of members.

The Appeal Tribunal may, upon hearing an appeal against a decision of the Local Authority take one the following actions:

- a) Dismiss the appeal and confirm the decision.
- b) Allow the appeal and quash the decision.
- c) Allow the appeal and direct that the proceedings in respect of which the decision was made, be conducted afresh either by the person who made that decision or such other person as the Appeal Tribunal may decide.
- d) Vary the decision as the Appeal Tribunal considers appropriate.

Before determining an appeal, the Appeal Tribunal shall give the appellant and the Local Authority or other person in the administration of this Act, either of whom may be represented by an attorney-at-law or any other person, the opportunity to be heard by the Tribunal; and the Tribunal may also elect to hear from any other person whom it considers to have sufficient interest in the outcome of the appeal.

109.6.1 Resolution. The decision of the Tribunal shall

be by resolution. Certified copies shall be furnished to the appellant and to the Local Authority from which the decision was challenged.

109.6.2 Administration of Tribunal decision. The Local Authority shall take immediate action to implement the decision of the Tribunal.

109.7 Court review. Any person, whether or not a previous party of the appeal, shall have the right to apply to the appropriate court for a writ of certiorari to correct errors of law. Application for review shall be made in the manner and time required by law following the filing of the decision in the office of the Local Authority.

SECTION 110 TEMPORARY EQUIPMENT, SYSTEMS AND USES

110.1 General. The building official is authorized to issue a permit for temporary *equipment*, systems and uses. Such permits shall be limited as to time of service, but shall not be permitted for more than 180 days. The building official is authorized to grant extensions for demonstrated cause.

110.2 Conformance. Temporary *equipment*, systems and uses shall conform to the structural strength, fire safety, means of egress, accessibility, light, ventilation and sanitary requirements of this code as necessary to ensure the public health, safety and general welfare.

110.3 Temporary utilities. The building official is authorized to give permission to temporarily supply utilities before an installation has been fully completed and the final certificate of completion has been issued. The part covered by the temporary certificate shall comply with the requirements specified for temporary lighting, heat or power in the code.

110.4 Termination of approval. The building official is authorized to terminate such permit for temporary *equipment*, systems or uses and to order the temporary *equipment*, systems or uses to be discontinued.

CHAPTER 2 DEFINITIONS

User note:

About this chapter: Codes, by their very nature, are technical documents. Every word, term and punctuation mark can add to or change the meaning of a technical requirement. It is necessary to maintain a consensus on the specific meaning of each term contained in the code. Chapter 2 performs this function by stating clearly what specific terms mean for the purposes of this code.

SECTION 201 GENERAL

201.1 Scope. Unless otherwise expressly stated, the following words and terms shall, for the purposes of this code, have the meanings indicated in this chapter.

201.2 Interchangeability. Words used in the present tense include the future; words in the masculine gender include the feminine and neuter; the singular number includes the plural and the plural, the singular.

201.3 Terms defined in other codes. Where terms are not defined in this code and are defined in the *Jamaica Building Code*, *Jamaica Fire Code*, *Jamaica Fuel Gas Code* or the *Jamaica Plumbing Code*, such terms shall have meanings ascribed to them as in those codes.

201.4 Terms not defined. Where terms are not defined through the methods authorized by this section, such terms shall have ordinarily accepted meanings such as the context implies.

SECTION 202 GENERAL DEFINITIONS

ABRASIVE MATERIALS. Moderately abrasive particulate in high concentrations, and highly abrasive particulate in moderate and high concentrations, such as alumina, bauxite, iron silicate, sand and slag.

ABSORPTION SYSTEM. A refrigerating system in which refrigerant is pressurized by pumping a chemical solution of refrigerant in absorbent, and then separated by the addition of heat in a generator, condensed (to reject heat), expanded, evaporated (to provide refrigeration), and reabsorbed in an absorber to repeat the cycle; the system can be single or multiple effect, the latter using multiple stages or internally cascaded use of heat to improve efficiency.

ACCESS (TO). That which enables a device, *appliance* or *equipment* to be reached by ready access or by a means that first requires the removal or movement of a panel or similar obstruction [see also "Ready access (to)"].

AIR. Air supplied to mechanical *equipment* and appliances for *combustion*, ventilation, cooling and similar purposes. Standard air is air at standard temperature and pressure, namely, 21°C (70°) and 101.3 kPa (29.92 inches of mercury).

AIR CONDITIONING. The treatment of air so as to control simultaneously the temperature, humidity, cleanness and dis-

tribution of the air to meet the requirements of a conditioned space.

AIR-CONDITIONING SYSTEM. A system that changes and controls the temperature and in some instances also the humidity or air cleanliness or pressure of the air in a room or rooms or building and generally consists of a condenser (heat exchanger); evaporator(s) or air handling unit(s) (heat exchanger); blowers; filters; supply, exhaust and return ducts; and shall include any apparatus installed in connection therewith.

AIR DISPERSION SYSTEM. Any diffuser system designed to both convey air into a room, space or area and diffuse air into that space while operating under positive pressure. Systems are commonly constructed of, but not limited to, fabric or plastic film.

AIR DISTRIBUTION SYSTEM. Any system of ducts, plenums and air-handling *equipment* that circulates air within a space or spaces and includes systems made up of one or more air-handling units.

AIR, EXHAUST. Air being removed from any space, *appliance* or piece of *equipment* and conveyed directly to the atmosphere by means of openings or ducts.

AIR-HANDLING UNIT. A unit with blower fan(s), cooling/heating coils, filter and damper used for the purpose of filtering, infusing cooling and/or heating into the air stream and distributing supply air to a room, space or area.

AIR, MAKEUP. Any combination of outdoor and transfer air imported into the airconditioned air stream to replace the air deliberately exhausted and lost to exfiltration to retain the designed air changes for a room, rooms or building.

AIR, OUTDOOR. Ambient air that enters a building through a ventilation system, through intentional openings for natural ventilation, or by infiltration.

AIR, TRANSFER. Air moved from one indoor space to another.

ALTERATION. A change in a mechanical system that involves an extension, addition or change to the arrangement, type or purpose of the original installation.

APPLIANCE. A device or apparatus that is manufactured and designed to utilize energy and for which this code provides specific requirements.

APPLIANCE, EXISTING. Any *appliance* regulated by this code that was legally installed prior to the effective date of this code, or for which a permit to install has been issued.

APPLIANCE TYPE.

High-heat appliance. Any *appliance* in which the products of *combustion* at the point of entrance to the flue under normal operating conditions have a temperature greater than

1093°C (2,000°F).

Low-heat appliance (residential appliance). Any *appliance* in which the products of *combustion* at the point of entrance to the flue under normal operating conditions have a temperature of 538°C (1,000°F) or less.

Medium-heat appliance. Any *appliance* in which the products of *combustion* at the point of entrance to the flue under normal operating conditions have a temperature of more than 538°C (1,000°F), but not greater than 1093°C (2,000°F)

APPLIANCE, VENTED. An *appliance* designed and installed in such a manner that all of the products of *combustion* are conveyed directly from the *appliance* to the outdoor atmosphere through an *approved chimney* or vent system.

APPROVED (materials or installation methods). Acceptable to the building official because the BSI or a BSI recognized body can vouch for its satisfactory quality when conditional specifications are met.

APPROVED (testing or certification or accreditation). Acceptable to the building official because the respective local agency (BSI or NCBJ or JANAAC or their recognized bodies) for testing, certification and accreditation can vouch for internationally accepted service quality that are based on international specifications. **APPROVED AGENCY.** An established and recognized agency that is regularly engaged in conducting tests, furnishing inspection services or furnishing product certification where such agency has been approved by the building official. **AUTOMATIC BOILER.** Any class of boiler that is equipped with the controls and limit devices specified in Chapter 10.

BATHROOM. A room containing a bathtub, shower, spa or similar bathing fixture.

BOILER. A closed heating *appliance* intended to supply hot water or steam for space heating, processing or power purposes. Low-pressure boilers operate at pressures less than or equal to 103 kPa (15 pounds per square inch (psi)) for steam and 1,103 kPa (160 psi) for water. High-pressure boilers operate at pressures exceeding those pressures.

BOILER ROOM. A room primarily utilized for the installation of a boiler.

BRAZED JOINT. A gas-tight joint obtained by the joining of metal parts with metallic mixtures or alloys that melt at a temperature above 538°C (1,000°F), but lower than the melting temperature of the parts to be joined.

BRAZING. A metal joining process wherein coalescence is produced by the use of a nonferrous filler metal having a melting point above 538°C (1,000°F), but lower than that of the base metal being joined. The filler material is distributed between the closely fitted surfaces of the joint by capillary attraction.

BREATHING ZONE. The region within an occupied space between planes 76 and 1830 mm (3 and 72 inches) above the floor and more than 610 mm (2 feet) from the walls of the space or from fixed air-conditioning *equipment*.

BTU. Abbreviation for British thermal unit, which is the quantity of heat required to raise the temperature of 454 g (1 pound) of water 0.56°C (1°F) (1 J = Btu = 1055 J).

BUILDING. Any structure utilized or intended for supporting or sheltering any *occupancy*.

BUILDING OFFICIAL. The Local Authority (Municipality) Building Department officer or Chief Engineering Officer or any duly authorized representative of the Department or other designated organization who is charged with the administration and enforcement of part or all of this code. This definition shall not include electrical works which is governed by separate laws and regulations in which the equivalent officer is the Electrical

Inspector.

BUILDING PRACTITIONERS. Persons with Jamaica Building Practitioner's Board recognized qualification and experience in one or more of the categories of construction management, construction supervision, contracting, technicians, draughting, tradesmen and special equipment operators and who are licensed in Jamaica by the Board to undertake designated work which may include design of *non-complex buildings* (simple buildings) of 300 square meters or less which are compliant with the Jamaica Small Building/Residential Code only. Building Practitioners with a building design license shall not seek building permit under the Jamaica Building Code.

BUILDING PROFESSIONALS. Persons who have graduated from an accredited professional degree program, have acquired sufficient Registration Board recognized work experience within their discipline, passed any required professional entry examination required and are registered by the Government of Jamaica Professional Registration Board in the disciplines of architecture or engineering or land surveying and has the competence to undertake on his own design of building elements or systems.

BUILDING SERVICES. The electrical, mechanical, building transportation, telecommunications, fire, data, sewage, plumbing, gas and garbage disposal services.

BUILDING WORKS. The design, construction, erection, alteration, repair, extension, modification, demolition, or removal of a building and all activities relating thereto such as:

- a) Change of class or use of a building under the Building Codes.
- b) Any operation normally undertaken by a person carrying on the business of building construction. This includes construction works external of the building such as fencing, landscaping, retaining walls, sewage disposal and driveways.

CEILING RADIATION DAMPER. A *listed* device installed in a ceiling membrane of a fire-resistance-rated floor/ceiling or roof/ceiling assembly to limit automatically the radiative heat transfer through an air inlet/outlet opening.

CHANGE OF BUILDING USE. A change in the use of a building or a portion of a building that results in any of the following:

1. A change of occupancy classification.
2. A change from one building group to another group within an occupancy classification.
3. Any change in use within a building group for which there is a change in application of the requirements of this code.

CHANGE OF OCCUPANCY. This term had to be replaced by "Change of building use" because it is widely used in the Jamaica Planning Act where it has a vastly different meaning from that in the International Mechanical Code on which this code is based. Legal advisers have recommended that to use this term in this Jamaica Mechanical Code will inevitably lead to confusion and litigation losses in the area change of

occupancy as lawyers exploit the widely different meaning in this code and the Planning Act.

CHIMNEY. A primarily vertical structure containing one or more flues, for the purpose of carrying gaseous products of *combustion* and air from a fuel-burning *appliance* to the outdoor atmosphere.

Factory-built chimney. A *listed* and *labeled chimney* composed of factory-made components, assembled in the field in accordance with manufacturer's instructions and the conditions of the listing.

Masonry chimney. A field-constructed *chimney* composed of solid masonry units, bricks, stones or concrete.

Metal chimney. A field-constructed *chimney* of metal.

CHIMNEY CONNECTOR. A pipe that connects a fuel-burning *appliance* to a *chimney*.

CLEARANCE. The minimum distance through air measured between the heat-producing surface of the mechanical *appliance*, device or *equipment* and the surface of the combustible material or assembly.

CLOSED COMBUSTION SOLID-FUEL-BURNING APPLIANCE. A heat-producing *appliance* that employs a *combustion* chamber that does not have openings other than the flue collar, fuel charging door and adjustable openings provided to control the amount of *combustion air* that enters the *combustion* chamber.

CLOTHES DRYER. An *appliance* used to dry wet laundry by means of heat.

CODE. These regulations, subsequent amendments thereto, or any emergency rule or regulation that the administrative authority having jurisdiction has lawfully adopted.

CODE OFFICIAL. See *Building Official*

COMBINATION FIRE/SMOKE DAMPER. A *listed* device installed in ducts and air transfer openings designed to close automatically upon the detection of heat and resist the passage of flame and smoke. The device is installed to operate automatically, be controlled by a smoke detection system, and where required, is capable of being positioned from a fire command center.

COMBUSTIBLE ASSEMBLY. Wall, floor, ceiling or other assembly constructed of one or more component materials that are not defined as noncombustible.

COMBUSTIBLE LIQUID. A liquid having a closed cup flash point at or above 38°C (100°F). Combustible liquids shall be subdivided as follows:

Class II. Liquids having a closed cup flash point at or above 38°C(100°F) and below 60°C (140°F).

Class IIIA. Liquids having a closed cup flash point at or above 60°C (140°F) and below 93°C (200°F) .

Class IIIB. Liquids having a closed cup flash point at or above 93°C (200°F).

The category of combustible liquids does not include compressed gases or cryogenic fluids.

COMBUSTIBLE MATERIAL. Any material not defined as noncombustible.

COMBUSTION. In the context of this code, refers to the rapid oxidation of fuel accompanied by the production of heat or heat and light.

COMBUSTION AIR. Air necessary for complete *combustion* of a fuel, including *theoretical air* and excess air.

COMBUSTION CHAMBER. The portion of an *appliance* within which *combustion* occurs.

COMBUSTION PRODUCTS. Constituents resulting from the *combustion* of a fuel with the oxygen of the air, including the inert gases, but excluding excess air.

COMMERCIAL COOKING APPLIANCES.

Appliances used in a commercial food service establishment for heating or cooking food. For the purpose of this definition, a commercial food service establishment is where food is prepared for sale or is prepared on a scale that is by volume and frequency not representative of domestic household cooking.

COMMERCIAL COOKING RECIRCULATING SYSTEM. Self-contained system consisting of the exhaust hood, the cooking *equipment*, the filters and the fire suppression system. The system is designed to capture cooking vapors and residues generated from commercial cooking *equipment*. The system removes contaminants from the *exhaust air* and recirculates the air to the space from which it was withdrawn.

COMMERCIAL KITCHEN HOODS.

Backshelf hood. A backshelf hood is also referred to as a low-proximity hood, or as a sidewall hood where wall mounted. Its front lower lip is low over the *appliance(s)* and is "set back" from the front of the *appliance(s)*. It is always closed to the rear of the *appliance(s)* by a panel where free-standing, or by a panel or wall where wall mounted, and its height above the cooking surface varies. (This style of hood can be constructed with partial end panels to increase its effectiveness in capturing the effluent generated by the cooking operation).

Double island canopy hood. A double island canopy hood is placed over back-to-back *appliances* or *appliance* lines. It is open on all sides and overhangs both fronts and the sides of the *appliance(s)*. It could have a wall panel between the backs of the *appliances*. (The fact that *exhaust air* is drawn from both sides of the double canopy to meet in the center causes each side of this hood to emulate a wall canopy hood, and thus it functions much the same with or without an actual wall panel between the backs of the *appliances*).

Eyebrow hood. An eyebrow hood is mounted directly to the face of an *appliance*, such as an oven and dishwasher, above the opening(s) or door(s) from which effluent is emitted, extending past the sides and overhanging the front of the opening to capture the effluent.

Pass-over hood. A pass-over hood is a free-standing form of a backshelf hood constructed low enough to pass food over the top.

Single island canopy hood. A single island canopy hood is placed over a single *appliance* or *appliance* line. It is open on all sides and overhangs the front, rear and sides of the *appliance(s)*. A single island canopy is more susceptible to cross drafts and requires a greater *exhaust air* flow than an equivalent sized wall-mounted canopy to capture and contain effluent generated by the cooking operation(s).

Wall canopy hood. A wall canopy exhaust hood is mounted against a wall above a single *appliance* or line of

appliance(s), or it could be free-standing with a back panel from the rear of the *appliances* to the hood. It overhangs the front and sides of the *appliance(s)* on all open sides.

The wall acts as a back panel, forcing the *makeup air* to be drawn across the front of the cooking *equipment*, thus increasing the effectiveness of the hood to capture and contain effluent generated by the cooking operation(s).

COMPENSATING HOODS. *Compensating hoods* are those having integral (built-in) *makeup air* supply. The *makeup air* supply for such hoods is generally supplied from: short-circuit flow from inside the hood, air curtain flow from the bottom of the front face, and front face discharge from the outside front wall of the hood. The compensating *makeup air*-flow can also be supplied from the rear or side of the hood, or the rear, front or sides of the cooking *equipment*. The *makeup air* flow can be one or a combination of methods.

COMPLEX BUILDINGS. Buildings with the following technical complexities which if not designed by registered *building professionals* are unlikely to withstand the many severe natural hazards to which Jamaica is frequently exposed:

1. Buildings of large sizes with or without very large halls or rooms
2. Buildings with configurations (shape) differing markedly from the square or traditional rectangular shapes.
3. Buildings with complex structures such as cantilevers, spiral staircases or storeys in excess of two.
4. Buildings where sections of an exterior shear panels or reinforced frame are not in one plane vertically from the foundation to the uppermost storey in which they are required.
5. Buildings where shear panel or reinforced frame members are not oriented in mutually perpendicular directions.
6. Buildings where sections of the shear panel or reinforced frame on any one storey above grade are constructed of dissimilar bracing systems.
7. Buildings where a section of a floor or roof is not laterally supported by a shear panel or reinforced frame on all edges.
8. Buildings where an opening in a floor or roof exceeds the lesser of 3.60 m² or 50% of the smaller dimension of the slab.
9. Building where portions of a suspended floor are vertically offset.
10. Buildings on virgin slopes greater than one vertical to three horizontal.
11. Buildings in expansive soil or land slippage areas.

COMPLEX BUILDING SERVICES.

Buildings with services that are technically complex and require Registered Professionals with the requisite skills to properly undertake the design. Technical services that shall cause a building to be a complex service building requiring engineering design attention are as follows:

1. Buildings having 3-phase electrical distribution system or a single phase system in excess of 70 Amps mains breaker.
2. Buildings with a central air-conditioning, cooling or heating/cooling system.

3. Plumbing systems requiring hot and cold water piping and have a minimum of 12 plumbing units.

4. Sewage systems requiring secondary or tertiary treatment.

5. Buildings with one or more automatic sprinkler system.

6. Buildings with in-built medical services such as gases.

COMPRESSOR. A specific machine, with or without accessories that takes air or other gas or refrigerant at a relatively low pressure and compresses it into a much higher pressure by changing its volume and/or its temperature.

COMPRESSOR, POSITIVE DISPLACEMENT. A compressor in which increase in pressure is attained by changing the internal volume of the compression chamber.

COMPRESSOR UNIT. A unit that takes air or other gas or refrigerant at a relatively low pressure and compresses it into a much higher pressure and consists of the compressor unit with its prime mover and accessories.

CONCEALED LOCATION. A location that cannot be accessed without damaging permanent parts of the building structure or finish surface. Spaces above, below or behind readily removable panels or doors shall not be considered as concealed.

CONDENSATE. The liquid that condenses from a gas (including flue gas) caused by a reduction in temperature.

CONDENSER. A heat exchanger designed to liquefy refrigerant vapor by removal of heat.

CONDENSING UNIT. A specific refrigerating machine combination for a given refrigerant, consisting of one or more power-driven compressors, condensers and, where required, liquid receivers, and the regularly furnished accessories.

CONDITIONED SPACE. An area, room or space that is enclosed within the building thermal envelope and that is directly heated or cooled or that is indirectly heated or cooled. Spaces are indirectly heated or cooled where they communicate through openings with conditioned spaces, where they are separated from conditioned spaces by uninsulated walls, floors or ceilings, or where they contain uninsulated ducts, piping or other sources of heating or cooling.

CONSTRUCTION DOCUMENTS. The written, graphic and pictorial documents prepared or assembled for describing the design, location and physical characteristics of the elements of the project necessary for obtaining a building permit. The construction drawings shall be drawn to an appropriate scale.

CONTROL. A manual or automatic device designed to regulate the gas, air, water or electrical supply to, or operation of, a mechanical system.

CONVERSION BURNER. A burner designed to supply gaseous fuel to an *appliance* originally designed to utilize another fuel.

COOKING APPLIANCE. See “*Commercial cooking appliances.*”

DAMPER. A manually or automatically controlled device to regulate draft or the rate of flow of air or *combustion* gases.

Volume damper. A device that, where installed, will restrict, retard or direct the flow of air in a duct, or the products of *combustion* in a heat-producing *appliance*, its vent connector, vent or *chimney* therefrom.

DESIGN FLOOD ELEVATION. The elevation of the “design flood,” including wave height, relative to the datum specified on the community’s legally designated flood hazard area map. In areas designated as Zone AO, the *design flood elevation* shall be the elevation of the highest existing grade of the building’s perimeter plus the depth number, in feet, specified on the flood hazard map. In areas designated as Zone AO where a depth number is not specified on the map, the depth number shall be taken as being equal to 610 mm (2 feet)

DESIGN WORKING PRESSURE. The maximum allowable working pressure for which a specific part of a system is designed.

DIRECT REFRIGERATION SYSTEM. A system in which the evaporator or condenser of the refrigerating system is in direct contact with the air or other substances to be cooled or heated.

DIRECT SOLAR SYSTEM. A solar thermal system in which the gas or liquid in the solar collector loop is not separated from the load.

DIRECT-VENT APPLIANCES. Appliances that are constructed and installed so that all air for *combustion* is derived from the outdoor atmosphere and all flue gases are discharged to the outdoor atmosphere.

DISCRETE PRODUCT. Products that are noncontinuous, individual, distinct pieces such as, but not limited to, electrical, plumbing and mechanical products and duct straps, duct fittings, duct registers and pipe hangers.

DRAFT. The pressure difference existing between the *appliance* or any component part and the atmosphere, that causes a continuous flow of air and products of *combustion* through the gas passages of the *appliance* to the atmosphere.

Induced draft. The pressure difference created by the action of a fan, blower or ejector, that is located between the *appliance* and the *chimney* or vent termination.

Natural draft. The pressure difference created by a vent or *chimney* because of its height, and the temperature difference between the flue gases and the atmosphere.

DRAIN-BACK SYSTEM. A solar thermal system in which the fluid in the solar collector loop is gravity drained from the collector into a holding tank under prescribed circumstances.

DRIP. The container placed at a low point in a system of piping to collect condensate and from which the condensate is removable.

DRY CLEANING SYSTEMS. Dry cleaning plants or systems are classified as follows:

Type I. Those systems using Class I flammable liquid solvents having a flash point below 38°C (100°F).

Type II. Those systems using Class II combustible liquid solvents having a flash point at or above 38°C (100°F) and below 60°C (140°F).

Type III. Those systems using Class III combustible liquid solvents having a flash point at or above 60°C (140°F).

Types IV and V. Those systems using Class IV nonflammable liquid solvents.

DUCT. A tube or conduit utilized for conveying air. The air passages of self-contained systems are not to be construed as air ducts.

DUCT FURNACE. A warm-air furnace normally installed in an air distribution duct to supply warm air for heating. This definition shall apply only to a warm-air heating *appliance* that, for air circulation, depends on a blower not furnished as part of the furnace.

DUCT SYSTEM. A continuous passageway for the transmission of air that, in addition to ducts, includes duct fittings, dampers, plenums, fans and accessory air-handling *equipment* and appliances.

DUCTLESS MINI-SPLIT SYSTEM. A heating and cooling system that is comprised of one or multiple indoor evaporator/air-handling units and an outdoor condensing unit that is connected by refrigerant piping and electrical wiring. A ductless mini-split system is capable of cooling or heating one or more rooms without the use of a traditional ductwork system.

DWELLING. A building or portion thereof that contains not more than two *dwelling* units.

DWELLING UNIT. A single unit providing complete, independent living facilities for one or more persons, including permanent provisions for living, sleeping, eating, cooking and sanitation.

ELECTRIC HEATING APPLIANCE. An *appliance* that produces heat energy to create a warm environment by the application of electric power to resistance elements, refrigerant compressors or dissimilar material junctions.

ENERGY RECOVERY VENTILATION SYSTEM. Systems that employ air-to-air heat exchangers to recover energy from or reject energy to *exhaust air* for the purpose of pre-heating, precooling, humidifying or dehumidifying outdoor *ventilation air* prior to supplying such air to a space, either directly or as part of an HVAC system.

ENVIRONMENTAL AIR. Air that is conveyed to or from occupied areas through ducts that are not part of the heating or air-conditioning system, such as ventilation for human usage, domestic kitchen range exhaust, bathroom exhaust, domestic clothes dryer exhaust and parking garage exhaust.

EQUIPMENT. Piping, ducts, vents, control devices and other components of systems other than appliances that are permanently installed and integrated to provide control of environmental conditions for buildings. This definition shall also include other systems specifically regulated in this code.

EQUIPMENT, EXISTING. Any *equipment* regulated by this code which was legally installed prior to the effective date of this code, or for which a permit to install has been issued.

EVAPORATIVE COOLER. A device used for reducing the sensible heat of air for cooling by the process of evaporation of water into an airstream.

EVAPORATIVE COOLING SYSTEM. The *equipment* and appliances intended or installed for the purpose of environmental cooling by an evaporative cooler from which the conditioned air is distributed through ducts or plenums to the conditioned area.

EVAPORATOR. That part of the system in which liquid refrigerant is vaporized to produce refrigeration.

EXCESS AIR. The amount of air provided in addition to *theoretical air* to achieve complete *combustion* of a fuel, thereby preventing the formation of dangerous products of *combustion*.

EXFILTRATION. 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 resulting from wind, the stack effect created by temperature differences between indoors and outdoors, and imbalances between supply and exhaust airflow rates.

EXHAUST SYSTEM. An assembly of connected ducts, plenums, fittings, registers, grilles and hoods through which air is conducted from the space or spaces and exhausted to the outdoor atmosphere.

EXTRA-HEAVY-DUTY COOKING APPLIANCE. Extra-heavy-duty cooking appliances are those utilizing open flame combustion of solid fuel at any time.

FIRE DAMPER. A *listed* device installed in ducts and air transfer openings designed to close automatically upon detection of heat and to restrict the passage of flame. Fire dampers are classified for use in either static systems that will automatically shut down in the event of a fire, or in dynamic systems that continue to operate during a fire. A dynamic fire damper is tested and rated for closure under elevated temperature airflow.

FIREPLACE. An assembly consisting of a hearth and fire chamber of noncombustible material and provided with a *chimney*, for use with solid fuels.

Factory-built fireplace. A *listed* and *labeled* fireplace and *chimney* system composed of factory-made components, and assembled in the field in accordance with manufacturer's instructions and the conditions of the listing.

Masonry fireplace. A field-constructed fireplace composed of solid masonry units, bricks, stones or concrete.

FIREPLACE STOVE. A free-standing chimney-connected solid-fuel-burning heater, designed to be operated with the fire chamber doors in either the open or closed position.

FLAME SAFEGUARD. A device that will automatically shut off the fuel supply to a main burner or group of burners when the means of ignition of such burners becomes inoperative, and when flame failure occurs on the burner or group of burners.

FLAME SPREAD INDEX. The numerical value assigned to a material tested in accordance with ASTM E 84 or UL

FLAMMABILITY CLASSIFICATION. Refrigerants shall be assigned to one of the three classes—1, 2 or 3—in accordance with ASHRAE 34. For Classes 2 and 3, the heat of *combustion* shall be calculated assuming that *combustion* products are in the gas phase and in their most stable state.

Class 1. Refrigerants that do not show flame propagation when tested in air at 101 kPa (14.7 psia) and 60°C (140°F)

Class 2. Refrigerants having a lower flammability limit (LFL) of more than 0.10 kg/m³ (0.00625 pound per cubic foot) at 60°C (140°F) and 101 kPa (14.7 psia) and a heat of combustion of less than 19 000 kJ/kg (8169 Btu/lb).

Class 3. Refrigerants that are highly flammable, having a LFL of less than or equal to 0.10 kg/m³ (0.00625 pound per cubic foot) at 60°C (140°F) and 101 kPa (14.7 psia) or a heat of combustion greater than or equal to 19 000 kJ/kg (8169 Btu/lb). **FLAMMABLE LIQUIDS.** Any liquid that has a flash point below 38°C (100°F) and has a vapor pressure not exceeding 276 kPa (40 psia) at 38°C (100°F). Flammable liquids shall be known as Class I liquids and shall be divided into the following classifications:

Class IA. Liquids having a flash point below 23°C (73°F) and a boiling point below 38°C (100°F).

Class IB. Liquids having a flash point below 23°C (73°F) and a boiling point at or above 38°C (100°F)..

Class IC. Liquids having a flash point at or above 23°C (73°F) and below 38°C (100°F).

FLUE LINER (LINING). A system or material used to form the inside surface of a flue in a *chimney* or vent, for the purpose of protecting the surrounding structure from the effects of *combustion* products and conveying *combustion* products without leakage to the atmosphere.

FOOD-GRADE FLUID. Potable water or a fluid containing additives listed in accordance with the Code of Federal Regulations, Title 21, Food and Drugs, Chapter 1, Food and Drug Administration, Parts 174-186.

FUEL GAS. A natural gas, manufactured gas, liquefied petroleum gas or a mixture of these.

FUEL OIL. Kerosene or any hydrocarbon oil having a flash point not less than 38°C (100°F)

FUEL-OIL PIPING SYSTEM. A closed piping system that connects a combustible liquid from a source of supply to a fuel-oil-burning *appliance*.

FURNACE. A completely self-contained heating unit that is designed to supply heated air to spaces remote from or adjacent to the *appliance* location.

FURNACE ROOM. A room primarily utilized for the installation of fuel-burning, space-heating and water-heating appliances other than boilers (see also “Boiler room”).

FUSIBLE PLUG. A device arranged to relieve pressure by operation of a fusible member at a predetermined temperature.

GROUND SOURCE HEAT PUMP LOOP SYSTEM. Piping buried in horizontal or vertical excavations or placed in a body of water for the purpose of transporting heat transfer liquid to and from a heat pump. Included in this definition are closed loop

FLAMMABLE VAPOR OR FUMES. Mixtures of gases in air at concentrations equal to or greater than the LFL and less than or equal to the upper flammability limit (UFL).

FLASH POINT. The minimum temperature corrected to a pressure of 101 kPa (14.7 psia) at which the application of a test flame causes the vapors of a portion of the sample to ignite under the conditions specified by the test procedures and apparatus. The flash point of a liquid shall be determined in accordance with ASTM D 56, ASTM D 93 or ASTM D 3278.

FLEXIBLE AIR CONNECTOR. A conduit for transferring air between an air duct or plenum and an air terminal unit or between an air duct or plenum and an air inlet or air outlet. Such conduit is limited in its use, length and location.

FLOOR AREA, NET. The actual occupied area, not including unoccupied accessory areas or thicknesses of walls.

FLOOR FURNACE. A completely self-contained furnace suspended from the floor of the space being heated, taking air for *combustion* from outside such space and with means for observing flames and lighting the *appliance* from such space.

FLUE. A passageway within a *chimney* or vent through which gaseous *combustion* products pass.

FLUE CONNECTION (BREECHING). A passage for conducting the products of *combustion* from a fuel-fired *appliance* to the vent or *chimney* (see also “*Chimney connector*” and “*Vent connector*”).

FLUE GASES. Products of *combustion* and excess air.

systems in which the liquid is recirculated and open loop systems in which the liquid is drawn from a well or other source.

HAZARDOUS LOCATION. Any location considered to be a fire hazard for flammable vapors, dust, combustible fibers or other highly combustible substances. The location is not necessarily categorized in the *Jamaica Building Code* as a high-hazard use group classification.

HEAT EXCHANGER. A device that transfers heat from one medium to another.

HEAT PUMP. A refrigeration system that extracts heat from one substance and transfers it to another portion of the same substance or to a second substance at a higher temperature for a beneficial purpose.

HEAT TRANSFER LIQUID. The operating or thermal storage liquid in a mechanical system, including water or other liquid base, and additives at the concentration present under operating conditions used to move heat from one location to another. Refrigerants are not included as heat transfer liquids.

HEAVY-DUTY COOKING APPLIANCE. Heavy-duty cooking *appliances* include electric under-fired broilers, electric chain (conveyor) broilers, gas under-fired broilers, gas chain (conveyor) broilers, gas open-burner ranges (with or without oven), electric and gas wok ranges, smokers, smoker ovens, and electric and gas over-fired (upright) broilers and salamanders.

HIGH-PROBABILITY SYSTEMS. A refrigeration system in which the basic design or the location of components is such that a leakage of refrigerant from a failed connection, seal or component will enter an *occupancy* classified area, other than the *machinery room*.

HIGH-SIDE PRESSURE. The parts of a refrigerating system subject to condenser pressure.

HIGH-VOLUME, LARGE-DIAMETER FAN. A low-speed ceiling fan that circulates large volumes of air and that is greater than 2134 mm (7 feet) in diameter.

HOOD. An air intake device used to capture by entrapment, impingement, adhesion or similar means, grease, moisture, heat and similar contaminants before they enter a duct system.

Type I. A kitchen hood for collecting and removing grease vapors and smoke. Such hoods are equipped with a fire suppression system.

Type II. A general kitchen hood for collecting and removing steam, vapor, heat, odors and products of *combustion*.

HYDROGEN GENERATING APPLIANCE. A self-contained package or factory-matched packages of integrated systems for generating gaseous hydrogen. Hydrogen generating appliances utilize electrolysis, reformation, chemical, or other processes to generate hydrogen.

IGNITION SOURCE. A flame, spark or hot surface capable of igniting flammable vapors or fumes. Such sources include *appliance* burners, burner ignitors and electrical switching devices.

IMMEDIATELY DANGEROUS TO LIFE OR HEALTH (IDLH). The concentration of airborne contaminants that poses a threat of death, immediate or delayed permanent adverse health effects, or effects that could prevent escape from such an environment. This contaminant concentration level is established by the National Institute of Occupational Safety and Health (NIOSH) based on both toxicity and flammability. It is generally expressed in parts per million by volume (ppm v/v) or milligrams per cubic meter (mg/m³).

INDIRECT REFRIGERATION SYSTEM. A system in which a secondary coolant cooled or heated by the refrigerating system is circulated to the air or other substance to be cooled or heated. Indirect systems are distinguished by the following methods of application:

Closed system. A system in which a secondary fluid is either cooled or heated by the refrigerating system and then circulated within a closed circuit in indirect contact with the air or other substance to be cooled or heated.

Double-indirect open-spray system. A system in which the secondary substance for an indirect open-spray system is heated or cooled by an intermediate coolant circulated from a second enclosure.

Open-spray system. A system in which a secondary coolant is cooled or heated by the refrigerating system and then circulated in direct contact with the air or other substance to be cooled or heated.

Vented closed system. A system in which a secondary coolant is cooled or heated by the refrigerating system and then passed through a closed circuit in the air or other substance to be cooled or heated, except that the evaporator or condenser is placed in an open or appropriately vented tank.

INDIRECT SOLAR SYSTEM. A solar thermal system in which the gas or liquid in the solar collector loop circulates between the solar collector and a heat exchanger and such gas or liquid is not drained from the system or supplied to the load during normal operation.

INFILTRATION. Uncontrolled inward air leakage to conditioned spaces through unintentional openings in ceilings, floors and walls from unconditioned spaces or the outdoors caused by pressure differences across these openings resulting from wind, the stack effect created by temperature differences between indoors and outdoors, and imbalances between supply and exhaust airflow rates.

INTERLOCK. A device actuated by another device with which it is directly associated, to govern succeeding operations of the same or allied devices. A circuit in which a given action cannot occur until after one or more other actions have taken place.

JOINT, FLANGED. A joint made by bolting together a pair of flanged ends.

JOINT, FLARED. A metal-to-metal compression joint in which a conical spread is made on the end of a tube that is compressed by a flare nut against a mating flare.

JOINT, PLASTIC ADHESIVE. A joint made in thermoset plastic piping by the use of an adhesive substance that forms a continuous bond between the mating surfaces without dissolving either one of them.

JOINT, PLASTIC HEAT FUSION. A joint made in thermoplastic piping by heating the parts sufficiently to permit fusion of the materials when the parts are pressed together.

JOINT, PLASTIC SOLVENT CEMENT. A joint made in thermoplastic piping by the use of a solvent or solvent cement that forms a continuous bond between the mating surfaces.

JOINT, SOLDERED. A gas-tight joint obtained by the joining of metal parts with metallic mixtures of alloys that melt at temperatures between 204°C (400°F) and 538 °C (1,000°F).

JOINT, WELDED. A gas-tight joint obtained by the joining of metal parts in molten state.

LABELED. *Equipment, materials or products to which have been affixed a label, seal, symbol or other identifying mark of a nationally recognized testing laboratory, approved agency or other organization concerned with product evaluation that maintains periodic inspection of the production of the labeled items and whose labeling indicates either that the *equipment, material or product* meets identified standards or has been tested and found suitable for a specified purpose.*

LIGHT-DUTY COOKING APPLIANCE. Light-duty cooking *appliances* include gas and electric ovens (including standard, bake, roasting, revolving, retherm, convection, combination convection/steamer, countertop conveyORIZED baking/finishing, deck and pastry), electric and gas steam-

jacketed kettles, electric and gas pasta cookers, electric and gas compartment steamers (both pressure and atmospheric) and electric and gas cheese-melters.

LIMIT CONTROL. A device responsive to changes in pressure, temperature or level for turning on, shutting off or throttling the gas supply to an *appliance*.

LIMITED CHARGE SYSTEM. A system in which, with the compressor idle, the design pressure will not be exceeded when the refrigerant charge has completely evaporated.

LISTED. *Equipment, materials, products or services included in a list published by an organization acceptable to the code official and concerned with evaluation of products or services that maintains periodic inspection of production of *listed equipment* or materials or periodic evaluation of services and whose listing states either that the *equipment, material, product or service* meets identified standards or has been tested and found suitable for a specified purpose.*

LIVING SPACE. Space within a *dwelling unit* utilized for living, sleeping, eating, cooking, bathing, washing and sanitation purposes.

LOW-PROBABILITY PUMP. A pump that is designed to prevent atmospheric release of the pumped fluid by one of the following methods: 1. The pump is permanently sealed; 2. The pump incorporates a static seal; 3. The pump incorporates not less than two sequential dynamic shaft seals to isolate the pumped fluid from atmosphere at shaft penetrations and automatically shuts down upon failure of any seal.

LOWER EXPLOSIVE LIMIT (LEL). See “LFL.”

LOWER FLAMMABLE LIMIT (REFRIGERANT) (LFL). The minimum concentration of refrigerant that is capable of propagating a flame through a homogeneous mixture of refrigerant and air.

LOWER FLAMMABLE LIMIT (LFL). The minimum concentration of vapor in air at which propagation of flame will occur in the presence of an ignition source. The LFL is sometimes referred to as LEL or lower explosive limit.

LOW-PRESSURE HOT-WATER-HEATING BOILER. A boiler furnishing hot water at pressures not exceeding 1103 kPa (160 psi) and at temperatures not exceeding 121 °C (250°F).

LOW-PRESSURE STEAM-HEATING BOILER. A boiler furnishing steam at pressures not exceeding 103 kPa (15 psi).

LOW-PROBABILITY SYSTEMS. A refrigeration system in which the basic design or the location of components is such that a leakage of refrigerant from a failed connection, seal or component will not enter an occupancy-classified area, other than the *machinery room*.

LOW-SIDE PRESSURE. The parts of a refrigerating system subject to evaporator pressure.

MACHINERY ROOM. An enclosed space that is required by Chapter 11 to contain refrigeration equipment and to comply with Sections 1105 and 1106.

MECHANICAL DRAFT SYSTEM. A venting system designed to remove flue or vent gases by mechanical means, that consists of an induced-draft portion under nonpositive

static pressure or a forced-draft portion under positive static pressure.

Forced-draft venting system. A portion of a venting system using a fan or other mechanical means to cause the removal of flue or vent gases under positive static pressure.

Induced-draft venting system. A portion of a venting system using a fan or other mechanical means to cause the removal of flue or vent gases under nonpositive static vent pressure.

Power venting system. A portion of a venting system using a fan or other mechanical means to cause the removal of flue or vent gases under positive static vent pressure.

MECHANICAL EQUIPMENT/APPLIANCE ROOM. A room or space in which nonfuel-fired mechanical *equipment* and *appliances* are located.

MECHANICAL EXHAUST SYSTEM. A system for removing air from a room or space by mechanical means.

MECHANICAL JOINT.

1. A connection between pipes, fittings, or pipes and fittings that is not welded, brazed, caulked, soldered, solvent cemented or heat fused.
2. A general form of gas or liquid-tight connections obtained by the joining of parts through a positive holding mechanical construction such as, but not limited to, flanged, screwed, clamped or flared connections.

MECHANICAL SYSTEM. A system specifically addressed and regulated in this code and composed of components, devices, *appliances* and *equipment*.

MEDIUM-DUTY COOKING APPLIANCE. Medium-duty cooking *appliances* include electric discrete element ranges (with or without oven), electric and gas hot-top ranges, electric and gas griddles, electric and gas double-sided griddles, electric and gas fryers (including open deep fat fryers, donut fryers, kettle fryers and pressure fryers), electric and gas conveyor pizza ovens, electric and gas tilting skillets (braising pans) and electric and gas rotisseries.

MODULAR BOILER. A steam or hot-water-heating assembly consisting of a group of individual boilers called modules intended to be installed as a unit without intervening stop valves. Modules are under one jacket or are individually jacketed. The individual modules shall be limited to a maximum input rating of 117 228 W (400,000 Btu/h) gas, 11.4 L/h (3 gallons per hour (gph) oil, or 115 kW (electric)..

NATURAL DRAFT SYSTEM. A venting system designed to remove flue or vent gases under nonpositive static vent pressure entirely by natural draft.

NATURAL VENTILATION. The movement of air into and out of a space through intentionally provided openings, such as windows and doors, or through nonpowered ventilators.

NET OCCUPIABLE FLOOR AREA. The floor area of an *occupiable space* defined by the inside surfaces of its walls but excluding shafts, column enclosures and other permanently enclosed, inaccessible and unoccupiable areas. Obstructions in the space such as furnishings, display or

storage racks and other obstructions, whether temporary or permanent, shall not be

deducted from the space area.

NO-FLOW CONDITION (SOLAR). A condition where thermal energy is not transferred from a solar thermal collector by means of flow of a heat transfer fluid.

NONFOOD-GRADE FLUID. Any fluid that is not designated as a food-grade fluid.

NONABRASIVE/ABRASIVE MATERIALS. Nonabrasive particulate in high concentrations, moderately abrasive particulate in low and moderate concentrations, and highly abrasive particulate in low concentrations, such as alfalfa, asphalt, plaster, gypsum and salt.

NONCOMBUSTIBLE MATERIALS. Materials that, when tested in accordance with ASTM E 136, have not fewer than three of four specimens tested meeting all of the following criteria:

1. The recorded temperature of the surface and interior thermocouples shall not at any time during the test rise more than 30°C (54°F) above the furnace temperature at the beginning of the test.
2. There shall not be flaming from the specimen after the first 30 seconds.
3. If the weight loss of the specimen during testing exceeds 50 percent, the recorded temperature of the surface and interior thermocouples shall not at any time during the test rise above the furnace air temperature at the beginning of the test, and there shall not be flaming of the specimen.

OCCUPANCY. The purpose for which a building, or portion thereof, is utilized or occupied.

OCCUPATIONAL EXPOSURE LIMIT (OEL). The time-weighted average (TWA) concentration for a normal 8-hour workday and a 40-hour workweek to which nearly all workers can be repeatedly exposed without adverse effect, based on the OSHA PEL, ACGIH TLV-TWA, TERA OARS WEEL, or consistent value.

OCCUPIABLE SPACE. An enclosed space intended for human activities, excluding those spaces intended primarily for other purposes, such as storage rooms and *equipment* rooms, that are only intended to be occupied occasionally and for short periods of time.

OFFSET (VENT). A combination of *approved* bends that make two changes in direction bringing one section of the vent out of line but into a line parallel with the other section.

OUTDOOR AIR. Air taken from the outdoors, and therefore not previously circulated through the system.

OUTDOOR OPENING. A door, window, louver or skylight openable to the outdoor atmosphere.

OUTLET. A threaded connection or bolted flange in a piping system to which a gas-burning *appliance* is attached.

PANEL HEATING. A method of radiant space heating in which heat is supplied by large heated areas of room surfaces. The heating element usually consists of warm water piping, warm air ducts, or electrical resistance elements embedded in or located behind ceiling, wall or floor surfaces.

PELLET FUEL-BURNING APPLIANCE. A closed-combustion, vented *appliance* equipped with a fuel-feed mecha-

nism for burning processed pellets of solid fuel of a specified size and composition.

PIPING. Where used in this code, "piping" refers to either pipe or tubing, or both.

Pipe. A rigid conduit of iron, steel, copper, copper-alloy, or plastic.

Tubing. Semirigid conduit of copper, copper-alloy, aluminum, plastic or steel.

PLASTIC, THERMOPLASTIC. A plastic that is capable of being repeatedly softened by increase of temperature and hardened by decrease of temperature.

PLASTIC, THERMOSETTING. A plastic that is capable of being changed into a substantially infusible or insoluble product when cured under application of heat or chemical means.

PLENUM. An enclosed portion of the building structure, other than an *occupiable space* being conditioned, that is designed to allow air movement, and thereby serve as part of an air distribution system.

POLLUTION-CONTROL UNIT (PCU). Manufactured equipment that is installed in a grease exhaust duct system for the purpose of extracting smoke, grease particles and odors from the exhaust flow by means of a series of filters.

PORTABLE FUEL CELL APPLIANCE. A fuel cell generator of electricity that is not fixed in place. A portable fuel cell *appliance* utilizes a cord and plug connection to a grid-isolated load and has an integral fuel supply.

POWER BOILER. See "Boiler."

REMISES. A lot, plot or parcel of land, including any structure thereon.

PRESS-CONNECT JOINT. A permanent mechanical joint incorporating an elastomeric seal or an elastomeric seal and corrosion-resistant grip ring. The joint is made with a pressing tool and jaw or ring approved by the fitting manufacturer.

PRESSURE, FIELD TEST. A test performed in the field to prove system tightness.

PRESSURE-LIMITING DEVICE. A pressure-responsive mechanism designed to stop automatically the operation of the pressure-imposing element at a predetermined pressure.

PRESSURE RELIEF DEVICE. A pressure-actuated valve or rupture member designed to relieve excessive pressure automatically.

PRESSURE RELIEF VALVE. A pressure-actuated valve held closed by a spring or other means and designed to relieve pressure automatically in excess of the device's setting.

PRESSURE VESSELS. Closed containers, tanks or vessels that are designed to contain liquids or gases, or both, under pressure.

PRESSURE VESSELS REFRIGERANT. Any refrigerant-containing receptacle in a refrigerating system. This does not include evaporators where each separate section does not exceed 0.014 m³ (0.5 cubic

foot) of refrigerant-containing volume, regardless of the maximum inside dimensions, evaporator coils, controls, headers, pumps and piping.

PROTECTIVE ASSEMBLY (REDUCED CLEARANCE). Any noncombustible assembly that is *labeled* or constructed in accordance with Table 308.4.2 and is placed between combustible materials or assemblies and mechanical appliances, devices or *equipment*, for the purpose of reducing required airspace clearances. Protective assemblies attached directly to a combustible assembly shall not be considered as part of that combustible assembly.

PURGE. To clear of air, water or other foreign substances.

PUSH-FIT JOINTS. A type of mechanical joint consisting of elastomeric seals and corrosion-resistant tube grippers. Such joints are permanent or removable depending on the design.

QUICK-OPENING VALVE. A valve that opens completely by fast action, either manually or automatically controlled. A valve requiring one-quarter round turn or less is considered to be quick opening.

RADIANT HEATER. A heater designed to transfer heat primarily by direct radiation.

READY ACCESS (TO). That which enables a device, *appliance* or *equipment* to be directly reached, without requiring the removal or movement of any panel or similar obstruction [see "Access (to)"].

RECEIVER, LIQUID. A vessel permanently connected to a refrigeration system by inlet and outlet pipes for storage of liquid refrigerant.

RECIRCULATED AIR. Air removed from a conditioned space and intended for reuse as supply air.

RECLAIMED REFRIGERANTS. Refrigerants reprocessed to the same specifications as for new refrigerants by means including distillation. Such refrigerants have been chemically analyzed to verify that the specifications have been met. Reclaiming usually implies the use of processes or procedures that are available only at a reprocessing or manufacturing facility.

RECOGNIZED, BODY OR AGENCY. A body or agency with an established practice that is based on internationally accepted quality standards that is consistently applied to its regularly conducted testing or inspection services or product certification to the satisfaction of service users.

RECOVERED REFRIGERANTS. Refrigerants removed from a system in any condition without necessarily testing or processing them.

RECYCLED REFRIGERANTS. Refrigerants from which contaminants have been reduced by oil separation, removal of non-condensable gases, and single or multiple passes through devices that reduce moisture, acidity and particulate matter, such as replaceable core filter driers. These procedures usually are performed at the field job site or in a local service shop.

REFRIGERANT. A substance utilized to produce refrigeration by its expansion or vaporization.

REFRIGERANT SAFETY CLASSIFICATIONS. Groupings that indicate the toxicity and flammability

classes in accordance with Section 1103.1. The classification group is made up of a letter (A or B) that indicates the toxicity class, followed by a number (1, 2 or 3) that indicates the flammability class. Refrigerant blends are similarly classified, based on the compositions at their worst cases of fractionation, as separately determined for toxicity and flammability. In some cases, the worst case of fractionation is the original formulation.

Flammability. See "Flammability classification."

Toxicity. See "Toxicity classification."

REFRIGERATING SYSTEM. A combination of interconnected refrigerant-containing parts constituting one closed refrigerant circuit in which a refrigerant is circulated for the purpose of extracting heat.

REFRIGERATION CAPACITY RATING. Expressed as 0.75 kW (1 horsepower), 1 ton or 3.5 kW (12,000 Btu/h), shall all mean the same quantity.

REFRIGERATION MACHINERY ROOM. See "*Machinery room.*"

REFRIGERATION SYSTEM, ABSORPTION. A heat-operated, closed-refrigeration cycle in which a secondary fluid (the absorbent) absorbs a primary fluid (the refrigerant) that has been vaporized in the evaporator.

Direct system. A system in which the evaporator is in direct contact with the material or space refrigerated, or is located in air-circulating passages communicating with such spaces.

Indirect system. A system in which a brine coil cooled by the refrigerant is circulated to the material or space refrigerated, or is utilized to cool the air so circulated. Indirect systems are distinguished by the type or method of application.

REFRIGERATION SYSTEM CLASSIFICATION.

Refrigeration systems are classified according to the degree of probability that leaked refrigerant from a failed connection, seal or component will enter an occupied area. The distinction is based on the basic design or location of the components.

REFRIGERATION SYSTEM, MECHANICAL. A combination of interconnected refrigeration-containing parts constituting one closed refrigerant circuit in which a refrigerant is circulated for the purpose of extracting heat and in which a compressor is used for compressing the refrigerant vapor.

REFRIGERATION SYSTEM, SELF-CONTAINED. A complete factory-assembled and tested system that is shipped in one or more sections and that does not have refrigerant-containing parts that are joined in the field by other than companion or block valves.

REGISTERED DESIGN BUILDING PROFESSIONAL. An individual who has graduated from an accredited professional degree program, have acquired sufficient Registration Board recognized work experience within their discipline, passed any required professional entry examination and are registered by a Government of Jamaica Professional Registration Board in one of the disciplines of architecture, engineering or land surveying and

has the competence to undertake on his/her own, design of building elements or building service systems.

RETURN AIR. That portion of the supply air that comes from an *approved* conditioned space or location and is mixed with makeup air to produce the supply air to the conditioned space(s).

RETURN AIR SYSTEM. An assembly of connected ducts, plenums, fittings, registers and grilles through which air from the space or spaces to be heated or cooled is conducted back to the supply unit (see also "Supply air system").

ROOM HEATER VENTED. A free-standing heating unit burning solid or liquid fuel for direct heating of the space in and adjacent to that in which the unit is located.

SAFETY VALVE. A valve that relieves pressure in a steam boiler by opening fully at the rated discharge pressure. The valve is of the spring-pop type.

SELF-CONTAINED EQUIPMENT. Complete, factory-assembled and tested, heating, air-conditioning or refrigeration *equipment* installed as a single unit, and having all working parts, complete with motive power, in an enclosed unit of said machinery.

SHAFT. An enclosed space extending through one or more stories of a building, connecting vertical openings in successive floors, or floors and the roof.

SHAFT ENCLOSURE. The walls or construction forming the boundaries of a shaft.

SLEEPING UNIT. A room or space in which people sleep, which can also include permanent provisions for living, eating, and either sanitation or kitchen facilities but not both. Such rooms and spaces that are also part of a *dwelling unit* are not sleeping units.

SMOKE DAMPER. A *listed* device installed in ducts and air transfer openings designed to resist the passage of smoke. The device is installed to operate automatically, controlled by a smoke detection system, and where required, is capable of being positioned from a fire command center.

SMOKE-DEVELOPED INDEX. A numerical value assigned to a material tested in accordance with ASTM E84.

SOLAR THERMAL SYSTEM. A system that converts solar radiation to thermal energy for use in heating or cooling.

SOLID FUEL (COOKING APPLICATIONS). Applicable to commercial food service operations only, solid fuel is any bulk material such as hardwood, mesquite, charcoal or briquettes that is combusted to produce heat for cooking operations.

SOURCE CAPTURE SYSTEM. A mechanical exhaust system designed and constructed to capture air contaminants at their source and to exhaust such contaminants to the out door atmosphere.

STATIONARY FUEL CELL POWER PLANT. A self-contained package or factory-matched packages that constitute an automatically operated assembly of integrated systems for generating useful electrical energy and recoverable thermal energy that is permanently

connected and fixed in place.

STEAM-HEATING BOILER. A boiler operated at pressures not exceeding 103 kPa (15 psi) for steam.

STOP VALVE. A shutoff valve for controlling the flow of liquid or gases.

STORY. That portion of a building included between the upper surface of a floor and the upper surface of the floor next above, except that the topmost story shall be that portion of a building included between the upper surface of the topmost floor and the ceiling or roof above.

STRENGTH, ULTIMATE. The highest stress level that the component will tolerate without rupture.

SUPPLY AIR. That air delivered to each or any space supplied by the air distribution system or the total air delivered to all spaces supplied by the air distribution system, which provided for ventilating, heating, cooling, humidification, dehumidification and other similar purposes.

SUPPLY AIR SYSTEM. An assembly of connected ducts, plenums, fittings, registers and grilles through which air, heated or cooled, is conducted from the supply unit to the space or spaces to be heated or cooled (see also "Return air system").

THEORETICAL AIR. The exact amount of air required to supply oxygen for complete *combustion* of a given quantity of a specific fuel.

THERMAL RESISTANCE (R). A measure of the ability to retard the flow of heat. The *R*-value is the reciprocal of thermal conductance.

THIRD-PARTY CERTIFICATION AGENCY. An approved agency operating a product or material certification system that incorporates initial product testing, assessment and surveillance of a manufacturer's quality control system.

THIRD-PARTY CERTIFIED. Certification obtained by the manufacturer indicating that the function and performance characteristics of a product or material have been determined by testing and ongoing surveillance by an approved third-party certification agency. Assertion of certification is in the form of identification in accordance with the requirements of the third-party certification agency.

THIRD-PARTY TESTED. Procedure by which an approved testing laboratory provides documentation that a product, material or system conforms to specified requirements.

TLV-TWA (THRESHOLD LIMIT VALUE-TIME-WEIGHTED AVERAGE). The time-weighted average concentration of a refrigerant or other chemical in air for a normal 8-hour workday and a 40-hour workweek, to which nearly all workers are repeatedly exposed, day after day, without adverse effects, as adopted by the American Conference of Government Industrial Hygienists (ACGIH).

TOILET ROOM. A room containing a water closet and, frequently, a lavatory, but not a bathtub, shower, spa or similar bathing fixture.

TOXICITY CLASSIFICATION. Refrigerants shall be classified for toxicity in one of two classes in accordance with ASHRAE 34:

Class A. Refrigerants that have an

occupational exposure limit (OEL) of 400 parts per million (ppm) or greater.

Class B. Refrigerants that have an OEL of less than 400 ppm.

TRANSITION FITTINGS, PLASTIC TO STEEL.

An adapter for joining plastic pipe to steel pipe. The purpose of this fitting is to provide a permanent, pressure-tight connection between two materials that cannot be joined directly one to another.

UNIT HEATER. A self-contained *appliance* of the fan type, designed for the delivery of warm air directly into the space in which the *appliance* is located.

VENT. A pipe or other conduit composed of factory-made components, containing a passageway for conveying *combustion* products and air to the atmosphere, *listed* and *labeled* for use with a specific type or class of *appliance*.

Pellet vent. A vent *listed* and *labeled* for use with *listed* pellet-fuel-burning appliances.

Type L vent. A vent *listed* and *labeled* for use with the following:

1. Oil-burning appliances that are *listed* for use with Type L vents.
2. Gas-fired appliances that are *listed* for use with Type B vents.

VENT CONNECTOR. The pipe that connects an *approved* fuel-fired *appliance* to a vent.

VENT DAMPER DEVICE, AUTOMATIC. A device intended for installation in the venting system, in the outlet of an individual automatically operated fuel-burning *appliance* that is designed to open the venting system automatically when the *appliance* is in operation and to close off the venting system automatically when the *appliance* is in a standby or shutdown condition.

VENTILATION. The natural or mechanical process of supplying conditioned or unconditioned air to, or removing such air from, any space.

VENTILATION AIR. That portion of supply air that comes from the outside (outdoors), plus any recirculated air that has been treated to maintain the desired quality of air within a designated space.

VENTING SYSTEM. A continuous open passageway from the flue collar of an *appliance* to the outdoor atmosphere for the purpose of removing flue or vent gases. A venting system is usually composed of a vent or a *chimney* and vent connector, if used, assembled to form the open passage-way.

WATER HEATER. Any heating *appliance* or *equipment* that heats potable water and supplies such water to the potable hot water distribution system.

ZONE. One *occupiable space* or several occupiable spaces with similar *occupancy* classification (see Table 403.3.1.1), occupant density, zone air distribution effectiveness and zone primary airflow rate per unit area.

CHAPTER 3 GENERAL REGULATIONS

User note:

'About this chapter: Chapter 3 contains broadly applicable requirements that are necessarily placed in an overarching "general" chapter. These general requirements would not be suitably located in any other chapter that is specific to unique subject matter. General requirements include those related to installation, access, location, testing, structure and clearances.

**SECTION 301
GENERAL**

301.1 Scope. This chapter shall govern the approval and installation of all *equipment* and appliances that comprise parts of the building mechanical systems regulated by this code in accordance with Section 101.2.

301.2 Energy utilization. Heating, ventilating and air-conditioning systems of all structures shall be designed and installed for efficient utilization of energy in accordance with the *Jamaica Energy Conservation Code*.

301.3 Identification. Each length of pipe and tubing and each pipe fitting utilized in a mechanical system shall bear the identification of the manufacturer, its diameter in mm and material type.

301.4 Plastic pipe, fittings and components. Plastic pipe, fittings and components shall be *third-party certified* as conforming to NSF 14 or a BSI approved or recognized national or international standard(s) addressing the same risks.

301.5 Third-party testing and certification. Piping, tubing and fittings shall comply with the applicable referenced standards, specifications and performance criteria of this code and shall be identified in accordance with Section 301.3. Piping, tubing and fittings shall either be tested by the BSI or a BSI recognized third-party testing agency or certified by the National Certification Body of Jamaica (NCBJ) or a NCBJ recognized third-party certification agency.

301.6 Fuel gas appliances and equipment. The approval and installation of fuel gas distribution piping and *equipment*, fuel gas-fired appliances and fuel gas-fired *appliance* venting systems shall be in accordance with the *Jamaica Fuel Gas Code*.

301.7 Listed and labeled. Appliances regulated by this code shall be *listed* and *labeled* for the application in which they are installed and used, unless otherwise *approved* in accordance with Section 105.

Exception: Listing and labeling of *equipment* and appliances used for refrigeration shall be in accordance with Section 1101.2.

301.8 Labeling. Labeling shall be in accordance with the procedures set forth in Sections 301.8.1 through 301.8.2.3.

301.8.1 Testing. The Bureau of Standards (BSI) or a BSI recognized agency shall test a representative sample of the mechanical *equipment* and appliances being *labeled* to the relevant standard or standards. The BSI or the BSI recognized agency shall maintain a record of all of the tests performed. The record shall provide sufficient detail to verify compliance with the test standard.

301.8.2 Inspection and identification. The BSI or any BSI recognized testing agency shall periodically

perform an inspection, which shall be in-plant if necessary, of the mechanical *equipment* and appliances to be *labeled*. The inspection shall verify that the *labeled* mechanical *equipment* and appliances are representative of the mechanical *equipment* and appliances tested.

301.8.2.1 Independent. The BSI or any BSI recognized testing agency shall be objective and competent. To confirm its objectivity, the BSI or its recognized agency shall disclose all possible conflicts of interest.

301.8.2.2 Equipment. The BSI or any BSI recognized testing agency shall have adequate *equipment* to perform all required tests. The *equipment* shall be periodically calibrated to ensure that all measurements made are traceable to the Systeme Internationale (SI).

301.8.2.3 Personnel. The BSI or any BSI recognized testing agency shall employ *only* experienced personnel educated in conducting, supervising and evaluating tests designed to generate comparative testing and inspection data that can reliably verify the truth of label data on mechanical *equipment* and appliances.

301.9 Label information. A permanent factory-applied nameplate(s) shall be affixed to appliances on which shall appear in legible lettering, the manufacturer's name or trade-mark, the model number, serial number and the seal or mark of the *approved* agency. The lettering for single language labels shall be English but multilingual lettering shall be accepted if such labels include English. A label shall include the following:

1. Electrical *equipment* and appliances: Electrical rating in volts, amperes and motor phase; identification of individual electrical components in volts, amperes or watts, motor phase; wattage (Btu/h) output; and required clearances.
2. Absorption units: Hourly rating in Watts -W(Btu/h); minimum hourly rating for units having step or automatic modulating controls; type of fuel; type of refrigerant; cooling capacity in W (Btu/h); and required clearances.
3. Fuel-burning units: Hourly rating in Watts (Btu/h); type of fuel *approved* for use with the *appliance*; and required clearances.
4. Electric comfort heating appliances: electric rating in volts, amperes and phase; wattage in W (Btu/h) output rating; individual marking for each electrical component in amperes or watts, volts and phase; and required clearances from combustibles.

301.10 Electrical. Electrical wiring, controls and connections to *equipment* and appliances regulated by this code shall be in accordance with *the Jamaica Electrical Code*.

301.11 Plumbing connections. Potable water supply and building drainage system connections to *equipment* and appliances regulated by this code shall be in accordance with the *Jamaica Plumbing Code*.

301.12 Fuel types. Fuel-fired appliances shall be designed for use with the type of fuel to which they will be connected and the altitude at which they are installed. Appliances that comprise parts of the building mechanical system shall not be converted for the usage of a different fuel, except where *approved* by the *building official* and converted in accordance with the manufacturer's instructions. The fuel input rate shall not be increased or decreased beyond the limit rating for the altitude at which the *appliance* is installed.

301.13 Vibration isolation. Where vibration isolation of *equipment* and appliances is employed, an *approved* means of supplemental restraint shall be used to accomplish the support and restraint.

301.14 Repair. Defective material or parts shall be replaced or repaired in such a manner so as to preserve the original approval or listing.

301.15 Wind resistance. Mechanical *equipment*, appliances and supports that are exposed to wind shall be designed and installed to resist the wind pressures determined in accordance with the *Jamaica Building Code*.

301.16 Flood hazard. For structures located in flood hazard areas, mechanical systems, equipment and appliances shall be located at or above the **flood** elevation required by Section 1612 of the *Jamaica Building Code* for utilities and attendant equipment.

Exception: Mechanical systems, equipment and appliances are permitted to be located below the **flood** elevation required by Section 1612 of the *Jamaica Building Code* for utilities and attendant equipment provided that they are designed and installed to prevent water from entering or accumulating within the components and to resist hydrostatic and hydrodynamic loads and stresses, including the effects of buoyancy, during the occurrence of flooding up to such elevation.

301.16.1 Coastal high-hazard areas and coastal A zones. In coastal high-hazard areas and coastal A zones, mechanical systems and *equipment* shall not be mounted on or penetrate walls intended to break away under flood loads.

301.17 Rodentproofing. Buildings or structures and the walls enclosing habitable or occupiable rooms and spaces in which persons live, sleep or work, or in which feed, food or foodstuffs are stored, prepared, processed, served or sold, shall be constructed to protect against the entrance of rodents in accordance with the *Jamaica Building Code*.

301.18 Seismic resistance. Where earthquake loads are applicable in accordance with the *Jamaica Building Code*, mechanical system supports shall be designed and installed **to resist such** seismic forces in accordance with the *Jamaica Building Code*.

SECTION 302 PROTECTION OF STRUCTURE

302.1 Structural safety. The building or structure shall not be weakened by the installation of mechanical systems. Where floors, walls, ceilings or any other portion of the building or structure are required to be altered or replaced in

the process of installing or repairing any system, the building or structure shall be left in a safe structural condition in accordance with the *Jamaica Building Code*.

302.2 Penetrations of floor/ceiling assemblies and fire-resistance-rated assemblies. Penetrations of floor/ceiling assemblies and assemblies required to have a fire-resistance rating shall be protected in accordance with Chapter 7 of the *Jamaica Building Code*.

302.3 Cutting, notching and boring in wood framing. Where permitted by the *Jamaica Building Code* or the *Jamaica Small Building/Residential Code*, the cutting, notching and boring of wood framing members shall comply with Sections 302.3.1 through 302.3.4.

302.3.1 Joist notching. Notches on the ends of joists shall not exceed one-fourth the joist depth. Holes bored in joists shall not be within 50 mm (2 inches) of the top or bottom of the joist, and the diameter of any such hole shall not exceed one-third the depth of the joist. Notches in the top or bottom of joists shall not exceed one-sixth the depth and shall not be located in the middle third of the span.

302.3.2 Stud cutting and notching. In exterior walls and bearing partitions, a wood stud shall not be cut or notched in excess of 25 percent of its depth. In nonbearing partitions that do not support loads other than the weight of the partition, a stud shall not be cut or notched in excess of 40 percent of its depth.

302.3.3 Bored holes. The diameter of bored holes in **load bearing partition** wood studs shall not exceed 40 percent of the stud depth. The diameter of bored holes in wood studs shall not exceed 60 percent of the stud depth in nonbearing partitions. The diameter of bored holes in wood studs shall not exceed 60 percent of the stud depth in any wall where each stud is doubled, provided that not more than two such successive doubled studs are so bored. The edge of the bored hole shall be not closer than 16 mm (⁵/₈ inch) to the edge of the stud. Bored holes shall be not located at the same section of stud as a cut or notch.

302.3.4 Engineered wood products. Cuts, notches and holes bored in trusses, structural composite lumber, structural glue-laminated members and I-joists are prohibited except where permitted by the manufacturer's recommendations or where the effects of such alterations are specifically considered in the design of the member by a registered design **building** professional.

[**302.4 Alterations to trusses.** Truss members and components shall not be cut, drilled, notched, spliced or otherwise altered in any way without written concurrence and approval of a *registered design building professional*. Alterations resulting in the addition of loads to any member, such as HVAC *equipment* and water heaters, shall not be permitted without verification that the truss is capable of supporting such additional **loading in both static and dynamic conditions**.

302.5 Cutting, notching and boring in steel framing. The cutting, notching and boring of steel framing members shall comply with Sections 302.5.1 through 302.5.3.

302.5.1 Cutting, notching and boring holes in

structural steel framing. The cutting, notching and boring of holes in structural steel framing members shall be as prescribed by the *registered design building professional*.

302.5.2 Cutting, notching and boring holes in cold-formed steel framing. Flanges and lips of load-bearing cold-formed steel framing members shall not be cut or notched. Holes in webs of load-bearing cold-formed steel framing members shall be permitted along the centerline of the web of the framing member and shall not exceed the dimensional limitations, penetration spacing or minimum hole edge distance as prescribed by the registered design building professional. Cutting, notching and boring holes of steel floor/roof decking shall be as prescribed by the registered design building professional.

302.5.3 Cutting, notching and boring holes in non-structural cold-formed steel wall framing. Flanges and lips of nonstructural cold-formed steel wall studs shall not be cut or notched. Holes in webs of nonstructural cold-formed steel wall studs shall be permitted along the center-line of the web of the framing member, shall not exceed 38 mm (1½ inches) in width or 100 mm (4 inches) in length, and shall not be spaced less than 610 mm (24 inches) center to center from another hole or less than 255 mm (10 inches) from the bearing end.

SECTION 303 EQUIPMENT AND APPLIANCE LOCATION

303.1 General. Equipment and appliances shall be located as required by this section, specific requirements elsewhere in this code and the conditions of the equipment and appliance listing.

303.2 Hazardous locations. Appliances shall not be located in a hazardous location unless listed and approved for that specific environment.

303.3 Prohibited locations. Fuel-fired appliances shall not be located in, or obtain combustion air from, any of the following rooms or spaces:

1. Sleeping rooms.
2. Bathrooms.
3. Toilet rooms.
4. Storage closets.
5. Surgical rooms.

Exception: This section shall not apply to the following appliances:

1. Direct-vent appliances that obtain all combustion air directly from the outdoors.
2. Solid fuel-fired appliances, provided that combustion air is provided in accordance with the manufacturers' instructions.
3. Appliances installed in a dedicated enclosure in which all combustion air is taken directly from the outdoors, in accordance with Chapter 7. Access to such enclosure shall be through a solid door, weather-stripped in accordance with the exterior door air leakage requirements of the Jamaica Energy Conservation Code and equipped with an approved self-closing device.

303.4 Protection from damage. Appliances shall not be installed in a location where subject to mechanical damage unless protected by approved barriers.

303.5 Indoor locations. Furnaces and boilers installed in closets and alcoves shall be listed for such installation.

303.6 Outdoor locations. Appliances installed in other than indoor locations shall be listed and labeled for outdoor installation.

303.7 Pit locations. Appliances installed in pits or excavations shall not come in direct contact with the surrounding soil and shall be installed not less than 76 mm (3 inches) above the pit floor. The sides of the pit or excavation if not made in rocky or firm limestone soil shall be vertically sloped outward and consolidated (held back) not less than 305 mm (12 inches) from the appliance. Where the depth exceeds 305 mm (12 inches) below adjoining grade, the walls of the pit or excavation shall be lined with concrete or masonry. Such concrete or masonry shall extend not less than 100 mm (4 inches) above adjoining grade and shall have sufficient lateral load-bearing capacity to resist collapse. Excavation on the control side of the appliance shall extend not less than 760 mm (30 inches) horizontally. The appliance shall be protected from flooding in an approved manner.

303.8 Elevator shafts. Mechanical systems shall not be located in an elevator shaft.

303.9 Fireplaces in Group I-2, Condition 2 occupancies. Fuel-burning appliances and fireplaces in Group I-2, Condition 2 occupancies shall be in accordance with Section 901.4.

SECTION 304 INSTALLATION

304.1 General. Equipment and appliances shall be installed as required by the terms of their installation permit, in accordance with the conditions of the listing, the manufacturer's installation instructions and this code. Manufacturer's installation instructions shall be available on the job site at the time of the building official inspection.

304.2 Conflicts. Where conflicts between this code and the conditions of listing or the manufacturer's installation instructions occur, the provisions of this code shall apply.

Exception: Where a code provision is less restrictive than the conditions of the listing of the equipment or appliance or the manufacturer's installation instructions, the conditions of the listing and the manufacturer's installation instructions shall apply.

304.3 Elevation of ignition source. Equipment and appliances having an ignition source and located in hazardous locations and public garages, private garages, repair garages, automotive motor fuel-dispensing facilities and parking garages shall be elevated such that the source of ignition is not less than 455 mm (18 inches) above the floor surface on which the equipment or appliance rests. For the purpose of this section, rooms or spaces that are not part of the living space of a dwelling unit and that communicate directly with a private garage through openings shall be considered to be part of the private garage.

Exception: Elevation of the ignition source is not required for appliances that are listed as flammable vapor ignition resistant.

304.3.1 Parking garages. Connection of a parking garage with any room in which there is a fuel-fired *appliance* shall be by means of a vestibule providing a two-doorway separation, except that a single door is permitted where the sources of ignition in the *appliance* are elevated in accordance with Section 304.3.

Exception: This section shall not apply to *appliance* installations complying with Section 304.6.

304.4 Prohibited equipment and appliance location. Equipment and appliances having an *ignition source* shall not be installed in Group H occupancies or control areas where open use, handling or dispensing of combustible, flammable or explosive materials occurs.

304.5 Hydrogen-generating and refueling operations. Hydrogen-generating and refueling appliances shall be installed and located in accordance with their listing and the manufacturer's instructions. Ventilation shall be required in accordance with Section 304.5.1, 304.5.2 or 304.5.3 in public garages, private garages, repair garages, automotive motor fuel-dispensing facilities and parking garages that contain hydrogen-generating appliances or refueling systems. For the purpose of this section, rooms or spaces that are not part of the living space of a *dwelling unit* and that communicate directly with a private garage through openings shall be considered to be part of the private garage.

304.5.1 Natural ventilation. Indoor locations intended for hydrogen-generating or refueling operations shall be limited to a maximum floor area of 79 m² (850 square feet) and shall communicate with the outdoors in accordance with Sections 304.5.1.1 and 304.5.1.2. The maximum rated output capacity of hydrogen-generating appliances shall not exceed 0.00189 m³/s (4 standard cubic feet per minute) of hydrogen for each 23 m² (250 square feet) of floor area in such spaces. The minimum cross-sectional dimension of air openings shall be 76 mm (3 inches). Where ducts are used, they shall be of the same cross-sectional area as the free area of the openings to which they connect. In such locations, *equipment* and appliances having an *ignition source* shall be located such that the source of ignition is not within 305 mm (12 inches) of the ceiling.

304.5.1.1 Two openings. Two permanent openings shall be provided within the garage. The upper opening shall be located entirely within 305 mm (12 inches) of the ceiling of the garage. The lower opening shall be located entirely within 305 mm (12 inches) of the floor of the garage. Both openings shall be provided in the same exterior wall. The openings shall communicate directly with the outdoors and shall have a minimum free area of 1 m²/610 m³ (1/2 square foot per 1,000 cubic feet) of garage volume.

304.5.1.2 Louvers and grilles. In calculating free area required by Section 304.5.1, the required size of openings shall be based on the net free area of each opening. If the free area through a design of louver or grille is known, it shall be used in calculating the size opening required to provide the free area specified. If

the design and free area are not known, it shall be assumed that wood louvers will have 25-percent free area and metal louvers and grilles will have 75-percent free area. Louvers and grilles shall be fixed in the open position.

304.5.2 Mechanical ventilation. Indoor locations intended for hydrogen-generating or refueling operations shall be ventilated in accordance with Section 502.16. In such locations, *equipment* and appliances having an *ignition source* shall be located such that the source of ignition is below the mechanical ventilation outlet(s).

304.5.3 Specially engineered installations. As an alternative to the provisions of Sections 304.5.1 and 304.5.2, the necessary supply of air for ventilation and dilution of flammable gases shall be provided by an *approved* engineered system.

304.6 Public garages. Appliances shall not be located in public garages, motor fueling-dispensing facilities, repair garages or other areas frequented by motor vehicles unless they perform a function entirely beneficial to these areas. All such qualified appliances shall be installed not less than 2,400 mm (8 feet) above the floor. Where motor vehicles are capable of passing under an *appliance*, the *appliance* shall be installed at the clearances required by the *appliance* manufacturer and not less than 305 mm (1 foot) higher than the tallest vehicle garage door opening.

Exception: The requirements of this section shall not apply where the appliances are protected from motor vehicle impact and installed in accordance with Section 304.3 and NFPA 30A.

304.7 Private garages. Appliances shall not be located in private garages and carports unless they perform a function entirely beneficial to these areas. All such qualified appliances located in private garages and carports shall be installed with a minimum clearance of 1,830 mm (6 feet) above the floor.

Exception: The requirements of this section shall not apply where the appliances are protected from motor vehicle impact and installed in accordance with Section 304.3.

304.8 Construction and protection. Boiler rooms and furnace rooms shall be protected as required by the *Jamaica Building Code*.

304.9 Clearances to combustible construction. Heat-producing *equipment* and *appliances* shall be installed to maintain the required *clearances* to combustible construction as specified in the listing and manufacturer's instructions. Such clearances shall be reduced only in accordance with Section 308. *Clearances* to combustibles shall include such considerations as door swing, drawer pull, overhead projections or shelving and window swing, shutters, coverings and drapes. Devices such as doorstops or limits, closers, drapery ties or guards shall not be used to provide the required *clearances*.

304.10 Clearances from grade and roof. Equipment and *appliances* installed at grade level shall be supported on a level concrete slab or other *approved* material extending not less than 100 mm (4 inches) above the highest adjoining grade point or shall be suspended not less than

150 mm (6 inches) above the adjoining grade. Such support shall be in accordance with the manufacturer's installation instructions.

Where the equipment or appliances is to be mounted on the roof of a building the registered building professional shall ensure that the roof is structurally capable of accommodating the static loads of the equipment, appliances and mounting plinth plus the dynamic loads of the equipment and appliances. Equipment and appliances installed on concrete roofs shall be supported on a flat concrete plinth or other approved base material. The plinth shall extend not less than 76 mm (3 inches) above of level and at least 150 mm (6 inches) larger than the outside perimeter of the equipment base. The plinth shall be bonded to the roof concrete mass by removing all surface finish material, hacking up the exposed roof concrete mass and painting on a concrete bonding agent just before casting the plinth. Equipment hold-down J-bolts may be cast in the plinth or expansion bolts may be used as an alternative. The equipment plinth shall be constructed so it does not prevent the roof drains from operating efficiently and effectively in removing storm water from the roof. The entire equipment support shall be in accordance with the manufacturer's installation instructions and shall keep the equipment or appliance firmly in place throughout all likely natural hazards.

304.11 Guards. Guards shall be provided where various components that require service and roof hatch openings

are located within 3050 mm (10 feet) of a roof edge or open side of a walking surface and such edge or open side is located more than 760 mm (30 inches) above the floor, roof, or grade below. The guard shall extend not less than 760 mm (30 inches) beyond each end of components that require service. The top of the guard shall be located not less than 1065 mm (42 inches) above the elevated surface adjacent to the guard. The guard shall be constructed so as to prevent the passage of a 534 mm (21-inch-diameter) sphere and shall comply with the loading requirements for guards specified in the *Jamaica Building Code*.

Exception: Guards are not required where fall arrest/restraint anchorage connector devices that comply with ANSI/ASSE Z 359.1 are installed.

304.12 Area served. Appliances serving different areas of a building other than where they are installed shall be permanently marked in an *approved* manner that uniquely identifies the *appliance* and the area it serves.

SECTION 305 PIPING SUPPORT

305.1 General. All mechanical system piping that is run on-surfaced or off-surfaced or embedded in walls, ceilings, floors or attics shall be supported in accordance with this section.

305.2 Materials. Pipe hangers and supports shall have sufficient strength to withstand all anticipated static and specified dynamic loading conditions associated with the intended use. Pipe hangers and supports that are in direct contact with piping shall be of *approved* materials that are compatible with the piping and that will not promote galvanic action.

305.3 Structural attachment. Pipe hangers and anchors shall be securely fastened to the building elements in an *approved* manner so they remain firmly in place under all piping conveyance conditions of static or dynamic contents.

305.4 Interval of support. Piping shall be supported at distances not exceeding the spacing specified in Table 305.4, or in accordance with ANSI/MSS SP-58. In general mechanical system piping interval of supports shall vary according to the type of pipe being supported and the structural base to which the pipe support is attached (concrete, wood or drywalls). Mechanical piping support shall also depend on whether the piping is run off-surfaced, on-surfaced or within walls or ceilings. Mechanical system piping support shall also depend on the direction in which the pipe runs with the horizontal direction requiring much more support than the vertical. Subsections 305.4.1 to 305.4.3. outlines requirements for mechanical piping support for off-, on- and in-wall positions.

305.4.1 Supports for off-surface mechanical systems piping Off-surfaced mechanical systems piping supports may be installed on walls, ceilings or floors in service equipment rooms; storerooms; factories; agricultural sorting, packaging and storage areas as well as any other building areas where aesthetics, installation possibility and desirability do not rule out its construction. Mechanical systems piping supports installed in the hanging, cantilevered or floor mounted configuration shall be firmly anchored preferably to a building structural member but

where building structure anchorage is unavailable one shall be installed exclusively for the anchorage, or another sturdy building element shall be used. Mechanical systems piping hangers and supports shall be constructed to fully accommodate the static and dynamic loads imposed by the piping system under conveyance conditions. Mechanical systems piping supports shall be constructed to be located at equidistant spacing in accordance with Table 305.4 and to keep the pipes in horizontal plumb when they run horizontally and in vertical plumb when they run vertically, except in circumstances where other requirements, e.g. drainage, negates the plumb condition. Every off-surfaced mechanical systems pipe shall be anchored firmly to each support with an approved metallic strap or other appropriate restraining element that will resist the pipe propensity to move under various conveyance conditions. Notching and boring of floor, wall, or roof/ceiling structural members to accommodate piping hangers and supports shall not weaken them to the point where they are unable to fulfil their structural function. Notching and boring shall therefore strictly conform to the requirements of Chapters 5, 6 & 8 of the Jamaica Small Building/Residential Code.

305.4.2 Supports for on-surfaced mechanical systems

piping on concrete, wood, or drywall surfaces. On-surfaced mechanical piping systems may be installed on walls, ceilings, floors, or attics where it is more desirable or unavoidable. On-surfaced piping systems may be installed on concrete, wood, or drywall surfaces and shall be supported at equidistance points not exceeding that specified in Table 305.4. The supports that anchor each pipe to the building surface shall be firm and capable of bearing the static and dynamic forces imposed by the piping system under conveyance conditions. On-surfaced piping shall be installed in vertical and horizontal plumb and disguised as best as possible by using such locations as wall to floor, wall to ceiling and wall to wall intersections and the shortest vertical and horizontal runs. The registered design mechanical engineer for an on-surfaced mechanical system piping shall procure a written clearance from the registered design structural engineer for the static and dynamic loads to be imposed on the building structural system by the mechanical system piping. The written clearance for the designed on-surfaced mechanical systems piping shall be requested by the building official as one of the conditions for final approval of the mechanical works.

305.4.3 Supports for mechanical systems piping embedded in concrete or wood or drywall ceilings, walls, floors or attics.

Mechanical systems piping may be installed in walls, ceilings, floors, or attics whenever possible and desirable. Mechanical systems piping installed in poured-in-place concrete walls or ground slabs or suspended slabs shall be supported by the mass concrete which shall be poured after the pipe has been satisfactorily installed. Mechanical systems piping installed in masonry walls shall be supported by filling the masonry cavities in which the pipe runs with concrete. Mechanical systems piping installed in wooden or drywalls shall be supported by the structural elements in these walls either by attachment or penetration or both. Where pipes require support but there is no accommodating structural elements, supplementary structural elements shall be installed to provide the support for these pipes. In no case shall a pipe be unrestrained by a structural element if the distance between two consecutive supports exceeds 50% of the spacing outlined in Table 305.4.

Commented [KE2]: Follow Up: located

A level service space not less than 760 mm (30 inches) deep and 760 mm (30 inches) wide shall be present at the front or service side of the *appliance*. The clear access opening dimensions shall be not less than 510 mm by 760 mm (20 inches by 30 inches), and large enough to allow removal of the largest *appliance*. As a minimum, access to the attic space shall be provided by one of the following:

- (a) A permanent stair,
- (b) A pull-down stair and or
- (c) Access door from an upper floor level

Exceptions:

1. The passageway and level service space are not required where the *appliance* is capable of being serviced and removed through the required opening.
2. Where the passageway is unobstructed and not less than 1,830mm (6 feet) high and 560 mm (22 inches) wide for its entire length, the passageway shall be not greater than 15 250 mm (50 feet) in length.

306.3.1 Electrical requirements. A luminaire controlled by a switch located at the required passageway opening and a receptacle outlet shall be provided at or near the *appliance* location in accordance with the Jamaica Electrical Code.

306.3 Appliances under floors. Underfloor spaces contain- ing appliances shall be provided with an access opening and unobstructed passageway large enough to remove the largest *appliance*. The passageway shall be not less than 760 mm (30 inches) high and 560 mm (22 inches) wide, nor more than 6,100 mm (20 feet) in length measured along the centerline of the passageway from the opening to the *appliance*. A level service space not less than 760 mm (30 inches) deep and 760 mm (30 inches) wide shall be present at the front or service side of the *appliance*. If the depth of the passageway or the service space exceeds 305mm (12 inches) below the adjoining grade, the walls of the passageway shall be lined with concrete or masonry. Such concrete or masonry shall extend not less than 100 mm (4 inches) above the adjoining grade and shall have sufficient lateral-bearing capacity to resist collapse. The clear access opening dimensions shall be not less than 560mm by 760mm (22 inches by 30 inches), and large enough to allow removal of the largest *appliance*.

Exceptions:

1. The passageway is not required where the level ser- vice space is present when the access is open and the *appliance* is capable of being serviced and removed through the required opening.
2. Where the passageway is unobstructed and not less than 1,830 mm (6 feet) high and 560 mm (22 inches) wide for its entire length, the passageway shall not be limited in length.

306.4.1 Electrical requirements. A luminaire controlled by a switch located at the required passageway opening and a receptacle outlet shall be provided at or near the *appliance* location in accordance with the Jamaica Electrical Code.

306.5 Equipment and appliances on roofs or elevated structures. Where *equipment* requiring access or appliances are located on an elevated structure or the roof of a building such that personnel will have to climb higher than 4,800 (16 feet) above grade to access such equipment or appliances, an interior or exterior means of access shall be provided. Such access shall not require climbing over obstructions greater than 760 mm (30 inches) in height or walking on roofs having a slope greater than four units vertical in 12 units horizontal (33-percent slope). Such access shall not require the use of portable ladders. Where access involves climbing over parapet walls, the height shall be measured to the top of the parapet wall.

Permanent ladders installed to provide the required access shall comply with the following minimum design criteria:

1. The side railing shall extend above the parapet or roof edge not less than 760 mm (30 inches).
2. Ladders shall have rung spacing not to exceed 355 mm (14 inches) on center. The uppermost rung shall be not greater than 610 mm (24 inches) below the upper edge of the roof hatch, roof or parapet, as applicable.
3. Ladders shall have a toe spacing (the horizontal distance from the rung of a ladder towards the wall which supports its top extremity) of not less than 150 mm (6 inches) deep.
4. There shall be not less than 455 mm (18 inches) between rails.
5. Solid metal rungs shall have a minimum diameter of not less than 19 mm (0.75-inch) while hollow metal rungs shall have a minimum diameter of 32 mm (1.25-inch). Both solid and hollow rung ladders shall be capable of withstanding a 136 kg (300-pound) load.
6. Ladders over 9,150 mm (30 feet) in height shall be provided with offset sections and landings capable of withstanding 488 kg/m² (100 pounds per square foot). Landing dimensions shall be not less than 455 mm (18 inches) and not less than the width of the ladder served. A guard rail shall be provided on all open sides of the landing.
7. Climbing clearance. The distance from the centerline of the rungs to the nearest permanent object on the climbing side of the ladder shall be not less than 760 mm (30 inches) measured perpendicular to the rungs. This distance shall be maintained from the point of ladder access to the bottom of the roof hatch. A minimum clear width of 380 mm (15 inches) shall be provided on both sides of the ladder measured from the midpoint of and parallel with the rungs except where cages or wells are installed.
8. Landing required. The ladder shall be provided with a clear and unobstructed bottom landing area having a minimum dimension of 760 mm (30

Commented [KE3]: Follow Up: 22 inches (559 mm)560 mm (22 inches)

Commented [KE4]: Follow Up: 50 feet (15 250 mm)15 250 mm (50 feet)

Commented [KE5]: Follow Up: 22 inches by 30 inches) (559 mm by 762 mm)

inches) by 760 mm (30 inches) centered in front of the ladder.

9. Ladders shall be constructed from appropriate metals and protected against corrosion by *approved* means.
10. Access to ladders shall be provided at all times.
11. Exterior ladders providing roof access need not extend closer than 2,400 mm (8 feet) to the finished grade and shall extend to the equipment and appliance's level or service space.

Catwalks installed to provide the required access shall be not less than 610 mm (24 inches) wide and shall have railings as required for service platforms.

Exception: This section shall not apply to Group R-3 occupancies.

306.5.1 Sloped roofs. Where appliances, *equipment*, fans or other components that require service are installed on a roof having a slope of three units vertical in 12 units horizontal (25-percent slope) or greater and having an edge more than 760 mm (30 inches) above grade at such edge, a level platform shall be provided on each side of the *appliance or equipment* to which access is required for service, repair or maintenance. The platform shall be not less than 760 mm (30 inches) in any dimension and shall be provided with guards. The guards shall extend not less than 1,067 mm (42 inches) above the platform, shall be constructed so as to prevent the passage of a 535 mm (21-inch) diameter sphere and shall comply with the loading requirements for guards specified in the *Jamaica Building Code*. Access shall not require walking on roofs having a slope greater than four units vertical in 12 units horizontal (33-percent slope). Where access involves obstructions greater than 760 mm (30 inches) in height, such obstructions shall be provided with ladders installed in accordance with Section 306.5 or stairways installed in accordance with the requirements specified in the *Jamaica Building Code* in the path of travel to and from appliances, fans or *equipment* requiring service.

306.5.2 Electrical requirements. A receptacle outlet shall be provided at or near the *equipment* location in accordance with the *Jamaica Electrical Code*.

**SECTION 307
CONDENSATE DISPOSAL**

307.1 Fuel-burning appliances. Liquid *combustion* by-products of condensing appliances shall be collected and discharged to an *approved* plumbing fixture or a disposal area as specified by Section 307.2 in accordance with the manufacturer’s installation instructions. Condensate piping shall be of *approved* corrosion-resistant material and shall not be smaller than the drain connection on the appliance. Such piping shall maintain a minimum horizontal slope in the direction of discharge of not less than one-eighth unit vertical in 12 units horizontal (1-percent slope).

307.2 Evaporators and cooling coils. Condensate drain systems shall be provided for *equipment* and appliances containing evaporators or cooling coils. Condensate drain systems shall be designed, constructed and installed in accordance with Sections 307.2.1 through 307.2.5.

Exception: Evaporators and cooling coils that are designed to operate in sensible cooling only and not support condensation shall not be required to meet the requirements of this section.

307.2.1 Condensate disposal. Condensate from all

All cooling coils and evaporators shall be conveyed from the drain pan outlet to an *approved* place of disposal. Condensate disposal piping shall maintain a minimum horizontal slope in the direction of discharge of not less than one-eighth unit vertical in 12 units horizontal (1-percent slope). Condensate shall not

discharge into a street, alley, walkway, driveway or any other area so as to cause a health or safety hazard or nuisance. Condensate may be disposed of in one of the following ways:

- a. Directly to a roof drain that connects to an underground storm sewer system.
- b. Directly onto roofs covered with membrane type roof coverings where the condensate will drain to a roof drain that connects to an underground storm sewer system.
- c. Landscaped area in sandy and sandy loam soils containing flowers and other bedding plants. There must be 0.5 m² (5 square feet) of landscaped area for each 3,517 W (1 ton) of refrigeration, or air-conditioning.
- d. French drain consisting of a pit excavated below grade that is not less than 600 mm (2 feet) in diameter or square and 600 mm (2 feet) deep. The pit shall be filled with coarse gravel and the drainpipe shall extend into the pit and be securely anchored. A single French drain shall not receive the condensate discharge of more than 35,172 W (10 tons) nominal of combined cooling capacity. The pit shall be covered with sod after inspection. The French drain shall not be located so that it will receive direct discharge from a roof or a downspout or storm drain.

307.2.2 Drainpipe materials and sizes. Components of the condensate disposal system shall be cast iron, galvanized steel, copper, copper alloy, cross-linked polyethylene, polyethylene, ABS, CPVC, PVC, or polypropylene pipe or tubing. Components shall be selected for the pressure and temperature rating of the installation. Joints and connections shall be made in accordance with the applicable provisions of Chapter 7 of the *Jamaica Plumbing Code* relative to the material type. Condensate waste and drain line size shall be not less than 19mm (3/4-inch) internal diameter and shall not decrease in size from the drain pan connection to the place of condensate disposal. Where the drain pipes from more than one unit are manifolded together for condensate drainage, the pipe or tubing shall be sized in accordance with Table 307.2.2.

**TABLE 307.2.2
CONDENSATE DRAIN SIZING**

EQUIPMENT CAPACITY	MINIMUM CONDENSATE PIPE DIAMETER
Up to 70.34 kW of refrigeration	19 mm
Over 70.34 kW to 140.68 kW of refrigeration	25 mm
Over 140.68 kW to 316.53 kW of refrigeration	32 mm
Over 316.53 kW to 439.63 kW of refrigeration	38 mm
Over 439.63 kW to 879.25 kW of refrigeration	51 mm

For Inch Pound Units: 1 mm = 0.03937 inch, 1 kW = 0.2843 ton.

307.2.3 Auxiliary and secondary drain systems. In addition to

the requirements of Section 307.2.1, where damage to any building components could occur as a result of overflow from the *equipment* primary condensate removal system, one of the following auxiliary protection methods shall be provided for each cooling coil or fuel-fired *appliance* that produces condensate:

1. An auxiliary drain pan with a separate drain shall be provided under the coils on which condensation will occur. The auxiliary pan **drainage system** shall discharge to a conspicuous point of disposal to alert occupants in the event of a stoppage of the primary drain. The pan shall have a minimum depth of 38mm (1½ inches), shall be not less than 76mm (3 inches) larger than the **condensate producing** unit, or the coil dimensions in width and length and shall be constructed of corrosion-resistant material. Galvanized sheet steel pans shall have a minimum thickness of not less than **0.6010 mm [(0.0236 inch) (No. 24 gage)]**. Nonmetallic pans shall have a minimum thickness of not less than 1.6 mm (0.0625 inch).
2. A **second and** separate overflow drain line shall be connected to the drain pan provided with the *equipment*. **This second** overflow drain shall discharge to a conspicuous point of disposal to alert occupants in the event of a stoppage of the primary drain. The **second** overflow drain line shall **be connected** to the drain pan at a higher **elevation** than the primary drain connection.

3. An auxiliary drain pan without a **second** separate drain line shall be provided under the coils on which condensate will occur. Such pan shall be equipped with a water-level detection device conforming to UL 508 that will shut off the *equipment* served prior to overflow of the pan. The auxiliary drain pan shall be constructed in accordance with Item 1 of this section.

4. A water-level detection device conforming to UL 508 shall be provided that will shut off the *equipment* served in the event that the primary drain is blocked. The device shall be installed in the primary drain line, the overflow drain line, or in the equipment-supplied drain pan, located at a point higher than the primary drain line connection and below the overflow rim of such pan.

Exception: Fuel-fired appliances that automatically shut down operation in the event of a stoppage in the condensate drainage system.

307.2.3.1 Water-level monitoring devices. On downflow units and all other coils that do not have a secondary drain or provisions to install a secondary or auxiliary drain pan, a water-level monitoring device shall be installed inside the primary drain pan. This device shall shut off the *equipment* served in the event that the primary drain becomes restricted. Devices installed in the drain line shall not be permitted.

307.2.3.2 Appliance, equipment and insulation in pans. Where appliances, *equipment* or insulation are subject to water damage when auxiliary drain pans fill, that portion of the *appliance, equipment* and insulation shall be installed above the rim of the pan. Supports located inside of the pan to support the *appliance* or *equipment* shall be water resistant and *approved*.

307.2.4 Traps. Condensate drains shall be trapped as required by the *equipment* or *appliance* manufacturer.

307.2.4.1 Ductless mini-split system traps. Ductless mini-split equipment that produces condensate shall be provided with an inline check valve located in the drain line, or a trap.

307.2.5 Drain line maintenance. Condensate drain lines shall be configured to permit the clearing of blockages and performance of maintenance without requiring the drain line to be cut.

307.3 Condensate pumps. Condensate pumps located in uninhabitable spaces, such as attics and crawl spaces, shall be connected to the appliance or equipment served such that when the pump fails, the appliance or equipment will be prevented from operating. Pumps shall be installed in accordance with the manufacturers' instructions.

SECTION 308 CLEARANCE REDUCTION

308.1 Scope. This section shall govern the reduction in required *clearances* to combustible materials and combustible assemblies for *chimneys*, vents, kitchen exhaust equip-

ment, mechanical appliances, and mechanical devices and *equipment*.

308.2 Listed appliances and equipment. The reduction of the required *clearances* to combustibles for *listed* and *labeled* appliances and *equipment* shall be in accordance with the requirements of **Sections 308.3 and 308.4** except that such *clearances* shall not be reduced where reduction is specifically prohibited by the terms of the *appliance* or *equipment* listing.

308.3 Protective assembly construction and installation. Reduced *clearance* protective assemblies, including structural and support elements, shall be constructed of noncombustible materials. Spacers utilized to maintain an airspace between the protective assembly and the protected material or assembly shall be noncombustible. Where a space between the protective assembly and protected combustible material or assembly is specified, the same space shall be provided around the edges of the protective assembly and the spacers shall be placed so as to allow air circulation by convection in such space. Protective assemblies shall not be placed less than **25 mm (1 inch)** from the mechanical appliances, devices or *equipment*, regardless of the allowable reduced *clearance*.

308.4 Allowable reduction. The reduction of required *clearances* to combustible assemblies or combustible materials shall be based on the utilization of a reduced *clearance* protective assembly in accordance with Section 308.4.1 or 308.4.2.

308.4.1 Labeled assemblies. The allowable *clearance* reduction shall be based on an approved reduced *clearance* protective assembly that is listed and labeled in accordance with UL 1618.

308.4.2 Reduction table. The allowable *clearance* reduction shall be based on one of the methods specified in Table 308.4.2. Where required *clearances* are not listed in Table 308.4.2, the reduced *clearances* shall be determined by linear interpolation between the distances listed in the table. Reduced *clearances* shall not be derived by extrapolation below the range of the table.

308.4.2.1 Solid fuel-burning appliances. The *clearance* reduction methods specified in Table 308.4.2 shall not be utilized to reduce the *clearance* required for solid fuel-burning appliances that are *labeled* for installation with *clearances* of **305 mm** (12 inches) or less. Where appliances are *labeled* for installation with *clearances* of greater than **305 mm** (12 inches), the *clearance* reduction methods of Table 308.4.2 shall not reduce the *clearance* to less than **305 mm** (12 inches).

308.4.2.2 Masonry chimneys. The *clearance* reduction methods specified in Table 308.4.2 shall not be utilized to reduce the *clearances* required for masonry *chimneys* as specified in Chapter 8 of this code and the *Jamaica Building Code*.

308.4.2.3 Chimney connector pass-throughs. The *clearance* reduction methods specified in Table 308.4.2 shall not be utilized to reduce the *clearances* required for *chimney* connector pass-throughs as specified in Section 803.10.4.

308.4.2.4 Masonry fireplaces. The *clearance* reduction methods specified in Table 308.4.2 shall not be utilized to reduce the clearances required for masonry fireplaces as specified in Chapter 8 **of this code** and the *Jamaica Building Code*.

308.4.2.5 Kitchen exhaust ducts. The *clearance* reduction methods specified in Table 308.4.2 shall not be utilized to reduce the minimum *clearances* required by Section 506.3.11.1 for kitchen exhaust ducts enclosed in a shaft.

**SECTION 309
TEMPERATURE CONTROL**

309.1 Space-heating systems. Interior spaces intended for human occupancy **may** be provided with active or passive space-heating systems capable of maintaining an indoor temperature of not less than 20°C (68°F) at a point 915 mm (3 feet) above floor on the design heating day. The installation of portable space heaters **may** be used to achieve compliance with this section.

Exceptions:

1. Interior spaces where the primary purpose is not associated with human comfort.
2. Group F, H, S and U occupancies.

**SECTION 310
EXPLOSION CONTROL**

310.1 Required. Structures occupied for purposes involving explosion hazards shall be provided with explosion control where required by the *Jamaica Fire Code*. Explosion control systems shall be designed and installed in accordance with Section 911 of the *Jamaica Fire Code*.

**SECTION 311
SMOKE AND HEAT VENTS**

311.1 Required. *Approved* smoke and heat vents shall be installed in the roofs of one-story buildings where required by the *Jamaica Fire Code*. Smoke and heat vents shall be designed and installed in accordance with the *Jamaica Fire Code*.

**SECTION 312
HEATING AND COOLING LOAD CALCULATIONS**

312.1 Load calculations. Heating and cooling system design loads for the purpose of sizing systems, appliances and *equipment* shall be determined in accordance with the procedures described in the ASHRAE/ACCA Standard 183. Alternatively, design loads shall be determined by an *approved* equivalent computation procedure, using the design parameters specified in Chapter 3 [CE] of the *Jamaica Energy Conservation Code*.

**TABLE 308.4.2
CLEARANCE REDUCTION METHODS^b**

Commented [KE6]: Follow Up: TABLE 308.4.2

	REDUCED CLEARANCE WITH PROTECTION , (millimetres)^a	
	Horizontal combustible assemblies located above the heat source.	Horizontal combustible assemblies located beneath the heat source and

TYPE OF PROTECTIVE ASSEMBLY*	all vertical combustible assemblies.							
	Required clearance to combustibles without protection (millimetres)†				Required clearance to combustibles without protection (millimetres).			
	915	455	230	150	915	455	230	150
Galvanized sheet steel, having a minimum thickness of 0.5994 mm (No. 24 gage), mounted on 25 mm glass fiber or mineral wool batt reinforced with wire on the back, 25 mm off the combustible assembly.	455	230	125	76	305	150	76	76
Galvanized sheet steel, having a minimum thickness of 0.5994 mm (No. 24 gage), spaced 25 mm off the combustible assembly.	455	230	125	76	305	150	76	51
Two layers of galvanized sheet steel, having a minimum thickness of 0.5994 mm (No. 24 gage), having a 25 mm airspace between layers, spaced 25 mm off the combustible assembly.	455	230	125	76	305	150	76	76
Two layers of galvanized sheet steel, having a minimum thickness of 0.5994 mm (No. 24 gage), having 25 mm of fiberglass insulation between layers, spaced 25 mm off the combustible assembly.	455	230	125	76	305	150	76	76
12.5 mm inorganic insulating board, over 25 mm of fiberglass or mineral wool batt, against the combustible assembly.	610	305	150	100	455	230	125	76
88.5 mm brick wall, spaced 25 mm off the combustible wall.	—	—	—	—	305	150	150	150
88.5 mm brick wall, against the combustible wall.	—	—	—	—	610	305	150	125

For Inch Pound Units: 1 mm = 0.03937 inch, 1°F = 1.8°C + 32, 1 kg/m³ = 0.06242 pound per cubic foot, 1 W/(m² • K) = 6.944 Btu • in/(ft² • h • °F).

- a. Mineral wool and glass fiber batts (blanket or board) shall have a minimum density of 128.16 kg/m³ and a minimum melting point of 815.56 °C. Insulation material utilized as part of a clearance reduction system shall have a thermal conductivity of 0.144W/m² • K or less. Insulation board shall be formed of noncombustible material.
- b. For limitations on clearance reduction for solid fuel-burning appliances, masonry chimneys, connector pass-throughs, masonry fire places and kitchen ducts, see Sections 308.4.2.1 through 308.4.2.5.

CHAPTER 4 VENTILATION

User note:

About this chapter: Chapter 4 intends to provide an indoor atmosphere that protects the health and well-being of building occupants. Both mechanical and natural ventilation are addressed. Mechanical ventilation provides what is considered to be **post COVID** acceptable indoor air quality. Mechanical ventilation minimizes adverse health effects and provides an atmosphere that generally is not objectionable to occupants.

SECTION 401 GENERAL

401.1 Scope. This chapter shall govern the ventilation of spaces within a building intended to be occupied. Mechanical exhaust systems, including exhaust systems serving clothes dryers and cooking appliances; hazardous exhaust systems; dust, stock and refuse conveyor systems; sub-slab soil exhaust systems; smoke control systems; energy recovery ventilation systems and other systems specified in Section 502 shall comply with Chapter 5.

401.2 Ventilation required. Every occupied space shall be ventilated by natural means in accordance with Section 402 or by mechanical means in accordance with Section 403. Where the air infiltration rate in a dwelling unit is less than 5 air changes per hour when tested with a blower door at a pressure of 50 Pa (0.2-inch water column) in accordance with Section R402.4.1.2 of the *Jamaica Energy Conservation Code*, the dwelling unit shall be ventilated by mechanical means in accordance with Section 403. Ambulatory care facilities and Group I-2 occupancies shall be ventilated by mechanical means in accordance with Section 407. Medical experts have determined that it takes about 15 minutes of breathing in COVID contaminated air for a person to contract the virus. Bearing this in mind the air in all occupied spaces of all buildings shall be changed in less than 15 minutes. A minimum of 5 air changes per hour will meet this requirement. All air intake and air exhaust rates shall be adjusted to meet the 5 air changes per hour where the recommended rate does not meet this minimum requirement. The minimum of 5 air changes per hour shall be applicable to both naturally and forced ventilated, rooms, spaces and buildings. To minimize the energy needed to cool any larger intake of outside air to meet the minimum 5 air changes per hour, the air being exhausted shall be used to cool down the intake air by utilizing a heat exchanger.

401.2.1 Objectives to be met by ventilation. Ventilation systems design shall satisfy one or more of the following functions:

a. Provide adequate indoor air quality by air exchanges and filtration that remove and/or dilute virus contaminations, odours, dust and other pollutants from occupied spaces.

b. Provide adequate ventilation for the effective operation of processes.

c. Provide a heat exchange mechanism that improves the energy efficiency of conditioning systems.

d. Prevent condensation and its consequential fungus growth within the building envelope or part thereof.

e. Improve the comfort within an occupied space that is not conditioned.

401.3 When required. Ventilation shall be provided during the periods that the room or space is occupied and in the case of high occupancy rooms, spaces or buildings for the time needed to completely change the air after the last occupant has vacated the room, space or building.

401.4 Intake opening location. Air intake openings shall comply with all of the following:

1. Intake openings shall be located not less than 3,050 mm (10 feet) from lot lines or buildings on the same lot.
2. Mechanical and gravity outdoor air intake openings shall be located not less than 3,050 mm (10 feet) horizontally from any hazardous or noxious contaminant source, such as vents, streets, alleys, parking lots and loading docks, except as specified in Item 3 or Section 501.3.1. Outdoor air intake openings shall be permitted to be located less than 3,050 mm (10 feet) horizontally from streets, alleys, parking lots and loading docks provided that the openings are located not less than 7,625 mm (25 feet) vertically above such locations. Where openings front on a street or public way, the distance shall be measured from the closest edge of the street or public way.
3. Intake openings shall be located not less than 915 mm (3 feet) below contaminant sources where such sources are located within 3,050 mm (10 feet) of the opening.
4. Intake openings on structures in flood hazard areas shall be at or above the elevation required by Section

1612 of the *Jamaica Building Code* for utilities and attendant equipment.

401.5 Intake opening protection. Air intake openings that terminate outdoors shall be protected with corrosion-resistant screens, louvers or grilles. Openings in louvers, grilles and screens shall be sized in accordance with Table 401.5, and shall be protected against local weather conditions. Louvers that protect air intake openings in structures located in hurricane-prone regions, as defined in the *Jamaica Building Code*, shall comply with AMCA 550. Outdoor air intake openings located in exterior walls shall meet the provisions for exterior wall opening protectives in accordance with the *Jamaica Building Code*.

**TABLE 401.5
OPENING SIZES IN LOUVERS, GRILLES AND SCREENS
PROTECTING AIR INTAKE OPENINGS**

OUTDOOR OPENING TYPE	MINIMUM AND MAXIMUM OPENING SIZES IN LOUVERS, GRILLES AND SCREENS*
Intake openings in residential occupancies	Not < 6.35 mm and not > 19 mm
Intake openings in other than residential occupancies	> 6.35 mm and not > 25 mm

For Imperial: 1 mm = 0.03937 inch

- a. For rectangular openings, the table requirements apply to the shortest side. For round openings, the table requirements apply to the diameter.
- For square openings, the table requirements apply to any side.

401.6 Contaminant sources. Stationary local sources producing airborne particulates, heat, odors, fumes, spray, vapors, smoke or gases in such quantities as to be irritating or injurious to health shall be provided with an exhaust system in accordance with Chapter 5 or a means of collection and removal of the contaminants. Such exhaust shall discharge directly to an approved location at the exterior of the building.

401.7 Choice of ventilation strategy. Ventilation strategies shall be chosen from the following options:

- a. Natural ventilation for all or part of the building.
- b. Mechanical ventilation for all or part of the building.
- c. Conditioning (cooling or heating) for all or part of the building.
- d. Mixed mode systems (combination of natural & mechanical ventilation or natural ventilation & conditioning or forced ventilation & conditioning or elements of all three systems).

The selection of a ventilation strategy shall be governed by, energy and environmental concerns, comfort, location, building configuration, heat loads, internal and external pollution sources and cost. Energy and environmental concerns shall be given the highest priority in arriving at a ventilation strategy. Ultimately however, the use and occupancy of a space shall determine its ventilation needs.

FPN: There is no universal ventilation solution, but there are some best practice indicators that should be followed and are considered in subsequent sections of this code. Each

ventilation system design should be evaluated on its merits, to suit the particular circumstances. Consideration of the use of energy recovery ventilators is recommended and compliance with ASHRAE ventilation requirements is also recommended.

FPN: Excessive air infiltration can destroy the system performance of a ventilation strategy, this means that a good design combined with optimum air tightness are inevitable to achieve energy efficient ventilation. The inclusion of a requirement for air tightness in a specification does not lead to the choice of a particular design strategy. For example, mechanical ventilation is not necessarily the inevitable consequence of requiring that a building be airtight. Applying the axiom build tight, ventilate right, ventilation via natural openings may be suitable. However, it cannot be assumed that a mechanically ventilated building is suitably airtight.

SECTION 402 NATURAL VENTILATION

402.1 Natural ventilation. *Natural ventilation* of an occupied space shall be through windows, doors, louvers or other openings to the outdoors. The operating mechanism for such openings shall be provided with ready access so that the openings are readily controllable by the building occupants.

FPN: Wind driven ventilation can occur from single sided openings (openings on one side of the building) or double-sided openings (openings on two sides of the building).

FPN: Natural ventilation relies on moving air through a building under the natural forces of wind and / or buoyancy and therefore the openings that facilitate these air movements should be adjustable to create the level of ventilation required at a given moment.

402.2 Ventilation area required. The minimum openable area to the outdoors of a building shall depend on whether the building is constructed solely for conditioning or wholly for forced ventilation or solely for natural ventilation or a mixture of conditioning, forced and natural ventilations. If the building or space is constructed solely for air-conditioning or forced ventilation the openable area may be as low as 4 % of the floor area being ventilated. Where the building is constructed solely for natural ventilation the minimum openable area shall depend on the building type except for residential buildings where the minimum required openable area shall also vary with the building size. Table 402.2 shows the ventilation area requirements which shall be met for the various building types and sizes. The table shows that buildings ventilated solely by natural means require openable areas to the outdoor as high as 60% and as low as 10%.

TABLE 402.2 VENTILATION AREA REQUIREMENT FOR VARIOUS BUILDING TYPES AND SIZES

BUILDING TYPE	CONDITIONING STATUS	SIZE (S)	OPENABLE AREA
Assembly	Conditioned	All sizes	4 % maximum
Commercial	Conditioned	All sizes	4 % maximum
Educational	Conditioned	All sizes	4 % maximum
Industrial	Conditioned	All sizes	4 % maximum
Offices	Conditioned	All sizes	4 % maximum
Residential	Conditioned	All sizes	4 % maximum

Assembly	Unconditioned	All sizes	50 % minimum
Commercial	Unconditioned	All sizes	40 % minimum
Educational	Unconditioned	All sizes	50 % minimum
Industrial	Unconditioned	All sizes	60 % minimum
Offices	Unconditioned	All sizes	40 % minimum
Residential	Unconditioned	$S \leq 80 \text{ m}^2$	10 % minimum
Residential	Unconditioned	$200 \geq S > 80 \text{ m}^2$	12½ % minimum
Residential	Unconditioned	$S > 200 \text{ m}^2$	15 % minimum

For Inch Pound Units: 1 m² = 10.764 square feet

402.2.1 Ventilation depth. Natural ventilation shall be applicable to all building types but for effectiveness the building depth shall not exceed 15,250 mm (50 feet) from the nearest outdoor opening. The effective depth over which a particular ventilation strategy (option) is viable shall be determined from the multiple floor-to-ceiling heights given in Table 402.2.1. For example if the floor-to-ceiling height is 3,050 mm (10 feet) then the depth to which a single-sided single-opening ventilation strategy will be effective is 2 x 3,050 mm = 6,100 mm (20 feet). However, effective ventilation depth cannot be determined for all building configurations using Table 402.2.1 since buildings with floor depth to ceiling heights ratios greater than 3.5 shall not apply. Ventilation depth can be increased by construction features such as stacks, wind towers, atria and ventilated roof skylights or by conservatories. Such increases shall be governed by Table 402.2.1.

**TABLE 402.2.1
NATURAL VENTILATION OPTIONS AND THEIR
EFFECTIVE DEPTH**

STRATEGY	EFFECTIVE DEPTH RELATIVE TO OFFICE FLOOR-TO-CEILING HEIGHT
Single sided, single opening	2 x floor to ceiling height
Single sided, double opening	2.5 x floor to ceiling height
Cross flow	5 x floor to ceiling height
Stack ventilation	5 x floor to ceiling height
Atria	10 x floor to ceiling if centrally located.

402.3 Adjoining spaces. Where rooms and spaces without openings to the outdoors are ventilated through an adjoining room, the opening to the adjoining rooms shall be unobstructed and shall have an area not less than 8 percent of the floor area of the interior room or space, but not less than 2.3 m² (25 square feet). The minimum openable area to the outdoors shall be based on the total floor area being ventilated.

Exception: Exterior openings required for ventilation shall be permitted to open into a thermally isolated sunroom addition or patio cover, provided that the openable area between the sunroom addition or patio cover and the interior room has an area of not less than 8 percent of the floor area of the interior room or space, but not less than 1.86 m² (20 square feet). The minimum openable area to the outdoors shall be based on the total floor area being ventilated.

402.4 Openings below grade. Where openings below grade provide required *natural ventilation*, the outdoor horizontal clear space measured perpendicular to the opening shall be one and one-half times the depth of the opening. The depth of the opening shall be measured from the average adjoining ground level to the bottom of the opening.

SECTION 403 MECHANICAL VENTILATION

403.1 Ventilation system. Mechanical ventilation shall be provided by a method of supply air and return or *exhaust air* except that mechanical ventilation air requirements for Group R-2, R-3 and R-4 occupancies three stories and less in height above grade plane shall be provided by an exhaust system, supply system or combination thereof. The amount of supply air shall be approximately equal to the **sum** of return and **makeup air minus the exhaust air**. The system shall not be prohibited from producing negative or positive pressure. The system to convey *ventilation air* shall be designed and installed in accordance with Chapter 6.

403.1.1 Bathrooms and/or toilet rooms ventilation requirements. Bathrooms **and/or toilet rooms** ventilation shall be met from a choice of natural or mechanical means as follows:

- a. All residential building bathrooms **and/or toilet rooms** with direct outside wall having ventilation opening (openable windows to the outside) $\geq 7.5\%$ of floor area shall be exempted from being fitted with mechanical (forced) ventilation if desired.
- b. All bathrooms **and/or toilet rooms** in every building type that does not have direct outside wall ventilation $\geq 7.5\%$ of floor area shall be fitted with forced ventilation that satisfies the exhaust requirements of this code.
- c. All bathrooms **and/or toilet rooms intended** for general or public use in parks, hotels, offices, commercial, educational, and industrial properties with direct outside wall ventilation $\geq 15\%$ of floor area shall have mechanical (forced) ventilation if usage are likely to exceed 15 persons per hour at any point in its operation.

contaminants from exceeding that obtainable by the rate of outdoor air ventilation determined in accordance with Section 403.3, the minimum required rate of outdoor air shall be reduced in accordance with such engineered system design.

403.2.1 Recirculation of air. The outdoor air required by Section 403.3 shall not be recirculated. Air in excess of that required by Section 403.3 shall not be prohibited from being recirculated as a component of supply air to building spaces, except that:

1. Ventilation air shall not be recirculated from one *dwelling* to another or to dissimilar occupancies.
2. Supply air to an indoor swimming pool and associated deck areas shall not be recirculated unless such air is dehumidified to maintain the relative humidity of the area at 60 percent or less. Air from this area shall not be recirculated to other spaces where more than

403.2 Outdoor air required. The minimum outdoor airflow rate shall be determined in accordance with Section 403.3.

Exception: Where the *registered design building professional* demonstrates that an engineered ventilation system design will prevent the maximum concentration of

10 percent of the resulting supply airstream consists of air recirculated from these spaces.

3. Where mechanical exhaust is required by Note b in Table 403.3.1.1, recirculation of air from such spaces shall be prohibited. Recirculation of air that is contained completely within such spaces shall **also** be prohibited. Where recirculation of air is prohibited, all air supplied to such spaces shall be exhausted, including any air in excess of that required by Table 403.3.1.1.
4. Where mechanical exhaust is required by Note g in Table 403.3.1.1, mechanical exhaust shall be installed and all air exhausted from such spaces shall not be **recirculated**. Recirculation of air from bathrooms or toilet rooms shall not be permitted **for recirculation** under any circumstance.

403.2.2 Transfer air. Except where recirculation from such spaces is prohibited by Table 403.3.1.1, air transferred from occupiable spaces is not prohibited from serving as *makeup air* for required exhaust systems in such spaces as kitchens, baths, toilet rooms, elevators and smoking lounges. The amount of transfer air and *exhaust air* shall be sufficient to provide the flow rates as specified in Section 403.3.1.1. The required outdoor airflow rates specified in Table 403.3.1.1 shall be introduced directly into such spaces or into the occupied spaces from which air is transferred or a combination of both.

403.3 Outdoor air and local exhaust airflow rates. Group R-2, R-3 and R-4 occupancies three stories and less in height above grade plane shall be provided with outdoor air and local exhaust in accordance with Section 403.3.2. Other buildings intended to be occupied shall be provided with outdoor air and local exhaust in accordance with Section 403.3.1.

403.3.1 Other buildings intended to be occupied. The design of local exhaust systems and ventilation systems for outdoor air for occupancies other than Group R-2, R-3 and R-4 three stories and less above grade plane shall comply with Sections 403.3.1.1 through 403.3.1.5.

403.3.1.1 Outdoor airflow rate. Ventilation systems shall be designed to **change the air in the ventilated space at a minimum of 5 times per hour. Ventilation systems shall** have the capacity to supply the minimum outdoor airflow rate, determined in accordance with this section **and modified as needed to ensure that the minimum number of air changes are met.** In each occupiable space, the ventilation system shall be designed to deliver the required rate of outdoor airflow to the *breathing zone*. **Where the determined rate of outdoor airflow does not result in a minimum of 5 air changes per hour the ventilated airflow rate shall be upgraded to produce the minimum allowed air changes.** The occupant load utilized for design of the ventilation system shall be not less than the number determined from the estimated maximum occupant load rate indicated in Table 403.3.1.1. Ventilation rates for occupancies not represented in Table 403.3.1.1 shall be those for a listed *occupancy* classification that is most similar in

terms of occupant density, activities and building construction; or shall be determined by an *approved* engineering analysis. The ventilation system shall be designed to supply the required rate of *ventilation air* continuously during the period the building is occupied, except as otherwise stated in other provisions of **this** code.

With the exception of smoking lounges, the ventilation rates in Table 403.3.1.1 are based on the absence of smoking in occupiable spaces. Where smoking is anticipated in a space other than a smoking lounge, the ventilation system serving the space shall be designed to provide ventilation over and above that required by Table 403.3.1.1 in accordance with accepted engineering practice.

Exception: The occupant load is not required to be determined based on the estimated maximum occupant load rate indicated in Table 403.3.1.1 where *approved* statistical data document the accuracy of an alternate anticipated occupant density.

403.3.1.1.1 Zone outdoor airflow. The minimum outdoor airflow required to be supplied to each zone shall be determined as a function of *occupancy* classification and space air distribution effectiveness in accordance with Sections 403.3.1.1.1.1 through 403.3.1.1.1.3. **The minimum outdoor airflow rate used for the design of a ventilation system shall result in at least 5 air changes per hour for the zone or zones.**

403.3.1.1.1.1 Breathing zone outdoor airflow. The outdoor airflow rate required in the *breathing zone* (V_{bz}) of the *occupiable space* or spaces in a zone shall be determined in accordance with Equation 4-1.

$$V_{bz} = R_p P_z + R_a A_z \quad \text{(Equation 4-1)}$$

where:

A_z = Zone floor area: the *net occupiable floor area* of the space or spaces in the zone.

P_z = Zone population: the number of people in the space or spaces in the zone.

R_p = People outdoor air rate: the outdoor airflow rate required per person from Table 403.3.1.1.

R_a = Area outdoor air rate: the outdoor airflow rate required per unit area from Table 403.3.1.1.

403.3.1.1.1.2 Zone air distribution effectiveness. The zone air distribution effectiveness (E_z) shall be determined using Table 403.3.1.1.1.2.

**TABLE 403.3.1.1.1.2
ZONE AIR DISTRIBUTION EFFECTIVENESS^{a,b,c,d}**

AIR DISTRIBUTION CONFIGURATION	E_z
Ceiling or floor supply of cool air	1.0 ^e
Ceiling or floor supply of warm air and floor return	1.0
Ceiling supply of warm air and ceiling return	0.8 ^f
Floor supply of warm air and ceiling return	0.7
Makeup air drawn in on the opposite side of the room from the exhaust or return	0.8
Makeup air drawn in near to the exhaust or return location	0.5

For Inch Pound Units: 1 mm = 0.00328 foot, 1 m/s = 197.6285 foot per minute, 1°C = (°F) – 32/1.8.

a. “Cool air” is air cooler than space temperature.

- a. “Warm air” is air warmer than space temperature.
- b. “Ceiling” includes any point above the breathing zone.
- c. “Floor” includes any point below the breathing zone.
- d. Zone air distribution effectiveness of 1.2 shall be permitted for systems with a floor supply of cool air and ceiling return, provided that low-velocity displacement ventilation achieves unidirectional flow and thermal stratification.
- e. Zone air distribution effectiveness of 1.0 shall be permitted for systems with a ceiling supply of warm air, provided that supply air temperature is less than +9.4°C (15°F) above space temperature and provided that the 0.7616 m/s (150-foot-per-minute) supply air jet reaches to within 1,372 mm (4½ feet) of floor level.

403.3.1.1.1.3 Zone outdoor airflow. The zone outdoor airflow rate (V_{oz}), shall be determined in accordance with Equation 4-2.

$$V_{oz} = \frac{V_{bz}}{E_z} \quad \text{(Equation 4-2)}$$

403.3.1.1.2 System outdoor airflow. The outdoor air required to be supplied by each ventilation system shall be determined in accordance with Sections 403.3.1.1.2.1 through 403.3.1.1.2.3.4 as a function of system type and zone outdoor airflow rates.

403.3.1.1.2.1 Single zone systems. Where one air handler supplies a mixture of outdoor air and recirculated return air to only one zone, the system outdoor air intake flow rate (V_{ot}) shall be determined in accordance with Equation 4-3.

$$V_{ot} = V_{oz} \quad \text{(Equation 4-3)}$$

403.3.1.1.2.2 100-percent outdoor air systems. Where one air handler supplies only outdoor air to one or more zones, the system outdoor air intake flow rate (V_{ot}) shall be determined using Equation 4-4.

$$V_{ot} = \sum_{\text{all zones}} V_{oz} \quad \text{(Equation 4-4)}$$

403.3.1.1.2.3 Multiple zone recirculating systems. Where one air handler supplies a mixture of outdoor air and recirculated return air to more than one zone, the system outdoor air intake flow rate (V_{ot}) shall be determined in accordance with Sections 403.3.1.1.2.3.1 through 403.3.1.1.2.3.4.

403.3.1.1.2.3.1 Primary outdoor air fraction. The primary outdoor air fraction (Z_p) shall be determined for each zone in accordance with Equation 4-5.

$$Z_p = \frac{V_{oz}}{V_{pz}} \quad \text{(Equation 4-5)}$$

where:

V_{pz} = Primary airflow: The airflow rate supplied to the zone from the air-handling unit at which the outdoor air intake is located. It includes outdoor intake air and recirculated air from that air-handling unit but does not include air transferred or air recirculated to the

zone by other means. For design purposes, V_{pc} shall be the zone design primary airflow rate, except for zones with variable air volume supply and V_{pc} shall be the lowest expected primary airflow rate to the zone when it is fully occupied.

403.3.1.1.2.3.2 System ventilation efficiency. The system ventilation efficiency (E_v) shall be determined using Table 403.3.1.1.2.3.2 or Appendix A of ASHRAE 62.1.

TABLE 403.3.1.1.2.3.2 SYSTEM VENTILATION EFFICIENCY^{a,b}

Max (Z_p)	E_v
≤ 0.15	1
≤ 0.25	0.9
≤ 0.35	0.8
≤ 0.45	0.7
≤ 0.55	0.6
≤ 0.65	0.5
≤ 0.75	0.4
> 0.75	0.3

a. Max (Z_p) is the largest value of Z_p calculated using Equation 4-5 among all the zones served by the system.

b. Interpolating between table values shall be permitted.

403.3.1.2 Uncorrected outdoor air intake. The uncorrected outdoor air intake flow rate (V_{ou}) shall be determined in accordance with Equation 4-6.

$$V_{ou} = \frac{D \sum_{all\ zones} R_p P_z + \sum_{all\ zones} R_a A_z}{(Equation\ 4-6)}$$

where: $D = \frac{\sum_{all\ zones} R_p P_z}{\sum_{all\ zones} R_a A_z}$

R-4 occupancies three stories and less in height above grade plane shall comply with Sections 403.3.2.1 through 403.3.2.5.

403.3.2.1 Outdoor air for dwelling units. An outdoor air ventilation system consisting of a mechanical

D = Occupant diversity: the ratio of the system population to the sum of the zone populations, determined in accordance with Equation 4-7.

$$D = \frac{P_s}{\sum_{all\ zones} P_z} \quad (Equation\ 4-7)$$

where:

P_s = System population: The total number of occupants in the area served by the system. For design purposes, P_s shall be the maximum number of occupants expected to be concurrently in all zones served by the system. Equation 4-9.

403.3.1.1.2.3.4 Outdoor air intake flow rate. The

Exhaust ventilation. Exhaust airflow rate shall be provided in accordance with the requirements of Table 403.3.1.1. Outdoor air introduced into a space by an exhaust system shall be considered as contributing to the outdoor airflow required by Table 403.3.1.1.

403.3.1.3 System operation. The minimum flow rate of outdoor air that the ventilation system must be capable of supplying during its operation shall be permitted to be based on the rate per person indicated in Table 403.3.1.1 and the actual number of occupants present.

403.3.1.4 Variable air volume system control. Variable air volume air distribution systems, other than those designed to supply only 100-percent outdoor air, shall be provided with controls to regulate the flow of outdoor air. Such control system shall be designed to maintain the flow rate of outdoor air at a rate of not less than that required by Section 403.3 over the entire range of supply air operating rates.

403.3.1.5 Balancing. The ventilation air distribution system shall be provided with means to adjust the system to achieve not less than the minimum ventilation airflow rate as required by Sections 403.3 and 403.3.1.2. Ventilation systems shall be balanced by an approved method. Such balancing shall verify that the ventilation system is capable of supplying and exhausting the airflow rates required by Sections 403.3 and 403.3.1.2.

403.3.2 Group R-2, R-3 and R-4 occupancies, three stories and less. The design of local exhaust systems and ventilation systems for outdoor air in Group R-2, R-3 and

exhaust system, supply system or combination thereof shall be installed for each dwelling unit. Local exhaust or supply systems, including outdoor air ducts connected to the return side of an air handler, are permitted to serve as such a system. The outdoor air ventilation system shall be designed to provide the required rate of outdoor air continuously during the period that the building is occupied. The minimum continuous outdoor airflow rate shall be determined

in accordance with

$$Q_{OA} = [5.08A_{floor} + 353.93(N_{br} + 1)]10^{-3} \quad (Equation\ 4-9)$$

where:

outdoor air intake flow rate (V_{oi}) shall be determined in accordance with Equation 4-8.

$$V_{ou} = \frac{V_{oi}}{E_v} \quad \text{(Equation 4-8)}$$

Q_{OA} = outdoor airflow rate, m^3/s

A_{floor} = floor area, m^2

N_{br} = number of bedrooms; not to be less than one

Exception: The outdoor air ventilation system is not required to operate continuously where the system has controls that enable operation for not less than 1 hour of each 4-hour period. The average outdoor air-

flow rate over the 4-hour period shall be not less than that prescribed by Equation 4-9.

403.3.2.2 Outdoor air for other spaces. Corridors and other common areas within the conditioned space shall be provided with outdoor air at a rate of not less than 0.000305 m³/[s . m²] (0.06 cfm per square foot) of floor area.

403.3.2.3 Local exhaust. Local exhaust systems to the outdoors shall be provided in kitchens, bathrooms and toilet rooms and shall have the capacity to exhaust at the minimum airflow rate determined in accordance with Table 403.3.2.3. The airflow rates of Table 403.3.2.3 are based on:

1. A standard bathroom/toilet room size of 3m long x 3m wide x 3m high (10 ft x 10ft x 10ft) or 27m³ (1000ft³) which should cover at least 95% of bathrooms/toilet rooms in Jamaica.
2. Bathrooms/toilet rooms of all layout configurations having an internal volume of 27 m³ (1000ft³) or less.
3. Bathrooms/toilet rooms with continuously operated exhaust fan capable of obtaining a minimum of 6 air changes per hour or 10 minutes to exhaust the space. This air change rate will be about 1 or just less air change larger than the adjoining livable spaces naturally or mechanically ventilated. The higher exhaust air rate is vital to prevent smells from the bathrooms/toilet rooms migrating into the livable spaces.
4. Bathrooms/toilet rooms with intermittently operated exhaust fan will take about 4 minutes to exhaust the air in the space and therefore can rest for 6-minute between its ON cycles to achieve the same 6 air changes per hour.
5. The door to each bathroom/toilet room from the livable space having a fixed louvre register of minimum dimension 305 mm x 305 mm (1ft x 1ft) that allows air to flow from the livable space into the bathroom/toilet room while preserving the privacy of this space.
6. The exhaust rates of Table 403.3.2.3 shall not apply to bathrooms/toilet rooms with size larger than 3m long x 3m wide x 3m high (10 ft x 10ft x 10ft) or 27m³ (1000ft³). The air exhaust rate for this size bathroom/toilet room shall be determined as outlined below.
7. Air exhaust from kitchens shall be from hoods mounted above stoves, ovens and gas water heaters and ducted to the outdoors.
8. The airflow rate for kitchen hoods shall be at least 6 air exchanges per hour or 1 air change larger than that in the surrounding or adjoining living space.

In no case shall the recommended minimum airflow rate be used to justify air changes per hour of less than 6 or 1 air change per hour larger than that in the surrounding or adjoining living space. Where the surrounding or adjoining living space is designed for natural ventilation it shall be assumed that the minimum 5 air changes per hour has been met. The

air exhaust rate, A_e for any space shall be calculated from the following formula:

$$A_e = \frac{V \times N_c}{T} \quad \text{(Equation 4-10)}$$

$$\text{For IPU: } A_e = 0.0167V \times N_c$$

Where:

A_e = Exhaust airflow rate in m³/s (ft³/min)

V = Volume of the room or space being exhausted, m³ (ft³)

N_c = Number of air changes per hour

T = Exhaust Fan operating time of 1 hour converted to seconds, (minutes).

Where the recommended air exhaust rate of Table 403.3.2.3 and Table 403.3.1.1 results in less than 6 air changes per hour for kitchens, bathrooms or toilet rooms and less than 5 air changes per hour for livable spaces the air exhaust rate shall be upgraded to produce these minimum air changes per hour.

A continuous exhaust system shall be one designed to continuously operate while the space is occupied. A continuously operated exhaust system may be initiated and terminated by the light switch for the space, but termination shall include controls for a 10-minute delay of OFF so 1 air change can take place. An intermittent operated exhaust system may also be initiated and terminated by the light switch but since the intermittent exhaust rate is 2½ times that of the continuous this exhaust system shall be fitted with controls that allow operation for only 4 minutes before going offline. The final OFF shall be the 4-minute operation after the light switch has been placed in the off position.

**TABLE 403.3.2.3
MINIMUM REQUIRED LOCAL EXHAUST
RATES FOR GROUP R-2, R-3, AND R-4
OCCUPANCIES**

AREA TO BE EXHAUSTED	EXHAUST RATE CAPACITY
Kitchens	0.2250 m³/s intermittent or 0.0562 m³/s continuous
Bathrooms and toilet rooms	0.1125 m³/s intermittent or 0.0450 m³/s continuous

For Inch Pound Units: 1 m³/s = 2,119.093 cubic foot per minute.

403.3.2.1 System controls. Where provided within a dwelling unit, controls for outdoor air ventilation systems shall include text or a symbol indicating the system's function.

403.3.2.2 Ventilating equipment. Exhaust equipment serving single dwelling units shall be listed and labeled to provide the minimum required air flow in accordance with ANSI/AMCA 210-ANSI/ASHRAE 51.

SECTION 404 ENCLOSED PARKING GARAGES

- 1. Enclosed parking garages.** Mechanical ventilation systems for enclosed parking garages shall operate continuously or shall be automatically operated by means of carbon monoxide detectors applied in conjunction with nitrogen dioxide detectors. Such detectors shall be listed in accordance with UL 2075 and installed in accordance with their listing and the manufacturers' instructions. Automatic operation shall cycle the ventilation system between the following two modes of operation: Full-on at an airflow rate of not less than $0.00381 \text{ m}^3/(\text{s} \cdot \text{m}^2)$ [0.75 cfm per square foot] of the floor area served.
- 2. Standby** at an airflow rate of not less than $0.00025 \text{ m}^3/(\text{s} \cdot \text{m}^2)$ [0.05 cfm per square foot] of the floor area served.

402.2 Occupied spaces accessory to public garages. Connecting offices, waiting rooms, ticket booths and similar uses that are accessory to a public garage shall be maintained at a positive pressure and shall be provided with ventilation in accordance with Section 403.3.1.

SECTION 405 SYSTEMS CONTROL

405.1 General. Mechanical ventilation systems shall be provided with manual or automatic controls that will operate such systems whenever the spaces are occupied. Air-condi-

tioning systems that supply required *ventilation air* shall be provided with controls designed to automatically maintain the required outdoor air supply rate during occupancy.

SECTION 406 VENTILATION OF UNINHABITED SPACES

406.1 General. Uninhabited spaces, such as crawl spaces and attics, shall be provided with *natural ventilation* openings as required by the *Jamaica Building Code, the Jamaica Small Building/Residential Code or Jamaica Energy Conservation Code* or shall be provided with a mechanical exhaust and supply air system. The mechanical exhaust rate shall be not less than $0.0001 \text{ m}^3/\text{s} \cdot \text{m}^2$ (0.02 cfm per square foot) of horizontal area and shall be automatically controlled to operate when the relative humidity in the space served exceeds 60 percent.

SECTION 407 AMBULATORY CARE FACILITIES AND GROUP I-2 OCCUPANCIES

407.1 General. Mechanical ventilation for ambulatory care facilities and Group I-2 occupancies shall be designed and installed in accordance with this code and ASHRAE 170.

TABLE 403.3.1.1
MINIMUM VENTILATION RATES

Commented [KE7]: Follow Up: TABLE 403.3.1.1

OCCUPANCY CLASSIFICATION	OCCUPANT DENSITY #/92.9 m ² ^a	PEOPLE OUTDOOR AIRFLOW RATE IN BREATHING ZONE, R _e , m ³ /s/PERSON	AREA OUTDOOR AIRFLOW RATE IN BREATHING ZONE, R _a , m ³ /(s.m ²) ^a	EXHAUST AIRFLOW RATE m ³ /(s.m ²) ^a
Correctional facilities				
Booking/waiting	50	0.00354	0.000305	—
Cells				
without plumbing fixtures	25	0.00236	0.000610	—
with plumbing fixtures ^g	25	0.00236	0.000610	0.00508
Day room	30	0.00236	0.000305	—
Dining halls				
(see "Food and Beverage service")	—	—	—	—
Guard stations	15	0.00236	0.000305	—
Dry cleaners, laundries				
Coin-operated dry cleaner	20	0.00708	—	—
Coin-operated laundries	20	0.00354	0.000610	—
Commercial dry cleaner	30	0.01416	—	—
Commercial laundry	10	0.01180	—	—
Storage, pick up	30	0.00354	0.000610	—
Education				
Art classroom ^g	20	0.00472	0.000914	0.003556
Auditoriums	150	0.00236	0.000305	—
Classrooms (ages 5-8)	25	0.00472	0.000610	—
Classrooms (age 9 plus)	35	0.00472	0.000610	—
Computer lab	25	0.00472	0.000610	—
Corridors (see "Public spaces")	—	—	—	—
Day care (through age 4)	25	0.00472	0.0009144	—
Locker/dressing rooms ^g	65	0.00354	0.000305	—
Lecture hall (fixed seats)	150	0.00354	0.000305	—
Locker/dressing rooms ^g	—	—	—	0.00127
Media center	25	0.00472	0.0006096	—
Multiuse assembly	100	0.00354	0.0003048	—
Music/theater/dance	35	0.00472	0.0003048	—
Science laboratories ^g	25	0.00472	0.0009144	0.00508
Smoking lounges ^b	70	0.02831	—	—
Sports locker rooms ^g	—	—	—	0.00254
Wood/metal shops ^g	20	0.00472	0.0009144	0.00254
Food and beverage service				
Bars, cocktail lounges	100	0.00354	0.0009144	—
Cafeteria, fast food	100	0.00354	0.0009144	—
Dining rooms	70	0.00354	0.0009144	—
Kitchens (cooking) ^b	20	0.00354	0.0006096	0.003556

(continued)

TABLE 403.3.1.1—continued
MINIMUM VENTILATION RATES

Commented [KE8]: Follow Up: ABLE 403.3.1.1—continued

OCCUPANCY CLASSIFICATION	OCCUPANT DENSITY #/92.9 m ² ^a	PEOPLE OUTDOOR AIRFLOW RATE IN BREATHING ZONE, R _p , m ³ /s/PERSON	AREA OUTDOOR AIRFLOW RATE IN BREATHING ZONE, R _a , m ³ /(s.m ²) ^a	EXHAUST AIRFLOW RATE m ³ /(s.m ²) ^a
Hotels, motels, resorts and dormitories				
Bathrooms/toilet—private ^a	—	0.007079	—	0.127/0.254 ^f
Bedroom/living room	10	0.002360	0.0003048	—
Conference/meeting	50	0.002360	0.0003048	—
Dormitory sleeping areas	20	0.002360	0.0003048	—
Gambling casinos	120	0.003539	0.0009144	—
Lobbies/prefunction	30	0.003539	0.0003048	—
Multipurpose assembly	120	0.002360	0.0003048	—
Private dwellings, single and multiple				
Garages, common for multiple units ^b	—	—	—	0.00381
Kitchens ^b	—	—	—	0.127/508 ^f
Living areas ^c	Based on number of bedrooms. First bedroom, 2; each additional bedroom, 1	0.35 ACH but not less than .0070 m ³ /person	—	—
Toilet rooms and bathrooms ^a	—	—	—	0.127/0.254 ^f
Public spaces				
Corridors	—	—	0.0003048	—
Courtrooms	70	0.002360	0.0003048	—
Elevator car	—	—	—	0.00508
Legislative chambers	50	0.002360	0.0003048	—
Libraries	10	0.002360	0.0006096	—
Museums (children's)	40	0.003539	0.0006096	—
Museums/galleries	40	0.003539	0.0003048	—
Places of religious worship	120	0.002360	0.0003048	—
Shower room (per shower head) ^a	—	—	—	0.2540/0.1016 ^f
Smoking lounges ^b	70	0.028314	—	—
Toilet rooms public ^a	—	—	—	0.2540/3556 ^e
Retail stores, sales floors and showroom floors				
Dressing rooms	—	—	—	0.00127
Mall common areas	40	0.003539	0.0003048	—
Sales	15	0.003539	0.0006096	—
Shipping and receiving	2	0.004719	0.0006096	—
Smoking lounges ^b	70	0.028314	—	—
Storage rooms	—	—	0.0006096	—
Warehouses (see "Storage")	—	0.004719	0.0003048	—

(continued)

TABLE 403.3.1.1—continued
MINIMUM VENTILATION RATES

Commented [KE9]: Follow Up: ABLE 403.3.1.1—continued

OCCUPANCY CLASSIFICATION	OCCUPANT DENSITY #/92.9 m ² ^a	PEOPLE OUTDOOR AIRFLOW RATE IN BREATHING ZONE, R _p , m ³ /s/PERSON	AREA OUTDOOR AIRFLOW RATE IN BREATHING ZONE, R _a m ³ /(s.m ²) ^a	EXHAUST AIRFLOW RATE m ³ /(s.m ²) ^a
Specialty shops				
Automotive motor-fuel dispensing stations ^b	==	==	==	0.00762
Barber	25	0.003539	0.0003048	0.00254
Beauty salons ^b	25	0.009438	0.0006096	0.003048
Nail salons ^{b, h}	25	0.009438	0.0006096	0.003048
Embaling room ^b	==	==	==	0.01016
Pet shops (animal areas) ^b	10	0.003539	0.0009144	0.004572
Supermarkets	8	0.003539	0.0003048	==
Ice arenas without combustion engines	==	==	0.001524	0.00254
Spectator areas	150	0.003539	0.0003048	==
Swimming pools (pool and deck area)	==	==	0.0024384	==
Storage				
Repair garages, enclosed parking garages ^{b, d}	==	==	==	0.00381
Refrigerated warehouses/freezers	==	0.004719	==	==
Warehouses	==	0.004719	0.0003048	==
Theaters				
Auditoriums (see "Education")	==	==	==	==
Lobbies	150	0.002360	0.0003048	==
Stages, studios	70	0.004719	0.0003048	==
Ticket booths	60	0.002360	0.0003048	==
Transportation				
Platforms	100	0.003539	0.0003048	==
Transportation waiting	100	0.003539	0.0003048	==
Workrooms				
Bank vaults/safe deposit	5	0.002360	0.0003048	==
Computer (without printing)	4	0.002360	0.0003048	==
Copy, printing rooms	4	0.002360	0.0003048	0.002286
Darkrooms	==	==	==	0.00508
Meat processing ^e	10	0.007079	==	==
Pharmacy (prep. area)	10	0.002360	0.0009144	==
Photo studios	10	0.002360	0.0006096	==

For Inch Pound Units: 1 m³/s = 2,119.09 cubic foot per minute, 1 kg = 0.0011 ton, 1 m³/(s . m²) = 196.85 cubic foot per minute per square foot, °F = 1.8 °C + 32, 1 m² = 10.764 square foot

a. Based on net occupiable floor area.

b. Mechanical exhaust required and the recirculation of air from such spaces is prohibited. Recirculation of air that is contained completely within such spaces shall not be prohibited (see Section 403.2.1, Item 3).

c. Spaces unheated or maintained below 10°C (50°F) are not covered by these requirements unless the occupancy is continuous.

d. Ventilation systems in enclosed parking garages shall comply with Section 404.

e. Rates are per water closet or urinal. The higher rate shall be provided where the exhaust system is designed to operate intermittently. The lower rate shall be permitted only where the exhaust system is designed to operate continuously while occupied.

f. Rates are per room unless otherwise indicated. The higher rate shall be provided where the exhaust system is designed to operate intermittently. The lower rate shall be permitted only where the exhaust system is designed to operate continuously while occupied.

g. Mechanical exhaust is required and recirculation from such spaces is prohibited except that recirculation shall be permitted where the resulting supply airstream consists of not more than 10 percent air recirculated from these spaces. Recirculation of air that is contained completely within such spaces shall not be prohibited (see Section 403.2.1, Items 2 and 4). Recirculation of air from bathrooms or toilets shall not be permitted under any circumstance.

h. For nail salons, each manicure and pedicure station shall be provided with a source capture system capable of exhausting not less than 0.023595 m³/s (50 cfm) per station. Exhaust inlets shall be located in accordance with Section 502.20. Where one or more required source capture systems operate continuously during occupancy, the exhaust rate from such systems shall be permitted to be applied to the exhaust flow rate required by Table 403.3.1.1 for the nail salon.

CHAPTER 5 EXHAUST SYSTEMS

User note:

About this chapter: Chapter 5 addresses exhaust systems for, among others, kitchens, laboratories, processes, garages, hazardous systems, clothes dryers and smoke control systems. Many provisions are linked to the Jamaica Fire Code. Exhaust systems mitigate health and fire hazards by removing and diluting contaminants in buildings. Exhaust system discharge location is also addressed as an important concern.

SECTION 501 GENERAL

501.1 Scope. This chapter shall govern the design, construction and installation of mechanical exhaust systems, including exhaust systems serving clothes dryers and cooking appliances; hazardous exhaust systems; dust, stock and refuse conveyor systems; subslab soil exhaust systems; smoke control systems; energy recovery ventilation systems and other systems specified in Section 502.

501.2 Independent system required. Single or combined mechanical exhaust systems for environmental air shall be independent of all other exhaust systems. Dryer exhaust shall be independent of all other systems. Type I exhaust systems shall be independent of all other exhaust systems except as provided in Section 506.3.5. Single or combined Type II exhaust systems for food-processing operations shall be independent of all other exhaust systems. Kitchen exhaust systems shall be constructed in accordance with Section 505 for domestic cooking operations and Sections 506 through 509 for commercial cooking operations.

501.3 Exhaust discharge. The air removed by every mechanical exhaust system shall be discharged outdoors at a point where it will not cause a public nuisance and not less than the distances specified in Section 501.3.1. The air shall be discharged to a location from which it cannot again be readily drawn in by a ventilating system. Air shall not be exhausted into an attic, crawl space, or be directed onto walkways.

Exceptions:

1. Whole-house ventilation-type attic fans shall be permitted to discharge into the attic space of *dwelling units* having private attics.
2. Commercial cooking recirculating systems.
3. Where installed in accordance with the manufacturer's instructions and where mechanical or *natural ventilation* is otherwise provided in accordance with Chapter 4, *listed* and *labeled* domestic ductless range hoods walls and operable vapors, lines 3,050 mm (10 feet) from operable openings into buildings; **1,830 mm** (6 feet).

501.3.1 Location of exhaust outlets. The termination point of exhaust outlets and ducts discharging to the outdoors shall be located with the following minimum distances:

1. For ducts conveying explosive or flammable vapors, fumes and dusts: 3,050 mm (10 feet) from the property lines; 9,150 mm (30 feet) from exterior walls and roofs; 9,150 mm (30 feet) from combustible openings into buildings that are in the direction of the exhaust discharge; 3,050 mm (10 feet) above adjoining grade.
2. For other product-conveying outlets: 3050 mm (10 feet) from the property lines; 915 mm (3 feet) from exterior walls and roofs; 3,050 mm (10 feet) from operable openings into buildings; 3,050 mm (10 feet) above adjoining grade.
3. For all *environmental air* exhaust: 915 mm (3 feet) from property lines; 915 mm (3 feet) from operable openings into buildings for all occupancies other than Group U, and 3,050 mm (10 feet) from mechanical air intakes. Such exhaust shall not be considered hazardous or noxious.
4. Exhaust outlets serving structures in flood hazard areas shall be installed at or above the elevation required by Section 1612 of the *Jamaica Building Code* for utilities and attendant equipment.
5. For specific systems, see the following sections:
 - 5.1. Clothes dryer exhaust, Section 504.4.
 - 5.2. Kitchen hoods and other kitchen exhaust *equipment*, Sections 506.3.13, 506.4 and 506.5.
 - 5.3. Dust, stock and refuse conveying systems, Section 511.2.
 - 5.4. Subslab soil exhaust systems, Section 512.4.
 - 5.5. Smoke control systems, Section 513.10.3.
 - 5.6. Refrigerant discharge, Section 1105.7.
 - 5.7. Machinery room discharge, Section 1105.6.1.

501.3.2 Exhaust opening protection. Exhaust openings that terminate outdoors shall be protected with corrosion-resistant screens, louvers or grilles. Openings in screens, louvers and grills shall be sized not less than 6.35 mm (¼ inch) and not larger

than 12.7 mm (½ inch). Openings shall be protected against

local weather conditions. Louvers that protect exhaust openings in

structures located in hurricane-prone regions, as defined in the *Jamaica Building Code*, shall comply with AMCA Standard 550. Outdoor openings located in exterior walls shall meet the provisions for exterior wall opening protectives in accordance with the *Jamaica Building Code*.

501.4 Pressure equalization. Mechanical exhaust systems shall be sized to remove the quantity of air required by this chapter to be exhausted. The system shall operate when air is required to be exhausted. Where mechanical exhaust is required in a room or space in other than occupancies in Group R-3 and *dwelling units* in Group R-2, such space shall be maintained with a neutral or negative pressure. If a greater quantity of air is supplied by a mechanical ventilating supply system than is removed by a mechanical exhaust for a room, adequate means shall be provided for the natural or mechanical exhaust of the excess air supplied. If only a mechanical exhaust system is installed for a room or if a greater quantity of air is removed by a mechanical exhaust system than is supplied by a mechanical ventilating supply system for a room, adequate *makeup air* shall be provided to satisfy the deficiency.

501.5 Ducts. Where exhaust duct construction is not specified in this chapter, such construction shall comply with Chapter 6.

SECTION 502 REQUIRED SYSTEMS

502.1 General. An exhaust system shall be provided, maintained and operated as specifically required by this section and for all occupied areas where machines, vats, tanks, furnaces, forges, salamanders and other *appliances, equipment* and processes in such areas produce or throw off dust or particles sufficiently light to float in the air, or emit heat, odors, fumes, spray, gas or smoke in such quantities so as to be irritating or injurious to health or safety.

502.1.1 Exhaust location. The inlet to an exhaust system shall be located in the area of heaviest concentration of contaminants.

502.1.2 Fuel-dispensing areas. The bottom of an air inlet or exhaust opening in fuel-dispensing areas shall be located not more than **455 mm (18 inches)** above the floor.

502.1.3 Equipment, appliance and service rooms. *Equipment, appliance* and system service rooms that house sources of odors, fumes, noxious gases, smoke, steam, dust, spray or other contaminants shall be designed and constructed so as to prevent spreading of such contaminants to other occupied parts of the building.

502.1.4 Hazardous exhaust. The mechanical exhaust of high concentrations of dust or hazardous vapors shall conform to the requirements of Section 510.

502.2 Aircraft fueling and defueling. Compartments housing piping, pumps, air eliminators, water separators, hose reels and similar *equipment* used in aircraft fueling and defueling operations shall be adequately ventilated at floor level or within the floor itself.

502.3 Battery-charging areas for powered industrial trucks and equipment. Ventilation shall be provided in an *approved* manner in battery-charging areas for powered industrial trucks and *equip-*

per second.

A_{LD} = Area of the loading door, square **metres.**

ment to prevent a dangerous accumulation of flammable gases.

502.4 Stationary storage battery systems. Stationary storage battery systems shall be regulated and ventilated in accordance with Section 1206.2.11.3 of the *Jamaica Fire Code* and the general requirements of this chapter.

502.5 Ventilation of battery systems in cabinets. Stationary storage battery systems installed in cabinets shall be provided with ventilation in accordance with Section 502.4.

502.6 Dry cleaning plants. Ventilation in dry cleaning plants shall be adequate to protect employees and the public in accordance with this section, applicable areas of DOL 29 CFR Part 1910.1000, and **applicable Jamaican laws.**

502.6.1 Type II systems. Type II dry cleaning systems shall be provided with a mechanical ventilation system that is designed to **exhaust 0.00508 cubic metre of air per second for each square metre [1 cubic foot of air per minute for each square foot] of floor area (0.00508 m³/(s · m²) (1 cfm/ft²)]** in dry cleaning rooms and in drying rooms. The ventilation system shall operate automatically when the dry-cleaning *equipment* is in operation and shall have manual controls at an *approved* location.

502.6.2 Type IV and V systems. Type IV and V dry cleaning systems shall be provided with an automatically activated exhaust ventilation system to maintain an air velocity of not less than 0.51 m/s (100 feet per minute) through the loading door when the door is opened.

Exception: Dry cleaning units are not required to be provided with exhaust ventilation where an exhaust hood is installed immediately outside of and above the loading door and operates at an airflow rate as follows:

$$Q = 0.00004384 \times A_{LD} \quad \text{(Equation 5-1)}$$

Q = Flow rate exhausted through the hood, **metres**

502.6.3 Spotting and pretreating. Scrubbing tubs, scouring, brushing or spotting operations shall be located such that solvent vapors are captured and exhausted by the ventilating system.

502.7 Application of flammable finishes. Mechanical exhaust as required by this section shall be provided for operations involving the application of flammable finishes.

502.7.1 During construction. Ventilation shall be provided for operations involving the application of materials containing flammable solvents in the course of construction, *alteration* or demolition of a structure.

502.7.2 Limited spraying spaces. Positive mechanical ventilation that provides not less than six complete air changes per hour shall be installed in limited spraying spaces. Such system shall meet the requirements of the *Jamaica Fire Code* for handling flammable vapors. Explosion venting is not required.

502.7.3 Flammable vapor areas. Mechanical ventilation of flammable vapor areas shall be provided in accordance with Sections 502.7.3.1 through 502.7.3.6.

502.7.3.1 Operation. Mechanical ventilation shall be kept in operation at all times while spraying operations are being conducted and for a sufficient time thereafter to allow vapors from drying coated articles and finishing material residue to be exhausted. Spraying *equipment* shall be interlocked with the ventilation of the flammable vapor area such that spraying operations cannot be conducted unless the ventilation system is in operation.

502.7.3.2 Recirculation. Air exhausted from spraying operations shall not be recirculated.

Exceptions:

1. Air exhausted from spraying operations shall be permitted to be recirculated as *makeup air* for unmanned spray operations provided that:
 - 1.1. The solid particulate has been removed.
 - 1.2. The vapor concentration is less than 25 percent of the lower flammable limit (LFL).
 - 1.3. *Approved equipment* is used to monitor the vapor concentration.
 - 1.4. An alarm is sounded and spray operations are automatically shut down if the vapor concentration exceeds 25 percent of the LFL.
 - 1.5. In the event of shutdown of the vapor concentration monitor, 100 percent of the air volume specified in Section 510 is automatically exhausted.
2. Air exhausted from spraying operations is allowed to be recirculated as *makeup air* to manned spraying operations where all of the conditions provided in Exception 1 are included in the installation and documents have been prepared to show that the installation does not pose a life safety hazard to personnel inside the spray booth, spraying space or spray room.

502.7.3.3 Air velocity. The ventilation system shall be designed, installed and maintained so that the flammable contaminants are diluted in noncontaminated air to maintain concentrations in the exhaust air flow below 25 percent of the contaminant's lower flammable limit (LFL). In addition, the spray booth shall be provided with mechanical ventilation so that the average air velocity through openings is in accordance with Sections 502.7.3.3.1 and 502.7.3.3.2.

502.7.3.3.1 Open face or open front spray booth.

For spray application operations conducted in an open face or open front spray booth, the ventilation system shall be designed, installed and maintained so that the average air velocity into the spray booth through all openings is not less than 0.51 m/s (100 feet per minute).

Exception: For fixed or automated electrostatic spray application equipment, the average air velocity into the spray booth through all openings shall be not less than 0.25 m/s (50 feet per minute).

502.7.3.3.2 Enclosed spray booth or spray room with openings for product conveyance. For spray application operations conducted in an enclosed spray booth or spray room with openings for product conveyance, the ventilation system shall be designed, installed and maintained so that the average air velocity into the spray booth through openings is not less than 0.51 m/s (100 feet per minute).

Exceptions:

1. For fixed or automated electrostatic spray application equipment, the average air velocity into the spray booth through all openings shall be not less than 0.25 m/s (50 feet per minute).
2. Where methods are used to reduce cross drafts that can draw vapors and overspray through openings from the spray booth or spray room, the average air velocity into the spray booth or spray room shall be that necessary to capture and confine vapors and overspray to the spray booth or spray room.

502.7.3.4 Ventilation obstruction. Articles being sprayed shall be positioned in a manner that does not obstruct collection of overspray.

502.7.3.5 Independent ducts. Each spray booth and spray room shall have an independent exhaust duct system discharging to the outdoors.

Exceptions:

1. Multiple spray booths having a combined frontal area of 1.67 m² (18 square feet) or less are allowed to have a common exhaust where identical spray-finishing material is used in each booth. If more than one fan serves one booth, such fans shall be interconnected so that all fans operate simultaneously.
2. Where treatment of exhaust is necessary for air pollution control or energy conservation, ducts shall be allowed to be manifolded if all of the following conditions are met:
 - 2.1. The sprayed materials used are compatible and will not react or cause ignition of the residue in the ducts.

- 2.2. Nitrocellulose-based finishing material shall not be used.
- 2.3. A filtering system shall be provided to reduce the amount of overspray carried into the duct manifold.
- 2.4. Automatic sprinkler protection shall be provided at the junction of each booth exhaust with the manifold, in addition to the protection required by this chapter.

502.7.3.6 Fan motors and belts. Electric motors driving exhaust fans shall not be placed inside booths or ducts. Fan rotating elements shall be nonferrous or nonsparking or the casing shall consist of, or be lined with, such material. Belts shall not enter the duct or booth unless the belt and pulley within the duct are tightly enclosed.

502.7.4 Dipping operations. Flammable vapor areas of dip tank operations shall be provided with mechanical ventilation adequate to prevent the dangerous accumulation of vapors. Required ventilation systems shall be so arranged that the failure of any ventilating fan will automatically stop the dipping conveyor system.

502.7.5 Electrostatic apparatus. The flammable vapor area in spray-finishing operations involving electrostatic apparatus and devices shall be ventilated in accordance with Section 502.7.3.

502.7.6 Powder coating. Exhaust ventilation for powder coating operations shall be sufficient to maintain the atmosphere below one-half of the minimum explosive concentration for the material being applied. Nondeposited, air-suspended powders shall be removed through exhaust ducts to the powder recovery system.

502.7.7 Floor resurfacing operations. To prevent the accumulation of flammable vapors during floor resurfacing operations, mechanical ventilation at a minimum rate of $0.00508 \text{ m}^3/(\text{s} \cdot \text{m}^2)$ ($1 \text{ cfm}/\text{ft}^2$) of area being finished shall be provided. Such exhaust shall be by *approved* temporary or portable means. Vapors shall be exhausted to the outdoors.

502.8 Hazardous materials general requirements. Exhaust ventilation systems for structures containing hazardous materials shall be provided as required in Sections 502.8.1 through 502.8.5.

502.8.1 Storage in excess of the maximum allowable quantities. Indoor storage areas and storage buildings for hazardous materials in amounts exceeding the maximum allowable quantity per control area shall be provided with mechanical exhaust ventilation or *natural ventilation* where *natural ventilation* can be shown to be acceptable for the materials as stored.

Exceptions:

1. Storage areas for flammable solids complying with Section 5904 of the *Jamaica Fire Code*.

2. Storage areas and storage buildings for fireworks and explosives complying with Chapter 56 of the *Jamaica Fire Code*.

502.8.1.1 System requirements. Exhaust ventilation systems shall comply with all of the following:

1. The installation shall be in accordance with this code.
2. Mechanical ventilation shall be provided at a rate of not less than $0.00508 \text{ m}^3/(\text{s} \cdot \text{m}^2)$ (1 cfm per square foot) of floor area over the storage area.
3. The systems shall operate continuously unless alternate designs are *approved*.
4. A manual shutoff control shall be provided outside of the room in a position adjacent to the access door to the room or in another *approved* location. The switch shall be a break-glass or other *approved* type and shall be *labeled*: VENTILATION SYSTEM EMERGENCY SHUTOFF.
5. The exhaust ventilation shall be designed to consider the density of the potential fumes or vapors released. For fumes or vapors that are heavier than air, exhaust shall be taken from a point within 305 mm (12 inches) of the floor. For fumes or vapors that are lighter than air, exhaust shall be taken from a point within 305 mm (12 inches) of the highest point of the room.
6. The location of both the exhaust and inlet air openings shall be designed to provide air movement across all portions of the floor or room to prevent the accumulation of vapors.
7. The *exhaust air* shall not be recirculated to occupied areas if the materials stored are capable of emitting hazardous vapors and contaminants have not been removed. Air contaminated with explosive or flammable vapors, fumes or dusts; flammable, highly toxic or toxic gases; or radioactive materials shall not be recirculated.

502.8.2 Gas rooms, exhausted enclosures and gas cabinets. The ventilation system for gas rooms, exhausted enclosures and gas cabinets for any quantity of hazardous material shall be designed to operate at a negative pressure in relation to the surrounding area. Highly toxic and toxic gases shall comply with Sections 502.9.7.1, 502.9.7.2 and 502.9.8.4.

502.8.3 Indoor dispensing and use. Indoor dispensing and use areas for hazardous materials in amounts exceeding the maximum allowable quantity per control area shall be provided with exhaust ventilation in accordance with Section 502.8.1.

Exception: Ventilation is not required for dispensing and use of flammable solids other than finely divided particles.

502.8.4 Indoor dispensing and use-point sources.

Where gases, liquids or solids in amounts exceeding the maximum allowable quantity per control area and having a hazard ranking of 3 or 4 in accordance with NFPA 704 are dispensed or used, mechanical exhaust ventilation shall be provided to capture gases, fumes, mists or vapors at the point of generation.

Exception: Where it can be demonstrated that the gases, liquids or solids do not create harmful gases, fumes, mists or vapors.

502.8.5 Closed systems. Where closed systems for the use of hazardous materials in amounts exceeding the maximum allowable quantity per control area are designed to be opened as part of normal operations, ventilation shall be provided in accordance with Section 502.8.4.

502.9 Hazardous materials requirements for specific materials. Exhaust ventilation systems for specific hazardous materials shall be provided as required in Section 502.8 and Sections 502.9.1 through 502.9.11.

502.9.1 Compressed gases—medical gas systems.

Rooms for the storage of compressed medical gases in amounts exceeding the permit amounts for compressed gases in the *Jamaica Fire Code*, and that do not have an exterior wall, shall be exhausted through a duct to the exterior of the building. Both separate airstreams shall be enclosed in a 1-hour-rated shaft enclosure from the room to the exterior. *Approved* mechanical ventilation shall be provided at a minimum rate of $0.00508 \text{ m}^3/(\text{s} \cdot \text{m}^2)$ ($1 \text{ cfm}/\text{ft}^2$) of the area of the room.

Gas cabinets for the storage of compressed medical gases in amounts exceeding the permit amounts for compressed gases in the *Jamaica Fire Code* shall be connected to an exhaust system. The average velocity of ventilation at the face of access ports or windows shall be not less than 1.02 m/s (200 feet per minute) with a minimum velocity of 0.76 m/s (150 feet per minute) at any point at the access port or window.

502.9.2 Corrosives. Where corrosive materials in amounts exceeding the maximum allowable quantity per control area are dispensed or used, mechanical exhaust ventilation in accordance with Section 502.8.4 shall be provided.

502.9.3 Cryogenics. Storage areas for stationary or portable containers of cryogenic fluids in any quantity shall be ventilated in accordance with Section 502.8. Indoor areas where cryogenic fluids in any quantity are dispensed shall be ventilated in accordance with the requirements of Section 502.8.4 in a manner that captures any vapor at the point of generation.

Exception: Ventilation for indoor dispensing areas is not required where it can be demonstrated that the cryogenic fluids do not create harmful vapors.

502.9.4 Explosives. Squirrel cage blowers shall not be used for exhausting hazardous fumes, vapors or gases in operating buildings and rooms for the manufacture,

assembly or testing of explosives. Only nonferrous fan blades shall be used for fans located within the ductwork and through which hazardous materials are exhausted. Motors shall be located outside the duct.

502.9.5 Flammable and combustible liquids. Exhaust ventilation systems shall be provided as required by Sections 502.9.5.1 through 502.9.5.5 for the storage, use, dispensing, mixing and handling of flammable and combustible liquids. Unless otherwise specified, this section shall apply to any quantity of flammable and combustible liquids.

Exception: This section shall not apply to flammable and combustible liquids that are exempt from the *Jamaica Fire Code*.

502.9.5.1 Vaults. Vaults that contain tanks of Class I liquids shall be provided with continuous ventilation at a rate of not less than $0.00508 \text{ m}^3/(\text{s} \cdot \text{m}^2)$ ($1 \text{ cfm}/\text{ft}^2$) of floor area, but not less than $4.25 \text{ m}^3/\text{min}$ (150 cfm). Failure of the exhaust airflow shall automatically shut down the dispensing system. The exhaust system shall be designed to provide air movement across all parts of the vault floor. Supply and exhaust ducts shall extend to a point not greater than 305 mm (12 inches) and not less than 76 mm (3 inches) above the floor. The exhaust system shall be installed in accordance with the provisions of NFPA 91. Means shall be provided to automatically detect any flammable vapors and to automatically shut down the dispensing system upon detection of such flammable vapors in the exhaust duct at a concentration of 25 percent of the LFL.

502.9.5.2 Storage rooms and warehouses. Liquid storage rooms and liquid storage warehouses for quantities of liquids exceeding those specified in the *Jamaica Fire Code* shall be ventilated in accordance with Section 502.8.1.

502.9.5.3 Cleaning machines. Areas containing machines used for parts cleaning in accordance with the *Jamaica Fire Code* shall be adequately ventilated to prevent accumulation of vapors.

502.9.5.4 Use, dispensing and mixing. Continuous mechanical ventilation shall be provided for the use, dispensing and mixing of flammable and combustible liquids in open or closed systems in amounts exceeding the maximum allowable quantity per control area and for bulk transfer and process transfer operations. The ventilation rate shall be not less than $0.00508 \text{ m}^3/(\text{s} \cdot \text{m}^2)$ ($1 \text{ cfm}/\text{ft}^2$) of floor area over the design area. Provisions shall be made for the introduction of *makeup air* in a manner that will include all floor areas or pits where vapors can collect. Local or spot ventilation shall be provided where needed to prevent the accumulation of hazardous vapors.

Exception: Where *natural ventilation* can be shown to be effective for the materials used, dispensed or mixed.

502.9.5.5 Bulk plants or terminals. Ventilation shall be provided for portions of properties where flammable and combustible liquids are received by tank vessels, pipelines, tank cars or tank vehicles and are stored or blended in bulk for the purpose of distributing such liquids by tank vessels, pipelines, tank cars, tank vehicles or containers as required by Sections 502.9.5.5.1 through 502.9.5.5.3.

502.9.5.5.1 General. Ventilation shall be provided for rooms, buildings and enclosures in which Class I liquids are pumped, used or transferred. Design of ventilation systems shall consider the relatively high specific gravity of the vapors. Where *natural ventilation* is used, adequate openings in outside walls at floor level, unobstructed except by louvers or coarse screens, shall be provided. Where *natural ventilation* is inadequate, mechanical ventilation shall be provided.

502.9.5.5.2 Basements and pits. Class I liquids shall not be stored or used within a building having a basement or pit into which flammable vapors can travel, unless such area is provided with ventilation designed to prevent the accumulation of flammable vapors therein.

502.9.5.5.3 Dispensing of Class I liquids. Containers of Class I liquids shall not be drawn from or filled within buildings unless a provision is made to prevent the accumulation of flammable vapors in hazardous concentrations. Where mechanical ventilation is required, it shall be kept in operation while flammable vapors could be present.

502.9.6 Highly toxic and toxic liquids. Ventilation exhaust shall be provided for highly toxic and toxic liquids as required by Sections 502.9.6.1 and 502.9.6.2.

502.9.6.1 Treatment system. This provision shall apply to indoor and outdoor storage and use of highly toxic and toxic liquids in amounts exceeding the maximum allowable quantities per control area. Exhaust scrubbers or other systems for processing vapors of highly toxic liquids shall be provided where a spill or accidental release of such liquids can be expected to release highly toxic vapors at normal temperature and pressure.

502.9.6.2 Open and closed systems. Mechanical exhaust ventilation shall be provided for highly toxic and toxic liquids used in open systems in accordance with Section 502.8.4. Mechanical exhaust ventilation shall be provided for highly toxic and toxic liquids used in closed systems in accordance with Section 502.8.5.

Exception: Liquids or solids that do not generate highly toxic or toxic fumes, mists or vapors.

502.9.7 Highly toxic and toxic compressed gases— any quantity. Ventilation exhaust shall be provided for highly toxic and toxic compressed gases in any quantity as required by Sections 502.9.7.1 and 502.9.7.2.

502.9.7.1 Gas cabinets. Gas cabinets containing highly toxic or toxic compressed gases in any quantity shall comply with Section 502.8.2 and the following requirements:

1. The average ventilation velocity at the face of gas cabinet access ports or windows shall be not less than 1.02 m/s (200 feet per minute) with a minimum velocity

of 0.76 m/s (150 feet per minute) at any point at the access port or window.

1. Gas cabinets shall be connected to an exhaust system.
2. Gas cabinets shall not be used as the sole means of exhaust for any room or area.

502.9.7.2 Exhausted enclosures. Exhausted enclosures containing highly toxic or toxic compressed gases in any quantity shall comply with Section 502.8.2 and the following requirements:

1. The average ventilation velocity at the face of the enclosure shall be not less than 1.02 m/s (200 feet per minute) with a minimum velocity of 0.76 m/s (150 feet per minute).
2. Exhausted enclosures shall be connected to an exhaust system.
3. Exhausted enclosures shall not be used as the sole means of exhaust for any room or area.

502.9.8 Highly toxic and toxic compressed gases quantities exceeding the maximum allowable quantity per control area. Ventilation exhaust shall be provided for highly toxic and toxic compressed gases in amounts exceeding the maximum allowable quantities per control area as required by Sections 502.9.8.1 through 502.9.8.6.

502.9.8.1 Ventilated areas. The room or area in which indoor gas cabinets or exhausted enclosures are located shall be provided with exhaust ventilation. Gas cabinets or exhausted enclosures shall not be used as the sole means of exhaust for any room or area.

502.9.8.2 Local exhaust for portable tanks. A means of local exhaust shall be provided to capture leakage from indoor and outdoor portable tanks. The local exhaust shall consist of portable ducts or collection systems designed to be applied to the site of a leak in a valve or fitting on the tank. The local exhaust system shall be located in a gas room. Exhaust shall be directed to a treatment system where required by the *Jamaica Fire Code*.

502.9.8.3 Piping and controls -stationary tanks. Filling or dispensing connections on indoor stationary tanks shall be provided with a means of local exhaust. Such exhaust shall be designed to capture fumes and vapors. The exhaust shall be directed to a treatment system where required by the *Jamaica Fire Code*.

502.9.8.4 Gas rooms. The ventilation system for gas rooms shall be designed to operate at a negative pressure in relation to the surrounding area. The exhaust ventilation from gas rooms shall be directed to an exhaust system.

502.9.8.5 Treatment system. The exhaust ventilation from gas cabinets, exhausted enclosures and gas rooms, and local exhaust systems required in

Sections 502.9.8.2 and 502.9.8.3 shall be directed to a treatment system where required by the *Jamaica Fire Code*.

502.9.8.6 Process equipment. Effluent from indoor and outdoor process equipment containing highly toxic or toxic compressed gases which could be discharged to the atmosphere shall be processed through an exhaust scrubber or other processing system. Such systems shall be in accordance with the *Jamaica Fire Code*.

502.9.9 Ozone gas generators. Ozone cabinets and ozone gas-generator rooms for systems having a maximum ozone-generating capacity of 0.23 kg (1/2 pound) or more over a 24-hour period shall be mechanically ventilated at a rate of not less than six air changes per hour. For cabinets, the average velocity of ventilation at makeup air openings with cabinet doors closed shall be not less than 1.02 m/s (200 feet per minute).

502.9.10 LP-gas distribution facilities. LP-gas distribution facilities shall be ventilated in accordance with NFPA 58.

502.9.10.1 Portable container use. Above-grade underfloor spaces or basements in which portable LP-gas containers are used or are stored awaiting use or resale shall be provided with an approved means of ventilation.

Exception: Department of Transportation (DOT) specification cylinders with a maximum water capacity of 1.2 kg (2.7 pounds) for use in completely self-contained hand torches and similar applications. The quantity of LP-gas shall not exceed 9 kg (20 pounds).

502.9.11 Silane gas. Exhausted enclosures and gas cabinets for the indoor storage of silane gas in amounts exceeding the maximum allowable quantities per control area shall comply with Chapter 64 of the *Jamaica Fire Code*.

502.10 Hazardous production materials (HPM). Exhaust ventilation systems and materials for ducts utilized for the exhaust of HPM shall comply with this section, other applicable provisions of this code, the *Jamaica Building Code* and the *Jamaica Fire Code*.

502.10.1 Where required. Exhaust ventilation systems shall be provided in the following locations in accordance with the requirements of this section and the *Jamaica Building Code*.

1. Fabrication areas: Exhaust ventilation for fabrication areas shall comply with the *Jamaica Building Code*. Additional manual control switches shall be provided where required by the building official.
2. Workstations: A ventilation system shall be provided to capture and exhaust gases, fumes and vapors at workstations.
3. Liquid storage rooms: Exhaust ventilation for liquid storage rooms shall comply with Section 502.8.1.1 and the *Jamaica Building Code*.

4. HPM rooms: Exhaust ventilation for HPM rooms shall comply with Section 502.8.1.1 and the *Jamaica Building Code*.

5. Gas cabinets: Exhaust ventilation for gas cabinets shall comply with Section 502.8.2. The gas cabinet ventilation system is allowed to connect to a workstation ventilation system. Exhaust ventilation for gas cabinets containing highly toxic or toxic gases shall also comply with Sections 502.9.7 and 502.9.8.

6. Exhausted enclosures: Exhaust ventilation for exhausted enclosures shall comply with Section 502.8.2. Exhaust ventilation for exhausted enclosures containing highly toxic or toxic gases shall also comply with Sections 502.9.7 and 502.9.8.

7. Gas rooms: Exhaust ventilation for gas rooms shall comply with Section 502.8.2. Exhaust ventilation for gas rooms containing highly toxic or toxic gases shall also comply with Sections 502.9.7 and 502.9.8.

8. Cabinets containing pyrophoric liquids or Class 3 water-reactive liquids: Exhaust ventilation for cabinets in fabrication areas containing pyrophoric liquids shall be as required in Section 2705.2.3.4 of the *Jamaica Fire Code*.

502.10.2 Penetrations. Exhaust ducts penetrating fire barriers constructed in accordance with Section 707 of the *Jamaica Building Code* or horizontal assemblies constructed in accordance with Section 711 of the *Jamaica Building Code* shall be contained in a shaft of equivalent fire-resistance-rated construction. Exhaust ducts shall not penetrate fire walls. Fire dampers shall not be installed in exhaust ducts.

502.10.3 Treatment systems. Treatment systems for highly toxic and toxic gases shall comply with the *Jamaica Fire Code*.

502.11 Motion picture projectors. Motion picture projectors shall be exhausted in accordance with Section 502.11.1 or 502.11.2.

502.11.1 Projectors with an exhaust discharge. Projectors equipped with an exhaust discharge shall be directly connected to a mechanical exhaust system. The exhaust system shall operate at an exhaust rate as indicated by the manufacturer's installation instructions.

502.11.2 Projectors without exhaust connection. Projectors without an exhaust connection shall have contaminants exhausted through a mechanical exhaust system. The exhaust rate for electric arc projectors shall be not less than 0.09 m³/s (200 cubic feet per minute) per lamp. The exhaust rate for xenon projectors shall be not less than 0.14 m³/s (300 cfm) per lamp. Xenon projector exhaust shall be at a rate such that the exterior temperature of the lamp housing does not exceed 54°C (130°F). The lamp and projection room exhaust systems, whether combined or independent, shall not be interconnected with any other exhaust or return system within the building.

502.12 Organic coating processes. Enclosed structures involving organic coating processes in which Class I liquids

are processed or handled shall be ventilated at a rate of not less than $0.00508 \text{ m}^3/(\text{s} \cdot \text{m}^2)$ ($1 \text{ cfm}/\text{ft}^2$) of solid floor area. Ventilation shall be accomplished by exhaust fans that intake at floor levels and discharge to a safe location outside the structure. Noncontaminated intake air shall be introduced in such a manner that all portions of solid floor areas are provided with continuous uniformly distributed air movement.

502.13 Public garages. Mechanical exhaust systems for public garages, as required in Chapter 4, shall operate continuously or in accordance with Section 404.

502.14 Motor vehicle operation. In areas where motor vehicles operate, mechanical ventilation shall be provided in accordance with Section 403. Additionally, areas in which stationary motor vehicles are operated shall be provided with a *source capture system* that connects directly to the motor vehicle exhaust systems. Such system shall be engineered by a registered design building professional or shall be factory-built equipment designed and sized for the purpose.

Exceptions:

1. This section shall not apply where the motor vehicles being operated or repaired are electrically powered.
2. This section shall not apply to one and two-family dwellings.
3. This section shall not apply to motor vehicle service areas where engines are operated inside the building only for the duration necessary to move the motor vehicles in and out of the building.

502.15 Repair garages. Where Class I liquids or LP-gas are stored or used within a building having a basement or pit wherein flammable vapors could accumulate, the basement or pit shall be provided with ventilation designed to prevent the accumulation of flammable vapors therein.

502.16 Repair garages for vehicles fueled by lighter- than-air fuels. Repair garages used for the conversion and repair of vehicles that use compressed natural gas, liquefied natural gas, hydrogen or other lighter-than-air motor fuels shall be provided with an *approved* mechanical exhaust ventilation system. The mechanical exhaust ventilation system shall be in accordance with Section 502.16.1 or 502.16.2 as applicable.

Exceptions:

1. Repair garages where work is not performed on the fuel system and is limited to exchange of parts and maintenance not requiring open flame or welding on the compressed natural gas, liquefied natural gas, hydrogen or other lighter-than-air-fueled motor vehicle.
2. Repair garages for hydrogen-fueled vehicles where work is not performed on the hydrogen storage tank and is limited to the exchange of parts and maintenance not requiring open flame or welding on the hydrogen-fueled vehicle. During the work, the entire hydrogen fuel system shall contain a quantity of hydrogen that is less than 5.6 m^3 (200 cubic).

502.16.1 Repair garages for hydrogen-fueled vehicles. Repair garages used for the repair of hydrogen-fueled vehicles shall be provided with an approved exhaust ventilation system in accordance with this code and Chapter 6 of NFPA 2.

502.16.2 Exhaust ventilation system. Repair garages used for the repair of compressed natural gas, liquefied natural gas or other lighter-than-air motor fuel, other than hydrogen, shall be provided with an approved mechanical exhaust ventilation system. The mechanical exhaust ventilation system shall be in accordance with this code and Sections 502.16.2.1 and 502.16.2.2.

Exception: Where approved, natural ventilation shall be an alternative to mechanical exhaust ventilation.

502.16.2.1 Design. For indoor locations, air supply inlets and exhaust outlets for mechanical ventilation shall be arranged to provide uniformly distributed air movement with inlets uniformly arranged on walls near floor level and outlets located at the high point of the room in walls or the ceiling or roof.

Failure of the exhaust ventilation system shall cause the fueling system to shut down.

The exhaust ventilation rate shall be not less than $0.03 \text{ m}^3/\text{min}$ (1 cubic foot per minute) per 0.34 m^3 (12 cubic feet) of room volume.

502.16.2.2 Operation. The mechanical exhaust ventilation system shall operate continuously.

Exceptions:

1. Mechanical exhaust ventilation systems that are interlocked with a gas detection system designed in accordance with the *Jamaica Fire Code*.
2. Mechanical exhaust ventilation systems in garages that are used only for the repair of vehicles fueled by liquid fuels or odorized gases, such as compressed natural gas, where the exhaust ventilation system is electrically interlocked with the lighting circuit.

502.17 Tire rebuilding or recapping. Each room where rubber cement is used or mixed, or where flammable or combustible solvents are applied, shall be ventilated in accordance with the applicable provisions of NFPA 91.

502.17.1 Buffing machines. Each buffing machine shall be connected to a dust-collecting system that prevents the accumulation of the dust produced by the buffing process.

502.18 Specific rooms. Specific rooms, including bathrooms, locker rooms, smoking lounges and toilet rooms, shall be exhausted in accordance with the ventilation requirements of Chapter 4.

502.19 Indoor firing ranges. Ventilation shall be provided in an *approved* manner in areas utilized as indoor firing ranges. Ventilation shall be designed to protect employees and the public in accordance with applicable Jamaican laws and/or DOL 29 CFR 1910.1025 where applicable.

502.20 Manicure and pedicure stations. Manicure and pedicure stations shall be provided with an exhaust system in accordance with Table 403.3.1.1, Note h. Manicure tables and pedicure stations not provided with factory-installed

exhaust inlets shall be provided with exhaust inlets located not more than 305 mm (12 inches) horizontally and vertically from the point of chemical application.

SECTION 503 MOTORS AND FANS

503.1 General. Motors and fans shall be sized to provide the required air movement and a minimum of 5 air changes per hour for livable areas and 6 air changes per hour for kitchens, bathrooms and toilet rooms. Motors in areas that contain flammable vapors or dusts shall be of a type approved for such environments. A manually operated remote control installed at an approved location shall be provided to shut off fans or blowers in flammable vapor or dust systems. Electrical equipment and appliances used in operations that generate explosive or flammable vapors, fumes or dusts shall be interlocked with the ventilation system so that the equipment and appliances cannot be operated unless the ventilation fans are in operation. Motors for fans used to convey flammable vapors or dusts shall be located outside the duct or shall be protected with approved shields and dustproofing. Motors and fans shall be provided with a means of access for servicing and maintenance.

503.2 Fans. Parts of fans in contact with explosive or flammable vapors, fumes or dusts shall be of nonferrous or nonsparking materials, or their casing shall be lined or constructed of such material. Where the size and hardness of materials passing through a fan are capable of producing a spark, both the fan and the casing shall be of nonsparking materials. Where fans are required to be spark resistant, their bearings shall not be within the airstream, and all parts of the fan shall be grounded. Fans in systems-handling materials that are capable of clogging the blades, and fans in buffing or woodworking exhaust systems, shall be of the radial-blade or tube-axial type.

503.3 Equipment and appliance identification plate. Equipment and appliances used to exhaust explosive or flammable vapors, fumes or dusts shall bear an identification plate stating the ventilation rate for which the system was designed.

503.4 Corrosion-resistant fans. Fans located in systems conveying corrosives shall be of materials that are resistant to the corrosive or shall be coated with corrosion-resistant materials.

SECTION 504 CLOTHES DRYER EXHAUST

504.1 Installation. Clothes dryers shall be exhausted in accordance with the manufacturer's instructions. Dryer exhaust systems shall be independent of all other systems and shall convey the moisture and any products of combustion to the outside of the building.

Exception: This section shall not apply to listed and labeled condensing (ductless) clothes dryers.

504.2 Exhaust penetrations. Where a clothes dryer exhaust duct penetrates a wall or ceiling membrane, the annular space shall be sealed with noncombustible material, approved fire caulking or a noncombustible dryer exhaust duct wall receptacle. Ducts that exhaust clothes dryers shall not penetrate or be located within any fireblocking, draftstopping or any wall, floor/ceiling or other assembly required by the

Jamaica Building Code to be fire-resistance rated, unless such duct is constructed of galvanized steel or aluminum of the thickness specified in Section 603.4 and the fire-resistance rating is maintained in accordance with the *Jamaica Building Code*. Fire dampers, combination fire/smoke dampers and any similar devices that will obstruct the exhaust flow shall be prohibited in clothes dryer exhaust ducts.

504.3 Cleanout. Each vertical riser shall be provided with a means for cleanout.

504.4 Exhaust installation. Dryer exhaust ducts for clothes dryers shall terminate on the outside of the building and shall be equipped with a backdraft damper. Screens shall not be installed at the duct termination. Ducts shall not be connected or installed with sheet metal screws or other fasteners that will obstruct the exhaust flow. Clothes dryer exhaust ducts shall not be connected to a vent connector, vent or chimney. Clothes dryer exhaust ducts shall not extend into or through ducts or plenums. Clothes dryer exhaust ducts shall be sealed in accordance with Section 603.9.

504.4.1 Exhaust termination outlet and passageway size. The passageway of dryer exhaust duct terminals shall be undiminished in size and shall provide an open area of not less than 8,065 mm² (12.5 square inches).

504.5 Dryer exhaust duct power ventilators. Domestic dryer exhaust duct power ventilators shall be listed and labeled to UL 705 for use in dryer exhaust duct systems. The dryer exhaust duct power ventilator shall be installed in accordance with the manufacturer's instructions.

504.6 Makeup air. Installations exhausting more than 0.09 m³/s (200 cfm) shall be provided with makeup air. Where a closet is designed for the installation of a clothes dryer, an opening having an area of not less than 0.0645 m² (100 square inches) shall be provided in the closet enclosure or makeup air shall be provided by other approved means.

504.7 Protection required. Protective shield plates shall be placed where nails or screws from finish or other work are likely to penetrate the clothes dryer exhaust duct. Shield plates shall be placed on the finished face of all framing members where there is less than 32 mm (1¹/₄ inches) between the duct and the finished face of the framing member. Protective shield plates shall be constructed of steel, have a thickness of 1.6 mm (0.062 inch) and extend not less than 51 mm (2 inches) above sole plates and below top plates.

504.8 Domestic clothes dryer ducts. Exhaust ducts for domestic clothes dryers shall conform to the requirements of Sections 504.8.1 through 504.8.6.

504.8.1 Material and size. Exhaust ducts shall have a smooth interior finish and shall be constructed of metal not less than 0.4 mm (0.016 inch) in thickness. The exhaust duct size shall be 100 mm (4 inches) nominal in diameter.

504.8.2 Duct installation. Exhaust ducts shall be supported at 1,220 mm (4-foot) intervals and secured in place. The insert end of the duct shall extend into the adjoining duct or fitting in the direction of airflow. Ducts shall not

be joined with screws or similar fasteners that protrude more than 3.2 mm (1/8 inch) into the inside of the duct.

Where dryer exhaust ducts are enclosed in wall or ceiling cavities, such cavities shall allow the installation of the duct without deformation.

504.6.1 Transition ducts. Transition ducts used to connect the dryer to the exhaust duct system shall be a single length that is *listed and labeled* in accordance with UL 2158A. Transition ducts shall be not greater than 2,450 mm (8 feet) in length and shall not be concealed within construction.

504.6.2 Duct length. The maximum allowable exhaust duct length shall be determined by one of the methods specified in Sections 504.8.4.1 through 504.8.4.3.

504.6.2.1 Specified length. The maximum length of the exhaust duct shall be 10, 675 (35 feet) from the connection to the transition duct from the dryer to the outlet terminal. Where fittings are used, the maximum length of the exhaust duct shall be reduced in accordance with Table 504.8.4.1.

504.6.2.2 Manufacturer's instructions. The maximum length of the exhaust duct shall be determined by the dryer manufacturer's installation instructions. The code official shall be provided with a copy of the installation instructions for the make and model of the dryer. Where the exhaust duct is to be concealed, the installation instructions shall be provided to the code official prior to the concealment inspection. In the absence of fitting equivalent length calculations from the clothes dryer manufacturer, Table 504.8.4.1 shall be used.

504.6.2.3 Dryer exhaust duct power ventilator length. The maximum length of the exhaust duct shall be determined by the dryer exhaust duct power ventilator manufacturer's installation instructions.

504.6.3 Length identification. Where the exhaust duct equivalent length exceeds 10, 675 (35 feet), the equivalent length of the exhaust duct shall be identified on a permanent label or tag. The label or tag shall be located within 1,830 mm (6 feet) of the exhaust duct connection.

504.6.4 Exhaust duct required. Where space for a clothes dryer is provided, an exhaust duct system shall be installed. Where the clothes dryer is not installed at the time of occupancy, the exhaust duct shall be capped at the location of the future dryer.

Exception: Where a *listed* condensing clothes dryer is installed prior to occupancy of structure.

504.7 Commercial clothes dryers. The installation of dryer exhaust ducts serving commercial clothes dryers shall comply with the *appliance* manufacturer's installation instructions. Exhaust fan motors installed in exhaust systems shall be located outside of the airstream. In multiple installations, the fan shall operate continuously or be interlocked to operate when any individual unit is operating. Ducts shall have a minimum *clearance* of 152 mm (6 inches) to combustible materials. Clothes dryer transition ducts used to connect the *appliance* to the exhaust duct system shall be limited to single lengths not to exceed 2,450 mm (8 feet) in length and shall be

listed and labeled for the application. Transition ducts shall not be concealed within construction.

504.8 Common exhaust systems for clothes dryers located in multistory structures. Where a common multistory duct system is designed and installed to convey exhaust from multiple clothes dryers, the construction of the system shall be in accordance with all of the following:

1. The shaft in which the duct is installed shall be constructed and fire-resistance rated as required by the *Jamaica Building Code*.
2. Dampers shall be prohibited in the exhaust duct. Penetrations of the shaft and ductwork shall be protected in accordance with Section 607.5.5, Exception 2.
3. Rigid metal ductwork shall be installed within the shaft to convey the exhaust. The ductwork shall be constructed of sheet steel having a minimum thickness of 0.4712 mm (0.0187 inch) (No. 26 gage) and in accordance with SMACNA *Duct Construction Standards*.
4. The ductwork within the shaft shall be designed and installed without offsets.
5. The exhaust fan motor design shall be in accordance with Section 503.2.
6. The exhaust fan motor shall be located outside of the airstream.
7. The exhaust fan shall run continuously, and shall be connected to a standby power source.
8. Exhaust fan operation shall be monitored in an *approved* location and shall initiate an audible or visual signal when the fan is not in operation.
9. Makeup air shall be provided for the exhaust system.
10. A cleanout opening shall be located at the base of the shaft to provide *access* to the duct to allow for cleaning and inspection. The finished opening shall be not less than 305 mm by 305 mm (12 inches by 12 inches)
11. Screens shall not be installed at the termination.
12. The common multistory duct system shall serve only clothes dryers and shall be independent of other exhaust systems.

Commented [hE10]:

**TABLE 504.8.4.1
DRYER EXHAUST DUCT FITTING EQUIVALENT LENGTH**

Commented [KE11]: Follow Up: TABLE 504.8.4.1

DRYER EXHAUSTDUCT FITTING TYPE	EQUIVALENT LENGTH
100 mm radius mitered 45-degree elbow	760mm
100 mm radius mitered 90-degree elbow	1525mm
150 mm radius smooth 45-degree elbow	305 mm
150 mm radius smooth 90-degree elbow	535mm
205 mm radius smooth 45-degree elbow	305 mm
205 mm radius smooth 90-degree elbow	480 mm
255 radius smooth 45-degree elbow	22mm
255 mm radius smooth 90-degree elbow	455 mm

For Inch Pound Units: 1 mm = 0.03937 inch, 1 mm = 0.00328 foot, 1 degree = 0.0175 rad.

SECTION 505 DOMESTIC COOKING EXHAUST EQUIPMENT

505.1 General. Domestic cooking exhaust equipment shall comply with the requirements of this section.

505.2 Domestic cooking exhaust. Where domestic cooking exhaust equipment is provided, it shall comply with the following as applicable:

1. The fan for overhead range hoods and downdraft exhaust equipment not integral with the cooking appliance shall be listed and labeled in accordance with UL 507.
2. Overhead range hoods and downdraft exhaust equipment with integral fans shall comply with UL 507.
3. Domestic cooking appliances with integral downdraft exhaust equipment shall be listed and labeled in accordance with JS 277, UL 858 or ANSI Z21.1 as appropriate.
4. Microwave ovens with integral exhaust for installation over the cooking surface shall be listed and labeled in accordance with UL 923.

505.3 Exhaust ducts. Domestic cooking exhaust equipment shall discharge to the outdoors through sheet metal ducts constructed of galvanized steel, stainless steel, aluminum or copper. Such ducts shall have smooth inner walls, shall be air tight, shall be equipped with a backdraft damper, and shall be independent of all other exhaust systems. Installations in Group I-1 and I-2 occupancies shall be in accordance with the *Jamaica Building Code* and Section 904.13 of the *Jamaica Fire Code*.

Exceptions:

1. In other than Groups I-1 and I-2, where installed in accordance with the manufacturer's instructions and where mechanical or natural ventilation is otherwise provided in accordance with Chapter 4, listed and labeled ductless range hoods shall not be required to discharge to the outdoors.
2. Ducts for domestic kitchen cooking appliances equipped with downdraft exhaust systems shall be permitted to be constructed of Schedule 40 PVC pipe and fittings provided that the installation complies with all of the following:
 - 2.1. The duct shall be installed under a concrete slab poured on grade.
 - 2.2. The underfloor trench in which the duct is installed shall be completely backfilled with sand or gravel.
 - 2.3. The PVC duct shall extend not more than 25 mm (1 inch) above the indoor concrete floor surface.
 - 2.4. The PVC duct shall extend not more than 25 mm (1 inch) above grade outside of the building.
 - 2.5. The PVC ducts shall be solvent cemented.

505.4 Makeup air required. Exhaust hood systems capable of exhausting in excess of 0.19 m³/s (400 cfm) shall be provided with *makeup air* at a rate approximately equal to the

exhaust air rate. Such *makeup air* systems shall be equipped with a means of closure and shall be automatically controlled to start and operate simultaneously with the exhaust system.

505.5 Common exhaust systems for domestic kitchens located in multistory structures. Where a common multistory duct system is designed and installed to convey exhaust from multiple domestic kitchen exhaust systems, the construction of the system shall be in accordance with all of the following:

1. The shaft in which the duct is installed shall be constructed and fire-resistance rated as required by the *Jamaica Building Code*.
2. Dampers shall be prohibited in the exhaust duct, except as specified in Section 505.3. Penetrations of the shaft and ductwork shall be protected in accordance with Section 607.5.5, Exception 2.
3. Rigid metal ductwork shall be installed within the shaft to convey the exhaust. The ductwork shall be constructed of sheet steel having a minimum thickness of 0.4712 mm (0.0187 inch)(No. 26 gage) and in accordance with SMACNA *Duct Construction Standards*.
4. The ductwork within the shaft shall be designed and installed without offsets.
5. The exhaust fan motor design shall be in accordance with Section 503.2.
6. The exhaust fan motor shall be located outside of the airstream.
7. The exhaust fan shall run continuously, and shall be connected to a standby power source.
8. Exhaust fan operation shall be monitored in an approved location and shall initiate an audible or visual signal when the fan is not in operation.
9. Where the exhaust rate for an individual kitchen exceeds 0.19 m³/s (400 cfm) makeup air shall be provided in accordance with Section 505.4.
10. A cleanout opening shall be located at the base of the shaft to provide access to the duct to allow for cleanout and inspection. The finished openings shall be not less than 305 mm by 305 mm (12 inches by 12 inches).
11. Screens shall not be installed at the termination.
12. The common multistory duct system shall serve only kitchen exhaust and shall be independent of other exhaust systems.

505.6 Other than Group R. In other than Group R occupancies, where domestic cooktops, ranges, and open-top broilers are used for domestic purposes, domestic cooking exhaust systems shall be provided.

SECTION 506 COMMERCIAL KITCHEN HOOD VENTILATION SYSTEM DUCTS AND EXHAUST EQUIPMENT

506.1 General. Commercial kitchen hood ventilation ducts and exhaust *equipment* shall comply with the requirements of

this section. Commercial kitchen grease ducts shall be designed for the type of cooking *appliance* and hood served.

506.2 Corrosion protection. Ducts exposed to the outside atmosphere or subject to a corrosive environment shall be protected against corrosion in an *approved* manner.

506.3 Ducts serving Type I hoods. Type I exhaust ducts shall be independent of all other exhaust systems except as provided in Section 506.3.5. Commercial kitchen duct systems serving Type I hoods shall be designed, constructed and installed in accordance with Sections 506.3.1 through 506.3.13.3.

506.3.1 Duct materials. Ducts serving Type I hoods shall be constructed of materials in accordance with Sections 506.3.1.1 and 506.3.1.2.

506.3.1.1 Grease duct materials. Grease ducts serving Type I hoods shall be constructed of steel having a minimum thickness of 1.463 mm {0.0575 inch (No. 16 gage)} or stainless steel not less than 1.14 mm {0.0450 inch (No. 18 gage)} in thickness.

Exception: Factory-built commercial kitchen grease ducts *listed* and *labeled* in accordance with UL 1978 and installed in accordance with Section 304.1.

506.3.1.2 Makeup air ducts. Makeup air ducts connecting to or within 455 mm (18 inches) of a Type I hood shall be constructed and installed in accordance with Sections 603.1, 603.3, 603.4, 603.9, 603.10 and 603.12. Duct insulation installed within 455 mm (18 inches) of a Type I hood shall be noncombustible or shall be *listed* for the application.

506.3.2 Joints, seams and penetrations of grease ducts. Joints, seams and penetrations of grease ducts shall be made with a continuous liquid-tight weld or braze made on the external surface of the duct system.

Exceptions:

1. Penetrations shall not be required to be welded or brazed where sealed by devices that are *listed* for the application.
2. Internal welding or brazing shall not be prohibited provided that the joint is formed or ground smooth and is provided with ready access for inspection.
3. Factory-built commercial kitchen grease ducts *listed* and *labeled* in accordance with UL 1978 and installed in accordance with Section 304.1.

506.3.2.1 Duct joint types. Duct joints shall be butt joints, welded flange joints with a maximum flange depth of 12.5mm (1/2 inch) or overlapping duct joints of either the telescoping or bell type. Overlapping joints shall be installed to prevent ledges and obstructions from collecting grease or interfering with gravity drainage to the intended collection point. The difference between the inside cross-sectional dimensions of overlapping sections of duct shall not exceed 6.35 mm (1/4 inch). The length of overlap for overlapping duct joints shall not exceed 51 mm (2 inches).

506.3.2.2 Duct-to-hood joints. Duct-to-hood joints shall be made with continuous internal or external liquid-tight welded or brazed joints. Such joints shall be smooth, accessible for inspection, and without grease traps.

Exceptions: This section shall not apply to:

1. A vertical duct-to-hood collar connection made in the top plane of the hood in accordance with all of the following:
 - 1.1. The hood duct opening shall have a 25 mm (1-inch)-deep, full perimeter, welded flange turned down into the hood interior at an angle of 90 degrees (1.57 rad) from the plane of the opening.
 - 1.2. The duct shall have a 25 mm (1-inch)-deep flange made by a 25 mm by 25 mm (1-inch by 1-inch) angle iron welded to the full perimeter of the duct not less than 25 mm (1 inch) above the bottom end of the duct.
 - 1.3. A gasket rated for use at not less than 816°C (1500°F) is installed between the duct flange and the top of the hood.
 - 1.4. The duct-to-hood joint shall be secured by stud bolts not less than 6.35 mm (1/4 inch) in diameter welded to the hood with a spacing not greater than 100 mm (4 inches) on center for the full perimeter of the opening. The bolts and nuts shall be secured with lock-washers.
2. *Listed* and *labeled* duct-to-hood collar connections installed in accordance with Section 304.1.

506.3.2.3 Duct-to-exhaust fan connections. Duct-to-exhaust fan connections shall be flanged and gasketed at the base of the fan for vertical discharge fans; shall be flanged, gasketed and bolted to the inlet of the fan for side-inlet utility fans; and shall be flanged, gasketed and bolted to the inlet and outlet of the fan for in-line fans. Gasket and sealing materials shall be rated for continuous duty at a temperature of not less than 816°C (1500°F).

506.3.2.4 Vibration isolation. A vibration isolation connector for connecting a duct to a fan shall consist of noncombustible packing in a metal sleeve joint of *approved* design or shall be a coated-fabric flexible duct connector *listed* and *labeled* for the application. Vibration isolation connectors shall be installed only at the connection of a duct to a fan inlet or outlet.

506.3.2.5 Grease duct test. Prior to the use or concealment of any portion of a grease duct system, a leakage test shall be performed. Ducts shall be considered to be concealed where installed in shafts or covered by coatings or wraps that prevent the ductwork from being visually inspected on all sides. The permit holder shall

be responsible to provide the necessary *equipment* and perform the grease duct leakage test. A light test shall be performed to determine that all welded and brazed joints are liquid tight.

A light test shall be performed by passing a lamp having a power rating of not less than 100 watts through the entire section of ductwork to be tested. The lamp shall be open so as to emit light equally in all directions perpendicular to the duct walls. A test shall be performed for the entire duct system, including the hood-to-duct connection. The duct work shall be permitted to be tested in sections, provided that every joint is tested. For *listed* factory-built grease ducts, this test shall be limited to duct joints assembled in the field and shall exclude factory welds.

506.3.3 Grease duct supports. Grease duct bracing and supports shall be of noncombustible material securely attached to the structure and designed to carry gravity and seismic loads within the stress limitations of the *Jamaica Building Code*. Bolts, screws, rivets and other mechanical fasteners shall not penetrate duct walls.

506.3.4 Air velocity. Grease duct systems serving a Type I hood shall be designed and installed to provide an air velocity within the duct system of not less than 2.5 m/s (500 feet per minute).

Exception: The velocity limitations shall not apply within duct transitions utilized to connect ducts to differently sized or shaped openings in hoods and fans, provided that such transitions do not exceed 915 mm (3 feet) in length and are designed to prevent the trapping of grease.

506.3.5 Separation of grease duct system. A separate grease duct system shall be provided for each Type I hood. A separate grease duct system is not required where all of the following conditions are met:

1. All interconnected hoods are located within the same story.
2. All interconnected hoods are located within the same room or in adjoining rooms.
3. Interconnecting ducts do not penetrate assemblies required to be fire-resistance rated.
4. The grease duct system does not serve solid-fuel-fired appliances.

506.3.6 Grease duct clearances. Where enclosures are not required, grease duct systems and exhaust *equipment* serving a Type I hood shall have a *clearance* to combustible construction of not less than 455 mm (18 inches), and shall have a *clearance* to noncombustible construction and gypsum wallboard attached to noncombustible structures of not less than 76 mm (3 inches).

Exceptions:

1. Factory-built commercial kitchen grease ducts *listed* and *labeled* in accordance with UL 1978.
2. *Listed* and *labeled* exhaust *equipment* installed in accordance with Section 304.1.

3. Where commercial kitchen grease ducts are continuously covered on all sides with a *listed* and *labeled* field-applied grease duct enclosure material, system, product or method of construction specifically evaluated for such purpose in accordance with ASTM E2336, the required *clearance* shall be in accordance with the listing of such material, system, product or method.

506.3.7 Prevention of grease accumulation in grease ducts. Duct systems serving a Type I hood shall be constructed and installed so that grease cannot collect in any portion thereof, and the system shall slope not less than one-fourth unit vertical in 12 units horizontal (2-percent slope) toward the hood or toward a grease reservoir designed and installed in accordance with Section 506.3.7.1. Where horizontal ducts exceed 22 880 mm (75 feet) in length, the slope shall be not less than one unit vertical in 12 units horizontal (8.3-percent slope).

506.3.7.1 Grease duct reservoirs. Grease duct reservoirs shall:

1. Be constructed as required for the grease duct they serve.
2. Be located on the bottom of the horizontal duct or the bottommost section of the duct riser.
3. Extend across the full width of the duct and have a length of not less than 305 mm (12 inches).
4. Have a depth of not less than 25 mm (1 inch).
5. Have a bottom that slopes to a drain.
6. Be provided with a cleanout opening constructed in accordance with Section 506.3.8 and installed to provide direct access to the reservoir. The cleanout opening shall be located on a side or on top of the duct so as to permit cleaning of the reservoir.
7. Be installed in accordance with the manufacturer's instructions where manufactured devices are utilized.

506.3.8 Grease duct cleanouts and openings. Grease duct cleanouts and openings shall comply with all of the following:

1. Grease ducts shall not have openings except where required for the operation and maintenance of the system.
2. Sections of grease ducts that are inaccessible from the hood or discharge openings shall be provided with cleanout openings spaced not more than 6,100 mm (20 feet) apart and not more than 3,045 mm (10 feet) from changes in direction greater than 45 degrees (0.79 rad).
3. Cleanouts and openings shall be equipped with tight-fitting doors constructed of steel having a thickness not less than that required for the duct.
4. Cleanout doors shall be installed liquid tight.
5. Door assemblies including any frames and gaskets shall be approved for the application and shall not have fasteners that penetrate the duct.

6. Gasket and sealing materials shall be rated for not less than 816°C (1500°F).
7. Listed door assemblies shall be installed in accordance with the manufacturer's instructions.

506.3.8.1 Personnel entry. Where ductwork is large enough to allow entry of personnel, not less than one *approved or listed* opening having dimensions not less than 560 mm by 510 mm (22 inches by 20 inches) shall be provided in the horizontal sections, and in the top of vertical risers. Where such entry is provided, the duct and its supports shall be capable of supporting the additional load, and the cleanouts specified in Section 506.3.8 are not required.

506.3.8.2 Cleanouts serving in-line fans. A cleanout shall be provided for both the inlet side and outlet side of an in-line fan except where a duct does not connect to the fan. Such cleanouts shall be located within 915 mm (3 feet) of the fan duct connections.

506.3.9 Grease duct horizontal cleanouts. Cleanouts serving horizontal sections of grease ducts shall:

1. Be spaced not more than 6,100 mm (20 feet) apart.
2. Be located not more than 3,050 mm (10 feet) from changes in direction that are greater than 45 degrees (0.79 rad).
3. Be located on the bottom only where other locations are not available and shall be provided with internal damming of the opening such that grease will flow past the opening without pooling. Bottom cleanouts and openings shall be approved for the application and installed liquid-tight.
4. Not be closer than 25 mm (1 inch) from the edges of the duct.
5. Have opening dimensions of not less than 305 mm by 305 mm (12 inches by 12 inches). Where such dimensions preclude installation, the opening shall be not less than 305 mm (12 inches) on one side and shall be large enough to provide access for cleaning and maintenance.
6. Shall be located at grease reservoirs.

506.3.10 Underground grease duct installation. Underground grease duct installations shall comply with all of the following:

1. Underground grease ducts shall be constructed of steel having a minimum thickness of 1.463 mm {0.0575 inch (No. 16 gage)} and shall be coated to provide protection from corrosion or shall be constructed of stainless steel having a minimum thickness of 1.140 mm {0.0450 inch (No. 18 gage)}.
2. The underground duct system shall be tested and approved in accordance with Section 506.3.2.5 prior to coating or placement in the ground.
3. The underground duct system shall be completely encased in concrete with a minimum thickness of 100 mm (4 inches).
4. Ducts shall slope toward grease reservoirs.

5. A grease reservoir with a cleanout to allow cleaning of the reservoir shall be provided at the base of each vertical duct riser.
6. Cleanouts shall be provided with access to permit cleaning and inspection of the duct in accordance with Section 506.3.
7. Cleanouts in horizontal ducts shall be installed on the topside of the duct.
8. Cleanout locations shall be legibly identified at the point of access from the interior space.

506.3.11 Grease duct enclosures. A commercial kitchen grease duct serving a Type I hood that penetrates a ceiling, wall, floor or any concealed space shall be enclosed from the point of penetration to the outlet terminal. In-line exhaust fans not located outdoors shall be enclosed as required for grease ducts. A duct shall penetrate exterior walls only at locations where unprotected openings are permitted by the *Jamaica Building Code*. The duct enclosure shall serve a single grease duct and shall not contain other ducts, piping or wiring systems. Duct enclosures shall be a shaft enclosure in accordance with Section 506.3.11.1, a field-applied enclosure assembly in accordance with Section 506.3.11.2 or a factory-built enclosure assembly in accordance with Section 506.3.11.3. Duct enclosures shall have a fire-resistance rating of not less than that of the assembly penetrated and not less than 1 hour. Fire dampers and smoke dampers shall not be installed in grease ducts.

Exception: A duct enclosure shall not be required for a grease duct that penetrates only a nonfire-resistance-rated roof/ceiling assembly.

506.3.11.1 Shaft enclosure. Grease ducts constructed in accordance with Section 506.3.1 shall be permitted to be enclosed in accordance with the *Jamaica Building Code* requirements for shaft construction. Such grease duct systems and exhaust equipment shall have a clearance to combustible construction of not less than 455 mm (18 inches), and shall have a clearance to noncombustible construction and gypsum wallboard attached to noncombustible structures of not less than 150 mm (6 inches). Duct enclosures shall be sealed around the duct at the point of penetration and vented to the outside of the building through the use of weather-protected openings.

506.3.11.2 Field-applied grease duct enclosure. Grease ducts constructed in accordance with Section 506.3.1 shall be enclosed by a *listed* and *labeled* field-applied grease duct enclosure material, systems, product, or method of construction specifically evaluated for such purpose in accordance with ASTM E2336. The surface of the duct shall be continuously covered on all sides from the point at which the duct originates to the outlet terminal. Duct penetrations shall be protected with a through-penetration firestop system tested and *listed* in accordance with ASTM E814 or UL 1479 and having an "F" and "T" rating equal to the fire-resistance rating of the assembly being penetrated. The grease

duct enclosure and firestop system shall be installed in accordance with the listing and the manufacturer's instructions. Partial application of a field-applied grease duct enclosure shall not be installed for the sole purpose of reducing clearances to combustibles at isolated sections of grease duct. Exposed duct-wrap systems shall be protected where subject to physical damage.

506.3.11.3 Factory-built grease duct enclosure assemblies. Factory-built grease ducts incorporating integral enclosure materials shall be *listed* and *labeled* for use as grease duct enclosure assemblies specifically evaluated for such purpose in accordance with UL 2221. Duct penetrations shall be protected with a through-penetration firestop system tested and *listed* in accordance with ASTM E814 or UL 1479 and having an "F" and "T" rating equal to the fire-resistance rating of the assembly being penetrated. The grease duct enclosure assembly and firestop system shall be installed in accordance with the listing and the manufacturer's instructions.

506.3.12 Grease duct fire-resistive access opening. Where cleanout openings are located in ducts within a fire-resistance-rated enclosure, access openings shall be provided in the enclosure at each cleanout point. Access openings shall be equipped with tight-fitting sliding or hinged doors that are equal in fire-resistive protection to that of the shaft or enclosure. An *approved* sign shall be placed on access opening panels with wording as follows: "ACCESS PANEL. DO NOT OBSTRUCT."

506.3.13 Exhaust outlets serving Type I hoods. Exhaust outlets for grease ducts serving Type I hoods shall conform to the requirements of Sections 506.3.13.1 through 506.3.13.3.

506.3.13.1 Termination above the roof. Exhaust outlets that terminate above the roof shall have the discharge opening located not less than 1,015 mm (40 inches) above the roof surface.

506.3.13.2 Termination through an exterior wall. Exhaust outlets shall be permitted to terminate through exterior walls where the smoke, grease, gases, vapors and odors in the discharge from such terminations do not create a public nuisance or a fire hazard. Such terminations shall not be located where protected openings are required by the *Jamaica Building Code*. Such terminations shall be located in accordance with Section 506.3.13.3 and shall not be located within 915 mm (3 feet) of any opening in the exterior wall.

506.3.13.3 Termination location. Exhaust outlets shall be located not less than **3,050 mm (10 feet)** horizontally from parts of the same or contiguous buildings, adjacent buildings and adjacent property lines and shall be located not less than **3,050 mm (10 feet)** above the adjoining grade level. Exhaust outlets shall be located not less than 3,050 mm (10 feet) horizontally from or not less than 915 mm (3 feet) above air intake openings into any building.

Exception: Exhaust outlets shall terminate not less than 1,525 mm (5 feet) horizontally from parts of the

same or contiguous building, an adjacent building, adjacent property line and air intake openings into a building where air from the exhaust outlet discharges away from such locations.

506.4 Ducts serving Type II hoods. Commercial kitchen exhaust systems serving Type II hoods shall comply with Sections 506.4.1 and 506.4.2.

506.4.1 Ducts. Ducts and plenums serving Type II hoods shall be constructed of rigid metallic materials. Duct construction, installation, bracing and supports shall comply with Chapter 6. Ducts subject to positive pressure and ducts conveying moisture-laden or waste-heat-laden air shall be constructed, joined and sealed in an *approved* manner.

506.4.2 Type II terminations. Exhaust outlets serving Type II hoods shall terminate in accordance with the hood manufacturer's installation instructions and shall comply with all of the following:

1. Exhaust outlets shall terminate not less than 915 mm (3 feet) in any direction from openings into the building.
2. Outlets shall terminate not less than **3,050 mm (10 feet)** from property lines or buildings on the same lot.
3. Outlets shall terminate not less than **3,050 mm (10 feet)** above grade.
4. Outlets that terminate above a roof shall terminate not less than **760 mm (30 inches)** above the roof surface.
5. Outlets shall terminate not less than **760 mm (30 inches)** from exterior vertical walls
6. Outlets shall be protected against local weather conditions.
7. Outlets shall not be directed onto walkways.
8. Outlets shall meet the provisions for exterior wall opening protectives in accordance with the *Jamaica Building Code*.

506.5 Exhaust equipment. Exhaust *equipment*, including fans and grease reservoirs, shall comply with Sections 506.5.1 through 506.5.6 and shall be of an *approved* design or shall be *listed* for the application.

506.5.1 Exhaust fans. Exhaust fan housings serving a Type I hood shall be constructed as required for grease ducts in accordance with Section 506.3.1.1.

Exception: Fans *listed* and *labeled* in accordance with UL 762.

506.5.1.1 Fan motor. Exhaust fan motors shall be located outside of the exhaust airstream.

506.5.1.2 In-line fan location. Where enclosed duct systems are connected to in-line fans not located outdoors, the fan shall be located in a room or space having the same fire-resistance rating as the duct enclosure. Access shall be provided for servicing and cleaning of

fan components. Such rooms or spaces shall be ventilated in accordance with the fan manufacturer's installation instructions.

506.5.2 Pollution-control units. The installation of pollution-control units shall be in accordance with the manufacturer's installation instructions and all of the following:

1. Pollution-control units shall be listed and labeled in accordance with governing regulations or UL 1978.
2. Fans serving pollution-control units shall be listed and labeled in accordance with governing regulations or UL 762.
3. Pollution-control units shall be mounted and secured in accordance with the manufacturer's installation instructions and the *Jamaica Building Code*.
4. Pollution-control units located indoors shall be listed and labeled for such use. Where enclosed duct systems, as required by Section 506.3.11, are connected to a pollution control unit, such unit shall be located in a room or space having the same fire-resistance rating as the duct enclosure. Access shall be provided for servicing and cleaning of the unit. The space or enclosure shall be ventilated in accordance with the manufacturer's installation instructions.
5. A clearance of not less than 455 mm (18 inches) shall be maintained between the pollution-control unit and combustible material.
6. Roof-mounted pollution-control units shall be listed for outdoor installation and shall be mounted not less than 455 mm (18 inches) above the roof.
7. Exhaust outlets for pollution-control units shall be in accordance with Section 506.3.13.
8. An airflow differential pressure control shall be provided to monitor the pressure drop across the filter sections of a pollution-control unit. When the airflow is reduced below the design velocity, the airflow differential pressure control shall activate a visual alarm located in the area where cooking operations occur.
9. Pollution-control units shall be provided with a factory-installed fire suppression system.
10. Service space shall be provided in accordance with the manufacturer's instructions for the pollution-control unit and the requirements of Section 306.
11. Wash-down drains shall discharge through a grease interceptor and shall be sized for the flow. Drains, shall be sealed with a trap or other approved means to prevent air bypass. Where a trap is utilized it shall have a seal depth that accounts for the system pressurization and evaporation between cleanings.
12. Not Applicable.
13. Duct connections to pollution-control units shall be in accordance with Section 506.3.2.3. Where water splash or carryover can occur in the transition duct as a result of a washing operation, the transition duct shall slope downward toward the cabinet drain pan for a length not less than 455 mm (18 inches). Ducts shall transition to the full size of the unit's inlet and outlet openings.
14. Extra-heavy-duty appliance exhaust systems shall not be connected to pollution-control units

except where such units are specifically designed and listed for use with solid fuels.

15. Pollution-control units shall be maintained in accordance with the manufacturer's instructions.

506.5.3 Exhaust fan discharge. Exhaust fans shall be positioned so that the discharge will not impinge on the roof, other *equipment* or appliances or parts of the structure. A vertical discharge fan shall be manufactured with an *approved* drain outlet at the lowest point of the housing to permit drainage of grease to an *approved* grease reservoir.

506.5.4 Exhaust fan mounting. Up-blast fans serving Type I hoods and installed in a vertical or horizontal position shall be hinged, supplied with a flexible weatherproof electrical cable to permit inspection and cleaning and shall be equipped with a means of restraint to limit the swing of the fan on its hinge. The ductwork shall extend not less than 455 mm (18 inches) above the roof surface.

506.5.5 Clearances. Exhaust *equipment* serving a Type I hood shall have a *clearance* to combustible construction of not less than 455 mm (18 inches).

Exception: Factory-built exhaust *equipment* installed in accordance with Section 304.1 and *listed* for a lesser *clearance*.

506.5.6 Termination location. The outlet of exhaust *equipment* serving Type I hoods shall be in accordance with Section 506.3.13.

Exception: The minimum horizontal distance between vertical discharge fans and parapet-type building structures shall be 610 mm (2 feet) provided that such structures are not higher than the top of the fan discharge opening.

SECTION 507 COMMERCIAL KITCHEN HOODS

507.1 General. Commercial kitchen exhaust hoods shall comply with the requirements of this section. Hoods shall be Type I or II and shall be designed to capture and confine cooking vapors and residues. A Type I or Type II hood shall be installed at or above *appliances* in accordance with Sections 507.2 and 507.3. Where any cooking *appliance* under a single hood requires a Type I hood, a Type I hood shall be installed. Where a Type II hood is required, a Type I or Type II hood shall be installed. Where a Type I hood is installed, the installation of the entire system, including the hood, ducts, exhaust equipment and makeup air system shall comply with the requirements of Sections 506, 507, 508 and 509.

Exceptions:

1. Factory-built commercial exhaust hoods that are listed and labeled in accordance with UL 710 or equivalent standard), and

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installed in accordance with Section 304.1, shall not be required to comply with Sections 507.1.5, 507.2.3, 507.2.5, 507.2.8, 507.3.1, 507.3.3, 507.4 and 507.5.

2. Factory-built commercial cooking recirculating systems that are listed and labeled in accordance with UL 710B or other BSJ recognized standard, and installed in accordance with Section 304.1, shall not be required to comply with Sections 507.1.5, 507.2.3, 507.2.5, 507.2.8, 507.3.1, 507.3.3, 507.4 and 507.5. Spaces in which such systems are located shall be considered to be kitchens and shall be ventilated in accordance with Table 403.3.1.1. For the purpose of determining the floor area required to be ventilated, each individual appliance shall be considered as occupying not less than 9.3 m² (100 square feet).
3. Where cooking appliances are equipped with integral down-draft exhaust systems and such appliances and exhaust systems are listed and labeled for the application in accordance with NFPA 96, a hood shall not be required at or above them.

507.1.1 Operation. Commercial kitchen exhaust hood systems shall operate during the cooking operation. The hood exhaust rate shall comply with the listing of the hood or shall comply with Section 507.5. The exhaust fan serving a Type I hood shall have automatic controls that will activate the fan when any appliance that requires such Type I Hood is turned on, or a means of interlock shall be provided that will prevent operation of such appliances when the exhaust fan is not turned on. Where one or more temperature or radiant energy sensors are used to activate a Type I hood exhaust fan, the fan shall activate not more than 15 minutes after the first appliance served by that hood has been turned on. A method of interlock between an exhaust hood system and appliances equipped with standing pilot burners shall not cause the pilot burners to be extinguished. A method of interlock between an exhaust hood system and cooking appliances shall not involve or depend on any component of a fire-extinguishing system.

The net exhaust volumes for hoods shall be permitted to be reduced during part-load cooking conditions, where engineered or *listed* multispeed or variable speed controls automatically operate the exhaust system to maintain capture and removal of cooking effluents as required by this section. Reduced volumes shall not be below that required to maintain capture and removal of effluents from the idle cooking appliances that are operating in a standby mode.

507.1.1.1 Multiple hoods utilizing a single exhaust system. Where heat or radiant energy sensors are utilized in hood systems consisting of multiple hoods served by a single exhaust system, such sensors shall be provided in each hood. Sensors shall be capable of being accessed from the hood outlet or from a cleanout location.

507.1.2 Domestic cooking appliances used for commercial purposes. Domestic cooking appliances utilized for commercial purposes shall be provided with Type I or Type II hoods as required for the type of appliances

and processes in accordance with Sections 507.2 and 507.3. Domestic cooking appliances utilized for domestic cooking shall comply with Section 505.

507.1.3 Fuel-burning appliances. Where vented fuel-burning appliances are located in the same room or space as the hood, provisions shall be made to prevent the hood system from interfering with normal operation of the appliance vents.

507.1.4 Cleaning. A hood shall be designed to provide for thorough cleaning of the entire hood.

507.1.5 Exhaust outlets. Exhaust outlets located within the hood shall be located to optimize the capture of particulate matter. Each outlet shall serve not more than a 3,660 mm (12-foot) section of hood.

507.2 Type I hoods. Type I hoods shall be installed where cooking appliances produce grease or smoke as a result of the cooking process. Type I hoods shall be installed over *medium-duty, heavy-duty* and *extra-heavy-duty cooking appliances*.

Exception: A Type I hood shall not be required for an electric cooking appliance where an approved testing agency provides documentation that the appliance effluent contains 5 mg/m³ or less of grease when tested at an exhaust flow rate of 0.236 m³/s (500 cfm) in accordance with UL 710B.

507.2.1 Type I exhaust flow rate label. Type I hoods shall bear a label indicating the minimum exhaust flow rate in litres per second per linear meter (L/(s . m) [cfm per linear foot (ft³/(min . ft) of hood that provides for capture and containment of the exhaust effluent for the cooking appliances served by the hood, based on the cooking appliance duty classifications defined in this code.

507.2.2 Type I extra-heavy-duty. Type I hoods for use over *extra-heavy-duty cooking appliances* shall not cover *heavy-, medium- or light-duty appliances*. Such hoods shall discharge to an exhaust system that is independent of other exhaust systems.

507.2.3 Type I materials. Type I hoods shall be constructed of steel having a minimum thickness of 1.181 mm {0.0466 inch (No. 18 gage)} or stainless steel not less than 0.8525 mm [0.0335 inch (No. 20 MSG)] in thickness.

507.2.4 Type I supports. Type I hoods shall be secured in place by noncombustible supports. Type I hood supports shall be adequate for the applied load of the hood, the unsupported ductwork, the effluent loading and the possible weight of personnel working in or on the hood.

507.2.5 Type I hoods. External hood joints, seams and penetrations for Type I hoods shall be made with a continuous external liquid-tight weld or braze to the lowest outermost perimeter of the hood. Internal hood joints, seams, penetrations, filter support frames and other appendages attached inside the hood shall not be required to be welded or brazed but shall be otherwise sealed to be grease tight.

Exceptions:

1. Penetrations shall not be required to be welded or brazed where sealed by devices that are *listed* for the application.

- Internal welding or brazing of seams, joints and penetrations of the hood shall not be prohibited provided that the joint is formed smooth or ground so as to not trap grease, and is readily cleanable.

507.2.6 Clearances for Type I hood. A Type I hood shall be installed with a *clearance* to combustibles of not less than 455 mm (18 inches).

Exceptions:

- Clearance* shall not be required from gypsum wallboard or 12.7 mm (1/2-inch) or thicker cementitious wallboard attached to noncombustible structures provided that a smooth, cleanable, nonabsorbent and noncombustible material is installed between the hood and the gypsum or cementitious wallboard over an area extending not less than 455 mm (18 inches) in all directions from the hood.
- Type I hoods listed and labeled for clearances less than 455 mm (18 inches) in accordance with UL 710 shall be installed with the clearances specified by such listings.

507.2.7 Type I hoods penetrating a ceiling. Type I hoods or portions thereof penetrating a ceiling, wall or furred space shall comply with Section 506.3.11. Field-applied grease duct enclosure systems, as addressed in Section 506.3.11.2, shall not be utilized to satisfy the requirements of this section.

507.2.8 Type I grease filters. Type I hoods shall be equipped with grease filters listed and labeled in accordance with UL 1046. Grease filters shall be provided with access for cleaning or replacement. The lowest edge of a grease filter located above the cooking surface shall be not less than the height specified in Table 507.2.8.

**TABLE 507.2.8
MINIMUM DISTANCE BETWEEN THE
LOWEST EDGE OF A GREASE FILTER AND
THE COOKING SURFACE OR THE HEATING SURFACE**

TYPE OF COOKING APPLIANCES	HEIGHT ABOVE COOKING SURFACE (mm)
Without exposed flame	150
Exposed flame and burners	610
Exposed charcoal and charcoal type	1065

For Inch Pound Units: 1mm = 0.00328 feet.

507.2.8.1 Criteria. Filters shall be of such size, type and arrangement as will permit the required quantity of air to pass through such units at rates not exceeding those for which the filter or unit was designed or *approved*. Filter units shall be installed in frames or holders so as to be readily removable without the use of separate tools, unless designed and installed to be cleaned in place and the system is equipped for such cleaning in place. Where filters are designed and

required to be cleaned, removable filter units shall be of a size that will allow them to be cleaned in a dishwashing machine or pot sink. Filter units shall be arranged in place or provided with drip-intercepting devices to prevent grease or other condensate from dripping into food or on food preparation surfaces.

507.2.8.2 Mounting position of grease filters. Filters shall be installed at an angle of not less than 45 degrees (0.79 rad) from the horizontal and shall be equipped with a drip tray beneath the lower edge of the filters.

507.2.9 Grease gutters for Type I hood. Grease gutters shall drain to an *approved* collection receptacle that is fabricated, designed and installed to allow access for cleaning.

507.3 Type II hoods. Type II hoods shall be installed above dishwashers and appliances that produce heat or moisture and do not produce grease or smoke as a result of the cooking process, except where the heat and moisture loads from such appliances are incorporated into the HVAC system design or into the design of a separate removal system. Type II hoods shall be installed above all appliances that produce products of combustion and do not produce grease or smoke as a result of the cooking process. Spaces containing cooking appliances that do not require Type II hoods shall be provided with exhaust at a rate of 0.00033 m³/s (0.70 cfm per square foot). For the purpose of determining the floor area required to be exhausted, each individual appliance that is not required to be installed under a Type II hood shall be considered as occupying not less than 9.3 m² (100 square feet). Such additional square footage shall be provided with exhaust at a rate of 0.00356 m³/(s • m²) [0.70 cfm per square foot].

507.3.1 Type II hood materials. Type II hoods shall be constructed of steel having a minimum thickness of 0.7534 mm [0.0296 inch (No. 22 gage)] or stainless steel not less than 0.5550 mm [0.0220 inch (No. 24 gage)] in thickness, copper sheets weighing not less than 7.3 kg/m² (24 ounces per square foot) or of other *approved* material and gage.

507.3.2 Type II supports. Type II hood supports shall be adequate for the applied load of the hood, the unsupported ductwork, the effluent loading and the possible weight of personnel working in or on the hood.

507.3.3 Type II hoods joint, seams and penetrations. Joints, seams and penetrations for Type II hoods shall be constructed as set forth in Chapter 6, shall be sealed on the interior of the hood and shall provide a smooth surface that is readily cleanable and water tight.

507.4 Hood size and location. Hoods shall comply with the overhang, setback and height requirements in accordance with Sections 507.4.1 and 507.4.2, based on the type of hood.

507.4.1 Canopy size and location. The inside lower edge of canopy-type Type I and II commercial hoods shall overhang or extend a horizontal distance of not less than 152 mm (6 inches) beyond the edge of the top horizontal surface of the *appliance* on all open sides. The vertical distance between the front lower lip of the hood and such surface shall not exceed 1220 (4 feet).

Exception: The hood shall be permitted to be flush with the outer edge of the cooking surface where the hood is closed to the *appliance* side by a noncombustible wall or panel.

507.4.2 Noncanopy size and location. Noncanopy-type hoods shall be located not greater than 915 mm (3 feet) above the cooking surface. The edge of the hood shall be set back not greater than 305 mm (1 foot) from the edge of the cooking surface.

507.5 Capacity of hoods. Commercial food service hoods shall exhaust a minimum net quantity of air determined in accordance with this section and Sections 507.5.1 through

507.5.5. The net quantity of *exhaust air* shall be calculated by subtracting any airflow supplied directly to a hood cavity from the total exhaust flow rate of a hood. Where any combination of *heavy-duty*, *medium-duty* and *light-duty cooking appliances* are utilized under a single hood, the exhaust rate required by this section for the heaviest duty *appliance* covered by this hood shall be used for the entire hood.

507.5.1 Extra-heavy-duty cooking appliances. The minimum net airflow for hoods, as determined by Section 507.1, used for *extra-heavy-duty cooking appliances* shall be determined as shown in Table 507.5.1 below:

Table 507.5.1

Net airflow requirements for extra-heavy-duty cooking appliances

Type of Hood	Litres/second per linear millimeter
Backshelf/pass-over	Not allowed
Double island canopy (per side)	0.855
Eyebrow	Not allowed
Single island canopy	1.085
Wall-mounted canopy	0.855

For Inch pound Units: 1 L/s per linear mm = 0.0006452 cfm per linear foot

507.5.2 Heavy-duty cooking appliances. The minimum net airflow for hoods, as determined by Section 507.1, used for *heavy-duty cooking appliances* shall be determined as shown in Table 507.5.2 below:

Table 507.5.2

Net airflow requirements for heavy-duty cooking appliances

Type of Hood	Litres/second per linear millimeter
Backshelf/pass-over	0.620
Double island canopy (per side)	0.620
Eyebrow	Not allowed
Single island canopy	0.930
Wall-mounted canopy	0.620

For Inch pound Units: 1 L/s per linear mm = 0.0006452 cfm per linear foot.

507.5.3 Medium-duty cooking appliances. The minimum net airflow for hoods, as determined by Section 507.1, used for *medium-duty cooking appliances* shall be determined as shown in Table

507.5.3 below::

Table 507.5.3

Net airflow requirements for medium-duty cooking appliances

Type of Hood	Litres/second per linear millimeter
Backshelf/pass-over	0.465
Double island canopy (per side)	0.465
Eyebrow	0.388
Single island canopy	0.775
Wall-mounted canopy	0.465

For Inch pound Units: 1 L/s per linear mm = 0.0006452 cfm per linear foot.

507.5.4 Light-duty cooking appliances. The minimum net airflow for hoods, as determined by Section 507.1, used for *light-duty* cooking appliances and food service preparation shall be determined as shown in Table 507.5.4 below::

Table 507.5.4

Net airflow requirements for light-duty cooking appliances

Type of Hood	Litres/second per linear millimeter
Backshelf/pass-over	0.388
Double island canopy (per side)	0.388
Eyebrow	0.388
Single island canopy	0.620
Wall-mounted canopy	0.310

For Inch Pound Units: 1 L/s per linear metre = 0.6452 cfm per linear foot.

507.5.5 Dishwashing appliances. The minimum net airflow for Type II hoods used for dishwashing appliances shall be 0.155 L/s per linear millimeter (100 cfm per linear foot) of hood length.

Exception: Dishwashing appliances and *equipment* installed in accordance with Section 507.3.

507.6 Performance test. A performance test shall be conducted upon completion and before final approval of the installation of a ventilation system serving *commercial cooking appliances*. The test shall verify the rate of

508.2 all exhaust systems for the building. The *makeup air* shall not reduce the effectiveness of the exhaust system. *Makeup air* shall be provided by gravity or mechanical means or both. Mechanical *makeup air* systems shall be automatically controlled to start and operate simultaneously with the exhaust system. *Makeup air* intake opening locations shall comply with Section 401.4.

exhaust air- flow required by Section 507.5, makeup airflow required by Section 508 and proper operation as specified in this chapter. The permit holder shall furnish the necessary test *equipment* and devices required to perform the tests.

507.6.1 Capture and containment test. The permit holder shall verify capture and containment performance of the exhaust system. This field test shall be conducted with all appliances under the hood at operating temperatures, with all sources of outdoor air providing *makeup air* for the hood operating and with all sources of recirculated air providing conditioning for the space in which the hood is located operating. Capture and containment shall be verified visually by observing smoke or steam produced by actual or simulated cooking, such as that provided by smoke candles and smoke puffers. Smoke bombs shall not be used.

**SECTION 508
COMMERCIAL KITCHEN MAKEUP
AIR**

508.1 Makeup air. *Makeup air* shall be supplied during the operation of commercial kitchen exhaust systems that are provided for *commercial cooking appliances*. The amount of *makeup air* supplied to the building from all sources shall be approximately equal to the amount of *exhaust air* for

508.2.1 Makeup air temperature. The temperature differential between *makeup air* and the air in the conditioned space shall not exceed 6°C (10°F) except where the added heating and cooling loads of the *makeup air* do not exceed the capacity of the HVAC system.

508.2.2 Air balance. Design plans for a facility with a commercial kitchen ventilation system shall include a schedule or diagram indicating the design outdoor air balance. The design outdoor air balance shall indicate all exhaust and replacement air for the facility, plus the net exfiltration if applicable. The total replacement air airflow rate shall equal the total exhaust airflow rate plus the net exfiltration.

508.3 Compensating hoods. Manufacturers of compensating hoods shall provide a label indicating the minimum exhaust flow, the maximum makeup airflow or both that provides capture and containment of the exhaust effluent.

Exception: Compensating hoods with *makeup air* supplied only from the front face discharge and side face discharge openings shall not be required to be labeled with the maximum makeup airflow.

SECTION 509 FIRE SUPPRESSION SYSTEMS

509.1 Where required. *Cooking appliances* required by Section 507.2 to have a Type I hood shall be provided with an *approved* automatic fire suppression system complying with the *Jamaica Building Code* and the *Jamaica Fire Code*.

SECTION 510 HAZARDOUS EXHAUST SYSTEMS

510.1 General. This section shall govern the design and construction of duct systems for hazardous exhaust and shall determine where such systems are required. Hazardous exhaust systems are systems designed to capture and control hazardous emissions generated from product handling **or testing** or processes, and convey those emissions to the outdoors. Hazardous emissions include flammable vapors, gases, fumes, mists or dusts, and volatile or airborne materials posing a health hazard, such as toxic or corrosive materials. For the purposes of this section, the health-hazard rating of materials shall be as specified in NFPA 704 **and** any governing regulations in Jamaica.

For the purposes of the provisions of Section 510, a laboratory shall be defined as a facility where the use of chemicals is related to testing, analysis, teaching, research or developmental activities. Chemicals are used or synthesized on a nonproduction basis, rather than in a manufacturing process.

510.2 Where required. A hazardous exhaust system shall be required wherever operations involving the handling **or testing** or processing of hazardous materials, in the absence of such exhaust systems and under normal operating conditions, have the potential to create one of the following conditions:

1. A flammable vapor, gas, fume, mist or dust is present in concentrations exceeding 25 percent of the lower

flammability limit of the substance for the expected room temperature.

2. A vapor, gas, fume, mist or dust with a health-hazard rating of 4 is present in any concentration.
3. A vapor, gas, fume, mist or dust with a health-hazard rating of 1, 2 or 3 is present in concentrations exceeding 1 percent of the median lethal concentration of the substance for acute inhalation toxicity.

Exception:

1. Laboratories, as defined in Section 510.1, except where the concentrations listed in Item 1 are exceeded or a vapor, gas, fume, mist or dust with a health-hazard rating of 1, 2, 3 or 4 is present in concentrations exceeding 1 percent of the median lethal concentration of the substance for acute inhalation toxicity.

2. Where enacted regulations require more stringent requirements than the provisions of this code.

510.2.1 Lumber yards and woodworking facilities. *Equipment* or machinery located inside buildings at lumber yards and woodworking facilities that generates or emits combustible dust shall be provided with an *approved* dust-collection and exhaust system installed in accordance with this section and the *Jamaica Fire Code*. *Equipment* and systems that are used to collect, process or convey combustible dusts shall be provided with an *approved* explosion-control system.

510.2.2 Combustible fibers. *Equipment* or machinery within a building that generates or emits combustible fibers shall be provided with an *approved* dust-collecting and exhaust system. Such systems shall comply with this code and the *Jamaica Fire Code*.

510.3 Design and operation. The design and operation of the exhaust system shall be such that flammable contaminants are diluted in noncontaminated air to maintain concentrations in the exhaust flow below 25 percent of the contaminant's lower flammability limit.

510.4 Independent system. Hazardous exhaust systems shall be independent of other types of exhaust systems.

Incompatible materials, as defined in the *Jamaica Fire Code*, shall not be exhausted through a hazardous exhaust system. Hazardous exhaust systems shall not share common shafts with other duct systems, except where such systems are hazardous exhaust systems originating in the same fire area **and exhausting the same hazardous material(s).**

Exception: The provisions of this section shall not apply to laboratory exhaust systems where all of the following conditions apply:

1. All of the hazardous exhaust ductwork and other laboratory exhaust within both the occupied space and the shafts are under negative pressure while in operation.
2. The hazardous exhaust ductwork manifolded together within the occupied space must originate within the same fire area.
3. Hazardous exhaust ductwork originating in different fire areas and manifolded together in a

common shaft shall meet the provisions of Section 717.5.3, Exception 1, Item 1.1 of the *Jamaica Building Code*.

4. Each control branch has a flow regulating device.

5. Perchloric acid hoods and connected exhaust shall be prohibited from manifolding.
6. Radioisotope hoods are equipped with filtration, carbon beds or both where required by the *registered design building professional*.
7. Biological safety cabinets are filtered.
8. Each hazardous exhaust duct system shall be served by redundant exhaust fans that comply with **all** of the following:
 - 8.1. The fans shall operate sequentially so that the failure or switching off of one results in the automatic operation of the other and each fan shall be individually capable of providing the required exhaust rate.
 - 8.2. Each of the redundant fans shall have its own power and control circuit or subcircuit so it operates independently of the other fan and has its own electrical system protection.
 - 8.3. The operational status of each of the redundant fans shall be suitably displayed so a fan shut-down for failure can be identified and serviced expeditiously.

510.5 Design. Systems for removal of vapors, gases and smoke shall be designed by the constant velocity or equal friction methods. Systems conveying particulate matter shall be designed employing the constant velocity method.

510.6.1 Balancing. Systems conveying explosive or radioactive materials shall be pre-balanced by duct sizing. Other systems shall be balanced by duct sizing with balancing devices, such as dampers. Dampers provided to balance airflow shall have securely fixed minimum-position blocking devices to prevent restricting the flow below the required volume or velocity.

510.6.2 Emission control. The design of the system shall be such that the emissions are confined to the area in which they are generated by air currents, hoods or enclosures and shall be exhausted by a duct system to a safe location or treated by removing contaminants.

510.6.3 Hoods required. Hoods or enclosures shall be used where contaminants originate in a limited area of a space. The design of the hood or enclosure shall be such that air currents created by the exhaust systems will capture the contaminants and transport them directly to the exhaust duct.

510.6.4 Contaminant capture and dilution. The velocity and circulation of air in work areas shall be such that contaminants are captured by an airstream at the area where the emissions are generated and conveyed into a product-conveying duct system. Contaminated air from work areas where hazardous contaminants are generated shall be diluted below the thresholds specified in Section 510.2 with air that does not contain other hazardous contaminants.

510.6.5 Makeup air. Makeup air shall be provided at a rate approximately equal to the rate that air is exhausted by the hazardous exhaust system. Makeup air intakes shall be located in accordance with Section 401.4.

510.6.6 Clearances. The minimum *clearance* between hoods and combustible construction shall be the *clearance* required by the duct system.

510.6.7 Ducts. Hazardous exhaust duct systems shall extend directly to the exterior of the building and shall not extend into or through air-conditioning or other ducts and plenums. Hazardous exhaust duct systems on the building exterior shall extend to at least 1,200 mm (4 feet) above the roof of the building or other approved elevated location which will allow for effective natural diffusion of the hazardous contaminants before the diluted air is accessible for breathing in by building occupants or the walking public.

510.7 Penetrations. Penetrations of structural elements by a hazardous exhaust system shall conform to Sections 510.7.1 through 510.7.4.

Exception: Duct penetrations within Group H-5 occupancies as allowed by the *Jamaica Building Code*.

510.7.1 Fire dampers and smoke dampers. Fire dampers and smoke dampers are prohibited in hazardous exhaust ducts.

510.7.1.1 Shaft penetrations. Hazardous exhaust ducts that penetrate fire-resistance-rated shafts shall comply with Section 714.4.1 or 714.4.1.2 of the *Jamaica Building Code*.

510.7.2 Floors. Hazardous exhaust systems that penetrate a floor/ceiling assembly shall be enclosed in a fire-resistance-rated shaft constructed in accordance with the *Jamaica Building Code*.

510.7.3 Wall assemblies. Hazardous exhaust duct systems that penetrate fire-resistance-rated wall assemblies shall be enclosed in fire-resistance-rated construction from the point of penetration to the outlet terminal, except where the interior of the duct is equipped with an approved automatic fire suppression system. Ducts shall be enclosed in accordance with the *Jamaica Building Code* requirements for shaft construction and such enclosure shall have a minimum fire-resistance rating of not less than the highest fire-resistance-rated wall assembly penetrated.

510.7.4 Fire walls. Ducts shall not penetrate a fire wall.

510.8 Suppression required. Ducts shall be protected with an *approved* automatic fire suppression system installed in accordance with the *Jamaica Building Code*.

Exceptions:

1. An approved automatic fire suppression system shall not be required in ducts conveying materials, fumes, mists and vapors that are nonflammable and noncombustible under all conditions and at any concentrations.
2. Automatic fire suppression systems shall not be required in metallic and noncombustible, nonmetallic exhaust ducts in semiconductor fabrication facilities.
3. An *approved* automatic fire suppression system shall not be required in ducts where the largest cross-sectional diameter of the duct is less than 255 mm (10 inches).
4. For laboratories, as defined in Section 510.1, automatic fire protection systems shall not be required in laboratory hoods or exhaust systems.

510.8.1 Duct cleanout. Ducts conveying combustible dust as part of a dust collection system shall be equipped with cleanouts that are provided with approved access, pre-designed to be disassembled for cleaning, or engineered for automatic cleanouts. Where provided, cleanouts shall be located at the base of each vertical duct riser and at intervals not exceeding **6,100 mm (20 feet)** in horizontal sections of duct.

510.9 Duct construction. Ducts used to convey hazardous exhaust shall be constructed of materials *approved* for installation in such an exhaust system and shall comply with one of the following:

1. Ducts shall be constructed of *approved* G90 galvanized sheet steel, with a minimum nominal thickness as specified in Table 510.9.
2. Ducts used in systems exhausting nonflammable corrosive fumes or vapors shall be constructed of nonmetallic materials that exhibit a flame spread index of 25 or less and a smoke-developed index of 50 or less when tested in accordance with ASTM E84 or UL 723 and that are *listed* and *labeled* for the application.

Where the products being exhausted are detrimental to the duct material, the ducts shall be constructed of alternative materials that are compatible with the exhaust.

**TABLE 510.9
MINIMUM DUCT THICKNESS**

DIAMETER OF DUCT OR MAXIMUM SIDE DIMENSION	MINIMUM NOMINAL THICKNESS		
	Nonabrasive materials	Nonabrasive/abrasive materials	Abrasive materials
0 - 205 mm	0.7112 mm	0.8636 mm	1.016 mm
230 - 455 mm	0.8636 mm	1.016 mm	1.321 mm
480 - 760 mm	1.016 mm	1.321 mm	1.625 mm
Over 760 mm	1.321 mm	1.625 mm	2 mm

For **Inch Pound Units: 1 mm = 0.03937 inch.**

510.9.1 Duct joints. Ducts shall be made tight with lap joints having a minimum lap of 25 mm (1 inch). Joints used in ANSI/SMACNA Round Industrial Duct Construction Standards and ANSI/SMACNA Rectangular Industrial Duct Construction Standards are also acceptable.

510.9.2 Clearance to combustibles. Ducts shall have a *clearance* to combustibles in accordance with Table 510.9.2. Exhaust gases having temperatures in excess of 316°C (600°F) (shall be exhausted to a *chimney* in accordance with Section 511.2.

**TABLE 510.9.2
CLEARANCE TO COMBUSTIBLES**

TYPE OF EXHAUST OR TEMPERATURE OF EXHAUST (°C)	CLEARANCE TO COMBUSTIBLES (mm)
Less than 38	25
38 - 315	305
Flammable vapors	150

TYPE OF EXHAUST OR TEMPERATURE OF EXHAUST (°C)	CLEARANCE TO COMBUSTIBLES (mm)
Less than 38	25
38 - 315	305
Flammable vapors	150

For **Inch Pound: 1mm = 0.0394 inch, °C = [(°F) - 32]/1.8.**

510.9.3 Explosion relief. Systems exhausting potentially

explosive mixtures shall be protected with an *approved* explosion relief system or by an *approved* explosion prevention system designed and installed in accordance with NFPA 69 or other **BSJ recognized standard**. An explosion relief system shall be designed to minimize the structural and mechanical damage resulting from an explosion or deflagration within the exhaust system. An explosion prevention system shall be designed to prevent an explosion or deflagration from occurring.

510.10 Supports. Ducts shall be supported at intervals not exceeding 3,050 mm (10 feet). Supports shall be constructed of noncombustible material.

entry of sparks.

SECTION 511 DUST, STOCK AND REFUSE CONVEYING SYSTEMS

511.1 Dust, stock and refuse conveying systems. Dust, stock and refuse conveying systems shall comply with the provisions of Section 510 and Sections 511.1.1 through 511.2.

511.1.1 Collectors and separators. Collectors and separators involving such systems as centrifugal separators, bag filter systems and similar devices, and associated supports shall be constructed of noncombustible materials and shall be located on the exterior of the building or structure. A collector or separator shall not be located nearer than 3050 mm (10 feet) to combustible construction or to an unprotected wall or floor opening, unless the collector is provided with a metal vent pipe that extends above the highest part of any roof with a distance of 9150 mm (30 feet). **Exceptions:**

1. Collectors such as "Point of Use" collectors, close extraction weld fume collectors, spray finishing booths, stationary grinding tables, sanding booths, and integrated or machine-mounted collectors shall be permitted to be installed indoors provided that the installation is in accordance with the *Jamaica Fire Code* and the *Jamaica Electrical Code*.
2. Collectors in independent exhaust systems handling combustible dusts shall be permitted to be installed indoors provided that such collectors are installed in compliance with the *Jamaica Fire Code* and the *Jamaica Electrical Code*.

511.1.2 Discharge pipe. Discharge piping shall conform to the requirements for ducts, including clearances required for high-heat appliances, as contained in this code. A delivery pipe from a cyclone collector shall not convey refuse directly into the firebox of a boiler, furnace, Dutch oven, refuse burner, incinerator or other *appliance*.

511.1.3 Conveying systems exhaust discharge. An exhaust system shall discharge to the outside of the building either directly by flue or indirectly through the bin or vault into which the system discharges except where the contaminants have been removed. Exhaust system discharge shall be permitted to be recirculated provided that the solid particulate has been removed at a minimum efficiency of 99.9 percent at 10.00 mm (10 microns), vapor concentrations are less than 25 percent of the LFL, and *approved equipment* is used to monitor the vapor concentration.

511.1.4 Spark protection. The outlet of an openair exhaust terminal shall be protected with an *approved* metal or other noncombustible screen to prevent the

CHIMNEYS SERVING	MINIMUM THICKNESS		TERMINATION				CLEARANCE			
	Walls (mm)	Lining (mm)	Above roof opening (mm)	Above any part of building within,			Combustible construction (mm)		Noncombustible construction (mm)	
				3050	7625	15250	Interior inst.	Exterior inst.	Interior inst.	Exterior inst.
High-heat appliances (Over 1093°C)	3,226	115 mm laid on 115 mm bed	6,100	—	—	6,100	See Note c			
Low-heat appliances (538°C normal operation)	3,226	none	915	610	—	—	455	150	Up to 455 mm diameter, 51 mm	
Medium-heat appliances (1,093°C maximum) ^b	3,226	Up to 455 mm dia. 69.5 mm Over 455 mm -115 mm On 115mm bed	3,050	—	3,050	—	915	610	Over 455 mm diameter, 51mm	

For Inch Pound Units: 1 mm = 0.03937 inch, 1 mm = 0.00328 foot, °F = 1.8°C + 32.

a. Lining shall extend from bottom to top of outlet.

b. Lining shall extend from 610 mm (24 inches) below connector to 7,300 mm (24 feet) above.

c. Clearance shall be as specified by the design engineer and shall have sufficient clearance from buildings and structures to avoid overheating combustible materials (maximum 71.1 °C (160°F)).

Section 909 of the *Jamaica Building Code* shall undergo special inspections and tests sufficient to verify the proper commissioning of the smoke control design in its final installed condition. The design submission accompanying the *construction documents* shall clearly detail procedures and methods to be used and the items subject to such inspections and tests. Such commissioning shall be in accordance with generally accepted engineering practice and, where possible, based on published standards for the particular testing involved. The special inspections and tests required by this section shall be conducted under the same terms as found in Section 1704 of the *Jamaica Building Code*.

513.4 Analysis. A rational analysis supporting the types of smoke control systems to be employed, their methods of operation, the systems supporting them and the methods of construction to be utilized shall accompany the submitted *construction documents* and shall include, but not be limited to, the items indicated in Sections 513.4.1 through 513.4.7.

513.4.1 Stack effect. The system shall be designed such that the maximum probable normal or reverse stack effects will not adversely interfere with the system's capabilities. In determining the maximum probable stack effects, altitude, elevation, weather history and interior temperatures shall be used.

513.4.2 Temperature effect of fire. Buoyancy and expansion caused by the design fire in accordance with Section 513.9 shall be analyzed. The system shall be designed such that these effects do not adversely interfere with its capabilities.

513.4.3 Wind effect. The design shall consider the adverse effects of high winds on component resilience, system performance, building and community safety as well as ease of service restoration. Such consideration shall be consistent with the wind-loading provisions of the *Jamaica Building Code*.

513.4.4 HVAC systems. The design shall consider the effects of the heating, ventilating and air-conditioning (HVAC) systems on both smoke and fire transport. The analysis shall include all permutations of systems' status. The design shall consider the effects of fire on the HVAC systems.

513.4.5 Climate. The design shall consider the effects of high temperatures, wind speeds on systems, property and occupants. Air inlets and exhausts shall be located so as to prevent blockage from debris, building components or service systems and minimize the effect of winds on the performance of the exhaust system.

513.4.6 Duration of operation. All portions of active or engineered smoke control systems shall be capable of continued operation after detection of the fire event for a period of not less than either 20 minutes or 1.5 times the calculated egress time, whichever is greater.

513.4.7 Smoke control system interaction. The design shall consider the interaction effects of the operation of multiple smoke control systems for all design scenarios.

513.5 Smoke barrier construction. Smoke barriers required for passive smoke control and a smoke control system using the pressurization method shall comply with Section 709 of the *Jamaica Building Code*. The maximum allowable leakage area shall be the aggregate area calculated using the following leakage area ratios:

1. Walls: $A/A_w = 0.00100$

2. Interior exit stairways and ramps and exit passageways:

$$A/A_w = 0.00035$$

3. Enclosed exit access stairways and ramps and all other shafts: $A/A_w = 0.00150$

4. Floors and roofs: $A/A_f =$

0.00050 where:

A = Total leakage area, m² (square feet).

A_f = Unit floor or roof area of barrier, m² (square feet).

A_w = Unit wall area of barrier, m² (square feet).

The leakage area ratios shown do not include openings created by gaps around doors and operable windows. The total leakage area of the smoke barrier shall be determined in accordance with Section 513.5.1 and tested in accordance with Section 513.5.2.

513.5.1 Total leakage area. Total leakage area of the barrier is the product of the smoke barrier gross area times the allowable leakage area ratio, plus the area of other openings such as gaps around doors and operable windows.

513.5.2 Testing of leakage area. Compliance with the maximum total leakage area shall be determined by achieving the minimum air pressure difference across the barrier with the system in the smoke control mode for mechanical smoke control systems utilizing the pressurization method. Compliance with the maximum total leakage area of passive smoke control systems shall be verified through methods such as door fan testing or other methods, as approved by the fire code official.

513.5.3 Opening protection. Openings in smoke barriers shall be protected by automatic-closing devices actuated by the required controls for the mechanical smoke control system. Door openings shall be protected by door assemblies complying with the requirements of the *Jamaica Building Code* for doors in smoke barriers.

Exceptions:

1. Passive smoke control systems with automatic-closing devices actuated by spot-type smoke detectors listed for releasing service installed in accordance with the *Jamaica Building Code*.
2. Fixed openings between smoke zones that are protected utilizing the airflow method.
3. In Group I-1, Condition 2, Group I-2 and ambulatory care facilities, where a pair of opposite-swinging doors are installed across a corridor in accordance with Section 513.5.3.1, the doors shall not be required to be protected in accordance with Section 716 of the *Jamaica Building Code*. The doors shall be close-fitting within operational tolerances and shall not have a center mullion or undercuts in excess of 19 mm (³/₄ inch), louvers or grilles. The doors shall have head and jamb stops and astragals or rabbets at meeting edges and, where permitted by the door manufacturer's listing, positive-latching devices are not required.
4. In Group I-2 and ambulatory care facilities, where such doors are special-purpose horizontal

sliding, accordion or folding door assemblies installed in accordance with Section 1010.1.4.3 of the *Jamaica Building Code* and are automatic closing by smoke detection in accordance with Section 716.2.6.5 of the *Jamaica Building Code*.

5. Group I-3.
6. Openings between smoke zones with clear ceiling heights of **4,250 mm (14 feet)** or greater and bank down capacity of greater than 20 minutes as determined by the design fire size.

513.5.3.1 Group I-1 Condition 2; Group I-2 and ambulatory care facilities. In Group I-1 Condition 2; Group I-2 and *ambulatory care facilities*, where doors are installed across a *corridor*, the doors shall be automatic closing by smoke detection in accordance with Section 716.2.6.5 of the *Jamaica Building Code* and shall have a vision panel with fire-protection-rated glazing materials in fire-protection-rated frames, the area of which shall not exceed that tested.

513.5.3.2 Ducts and air transfer openings. Ducts and air transfer openings are required to be protected with a minimum Class II, 121°C (250°F) smoke damper complying with the *Jamaica Building Code*.

513.6 Pressurization method. The primary mechanical means of controlling smoke shall be by pressure differences across smoke barriers. Maintenance of a tenable environment is not required in the smoke control zone of fire origin.

513.6.1 Minimum pressure difference. The pressure difference across a smoke barrier used to separate smoke zones shall be not less than 12.4 Pa (0.05-inch water gage) in fully sprinklered buildings.

In buildings permitted to be other than fully sprinklered, the smoke control system shall be designed to achieve pressure differences not less than two times the maximum calculated pressure difference produced by the design fire.

513.6.2 Maximum pressure difference. The maximum air pressure difference across a smoke barrier shall be determined by required door-opening or closing forces. The actual force required to open exit doors when the system is in the smoke control mode shall be in accordance with the *Jamaica Building Code*. Opening and closing forces for other doors shall be determined by standard engineering methods for the resolution of forces and reactions. The calculated force to set a side-hinged, swinging door in motion shall be determined by:

$$F = F_{dc} + K(WA\Delta P)/2(W - d) \text{ (Equation 5-2)}$$

where:

A = Door area, m² (square feet).

d = Distance from door handle to latch edge of door, m (feet).

F = Total door opening force, N. (pounds).

F_{dc} = Force required to overcome closing device, N (pounds).

K = Coefficient, 5.2 **for metric (1.0 for IPU's)**.

W = Door width, m, (feet).

ΔP = Design pressure difference, Pa (inches water gage).

513.6.3 Pressurized stairways and elevator hoistways. Where stairways or elevator hoistways are pressurized, such pressurization systems shall comply with Section 513 as smoke control systems, in addition to the requirements of Sections 909.20 of the *Jamaica Building Code* and 909.21 of the *Jamaica Fire Code*.

513.7 Airflow design method. Where *approved* by the building official, smoke migration through openings fixed in a permanently open position, which are located between smoke control zones by the use of the airflow method, shall be permitted. The design airflows shall be in accordance with this section. Airflow shall be directed to limit smoke migration from the fire zone. The geometry of openings shall be considered to prevent flow reversal from turbulent effects. Smoke control systems using the airflow method shall be designed in accordance with NFPA 92 **or BSI recognized standard**.

513.7.1 Prohibited conditions. This method shall not be employed where either the quantity of air or the velocity of the airflow will adversely affect other portions of the smoke control system, unduly intensify the fire, disrupt plume dynamics or interfere with exiting. Airflow toward the fire shall not exceed 1.02 m/s (200 feet per minute). Where the calculated airflow exceeds this limit, the air-flow method shall not be used.

513.8 Exhaust method. Where *approved* by the building official, mechanical smoke control for large enclosed volumes, such as in atriums or malls, shall be permitted to utilize the exhaust method. Smoke control systems using the exhaust method shall be designed in accordance with NFPA 92 or equivalent standards.

513.8.1 Exhaust rate. The height of the lowest horizontal surface of the accumulating smoke layer shall be maintained not less than 1,830 mm (6 feet) above any walking surface that forms a portion of a required egress system within the smoke zone.

513.9 Design fire. The design fire shall be based on a rational analysis performed by the *registered design building professional* and *approved* by the building official. The design fire shall be based on the analysis in accordance with Section 513.4 and this section.

513.9.1 Factors considered. The engineering analysis shall include the characteristics of the fuel, fuel load, effects included by the fire and whether the fire is likely to be steady or unsteady.

513.9.2 Design fire fuel. Determination of the design fire shall include consideration of the type of fuel, fuel spacing and configuration.

513.9.3 Heat-release assumptions. The analysis shall make use of the best available data from *approved* sources and shall not be based on excessively stringent limitations of combustible material.

513.9.4 Sprinkler effectiveness assumptions. A documented engineering analysis shall be provided for conditions that assume fire growth is halted at the time of sprinkler activation.

513.10 Equipment. *Equipment* such as, but not limited to, fans, ducts, automatic dampers and balance dampers shall be suitable for their intended use, suitable for the probable exposure temperatures that the rational analysis indicates, and as *approved* by the code official.

513.10.1 Exhaust fans. Components of exhaust fans shall be rated and certified by the manufacturer for the probable temperature rise to which the components will be exposed. This temperature rise shall be computed by:

$$T_s = 460.69(Q_e/mc) + (T_a) \quad \text{(Equation 5-3)}$$

where:

c = Specific heat of smoke at smoke-layer temperature, kJ/kg .K, (Btu/lb°F).

m = Exhaust rate, kg/s, (pounds per second).

Q_e = Convective heat output of fire, kW, (Btu/s).

T_a = Ambient temperature, K, (°F).

T_s = Smoke temperature, K, (°F).

Exception: Reduced T_s as calculated based on the assurance of adequate dilution air.

513.10.2 Ducts. Duct materials and joints shall be capable of withstanding the probable temperatures and pressures to which they are exposed as determined in accordance with Section 513.10.1. Ducts shall be constructed and supported in accordance with Chapter 6. Ducts shall be leak tested to 1.5 times the maximum design pressure in accordance with nationally accepted practices. Measured leakage shall not exceed 5 percent of design flow. Results of such testing shall be a part of the documentation procedure. Ducts shall be supported directly from fire-resistance-rated structural elements of the building by substantial, noncombustible supports.

Exception: Flexible connections, for the purpose of vibration isolation, that are constructed of *approved* fire-resistance-rated materials.

513.10.3 Equipment, inlets and outlets. *Equipment* shall be located so as to not expose uninvolved portions of the building to an additional fire hazard. Outdoor air inlets shall be located so as to minimize the potential for introducing smoke or flame into the building. Exhaust outlets shall be so located as to minimize reintroduction of smoke into the building and to limit exposure of the building or adjacent buildings to an additional fire hazard.

513.10.4 Automatic dampers. Automatic dampers, regardless of the purpose for which they are installed within the smoke control system, shall be *listed* and conform to the requirements of *approved* recognized standards.

513.10.5 Fans. In addition to other requirements, belt-driven fans shall have 1.5 times the number of belts required for the design duty with the minimum number of belts being two. Fans shall be selected for stable performance based on normal temperature and, where applicable, elevated temperature. Calculations and manufacturer's fan curves shall be part of the documentation procedures. Fans shall be supported and restrained by noncombustible devices in accordance with the structural design require-

ments of the *Jamaica Building Code*. Motors driving fans shall not be operating beyond their nameplate kilowatts (horse-power) as determined from measurement of actual current draw. Motors driving fans shall have a minimum service factor of 1.15.

513.11 Standby power. The smoke control system shall be supplied with standby power in accordance with Section 2702 of the *Jamaica Building Code*.

513.11.1 Equipment room. The standby power source and its transfer switches shall be in a room separate from the normal power transformers and switch gear and ventilated directly to and from the exterior. The room shall be enclosed with not less than 1-hour fire-resistance-rated fire barriers constructed in accordance with Section 707 of the *Jamaica Building Code* or horizontal assemblies constructed in accordance with Section 711 of the *Jamaica Building Code*, or both.

513.11.2 Power sources and power surges. Elements of the smoke management system relying on volatile memories or the like shall be supplied with uninterruptible power sources of sufficient duration to span 15-minute primary power interruption. Elements of the smoke management system susceptible to power surges shall be suitably protected by conditioners, suppressors or other *approved* means.

513.12 Detection and control systems. Fire detection systems providing control input or output signals to mechanical smoke control systems or elements thereof shall comply with the requirements of Section 907 of the *Jamaica Building Code*. Such systems shall be equipped with a control unit complying with UL 864 and listed as smoke control *equipment*.

513.12.1 Verification. Control systems for mechanical smoke control systems shall include provisions for verification. Verification shall include positive confirmation of actuation, testing, manual override and the presence of power downstream of all disconnects. A preprogrammed weekly test sequence shall report abnormal conditions audibly, visually and by printed report. The preprogrammed weekly test shall operate all devices, equipment and components used for smoke control.

Exception: Where verification of individual components tested through the preprogrammed weekly testing sequence will interfere with, and produce unwanted effects to, normal building operation, such individual components are permitted to be bypassed from the pre-programmed weekly testing, where *approved* by the building official and in accordance with both of the following:

1. Where the operation of components is bypassed from the preprogrammed weekly test, presence of power downstream of all disconnects shall be verified weekly by a listed control unit.
2. Testing of all components bypassed from the pre-programmed weekly test shall be in accordance with Section 909.20.6 of the *Jamaica Fire Code*.

513.12.2 Wiring. In addition to meeting the requirements of the *Jamaica Electrical Code*, all wiring, regardless of voltage, shall be fully enclosed within continuous raceways.

513.12.3 Activation. Smoke control systems shall be activated in accordance with the *Jamaica Building Code* or the *Jamaica Fire Code*.

513.12.4 Automatic control. Where complete automatic control is required or used, the automatic control sequences shall be initiated from an appropriately zoned automatic sprinkler system complying with Section 903.3.1.1 of the *Jamaica Fire Code*, from manual controls provided with *ready access* for the fire department, and any smoke detectors required by engineering analysis.

513.13 Control-air tubing. Control-air tubing shall be of sufficient size to meet the required response times. Tubing shall be flushed clean and dry prior to final connections. Tubing shall be adequately supported and protected from damage. Tubing passing through concrete or masonry shall be sleeved and protected from abrasion and electrolytic action.

513.13.1 Materials. Control-air tubing shall be hard-drawn copper, Type L, ACR in accordance with ASTM B42, ASTM B43, ASTM B68, ASTM B88, ASTM B251 and ASTM B280. Fittings shall be wrought copper or copper alloy, solder type in accordance with ASME B16.18 or ASME B16.22. Changes in direction shall be made with appropriate tool bends. Copper alloy compression-type fittings shall be used at final connection to devices; other joints shall be brazed using a BCuP5 brazing alloy with solidus above 593°C (1,100°F) and liquids below 816°C (1,500°F). Brazing flux shall be used on copper-to-copper alloy joints only.

Exception: Nonmetallic tubing used within control panels and at the final connection to devices provided that all of the following conditions are met:

1. Tubing shall comply with the requirements of Section 602.2.1.3.
2. Tubing and connected device shall be completely enclosed within a galvanized or paint-grade steel enclosure having a minimum thickness of 0.7534 mm (No. 22 gage) [0.0296 inch]. Entry to the enclosure shall be by copper tubing with a protective grommet of Neoprene or Teflon or by suitable brass compression to male barbed adapter.
3. Tubing shall be identified by appropriately documented coding.
4. Tubing shall be neatly tied and supported within the enclosure. Tubing bridging cabinets and doors or movable devices shall be of sufficient length to avoid tension and excessive stress. Tubing shall be protected against abrasion. Tubing connected to devices on doors shall be fastened along hinges.

513.13.2 Isolation from other functions. Control tubing serving other than smoke control functions shall be isolated by automatic isolation valves or shall be an independent system.

513.13.3 Testing. Control-air tubing shall be tested at three times the operating pressure for not less than 30 minutes without any noticeable loss in gauge pressure prior to final connection to devices.

513.14 Marking and identification. The detection and control systems shall be clearly marked at all junctions, accesses and terminations.

513.15 Control diagrams. Identical control diagrams shall be provided and maintained as required by the *Jamaica Fire Code*.

513.16 Fire fighter's smoke control panel. A fire fighter's smoke control panel for fire department emergency response purposes only shall be provided in accordance with the *Jamaica Fire Code*.

513.17 System response time. Smoke control system activation shall comply with the *Jamaica Fire Code*.

513.18 Acceptance testing. Devices, equipment, components and sequences shall be tested in accordance with the *Jamaica Fire Code*.

513.19 System acceptance. Acceptance of the smoke control system shall be in accordance with the *Jamaica Fire Code*.

SECTION 514 ENERGY RECOVERY VENTILATION SYSTEMS

514.1 General. Energy recovery ventilation systems shall be installed in accordance with this section. Where required for purposes of energy conservation, energy recovery ventilation systems shall comply with the *Jamaica Energy Conservation Code*. Ducted heat recovery ventilators shall be listed and labeled in accordance with UL 1812 or **BSI recognized standard**. Nonducted heat recovery ventilators shall be listed and labeled in accordance with UL 1815.

514.2 Prohibited applications. Energy recovery ventilation systems shall not be used in the following systems:

1. Hazardous exhaust systems covered in Section 510.
2. Dust, stock and refuse systems that convey explosive or flammable vapors, fumes or dust.
3. Smoke control systems covered in Section 513.
4. Commercial kitchen exhaust systems serving Type I or Type II hoods.
5. Clothes dryer exhaust systems covered in Section 504.

Exception: The application of ERV equipment that recovers sensible heat only utilizing coil-type heat exchangers shall not be limited by this section.

514.3 Access. A means of access shall be provided to the heat exchanger and other components of the system as required for service, maintenance, repair or replacement.

514.4 Recirculated air. Air conveyed within energy recovery systems shall not be considered as recirculated air where the energy recovery ventilation system is constructed to limit cross-leakage between air streams to less than 10 percent of the total airflow design capacity.

CHAPTER 6

DUCT SYSTEMS

User note:

About this chapter: Chapter 6 addresses duct systems used in HVAC systems and some exhaust systems. Some exhaust system ducts are addressed in Chapter 5, such as kitchen exhaust ducts and clothes dryer exhaust ducts. This chapter addresses air plenums such as above-ceiling and below-floor plenums. Section 607 covers fire and smoke dampers, consistent with the requirements of the Jamaica Building Code.

SECTION 601 GENERAL

601.1 Scope. Duct systems used for the movement of air in air-conditioning, heating, ventilating and exhaust systems shall conform to the provisions of this chapter except as otherwise specified in Chapters 5 and 7.

Exception: Ducts discharging combustible material directly into any *combustion* chamber shall conform to the requirements of NFPA 82.

601.2 Air movement in egress elements. Corridors shall not serve as supply, return, exhaust, relief or *ventilation air* ducts.

Exceptions:

1. Use of a corridor as a source of *makeup air* for exhaust systems in rooms that open directly onto such corridors, including toilet rooms, bathrooms, dressing rooms, smoking lounges and janitor closets, shall be permitted, provided that each such corridor is directly supplied with outdoor air at a rate greater than the rate of *makeup air* taken from the corridor.
2. Where located within a *dwelling unit*, the use of corridors for conveying return air shall not be prohibited.
3. Where located within tenant spaces of 93 m² (11,000 square feet) or less in area, use of corridors for conveying return air is permitted.
4. Incidental air movement from pressurized rooms within health care facilities, provided that the corridor is not the primary source of supply or return to the room.

601.2.1 Corridor ceiling. Use of the space between the corridor ceiling and the floor or roof structure above as a return air *plenum* is permitted for one or more of the following conditions:

1. The corridor is not required to be of fire-resistance-rated construction.
2. The corridor is separated from the *plenum* by fire-resistance-rated construction.
3. The air-handling system serving the corridor is shut down upon activation of the air-handling unit smoke detectors required by this code.

4. The air-handling system serving the corridor is shut down upon detection of sprinkler waterflow where the building is equipped throughout with an automatic sprinkler system.
5. The space between the corridor ceiling and the floor or roof structure above the corridor is used as a component of an *approved* engineered smoke control system.

601.3 Exits. *Equipment* and ductwork for exit enclosure ventilation shall comply with one of the following items:

1. Such *equipment* and ductwork shall be located exterior to the building and shall be directly connected to the exit enclosure by ductwork enclosed in construction as required by the *Jamaica Building Code* for shafts.
2. Where such *equipment* and ductwork is located within the exit enclosure, the intake air shall be taken directly from the outdoors and the *exhaust air* shall be discharged directly to the outdoors, or such air shall be conveyed through ducts enclosed in construction as required by the *Jamaica Building Code* for shafts.
3. Where located within the building, such *equipment* and ductwork shall be separated from the remainder of the building, including other mechanical *equipment*, with construction as required by the *Jamaica Building Code* for shafts.

In each case, openings into fire-resistance-rated construction shall be limited to those needed for maintenance and operation and shall be protected by self-closing fire-resistance-rated devices in accordance with the *Jamaica Building Code* for enclosure wall opening protectives. Exit enclosure ventilation systems shall be independent of other building ventilation systems.

601.4 Contamination prevention. Exhaust ducts under positive pressure, chimneys and vents shall not extend into or pass through ducts or plenums.

Exceptions:

1. Exhaust systems located in ceiling return air plenums over spaces that are permitted to have 10 percent recirculation in accordance with Section 403.2.1, Item 4. The exhaust duct joints, seams and connections shall comply with Section 603.9.
2. This section shall not apply to chimneys and vents that pass through plenums where such venting sys-

tems comply with one of the following requirements:

- 2.1. The venting system shall be listed for positive pressure applications and shall be sealed in accordance with the vent manufacturer's instructions.
- 2.2. The venting system shall be installed such that fittings and joints between sections are not installed in the above-ceiling space.
- 2.3. The venting system shall be installed in a conduit or enclosure with sealed joints separating the interior of the conduit or enclosure from the ceiling space.

601.5 Return air openings. Return air openings for heating, ventilation and air-conditioning systems shall comply with all of the following:

1. Openings shall not be located less than 3050 mm (10 feet) measured in any direction from an open combustion chamber or draft hood of another appliance located in the same room or space.
2. Return air shall not be taken from a hazardous or insanitary location or a refrigeration room as defined in this code.
3. The amount of return air taken from any room or space shall be not greater than the flow rate of supply air delivered to such room or space.
4. Return and transfer openings shall be sized in accordance with the appliance or equipment manufacturer's installation instructions, ACCA Manual D or the design of the registered design building professional.
5. Return air taken from one dwelling unit shall not be discharged into another dwelling unit.
6. Taking return air from a crawl space shall not be accomplished through a direct connection to the return side of a forced air furnace. Transfer openings in the crawl space enclosure shall not be prohibited.
7. Return air shall not be taken from a closet, bathroom, toilet room, kitchen, garage, boiler room, furnace room or unconditioned attic.
8. Return air shall not be taken from indoor swimming pool enclosures and associated deck areas.

Exceptions:

1. Where the air from such spaces is dehumidified in accordance with Section 403.2.1, Item 2.
2. Dedicated HVAC systems serving only such spaces.

Exceptions:

1. Taking return air from a kitchen is not prohibited where such return air openings serve the kitchen and are located not less than 3050 mm (10 feet) from the cooking appliances.

2. Dedicated forced air systems serving only the garage shall not be prohibited from obtaining return air from the garage.

**SECTION 602
PLENUMS**

602.1 General. Supply, return, exhaust, relief and ventilation air plenums shall be limited to uninhabited crawl spaces, areas above a ceiling or below the floor, attic spaces, mechanical equipment rooms and the framing cavities addressed in Section 602.3. Plenums shall be limited to one fire area. Air systems shall be ducted from the boundary of the fire area served directly to the air-handling equipment. Fuel-fired appliances shall not be installed within a plenum.

602.2 Construction. *Plenum* enclosure construction materials that are exposed to the airflow shall comply with the requirements of Section 703.5 of the *Jamaica Building Code* or such materials shall have a flame spread index of not more than 25 and a smoke-developed index of not more than 50 when tested in accordance with ASTM E84 or UL 723.

The use of gypsum boards to form plenums shall be limited to systems where the air temperatures do not exceed 52°C (125°F) and the building and mechanical system design conditions are such that the gypsum board surface temperature will be maintained above the airstream dew-point temperature. Air plenums formed by gypsum boards shall not be incorporated in air-handling systems utilizing evaporative coolers.

602.2.1 Materials within plenums. Except as required by Sections 602.2.1.1 through 602.2.1.8, materials within plenums shall be noncombustible or shall be listed and labeled as having a flame spread index of not more than 25 and a smoke-developed index of not more than 50 when tested in accordance with ASTM E84 or UL 723.

Exceptions:

1. Rigid and flexible ducts and connectors shall conform to Section 603.
2. Duct coverings, linings, tape and connectors shall conform to Sections 603 and 604.
3. This section shall not apply to materials exposed within plenums in one- and two-family dwellings.
4. This section shall not apply to smoke detectors.
5. Combustible materials fully enclosed within one of the following:
 - 5.1. Continuous noncombustible raceways or enclosures.
 - 5.2. Approved gypsum board assemblies.
 - 5.3. Materials listed and labeled for installation within a plenum and listed for the application.
6. Materials in Group H, Division 5 fabrication areas and the areas above and below the fabrica

tion area that share a common air recirculation path with the fabrication area.

602.2.1.1 Wiring. Combustible electrical wires and cables and optical fiber cables exposed within a plenum shall be listed and labeled as having a peak optical density not greater than 0.50, an average optical density not greater than 0.15, and a flame spread distance not greater than 1525 mm (5 feet) when tested in accordance with NFPA 262, or shall be installed in metal raceways or metal sheathed cable. Combustible optical fiber and communication raceways exposed within a plenum shall be listed and labeled as having a peak optical density not greater than 0.5, an average optical density not greater than 0.15, and a flame spread distance not greater than 1525 mm (5 feet) when tested in accordance with UL 2024. Only plenum-rated wires and cables shall be installed in plenum-rated raceways.

602.2.1.2 Fire sprinkler piping. Plastic fire sprinkler piping exposed within a *plenum* shall be used only in wet pipe systems and shall be listed and labeled as having a peak optical density not greater than 0.50, an average optical density not greater than 0.15, and a flame spread distance not greater than 1525 mm (5 feet) when tested in accordance with UL 1887.

602.2.1.3 Pneumatic tubing. Combustible pneumatic tubing exposed within a *plenum* shall be listed and labeled as having a peak optical density not greater than 0.50, an average optical density not greater than 0.15, and a flame spread distance not greater than 1525 mm (5 feet) when tested in accordance with UL 1820.

602.2.1.4 Electrical equipment in plenums. Electrical *equipment* exposed within a *plenum* shall comply with Sections 602.2.1.4.1 and 602.2.1.4.2.

602.2.1.4.1 Equipment in metallic enclosures. Electrical *equipment* with metallic enclosures exposed within a *plenum* shall be permitted.

602.2.1.4.2 Equipment in combustible enclosures. Electrical *equipment* with combustible enclosures exposed within a *plenum* shall be *listed* and *labeled* for such use in accordance with UL 2043.

602.2.1.5 Discrete plumbing and mechanical products in plenums. Where discrete plumbing and mechanical products and appurtenances are located in a plenum and have exposed combustible material, they shall be listed and labeled for such use in accordance with UL 2043 or **BSJ recognized standard**.

602.2.1.6 Foam plastic in plenums as interior finish or interior trim. Foam plastic in plenums used as interior wall or ceiling finish or interior trim shall exhibit a flame spread index of 25 or less and a smoke-developed index of 50 or less when tested in accordance with ASTM E84 or UL 723 at the maximum thickness and density intended for use, and shall be tested in accordance with NFPA 286 and meet the acceptance criteria of Section 803.1.2 of the *Jamaica Building Code*. As an alternative to testing to

NFPA 286, the foam plastic shall be approved based on tests conducted in

accordance with Section 2603.9 of the *Jamaica Building Code*.

Exceptions:

1. Foam plastic in plenums used as interior wall or ceiling finish or interior trim shall exhibit a flame spread index of 75 or less and a smoke-developed index of 450 or less when tested in accordance with ASTM E84 or UL 723 at the maximum thickness and density intended for use, where it is separated from the airflow in the plenum by a thermal barrier complying with Section 2603.4 of the *Jamaica Building Code*.
2. Foam plastic in plenums used as interior wall or ceiling finish or interior trim, shall exhibit a flame spread index of 75 or less and a smoke-developed index of 450 or less when tested in accordance with ASTM E84 or UL 723 at the maximum thickness and density intended for use, where it is separated from the airflow in the plenum by corrosion-resistant steel having a base metal thickness of not less than 0.4 mm (0.0160 inch).
3. Foam plastic in plenums used as interior wall or ceiling finish or interior trim, shall exhibit a flame spread index of 75 or less and a smoke-developed index of 450 or less when tested in accordance with ASTM E84 or UL 723 at the maximum thickness and density intended for use, where it is separated from the airflow in the plenum by not less than a **25 mm (1-inch)** thickness of masonry or concrete.

602.2.1.7 Plastic plumbing piping and tubing. Plastic piping and tubing used in plumbing systems shall be listed and labeled as having a flame spread index not greater than 25 and a smoke-developed index not greater than 50 when tested in accordance with ASTM E84 or UL 723.

Exception: Plastic water distribution piping and tubing listed and labeled in accordance with UL 2846 as having a peak optical density not greater than 0.50, an average optical density not greater than 0.15, and a flame spread distance not greater than 1525 mm (5 feet), and installed in accordance with its listing.

602.2.1.8 Pipe and duct insulation within plenums. Pipe and duct insulation contained within plenums, including insulation adhesives, shall have a flame spread index of not more than 25 and a smoke developed index of not more than 50 when tested in accordance with ASTM E84 or UL 723, using the specimen preparation and mounting procedures of ASTM E2231. Pipe and duct insulation shall not flame, glow, smolder or smoke when tested in accordance with ASTM C411 at the temperature to which they are exposed in service. The test temperature shall not fall below 121°C (250°F). Pipe and duct insulation shall be listed and labeled.

602.3 Stud cavity and joist space plenums. Stud wall cavities and the spaces between solid floor joists to be utilized as air plenums shall comply with the following conditions:

1. Such cavities or spaces shall not be utilized as a *plenum* for supply air.
2. Such cavities or spaces shall not be part of a required fire-resistance-rated assembly.
3. Stud wall cavities shall not convey air from more than one floor level.
4. Stud wall cavities and joist space plenums shall comply with the floor penetration protection requirements of the *Jamaica Building Code*.
5. Stud wall cavities and joist space plenums shall be isolated from adjacent concealed spaces by *approved* fire-blocking as required in the *Jamaica Building Code*.
6. Stud wall cavities in the outside walls of building envelope assemblies shall not be utilized as air plenums.

602.4 Flood hazard. For structures located in flood hazard areas, plenum spaces shall be located above the elevation required by Section 1612 of the *Jamaica Building Code* for utilities and attendant equipment or shall be designed and constructed to prevent water from entering or accumulating within the plenum spaces during floods up to such elevation. If the plenum spaces are located below the elevation required by Section 1612 of the *Jamaica Building Code* for utilities and attendant equipment, they shall be capable of resisting hydrostatic and hydrodynamic loads and stresses, including the effects of buoyancy, during the occurrence of flooding up to such elevation.

**SECTION 603
DUCT CONSTRUCTION AND INSTALLATION**

603.1 General. An air distribution system shall be designed and installed to supply the required distribution of air. The installation of an air distribution system shall not affect the fire protection requirements specified in the *Jamaica Building Code*. Ducts shall be constructed, braced, reinforced and installed to provide structural strength and durability.

603.2 Duct sizing. Ducts installed within a single dwelling unit shall be sized in accordance with ACCA Manual D, the appliance manufacturer's installation instructions or other approved methods. Ducts installed within all other buildings shall be sized in accordance with the ASHRAE *Handbook of Fundamentals* or other equivalent computation procedure.

603.3 Duct classification. Ducts shall be classified based on the maximum operating pressure of the duct at pressures of positive or negative 125, 250, 500, 750, 1000, 1500 or 2500 Pa (0.5, 1.0, 2.0, 3.0, 4.0, 6.0 or 10.0 inches w.c.) **1 Pa = 0.004020 inch of water column (1 inch w.c. = 248.7 Pa).** The pressure classification of ducts shall equal or exceed the design pressure of the air distribution in which the ducts are utilized.

603.4 Metallic ducts. Metallic ducts shall be constructed as specified in the SMACNA *HVAC Duct Construction Standards—Metal and Flexible* or other BSI recognized standard.

Exception: Ducts installed within single *dwelling units* shall have a minimum thickness as specified in Table 603.4.

603.4.1 Minimum fasteners. Round metallic ducts shall be mechanically fastened by means of not less than three sheet metal screws or rivets spaced equally around the joint.

Exception: Where a duct connection is made that is partially inaccessible, three screws or rivets shall be

**TABLE 603.4
DUCT CONSTRUCTION MINIMUM SHEET METAL THICKNESS FOR SINGLE DWELLING UNITS***

Duct Classification	Duct Size (inches)	Minimum Sheet Metal Thickness (inches)	
		Round	Rectangular
125 Pa	12	0.015	0.015
	18	0.015	0.015
250 Pa	12	0.015	0.015
	18	0.015	0.015
500 Pa	12	0.015	0.015
	18	0.015	0.015
750 Pa	12	0.015	0.015
	18	0.015	0.015
1000 Pa	12	0.015	0.015
	18	0.015	0.015
1500 Pa	12	0.015	0.015
	18	0.015	0.015
2500 Pa	12	0.015	0.015
	18	0.015	0.015

ROUND DUCT DIAMETER (mm)	STATIC PRESSURE			
	124.5Pa		249 Pa	
	Thickness (mm)		Thickness (mm)	
	Galvanized	Aluminum	Galvanized	Aluminum
< 305	0.3302	0.4572	0.3302	0.4572
305 to 355	0.3302	0.4572	0.4064	0.5842
380 to 430	0.4064	0.5842	0.4826	0.6858
455	0.4064	0.5842	0.6096	0.8636
480 to 510	0.4826	0.6858	0.6096	0.8636
RECTANGULAR DUCT DIMENSION (mm)	STATIC PRESSURE			
	124.5Pa		249 Pa	
	Thickness (mm)		Thickness (mm)	
	Galvanized	Aluminum	Galvanized	Aluminum
≤ 205	0.3302	0.4572	0.3302	0.4572
230 to 255	0.3302	0.4572	0.4064	0.5842
280 to 305	0.4064	0.5842	0.4826	0.6858
330 to 405	0.4826	0.6858	0.4826	0.6858
430 to 455	0.4826	0.6858	0.6096	0.8636
480 to 510	0.6096	0.8636	0.6096	0.8636

For Inch Pound Units: 1 mm = 0.03937 inch, 1 Pa = 0.00402-inch water gauge pressure.

a. Ductwork that exceeds 508 (20 inches) by dimension or exceeds a pressure of 249 Pa (1-inch) water gauge shall be constructed in accordance with SMACNA HVAC Duct Construction Standards—Metal and Flexible.

equally spaced on the exposed portion so as to prevent a hinge effect.

603.4.2 Duct lap. Crimp joints for round and oval metal ducts shall be lapped not less than 25 mm (1 inch) and the male end of the duct shall extend into the adjoining duct in the direction of airflow.

603.5 Nonmetallic ducts. Nonmetallic ducts shall be constructed with Class 0 or Class 1 duct material and shall comply with UL 181 or other **BSJ** approved equivalent **standard**. Fibrous duct construction shall conform to the SMACNA *Fibrous Glass Duct Construction Standards* or NAIMA *Fibrous Glass Duct Construction Standards* or other **BSJ** approved equivalent **standard**. The air temperature within nonmetallic ducts shall not exceed 121°C (250°F).

603.5.1 Gypsum ducts. The use of gypsum boards to form air shafts (ducts) shall be limited to return air systems where the air temperatures do not exceed 52°C (125°F) and the gypsum board surface temperature is maintained above the airstream dew-point temperature. Air ducts formed by gypsum boards shall not be incorporated in air-handling systems utilizing evaporative coolers.

603.5.2 Phenolic ducts. Nonmetallic phenolic ducts shall be constructed and installed in accordance with the SMACNA *Phenolic Duct Construction Standards*.

603.6 Flexible air ducts and flexible air connectors. Flexible air ducts, both metallic and nonmetallic, shall comply with Sections 603.6.1, 603.6.1.1, 603.6.3 and 603.6.4. Flexible air connectors, both metallic and nonmetallic, shall comply with Sections 603.6.2 through 603.6.4.

603.6.1 Flexible air ducts. Flexible air ducts, both metallic and nonmetallic, shall be tested in accordance with UL181. Such ducts shall be *listed* and *labeled* as Class 0 or Class 1 flexible air ducts and shall be installed in accordance with Section 304.1.

603.6.1.1 Duct length. Flexible air ducts shall not be limited in length.

603.6.2 Flexible air connectors. Flexible air connectors, both metallic and nonmetallic, shall be tested in accordance with UL 181. Such connectors shall be *listed* and *labeled* as Class 0 or Class 1 flexible air connectors and shall be installed in accordance with Section 304.1.

603.6.2.1 Connector length. Flexible air connectors shall be limited in length to 4,250 mm (14 feet).

603.6.2.2 Connector penetration limitations. Flexible air connectors shall not pass through any wall, floor or ceiling.

603.6.3 Air temperature. The design temperature of air to be conveyed in flexible air ducts and flexible air connectors shall be less than 121°C (250°F).

603.6.4 Flexible air duct and air connector clearance. Flexible air ducts and air connectors shall be installed with a minimum *clearance* to an *appliance* as specified in the *appliance* manufacturer's installation instructions.

603.7 Rigid duct penetrations. Duct system penetrations of walls, floors, ceilings and roofs and air transfer openings in such building components shall be protected as required by

Section 607. Ducts in a private garage that penetrate a wall or ceiling that separates a dwelling from a private garage shall be continuous, shall be constructed of sheet steel having a thickness of not less than 0.4712 mm [0.0187 inch (No. 26 gage)] and shall not have openings into the garage. Fire and smoke dampers are not required in such ducts passing through the wall or ceiling separating a dwelling from a private garage except where required by Chapter 7 of the *Jamaica Building Code*.

603.8 Underground ducts. Ducts shall be *approved* for underground installation. Metallic ducts not having an *approved* protective coating shall be completely encased in not less than 51 mm (2 inches) of concrete.

603.8.1 Slope. Ducts shall have a minimum slope of 10.4 mm/m (1/8 inch per foot) to allow drainage to a point provided with access.

603.8.2 Sealing. Ducts shall be sealed, secured and tested prior to concrete encasement or direct burial. Ducts shall be leak tested as required by Section C403 of the *Jamaica Energy Conservation Code*.

603.8.3 Plastic ducts and fittings. Plastic ducts shall be constructed of PVC having a minimum pipe stiffness of 55 kPa (8 psi) at 5-percent deflection when tested in accordance with ASTM D2412. Plastic duct fittings shall be constructed of either PVC or high-density polyethylene. Plastic duct and fittings shall be utilized in underground installations only. The maximum design temperature for systems utilizing plastic duct and fittings shall be 66°C (150°F).

603.9 Joints, seams and connections. Longitudinal and transverse joints, seams and connections in metallic and non-metallic ducts shall be constructed as specified in SMACNA *HVAC Duct Construction Standards—Metal and Flexible* and NAIMA *Fibrous Glass Duct Construction Standards* or **BSJ** approved equivalent **standard**. Joints, longitudinal and transverse seams and connections in ductwork shall be securely fastened and sealed with welds, gaskets, mastics (adhesives), mastic-plus-embedded-fabric systems, liquid sealants or tapes. Tapes and mastics used to seal fibrous glass ductwork shall be listed and labeled in accordance with UL 181A and shall be marked "181 A-P" for pressure-sensitive tape, "181 A-M" for mastic or "181 A-H" for heat-sensitive tape. Tapes and mastics used to seal metallic and flexible air ducts and flexible air connectors shall comply with UL 181B and shall be marked "181 B-FX" for pressure-sensitive tape or "181 B-M" for mastic. Duct connections to flanges of air distribution system equipment shall be sealed and mechanically fastened. Mechanical fasteners for use with flexible nonmetallic air ducts shall comply with UL 181B and shall be marked "181 B-C." Closure systems used to seal all ductwork shall be installed in accordance with the manufacturer's instructions.

Exception: For ducts having a static pressure classification of less than 500 Pa (2 inches of water column), additional closure systems shall not be required for continuously welded joints and seams and locking-type joints and seams. This exception shall not apply to snap-

lock and button-lock type joints and seams located outside of conditioned spaces.

603.10 Supports. Ducts shall be supported in accordance with SMACNA *HVAC Duct Construction Standards—Metal and Flexible or other BSI approved equivalent standard*. Flexible and other factory-made ducts shall be supported in accordance with the manufacturer's instructions.

603.11 Furnace connections. Ducts connecting to a furnace shall have a *clearance* to combustibles in accordance with the furnace manufacturer's installation instructions.

603.12 Condensation. Provisions shall be made to prevent the formation of condensation on the exterior of any duct.

603.13 Flood hazard areas. For structures in flood hazard areas, ducts shall be located above the elevation required by Section 1612 of the *Jamaica Building Code* for utilities and attendant equipment or shall be designed and constructed to prevent water from entering or accumulating within the ducts during floods up to such elevation. If the ducts are located below the elevation required by Section 1612 of the *Jamaica Building Code* for utilities and attendant equipment, the ducts shall be capable of resisting hydrostatic and hydrodynamic loads and stresses, including the effects of buoyancy, during the occurrence of flooding up to such elevation.

603.14 Location. Ducts shall not be installed in or within 100 mm (4 inches) of the earth, except where such ducts comply with Section 603.8.

603.15 Mechanical protection. Ducts installed in locations where they are exposed to risk of mechanical damage by vehicles or from other causes shall be protected by *approved* barriers.

603.16 Weather protection. Ducts including linings, coverings and vibration isolation connectors installed on the exterior of the building shall be protected against the elements.

603.17 Air dispersion systems. Air dispersion systems shall:

1. Be installed entirely in exposed locations.
2. Be utilized in systems under positive pressure.
3. Not pass through or penetrate fire-resistant-rated construction.
4. Be listed and labeled in compliance with UL 2518.

603.18 Registers, grilles and diffusers. Duct registers, grilles and diffusers shall be installed in accordance with the manufacturer's instructions. Volume dampers or other means of supply air adjustment shall be provided in the branch ducts or at each individual duct register, grille or diffuser. Each volume damper or other means of supply air adjustment used in balancing shall be provided with access.

603.18.1 Floor registers. Floor registers shall resist, without structural failure, a 90.8 kg (200-pound) concentrated load on a 51 mm (2-inch-diameter) disc applied to the most critical area of the exposed face.

603.18.2 Prohibited locations. Diffusers, registers and grilles shall be prohibited in the floor or its upward extension within toilet and bathing rooms required by the *Jamaica Building Code* to have smooth, hard, nonabsorbent surfaces.

Exception: *Dwelling units.*

SECTION 604 INSULATION

604.1 General. Duct insulation shall conform to the requirements of Sections 604.2 through 604.13 and the *Jamaica Energy Conservation Code*.

604.2 Surface temperature. Ducts that operate at temperatures exceeding 50°C (120°F) shall have sufficient thermal insulation to limit the exposed surface temperature to 50°C (120°F).

604.3 Coverings and linings. Coverings and linings, including adhesives where used, shall have a flame spread index not more than 25 and a smoke-developed index not more than 50, when tested in accordance with ASTM E84 or UL 723, using the specimen preparation and mounting procedures of ASTM E2231. Duct coverings and linings shall not flame, glow, smolder or smoke when tested in accordance with ASTM C411 at the temperature to which they are exposed in service. The test temperature shall not fall below 120°C (250°F). Coverings and linings shall be listed and labeled.

604.4 Foam plastic insulation. Foam plastic used as duct coverings and linings shall conform to the requirements of Section 604.

604.5 Appliance insulation. *Listed* and *labeled* appliances that are internally insulated shall be considered as conforming to the requirements of Section 604.

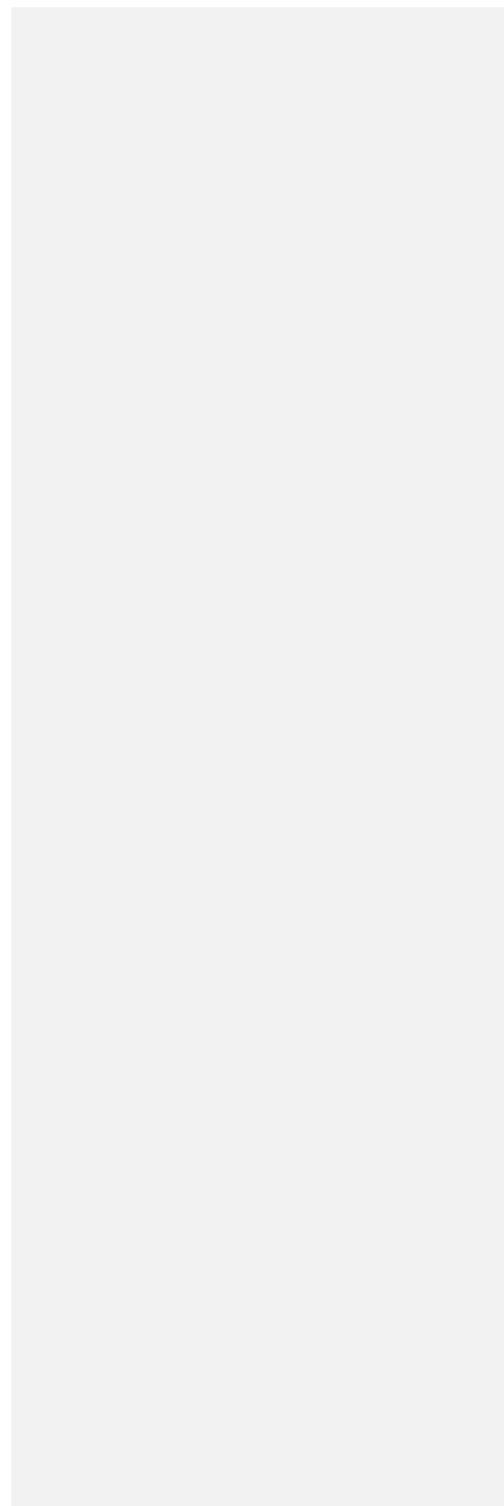
604.6 Penetration of assemblies. Duct coverings shall not penetrate a wall or floor required to have a fire-resistance rating or required to be fireblocked.

604.7 Identification. External duct insulation, except spray polyurethane foam, and factory-insulated flexible duct shall be legibly printed or identified at intervals not greater than 915 mm (36 inches) with the name of the manufacturer, the thermal resistance *R*-value at the specified installed thickness and the flame spread and smoke-developed indices of the composite materials. Duct insulation product *R*-values shall be based on insulation only, excluding air films, vapor retarders or other duct components, and shall be based on tested *C*-values at 24°C (75°F) mean temperature at the installed thickness, in accordance with recognized industry procedures. The installed thickness of duct insulation used to determine its *R*-value shall be determined as follows:

1. For duct board, duct liner and factory-made rigid ducts not normally subjected to compression, the nominal insulation thickness shall be used.
2. For duct wrap, the installed thickness shall be assumed to be 75 percent (25 percent compression) of nominal thickness.
3. For factory-made flexible air ducts, the installed thickness shall be determined by dividing the difference between the actual outside diameter and nominal inside diameter by two.
4. For spray polyurethane foam, the aged *R*-value per inch, measured in accordance with recognized industry standards, shall be provided to the customer in writing at the time of foam application.

604.8 Lining installation. Linings shall be interrupted at the area of operation of a fire damper and at not less than

150 mm (6 inches)



upstream of and 150 mm (6 inches) downstream of electric-resistance and fuel-burning heaters in a duct system. Metal nosings or sleeves shall be installed over exposed duct liner edges that face opposite the direction of airflow.

604.9 Thermal continuity. Where a duct liner has been interrupted, a duct covering of equal thermal performance shall be installed.

604.10 Service openings. Service openings shall not be concealed by duct coverings unless the exact location of the opening is properly identified.

604.11 Vapor retarders. Where ducts used for cooling are externally insulated, the insulation shall be covered with a vapor retarder having a maximum permeance of $2.87 \text{ ng}/(\text{Pa} \cdot \text{s} \cdot \text{m}^2)$ [0.05 perm] or aluminum foil having a minimum thickness of 0.051 mm (2 mils). Insulations having a permeance of $2.87 \text{ ng}/(\text{Pa} \cdot \text{s} \cdot \text{m}^2)$ [0.05 perm] or less shall not be required to be covered. Joints and seams shall be sealed to maintain the continuity of the vapor retarder.

Exception: A vapor retarder is not required for spray polyurethane foam insulation having a water vapor permeance of not greater than $1722 \text{ ng}/(\text{s} \cdot \text{m}^2 \cdot \text{Pa})$ [3 perms per inch] at the installed thickness.

604.12 Weatherproof barriers. Insulated exterior ducts shall be protected with an *approved* weatherproof barrier.

604.13 Internal insulation. Materials used as internal insulation and exposed to the airstream in ducts shall be shown to be durable when tested in accordance with UL 181. Exposed internal insulation that is not impermeable to water shall not be used to line ducts or plenums from the exit of a cooling coil to the downstream end of the drain pan.

SECTION 605 AIR FILTERS

605.1 General. Heating and air-conditioning systems shall be provided with *approved* air filters. Filters shall be installed such that all return air, outdoor air and makeup air is filtered upstream from any heat exchanger or coil. Filters shall be installed in an *approved* convenient location. Liquid adhesive coatings used on filters shall have a flash point not lower than 163°C (325°F).

605.2 Approval. Media-type and electrostatic-type air filters shall be *listed* and *labeled*. Media-type air filters shall comply with UL 900. High-efficiency particulate air filters shall comply with UL 586. Electrostatic-type air filters shall comply with UL 867. For all three categories of filters, conformance with **other BSJ recognized standard** may be accepted. Air filters utilized within *dwelling units* shall be designed for the intended application and shall not be required to be *listed* and *labeled*.

605.3 Airflow over the filter. Ducts shall be constructed to allow an even distribution of air over the entire filter.

SECTION 606 SMOKE DETECTION SYSTEMS CONTROL

606.1 Controls required. Air distribution systems shall be equipped with smoke detectors *listed* and *labeled* for installa-

tion in air distribution systems, as required by this section. Duct smoke detectors shall comply with UL 268A or **other BSJ approved standard**. Other smoke detectors shall comply with UL 268 or **other BSJ approved standard**.

606.2 Where required. Smoke detectors shall be installed where indicated in Sections 606.2.1 through 606.2.3.

Exception: Smoke detectors shall not be required where air distribution systems are incapable of spreading smoke beyond the enclosing walls, floors and ceilings of the room or space in which the smoke is generated.

606.2.1 Return air systems. Smoke detectors shall be installed in return air systems with a design capacity greater than $0.9 \text{ m}^3/\text{s}$ (2,000 cfm), in the return air duct or *plenum* upstream of any filters, *exhaust air* connections, outdoor air connections, or decontamination *equipment* and appliances.

Exception: Smoke detectors are not required in the return air system where all portions of the building served by the air distribution system are protected by area smoke detectors connected to a fire alarm system in accordance with the *Jamaica Fire Code*. The area smoke detection system shall comply with Section 606.4.

606.2.2 Common supply and return air systems. Where multiple air-handling systems share common supply or return air ducts or plenums with a combined design capacity greater than $0.9 \text{ m}^3/\text{s}$ (2,000 cfm), the return air system shall be provided with smoke detectors in accordance with Section 606.2.1.

Exception: Individual smoke detectors shall not be required for each fan-powered terminal unit, provided that such units do not have an individual design capacity greater than $0.9 \text{ m}^3/\text{s}$ (2,000 cfm) and will be shut down by activation of one of the following:

1. Smoke detectors required by Sections 606.2.1 and 606.2.3.
2. An *approved* area smoke detector system located in the return air *plenum* serving such units.
3. An area smoke detector system as prescribed in the exception to Section 606.2.1.

In all cases, the smoke detectors shall comply with Sections 606.4 and 606.4.1.

606.2.3 Return air risers. Where return air risers serve two or more stories and serve any portion of a return air system having a design capacity greater than $7.1 \text{ m}^3/\text{s}$ (15,000 cfm), smoke detectors shall be installed at each story. Such smoke detectors shall be located upstream of the connection between the return air riser and any air ducts or plenums.

606.3 Installation. Smoke detectors required by this section shall be installed in accordance with NFPA 72 or **other BSJ approved standard**. The required smoke detectors shall be installed to monitor the entire airflow conveyed by the system including return air and exhaust or relief air. Access shall be provided to smoke detectors for inspection and maintenance.

606.4 Controls operation. Upon activation, the smoke detectors shall shut down all operational capabilities of the air distribution system in accordance with the listing and labeling of appliances used in the system. Air distribution systems that are part of a smoke control system shall switch to the smoke control mode upon activation of a detector.

606.4.1 Supervision. The duct smoke detectors shall be connected to a fire alarm system where a fire alarm system is required by Section 907.2 of the *Jamaica Fire Code*. The actuation of a duct smoke detector shall activate a visible and audible supervisory signal at a constantly attended location. In facilities that are required to be monitored by a supervising station, duct smoke detectors shall report only as a supervisory signal, not as a fire alarm.

Exceptions:

1. The supervisory signal at a constantly attended location is not required where the duct smoke detector activates the building's alarm-indicating appliances.
2. In occupancies not required to be equipped with a fire alarm system, actuation of a smoke detector shall activate a visible and audible signal in an *approved* location. Duct smoke detector trouble conditions shall activate a visible or audible signal in an *approved* location and shall be identified as air duct detector trouble.

**SECTION 607
DUCT AND TRANSFER OPENINGS**

607.1 General. The provisions of this section shall govern the protection of duct penetrations and air transfer openings in assemblies required to be protected.

607.1.1 Ducts between shafts. Ducts transitioning horizontally between shafts shall not require a shaft enclosure provided that the duct penetration into each associated shaft is protected with dampers complying with this section.

607.1.2 Ducts that penetrate fire-resistance-rated assemblies without dampers. Ducts that penetrate fire-resistance-rated walls and are not required by this section to have fire dampers shall comply with the requirements of Sections 714.3 through 714.4.3 of the *Jamaica Building Code*. Ducts that penetrate horizontal assemblies not required to be contained within a shaft and not required by this section to have fire dampers shall comply with the requirements of Section 714.5 of the *Jamaica Building Code*.

607.1.2.1 Ducts that penetrate nonfire-resistance-rated assemblies. The space around a duct penetrating a nonfire-resistance-rated floor assembly shall comply with Section 717.6.3 of the *Jamaica Building Code*.

607.2 Installation. Fire dampers, smoke dampers, combination fire/smoke dampers and ceiling radiation dampers located within air distribution and smoke control systems

shall be installed in accordance with the requirements of this section, and the manufacturer's instructions and listing.

607.2.1 Smoke control system. Where the installation of a fire damper will interfere with the operation of a required smoke control system in accordance with Section 909 of the *Jamaica Building Code*, *approved* alternative protection shall be used. Where mechanical systems including ducts and dampers used for normal building ventilation serve as part of the smoke control system, the expected performance of these systems in smoke control mode shall be addressed in the rational analysis required by Section 909.4 of the *Jamaica Building Code*.

607.2.2 Hazardous exhaust ducts. Fire dampers for hazardous exhaust duct systems shall comply with Section 510.

607.3 Damper testing, ratings and actuation. Damper testing, ratings and actuation shall be in accordance with Sections 607.3.1 through 607.3.3.5.

607.3.1 Damper testing. *Dampers* shall be listed and labeled in accordance with the standards in this section. *Fire dampers* shall comply with the requirements of UL 555. Only *fire* dampers labeled for use in dynamic systems shall be installed in heating, ventilating and air-conditioning systems designed to operate with fans on during a fire. *Smoke dampers* shall comply with the requirements of UL 555S. *Combination fire/smoke dampers* shall comply with the requirements of both UL 555 and UL 555S. *Ceiling radiation dampers* shall comply with the requirements of UL 555C or shall be tested as part of a fire-resistance-rated floor/ceiling or roof/ceiling assembly in accordance with ASTM E119 or UL 263. Only ceiling radiation dampers labeled for use in dynamic systems shall be installed in heating, ventilation and air-conditioning systems designed to operate with fans on during a fire. Corridor dampers shall comply with requirements of both UL 555 and UL 555S. Corridor dampers shall demonstrate acceptable closure performance when subjected to 0.76 m/s (150 feet per minute) velocity across the face of the damper using the UL 555 fire exposure test.

607.3.2 Damper rating. Damper ratings shall be in accordance with Sections 607.3.2.1 through 607.3.2.4.

607.3.2.1 Fire damper ratings. Fire dampers shall have the minimum rating specified in Table 607.3.2.1.

**TABLE 607.3.2.1 FIRE
DAMPER RATING**

TYPE OF PENETRATION	MINIMUM DAMPER RATING (hour)
Less than 3-hour fire-resistance-rated assemblies	1½
3-hour or greater fire-resistance-rated assemblies	3

607.3.2.2 Smoke damper ratings. Smoke damper leakage ratings shall be Class I or II. Elevated temperature ratings shall be not less than 121°C (250°F).

607.3.2.3 Combination fire/smoke damper ratings. Combination fire/smoke dampers shall have the

minimum rating specified for fire dampers in Table 607.3.2.1 and shall have the minimum rating specified for smoke dampers in Section 607.3.2.2.

607.3.2.4 Corridor damper ratings. Corridor dampers shall have the following minimum ratings.

1. One-hour fire-resistance rating.
2. Class I or II leakage rating as specified in Section 607.3.2.2.

607.3.3 Damper actuation. Damper actuation shall be in accordance with Sections 607.3.3.1 through 607.3.3.5 as applicable.

607.3.3.1 Fire damper actuation device. The fire damper actuation device shall meet one of the following requirements:

1. The operating temperature shall be approximately 28°C (50°F) above the normal temperature within the duct system, but not less than 71°C (160°F).
2. The operating temperature shall be not more than 177°C (350°F) where located in a smoke control system complying with Section 909 of the *Jamaica Building Code*.

607.3.3.2 Smoke damper actuation. The smoke damper shall close upon actuation of a *listed* smoke detector or detectors installed in accordance with Section 907.3 of the *Jamaica Building Code* and one of the following methods, as applicable:

1. Where a smoke damper is installed within a duct, a smoke detector shall be installed inside the duct or outside the duct with sampling tubes protruding into the duct. The detector or tubes within the duct shall be within 1525 mm (5 feet) of the damper. Air outlets and inlets shall not be located between the detector or tubes and the damper. The detector shall be *listed* for the air velocity, temperature and humidity anticipated at the point where it is installed. Other than in mechanical smoke control systems, dampers shall be closed upon fan shutdown where local smoke detectors require a minimum velocity to operate.
2. Where a smoke damper is installed above smoke barrier doors in a smoke barrier, a spot-type detector shall be installed on either side of the smoke barrier door opening. The detector shall be listed for releasing service if used for direct inter-face with the damper.
3. Where a smoke damper is installed within an unducted opening in a wall, a spot-type detector shall be installed within 1524 mm (5 feet) horizontally of the damper. The detector shall be listed for releasing service if used for direct interface with the damper.
4. Where a smoke damper is installed in a corridor wall or ceiling, the damper shall be permitted to be controlled by a smoke detection system installed in the corridor.

5. Where a smoke detection system is installed in all areas served by the duct in which the damper will be located, the smoke dampers shall be permitted to be controlled by the smoke detection system.

607.3.3.3 Combination fire/smoke damper actuation. Combination fire/smoke damper actuation shall be in accordance with Sections 607.3.3.1 and 607.3.3.2. Combination fire/smoke dampers installed in smoke control system shaft penetrations shall not be actuated by local area smoke detection unless it is secondary to the smoke management system controls.

607.3.3.4 Ceiling radiation damper actuation. The operating temperature of a ceiling radiation damper actuation device shall be 28°C (50°F) above the normal temperature within the duct system, but not less than 71°C (160°F).

607.3.3.5 Corridor damper actuation. Corridor damper actuation shall be in accordance with Sections 607.3.3.1 and 607.3.3.2.

607.4 Access and identification. Fire and smoke dampers shall be provided with an *approved* means of access, large enough to permit inspection and maintenance of the damper and its operating parts. The access shall not affect the integrity of fire-resistance-rated assemblies. The access openings shall not reduce the fire-resistance rating of the assembly. Access points shall be permanently identified on the exterior by a label having letters not less than 12.5 mm (0.5 inch) in height reading: FIRE/SMOKE DAMPER, SMOKE DAMPER or FIRE DAMPER. Access doors in ducts shall be tight fitting and suitable for the required duct construction.

607.5 Where required. Fire dampers, smoke dampers, combination fire/smoke dampers, ceiling radiation dampers and corridor dampers shall be provided at the locations prescribed in Sections 607.5.1 through 607.5.7. Where an assembly is required to have both fire dampers and smoke dampers, combination fire/smoke dampers or a fire damper and smoke damper shall be provided.

607.5.1 Fire walls. Ducts and air transfer openings permitted in fire walls in accordance with Section 706.11 of the *Jamaica Building Code* shall be protected with approved/*listed* fire dampers installed in accordance with their listing. **Hazardous exhaust ducts shall be routed to avoid or minimize penetration of firewalls.** **607.5.1.1 Horizontal exits.** A *listed smoke damper* designed to resist the passage of smoke shall be provided at each point that a duct or air transfer opening penetrates a *fire wall* that serves as a horizontal *exit*.

607.5.2 Fire barriers. Ducts and air transfer openings that penetrate fire barriers shall be protected with *listed* fire dampers installed in accordance with their listing. Ducts and air transfer openings shall not penetrate enclosures for interior exit stairways and ramps and exit passageways except as permitted by Sections 1023.5 and 1024.6, respectively, of the *Jamaica Building Code*.

Exception: Fire dampers are not required at penetrations of fire barriers where any of the following apply:

1. Penetrations are tested in accordance with ASTM E119 or UL 263 as part of the fire-resistance-rated assembly.

2. Ducts are used as part of an *approved* smoke control system in accordance with Section 513 and where the fire damper would interfere with the operation of the smoke control system.
3. Such walls are penetrated by ducted HVAC systems, have a required fire-resistance rating of 1 hour or less, are in areas of other than Group H and are in buildings equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1 or 903.3.1.2 of the *Jamaica Building Code*. For the purposes of this exception, a ducted HVAC system shall be a duct system for the structure's HVAC system. Such a duct system shall be constructed of sheet steel not less than **0.55 mm [0.0217 inch (26 gage)]** thickness and shall be continuous from the air-handling *appliance* or *equipment* to the air outlet and inlet terminals.

607.5.2.1 Horizontal exits. A *listed* smoke damper designed to resist the passage of smoke shall be provided at each point that a duct or air transfer opening penetrates a *fire barrier* that serves as a horizontal *exit*.

607.5.3 Fire partitions. Ducts and air transfer openings that penetrate fire partitions shall be protected with *listed* fire dampers installed in accordance with their listing.

Exception: In occupancies other than Group H, fire dampers are not required where any of the following apply:

1. Corridor walls in buildings equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1 or 903.3.1.2 of the *Jamaica Building Code* and the duct is protected as a through penetration in accordance with Section 714 of the *Jamaica Building Code*.
2. The partitions are tenant partitions in covered and open mall buildings where the walls are not required by provisions elsewhere in the *Jamaica Building Code* to extend to the underside of the floor or roof sheathing, slab or deck above.
3. The duct system is constructed of *approved* materials in accordance with Section 603 and the duct penetrating the wall complies with all of the following requirements:
 - 3.1. The duct shall not exceed 0.06 m² (100 square inches).
 - 3.2. The duct shall be constructed of steel not less than 0.55 mm (0.0217 inch) in thickness.
 - 3.3. The duct shall not have openings that communicate the corridor with adjacent spaces or rooms.
 - 3.4. The duct shall be installed above a ceiling.

3.5. The duct shall not terminate at a wall register in the fire-resistance-rated wall.

3.6. A minimum 305 mm (12-inch-long) by 1.52 mm (0.060-inch) thick steel sleeve shall be centered in each duct opening. The sleeve shall be secured to both sides of the wall and all four sides of the sleeve with minimum 38 mm by 38 mm by 1.52 mm (1½-inch by 1½-inch by 0.060-inch) steel retaining angles. The retaining angles shall be secured to the sleeve and the wall with M5 (No. 10) screws. The annular space between the steel sleeve and the wall opening shall be filled with rock (mineral) wool batting on all sides.

4. Such walls are penetrated by ducted HVAC systems, have a required fire-resistance rating of 1 hour or less, and are in areas of other than Group H and are in buildings equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1 or 903.3.1.2 of the *Jamaica Building Code*. For the purposes of this exception, a ducted HVAC system shall be a duct system for conveying supply, return or exhaust air as part of the structure's HVAC system. Such a duct system shall be constructed of sheet steel not less than **0.55 mm [0.0217 inch (26 gage)]** in thickness and shall be continuous from the air-handling *appliance* or *equipment* to the air outlet and inlet terminals.

607.5.4 Corridors/smoke barriers. A *listed* smoke damper designed to resist the passage of smoke shall be provided at each point a duct or air transfer opening penetrates a smoke barrier wall or a corridor enclosure required to have smoke and draft control doors in accordance with the *Jamaica Building Code*.

A corridor damper shall be provided where corridor ceilings, constructed as required for the corridor walls as permitted in Section 708.4, Exception 3, of the *Jamaica Building Code*, are penetrated.

A ceiling radiation damper shall be provided where the ceiling membrane of a fire-resistance-rated floor/ceiling or roof/ceiling assembly, constructed as permitted in Section 708.4, Exception 2, of the *Jamaica Building Code*, is penetrated.

Smoke dampers and smoke damper actuation methods shall comply with Section 607.5.4.1.

Exceptions:

1. Smoke dampers are not required in corridor penetrations where the building is equipped throughout with an *approved* smoke control system in accordance with Section 513 and smoke dampers are not necessary for the operation and control of the system.
2. Smoke dampers are not required in smoke barrier penetrations where the openings in ducts are limited to a single smoke compartment and the ducts are constructed of steel.

3. Smoke dampers are not required in corridor penetrations where the duct is constructed of steel not less than 0.48 mm (0.019 inch) in thickness and there are no openings serving the corridor.
4. Smoke dampers are not required in smoke barriers required by Section 407.5 of the *Jamaica Building Code* for Group I-2, Condition 2 where the HVAC system is fully ducted in accordance with Section 603 and where buildings are equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1 of the *Jamaica Building Code* and equipped with quick-response sprinklers in accordance with Section 903.3.2 of the *Jamaica Building Code*.

607.5.4.1 Smoke damper. Smoke dampers shall close as required by Section 607.3.3.2.

607.5.5 Shaft enclosures. Shaft enclosures that are permitted to be penetrated by ducts and air transfer openings shall be protected with listed fire and smoke dampers installed in accordance with their listing.

Exceptions:

1. Fire dampers are not required at penetrations of shafts where any of the following apply:
 - 1.1. Steel exhaust subducts extend not less than 560 mm (22 inches) vertically in exhaust shafts provided that there is a continuous airflow upward to the outdoors.
 - 1.2. Penetrations are tested in accordance with ASTM E119 or UL 263 as part of the fire-resistance-rated assembly.
 - 1.3. Ducts are used as part of an *approved* smoke control system in accordance with Section 909 of the *Jamaica Building Code*, and where the fire damper will interfere with the operation of the smoke control system.
 - 1.4. The penetrations are in parking garage exhaust or supply shafts that are separated from other building shafts by not less than 2-hour fire-resistance-rated construction.
2. In Group B and R occupancies equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1 of the *Jamaica Building Code*, smoke dampers are not required at penetrations of shafts where kitchen, clothes dryer, bathroom and toilet room exhaust openings with steel exhaust subducts, having a minimum thickness of 0.4712 mm [0.0187 inch (No. 26 gage)], extend not less than 560 mm (22 inches) vertically and the exhaust fan at the upper terminus is powered continuously in accordance with the provisions of Section 909.11 of the *Jamaica Building Code*, and maintains air-flow upward to the outdoors.

3. Smoke dampers are not required at penetrations of exhaust or supply shafts in parking garages that are separated from other building shafts by not less than 2-hour fire-resistance-rated construction.
4. Smoke dampers are not required at penetrations of shafts where ducts are used as part of an *approved* mechanical smoke control system designed in accordance with Section 909 of the *Jamaica Building Code* and where the smoke damper will interfere with the operation of the smoke control system.
5. Fire dampers and combination fire/smoke dampers are not required in kitchen and clothes dryer exhaust systems where dampers are prohibited by this code.

607.5.5.1 Enclosure at the bottom. Shaft enclosures that do not extend to the bottom of the building or structure shall be protected in accordance with Section 713.11 of the *Jamaica Building Code*.

607.5.6 Exterior walls. Ducts and air transfer openings in fire-resistance-rated exterior walls required to have protected openings in accordance with Section 705.10 of the *Jamaica Building Code* shall be protected with *listed* fire dampers installed in accordance with their listing.

607.5.7 Smoke partitions. A *listed* smoke damper designed to resist the passage of smoke shall be provided at each point where an air transfer opening penetrates a smoke partition. Smoke dampers and smoke damper actuation methods shall comply with Section 607.3.3.2.

Exception: Where the installation of a smoke damper will interfere with the operation of a required smoke control system in accordance with Section 513, *approved* alternate protection shall be used.

607.6 Horizontal assemblies. Penetrations by air ducts of a floor, floor/ceiling assembly or the ceiling membrane of a roof/ceiling assembly shall be protected by a shaft enclosure that complies with Section 713 and Sections 717.6.1 through 717.6.3 of the *Jamaica Building Code* or shall comply with Sections 607.6.1 through 607.6.3.

607.6.1 Through penetrations. In occupancies other than Groups I-2 and I-3, a duct constructed of *approved* materials in accordance with Section 603 that penetrates a fire-resistance-rated floor/ceiling assembly that connects not more than two stories is permitted without shaft enclosure protection provided that a *listed* fire damper is installed at the floor line or the duct is protected in accordance with Section 714.5 of the *Jamaica Building Code*. For air transfer openings, see Item 6, Section 712.1.9 of the *Jamaica Building Code*.

Exception: A duct is permitted to penetrate three floors or less without a fire damper at each floor provided that it meets all of the following requirements.

1. The duct shall be contained and located within the cavity of a wall and shall be constructed of

steel having a minimum thickness of 0.4712 mm (0.0187 inch or (No. 26 gage).

2. The duct shall open into only one *dwelling unit* or *sleeping unit* and the duct system shall be continuous from the unit to the exterior of the building.
3. The duct shall not exceed a 100 mm (4-inch) nominal diameter and the total area of such ducts shall not exceed 64 516 mm² per 9.3 m² (100 square inches for any 100 square feet) of the floor area.
4. The annular space around the duct is protected with materials that prevent the passage of flame and hot gases sufficient to ignite cotton waste when subjected to ASTM E119 or UL 263 time-temperature conditions under a minimum positive pressure differential of 2.49 Pa (0.01 inch) of water at the location of the penetration for the time period equivalent to the fire-resistance rating of the construction penetrated.
5. Grille openings located in a ceiling of a fire-resistance-rated floor/ceiling or roof/ceiling assembly shall be protected with a *listed* ceiling radiation damper installed in accordance with Section 607.6.2.1.

607.6.2 Membrane penetrations. Ducts and air transfer openings constructed of *approved* materials, in accordance with Section 603, that penetrate the ceiling membrane of a fire-resistance-rated floor/ceiling or roof/ ceiling assembly shall be protected with one of the following:

1. A shaft enclosure in accordance with Section 713 of the *Jamaica Building Code*.
2. A *listed* ceiling radiation damper installed at the ceiling line where a duct penetrates the ceiling of a fire-resistance-rated floor/ceiling or roof/ceiling assembly.

Exceptions:

1. A fire-resistance-rated assembly tested in accordance with ASTM E119 or UL 263 showing that ceiling radiation dampers are not required in order to maintain the fire-resistance rating of the assembly.
 2. Where exhaust duct or outdoor air duct penetrations are protected in accordance with Section 714.5.1.2 of the *Jamaica Building Code*, are located within the cavity of a wall and do not pass through another dwelling unit or tenant space.
 3. Where duct and air transfer openings are protected with a duct outlet penetration system tested as part of a fire-resistance-rated assembly in accordance with ASTM E119 or UL 263.
3. A *listed* ceiling radiation damper installed at the ceiling line where a diffuser with no duct attached

penetrates the ceiling of a fire-resistance-rated floor/ ceiling or roof/ceiling assembly.

Exceptions:

1. A fire-resistance-rated assembly tested in accordance with ASTM E119 or UL 263 showing that ceiling radiation dampers are not required in order to maintain the fire-resistance rating of the assembly.
2. Where duct and air transfer openings are protected with a duct outlet penetration system tested as part of a fire-resistance-rated assembly in accordance with ASTM E119 or UL 263.

607.6.2.1 Ceiling radiation dampers testing and installation. *Ceiling radiation dampers* shall be tested in accordance with Section 607.3.1. *Ceiling radiation dampers* shall be installed in accordance with the details listed in the fire-resistance-rated assembly and the manufacturer's installation instructions and the listing.

607.6.3 Nonfire-resistance-rated floor assemblies. Duct systems constructed of approved materials in accordance with Section 603 that penetrate nonfire-resistance-rated floor assemblies shall be protected by any of the following methods:

1. A shaft enclosure in accordance with Section 713 of the *Jamaica Building Code*.
2. The duct connects not more than two stories, and the annular space around the penetrating duct is protected with an *approved* noncombustible material that resists the free passage of flame and the products of *combustion*.
3. In floor assemblies composed of noncombustible materials, a shaft shall not be required where the duct connects not more than three stories, and the annular space around the penetrating duct is protected with an approved noncombustible material that resists the free passage of flame and the products of combustion and a fire damper is installed at each floor line.

Exception: Fire dampers are not required in ducts within individual residential *dwelling units*.

607.7 Flexible ducts and air connectors. Flexible ducts and air connectors shall not pass through any fire-resistance-rated assembly.

COMBUSTION AIR

User note:

About this chapter: Chapter 7 defers to the Jamaica Fuel Gas Code⁷ for combustion air provisions for gas-fired appliances. This code addresses oil-fired and solid-fuel-fired appliances; therefore, Chapter 7 is brief, referring to the manufacturer for solid-fuel appliances and NFPA 31 for oil-fired appliances. Combustion air must be provided to appliances to prevent poor combustion that can create multiple health and safety hazards.

SECTION 701 GENERAL

701.1 Scope. Solid fuel-burning *appliances* shall be provided with *combustion air* in accordance with the appliance manufacturer's installation instructions. Oil-fired *appliances* shall be provided with *combustion air* in accordance with NFPA 31. The methods of providing *combustion air* in this chapter do not apply to fireplaces, fireplace stoves and direct-vent *appliances*. The requirements for combustion and dilution air for gas-fired *appliances* shall be in accordance with the *Jamaica Fuel Gas Code*.

Exception: The building official may exempt single or duplex or quadruplex detached residential houses from providing forced outdoor combustion air intake or forced combustion products exhaust air for oil or gas fired appliances so long as he/she is satisfied that adequate natural ventilation provision is in place for the products of combustion to leave all livable space within twelve minutes of generation. This means that a minimum of 5 air changes per hour shall be ascertained.

701.2 Dampered openings. Where combustion air openings are provided with volume, smoke or fire dampers, the dampers shall be interlocked with the firing cycle of the appliances served, so as to prevent operation of any appliance that draws combustion air from the room or space when any of the dampers are closed. Manual dampers shall not be installed in combustion air ducts. Ducts not provided with dampers and that pass through rated construction shall be enclosed in a shaft in accordance with the *Jamaica Building Code*.

CHAPTER 8 CHIMNEYS AND VENTS

User note:

About this chapter: Chapter 8 addresses venting means for fuel-fired appliances other than gas-fired. The Jamaica Fuel Gas Code [→] addresses gas-fired appliances. Chimneys include masonry and factory built; vents include Type L and pellet vents.

SECTION 801 GENERAL

801.1 Scope. This chapter shall govern the installation, maintenance, repair and approval of factory-built chimneys, chimney liners, vents and connectors. This chapter shall govern the utilization of masonry chimneys. Gas-fired appliances shall be vented in accordance with the *Jamaica Fuel Gas Code*.

801.2 General. Every fuel-burning appliance shall discharge the products of combustion to a vent, factory-built chimney or masonry chimney, except for appliances vented in accordance with Section 804. The chimney or vent shall be designed for the type of appliance being vented.

Exception: Commercial cooking appliances vented by a Type I hood installed in accordance with Section 507.

801.2.1 Oil-fired appliances. Oil-fired appliances shall be vented in accordance with this code and NFPA 31.

801.3 Masonry chimneys. Masonry chimneys shall be constructed in accordance with the *Jamaica Building Code*.

801.4 Positive flow. Venting systems shall be designed and constructed so as to develop a positive flow adequate to convey all combustion products to the outside atmosphere.

801.5 Design. Venting systems shall be designed in accordance with this chapter or shall be approved engineered systems.

801.6 Minimum size of chimney or vent. Except as otherwise provided for in this chapter, the size of the chimney or vent, serving a single appliance, except engineered systems, shall have a minimum area equal to the area of the appliance connection.

801.7 Solid fuel appliance flues. The cross-sectional area of a flue serving a solid-fuel-burning appliance shall be not greater than three times the cross-sectional area of the appliance flue collar or flue outlet.

801.8 Abandoned inlet openings. Abandoned inlet openings in chimneys and vents shall be closed by an approved method.

801.9 Positive pressure. Where an appliance equipped with a forced or induced draft system creates a positive pressure in the venting system, the venting system shall be designed and listed for positive pressure applications.

801.10 Connection to fireplace. Connection of appliances to chimney flues serving fireplaces shall be in accordance with Sections 801.10.1 through 801.10.3.

801.10.1 Closure and access. A noncombustible seal shall be provided below the point of connection to prevent entry of room air into the flue. Means shall be provided for access to the flue for inspection and cleaning.

801.10.2 Connection to factory-built fireplace flue. An appliance shall not be connected to a flue serving a factory-built fireplace unless the appliance is specifically listed for such installation. The connection shall be made in accordance with the appliance manufacturer's installation instructions.

801.10.3 Connection to masonry fireplace flue. A connector shall extend from the appliance to the flue serving a masonry fireplace such that the flue gases are exhausted directly into the flue. The connector shall be provided with access or shall be removable for inspection and cleaning of both the connector and the flue. Listed direct connection devices shall be installed in accordance with their listing.

801.11 Multiple solid fuel prohibited. A solid fuel-burning appliance or fireplace shall not connect to a chimney passageway venting another appliance.

801.12 Chimney entrance. Connectors shall connect to a chimney flue at a point not less than 305 mm (12 inches) above the lowest portion of the interior of the chimney flue.

801.13 Cleanouts. Masonry chimney flues shall be provided with a cleanout opening having a minimum height of 150 mm (6 inches). The upper edge of the opening shall be located not less than 150 mm (6 inches) below the lowest chimney inlet opening. The cleanout shall be provided with a tight-fitting, noncombustible cover.

Exception: Cleanouts shall not be required for chimney flues serving masonry fireplaces, if such flues are provided with access through the fireplace opening.

801.14 Connections to exhauster. Appliance connections to a chimney or vent equipped with a power exhauster shall be made on the inlet side of the exhauster. Joints and piping on the positive pressure side of the exhauster shall be listed for positive pressure applications as specified by the manufacturer's installation instructions for the exhauster.

801.15 Fuel-fired appliances. Masonry chimneys utilized to vent fuel-fired appliances shall be located, constructed and sized as specified in the manufacturer's installation instructions for the appliances being vented.

801.16 Flue lining. Masonry chimneys shall be lined. The lining material shall be compatible with the type of appliance connected, in accordance with the appliance listing and manufacturer's installation instructions. Listed materials used as

flue linings shall be installed in accordance with their listings and the manufacturer's instructions.

801.16.1 Residential and low-heat appliances (general). Flue lining systems for use with residential-type and low-heat appliances shall be limited to the following:

1. Clay flue lining complying with the requirements of ASTM C315 or equivalent. Clay flue lining shall be installed in accordance with the *Jamaica Building Code*.
2. *Listed* and *labeled* chimney lining systems complying with UL 1777.
3. Other *approved* materials that will resist, without cracking, softening or corrosion, flue gases and condensate at temperatures up to 982°C (1,800°F).

801.17 Space around lining. The space surrounding a flue lining system or other vent installed within a masonry *chimney* shall not be used to vent any other *appliance*. This shall not prevent the installation of a separate flue lining in accordance with the manufacturer's installation instructions and this code.

801.18 Existing chimneys and vents. Where an *appliance* is permanently disconnected from an existing *chimney* or vent, or where an *appliance* is connected to an existing *chimney* or vent during the process of a new installation, the *chimney* or vent shall comply with Sections 801.18.1 through 801.18.4.

801.18.1 Size. The *chimney* or vent shall be resized as necessary to control flue gas condensation in the interior of the *chimney* or vent and to provide the *appliance* or *appliances* served with the required draft. For the venting of oil-fired *appliances* to masonry chimneys, the resizing shall be in accordance with NFPA 31.

801.18.2 Flue passageways. The flue gas passageway shall be free of obstructions and combustible deposits and shall be cleaned if previously used for venting a solid or liquid fuel-burning *appliance* or fireplace. The flue liner, *chimney* inner wall or vent inner wall shall be continuous and shall be free of cracks, gaps, perforations or other damage or deterioration that would allow the escape of *combustion* products, including gases, moisture and creosote. Where an oil-fired *appliance* is connected to an existing masonry *chimney*, such *chimney* flue shall be repaired or relined in accordance with NFPA 31.

801.18.3 Cleanout. Masonry chimneys shall be provided with a cleanout opening complying with Section 801.13.

801.18.4 Clearances. Chimneys and vents shall have airspace *clearance* to combustibles in accordance with the *Jamaica Building Code* and the *chimney* or vent manufacturer's installation instructions.

Exception: Masonry chimneys without the required airspace *clearances* shall be permitted to be used if lined or relined with a *chimney* lining system *listed* for use in chimneys with reduced *clearances* in accordance with UL 1777. The *chimney clearance* shall be not less than permitted by the terms of the *chimney* liner listing and the manufacturer's instructions.

801.18.4.1 Fireblocking. Noncombustible fireblocking shall be provided in accordance with the *Jamaica Building Code*.

801.19 Multistory prohibited. Common venting systems for appliances located on more than one floor level shall be prohibited, except where all of the appliances served by the common vent are located in rooms or spaces that are accessed only from the outdoors. The *appliance* enclosures shall not communicate with the occupiable areas of the building.

801.20 Plastic vent joints. Plastic pipe and fittings used to vent appliances shall be installed in accordance with the *appliance* manufacturer's installation instructions.

SECTION 802 VENTS

802.1 General. Vent systems shall be *listed* and *labeled*. Type L vents and pellet vents shall be tested in accordance with UL 641.

802.2 Vent application. The application of vents shall be in accordance with Table 802.2.

**TABLE 802.2
VENT APPLICATION**

VENT TYPES	APPLIANCE TYPES
Type L oil vents	Oil-burning appliances listed and labeled for venting with Type L vents; gas appliances listed and labeled for venting with Type B vents.
Pellet vents	Pellet fuel-burning appliances listed and labeled for venting with pellet vents.

802.3 Installation. Vent systems shall be sized, installed and terminated in accordance with the vent and *appliance* manufacturer's installation instructions.

802.4 Vent termination caps required. Type L vents shall terminate with a *listed* and *labeled* cap in accordance with the vent manufacturer's installation instructions.

802.5 Type L vent terminations. Type L vents shall terminate not less than 610 mm (2 feet) above the highest point of the roof penetration and not less than 610 mm (2 feet) higher than any portion of a building within 3050 mm (10 feet).

802.6 Minimum vent heights. Vents shall terminate not less than 1525 mm (5 feet) in vertical height above the highest connected *appliance* flue collar.

Exceptions:

1. Venting systems of direct vent *appliances* shall be installed in accordance with the *appliance* and the vent manufacturer's instructions.
2. *Appliances listed* for outdoor installations incorporating integral venting means shall be installed in accordance with their listings and the manufacturer's installation instructions.
3. Pellet vents shall be installed in accordance with the *appliance* and the vent manufacturer's installation instructions.

802.7 Support of vents. All portions of vents shall be adequately supported for the design and weight of the materials employed.

802.8 Insulation shield. Where vents pass through insulated assemblies, an insulation shield constructed of not less than No. 26 gage sheet metal shall be installed to provide *clear-*

ance between the vent and the insulation material. The clearance shall be not less than the clearance to combustibles specified by the vent manufacturer's installation instructions. Where vents pass through attic space, the shield shall terminate not less than 51 mm (2 inches) above the insulation materials and shall be secured in place to prevent displacement. Insulation shields provided as part of a listed vent system shall be installed in accordance with the manufacturer's installation instructions.

802.9 Door swing. Appliance and equipment vent terminals shall be located such that doors cannot swing within 305 mm (12 inches) horizontally of the vent terminals. Doorstops or closers shall not be installed to obtain this clearance.

SECTION 803 CONNECTORS

803.1 Connectors required. Connectors shall be used to connect appliances to the vertical chimney or vent, except where the chimney or vent is attached directly to the appliance.

803.2 Location. Connectors shall be located entirely within the room in which the connecting appliance is located, except as provided for in Section 803.10.4. Where passing through an unheated space, a connector shall not be constructed of single-wall pipe.

803.3 Size. The connector shall not be smaller than the size of the flue collar supplied by the manufacturer of the appliance. Where the appliance has more than one flue outlet, and in the absence of the manufacturer's specific instructions, the connector area shall be not less than the combined area of the flue outlets for which it acts as a common connector.

803.4 Branch connections. Branch connections to the vent connector shall be made in accordance with the vent manufacturer's instructions.

803.5 Manual dampers. Manual dampers shall not be installed in connectors except in chimney connectors serving solid fuel-burning appliances.

803.6 Automatic dampers. Automatic dampers shall be listed and labeled in accordance with UL 17 for oil-fired heating appliances. The dampers shall be installed in accordance with the manufacturer's instructions. An automatic vent damper device shall not be installed on an existing appliance unless the appliance is listed and labeled and the device is installed in accordance with the terms of its listing. The name of the installer and date of installation shall be marked on a label affixed to the damper device.

803.7 Connectors serving two or more appliances. Where two or more connectors enter a common vent or chimney, the smaller connector shall enter at the highest level consistent with available headroom or clearance to combustible material.

803.8 Vent connector construction. Vent connectors shall be constructed of metal. The minimum thickness of the connector shall be 0.345 mm [0.0136 inch (No. 28 gage)] for galvanized steel, 0.6 mm [0.022 inch (No. 26 B & S gage)] for copper, and 0.5 mm [0.020 inch (No. 24 B & S gage)] for aluminium.

TABLE 803.9(1)
MINIMUM CHIMNEY CONNECTOR
THICKNESS FOR LOW-HEAT APPLIANCES

DIAMETER OF CONNECTOR (millimetres)	MINIMUM NOMINAL THICKNESS (galvanized) (millimetres)
125 and smaller	0.5588
Larger than 125 and up to 255	0.7112
Larger than 255 and up to 405	0.8636
Larger than 405	1.6256

For SI: 1 mm = 0.0394 inch.

TABLE 803.9(2)
MINIMUM CHIMNEY CONNECTOR
THICKNESS FOR MEDIUM- AND HIGH-HEAT APPLIANCES

AREA (square mm)	EQUIVALENT ROUND DIAMETER (mm)	MINIMUM THICKNESS (mm)
0 - 99,355	0 - 355	1.5
100,001 - 130,000	380 - 400	2
130,001 - 165,000	430 - 45	2.5
Greater than 165,000	Greater than 455	3.3

For Inch Pound Units: 1 mm = 0.03937 inch, 1 mm² = 0.0016 square inch.

803.9 Chimney connector construction. Chimney connectors for low-heat appliances shall be of sheet steel pipe having resistance to corrosion and heat not less than that of galvanized steel specified in Table 803.9(1). Connectors for medium-heat appliances and high-heat appliances shall be of sheet steel not less than the thickness specified in Table 803.9(2).

803.10 Installation. Connectors shall be installed in accordance with Sections 803.10.1 through 803.10.6.

803.10.1 Supports and joints. Connectors shall be supported in an approved manner, and joints shall be fastened with sheet metal screws, rivets or other approved means.

803.10.2 Length. The maximum horizontal length of a single-wall connector shall be 75 percent of the height of the chimney or vent.

803.10.3 Connection. The connector shall extend to the inner face of the *chimney* or vent liner, but not beyond. A connector entering a masonry *chimney* shall be cemented to masonry in an *approved* manner. Where thimbles are installed to facilitate removal of the connector from the masonry *chimney*, the thimble shall be permanently cemented in place with high-temperature cement.

803.10.4 Connector pass-through. *Chimney* connectors shall not pass through any floor or ceiling, nor through a fire-resistance-rated wall assembly. *Chimney* connectors for domestic-type *appliances* shall not pass through walls or partitions constructed of combustible material to reach a masonry *chimney* except where one of the following apply:

1. The connector is *labeled* for wall pass-through and is installed in accordance with the manufacturer's instructions.

2. The connector is put through a device *labeled* for wall pass-through.
3. The connector has a diameter not larger than 255 mm (10 inches) and is installed in accordance with one of the methods in Table 803.10.4. Concealed metal parts of the pass-through system in contact with flue gases shall be of stainless steel or equivalent material that resists corrosion, softening or cracking up to 980°C (1,800°F).

**TABLE 803.10.4
CHIMNEY CONNECTOR SYSTEMS AND CLEARANCES
TO COMBUSTIBLE WALL MATERIALS FOR DOMESTIC
HEATING APPLIANCES^{a, b, c, d}**

System A (305mm, clearance)	A 88.5 mm-thick brick wall shall be framed into the combustible wall. An 16 mm-thick fire-clay liner (ASTM C315 or equivalent) ^e shall be firmly cemented in the center of the brick wall maintaining a 305 mm clearance to combustibles. The clay liner shall run from the outer surface of the bricks to the inner surface of the chimney liner.
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System B (230mm, clearance)	A labeled solid-insulated factory-built chimney section (25 mm insulation) the same inside diameter as the connector shall be utilized. Sheet steel supports shall be fastened to the wall surface and to the chimney section. Fasteners shall not penetrate the chimney flue liner. The chimney length shall be flush with the masonry chimney liner and sealed to the masonry with water-insoluble refractory cement. Chimney manufacturers' parts shall be utilized to securely fasten the chimney connector to the chimney section.
System C (150 mm, clearance)	A steel ventilated thimble having a minimum thickness of 0.6 mm having two 25 mm air channels shall be installed with a steel chimney connector. Steel supports shall be cut to maintain a 150 mm clearance between the thimble and combustibles. The chimney connector and steel supports shall have a minimum thickness of 0.6 mm. One side of the support shall be fastened to the wall on all sides. Glass-fiber insulation shall fill the 150-mm space between the thimble and the supports.
System D (52 mm, clearance)	A labeled solid-insulated factory-built chimney section (25 mm insulation) with a diameter 50 mm larger than the chimney connector shall be installed with a steel chimney connector having a minimum thickness of 0.6 mm. Sheet steel supports shall be positioned to maintain a 50 mm clearance to combustibles and to hold the chimney connector to ensure that a 25 mm airspace surrounds the chimney connector through the chimney section. The steel support shall be fastened to the wall on all sides and the chimney section shall be fastened to the supports. Fasteners shall not penetrate the liner of the chimney section.

For Inch Pound Units 1 mm = 0.03937 inch, 1 W/m² · K = 6.944 Btu · in/ft² · h · °F

- Insulation material that is part of the wall pass-through system shall be noncombustible and shall have a thermal conductivity of 0.144 W/m² · K (1.0 Btu · in/ft² · h · °F) or less.
- b. All clearances and thicknesses are minimums.
- c. Materials utilized to seal penetrations for the connector shall be noncombustible.
- d. Connectors for all systems except System B shall extend through the wall pass-through system to the inner face of the flue liner.
- e. ASTM C315.

803.10.5 Pitch. Connectors shall rise vertically to the chimney or vent with a minimum pitch equal to one-fourth unit vertical in 12 units horizontal (2-percent slope).

803.10.6 Clearances. Connectors shall have a minimum clearance to combustibles in accordance with Table 803.10.6. The clearances specified in Table 803.10.6 apply, except where the listing and labeling of an appliance specifies a different clearance, in which case the labeled clearance shall apply. The clearance to combustibles for connectors shall be reduced only in accordance with Section 308.

**TABLE 803.10.6
CONNECTOR CLEARANCES TO
COMBUSTIBLES**

TYPE OF APPLIANCE	MINIMUM CLEARANCE (mm)
Domestic-type appliances	
Chimney and vent connectors	455
Electric and oil incinerators	455
Oil and solid-fuel appliances	455
Oil appliances labeled for venting with Type L vents	230
Commercial, industrial-type appliances	
Low-heat appliances	
Chimney connectors	
Oil and solid-fuel boilers, furnace and water heaters	455
Oil unit heaters	455
Other low-heat industrial appliances	455
Medium-heat appliances	
Chimney connectors	
All oil and solid-fuel appliances	915
High-heat appliances	
Masonry or metal connectors	(As determined by the code official)
All oil and solid-fuel appliances	(As determined by the code official)

For Inch Pound Units: 1 mm = 0.03937 inch.

**SECTION 804
DIRECT-VENT, INTEGRAL VENT AND
MECHANICAL DRAFT SYSTEMS**

804.1 Direct-vent terminations. Vent terminals for direct-vent appliances shall be installed in accordance with the manufacturer's instructions.

804.2 Appliances with integral vents. Appliances incorporating integral venting means shall be installed in accordance with their listings and the manufacturer's installation instructions.

804.2.1 Terminal clearances. Appliances designed for natural draft venting and incorporating integral venting means shall be located so that a minimum clearance of (230 mm (9 inches) is maintained between vent terminals and from any openings through which combustion products enter the building. Appliances using forced draft venting shall be located so that a minimum clearance of 305 mm (12 inches) is maintained between vent terminals and from

any openings through which *combustion* products enter the building.

804.3 Mechanical draft systems. Mechanical draft systems of either forced or induced draft design shall be listed and labeled in accordance with UL 378 and shall comply with Sections 804.3.1 through 804.3.8.

804.3.1 Forced draft systems. Forced draft systems and all portions of induced draft systems under positive pressure during operation shall be designed and installed so as to be gas tight to prevent leakage of *combustion* products into a building.

804.3.2 Automatic shutoff. Power exhausters serving automatically fired *appliances* shall be electrically connected to each *appliance* to prevent operation of the *appliance* when the power exhauster is not in operation.

804.3.3 Termination. The termination of *chimneys* or vents equipped with power exhausters shall be located not less than 3050 mm (10 feet) from the lot line or from adjacent buildings. The exhaust shall be directed away from the building.

804.3.4 Horizontal terminations. Horizontal terminations shall comply with the following requirements:

1. Where located adjacent to walkways, the termination of mechanical draft systems shall be not less than 2150 mm (7 feet) above the level of the walkway.
2. Vents shall terminate not less than 915 mm (3 feet) above any forced air inlet located within 3050 mm (10 feet).
3. The vent system shall terminate not less than 1220 mm (4 feet) below, 1220 mm (4 feet) horizontally from or 305 mm (1 foot) above any door, window or gravity air inlet into the building.
4. The vent termination point shall not be located closer than 915 mm (3 feet) to an interior corner formed by two walls perpendicular to each other.
5. The vent termination shall not be mounted directly above or within 915 mm (3 feet) horizontally from an oil tank vent or gas meter.
6. The bottom of the vent termination shall be located not less than 305 mm (1 foot) above finished grade.

804.3.5 Vertical terminations. Vertical terminations shall comply with the following requirements:

1. Where located adjacent to walkways, the termination of mechanical draft systems shall be not less than 2135 mm (7 feet) above the level of the walkway.
2. Vents shall terminate not less than 915 mm (3 feet) above any forced air inlet located within 3050 mm (10 feet)3050 mm (10 feet) horizontally.
3. Where the vent termination is located below an adjacent roof structure, the termination point shall be located not less than 915 mm (3 feet)

from such structure.

4. The vent shall terminate not less than 1220 mm (4 feet) below, than 1220 mm (4 horizontally from or 305 mm (1 foot) above any door, window or gravity air inlet for the building.
5. A vent cap shall be installed to prevent rain from entering the vent system.
6. The vent termination shall be located not less than 915 mm (3 feet) horizontally from any portion of the roof structure.

804.3.6 Exhauster connections. An *appliance* vented by natural draft shall not be connected into a vent, *chimney* or vent connector on the discharge side of a mechanical flue exhauster.

804.3.7 Exhauster sizing. Mechanical flue exhausters and the vent system served shall be sized and installed in accordance with the manufacturer's installation instructions.

804.3.8 Mechanical draft systems for manually fired appliances and fireplaces. A mechanical draft system shall be permitted to be used with manually fired appliances and fireplaces where such system complies with all of the following requirements:

1. The mechanical draft device shall be listed and labeled in accordance with UL 378, and shall be installed in accordance with the manufacturer's instructions.
2. A device shall be installed that produces visible and audible warning upon failure of the mechanical draft device or loss of electrical power, at any time that the mechanical draft device is turned on. This device shall be equipped with a battery backup if it receives power from the building wiring.
3. A smoke detector shall be installed in the room with the *appliance* or fireplace. This device shall be equipped with a battery backup if it receives power from the building wiring.

SECTION 805 FACTORY-BUILT CHIMNEYS

805.1 Listing. Factory-built *chimneys* shall be *listed* and *labeled* and shall be installed and terminated in accordance with the manufacturer's installation instructions.

805.2 Solid fuel appliances. Factory-built *chimneys* installed in *dwelling units* with solid fuel-burning appliances shall comply with the Type HT requirements of UL 103 and shall be marked "Type HT" and "Residential Type and Building Heating Appliance Chimney."

Exception: *Chimneys* for use with open *combustion* chamber fireplaces shall comply with the requirements of UL 103 and shall be marked "Residential Type and Building Heating Appliance Chimney."

Chimneys for use with open *combustion* chamber appliances installed in buildings other than *dwelling units* shall comply with the requirements of UL 103 and shall be marked "Building Heating Appliance Chimney" or "Residential Type and Building Heating Appliance Chimney."

805.3 Factory-built chimney offsets. Where a factory-built chimney assembly incorporates offsets, no part of the chimney shall be at an angle of more than 30 degrees (0.52 rad) from vertical at any point in the assembly and the chimney assembly shall not include more than four elbows.

805.4 Support. Where factory-built *chimneys* are supported by structural members, such as joists and rafters, such members shall be designed to support the additional load.

805.5 Medium-heat appliances. Factory-built *chimneys* for medium-heat appliances producing flue gases having a temperature above 538°C (1,000°F) measured at the entrance to the *chimney* shall comply with UL 959.

805.6 Decorative shrouds. Decorative shrouds shall not be installed at the termination of factory-built *chimneys* except where such shrouds are *listed* and *labeled* for use with the specific factory-built *chimney* system and are installed in accordance with Section 304.1.

805.7 Insulation shield. Where factory-built chimneys pass through insulated assemblies, an insulation shield constructed of steel having a thickness of not less than 0.4712 mm [0.0187 inch (No. 26 gage)] shall be installed to provide clearance between the chimney and the insulation material. The clearance shall be not less than the clearance to combustibles specified by the chimney manufacturer's installation instructions. Where chimneys pass through attic space, the shield shall terminate not less than 51 mm (2 inches) above the insulation materials and shall be secured in place to prevent displacement. Insulation shields provided as part of a listed chimney system shall be installed in accordance with the manufacturer's instructions.

SECTION 806 METAL CHIMNEYS

806.1 General. Metal *chimneys* shall be constructed and installed in accordance with NFPA 211.

CHAPTER 9

SPECIFIC APPLIANCES, FIREPLACES AND SOLID FUEL-BURNING EQUIPMENT

User note:

About this chapter: Chapter 9 focuses on specific types of appliances and fireplaces. It also addresses heat-rejection equipment, combustion engines, gas turbines, kilns, fuel cells, evaporative coolers, radiant heating systems and hydrogen systems.

SECTION 901 GENERAL

901.1 Scope. This chapter shall govern the approval, design, installation, construction, maintenance, *alteration* and repair of the appliances and *equipment* specifically identified herein and factory-built fireplaces. The approval, design, installation, construction, maintenance, *alteration* and repair of gas-fired appliances shall be regulated by the *Jamaica Fuel Gas Code*.

901.2 General. The requirements of this chapter shall apply to the mechanical *equipment* and appliances regulated by this chapter, in addition to the other requirements of this code.

901.3 Hazardous locations. Fireplaces and solid fuel-burning appliances shall not be installed in hazardous locations.

901.4 Solid fuel-burning fireplaces and appliances in Group I-2, Condition 2. In Group I-2, Condition 2 occupancies, solid fuel-burning fireplaces and appliances are prohibited.

SECTION 902 MASONRY FIREPLACES

902.1 General. Masonry fireplaces shall be constructed in accordance with the *Jamaica Building Code*.

902.2 Fireplace accessories. Listed and labeled fireplace accessories shall be installed in accordance with the conditions of the listing and the manufacturer's instructions. Fireplace accessories shall comply with UL 907.

SECTION 903 FACTORY-BUILT FIREPLACES

903.1 General. Factory-built fireplaces shall be *listed* and *labeled* and shall be installed in accordance with the conditions of the listing. Factory-built fireplaces shall be tested in accordance with UL 127.

903.2 Hearth extensions. Hearth extensions of approved factory-built fireplaces shall be installed in accordance with the listing of the fireplace. The hearth extension shall be readily distinguishable from the surrounding floor area. Listed and labeled hearth extensions shall comply with UL 1618.

903.3 Unvented gas log heaters. An unvented gas log heater shall not be installed in a factory-built fireplace unless the

fireplace system has been specifically tested, *listed* and *labeled* for such use in accordance with UL 127.

903.4 Gasketed fireplace doors. A gasketed fireplace door shall not be installed on a factory-built fireplace except where the fireplace system has been specifically tested, listed and labeled for such use in accordance with UL 127.

SECTION 904 PELLET FUEL-BURNING APPLIANCES

904.1 General. Pellet fuel-burning appliances shall be *listed* and *labeled* in accordance with ASTM E1509 and shall be installed in accordance with the terms of the listing.

904.2 Permitted places of use. The building official may allow pellet fuel-burning appliances to be installed and operated within commercial, industrial and institutional buildings but only in detached single family residential buildings. In granting a permit to install and operate this type of appliance the building official shall ascertain that satisfactory forced combustion air extraction means is in place to remove the products of combustion as they are generated.

SECTION 905 FIREPLACE STOVES AND ROOM HEATERS

905.1 General. Fireplace stoves and solid-fuel-type room heaters shall be *listed* and *labeled* and shall be installed in accordance with the conditions of the listing. Fireplace stoves shall be tested in accordance with UL 737. Solid-fuel-type room heaters shall be tested in accordance with UL 1482. Fireplace inserts intended for installation in fireplaces shall be *listed* and *labeled* in accordance with the requirements of UL 1482 and shall be installed in accordance with the manufacturer's instructions.

905.2 Connection to fireplace. The connection of solid fuel appliances to *chimney* flues serving fireplaces shall comply with Sections 801.7 and 801.10.

905.3 Hearth extensions. Hearth extensions for fireplace stoves shall be installed in accordance with the listing of the fireplace stove. The hearth extension shall be readily distinguishable from the surrounding floor area. Listed and labeled hearth extensions shall comply with UL 1618.

SECTION 906 FACTORY-BUILT BARBECUE APPLIANCES

906.1 General. Factory-built barbecue appliances shall be of an *approved* type and shall be installed in accordance with the manufacturer's instructions, this chapter and Chapters 3, 5, 7 and 8, and the *Jamaica Fuel Gas Code*.

SECTION 907 INCINERATORS AND CREMATORIES

907.1 General. Incinerators and crematories shall be *listed* and *labeled* in accordance with UL 791 and shall be installed in accordance with the manufacturer's instructions **and the building official permit requirements.**

SECTION 908 COOLING TOWERS, EVAPORATIVE CONDENSERS AND FLUID COOLERS

908.1 General. A cooling tower used in conjunction with an air-conditioning *appliance* shall be installed in accordance with the manufacturer's instructions. Factory-built cooling towers shall be listed in accordance with UL 1995.

908.2 Access. Cooling towers, evaporative condensers and fluid coolers shall be provided with ready access.

908.3 Location. Cooling towers, evaporative condensers and fluid coolers shall be located to prevent the discharge vapor plumes from entering occupied spaces. Plume discharges shall be not less than 1,525 mm (5 feet) above or 6,100 mm (20 feet) away from any ventilation inlet to a building. Location on the property shall be as required for buildings in accordance with the *Jamaica Building Code*.

908.4 Support and anchorage. Supports for cooling towers, evaporative condensers and fluid coolers shall be designed in accordance with the *Jamaica Building Code*. Seismic restraints shall be as required by the *Jamaica Building Code*.

908.5 Water supply. Cooling towers, evaporative coolers and fluid coolers shall be provided with an approved water supply, sized for peak demand. The quality of water shall be provided in accordance with the equipment manufacturer's recommendations. The piping system and protection of the potable water supply system shall be installed as required by the *Jamaica Plumbing Code*.

908.6 Drainage. Drains, overflows and blowdown provisions shall be indirectly connected to an *approved* disposal location. Discharge of chemical waste shall be *approved* by the appropriate regulatory authority.

908.7 Refrigerants and hazardous fluids. Heat exchange *equipment* that contains a refrigerant and that is part of a closed refrigeration system shall comply with Chapter 11. Heat exchange *equipment* containing heat transfer fluids which are flammable, combustible or hazardous shall comply with the *Jamaica Fire Code*.

908.8 Cooling towers. Cooling towers, both open circuit and closed circuit type, and evaporative condensers shall comply with Sections 908.8.1 and 908.8.2.

908.8.1 Conductivity or flow-based control of cycles of concentration. Cooling towers and evaporative condensers shall include controls that automate system bleed based on conductivity, fraction of metered makeup volume, metered bleed volume, recirculating pump run time or bleed time.

908.8.2 Drift eliminators. Cooling towers and evaporative condensers shall be equipped with drift eliminators that have a maximum drift rate of 0.005 percent of the cir-

culated water flow rate as established in the equipment's design specifications.

SECTION 909 VENTED WALL FURNACES

909.1 General. Vented wall furnaces shall be installed in accordance with their listing and the manufacturer's instructions. Oil-fired furnaces shall be tested in accordance with UL 730.

909.2 Location. Vented wall furnaces shall be located so as not to cause a fire hazard to walls, floors, combustible furnishings or doors. Vented wall furnaces installed between bathrooms and adjoining rooms shall not circulate air from bathrooms to other parts of the building.

909.3 Door swing. Vented wall furnaces shall be located so that a door cannot swing within 305 mm (12 inches) of an air inlet or air outlet of such furnace measured at right angles to the opening. Doorstops or door closers shall not be installed to obtain this *clearance*.

909.4 Ducts prohibited. Ducts shall not be attached to wall furnaces. Casing extension boots shall not be installed unless *listed* as part of the *appliance*.

909.5 Manual shutoff valve. A manual shutoff valve shall be installed ahead of all controls.

909.6 Access. Vented wall furnaces shall be provided with access for cleaning of heating surfaces, removal of burners, replacement of sections, motors, controls, filters and other working parts, and for adjustments and lubrication of parts requiring such attention. Panels, grilles and access doors that must be removed for normal servicing operations shall not be attached to the building construction.

SECTION 910 FLOOR FURNACES

910.1 General. Floor furnaces shall be installed in accordance with their listing and the manufacturer's instructions. Oil-fired furnaces shall be tested in accordance with UL 729.

910.2 Placement. Floor furnaces shall not be installed in the floor of any aisle or passageway of any auditorium, public hall, place of assembly, or in any egress element from any such room or space.

With the exception of wall register models, a floor furnace shall not be placed closer than 150 mm (6 inches) to the nearest wall, and wall register models shall not be placed closer than 150 mm (6 inches) to a corner.

The furnace shall be placed such that a drapery or similar combustible object will not be nearer than 305 mm (12 inches) to any portion of the register of the furnace. Floor furnaces shall not be installed in concrete floor construction built on grade. The controlling thermostat for a floor furnace shall be located within the same room or space as the floor furnace or shall be located in an adjacent room or space that is permanently open to the room or space containing the floor furnace.

910.3 Bracing. The floor around the furnace shall be braced and headed with a support framework design in accordance with the *Jamaica Building Code*.

Commented [KE13]: Follow Up: 12 inches (305 mm)305 mm (12 inches)

910.4 Clearance. The lowest portion of the floor furnace shall have not less than a 150 mm (6 inch) clearance from the grade level; except where the lower 150 mm (6 inch) portion of the floor furnace is sealed by the manufacturer to prevent entrance of water, the minimum clearance shall be reduced to not less than 51 mm (2 inches). Where these clearances are not present, the ground below and to the sides shall be excavated to form a pit under the furnace so that the required clearance is provided beneath the lowest portion of the furnace. A 305 mm (12-inch) minimum clearance shall be provided on all sides except the control side, which shall have an 455 mm (18-inch) minimum clearance.

SECTION 911 DUCT FURNACES

911.1 General. Duct furnaces shall be installed in accordance with the manufacturer's instructions. Electric duct furnaces shall comply with UL 1996.

SECTION 912 INFRARED RADIANT HEATERS

912.1 General. Electric infrared radiant heaters shall comply with UL 499.

912.2 Support. Infrared radiant heaters shall be fixed in a position independent of fuel and electric supply lines. Hangers and brackets shall be noncombustible material.

912.3 Clearances. Heaters shall be installed with clearances from combustible material in accordance with the manufacturer's installation instructions.

SECTION 913 CLOTHES DRYERS

913.1 General. Clothes dryers shall be installed in accordance with the manufacturer's instructions. Electric residential clothes dryers shall be tested in accordance with UL 2158. Electric coin-operated clothes dryers shall be tested in accordance with UL 2158. Electric commercial clothes dryers shall be tested in accordance with UL 1240.

913.2 Exhaust required. Clothes dryers shall be exhausted in accordance with Section 504.

913.3 Clearances. Clothes dryers shall be installed with clearance to combustibles in accordance with the manufacturer's instructions.

SECTION 914 SAUNA HEATERS

914.1 Location and protection. Sauna heaters shall be located so as to minimize the possibility of accidental contact by a person in the room.

914.1.1 Guards. Sauna heaters shall be protected from accidental contact by an *approved* guard or barrier of material having a low coefficient of thermal conductivity. The guard shall not substantially affect the transfer of heat from the heater to the room.

914.2 Installation. Sauna heaters shall be *listed* and *labeled* in accordance with UL 875 and shall be installed in accordance with their listing and the manufacturer's instructions.

914.3 Access. Panels, grilles and access doors that are required to be removed for normal servicing operations shall not be attached to the building.

914.4 Heat and time controls. Sauna heaters shall be equipped with a thermostat that will limit room temperature to 90°C (194°F). If the thermostat is not an integral part of the sauna heater, the heat-sensing element shall be located within 150mm (6 inches) of the ceiling. If the heat-sensing element is a capillary tube and bulb, the assembly shall be attached to the wall or other support, and shall be protected against physical damage.

914.4.1 Timers. A timer, if provided to control main burner operation, shall have a maximum operating time of 1 hour. The control for the timer shall be located outside the sauna room.

914.5 Sauna room. A ventilation opening into the sauna room shall be provided. The opening shall be not less than 100 mm by 205 mm (4 inches by 8 inches) located near the top of the door into the sauna room.

914.5.1 Warning notice. The following permanent notice, constructed of *approved* material, shall be mechanically attached to the sauna room on the outside:

WARNING: DO NOT EXCEED 30 MINUTES IN SAUNA. EXCESSIVE EXPOSURE CAN BE HARMFUL TO HEALTH. ANY PERSON WITH POOR HEALTH SHOULD CONSULT A PHYSICIAN BEFORE USING SAUNA.

The words shall contrast with the background and the wording shall be in letters not less than 6.35 mm (1/4 inch) high.

Exception: This section shall not apply to one- and two-family dwellings.

SECTION 915 ENGINE AND GAS TURBINE-POWERED EQUIPMENT AND APPLIANCES

915.1 General. The installation of liquid-fueled stationary internal *combustion* engines and gas turbines, including exhaust, fuel storage and piping, shall meet the requirements of NFPA 37. Stationary engine generator assemblies shall meet the requirements of UL 2200.

915.2 Powered equipment and appliances. Permanently installed *equipment* and appliances powered by internal *combustion* engines and turbines shall be installed in accordance with the manufacturer's instructions and NFPA 37.

SECTION 916 POOL AND SPA HEATERS

916.1 General. Pool and spa heaters shall be installed in accordance with the manufacturer's instructions. Oil-fired pool and spa heaters shall be tested in accordance with UL 726. Electric pool and spa heaters shall be tested in accor-

dance with UL 1261. Pool and spa heat pump water heaters shall comply with UL 1995 or CSA C22.2 No. 236.

Exception: Portable residential spas and portable residential exercise spas shall comply with UL 1563 or CSA C22.2 No. 218.1.

SECTION 917 COOKING APPLIANCES

917.1 Cooking appliances. Cooking appliances that are designed for permanent installation, including ranges, ovens, stoves, broilers, grills, fryers, griddles and barbecues, shall be *listed, labeled* and installed in accordance with the manufacturer's instructions. Commercial electric cooking appliances shall be *listed* and *labeled* in accordance with UL 197. Household electric ranges shall be *listed* and *labeled* in accordance with UL 858. Microwave cooking appliances shall be *listed* and *labeled* in accordance with UL 923. Oil-burning stoves shall be *listed* and *labeled* in accordance with UL 896. Solid-fuel-fired ovens shall be *listed* and *labeled* in accordance with UL 2162.

917.2 Domestic appliances. Cooking appliances installed within *dwelling units* and within areas where domestic cooking operations occur shall be *listed* and *labeled* as household-type appliances for domestic use.

SECTION 918 FORCED-AIR WARM-AIR FURNACES

918.1 Forced-air furnaces. Oil-fired furnaces shall be tested in accordance with UL 727. Electric furnaces shall be tested in accordance with UL 1995. Solid fuel furnaces shall be tested in accordance with UL 391. Forced-air furnaces shall be installed in accordance with the listings and the manufacturer's instructions.

918.2 Heat pumps. Electric heat pumps shall be tested in accordance with UL 1995.

918.3 Dampers. Volume dampers shall not be placed in the air inlet to a furnace in a manner that will reduce the required air to the furnace.

918.4 Circulating air ducts for forced-air warm-air furnaces. Circulating air for fuel-burning, forced-air-type, warm-air furnaces shall be conducted into the blower housing from outside the furnace enclosure by continuous air-tight ducts.

918.5 Outdoor and return air openings. Outdoor intake openings shall be located in accordance with Section 401.4. Return air openings shall be located in accordance with Section 601.5.

918.6 Outdoor opening protection. Outdoor air intake openings shall be protected in accordance with Section 401.5.

SECTION 919 CONVERSION BURNERS

919.1 Conversion burners. The installation of conversion burners shall conform to ANSI Z21.8.

SECTION 920 UNIT HEATERS

920.1 General. Unit heaters shall be installed in accordance with the listing and the manufacturer's instructions. Oil-fired unit heaters shall be tested in accordance with UL 731.

920.2 Support. Suspended-type unit heaters shall be supported by elements that are designed and constructed to accommodate the weight and dynamic loads. Hangers and brackets shall be of noncombustible material. Suspended-type oil-fired unit heaters shall be installed in accordance with NFPA 31.

920.3 Ductwork. A unit heater shall not be attached to a warm-air duct system unless *listed* for such installation.

SECTION 921 VENTED ROOM HEATERS

921.1 General. Vented room heaters shall be *listed* and *labeled* and shall be installed in accordance with the conditions of the listing and the manufacturer's instructions.

SECTION 922 KEROSENE AND OIL-FIRED STOVES

922.1 General. Kerosene and oil-fired stoves shall be listed and labeled and shall be installed in accordance with the conditions of the listing and the manufacturer's instructions. Kerosene and oil-fired stoves shall comply with NFPA 31 and UL 896.

SECTION 923 SMALL CERAMIC KILNS

923.1 General. Kilns shall be listed and labeled unless otherwise approved in accordance with Section 105.2. Electric kilns shall comply with UL 499. The approval of unlisted appliances in accordance with Section 105.2 shall be based on approved engineering evaluation.

923.1.1 Installation. Kilns shall be installed in accordance with the manufacturer's instructions and the provisions of this code.

SECTION 924 STATIONARY FUEL CELL POWER SYSTEMS

924.1 General. Stationary fuel cell power systems having a power output not exceeding 10 MW shall be tested in accordance with ANSI/CSA America FC 1 and shall be installed in accordance with the manufacturer's instructions, NFPA 853, the *Jamaica Building Code* and the *Jamaica Fire Code*.

SECTION 925 MASONRY HEATERS

925.1 General. Masonry heaters shall be constructed in accordance with the *Jamaica Building Code*.

**SECTION 926
GASEOUS HYDROGEN SYSTEMS**

926.1 Installation. The installation of gaseous hydrogen systems shall be in accordance with the applicable requirements of this code, the *Jamaica Fire Code*, the *Jamaica Fuel Gas Code* and the *Jamaica Building Code*.

**SECTION 927
RADIANT HEATING SYSTEMS**

927.1 General. Electric radiant heating systems shall be installed in accordance with the manufacturer's instructions and shall be listed for the application.

927.2 Clearances. Clearances for radiant heating panels or elements to any wiring, outlet boxes and junction boxes used for installing electrical devices or mounting luminaires shall be in accordance with the *Jamaica Building Code* and the *Jamaica Electrical Code*.

927.3 Installation on wood or steel framing. Radiant panels installed on wood or steel framing shall conform to the following requirements:

1. Heating panels shall be installed parallel to framing members and secured to the surface of framing members or shall be mounted between framing members.
2. Mechanical fasteners shall penetrate only the unheated portions provided for this purpose. Panels shall not be fastened at any point closer than 6.35 mm ($1/4$ inch) to an element. Other methods of attachment of the panels shall be in accordance with the panel installation instructions.
3. Unless listed and labeled for field cutting, heating panels shall be installed as complete units.

927.4 Installation in concrete or masonry. Radiant heating systems installed in concrete or masonry shall conform to the following requirements:

1. Radiant heating systems shall be identified as being suitable for the installation, and shall be secured in place as specified in the manufacturer's instructions.
2. Radiant heating panels and radiant heating panel sets shall not be installed where they bridge expansion joints unless they are protected from expansion and contraction.

927.5 Finish surfaces. Finish materials installed over radiant heating panels and systems shall be installed in accordance with the manufacturer's instructions. Surfaces shall be secured so that fasteners do not pierce the radiant heating elements.

**SECTION 928
EVAPORATIVE COOLING EQUIPMENT**

928.1 General. Evaporative cooling equipment shall:

1. Be installed in accordance with the manufacturer's instructions.
2. Be installed on level platforms in accordance with Section 304.10.

3. Have openings in exterior walls or roofs flashed in accordance with the *Jamaica Building Code*.

4. Be provided with an approved water supply, sized for peak demand. The quality of water shall be provided in accordance with the equipment manufacturer's recommendations. The piping system and protection of the potable water supply system shall be installed as required by the *Jamaica Plumbing Code*.

5. Have air intake opening locations in accordance with Section 401.4.

**SECTION 929
HIGH-VOLUME LARGE-DIAMETER FANS**

929.1 General. Where provided, high-volume large-diameter fans shall be tested and labeled in accordance with AMCA 230, listed and labeled in accordance with UL 507, and installed in accordance with the manufacturer's instructions.

CHAPTER 10

BOILERS, WATER HEATERS AND PRESSURE VESSELS

User note:

About this chapter: Chapter 10 addresses boilers, water heaters, expansion tanks and pressure vessels in general, such as compressed air vessels. This chapter includes requirements for components of hydronic HVAC systems, with the focus being on safety, maintenance, testing and safety control devices.

SECTION 1001 GENERAL

1001.1 Scope. This chapter shall govern the installation, alteration and repair of boilers, water heaters and pressure vessels.

Exceptions:

1. Pressure vessels used for unheated water supply.
2. Portable unfired pressure vessels and Interstate Commerce Commission containers.
3. Containers for bulk oxygen and medical gas.
4. Unfired pressure vessels having a volume of 0.14 m³ (5 cubic feet) or less operating at pressures not exceeding 1724 kPa (250 pounds per square inch psi) and located within occupancies of Groups B, F, H, M, R, S and U.
5. Pressure vessels used in refrigeration systems that are regulated by Chapter 11 of this code.
6. Pressure tanks used in conjunction with coaxial cables, telephone cables, power cables and other similar humidity control systems.
7. Any boiler or pressure vessel subject to inspection by **the factories or other statutorily empowered inspectors.**

SECTION 1002 WATER HEATERS

1002.1 General. Potable water heaters and hot water storage tanks shall be listed and labeled and installed in accordance with the manufacturer's instructions, the *Jamaica Plumbing Code* and this code. Water heaters shall be capable of being removed without first removing a permanent portion of the building structure. The potable water connections and relief valves for all water heaters shall conform to the requirements of the *Jamaica Plumbing Code*. Domestic electric water heaters shall comply with UL 174 or UL 1453 or other BSJ recognized standards. Commercial electric water heaters shall comply with UL 1453. Oil-fired water heaters shall comply with UL 732. Solidfuel-fired water heaters shall comply with UL 2523. Solar thermal water heating systems shall comply with Chapter 14 and ICC 900/SRCC 300.

1002.2 Water heaters utilized for space heating. Water heaters utilized both to supply potable hot water and provide hot water for space-heating applications shall be *listed and labeled* for such applications by the manufacturer and shall be installed in accordance with the manufacturer's instructions and the *Jamaica Plumbing Code*.

1002.2.1 Sizing. Water heaters utilized for both potable water heating and space-heating applications shall be sized to prevent the space-heating load from diminishing the required potable water-heating capacity.

1002.2.2 Temperature limitation. Where a combination potable water-heating and space-heating system requires water for space heating at temperatures higher than 60°C (140°F), a temperature-actuated mixing valve that conforms to ASSE 1017 shall be provided to temper the water supplied to the potable hot water distribution system to a temperature of 60°C (140°F) or less.

1002.3 Supplemental water-heating devices. Potable water-heating devices that utilize refrigerant-to-water heat exchangers shall be *approved* and installed in accordance with the *Jamaica Plumbing Code* and the manufacturer's instructions.

SECTION 1003 PRESSURE VESSELS

1003.1 General. All pressure vessels, unless otherwise approved, shall be constructed and certified in accordance with the *ASME Boiler and Pressure Vessel Code* or other approved standards/codes, and shall be installed in accordance with the manufacturer's instructions and nationally recognized standards. Directly fired pressure vessels shall meet the requirements of Section 1004. **Pressure vessels shall also meet the requirements of the Jamaica Factories Act and any other law governing their design, installation, use, maintenance or repair.**

1003.2 Piping. All piping materials, fittings, joints, connections and devices associated with systems utilized in conjunction with pressure vessels shall be designed for the specific application and shall be *approved*.

1003.3 Welding. Welding on pressure vessels shall be performed by a competent welder with at least level III certificate (or equivalent) from an accredited or HEART NTA recognized training and certification institution. Welding shall be carried out in accordance with an *approved* standard.

SECTION 1004 BOILERS

1004.1 Standards. Boilers shall be designed, constructed and certified in accordance with the *ASME Boiler and Pressure Vessel Code*, Section I or IV. Controls and safety devices for boilers with fuel input ratings of 3,662,500 W (12,500,000 Btu/hr) or less shall meet the requirements of ASME CSD-1. Controls and safety devices for boilers with inputs greater than 3,662,500 W (12,500,000 Btu/hr) shall meet the requirements of NFPA 85, or other BSJ approved standards. Packaged oil-fired boilers shall be listed and labeled in accordance with UL 726. Packaged elec

tric boilers shall be listed and labeled in accordance with UL 834. Solid-fuel-fired boilers shall be listed and labeled in accordance with UL 2523.

1004.2 Installation. In addition to the requirements of this code, the installation of boilers shall comply with the Factories Act and conform to the manufacturer's instructions. Operating instructions of a permanent type shall be attached to the boiler. Boilers shall have all controls set, adjusted and tested by the installer. The manufacturer's rating data and the nameplate shall be attached to the boiler.

1004.3 Working clearance. Clearances shall be maintained around boilers, generators, heaters, tanks and related equipment and appliances so as to permit inspection, servicing, repair, replacement and visibility of all measuring devices. Where boilers are installed or replaced, clearance shall be provided to allow access for inspection, maintenance and repair. Passageways around all sides of boilers shall have an unobstructed width of not less than 455 mm (18 inches), unless otherwise approved.

1004.3.1 Top clearance. Clearances from the tops of boilers to the ceiling or other overhead obstruction shall be in accordance with Table 1004.3.1.

**TABLE 1004.3.1
BOILER TOP CLEARANCES**

BOILER TYPE	MINIMUM CLEARANCES FROM TOP OF BOILER TO CEILING OR OTHER OVERHEAD OBSTRUCTION (mm)
All boilers with manholes on top of the boiler except where a greater clearance is required in this table.	915
All boilers without manholes on top of the boiler except high-pressure steam boilers and where a greater clearance is required in this table.	610
High-pressure steam boilers with steam generating capacity not exceeding 2,268 kg/h.	915
High-pressure steam boilers with steam generating capacity exceeding 2,268 kg/h.	2150
High-pressure steam boilers having heating surface not exceeding 93 m ² .	915
High-pressure steam boilers having heating surface in excess of 93 m ² .	2150
High-pressure steam boilers with input not exceeding 1,465 kW.	915
High-pressure steam boilers with input in excess of 1,465 kW.	2150
Steam-heating boilers and hot water heating boilers with input exceeding 1,465 kW.	915
Steam-heating boilers exceeding 2,268 kg/h.	915
Steam-heating boilers and hot water heating boilers having heating surface exceeding 93 m ² .	915

BOILER TYPE	MINIMUM CLEARANCES FROM TOP OF BOILER TO CEILING OR OTHER OVERHEAD OBSTRUCTION (mm)
All boilers with manholes on top of the boiler except where a greater clearance is required in this table.	915
All boilers without manholes on top of the boiler except high-pressure steam boilers and where a greater clearance is required in this table.	610
High-pressure steam boilers with steam generating capacity not exceeding 2,268 kg/h.	915
High-pressure steam boilers with steam generating capacity exceeding 2,268 kg/h.	2150
High-pressure steam boilers having heating surface not exceeding 93 m ² .	915
High-pressure steam boilers having heating surface in excess of 93 m ² .	2150
High-pressure steam boilers with input not exceeding 1,465 kW.	915
High-pressure steam boilers with input in excess of 1,465 kW.	2150
Steam-heating boilers and hot water heating boilers with input exceeding 1,465 kW.	915
Steam-heating boilers exceeding 2,268 kg/h.	915
Steam-heating boilers and hot water heating boilers having heating surface exceeding 93 m ² .	915

For Inch Pound Units: 1 mm = 0.00328 foot, 1 m² = 10.764 square foot, 1 kg/h = 2.2046 pound per hour, 1 W = 3.413 Btu/hr.

1004.4 Mounting. Equipment shall be set or mounted on a level base capable of supporting and distributing the weight contained thereon. Boilers, tanks and equipment shall be secured in accordance with the manufacturer's installation instructions.

1004.5 Floors. Boilers shall be mounted on floors of non-combustible construction, unless listed for mounting on combustible flooring.

1004.6 Boiler rooms and enclosures. Boiler rooms and enclosures and access thereto shall comply with the Jamaica Building Code and Chapter 3 of this code. Boiler rooms shall be equipped with a floor drain or other approved means for disposing of liquid waste.

1004.7 Operating adjustments and instructions. Hot water and steam boilers shall have all operating and safety controls set and operationally tested by the installing contractor. A complete control diagram and boiler operating instructions shall be furnished by the installer for each installation.

SECTION 1005

BOILER CONNECTIONS

1005.1 Valves. Every boiler or modular boiler shall have a shutoff valve in the supply and return piping. For multiple boiler or multiple modular boiler installations, each boiler or modular boiler shall have individual shutoff valves in the supply and return piping.

Exception: Shutoff valves are not required in a system having a single low-pressure steam boiler.

1005.2 Potable water supply. The water supply to all boilers shall be connected in accordance with the *Jamaica Plumbing Code*.

SECTION 1006 SAFETY AND PRESSURE RELIEF VALVES AND CONTROLS

1006.1 Safety valves for steam boilers. Steam boilers shall be protected with a safety valve.

1006.2 Safety relief valves for hot water boilers. Hot water boilers shall be protected with a safety relief valve.

1006.3 Pressure relief for pressure vessels. Pressure vessels shall be protected with a pressure relief valve or pressure-limiting device as required by the manufacturer's installation instructions for the pressure vessel.

1006.4 Approval of safety and safety relief valves. Safety and safety relief valves shall be *listed* and *labeled*, and shall have a minimum rated capacity for the *equipment* or appliances served. Safety and safety relief valves shall be set at not greater than the nameplate pressure rating of the boiler or pressure vessel.

1006.5 Installation. Safety or relief valves shall be installed directly into the safety or relief valve opening on the boiler or pressure vessel. Valves shall not be located on either side of a safety or relief valve connection. The relief valve shall discharge by gravity.

1006.6 Safety and relief valve discharge. Safety and relief valve discharge pipes shall be of rigid pipe that is approved for the temperature of the system. High-pressure-steam safety valves shall be vented to the outside of the structure. The discharge piping serving pressure relief valves, temperature relief valves and combinations of such valves shall:

1. Not be directly connected to the drainage system.
2. Discharge through an air break located in the same room as the appliance.
3. Not be smaller than the diameter of the outlet of the valve served and shall discharge full size to the air break.
4. Serve a single relief device and shall not connect to piping serving any other relief device or equipment.
5. Discharge to the floor, to the pan serving the boiler or storage tank, to a waste receptor or to the outdoors.
6. Discharge in a manner that does not cause personal injury or structural damage.

7. Discharge to a termination point that is readily observable by the building occupants.
8. Not be trapped.
9. Be installed so as to flow by gravity.
10. Not terminate more than 150 mm (6 inches) above the floor or waste receptor.
11. Not have a threaded connection at the end of such piping.
12. Not have valves or tee fittings.
13. Be constructed of those materials listed in Section of the *Jamaica Plumbing Code* or materials tested, rated and approved for such use in accordance with ASME A112.4.1.

1006.7 Boiler safety devices. Boilers shall be equipped with controls and limit devices as required by the manufacturer's installation instructions and the conditions of the listing.

1006.8 Electrical requirements. The power supply to the electrical control system shall be from a two-wire branch circuit that has a grounded conductor, or from an isolation transformer with a two-wire secondary. Where an isolation transformer is provided, one conductor of the secondary winding shall be grounded. Control voltage shall not exceed 150 volts nominal, line to line. Control and limit devices shall interrupt the ungrounded side of the circuit. A means of manually disconnecting the control circuit shall be provided and controls shall be arranged so that when deenergized, the burner shall be inoperative. Such disconnecting means shall be capable of being locked in the off position and shall be provided with ready access.

SECTION 1007 BOILER LOW-WATER CUTOFF

1007.1 General. Steam and hot water boilers shall be protected with a low-water cutoff control.

Exception: A low-water cutoff is not required for coil-type and water-tube-type boilers that require forced circulation of water through the boiler and that are protected with a flow sensing control.

1007.2 Operation. Low-water cutoff controls and flow sensing controls required by Section 1007.1 shall automatically stop the *combustion* operation of the *appliance* when the water level drops below the lowest safe water level as established by the manufacturer or when water circulation stops, respectively.

SECTION 1008 BOTTOM BLOWOFF VALVE

1008.1 General. Steam boilers shall be equipped with bottom blowoff valve(s). The valve(s) shall be installed in the opening provided on the boiler. The minimum size of the valve(s) and associated piping shall be the size specified by the boiler manufacturer or the size of the boiler blowoff-valve opening. Where the maximum allowable working pressure of the boiler exceeds 689 kPa (100 psig), two bottom blowoff valves shall be provided consisting of either two slow-opening valves in series or one quick-opening

valve and one slow-opening valve in series, with the quick-opening valve installed closest to the boiler.

1008.2 Discharge. Blowoff valves shall discharge to a safe place of disposal. Where discharging to the drainage system, the installation shall conform to the *Jamaica Plumbing Code*.

**SECTION 1009
HOT WATER BOILER EXPANSION TANK**

1009.1 Where required. An expansion tank shall be installed in every hot water system. For multiple boiler installations, not less than one expansion tank is required. Expansion tanks shall be of the closed or open type. Tanks shall be rated for the pressure of the hot water system.

Exception: Expansion tanks shall not be required in the collector loop of drain-back systems.

1009.2 Closed-type expansion tanks. Closed-type expansion tanks shall be installed in accordance with the manufacturer's instructions. Expansion tanks for systems designed to have an operating pressure in excess of 207 kPa (30 psi) shall be constructed and certified in accordance with the ASME *Boiler and Pressure Vessel Code*. The size of the tank shall be based on the capacity of the hot-water-heating system. The minimum size of the tank shall be determined in accordance with the following equation where all necessary information is known:

$$V_i = \frac{(0.000738T - 0.03348)V_s}{\frac{(P_a) - (P_a)}{P_f - P_o}} \quad \text{(Equation 10-1)}$$

$$V_i = \frac{(0.00041T - 0.0466)V_s}{\frac{(P_a) - (P_a)}{P_f - P_o}} \quad \text{(For Inch Pound Units)}$$

- where:
- V_i = Minimum volume of tanks, **Liters [L] (gallons)**.
 - V_s = Volume of system, not including expansion tanks, **L (gallons)**.
 - T = Average operating temperature, °C. (°F)
 - P_a = Atmospheric pressure, kPa (psi).
 - P_f = Fill pressure, kPa (psi).
 - P_o = Maximum operating pressure, kPa (psi).

Where all necessary information is not known, the minimum size of the tank shall be determined from Table 1009.2.

TABLE 1009.2

CLOSED-TYPE EXPANSION TANK SIZING

SYSTEM VOLUME IN LITRES	TANK CAPACITIES IN LITRES	
	Pressurized Diaphragm Type	Nonpressurized Type
380	34	57
760	65	115
1,140	95	171
1,520	125	228
1,900	160	285
3,800	315	570
7,600	626	1,139

For Inch Pound Units: 1 L = 0.2635 gallon.

1009.3 Open-type expansion tanks. Open-type expansion tanks shall be located not less than 100 mm (4 feet) above the highest heating element. The tank shall be adequately sized for the hot water system. An overflow with a minimum diameter of 25 mm (1 inch) shall be installed at the top of the tank. The overflow shall discharge to the drainage system in accordance with the *Jamaica Plumbing Code*.

**SECTION 1010
GAUGES**

1010.1 Hot water boiler gauges. Every hot water boiler shall have a pressure gauge and a temperature gauge, or a combination pressure and temperature gauge. The gauges shall indicate the temperature and pressure within the normal range of the system's operation.

1010.2 Steam boiler gauges. Every steam boiler shall have a water-gauge glass and a pressure gauge. The pressure gauge shall indicate the pressure within the normal range of the system's operation.

1010.2.1 Water-gauge glass. The gauge glass shall be installed so that the midpoint is at the normal boiler water level.

CHAPTER 11 REFRIGERATION

User note:

About this chapter: Chapter 11 provides for the protection of life and property from the potential fire and health hazards associated with refrigerant chemicals and the machinery that contains such chemicals. Some refrigerants are toxic, some are flammable and some are both. This chapter refers to the Jamaica Fire Code , ASHRAE 15 and IAR standards 2 through 5.

SECTION 1101 GENERAL

1101.1 Scope. This chapter shall govern the design, installation, construction and repair of refrigeration systems that vaporize and liquefy a fluid during the refrigerating cycle. Refrigerant piping design and installation, including pressure vessels and pressure relief devices, shall conform to this code. Permanently installed refrigerant storage systems and other components shall be considered as part of the refrigeration system to which they are attached.

1101.2 Factory-built equipment and appliances. *Listed and labeled* self-contained, factory-built *equipment* and appliances shall be tested in accordance with UL 207, 412, 471 or 1995. Such *equipment* and appliances are deemed to meet the design, manufacture and factory test requirements of this code if installed in accordance with their listing and the manufacturer's instructions.

1101.3 Protection. Any portion of a refrigeration system that is subject to physical damage shall be protected in an *approved* manner.

1101.4 Water connection. Water supply and discharge connections associated with refrigeration systems shall be made in accordance with this code and the *Jamaica Plumbing Code*.

1101.5 Fuel gas connection. Fuel gas devices, *equipment* and appliances used with refrigeration systems shall be installed in accordance with the *Jamaica Fuel Gas Code*.

1101.6 General. Refrigeration systems shall comply with the requirements of the National Environment and Planning Agency (NEPA) and of this code and, except as modified by this code, ASHRAE 15. Ammonia-refrigerating systems shall comply with this code and, except as modified by this code, ASHRAE 15, IAR 2, IAR 3, IAR 4 and IAR 5.

1101.7 Maintenance. Mechanical refrigeration systems shall be maintained in proper operating condition, free from accumulations of oil, dirt, *dust*, waste, excessive corrosion, other debris and leaks *by conducting regular and planned inspections, pressure difference measurements across filters, washing or vacuuming or replacement of filters, checking for and correcting refrigerant leaks, recharging or topping up refrigerant levels as needed, repairing or replacing damaged insulation and any other action that will keep the refrigeration system operating at optimum level.*

1101.8 Change in refrigerant type. The type of refrigerant in refrigeration systems having a refrigerant circuit containing more than 100 kg (220 pounds) of Group A1 or 14 kg (30 pounds) of any other group refrigerant shall not be changed without prior notification and *approval* of NEPA (the building official) and compliance with *manufacturer's instructions as*

well as the applicable code provisions for the new refrigerant type.

1101.9 Refrigerant discharge. Notification of refrigerant discharge shall be provided in accordance with the *Jamaica Fire Code*.

1101.10 Locking access port caps. Refrigerant circuit access ports located outdoors shall be fitted with locking-type tamper-resistant caps or shall be otherwise secured to prevent unauthorized access.

Exception: This section shall not apply to refrigerant circuit access ports on equipment installed in controlled areas such as on roofs with locked access hatches or doors.

SECTION 1102 SYSTEM REQUIREMENTS

1102.1 General. The system classification, allowable refrigerants, maximum quantity, enclosure requirements, location limitations, and field pressure test requirements shall be determined as follows:

1. Determine the refrigeration system's classification, in accordance with Section 1103.3.
2. Determine the refrigerant classification in accordance with Section 1103.1.
3. Determine the maximum allowable quantity of refrigerant in accordance with Section 1104, based on type of refrigerant, system classification and *occupancy*.
4. Determine the system enclosure requirements in accordance with Section 1104.
5. Refrigeration *equipment* and *appliance* location and installation shall be subject to the limitations of Chapter 3.
6. Nonfactory-tested, field-erected *equipment* and appliances shall be pressure tested in accordance with Section 1108.

1102.2 Refrigerants. The refrigerant shall be that which the *equipment* or *appliance* was designed to utilize or converted to utilize. Refrigerants not identified in Table 1103.1 shall be *approved* before use.

1102.2.1 Mixing. Refrigerants, including refrigerant blends, with different designations in ASHRAE 34 shall not be mixed in a system.

Exception: Addition of a second refrigerant is allowed where permitted by the *equipment* or *appliance* manu-

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fracturer to improve oil return at low temperatures. The refrigerant and amount added shall be in accordance with the manufacturer's instructions.

1102.2.2 Purity. Refrigerants used in refrigeration systems shall be new, recovered or *reclaimed refrigerants* in accordance with Section 1102.2.2.1, 1102.2.2.2 or 1102.2.2.3. Where required by the *equipment or appliance* owner or the building official, the installer shall furnish a signed declaration that the refrigerant used meets the requirements of Section 1102.2.2.1, 1102.2.2.2 or 1102.2.2.3.

Exception: The refrigerant used shall meet the purity specifications set by the manufacturer of the *equipment or appliance* in which such refrigerant is used where such specifications are different from that specified in Sections 1102.2.2.1, 1102.2.2.2 and 1102.2.2.3.

1102.2.2.1 New refrigerants. Refrigerants shall be of a purity level specified by the *equipment or appliance* manufacturer.

1102.2.2.2 Recovered refrigerants. Refrigerants that are recovered from refrigeration and air-conditioning systems shall not be reused in other than the system from which they were recovered and in other systems of the same owner. *Recovered refrigerants* shall be filtered and dried before reuse. *Recovered refrigerants* that show clear signs of contamination shall not be reused unless reclaimed in accordance with Section 1102.2.2.3.

1102.2.2.3 Reclaimed refrigerants. Used refrigerants shall not be reused in a different owner's *equipment or appliances* unless tested and found to meet the purity requirements of AHRI 700. Contaminated refrigerants shall not be used unless reclaimed and found to meet the purity requirements of AHRI 700.

1102.3 Access port protection. Refrigerant access ports shall be protected in accordance with Section 1101.10 whenever refrigerant is added to or recovered from refrigeration or air-conditioning systems.

SECTION 1103 REFRIGERATION SYSTEM CLASSIFICATION

1103.1 Refrigerant classification. Refrigerants shall be classified in accordance with ASHRAE 34 as listed in Table 1103.1.

1103.2 Occupancy classification. Locations of refrigerating systems are described by *occupancy* classifications that consider the ability of people to respond to potential exposure to refrigerants. Where *equipment* or appliances, other than piping, are located outside a building and within 6,100 mm (20 feet) of any building opening, such *equipment* or appliances shall be governed by the *occupancy* classification of the building. *Occupancy* classifications shall be defined as follows:

1. Institutional *occupancy* is that portion of premises from which occupants cannot readily leave without the assistance of others because they are disabled, debilitated or

confined. Institutional occupancies include, among others, hospitals, nursing homes, asylums and spaces containing locked cells.

2. Public assembly *occupancy* is that portion of premises where large numbers of people congregate and from which occupants cannot quickly vacate the space. Public assembly occupancies include, among others, auditoriums, ballrooms, classrooms, passenger depots, restaurants and theaters.
3. Residential *occupancy* is that portion of premises that provides the occupants with complete independent living facilities, including permanent provisions for living, sleeping, eating, cooking and sanitation. Residential occupancies include, among others, dormitories, hotels, multiunit apartments and private residences.
4. Commercial *occupancy* is that portion of premises where people transact business, receive personal service or purchase food and other goods. Commercial occupancies include, among others, office and professional buildings, markets (but not large mercantile occupancies) and work or storage areas that do not qualify as industrial occupancies.
5. Large mercantile *occupancy* is that portion of premises where more than 100 persons congregate on levels above or below street level to purchase personal merchandise.
6. Industrial *occupancy* is that portion of premises that is not open to the public, where access by authorized persons is controlled, and that is used to manufacture, process or store goods such as chemicals, food, ice, meat or petroleum.
7. Mixed *occupancy* occurs where two or more occupancies are located within the same building. Where each *occupancy* is isolated from the rest of the building by tight walls, floors and ceilings and by self-closing doors, the requirements for each *occupancy* shall apply to its portion of the building. Where the various occupancies are not so isolated, the *occupancy* having the most stringent requirements shall be the governing *occupancy*.

1103.3 System classification. Refrigeration systems shall be classified according to the degree of probability that refrigerant leaked from a failed connection, seal or component could enter an occupied area. The distinction is based on the basic design or location of the components.

1103.3.1 Low-probability systems. Double-indirect open-spray systems, indirect closed systems and indirect-vented closed systems shall be classified as low-probability systems, provided that all refrigerant-containing piping and fittings are isolated where the quantities in Table 1103.1 are exceeded.

1103.3.2 High-probability systems. Direct systems and indirect open-spray systems shall be classified as high-probability systems.

Exception: An indirect open-spray system shall not be required to be classified as a high-probability system if

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CHEMICAL REFRIGERANT	FORMULA	CHEMICAL NAME OF BLEND	REFRIGERANT CLASSIFICATION	AMOUNT OF REFRIGERANT PER OCCUPIED SPACE				DEGREES OF HAZARD ^a
				Kilograms per 28.3 cubic metres	ppm	g/m ³	OEL ^a	
R-11 ^d	CCl ₃ F	trichlorofluoromethane	A1	0.177	1,100	6.2	1,000	2-0-0 ^b
R-12 ^d	CCl ₂ F ₂	dichlorodifluoromethane	A1	2,542	18,000	90	1,000	2-0-0 ^b
R-13 ^d	CClF ₃	chlorotrifluoromethane	A1	—	—	—	1,000	2-0-0 ^b
R-13B1 ^d	CBrF ₃	bromotrifluoromethane	A1	—	—	—	1,000	2-0-0 ^b
R-14	CF ₄	tetrafluoromethane (carbon tetrafluoride)	A1	11,350	110,000	400	1,000	2-0-0 ^b
R-22	CHClF ₂	chlorodifluoromethane	A1	5,902	59,000	210	1,000	2-0-0 ^b
R-23	CHF ₃	trifluoromethane (fluoroform)	A1	3,314	41,000	120	1,000	2-0-0 ^b
R-30	CH ₂ Cl ₂	dichloromethane (methylene chloride)	B1	—	—	—	—	—
R-32	CH ₂ F ₂	difluoromethane (methylene fluoride)	A2 ^f	2,179	36,000	77	1,000	1-4-0
R-40	CH ₃ Cl	chloromethane (methyl chloride)	B2	—	—	—	—	—
R-50	CH ₄	methane	A3	—	—	—	1,000	—
R-113 ^d	CCl ₂ FCClF ₂	1,1,2-trichloro-1,2,2-trifluoroethane	A1	0.545	2,600	20	1,000	2-0-0 ^b
R-114 ^d	CClF ₂ CClF ₃	1,2-dichloro-1,1,2,2-tetrafluoroethane	A1	3,950	20,000	140	1,000	2-0-0 ^b
R-115	CClF ₂ CF ₃	chloropentafluoroethane	A1	21,338	120,000	760	1,000	—
R-116	CF ₃ CF ₃	hexafluoroethane	A1	15,436	97,000	550	1,000	1-0-0
R-123	CHCl ₂ CF ₃	2,2-dichloro-1,1,1-trifluoroethane	B1	1,589	9,100	57	50	2-0-0 ^b
R-124	CHClFCF ₃	2-chloro-1,1,1,2-tetrafluoroethane	A1	1,589	10,000	56	1,000	2-0-0 ^b
R-125	CHF ₂ CF ₃	pentafluoroethane	A1	10,442	75,000	370	1,000	2-0-0 ^b
R-134a	CH ₂ FCF ₃	1,1,1,2-tetrafluoroethane	A1	5,902	50,000	210	1,000	2-0-0 ^b
R-141b	CH ₂ CCl ₂ F	1,1-dichloro-1-fluoroethane	—	0.354	2,600	12	500	2-1-0
R-142b	CH ₃ CClF ₂	1-chloro-1,1-difluoroethane	A2	2,315	20,000	83	1,000	2-4-0
R-143a	CH ₃ CF ₃	1,1,1-trifluoroethane	A2 ^f	2,043	21,000	70	1,000	2-0-0 ^b
R-152a	CH ₃ CHF ₂	1,1-difluoroethane	A2	0,908	12,000	32	1,000	1-4-0
R-170	CH ₃ CH ₃	ethane	A3	0,245	7,000	8,7	1,000	2-4-0
R-E170	CH ₃ OCH ₃	Methoxymethane (dimethyl ether)	A3	0,454	8,500	16	1,000	—
R-218	CF ₃ CF ₂ CF ₃	octafluoropropane	A1	19,522	90,000	690	1,000	2-0-0 ^b
R-227ea	CF ₃ CHF ₂ CF ₃	1,1,1,2,3,3,3-heptafluoropropane	A1	16,344	84,000	580	1,000	—
R-236fa	CF ₃ CH ₂ CF ₃	1,1,1,3,3,3-hexafluoropropane	A1	9,534	55,000	340	1,000	2-0-0 ^b
R-245fa	CHF ₂ CH ₂ CF ₃	1,1,1,3,3-pentafluoropropane	B1	5,448	34,000	190	300	2-0-0 ^b
R-290	CH ₃ CH ₂ CH ₃	propane	A3	0,254	5,300	9,5	1,000	2-4-0
R-C318	-(CF ₂) ₄ -	octafluorocyclobutane	A1	18,614	80,000	660	1,000	—
R-400 ^d	zeotrope	R-12/114 (50.0/50.0)	A1	4,540	28,000	160	1,000	2-0-0 ^b

CHEMICAL REFRIGERANT	FORMULA	CHEMICAL NAME OF BLEND	REFRIGERANT CLASSIFICATION	AMOUNT OF REFRIGERANT PER OCCUPIED SPACE				DEGREES OF HAZARD ^a
				Kilograms per 28.3 cubic metres	ppm	g/m ³	OEL ^b	
R-400 ^d	zeotrope	R-12/114 (60.0/40.0)	A1	4.994	30,000	170	1,000	—
R-401A	zeotrope	R-22/152a/124 (53.0/13.0/34.0)	A1	2.996	27,000	110	1,000	2-0-0 ^b
R-401B	zeotrope	R-22/152a/124 (61.0/11.0/28.0)	A1	3.269	30,000	120	1,000	2-0-0 ^b
R-401C	zeotrope	R-22/152a/124 (33.0/15.0/52.0)	A1	2.361	20,000	84	1,000	2-0-0 ^b
R-402A	zeotrope	R-125/290/22 (60.0/2.0/38.0)	A1	7.718	66,000	270	1,000	2-0-0 ^b
R-402B	zeotrope	R-125/290/22 (38.0/2.0/60.0)	A1	6.810	63,000	240	1,000	2-0-0 ^b
R-403A	zeotrope	R-290/22/218 (5.0/75.0/20.0)	A2	3.450	33,000	120	1,000	2-0-0 ^b
R-403B	zeotrope	R-290/22/218 (5.0/56.0/39.0)	A1	8.172	70,000	290	1,000	2-0-0 ^b
R-404A	zeotrope	R-125/143a/134a (44.0/52.0/4.0)	A1	14.074	130,000	500	1,000	2-0-0 ^b
R-405A	zeotrope	R-22/152a/142b/C318 (45.0/7.0/5.5/2.5)	—	7.264	57,000	260	1,000	—
R-406A	zeotrope	R-22/600a/142b (55.0/4.0/41.0)	A2	2.134	21,000	25	1,000	—
R-407A	zeotrope	R-32/125/134a (20.0/40.0/40.0)	A1	8.626	83,000	300	1,000	2-0-0 ^b
R-407B	zeotrope	R-32/125/134a (10.0/70.0/20.0)	A1	9.534	79,000	330	1,000	2-0-0 ^b
R-407C	zeotrope	R-32/125/134a (23.0/25.0/52.0)	A1	8.172	81,000	290	1,000	2-0-0 ^b
R-407D	zeotrope	R-32/125/134a (15.0/15.0/70.0)	A1	7.264	68,000	250	1,000	2-0-0 ^b
R-407E	zeotrope	R-32/125/134a (25.0/15.0/60.0)	A1	7.718	80,000	280	1,000	2-0-0 ^b
R-407F	zeotrope	R-32/125/134a (30.0/30.0/40.0)	A1	9.080	95,000	320	1,000	—
R-408A	zeotrope	R-125/143a/22 (7.0/46.0/47.0)	A1	9.534	95,000	340	1,000	2-0-0 ^b
R-409A	zeotrope	R-22/124/142b (60.0/25.0/15.0)	A1	3.223	29,000	110	1,000	2-0-0 ^b
R-409B	zeotrope	R-22/124/142b (65.0/25.0/10.0)	A1	3.314	30,000	120	1,000	2-0-0 ^b
R-410A	zeotrope	R-32/125 (50.0/50.0)	A1	11.804	140,000	420	1,000	2-0-0 ^b
R-410B	zeotrope	R-32/125 (45.0/55.0)	A1	12.258	140,000	430	1,000	2-0-0 ^b
R-411A	zeotrope	R-127/22/152a (1.5/87.5/11.0)	A2	1.317	14,000	46	990	—
R-411B	zeotrope	R-1270/22/152a (3.0/94.0/3.0)	A2	1.271	13,000	45	980	—
R-412A	zeotrope	R-22/218/142b (70.0/5.0/25.0)	A2	2.315	22,000	82	1,000	—
R-413A	zeotrope	R-218/134a/600a (9.0/88.0/3.0)	A2	2.633	22,000	94	1,000	—
R-414A	zeotrope	R-22/124/600a/142b (51.0/28.5/4.0/16.5)	A1	2.906	26,000	100	1,000	—
R-414B	zeotrope	R-22/124/600a/142b (50.0/39.0/1.5/9.5)	A1	2.724	23,000	95	1,000	—
R-415A	zeotrope	R-22/152a (82.0/18.0)	A2	1.317	14,000	47	1,000	—
R-415B	zeotrope	R-22/152a (25.0/75.0)	A2	0.953	12,000	34	1,000	—
R-416A	zeotrope	R-134a/124/600 (59.0/39.5/1.5)	A1	1.771	14,000	62	1,000	2-0-0 ^b
R-417A	zeotrope	R-125/134a/600 (46.6/50.0/3.4)	A1	1.589	13,000	56	1,000	2-0-0 ^b
R-417B	zeotrope	R-125/134a/600 (79.0/18.3/2.7)	A1	1.952	15,000	70	1,000	—
R-417C	zeotrope	R-125/134a/600 (19.5/78.8/1.7)	A1	2.452	21,000	87	1,000	—

(continued)

CHEMICAL REFRIGERANT	FORMULA	CHEMICAL NAME OF BLEND	REFRIGERANT CLASSIFICATION	AMOUNT OF REFRIGERANT PER OCCUPIED SPACE				DEGREES OF HAZARD ^a
				Kilograms per 28.3 cubic metres	ppm	g/m ³	OEL ^b	
R-418A	zeotrope	R-290/22/152a (1.5/96.0/2.5)	A2	2.179	22,000	77	1,000	—
R-419A	zeotrope	R-125/134a/E170 (77.0/19.0/4.0)	A2	1.907	15,000	67	1,000	—
R-419B	zeotrope	R-125/134a/E170 (48.5/48.0/3.5)	A2	2.088	17,000	74	1,000	—
R-420A	zeotrope	R-134a/142b (88.0/12.0)	A1	5.448	45,000	190	1,000	2-0-0 ^b
R-421A	zeotrope	R-125/134a (58.0/42.0)	A1	7.718	61,000	280	1,000	2-0-0 ^b
R-421B	zeotrope	R-125/134a (85.0/15.0)	A1	9.534	69,000	330	1,000	2-0-0 ^b
R-422A	zeotrope	R-125/134a/600a (85.1/11.5/3.4)	A1	8.172	63,000	290	1,000	2-0-0 ^b
R-422B	zeotrope	R-125/134a/600a (55.0/42.0/3.0)	A1	7.264	56,000	250	1,000	2-0-0 ^b
R-422C	zeotrope	R-125/134a/600a (82.0/15.0/3.0)	A1	8.172	62,000	290	1,000	2-0-0 ^b
R-422D	zeotrope	R-125/134a/600a (65.1/31.5/3.4)	A1	7.264	58,000	260	1,000	2-0-0 ^b
R-422E	zeotrope	R-125/134a/600a (58.0/39.3/2.7)	A1	7.264	57,000	260	1,000	—
R-423A	zeotrope	R-134a/227ea (52.5/47.5)	A1	8.626	59,000	310	1,000	2-0-0 ^b
R-424A	zeotrope	R-125/134a/600a/600/601a (50.5/47.0/0.9/1.0/0.6)	A1	2.815	23,000	100	970	2-0-0 ^b
R-425A	zeotrope	R-32/134a/227ea (18.5/69.5/12.0)	A1	7.264	72,000	260	1,000	2-0-0 ^b
R-426A	zeotrope	R-125/134a/600a/601a (5.1/93.0/1.3/0.6)	A1	2.361	20,000	83	990	—
R-427A	zeotrope	R-32/125/143a/134a (15.0/25.0/10.0/50.0)	A1	8.172	79,000	290	1,000	2-1-0
R-428A	zeotrope	R-125/143a/290/600a (77.5/20.0/0.6/1.9)	A1	10.442	83,000	370	1,000	—
R-429A	zeotrope	R-E170/152a/600a (60.0/10.0/30.0)	A3	0.368	6,300	13	1,000	—
R-430A	zeotrope	R-152a/600a (76.0/24.0)	A3	0.590	8,000	21	1,000	—
R-431A	zeotrope	R-290/152a (71.0/29.0)	A3	0.313	5,500	11	1,000	—
R-432A	zeotrope	R-1270/E170 (80.0/20.0)	A3	0.059	1,200	2.1	700	—
R-433A	zeotrope	R-1270/290 (30.0/70.0)	A3	0.154	3,100	5.5	880	—
R-433B	zeotrope	R-1270/290 (5.0-95.0)	A3	0.232	4,500	8.1	950	—
R-433C	zeotrope	R-1270/290 (25.0-75.0)	A3	0.186	3,600	6.6	790	—
R-434A	zeotrope	R-125/143a/600a (63.2/18.0/16.0/2.8)	A1	9.080	73,000	320	1,000	—
R-435A	zeotrope	R-E170/152a (80.0/20.0)	A3	0.499	8,500	17	1,000	—
R-436A	zeotrope	R-290/600a (56.0/44.0)	A3	0.227	4,000	8.1	1,000	—
R-436B	zeotrope	R-290/600a (52.0/48.0)	A3	0.232	4,000	8.1	1,000	—
R-437A	zeotrope	R-125/134a/600/601 (19.5/78.5/1.4/0.6)	A1	2.270	19,000	82	990	—
R-438A	zeotrope	R-32/125/134a/600/601a (8.5/45.0/44.2/1.7/0.6)	A1	2.225	20,000	79	990	—
R-439A	zeotrope	R-32/125/600a (50.0/47.0/3.0)	A2	2.134	26,000	76	990	—
R-440A	zeotrope	R-290/134a/152a (0.6/1.6/97.8)	A2	0.863	12,000	31	1,000	—
R-441A	zeotrope	R-170/290/600a/600 (3.1/54.8/6.0/36.1)	A3	0.177	3,200	6.3	1,000	—
R-442A	zeotrope	R-32/125/134a/152a/227ea (31.0/31.0/30.0/3.0/5.0)	A1	9.534	100,000	330	1,000	—

(continued)

CHEMICAL REFRIGERANT	FORMULA	CHEMICAL NAME OF BLEND	REFRIGERANT CLASSIFICATION	AMOUNT OF REFRIGERANT PER OCCUPIED SPACE				DEGREES OF HAZARD ^a
				Kilograms per 28.3 cubic metres	ppm	g/m ³	OEL ^a	
R-443A	zeotrope	R-1270/290/600a (55.0/40.0/5.0)	A3	0.086	1,700	3.1	580	—
R-444A	zeotrope	R-32/152a/1234ze(E) (12.0/5.0/83.0)	A2 ^f	2.315	21,000	81	850	—
R-444B	zeotrope	R-32/152a/1234ze(E) (41.5/10.0/48.5)	A2 ^f	1.952	23,000	69	890	—
R-445A	zeotrope	R-744/134a/1234ze(E) (6.0/9.0/85.0)	A2 ^f	1.907	16,000	67	930	—
R-446A	zeotrope	R-32/1234ze(E)/600 (68.0/29.0/3.0)	A2 ^f	1.135	16,000	39	960	—
R-447A	zeotrope	R-32/125/1234ze(E) (68.0/3.5/28.5)	A2 ^f	1.180	16,000	42	900	—
R-448A	zeotrope	R-32/125/1234yf/134a/1234ze(E) (26.0/26.0/20.0/21.0/7.0)	A1	10.896	110,000	390	890	—
R-449A	zeotrope	R-32/125/1234yf/134a (24.3/24.7/25.3/25.7)	A1	10.442	100,000	370	830	—
R-450A	zeotrope	R-134a/1234ze(E) (42.0/58.0)	A1	9.080	72,000	320	880	—
R-451A	zeotrope	R-1234yf/134a (89.8/10.2)	A2 ^f	2.406	18,000	81	520	—
R-451B	zeotrope	R-1234yf/134a (88.8/11.2)	A2 ^f	2.406	18,000	81	530	—
R-452A	zeotrope	R-32/125/1234yf (11.0/59.0/30.0)	A1	12.258	100,000	440	780	—
R-500 ^e	azeotrope	R-12/152a (73.8/26.2)	A1	3.450	30,000	120	1,000	2-0-0 ^b
R-501 ^d	azeotrope	R-22/12 (75.0/25.0)	A1	5.902	54,000	210	1,000	—
R-502 ^e	azeotrope	R-22/115 (48.8/51.2)	A1	9.534	73,000	330	1,000	2-0-0 ^b
R-503 ^e	azeotrope	R-23/13 (40.1/59.9)	—	—	—	—	1,000	2-0-0 ^b
R-504 ^d	azeotrope	R-32/115 (48.2/51.8)	—	12.712	140,000	450	1,000	—
R-507A	azeotrope	R-125/143a (50.0/50.0)	A1	14.528	130,000	520	1,000	2-0-0 ^b
R-508A	azeotrope	R-23/116 (39.0/61.0)	A1	6.356	55,000	220	1,000	2-0-0 ^b
R-508B	azeotrope	R-23/116 (46.0/54.0)	A1	5.902	52,000	200	1,000	2-0-0 ^b
R-509A	azeotrope	R-22/218 (44.0/56.0)	A1	10.896	75,000	390	1,000	2-0-0 ^b

(continued)

(continued)

CHEMICAL REFRIGERANT	FORMULA	CHEMICAL NAME OF BLEND	REFRIGERANT CLASSIFICATION	AMOUNT OF REFRIGERANT PER OCCUPIED SPACE				DEGREES OF HAZARD ^a
				Kilograms per 28.3 cubic metres	ppm	g/m ³	OEL ^e	
R-510A	azeotrope	R-E170/600a (88.0/12.0)	A3	0.395	7,300	14	1,000	—
R-511A	azeotrope	R-290/E170 (95.0/5.0)	A3	0.268	5,300	9.5	1,000	—
R-512A	azeotrope	R-134a/152a (5.0/95.0)	A2	0.863	11,000	31	1,000	—
R-513A	azeotrope	R-1234yf/134a (56.0/44.0)	A1	9.080	72,000	320	650	—
R-600	CH ₃ CH ₂ CH ₂ CH ₃	butane	A3	0.068	1,000	2.4	1,000	1-4-0
R-600a	CH(CH ₃) ₂ CH ₃	2-methylpropane (isobutane)	A3	0.268	4,000	9.6	1,000	2-4-0
R-601	CH ₃ CH ₂ CH ₂ CH ₂ CH ₃	pentane	A3	0.082	1,000	2.9	600	—
R-601a	(CH ₃) ₂ CHCH ₂ CH ₃	2-methylbutane (isopentane)	A3	0.082	1,000	2.9	600	—
R-610	ethoxyethane (ethyl ether)	CH ₃ CH ₂ OCH ₂ CH ₃	—	—	—	—	400	—
R-611	methyl formate	HCOOCH ₃	B2	—	—	—	100	—
R-717	NH ₃	ammonia	B2 ^f	0.0064	320	0.22	25	3-3-0 ^c
R-718	H ₂ O	water	A1	—	—	—	—	0-0-0
R-744	CO ₂	carbon dioxide	A1	2.043	40,000	72	5,000	2-0-0 ^b
R-1150	CH ₂ =CH ₂	ethene (ethylene)	A3	—	—	—	200	1-4-2
R-1233zd(E)	CF ₃ CH=CHCl	trans-1-chloro-3,3,3-trifluoro-1-propene	A1	2.406	16,000	85	800	—
R-1234yf	CF ₃ CF=CH ₂	2,3,3,3-tetrafluoro-1 propene	A2 ^f	2.134	16,000	75	500	—
R-1234ze(E)	CF ₃ CH=CHF	trans-1,3,3,3-tetrafluoro-1-propene	A2 ^f	2.134	16,000	75	800	—
R-1270	CH ₃ CH=CH ₂	Propene (propylene)	A3	0.045	1,000	1.7	500	1-4-1

For Inch Pound Units: 1 kg = 2.203 pound, 1 m³ = 35.3357 cubic foot

- Degrees of hazard are for health, fire, and reactivity, respectively, in accordance with NFPA 704.
- Reduction to 1-0-0 is allowed if analysis satisfactory to the building official shows that the maximum concentration for a rupture or full loss of refrigerant charge would not exceed the IDLH, considering both the refrigerant quantity and room volume.
- For installations that are entirely outdoors, use 3-1-0.
- Class I ozone depleting substance; prohibited for new installations.
- Occupational Exposure Limit based on the OSHA PEL, ACGIH TLV-TWA, the TERA WEEL or consistent value on a time-weighted average (TWA) basis (unless noted C for ceiling) for an 8 hr/d and 40 hr/wk.
- The ASHRAE Standard 34 flammability classification for this refrigerant is 2L, which is a subclass of Class 2.

the pressure of the secondary coolant is at all times (operating and standby) greater than the pressure of the refrigerant.

SECTION 1104 SYSTEM APPLICATION REQUIREMENTS

1104.1 General. The refrigerant, occupancy and system classification cited in this section shall be determined in accordance with Sections 1103.1, 1103.2 and 1103.3, respectively.

1104.2 Machinery room. Except as provided in Sections 1104.2.1 and 1104.2.2, all components containing the refrigerant shall be located either outdoors or in a *machinery room* where the quantity of refrigerant in an independent circuit of a system exceeds the amounts shown in Table 1103.1. For refrigerant blends not listed in Table 1103.1, the same requirement shall apply where the amount for any blend component exceeds that indicated in Table 1103.1 for that component. This requirement shall also apply where the combined amount of the blend components exceeds a limit of 69,100 parts per million (ppm) by volume. Machinery rooms required by this section shall be constructed and maintained in accordance with Section 1105 for Group A1 and B1 refrigerants and in accordance with Sections 1105 and 1106 for Group A2, B2, A3 and B3 refrigerants.

Exceptions:

1. Machinery rooms are not required for *listed equipment* and appliances containing not more than 3 kg (6.6 pounds) of refrigerant, regardless of the refrigerant's safety classification, where installed in accordance with the equipment's or appliance's listing and the *equipment or appliance* manufacturer's installation instructions.
2. Piping in conformance with Section 1107 is allowed in other locations to connect components installed in a *machinery room* with those installed outdoors.

1104.2.1 Institutional occupancies. The amounts shown in Table 1103.1 shall be reduced by 50 percent for all areas of institutional occupancies except kitchens, laboratories and mortuaries. The total of all Group A2, B2, A3 and B3 refrigerants shall not exceed 250 kg (550 pounds) in occupied areas or machinery rooms.

1104.2.2 Industrial occupancies and refrigerated rooms. This section applies only to rooms and spaces that: are within industrial occupancies; contain a refrigerant evaporator; are maintained at temperatures below 20°C (68°F); and are used for manufacturing, food and beverage preparation, meat cutting, other processes and storage. Where a machinery room would otherwise be required by Section 1104.2, a machinery room shall not be required where all of the following conditions are met:

1. The space containing the machinery is separated from other occupancies by tight construction with tight-fitting doors.
2. Access is restricted to authorized personnel.

3. Refrigerant detectors are installed as required for machinery rooms in accordance with Section 1105.3.

Exceptions:

1. Refrigerant detectors are not required in unoccupied areas that contain only continuous piping that does not include valves, valve assemblies, equipment, or equipment connections.
2. Where approved alternatives are provided, refrigerant detectors for ammonia refrigeration are not required for rooms or areas that are always occupied, and for rooms or areas that have high humidity or other harsh environmental conditions that are incompatible with detection devices.
4. Surfaces having temperatures exceeding 427°C (800°F) and open flames are not present where any Group A2, B2, A3 or B3 refrigerant is used (see Section 1104.3.4).
5. All electrical *equipment* and appliances conform to Class 1, Division 2, hazardous location classification requirements of [the Jamaica Electrical Code](#) where the quantity of any Group A2, B2, A3 or B3 refrigerant, other than ammonia, in a single independent circuit would exceed 25 percent of the lower flammability limit (LFL) upon release to the space.
6. All refrigerant-containing parts in systems with a total connected compressor power exceeding 74.6 kW [[100 horsepower \(hp\)](#)]*—except evaporators used for refrigeration or dehumidification, condensers used for heating, control and pressure relief valves for either, low-probability pumps and connecting piping—*are located either outdoors or in a *machinery room*.

1104.3 Refrigerant restrictions. Refrigerant applications, maximum quantities and use shall be restricted in accordance with Sections 1104.3.1 through 1104.3.4.

1104.3.1 Air-conditioning for human comfort. In other than industrial occupancies where the quantity in a single independent circuit does not exceed the amount in Table 1103.1, Group B1, B2 and B3 refrigerants shall not be used in high-probability systems for air-conditioning for human comfort.

1104.3.2 Nonindustrial occupancies. Group A2 and B2 refrigerants shall not be used in high-probability systems where the quantity of refrigerant in any independent refrigerant circuit exceeds the amount shown in Table 1104.3.2. Group A3 and B3 refrigerants shall not be used except where *approved*.

Exception: This section does not apply to laboratories where the floor area per occupant is not less than 9.3 m² (100 square feet).

1104.3.3 All occupancies. The total of all Group A2, B2, A3 and B3 refrigerants other than R-717, ammonia, shall not exceed 499 kg (1,100 pounds) except where *approved*.

1104.3.4 Protection from refrigerant decomposition. Where any device having an open flame or surface temperature greater than 427°C (800°F) is used in a room containing more than 3 kg (6.6 pounds) of refrigerant in a single independent circuit, a hood and exhaust system shall be provided in accordance with Section 510. Such exhaust system shall exhaust *combustion* products to the outdoors.

Exception: A hood and exhaust system shall not be required where any of the following apply:

1. The refrigerant is R-717, R-718 or R-744.
2. The *combustion* air is ducted from the outdoors in a manner that prevents leaked refrigerant from being combusted.
3. A refrigerant detector is used to stop the *combustion* in the event of a refrigerant leak (see Sections 1105.3 and 1105.5).

1104.4 Volume calculations. Volume calculations shall be in accordance with Sections 1104.4.1 through 1104.4.3.

1104.4.1 Noncommunicating spaces. Where the refrigerant-containing parts of a system are located in one or more spaces that do not communicate through permanent openings or HVAC ducts, the volume of the smallest, enclosed occupied space shall be used to determine the permissible quantity of refrigerant in the system.

1104.4.2 Communicating spaces. Where an evaporator or condenser is located in an air duct system, the volume of the smallest, enclosed occupied space served by the duct system shall be used to determine the maximum allowable quantity of refrigerant in the system.

Exception: If airflow to any enclosed space cannot be reduced below one-quarter of its maximum, the entire space served by the air duct system shall be used to determine the maximum allowable quantity of refrigerant in the system.

1104.4.3 Plenums. Where the space above a suspended ceiling is continuous and part of the supply or return air *plenum* system, this space shall be included in calculating the volume of the enclosed space.

**SECTION 1105
MACHINERY ROOM, GENERAL REQUIREMENTS**

1105.1 Design and construction. Machinery rooms shall be designed and constructed in accordance with the *Jamaica Building Code* and this section.

1105.2 Openings. Ducts and air handlers in the *machinery room* that operate at a lower pressure than the room shall be sealed to prevent any refrigerant leakage from entering the airstream.

1105.3 Refrigerant detector. Refrigerant detectors in machinery rooms shall be provided as required by Sections 605.8 and 605.17 of the *Jamaica Fire Code*.

1105.4 Tests. Periodic tests of the mechanical ventilating system shall be performed in accordance with manufacturer's specifications and as required by the building official.

1105.5 Fuel-burning appliances. Fuel-burning appliances and *equipment* having open flames and that use *combustion* air from the *machinery room* shall not be installed in a *machinery room*.

Exceptions:

1. Where the refrigerant is carbon dioxide or water.
2. Fuel-burning appliances shall not be prohibited in the same *machinery room* with refrigerant-containing *equipment* or appliances where *combustion* air is ducted from outside the *machinery room* and sealed in such a manner as to prevent any refrigerant leakage from entering the *combustion* chamber, or where a refrigerant vapor detector is employed to automatically shut off the *combustion* process in the event of refrigerant leakage.

1105.6 Ventilation. Machinery rooms shall be mechanically ventilated to the outdoors.

Exception: Where a refrigerating system is located outdoors more than 6,100 mm (20 feet) from any building opening and is enclosed by a penthouse, lean-to or other open structure, natural or mechanical ventilation shall be provided. Location of the openings shall be based on the relative density of the refrigerant to air. The free-aperture cross section for the ventilation of the *machinery room* shall be not less than:

$$F = 0.138 \sqrt{G} \quad \text{(Equation 11-1)}$$

For IPU: $F = \sqrt{G}$

where:

F = The free opening area in square metres (m²), [ft²].
 G = The mass of refrigerant in kilograms (kg), [lb] in the largest system, any part of which is located in the *machinery room*.

**TABLE 1104.3.2
MAXIMUM PERMISSIBLE QUANTITIES OF REFRIGERANTS**

TYPE OF REFRIGERATION SYSTEM	MAXIMUM WEIGHT IN KILOGRAMS FOR VARIOUS OCCUPANCIES			
	Institutional	Assembly	Residential	All other occupancies
Sealed absorption system				
In exit access	0	0	1.5	1.5
In adjacent outdoor locations	0	0	10	10
In other than exit access	0	3	3	3
Unit systems				
In other than exit access	0	0	3	3

For Inch Pound Units: 1 kg = 2.203 pounds.

1105.6.1 Discharge location. The discharge of the air shall be to the outdoors in accordance with Chapter 5. Exhaust from mechanical ventilation systems shall be discharged not less than 6,100 mm (20 feet) from a property line or openings into buildings.

1105.6.1.1 Indoor exhaust opening location. Indoor mechanical exhaust intake openings shall be located where refrigerant leakage is likely to concentrate based on the refrigerant's relative density to air, and the locations of the air current paths and refrigerating machinery.

1105.6.2 Makeup air. Provisions shall be made for *makeup air* to replace that being exhausted. Openings for *makeup air* shall be located to avoid intake of *exhaust air*. Supply and exhaust ducts to the *machinery room* shall not serve any other area, shall be constructed in accordance with Chapter 5 and shall be covered with corrosion-resistant screen of not less than 6.35 mm (1/4 inch) mesh.

1105.6.3 Ventilation rate. For other than ammonia systems, the mechanical ventilation systems shall be capable of exhausting the minimum quantity of air both at normal operating and emergency conditions, as required by Sections 1105.6.3.1 and 1105.6.3.2. The minimum required emergency ventilation rate for ammonia shall be 30 air changes per hour in accordance with IIR2. Multiple fans or multispeed fans shall be allowed to produce the emergency ventilation rate and to obtain a reduced airflow for normal ventilation.

1105.6.3.1 Quantity—normal ventilation. During occupied conditions, the mechanical ventilation system shall exhaust the larger of the following:

1. Not less than 0.0025 m³/s • m² (0.5 cfm per square foot) of *machinery room* area or 0.009 m³/s (20 cfm) per person.
2. A volume required to limit the room temperature rise to 10°C (18°F) taking into account the ambient heating effect of all machinery in the room.

1105.6.3.2 Quantity—emergency conditions. Upon actuation of the refrigerant detector required in Section 1105.3, the mechanical ventilation system shall *exhaust air* from the *machinery room* in the following quantity:

$$Q = 0.07 \times \sqrt{G} \quad \text{(Equation 11-2)}$$

For IPU: $Q = 100 \times \sqrt{G}$

where:

Q = The airflow in cubic metres per second (m³/s), [ft³/min].

G = The design mass of refrigerant in kilograms (kg), [lbs] in the largest system, any part of which is located in the *machinery room*.

1105.7 Termination of relief devices. Pressure relief devices, fusible plugs and purge systems located within the *machinery room* shall terminate outside of the structure at a location not less than 4,575 mm (15 feet) above the adjoining grade level and not less than 6,100 mm (20 feet) from any window, ventilation opening or exit.

1105.8 Ammonia discharge. Pressure relief valves for

1105.9 Emergency pressure control system. Permanently installed refrigeration systems containing more than 3 kg (6.6 Pounds) of flammable, toxic or highly toxic refrigerant or ammonia shall be provided with an emergency pressure control system in accordance with Section 605.10 of the *Jamaica Fire Code*.

SECTION 1106 MACHINERY ROOM, SPECIAL REQUIREMENTS

1106.1 General. Where required by Section 1104.2, the *machinery room* shall meet the requirements of this section in addition to the requirements of Section 1105.

1106.2 Elevated temperature. There shall not be an open flame-producing device or continuously operating hot surface over 427°C (800°F) permanently installed in the room.

1106.3 Ammonia room ventilation. Ventilation systems in ammonia machinery rooms shall be operated continuously at the ventilation rate specified in Section 1105.6.3.

Exceptions:

1. Machinery rooms equipped with a vapor detector that will automatically start the ventilation system at the ventilation rate specified in Section 1105.6.3, and that will actuate an alarm at a detection level not to exceed 1,000 ppm.
2. Machinery rooms conforming to the Class 1, Division 2, *hazardous location* classification requirements of the *Jamaica Electrical Code*.

1106.4 Flammable refrigerants. Where refrigerants of Groups A2, A3, B2 and B3 are used, the *machinery room* shall conform to the Class 1, Division 2, *hazardous location* classification requirements of the *Jamaica Electrical Code*.

Exceptions:

1. Ammonia *machinery rooms* that are provided with *ventilation* in accordance with Section 1106.3.
2. *Machinery rooms* for systems containing Group A2L refrigerants that are in accordance with Section 1106.5.

1106.5 Special requirements for Group A2L refrigerant machinery rooms. *Machinery rooms* for systems containing

Group A2L refrigerants shall comply with Sections 1106.5.1 through 1106.5.3.

Exception: *Machinery rooms* conforming to the Class I, Division 2, *hazardous location* classification requirements of the *Jamaica Electrical Code* are not required to comply with Sections ammonia systems shall discharge in accordance with ASHRAE 15.

1106.5.1 and 1106.5.2.

1106.5.1 Refrigerant detection system. The *machinery room* shall be provided with a *refrigerant* detection system. The *refrigerant* detection system shall be in accordance with Section 605.8 of the *Jamaica Fire Code* and all of the following:

1. The detectors shall activate at or below a *refrigerant* concentration of 25% of the *LFL*.
2. Upon activation, the detection system shall activate the emergency ventilation system required by Section 1106.5.2.
3. The detection, signaling and control circuits shall be supervised.

1106.5.2 Emergency ventilation system. An emergency ventilation system shall be provided at the minimum exhaust rate specified in ASHRAE 15 or Table 1106.5.2. Shutdown of the emergency ventilation system shall be by manual means.

**TABLE 1106.5.2
MINIMUM EXHAUST RATES**

REFRIGERANT	Q(m/sec)	Q(cfm)
R32	15.4	32,600
R143	13.6	28,700
R444A	6.46	13,700
R444B	10.6	22,400
R445A	7.83	16,600
R446A	23.9	50,700
R447A	23.8	50,400
R451A	7.04	15,000
R451B	7.05	15,000
R1234yf	7.80	16,600
R1234ze(E)	5.92	12,600

1106.5.3 Emergency ventilation system discharge. The emergency ventilation system point of discharge to the atmosphere shall be located outside of the structure at not less than 4575 mm (15 feet) above the adjoining grade level and not less than 6100 mm (20 feet) from any window, ventilation opening or exit.

1106.6 Remote controls. Remote control of the mechanical equipment and appliances located in the machinery room shall comply with Sections 1106.6.1 and 1106.6.2.

1106.6.1 Refrigeration system emergency shutoff. A clearly identified switch of the break-glass type or with an approved tamper-resistant cover shall provide off-only control of refrigerant compressors, refrigerant pumps, and normally closed, automatic refrigerant valves located in the machinery room. Additionally, this equipment shall be automatically shut off whenever the refrigerant vapor concentration in the machinery room exceeds the vapor detector's upper detection limit or 25 percent of the LEL, whichever is lower.

1106.6.2 Ventilation system. A clearly identified switch of the break-glass type or with an approved tamper-resistant cover shall provide on-only control of the machinery room ventilation fans.

1106.7 Emergency signs and labels. Refrigeration units and systems shall be provided with *approved* emergency signs, charts, and labels in accordance with the *Jamaica Fire Code*.

SECTION 1107 REFRIGERANT PIPING

1107.1 General. The design of refrigerant piping shall be in accordance with ASME B31.5. Refrigerant piping shall be installed, tested and placed in operation in accordance with this chapter.

1107.2 Piping location. Refrigerant piping that crosses an open space that affords passageway in any building shall be not less than 2210 mm (7 feet 3 inches) above the floor unless the piping is located against the ceiling of such space. Refrigerant piping shall not be placed in any of the following:

1. A fire-resistance-rated exit access corridor.
2. An interior exit stairway.
3. An interior exit ramp.
4. An exit passageway.
5. An elevator, dumbwaiter or other shaft containing a moving object.
6. A shaft that has one or more openings into a fire-resistance-rated exit access corridor, interior exit stairway or ramp or exit passageway.

1107.2.1 Piping in concrete floors. Refrigerant piping installed in concrete floors shall be encased in pipe ducts. The piping shall be isolated and supported to prevent damaging vibration, stress and corrosion.

1107.2.2 Refrigerant penetrations. Refrigerant piping shall not penetrate floors, ceilings or roofs.

Exceptions:

1. Penetrations connecting the basement and the first floor.
2. Penetrations connecting the top floor and a machinery penthouse or roof installation.
3. Penetrations connecting adjacent floors served by the refrigeration system.
4. Penetrations by piping in a direct system where the refrigerant quantity does not exceed Table 1103.1 for the smallest occupied space through which the piping passes.
5. In other than industrial occupancies and where the refrigerant quantity exceeds Table 1103.1 for the smallest space, penetrations for piping that connects separate pieces of *equipment* that are either:
 - 5.1. Enclosed by an *approved* gas-tight, fire-resistive duct or shaft with openings to those floors served by the refrigeration system.
 - 5.2. Located on the exterior of the building where vented to the outdoors or to the space served by the system and not used as an air shaft, closed court or similar space.

1107.3 Pipe enclosures. Rigid or flexible metal enclosures or pipe ducts shall be provided for soft, annealed copper tubing and used for refrigerant piping erected on the premises and containing other than Group A1 or B1 refrigerants. Enclosures shall not be required for connections between condensing units and the nearest riser box(es), provided such connections do not exceed 1830mm (6 feet) in length.

1107.4 Condensation. Refrigerating piping and fittings, brine piping and fittings that, during normal operation, will

reach a surface temperature below the dew point of the surrounding air, and are located in spaces or areas where condensation will cause a safety hazard to the building occupants, structure, electrical *equipment* or any other *equipment* or appliances, shall be protected in an *approved* manner to prevent such damage.

1107.5 Materials for refrigerant pipe and tubing. Piping materials shall be as set forth in Sections 1107.5.1 through 1107.5.5.

1107.5.1 Steel pipe. Carbon steel pipe with a wall thickness not less than Schedule 80 shall be used for Group A2, A3, B2 or B3 refrigerant liquid lines for sizes 38 mm (1.5 inches) and smaller. Carbon steel pipe with a wall thickness not less than Schedule 40 shall be used for Group A1 or B1 refrigerant liquid lines 150mm (6 inches) and smaller, Group A2, A3, B2 or B3 refrigerant liquid lines sizes 51 mm (2 inches) through 150mm (6 inches) and all refrigerant suction and discharge lines 150mm (6 inches) and smaller. Type F steel pipe shall not be used for refrigerant lines having an operating temperature less than -29°C (-20°F).

1107.5.2 Copper and copper-alloy pipe. Standard iron-pipe size, copper and copper-alloy (not less than 80-percent copper) pipe shall conform to ASTM B42 and ASTM B43.

1107.5.3 Copper tube. Copper tube used for refrigerant piping erected on the premises shall be seamless copper tube of Type ACR (hard or annealed) complying with ASTM B280 or ASTM B819. Annealed temper copper tube shall not be used in sizes larger than a 51mm (2-inch) nominal size. Mechanical joints other than press-connect joints listed for refrigerant piping shall not be used on annealed temper copper tube in sizes larger than 22 mm (7/8-inch)OD size.

1107.5.4 Copper tubing joints. Copper tubing joints used in refrigerating systems containing Group A2, A3, B2 or B3 refrigerants shall be brazed. Soldered joints shall not be used in such refrigerating systems.

1107.5.5 Aluminum tube. Type 3003-0 aluminum tubing with high-pressure fittings shall not be used with methyl chloride and other refrigerants known to attack aluminum.

1107.6 Joints and refrigerant-containing parts in air ducts. Joints and all refrigerant-containing parts of a refrigerating system located in an air duct of an air-conditioning system carrying conditioned air to and from human-occupied space shall be constructed to withstand, without leakage, a pressure of 150 percent of the higher of the design pressure or pressure relief device setting.

1107.7 Exposure of refrigerant pipe joints. Refrigerant pipe joints erected on the premises shall be exposed for visual inspection prior to being covered or enclosed.

1107.8 Stop valves. Systems containing more than **3 kg (6.6 pounds)** of a refrigerant in systems using positive-displacement compressors shall have stop valves installed as follows:

1. At the inlet of each compressor, compressor unit or condensing unit.

2. At the discharge outlet of each compressor, compressor unit or condensing unit and of each liquid receiver.

Exceptions:

1. Systems that have a refrigerant pump-out function capable of storing the entire refrigerant charge in a receiver or heat exchanger.
2. Systems that are equipped with provisions for pump-out of the refrigerant using either portable or permanently installed recovery *equipment*.
3. Self-contained systems.

1107.8.1 Liquid receivers. Systems containing 45 kg (100 pounds) or more of a refrigerant, other than systems utilizing nonpositive displacement compressors, shall have stop valves, in addition to those required by Section 1107.8, on each inlet of each liquid receiver. Stop valves shall not be required on the inlet of a receiver in a condensing unit, nor on the inlet of a receiver that is an integral part of the condenser.

1107.8.2 Copper tubing. Stop valves used with soft annealed copper tubing or hard-drawn copper tubing 22 mm (7/8-inch)OD standard size or smaller shall be securely mounted, independent of tubing fastenings or supports.

1107.8.3 Identification. Stop valves shall be identified where their intended purpose is not obvious. Numbers shall not be used to label the valves, unless a key to the numbers is located near the valves.

**SECTION 1108
FIELD TEST**

1108.1 General. Every refrigerant-containing part of every system that is erected on the premises, except compressors, condensers, vessels, evaporators, safety devices, pressure gauges and control mechanisms that are *listed* and factory tested, shall be tested and proved tight after complete installation, and before operation. Tests shall include both the high- and low-pressure sides of each system at not less than the lower of the design pressures or the setting of the pressure relief device(s). The design pressures for testing shall be those listed on the condensing unit, compressor or compressor unit nameplate, as required by ASHRAE 15.

Exceptions:

1. Gas bulk storage tanks that are not permanently connected to a refrigeration system.
2. Systems erected on the premises with copper tubing not exceeding 16 mm (5/8-inch) OD, with wall thickness as required by ASHRAE 15, shall be tested in accordance with Section 1108.1, or by means of refrigerant charged into the system at the saturated vapor pressure of the refrigerant at **21 °C (70 °F)** or higher.
3. Limited-charge systems equipped with a pressure relief

device, erected on the premises, shall be tested at a pressure not less than one and one-half times the pressure setting of the relief device. If the *equipment or appliance* has been tested by the manufacturer at one and one-half times the design pressure, the test after erection on the premises shall be conducted at the design pressure.

1108.1.1 Booter compressor. Where a compressor is used as a booster to obtain an intermediate pressure and discharges into the suction side of another compressor, the booster compressor shall be considered to be a part of the low side, provided that it is protected by a pressure relief device.

1108.1.2 Central/nonpositive displacement compressors. In field-testing systems using centrifugal or other nonpositive displacement compressors, the entire system shall be considered as the low-side pressure for field-test purposes.

1108.2 Test gases. Tests shall be performed with an inert dried gas including, but not limited to, nitrogen and carbon dioxide. Oxygen, air, combustible gases and mixtures containing such gases shall not be used.

Exception: The use of air is allowed to test R-717, ammonia, systems provided that they are subsequently evacuated before charging with refrigerant.

1108.3 Test apparatus. The means used to build up the test pressure shall have either a pressure-limiting device or a pressure-reducing device and a gauge on the outlet side.

1108.4 Declaration. A certificate of test shall be provided for all systems containing 25 kg (55 pounds) or more of refrigerant. The certificate shall give the name of the refrigerant and the field test pressure applied to the high side and the low side of the system. The certification of test shall be signed by the installer and shall be made part of the public record.

SECTION 1109 PERIODIC TESTING

1109.1 Testing required. The following emergency devices and systems shall be periodically tested in accordance with the manufacturer's instructions and as required by the **building official**:

1. Treatment and flaring systems.
2. Valves and appurtenances necessary to the operation of emergency refrigeration control boxes.
3. Fans and associated equipment intended to operate emergency ventilation systems.
4. Detection and alarm systems

SECTION 1110 COMMISSIONING REQUIREMENTS

1110.1 General. The optimum operational performance, and availability as well as maintenance of refrigeration systems depend to a great extent on the quality of the commissioning. Good quality commissioning shall:

1. Establish the optimum set points for the variable operating devices and equipment within the refrigeration system.

2. Provide these set points to maintenance personnel as markers for optimum operational efficiency and system availability.
3. Provide to maintenance personnel advice on the area(s) of the system that requires close monitoring and intermittent adjustment.

1110.2 Detailed requirements for commissioning. Details of the refrigeration plant and/or system to be commissioned shall be supplied to the commissioning engineer. The details shall include the following:

1. Comprehensive information on the refrigerant and compressor lubricant.
2. Full description of the equipment and operation of the refrigeration system including the control sub-system.
3. Comprehensive safety instructions for normal functioning and fault conditions.
4. Complete schematics of the refrigerating system with industry recognised graphics and symbols.

1110.3 Refrigerant piping. As-installed schematic layout drawings for the refrigerant piping system shall be provided with the following information:

1. Full details of any refrigerant distribution pipe work, including pipe size, insulation thickness, the location of valves, instrumentation, safety devices and fittings.
2. Full details of any refrigerant leakage detection system arrangement, together with numbers of sensors and alarm sounders or indicators and their locations.
3. Clear details of any system or arrangement associated with the refrigeration system, such as piped or ducted discharges to the atmosphere, together with any associated mechanical arrangements.
4. Indication of relief valve positions and relief lines to a safe space.
5. Manufacturer's recommended settings for inline devices and equipment in the startup and operating phases of the commissioning process.

1110.4 Chilled water evaporators and condenser coolant piping. Where there is evaporator chilled water and/or condenser cooling solution pipe work to be installed on site, the schematic drawing shall include:

1. Details of coolant composition (water, glycol, water and glycol, etc), volume, flow rates and temperature range, quoting ambient temperatures for air where appropriate, for condensers and evaporators.
2. Details of any regulating, automatic control or safety devices associated with the coolant.
3. Electrical wiring diagrams and/or pneumatic distribution diagrams for the equipment coolant system including details of all interlock arrangements.

1110.5 Documentation with schematics. The schedules of the relevant plant items shall have technical data as follows:

1. Refrigeration Condensers: water/glycol flow rates, pressure drops and 'ON' and 'OFF' temperatures; air flow rates and 'ON' and 'OFF' temperatures for air-cooled condensers; refrigerant condensing temperature.
2. Refrigeration Evaporators: Chilled water/glycol flow rates, pressure drops and 'ON' and 'OFF' temperatures;

air dry and wet bulb 'ON' and 'OFF' temperatures for the cooling coil or direct refrigerant coil; refrigerant evaporating temperature.

1110.6 Refrigeration system details - mechanical: The following information shall be provided:

1. The name and number of the refrigerant, and the name and details of the compressor lubricant specified or recommended by the manufacturer.
2. The weight of the refrigerant charge, and whether the system is supplied fully charged or with a holding charge.
3. The volume of lubricant charge for the compressors.
4. The volume of secondary fluid required for the system.
5. Whether the medium to be cooled is other than air or water and, if so, full details of the chemical constituents and physical characteristics.
6. The manufacturer's specified settings for all safety devices.
7. Design temperatures, pressures and volume flow rates at stated operating conditions for all fluids at defined indication and measuring points.
8. The method and range of capacity control, type and position of sensors.
9. Environmental considerations.
10. Water treatment details.

1110.7 Refrigeration system details – electrical. The following information shall be provided:

1. The declared supply voltage and frequency.
2. The type of compressor motor and the method of starting including details of staged or reduced voltage starting and motor run-up times.
3. Type of speed control of motor where applicable.
4. The motor starting and running currents stated by the manufacturer.
5. Number of starts per hour.
6. Details of electrical protection devices for the compressor motors.
7. The fuse or circuit breaker ratings for the compressor motor.
8. The design settings for starter overloads and any adjustable thermal cutouts.
9. Full details of interlock arrangements and starting sequences for ancillary equipment including any associated time delays or run-on requirements.

1110.8 Commissioning process. The following completed tasks shall constitute an acceptable commissioning process:

1. Close physical examination of the entire mechanical; electrical and controls installation to ensure that all equipment, devices, materials, onnections and terminations are in their proper place; securely anchored or terminated; geometrically aligned; professionally installed and is in congruence with the design mechanical, electrical and controls drawings; manufacturer's installation instructions.
2. Recording of all nonconformity or unacceptable installation practice.
3. Obtain expeditious correction of all physical nonconformities and correction of those issues affecting safety and performance prior to the start-up phase commencement.

4. Conduct all non-operational measurements such as supply voltages to various equipment and devices or refrigerant charge pressure or cable resistance or ground resistance and record all values then make comparative checks with manufacturer's recommended values.

5. Obtain expeditious correction of all measurement nonconformities and correction of those items affecting safety and performance prior to the start-up phase commencement.

6. Following the clearance of all non-conformities, conduct start up equipment operation tests at reduced load according to the manufacturer's instructions and record all voltage, current, pressure, temperature, humidity, flow rate and any other measurements needed to assess performance and compare these with manufatururer's or code recommended values.

7. Obtain expeditious correction of all nonconformities prior to the commencement of the full-load tests.

8. Following the clearance of all reduced load non-conformities, conduct start up equipment operation tests at full load according to the manufacturer's instructions and record all voltage, current, pressure, temperature, humidity, flow rate and any other measurements needed to assess performance and compare these with manufatururer's or code recommended values.

9. Obtain expeditious correction of any nonconformity arising from the before repeating, if necessary, the full-load tests.

10. Prepare a comprehensive report in which operational measurement markers are recommended for maintenance usage.

CHAPTER 12

HYDRONIC PIPING

User note:

About this chapter: Chapter 12 addresses the piping systems used in heating and cooling systems. Such piping typically conveys water, water and antifreeze solutions, steam and condensate. The fluids conveyed are heated or cooled by boilers, chillers, and heat pumps, which are all components of HVAC systems.

SECTION 1201 GENERAL

1201.1 Scope. The provisions of this chapter shall govern the construction, installation, *alteration* and repair of hydronic piping systems. This chapter shall apply to hydronic piping systems that are part of heating, ventilation and air-conditioning systems. Such piping systems shall include steam, hot water, chilled water, steam condensate and ground source heat pump loop systems. Potable cold and hot water distribution systems shall be installed in accordance with the *Jamaica Plumbing Code*.

1201.2 Sizing. Piping and piping system components for hydronic systems shall be sized for the demand of the system.

1201.3 Standards. As an alternative to the provisions of Sections 1202 and 1203, piping shall be designed, installed, inspected and tested in accordance with ASME B31.9.

SECTION 1202 MATERIAL

1202.1 Piping. Piping material shall conform to the standards cited in this section and the fittings used with a

selected type of pipe shall not be made from dissimilar material that sets up electrolytic corrosion between the pipe and fitting.

Exception: Embedded piping regulated by Section 1209.

1202.2 Used materials. Reused pipe, fittings, valves or other materials shall be clean and free of foreign materials and shall be *approved* by the building official for reuse.

1202.3 Material rating. Materials shall be rated for the operating temperature and pressure of the hydronic system. Materials shall be suitable for the type of fluid in the hydronic system.

1202.4 Piping materials standards. Hydronic pipe shall conform to the standards listed in Table 1202.4. The exterior of the pipe shall be protected from corrosion and degradation.

**TABLE 1202.4
HYDRONIC PIPE**

MATERIAL	STANDARD (see Chapter 15)
Acrylonitrile butadiene styrene (ABS) plastic pipe	ASTM D1527; ASTM F2806
Chlorinated polyvinyl chloride (CPVC) plastic pipe	ASTM D2846; ASTM F441; ASTM F442
Copper or copper-alloy pipe	ASTM B42; ASTM B43; ASTM B302
Copper or copper-alloy tube (Type K, L or M)	ASTM B75; ASTM B88; ASTM B135; ASTM B251
Cross-linked polyethylene/aluminum/cross-linked polyethylene (PEX-AL-PEX) pressure pipe	ASTM F1281; CSA CAN/CSA-B-137.10
Cross-linked polyethylene (PEX) tubing	ASTM F876
Ductile iron pipe	AWWA C115/A21.15; AWWA C151/A21.51
Lead pipe	FS WW-P-325B
Polyethylene/aluminum/polyethylene (PE-AL-PE) pressure pipe	ASTM F1282; CSA B137.9
Polypropylene (PP) plastic pipe	ASTM F2389
Polyvinyl chloride (PVC) plastic pipe	ASTM D1785; ASTM D2241
Raised temperature polyethylene (PE-RT)	ASTM F2623; ASTM F2769; CSA B137.18
Steel pipe	ASTM A53; ASTM A106
Steel tubing	ASTM A254

1202.5 Pipe fittings. Hydronic pipe fittings shall be *approved* for installation with the piping materials to be installed, and shall conform to the respective pipe standards or to the standards listed in Table 1202.5.

**TABLE 1202.5
HYDRONIC PIPE FITTINGS**

MATERIAL	STANDARD (see Chapter 15)
Copper and copper alloys	ASME B16.15; ASME B16.18; ASME B16.22; ASME B16.26; ASME B16.24; ASME B16.51; ASSE 1061; ASTM F1974
Ductile iron and gray iron	ANSI/AWWA C110/A21.10; AWWA C153/A21.53; ASTM A395; ASTM A536; ASTM F1476; ASTM F1548
Ductile iron	ANSI/AWWA C153/A21.53
Gray iron	ASTM A126
Malleable iron	ASME B16.3
PE-RT fittings	ASSE 1061; ASTM D3261; ASTM F1807; ASTM F2098; ASTM F2159; ASTM F2735; ASTM F2769; CSA B137.1; CSA B137.18
PEX fittings	ASSE 1061; ASTM F877; ASTM F1807; ASTM F1960; ASTM F2080; ASTM F2159
Plastic	ASTM D2466; ASTM D2467; ASTM F438; ASTM F439; ASTM F877; ASTM F2389; ASTM F2735
Steel	ASME B16.5; ASME B16.9; ASME B16.11; ASME B16.28; ASTM A53; ASTM A106; ASTM A234; ASTM A395; ASTM A420; ASTM A536; ASTM F1476; ASTM F1548

1202.6 Valves. Valves shall be constructed of materials that are compatible with the type of piping material and fluids in the system. Valves shall be rated for the temperatures and pressures of the systems in which the valves are installed.

1202.7 Flexible connectors, expansion and vibration compensators. Flexible connectors, expansion and vibration control devices and fittings shall be of an *approved* type which shall not be made from dissimilar material that sets up electrolytic corrosion between the pipe and fitting.

SECTION 1203 JOINTS AND CONNECTIONS

1203.1 Approval. Joints and connections shall be of an *approved* type. Joints and connections shall be tight and leak-free for the pressure of the hydronic system.

1203.1.1 Joints between different piping materials.

Joints between different piping materials shall be made with *approved* adapter fittings.

1203.2 Preparation of pipe ends. Pipe shall be cut square, reamed and chamfered, and shall be free of burrs and obstructions. Pipe ends shall have full-bore openings and shall not be

undercut. **1203.3 Joint preparation and installation.** Where required by Sections 1203.4 through 1203.12, the preparation and installation of brazed, mechanical, soldered, solvent-cemented, threaded and welded joints shall comply with Sections 1203.3.1 through 1203.3.8.2.

1203.3.1 Brazed joints. Joint surfaces shall be cleaned. An *approved* flux shall be applied where required. The joint shall be brazed with a filler metal conforming to AWS A5.8.

1203.3.2 Mechanical joints. Mechanical joints shall be installed in accordance with the manufacturer's instructions.

1203.3.3 Soldered joints. Solder joints shall be made in accordance with ASTM B828. Cut tube ends shall be reamed to the full inside diameter of the tube end. A flux conforming to ASTM B813 shall be applied. The joint shall be soldered with a solder conforming to ASTM B32.

1203.3.4 Solvent-cemented joints. Joint surfaces shall be clean and free of moisture. An *approved* primer shall be applied to CPVC and PVC pipe-joint surfaces. Joints shall be made while the cement is wet. Solvent cement conforming to the following standards shall be applied to all joint surfaces:

1. ASTM D2235 for ABS joints.
2. ASTM F493 for CPVC joints.
3. ASTM D2564 for PVC joints.

CPVC joints shall be made in accordance with ASTM D2846.

Exception: For CPVC pipe joint connections, a primer is not required where all of the following conditions apply:

1. The solvent cement used is third-party certified as conforming to ASTM F493.
2. The solvent cement is yellow in color.
3. The solvent cement is used only for joining 12.5mm (1/2-inch) through 51 mm (2-inch) diameter CPVC pipe and fittings.
4. The CPVC pipe and fittings are manufactured in accordance with ASTM D2846.

1203.3.5 Threaded joints. Threads shall conform to ASME B1.20.1. Schedule 80 or heavier plastic pipe shall be threaded with dies specifically designed for plastic pipe. Thread lubricant, pipe-joint compound or tape shall be applied on the male threads only and shall be *approved* for application on the piping material.

1203.3.6 Welded joints. Joint surfaces shall be cleaned by an *approved* procedure. Joints shall be welded with an *approved* filler metal.

1203.3.7 Grooved and shouldered mechanical joints. Grooved and shouldered mechanical joints shall conform to the requirements of ASTM F1476 and shall be installed in accordance with the manufacturer's instructions.

1203.3.8 Mechanically formed tee fittings. Mechanically extracted outlets shall have a height not less than three times the thickness of the branch tube wall.

1203.3.8.1 Full flow assurance. Branch tubes shall not restrict the flow in the run tube. A dimple/depth stop shall be formed in the branch tube to ensure that pene-

tration into the outlet is of the correct depth. For inspection purposes, a second dimple shall be placed 6.35 mm ($\frac{1}{4}$ inch) above the first dimple. Dimples shall be aligned with the tube run.

1203.3.8.2 Brazed joints. Mechanically formed tee fittings shall be brazed in accordance with Section 1203.3.1.

1203.4 ABS plastic pipe. Joints between ABS plastic pipe or fittings shall be solvent-cemented or threaded joints conforming to Section 1203.3.

1203.5 Copper or copper-alloy pipe. Joints between copper or copper-alloy pipe or fittings shall be brazed, mechanical, soldered, threaded or welded joints conforming to Section 1203.3.

1203.6 Copper or copper-alloy tubing. Joints between copper or copper-alloy tubing or fittings shall be brazed, mechanical or soldered joints conforming to Section 1203.3, flared joints conforming to Section 1203.6.1, push-fit joints conforming to Section 1203.6.2 or *press-connect* joints conforming to Section 1203.6.3.

1203.6.1 Flared joints. Flared joints shall be made by a tool designed for that operation.

1203.6.2 Push-fit joints. Push-fit joints shall be installed in accordance with the manufacturer's instructions.

1203.6.3 Press-connect joints. *Press-connect joints* shall be installed in accordance with the manufacturer's instructions.

1203.7 CPVC plastic pipe. Joints between CPVC plastic pipe or fittings shall be solvent-cemented or threaded joints conforming to Section 1203.3.

1203.8 Polybutylene plastic pipe and tubing. Joints between polybutylene plastic pipe and tubing or fittings shall be mechanical joints conforming to Section 1203.3 or heat-fusion joints conforming to Section 1203.8.1.

1203.8.1 Heat-fusion joints. Joints shall be of the socket-fusion or butt-fusion type. Joint surfaces shall be clean and free of moisture. Joint surfaces shall be heated to melt temperatures and joined. The joint shall be undisturbed until cool. Joints shall be made in accordance with ASTM D3309.

1203.9 Cross-linked polyethylene (PEX) plastic tubing. Joints between cross-linked polyethylene plastic tubing and fittings shall conform to Sections 1203.9.1 through 1203.9.3. Mechanical joints shall conform to Section 1203.3.

1203.9.1 Compression-type fittings. Where compression-type fittings include inserts and ferrules or O-rings, the fittings shall be installed without omitting the inserts and ferrules or O-rings.

1203.9.2 Plastic-to-metal connections. Soldering on the metal portion of the system shall be performed not less than 457 mm (18 inches) from a plastic-to-metal adapter in the same water line.

1203.9.3 Push-fit joints. Push-fit joints that create a seal

on the outside diameter of the tubing shall not be used

with tubing that has an ethylene vinyl alcohol copolymer (EVOH) oxygen barrier layer.

1203.10 PVC plastic pipe. Joints between PVC plastic pipe and fittings shall be solvent-cemented or threaded joints conforming to Section 1203.3.

1203.11 Steel pipe. Joints between steel pipe or fittings shall be mechanical joints that are made with an *approved* elastomeric seal, or shall be threaded or welded joints conforming to Section 1203.3.

1203.12 Steel tubing. Joints between steel tubing or fittings shall be mechanical or welded joints conforming to Section 1203.3.

1203.13 Polypropylene (PP) plastic. Joints between PP plastic pipe and fittings shall comply with Sections 1203.13.1 and 1203.13.2.

1203.13.1 Heat-fusion joints. Heat-fusion joints for polypropylene (PP) pipe and tubing joints shall be installed with socket-type heat-fused polypropylene fittings, electro-fusion polypropylene fittings or by butt fusion. Joint surfaces shall be clean and free from moisture. The joint shall be undisturbed until cool. Joints shall be made in accordance with ASTM F2389.

1203.13.2 Mechanical and compression sleeve joints. Mechanical and compression sleeve joints shall be installed in accordance with the manufacturer's instructions.

1203.14 Raised temperature polyethylene (PE-RT) plastic tubing. Joints between raised temperature polyethylene tubing and fittings shall conform to Sections 1203.14.1 through 1203.14.3. Mechanical joints shall conform to Section 1203.3.

1203.14.1 Compression-type fittings. Where compression-type fittings include inserts and ferrules or O-rings, the fittings shall be installed without omitting the inserts and ferrules or O-rings.

1203.14.2 PE-RT-to-metal connections. Solder joints in a metal pipe shall not occur within **455 mm (18 inches)** of a transition from such metal pipe to PE-RT pipe.

1203.14.3 Push-fit joints. Push-fit joints that create a seal on the outside diameter of the tubing shall not be used with tubing that has an ethylene vinyl alcohol copolymer (EVOH) oxygen barrier layer.

1203.15 Polyethylene/aluminum/polyethylene (PE-AL-PE) pressure pipe. Joints between polyethylene/aluminum/polyethylene pressure pipe and fittings shall conform to Sections 1203.15.1 and 1203.15.2. Mechanical joints shall comply with Section 1203.3.

1203.15.1 Compression-type fittings. Where compression-type fittings include inserts and ferrules or O-rings, the fittings shall be installed without omitting the inserts and ferrules or O-rings.

1203.15.2 PE-AL-PE-to-metal connections. Solder joints in a metal pipe shall not occur within **455 mm (18 inches)** of a transition from such metal pipe to PE-AL-PE pipe.

1203.16 Cross-linked polyethylene/aluminum/cross-linked polyethylene (PEX-AL-PEX) pressure pipe. Joints between cross-linked polyethylene/aluminum/cross-linked polyethylene pressure pipe and fittings shall conform to Sections 1203.16.1 and 1203.16.2. Mechanical joints shall comply with Section 1203.3.

1203.16.1 Compression-type fittings. Where compression-type fittings include inserts and ferrules or O-rings, the fittings shall be installed without omitting the inserts and ferrules or O-rings.

1203.16.2 PEX-AL-PEX-to-metal connections. Solder joints in a metal pipe shall not occur within **455 mm (18 inches)** of a transition from such metal pipe to PEX-AL-PEX pipe.

SECTION 1204 PIPE INSULATION

1204.1 Insulation characteristics. Pipe insulation installed in buildings shall conform to the requirements of the *Jamaica Energy Conservation Code*; shall be tested in accordance with ASTM E84 or UL 723, using the specimen preparation and mounting procedures of ASTM E2231; and shall have a maximum flame spread index of 25 and a smoke-developed index not exceeding 450. Insulation installed in an air plenum shall comply with Section 602.2.1.

Exception: The maximum flame spread index and smoke-developed index shall not apply to one- and two-family dwellings.

1204.2 Required thickness. Hydronic piping shall be insulated to the thickness required by the *Jamaica Energy Conservation Code*.

SECTION 1205 VALVES

1205.1 Where required. Shutoff valves shall be installed in hydronic piping systems in the locations indicated in Sections 1205.1.1 through 1205.1.6.

1205.1.1 Heat exchangers. Shutoff valves shall be installed on the supply and return side of a heat exchanger.

Exception: Shutoff valves shall not be required where heat exchangers are integral with a boiler; or are a component of a manufacturer's boiler and heat exchanger packaged unit and are capable of being isolated from the hydronic system by the supply and return valves required by Section 1005.1.

1205.1.2 Central systems. Shutoff valves shall be installed on the building supply and return of a central utility system.

1205.1.3 Pressure vessels. Shutoff valves shall be installed on the connection to any pressure vessel.

1205.1.4 Pressure-reducing valves. Shutoff valves shall be installed on both sides of a pressure-reducing valve.

1205.1.5 Equipment and appliances. Shutoff valves shall be installed on connections to mechanical *equipment* and appliances. This requirement does not apply to components of a hydronic system such as pumps, air separators, metering devices and similar *equipment*.

1205.1.6 Expansion tanks. Shutoff valves shall be installed at connections to nondiaphragm-type expansion tanks.

1205.2 Reduced pressure. A pressure relief valve shall be installed on the low-pressure side of a hydronic piping system that has been reduced in pressure. The relief valve shall be set at the maximum pressure of the system design. The valve shall be installed in accordance with Section 1006.

SECTION 1206 PIPING INSTALLATION

1206.1 General. Piping, valves, fittings and connections shall be installed in accordance with the conditions of approval.

1206.2 System drain down. Hydronic piping systems shall be designed and installed to permit the system to be drained. Where the system drains to the plumbing drainage system, the installation shall conform to the requirements of the *Jamaica Plumbing Code*.

Exception: The buried portions of systems embedded underground or under floors.

1206.3 Protection of potable water. The potable water system shall be protected from backflow in accordance with the *Jamaica Plumbing Code*.

1206.4 Pipe penetrations. Openings for pipe penetrations in walls, floors or ceilings shall be larger than the penetrating pipe. Openings through concrete or masonry building elements shall be sleeved. The annular space surrounding pipe penetrations shall be protected in accordance with the *Jamaica Building Code*.

1206.5 Clearance to combustibles. A pipe in a hydronic piping system in which the exterior temperature exceeds 121°C (250°F) shall have a minimum *clearance* of 25 mm (1 inch) to combustible materials.

1206.6 Contact with building material. A hydronic piping system shall not be in direct contact with building materials that cause the piping material to degrade or corrode, or that interfere with the operation of the system.

1206.7 Water hammer. The flow velocity of the hydronic piping system shall be controlled to reduce the possibility of water hammer. Where a quick-closing valve creates water hammer, an *approved* water-hammer arrestor shall be installed. The arrestor shall be located within a range as specified by the manufacturer of the quick-closing valve.

1206.8 Steam piping pitch. Steam piping shall be installed to drain to the boiler or the steam trap. Steam systems shall not have drip pockets that reduce the capacity of the steam piping.

1206.9 Strains and stresses. Piping shall be installed so as to prevent detrimental strains and stresses in the pipe. Provisions shall be made to protect piping from damage resulting from expansion, contraction and structural settlement. Piping shall be installed so as to avoid structural stresses or strains within building components.

1206.9.1 Flood hazard. Piping located in a flood hazard area shall be capable of resisting hydrostatic and hydrodynamic loads and stresses, including the effects of buoyancy, during the occurrence of flooding to the *design flood elevation*.

1206.10 Pipe support. Pipe shall be supported in accordance with Section 305.

1206.11 Condensation. Provisions shall be made to prevent the formation of condensation on the exterior of piping.

SECTION 1207 TRANSFER FLUID

1207.1 Flash point. The flash point of transfer fluid in a hydronic piping system shall be not less than 28°C (50°F) above the maximum system operating temperature.

1207.2 Makeup water. The transfer fluid shall be compatible with the makeup water supplied to the system.

SECTION 1208 TESTS

1208.1 General. Hydronic piping systems shall be tested hydrostatically at one and one-half times the maximum system design pressure, but not less than 689 kPa (100 psi). The duration of each test shall be not less than 15 minutes.

Exception: For PEX piping systems, testing with a compressed gas shall be an alternative to hydrostatic testing where compressed air or other gas pressure testing is specifically authorized by all of the manufacturers' instructions for the PEX pipe and fitting products installed at the time the system is being tested, and compressed air or other gas testing is not otherwise prohibited by applicable codes, laws or regulations outside of this code.

SECTION 1209 EMBEDDED PIPING

1209.1 Materials. Piping for heating panels shall be standard-weight steel pipe, Type L copper tubing, polybutylene or other *approved* plastic pipe or tubing rated at 689 kPa (100 psi) at 82°C (180°F).

1209.2 Pressurizing during installation. Piping to be embedded in concrete shall be pressure tested prior to pouring concrete. During pouring, the pipe shall be maintained at the proposed operating pressure.

1209.3 Embedded joints. Joints of pipe or tubing that are embedded in a portion of the building, such as concrete or

plaster, shall be in accordance with the requirements of Sections 1209.3.1 through 1209.3.5.

1209.3.1 Steel pipe joints. Steel pipe shall be welded by electrical arc or oxygen/acetylene method.

1209.3.2 Copper tubing joints. Copper tubing shall be joined by brazing complying with Section 1203.3.1.

1209.3.3 Polybutylene joints. Polybutylene pipe and tubing shall be installed in continuous lengths or shall be joined by heat fusion in accordance with Section 1203.8.1.

1209.3.4 Polyethylene of raised temperature (PE-RT) joints. PE-RT tubing shall be installed in continuous lengths or shall be joined by hydronic fittings listed in Table 1202.5.

1209.3.5 Cross-linked polyethylene (PEX) joints. PEX tubing shall be installed in continuous lengths or shall be joined by hydronic fittings listed in Table 1202.5.

1209.4 Not embedded related piping. Joints of other piping in cavities or running exposed shall be joined by *approved* methods in accordance with manufacturer's installation instructions and related sections of this code.

1209.5 Thermal barrier required. Radiant floor heating systems shall be provided with a thermal barrier in accordance with Sections 1209.5.1 and 1209.5.2. Insulation *R*-values for slab-on-grade and suspended floor installation shall be in accordance with the *Jamaica Energy Conservation Code*.

Exception: Insulation shall not be required in engineered systems where it can be demonstrated that the insulation will decrease the efficiency or have a negative effect on the installation.

1209.5.1 Thermal break required. A thermal break shall be provided consisting of asphalt expansion joint materials or similar insulating materials at a point where a heated slab meets a foundation wall or other conductive slab.

1209.5.2 Thermal barrier material marking. Insulating materials utilized in thermal barriers shall be installed such that the manufacturer's *R*-value mark is readily observable upon inspection.

SECTION 1210 PLASTIC PIPE GROUND-SOURCE HEAT PUMP LOOP SYSTEMS

1210.1 Ground-source heat pump-loop water piping. Ground-source heat pump ground-loop piping and tubing material for water-based systems shall conform to the standards cited in this section.

1210.2 Used materials. Reused pipe, fittings, valves, and other materials shall not be permitted in ground-source heat pump loop systems.

1210.3 Material rating. Pipe and tubing shall be rated for the operating temperature and pressure of the ground-source heat pump loop system. Fittings shall be suitable for the pressure

applications and recommended by the manufacturer for installation with the pipe and tubing material installed. Where used underground, materials shall be suitable for burial.

1210.4 Piping and tubing materials standards. Ground-source heat pump ground-loop pipe and tubing shall conform to the standards listed in Table 1210.4.

1210.5 Fittings. Ground-source heat pump pipe fittings shall be approved for installation with the piping materials to be installed, shall conform to the standards listed in Table 1210.5 and, if installed underground, shall be suitable for burial.

1210.6 Joints. Joints and connections shall be of an approved type. Joints and connections shall be tight for the pressure of the ground-source loop system. Joints used underground shall be approved for buried applications.

1210.6.1 Joints between different piping materials. Joints between different piping materials shall be made with approved transition fittings.

1210.6.2 Preparation of pipe ends. Pipe shall be cut square, be reamed, and be free of burrs and obstructions. CPVC, PE, and PVC pipe shall be chamfered. Pipe ends shall have full-bore openings and shall not be undercut.

1210.6.3 Joint preparation and installation. Where required by Sections 1210.6.4 through 1210.6.8, the preparation and installation of mechanical and thermoplas-

tic-welded joints shall comply with Sections 1210.6.3.1 and 1210.6.3.2.

1210.6.3.1 Mechanical joints. Mechanical joints shall be installed in accordance with the manufacturer's instructions.

1210.6.3.2 Thermoplastic-welded joints. Joint surfaces for thermoplastic-welded joints shall be cleaned by an approved procedure. Joints shall be welded in accordance with the manufacturer's instructions.

1210.6.4 CPVC plastic pipe. Joints between CPVC plastic pipe or fittings shall be solvent-cemented or threaded joints complying with Section 1203.3.

1210.6.5 Cross-linked polyethylene (PEX) plastic tubing. Joints between cross-linked polyethylene plastic tubing and fittings shall comply with Sections 1210.6.5.1 and 1210.6.5.2. Mechanical joints shall comply with Section 1210.6.3.

1210.6.5.1 Compression-type fittings. Where compression-type fittings include inserts and ferrules or O-rings, the fittings shall be installed without omitting the inserts and ferrules or O-rings.

1210.6.5.2 Plastic-to-metal connections. Soldering on the metal portion of the system shall be performed not less than 455 mm (18 inches) from a plastic-to-metal adapter in the same water line.

**TABLE 1210.4
GROUND-SOURCE LOOP PIPE**

MATERIAL	STANDARD (see Chapter 15)
Chlorinated polyvinyl chloride (CPVC)	ASTM D2846; ASTM F441; ASTM F442
Cross-linked polyethylene (PEX)	ASTM F876; CSA B137.5
Polyethylene/aluminum/polyethylene (PE-AL-PE) pressure pipe	ASTM F1282; CSA B137.9
High-density polyethylene (HDPE)	ASTM D2737; ASTM D3035; ASTM F714; AWWA C901; CSA B137.1; CSA C448; NSF 358-1
Polypropylene (PP-R)	ASTM F2389; CSA B137.11; NSF 358-2
Polyvinyl chloride (PVC)	ASTM D1785; ASTM D2241
Raised temperature polyethylene (PE-RT)	ASTM F2623; ASTM F2769; CSA B137.18

**TABLE 1210.5
GROUND-SOURCE LOOP PIPE FITTINGS**

PIPE MATERIAL	STANDARD (see Chapter 15)
Chlorinated polyvinyl chloride (CPVC)	ASTM D2846; ASTM F437; ASTM F438; ASTM F439; CSA B137.6
Cross-linked polyethylene (PEX)	ASTM F877; ASTM F1807; ASTM F1960; ASTM F2080; ASTM F2159; ASTM F2434; CSA B137.5
Polyethylene/aluminum/polyethylene (PE-AL-PE)	ASTM F1282; ASTM F2434; CSA B137.9
High Density Polyethylene (HDPE)	ASTM D2683; ASTM D3261; ASTM F1055; CSA B137.1; CSA C448; NSF 358-1
Polypropylene (PP-R)	ASTM F2389; CSA B137.11; NSF 358-2
Polyvinyl chloride (PVC)	ASTM D2464; ASTM D2466; ASTM D2467; CSA B137.2; CSA B137.3
Raised temperature polyethylene (PE-RT)	ASTM D3261; ASTM F1807; ASTM F2098; ASTM F2159; ASTM F2735; ASTM F2769; CSA B137.1; CSA B137.18

1210.6.6 Polyethylene plastic pipe and tubing for ground-source heat pump loop systems. Joints between polyethylene plastic pipe and tubing or fittings for ground-source heat pump loop systems shall be heat-fusion joints complying with Section 1210.6.6.1, electrofusion joints complying with Section 1210.6.6.2, or stab-type insertion joints complying with Section 1210.6.6.3.

1210.6.6.1 Heat-fusion joints. Joints shall be of the socket-fusion, saddle-fusion or butt-fusion type, joined in accordance with ASTM D2657. Joint surfaces shall be clean and free from moisture. Joint surfaces shall be heated to melt temperatures and joined. The joint shall be undisturbed until cool. Fittings shall be manufactured in accordance with ASTM D2683 or ASTM D3261.

1210.6.6.2 Electrofusion joints. Joints shall be of the electrofusion type. Joint surfaces shall be clean and free from moisture, and scoured to expose virgin resin. Joint surfaces shall be heated to melt temperatures for the period of time specified by the manufacturer. The joint shall be undisturbed until cool. Fittings shall be manufactured in accordance with ASTM F1055.

1210.6.6.3 Stab-type insert fittings. Joint surfaces shall be clean and free from moisture. Pipe ends shall be chamfered and inserted into the fittings to full depth. Fittings shall be manufactured in accordance with ASTM F1924.

1210.6.7 Polypropylene (PP) plastic. Joints between PP plastic pipe and fittings shall comply with Sections 1210.6.7.1 and 1210.6.7.2.

1210.6.7.1 Heat-fusion joints. Heat-fusion joints for polypropylene (PP) pipe and tubing joints shall be installed with socket-type heat-fused polypropylene fittings, electrofusion polypropylene fittings or by butt fusion. Joint surfaces shall be clean and free from moisture. The joint shall be undisturbed until cool. Joints shall be made in accordance with ASTM F2389.

1210.6.7.2 Mechanical and compression sleeve joints. Mechanical and compression sleeve joints shall be installed in accordance with the manufacturer's instructions.

1210.6.8 Raised temperature polyethylene (PE-RT) plastic tubing. Joints between raised temperature polyethylene tubing and fittings shall comply with Sections 1210.6.8.1 and 1210.6.8.2. Mechanical joints shall comply with Section 1210.6.3.

1210.6.8.1 Compression-type fittings. Where compression-type fittings include inserts and ferrules or O-rings, the fittings shall be installed without omitting the inserts and ferrules or O-rings.

1210.6.8.2 PE-RT-to-metal connections. Solder joints in a metal pipe shall not occur within **455 mm (18 inches)** of a transition from such metal pipe to PE-RT pipe.

1210.6.9 PVC plastic pipe. Joints between PVC plastic pipe and fittings shall be solvent-cemented or threaded joints comply with Section 1203.3.

1210.7 Shutoff valves. Shutoff valves shall be installed in ground-source loop piping systems in the locations indicated in Sections 1210.7.1 through 1210.7.7.

1210.7.1 Heat exchangers. Shutoff valves shall be installed on the supply and return side of a heat exchanger.

Exception: Shutoff valves shall not be required where heat exchangers are integral with a boiler or are a component of a manufacturer's boiler and heat exchanger packaged unit and are capable of being isolated from the hydronic system by the supply and return valves required by Section 1005.1.

1210.7.2 Central systems. Shutoff valves shall be installed on the building supply and return of a central utility system.

1210.7.3 Pressure vessels. Shutoff valves shall be installed on the connection to any pressure vessel.

1210.7.4 Pressure-reducing valves. Shutoff valves shall be installed on both sides of a pressure-reducing valve.

1210.7.5 Equipment and appliances. Shutoff valves shall be installed on connections to mechanical *equipment* and appliances. This requirement does not apply to components of a ground-source loop system such as pumps, air separators, metering devices, and similar *equipment*.

1210.7.6 Expansion tanks. Shutoff valves shall be installed at connections to nondiaphragm-type expansion tanks.

1210.7.7 Reduced pressure. A pressure relief valve shall be installed on the low-pressure side of a hydronic piping system that has been reduced in pressure. The relief valve shall be set at the maximum pressure of the system design. The valve shall be installed in accordance with Section 1006.

1210.8 Installation. Piping, valves, fittings, and connections shall be installed in accordance with the conditions of approval.

1210.8.1 Protection of potable water. Where ground-source heat pump ground-loop systems have a connection to a potable water supply, the potable water system shall be protected from backflow in accordance with the *Jamaica Plumbing Code*.

1210.8.2 Pipe penetrations. Openings for pipe penetrations in walls, floors and ceilings shall be larger than the penetrating pipe. Openings through concrete or masonry building elements shall be sleeved. The annular space surrounding pipe penetrations shall be protected in accordance with the *Jamaica Building Code*.

1210.8.3 Clearance from combustibles. A pipe in a ground-source heat pump piping system having an exterior surface temperature exceeding 121°C (250°F) shall have a minimum *clearance* of 25 mm (1 inch) from combustible materials.

1210.8.4 Contact with building material. A ground-source heat pump ground-loop piping system shall not be in direct contact with building materials that cause the piping or fitting material to degrade or corrode, or that interfere with the operation of the system.

1210.8.5 Strains and stresses. Piping shall be installed so as to prevent detrimental strains and stresses in the pipe. Provisions shall be made to protect piping from damage resulting from expansion, contraction and structural settlement. Piping shall be installed so as to avoid structural stresses or strains within building components.

1210.8.6 Flood hazard. Piping located in a flood hazard area shall be capable of resisting hydrostatic and hydrodynamic loads and stresses, including the effects of buoyancy, during the occurrence of flooding to the *design flood elevation*.

1210.8.7 Pipe support. Pipe shall be supported in accordance with Section 305.

1210.8.8 Velocities. Ground-source heat pump ground-loop systems shall be designed so that the flow velocities do not exceed the maximum flow velocity recommended by the pipe and fittings manufacturer and shall be controlled to reduce the possibility of water hammer.

1210.8.9 Labeling and marking. Ground-source heat pump ground-loop system piping shall be marked with tape, metal tags or other method where it enters a building indicating "GROUND-SOURCE HEAT PUMP LOOP

SYSTEM." The marking shall indicate any antifreeze used in the system by name and concentration.

1210.8.10 Chemical compatibility. Antifreeze and other materials used in the system shall be chemically compatible with the pipe, tubing, fittings, and mechanical systems.

1210.9 Makeup water. The transfer fluid shall be compatible with the makeup water supplied to the system.

1210.10 Tests. Before connection header trenches are back-filled, the assembled loop system shall be pressure tested with water at 689 kPa (100 psi) for 15 minutes, in which time there shall not be observed leaks. Flow and pressure loss testing shall be performed and the actual flow rates and pressure drops shall be compared to the calculated design values. If actual flow rate or pressure drop values differ from calculated design values by more than 10 percent, the cause shall be identified and corrective action taken.

1210.11 Embedded piping. Ground-source heat pump ground-loop piping to be embedded in concrete shall be pressure tested prior to pouring concrete. During pouring, the pipe shall be maintained at the proposed operating pressure.

CHAPTER 13 FUEL OIL PIPING AND STORAGE

User note:

About this chapter: Chapter 13 is devoted to fuel oil piping and fuel oil storage related to heating appliances, power generators and similar equipment/appliances. The requirements focus on preventing fuel leaks and equipment failures that could result in severe fire hazards.

SECTION 1301 GENERAL

1301.1 Scope. This chapter shall govern the design, installation, construction and repair of fuel-oil storage and piping systems. The storage of fuel oil and flammable and combustible liquids shall be in accordance with Chapters 6 and 57 of the *Jamaica Fire Code*.

1301.2 Storage and piping systems. Fuel-oil storage systems shall comply with Section 603.3 of the *Jamaica Fire Code*. Fuel-oil piping systems shall comply with the requirements of this code.

1301.3 Fuel type. An *appliance* shall be designed for use with the type of fuel to which it will be connected. Such *appliance* shall not be converted from the fuel specified on the rating plate for use with a different fuel without securing reapproval from the code official.

1301.4 Fuel tanks, piping and valves. The tank, piping and valves for appliances burning oil shall be installed in accordance with the requirements of this chapter. Where an oil burner is served by a tank, any part of which is above the level of the burner inlet connection and where the fuel supply line is taken from the top of the tank, an *approved* antisiphon valve or other siphon-breaking device shall be installed in lieu of the shutoff valve.

1301.5 Tanks abandoned or removed. All exterior above-grade fill piping shall be removed when tanks are abandoned or removed. Tank abandonment and removal shall be in accordance with Section 5704.2.13 of the *Jamaica Fire Code*.

1301.6 Performance. Fuel oil storage installations, including pipework connecting them to the combustion appliances in the buildings served, shall be located and constructed so that there is reasonable protection from fires, which may occur in buildings or beyond the lot boundaries.

SECTION 1302 MATERIAL

1302.1 General. Piping materials shall conform to the standards cited in this section.

1302.2 Rated for system. All materials shall be rated for the operating temperatures and pressures of the system, and shall be compatible with the type of liquid.

1302.3 Pipe standards. Fuel oil pipe shall comply with one of the standards listed in Table 1302.3.

1302.4 Nonmetallic pipe. Nonmetallic pipe shall be *listed* and *labeled* as being acceptable for the intended application

be installed only outdoors, underground.

TABLE 1302.3 FUEL OIL PIPING

MATERIAL	STANDARD (see Chapter 15)
Copper or copper-alloy pipe	ASTM B42; ASTM B43; ASTM B302
Copper or copper-alloy tubing (Type K, L or M)	ASTM B75; ASTM B88; ASTM B280; ASME B16.51
Labeled pipe	(See Section 1302.4)
Nonmetallic pipe	ASTM D2996
Steel pipe	ASTM A53; ASTM A106
Steel tubing	ASTM A254; ASTM A539

1302.5 Fittings and valves. Fittings and valves shall be *approved* for the piping systems, and shall be compatible with, or shall be of the same material as, the pipe or tubing.

1302.6 Bending of pipe. Pipe shall be *approved* for bending. Pipe bends shall be made with *approved equipment*. The bend shall not exceed the structural limitations of the pipe.

1302.7 Pumps. Pumps that are not part of an *appliance* shall be of a positive-displacement type. The pump shall automatically shut off the supply when not in operation. Pumps shall be *listed* and *labeled* in accordance with UL 343.

1302.8 Flexible connectors and hoses. Flexible connectors and hoses shall be *listed* and *labeled* in accordance with UL 536.

SECTION 1303 JOINTS AND CONNECTIONS

1303.1 Approval. Joints and connections shall be *approved* and of a type *approved* for fuel-oil piping systems. Threaded joints and connections shall be made tight with suitable lubricant or pipe compound. Unions requiring gaskets or packings, right or left couplings, and sweat fittings employing solder having a melting point of less than 538°C (1,000°F) shall not be used in oil lines. Cast-iron fittings shall not be used. Joints and connections shall be tight for the pressure required by test.

1303.1.1 Joints between different piping materials. Joints between different piping materials shall be made with *approved* adapter fittings. Joints between different metallic piping materials shall be made with *approved* dielectric fittings or copper-alloy converter fittings.

1303.2 Preparation of pipe ends. Pipe shall be cut square, reamed and chamfered and be free from all burrs and obstruc-

for flammable and combustible liquids. Nonmetallic pipe shall

tions. Pipe ends shall have full-bore openings and shall not be undercut.

1303.3 Joint preparation and installation. Where required by Sections 1303.4 through 1303.9, the preparation and installation of brazed, mechanical, threaded and welded joints shall comply with Sections 1303.3.1 through 1303.3.4.

1303.3.1 Brazed joints. All joint surfaces shall be cleaned. An *approved* flux shall be applied where required. The joints shall be brazed with a filler metal conforming to AWS A5.8.

1303.3.2 Mechanical joints. Mechanical joints shall be installed in accordance with the manufacturer's instructions. Press-connect joints shall conform to one of the standards listed in Table 1302.3.

1303.3.3 Threaded joints. Threads shall conform to ASME B1.20.1. Pipe-joint compound or tape shall be applied on the male threads only.

1303.3.4 Welded joints. All joint surfaces shall be cleaned by an *approved* procedure. The joint shall be welded with an *approved* filler metal.

1303.4 Copper or copper-alloy pipe. Joints between copper or copper-alloy pipe or fittings shall be brazed, mechanical, threaded or welded joints complying with Section 1303.3.

1303.5 Copper or copper-alloy tubing. Joints between copper or copper-alloy tubing or fittings shall be brazed, mechanical joints complying with Section 1303.3, press-connect joints that conform to one of the standards in Table 1302.3 or flared joints. Flared joints shall be made by a tool designed for that operation.

1303.6 Nonmetallic pipe. Joints between nonmetallic pipe or fittings shall be installed in accordance with the manufacturer's instructions for the *labeled* pipe and fittings.

1303.7 Steel pipe. Joints between steel pipe or fittings shall be threaded or welded joints complying with Section 1303.3 or mechanical joints complying with Section 1303.7.1.

1303.7.1 Mechanical joints. Joints shall be made with an *approved* elastomeric seal. Mechanical joints shall be installed in accordance with the manufacturer's instructions. Mechanical joints shall be installed outdoors, under- ground, unless otherwise *approved*.

1303.8 Steel tubing. Joints between steel tubing or fittings shall be mechanical or welded joints complying with Section 1303.3.

1303.9 Piping protection. Proper allowance shall be made for expansion, contraction, jarring and vibration. Piping other than tubing, connected to underground tanks, except straight fill lines and test wells, shall be provided with flexible connectors, or otherwise arranged to permit the tanks to settle without impairing the tightness of the piping connections.

SECTION 1304 PIPING SUPPORT

1304.1 General. Pipe supports shall be in accordance with Section 305.

FUEL OIL PIPING AND STORAGE

SECTION 1305 FUEL OIL SYSTEM INSTALLATION

1305.1 Size. The fuel oil system shall be sized for the maximum capacity of fuel oil required. The minimum size of a supply line shall be 9.5 mm ($\frac{3}{8}$ -inch) inside diameter nominal pipe or 9.5 mm ($\frac{3}{8}$ -inch) outside diameter tubing. The minimum size of a return line shall be 6.35 mm ($\frac{1}{4}$ -inch) inside diameter nominal pipe or 7.92mm ($\frac{5}{16}$ -inch) outside diameter tubing. Copper tubing shall have 0.9 mm (0.035-inch) nominal and 0.8 mm (0.032-inch) minimum wall thickness.

1305.2 Protection of pipe, equipment and appliances. Fuel oil pipe, *equipment* and appliances shall be protected from physical damage.

1305.2.1 Flood hazard. Fuel oil pipe, equipment and appliances located in flood hazard areas shall be located above the elevation required by Section 1612 of the *Jamaica Building Code* for utilities and attendant equipment or shall be capable of resisting hydrostatic and hydrodynamic loads and stresses, including the effects of buoyancy, during the occurrence of flooding up to such elevation.

1305.3 Supply piping. Supply piping shall connect to the top of the fuel oil tank. Fuel oil shall be supplied by a transfer pump or automatic pump or by other *approved* means.

Exception: This section shall not apply to inside or above-ground fuel oil tanks.

1305.4 Return piping. Return piping shall connect to the top of the fuel oil tank. Valves shall not be installed on return piping.

1305.5 System pressure. The system shall be designed for the maximum pressure required by the fuel-oil-burning *appliance*. Air or other gases shall not be used to pressurize tanks.

1305.6 Fill piping. A fill pipe shall terminate outside of a building at a point not less than 610 mm (2 feet) from any building opening at the same or lower level. A fill pipe shall terminate in a manner designed to minimize spilling when the filling hose is disconnected. Fill opening shall be equipped with a tight metal cover designed to discourage tampering.

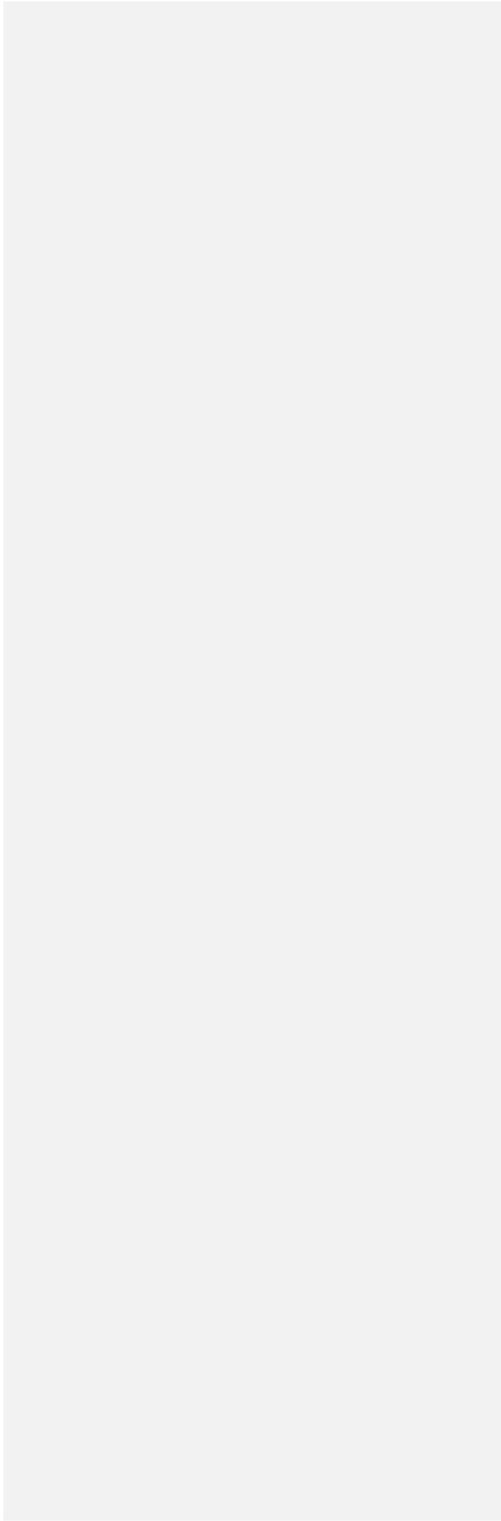
1305.7 Vent piping. Liquid fuel vent pipes shall terminate outside of buildings at a point not less than 610 mm (2 feet) measured vertically or horizontally from any building opening. Outer ends of vent pipes shall terminate in a weather-proof vent cap or fitting or be provided with a weatherproof hood. Vent caps shall have a minimum free open area equal to the cross-sectional area of the vent pipe and shall not employ screens finer than No. 4 mesh. Vent pipes from tanks containing heaters shall be extended to a location where oil vapors discharging from the vent will be readily diffused. If the static head with a vent pipe filled with oil exceeds 69 kPa [10 pounds per square inch (psi)], the tank shall be designed for the maximum static head that will be imposed.

Liquid fuel vent pipes shall not be cross connected with fill pipes, lines from burners or overflow lines from auxiliary tanks.

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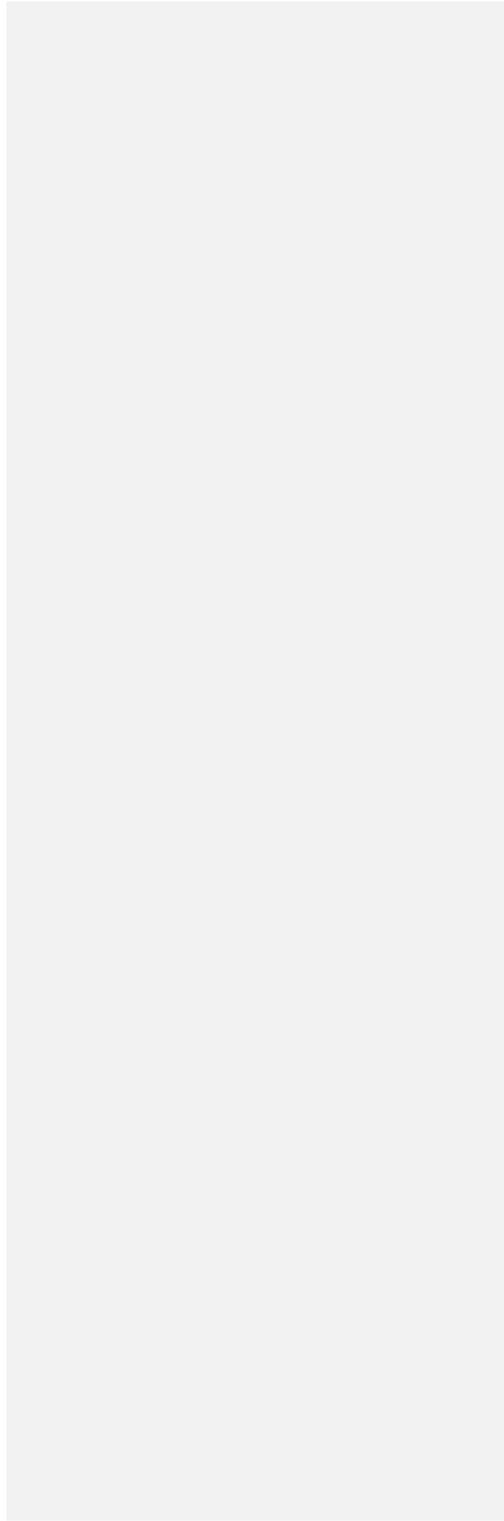
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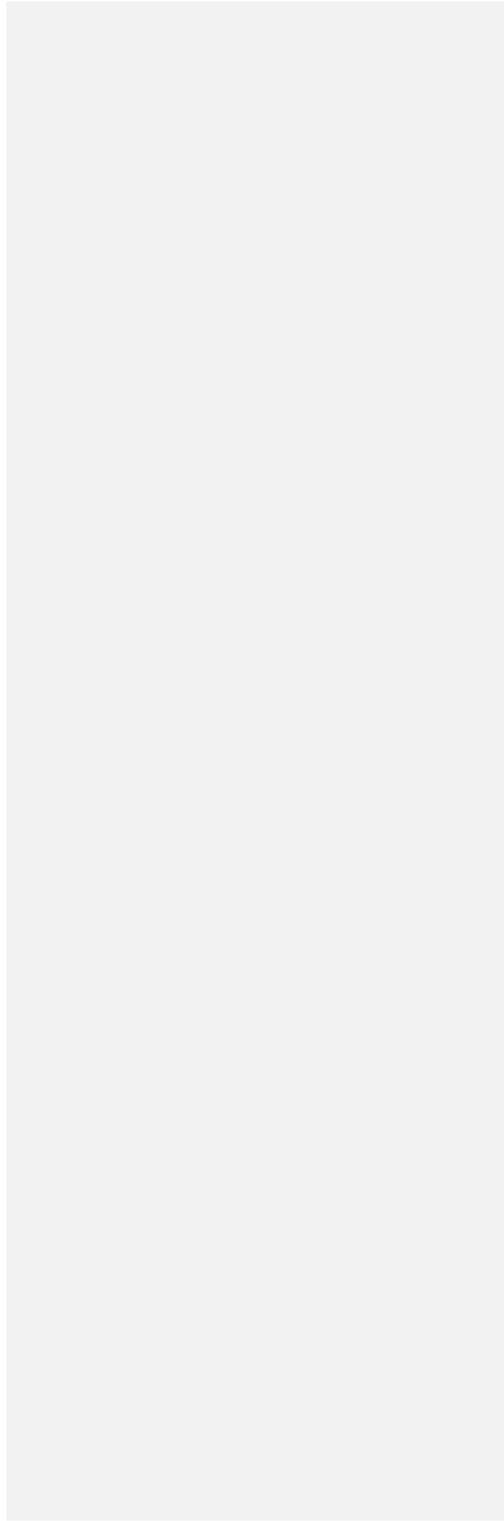
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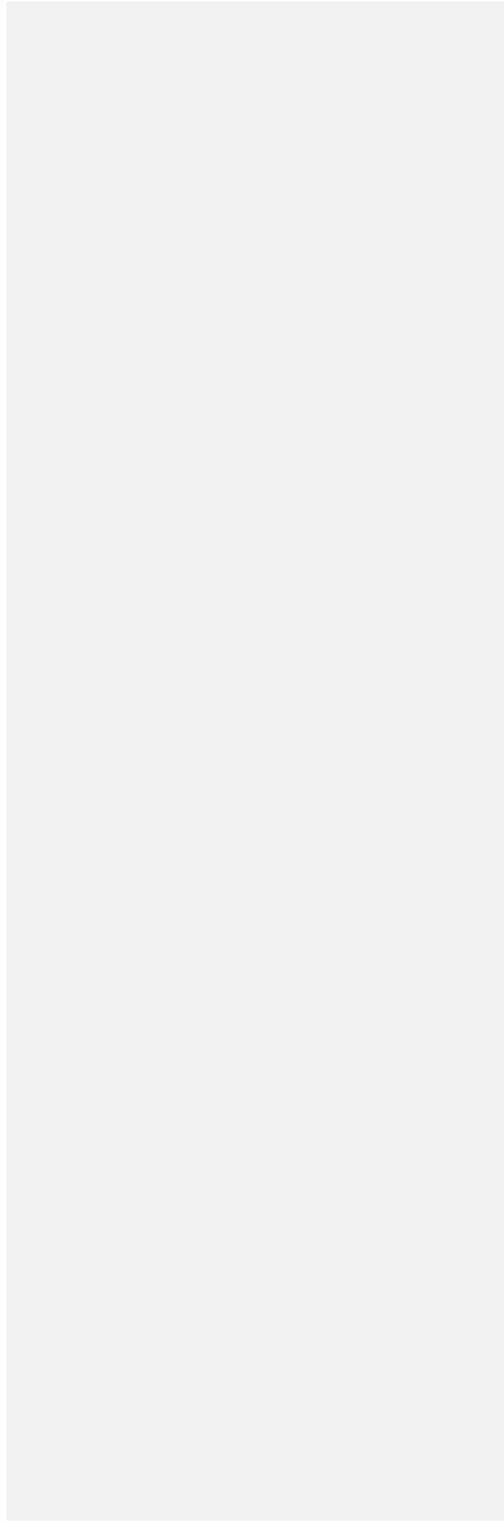
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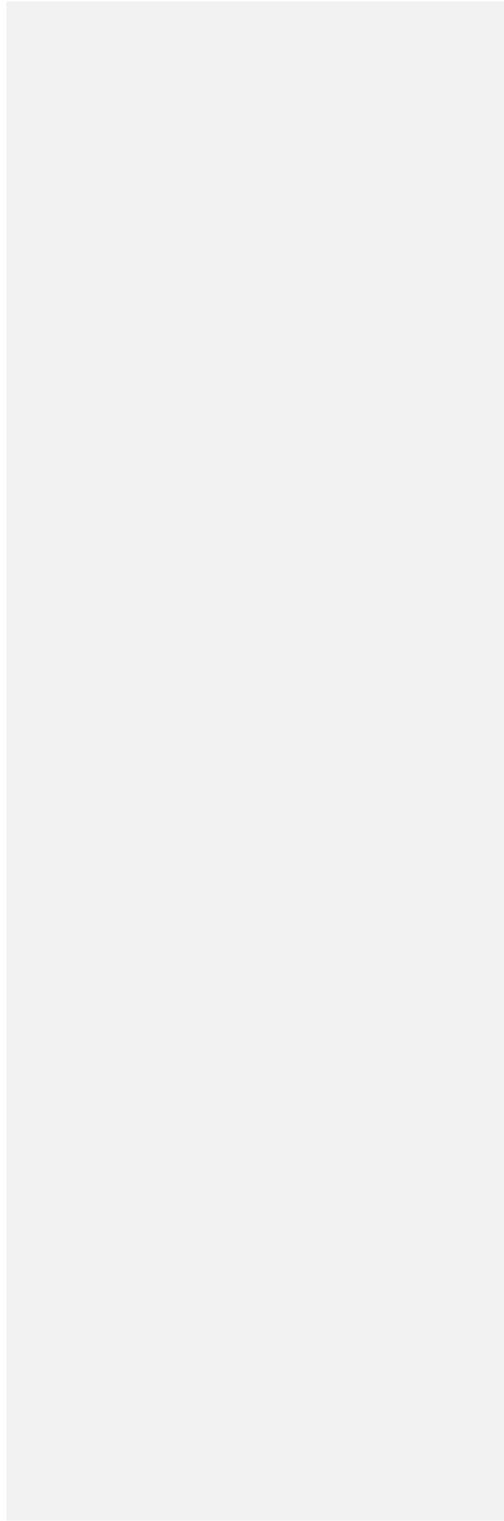
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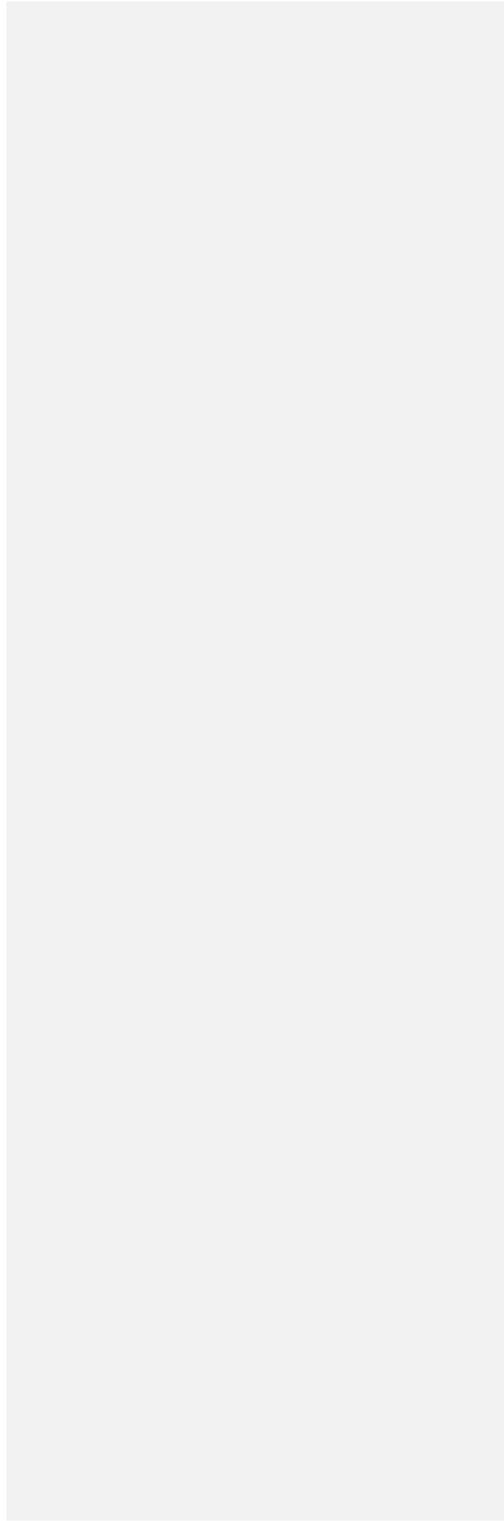
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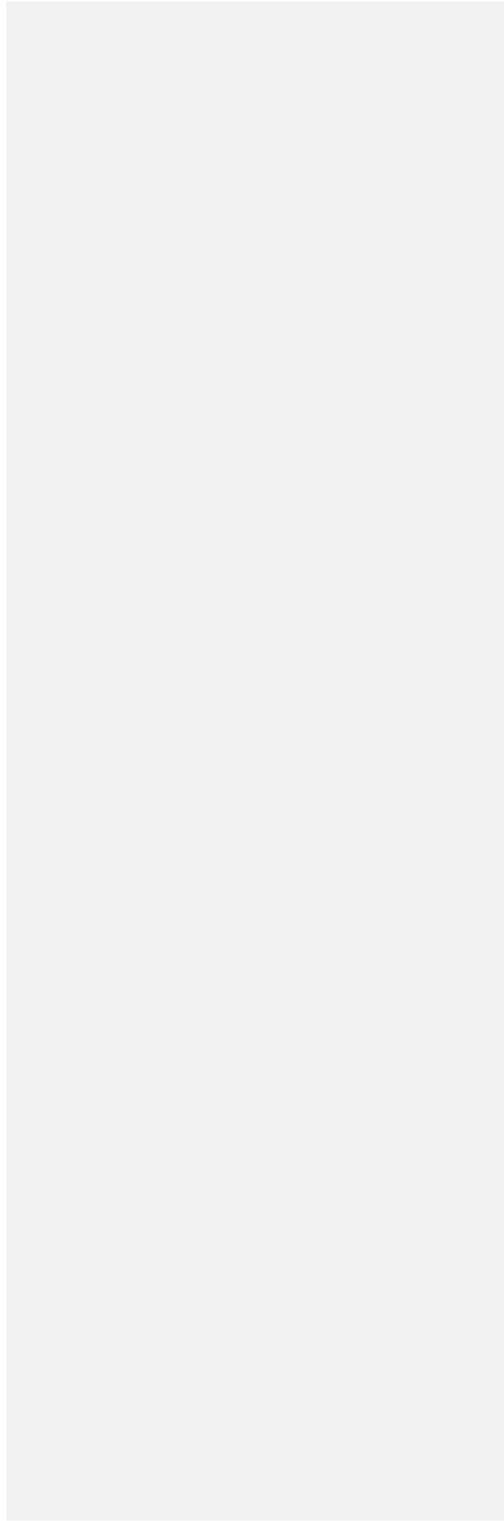
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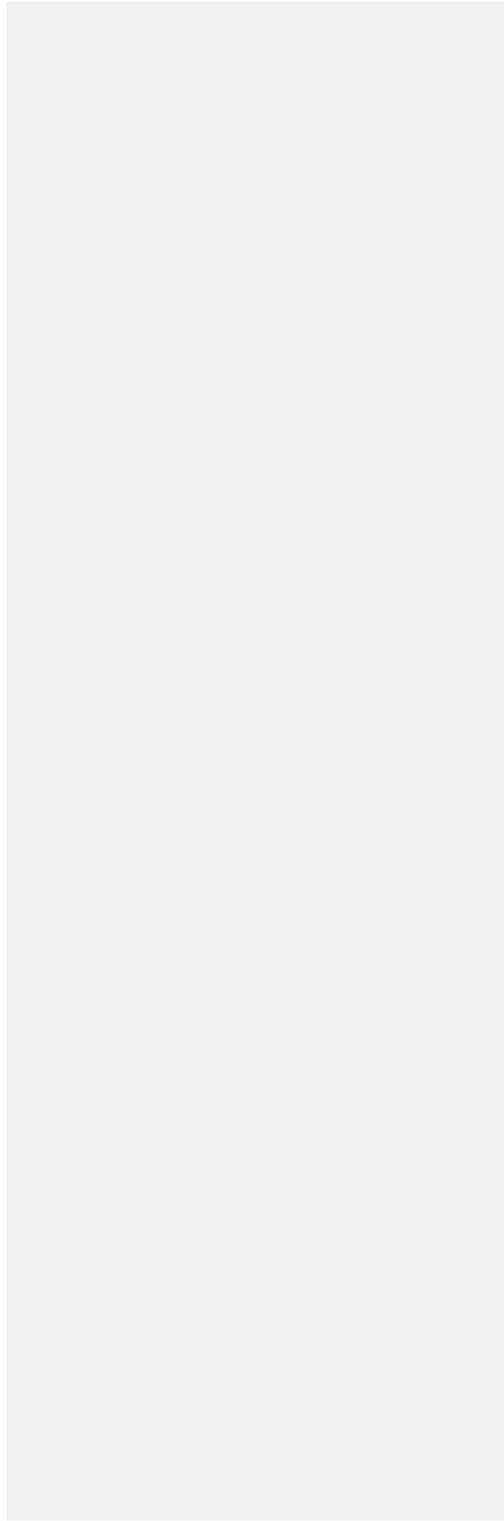


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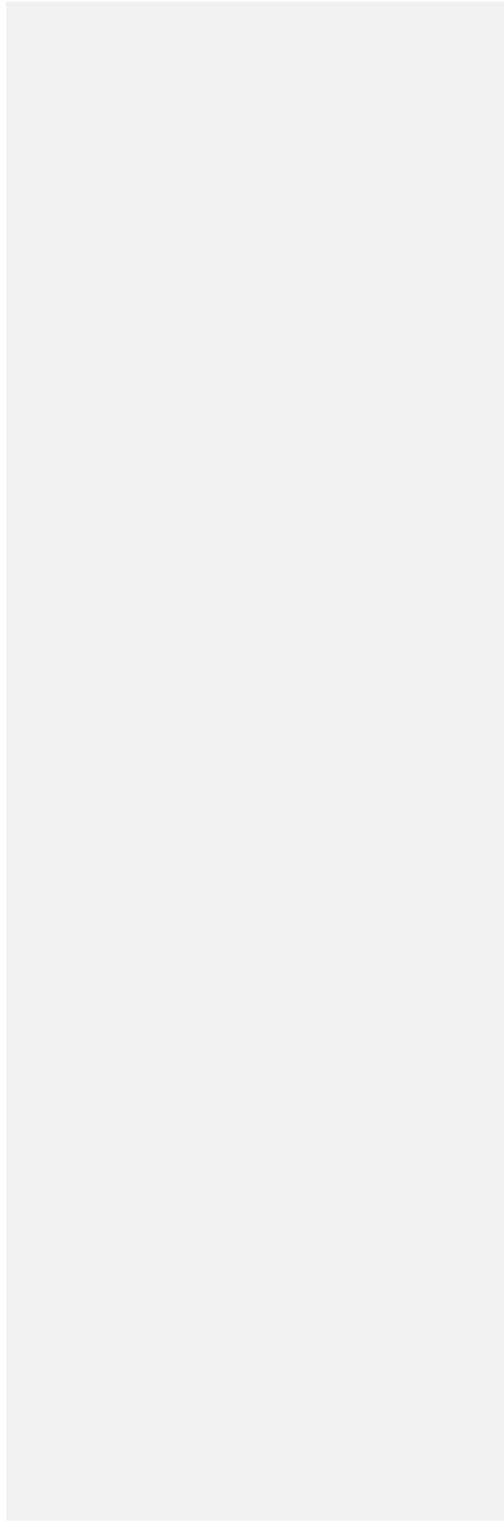
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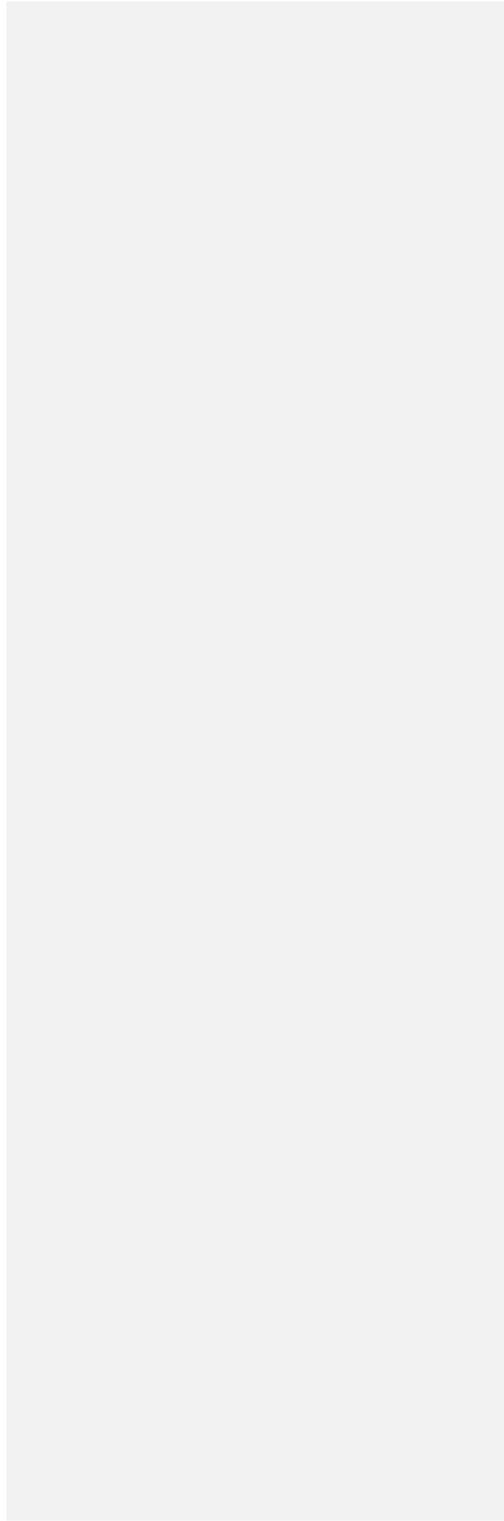
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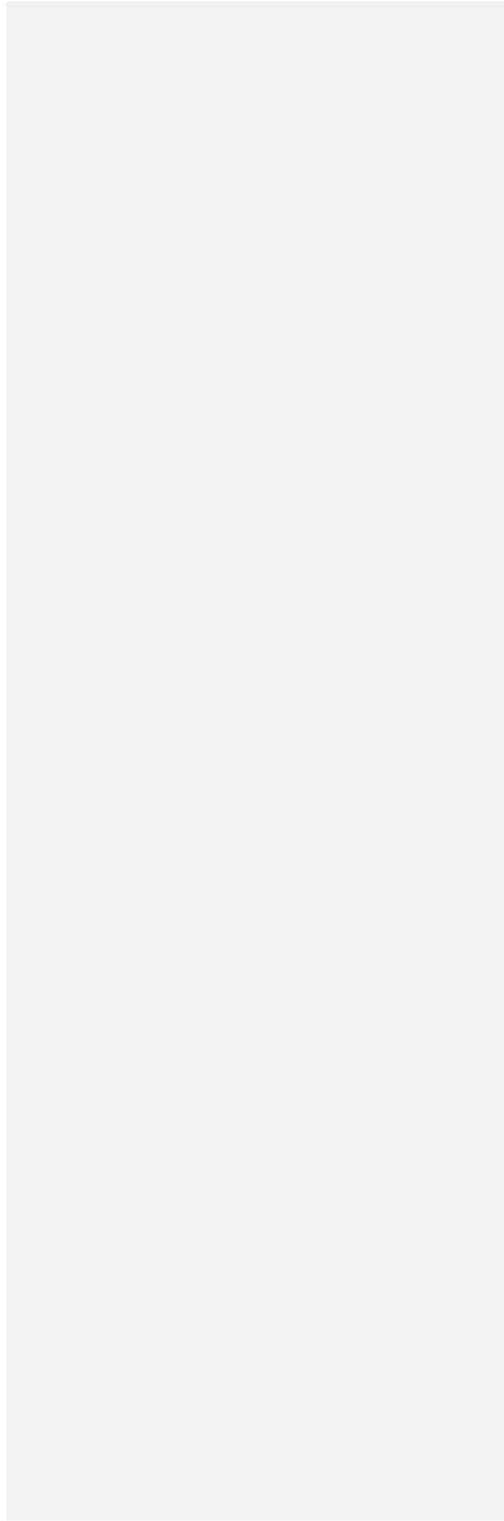
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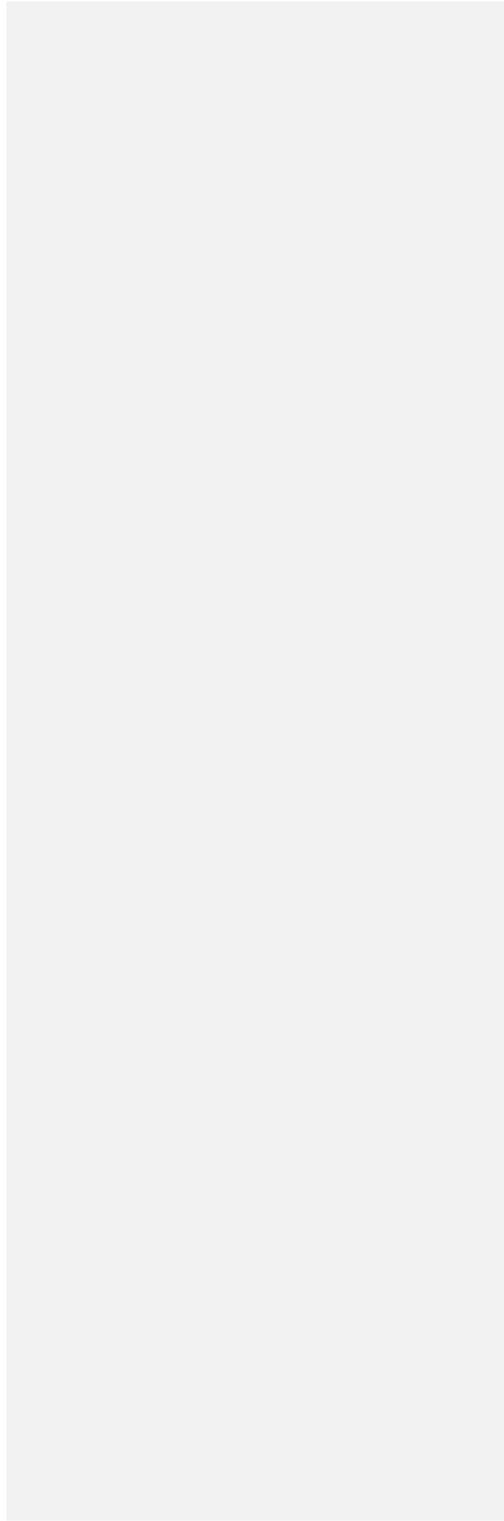
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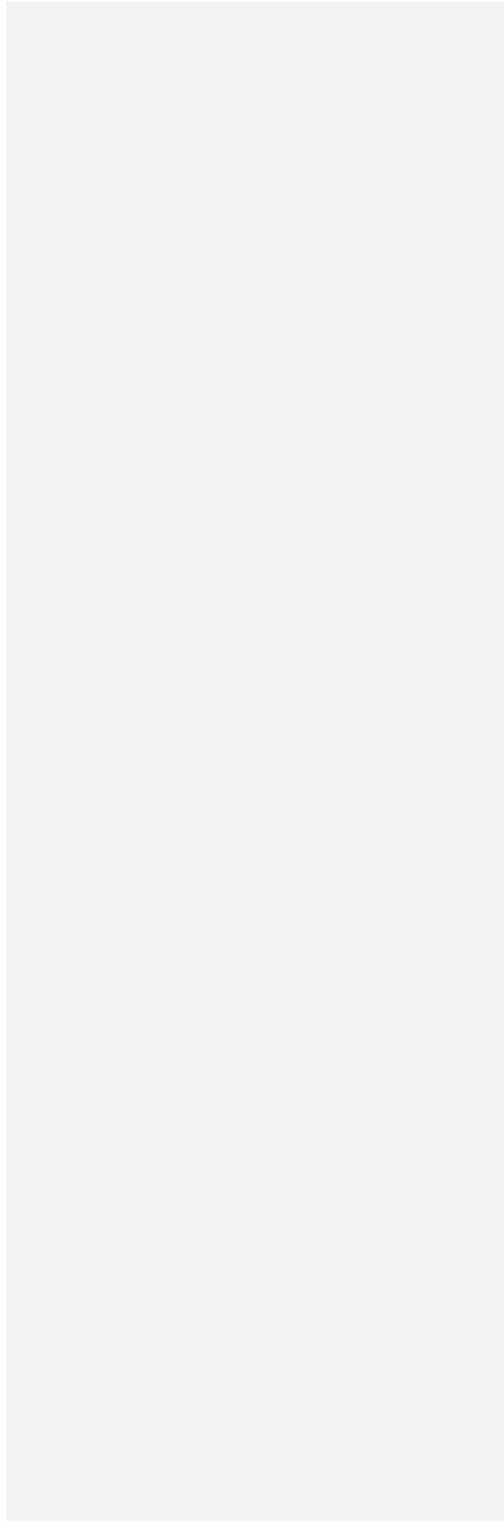
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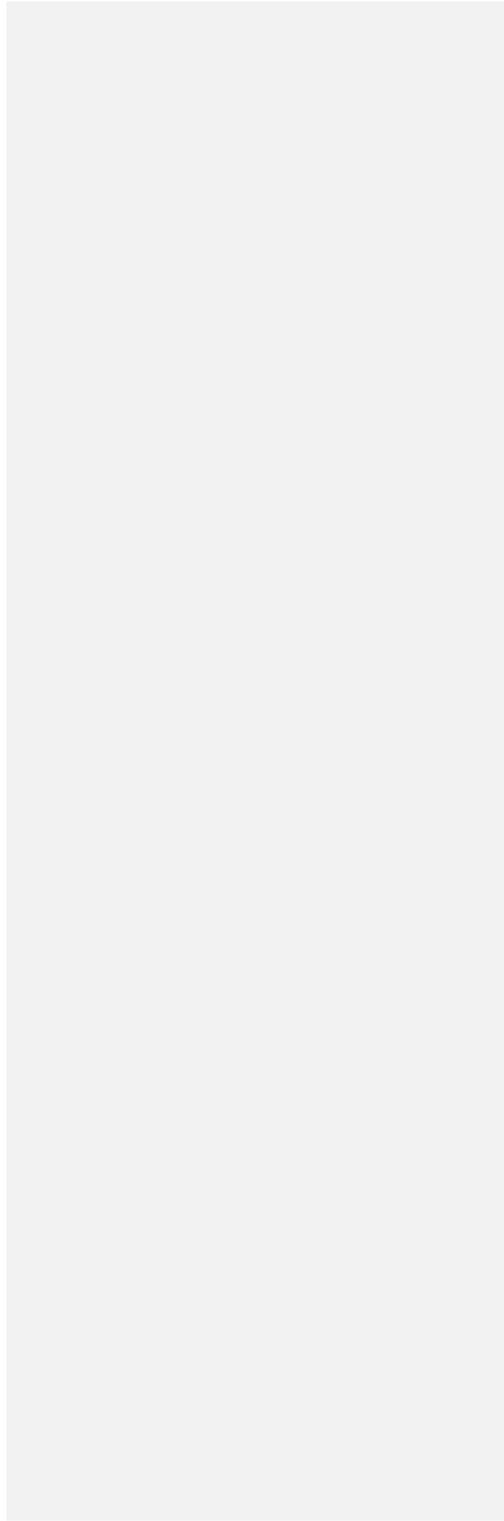
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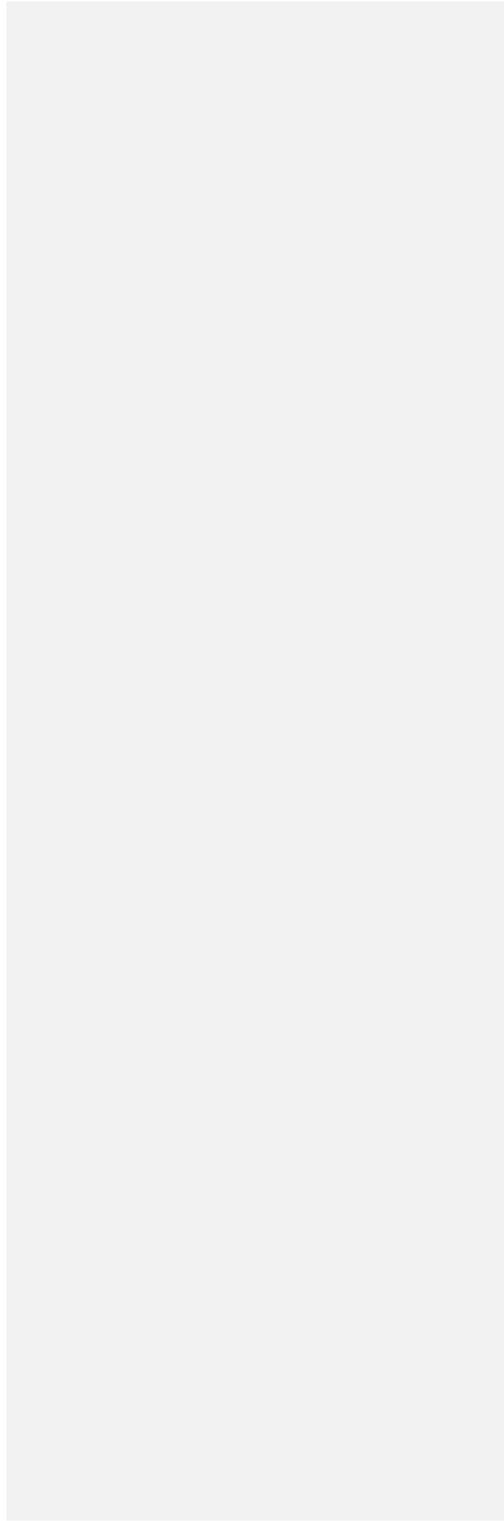


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SECTION 1309
OIL SPILLAGE MITIGATION

1309.1 General. The handling of fuel oil supply and storage has a high probability that spillage will occur at some point in time. This section outlines the measures to be implemented so oil spillage will not result in damage to the environment.

1309.2 Conditions warranting containment of oil spillages. Containment planning shall be put in place where the risk and cost of oil pollution due to handling methodology and proximity to critical environmental facilities could be significant. An oil storage installation shall be regarded as posing a significant pollution risk which shall be mitigated if it satisfies one or more of the following conditions:

1. Has a total capacity of more than 2500 litres and/or resupplied by pumping.
2. Is located within 10,000 mm (33 feet) of an inland freshwater source or coastal waters.
3. Is located where spillage could run into an open drain or to a loose-fitting manhole cover.
4. Is located within 50,000 mm (167 feet) of sources of potable water, such as wells, reservoirs, dams, lakes, boreholes, rivers or springs.
5. Is located where oil spilled from the installation could reach one of the water sources listed above by running across hard ground.

6. Is located where the storage tank vent pipe outlet cannot be seen from the intended filling point.

1309.3 Secondary containment. Where the risk of oil pollution is high, secondary containment plans shall be implemented. Such plans shall include one or more of the following:

1. Provide an integrally bonded prefabricated tank.
2. Construction of a bund from steel reinforced masonry or steel reinforced poured-in-place concrete in accordance with the *Jamaica Building Code*.
3. Where the bund walls are part of the walls of a chamber or building enclosing the tank, any door through such walls shall be above the bund level.
4. Structural engineering advice shall be sought where the bund performs a structural role as part of a building.

1309.4 Bunds. Bunds, whether part of prefabricated tank systems or constructed on site, shall have a capacity of at least 110% of the largest tank it contains and shall be able to retain all the oil leaked from the storage tank.

1309.5 Label. An oil storage installation shall carry a label in a prominent on site location and in permanent print with at least 12.5 mm (½ inch) high letters a list of advice on what to do if an oil spill occurs and the environmental agency's emergency telephone number to report such spill.

CHAPTER 14

SOLAR THERMAL SYSTEMS

User note:

About this chapter: Chapter 14 addresses solar thermal systems, not photovoltaic systems. The provisions are intended to protect property and life from the hazards associated with high-temperature liquids, pressurized systems and toxic fluids. There are also provisions to protect the building structure and the solar thermal system components from damage.

SECTION 1401 GENERAL

1401.1 Scope. This chapter shall govern the design, construction, installation, *alteration* and repair of solar thermal systems, *equipment* and appliances intended to utilize solar energy for space heating or cooling, domestic hot water heating, swimming pool heating or process heating.

1401.1.1 Constituents parts of a solar thermal system. In general, solar thermal systems shall include a method of solar energy collection, the working fluid transmitting the collected heat, heat exchanger, pipe work, controls, pump(s) and storage container to balance the supply with demand.

1401.2 Potable water supply. Potable water supplies to solar systems shall be protected against contamination in accordance with the *Jamaica Plumbing Code*.

Exception: Where all solar system piping is a part of the potable water distribution system, in accordance with the requirements of the *Jamaica Plumbing Code*, and all components of the piping system are *listed* for potable water use, cross-connection protection measures shall not be required.

1401.3 Heat exchangers. Heat exchangers used in domestic water-heating systems shall be *approved* for the intended use. The system shall have adequate protection to ensure that the potability of the water supply and distribution system is properly safeguarded. The heat exchanger passes on the collected heat to the fluid to be heated and shall be constructed to be compatible with both fluids over their working ranges.

1401.4 Solar thermal equipment and appliances. Solar thermal *equipment* and appliances shall conform to the requirements of this chapter and ICC 900/SRCC 300. Solar thermal systems shall be listed and labeled in accordance with ICC 900/SRCC 300 and shall be installed in accordance with the manufacturer's instructions and ICC 900/SRCC 300.

1401.4.1 Collectors and panels. Solar thermal collectors and panels shall be listed and labeled in accordance with ICC 901/SRCC 100.

SECTION 1402 DESIGN AND INSTALLATION

1402.1 General. The design and installation of solar thermal systems shall comply with Sections 1402.1 through

1402.8. Solar thermal systems shall be listed and labeled in accordance with ICC 900/SRCC 300 and shall be installed in accordance with the manufacturer's instructions and ICC 900/SRCC 300.

1402.2 Access. Access shall be provided to solar thermal equipment for maintenance. Solar thermal systems and appurtenances shall not obstruct or interfere with the operation of any doors, windows or other building components requiring operation or access. Roof-mounted solar thermal equipment shall not obstruct or interfere with the operation of roof-mounted equipment, appliances, chimneys, roof hatches, smoke vents, skylights and other roof penetrations and openings.

1402.3 Pressure and temperature. Solar thermal system components containing pressurized fluids shall be protected against pressures and temperatures exceeding design limitations with pressure and temperature relief valves or pressure relief valves. System components shall have a working pressure rating of not less than the setting of the pressure relief device.

1402.3.1 Relief device. Each section of the system in which excessive pressures are capable of developing shall have a relief device located so that a section cannot be valved off or otherwise isolated from a relief device. Relief valves shall comply with the requirements of Section 1006.6. For indirect solar systems, pressure relief valves in solar loops shall also comply with ICC 900/SRCC 300.

1402.3.2 Vacuum. System components that might be subjected to a vacuum while in operation or during shutdown shall be designed to withstand such vacuum or shall be protected with vacuum relief valves.

1402.4 Protection from freezing. Not applicable.

1402.4.1 Drain-back systems. Not applicable.

1402.4.2 Freeze-protection valves. Not applicable. SOLAR THERMAL SYSTEMS

1402.5 Protection of potable water. Where a solar thermal system heats potable water to supply a potable hot water distribution or any other type of heating system, the solar thermal system shall be in accordance with Sections 1402.5.1 through 1402.5.3 as applicable.

1402.5.1 Indirect systems. Water supplies of any type shall not be connected to the solar heating loop of an indirect solar thermal hot water heating system. This requirement shall not prohibit the presence of inlets or outlets on the solar heating loop for the purposes of servicing the fluid in the solar heating loop.

1402.5.2 Direct systems for potable water distribution systems. Where a solar thermal system directly heats potable water for a potable water distribution system, the pipe,

fittings, valves and other components that are in contact with the potable water in the system shall comply with the requirements of the *Jamaica Plumbing Code*.

1402.5.3 Direct systems for other than potable water distribution systems. Where a solar thermal system directly heats water for a system other than a potable water distribution system, a potable water supply connected to such system shall be protected against backflow in accordance with the *Jamaica Plumbing Code*.

1402.6 Protection of equipment. Solar thermal *equipment* exposed to risks from vehicular traffic shall be installed not less than 1,830 mm (6 feet) above the finished floor.

Exception: This section shall not apply where the *equipment* is protected from motor vehicle impact.

1402.7 Protection of structure. In the process of installing or repairing any part of a solar thermal system, the building or structure shall be left in a safe structural condition in accordance with Sections 302, 1402.7.1 and 1402.7.2.

1402.7.1 Controlling condensation. Where attics or structural spaces are part of a passive solar system, ventilation of such spaces, as required by Section 406, is not required where other *approved* means of controlling condensation are provided.

1402.7.2 Penetrations. Roof and wall penetrations shall be flashed and sealed to prevent entry of water, rodents and insects in accordance with Section 302.

1402.8 Equipment. The solar thermal system shall be equipped in accordance with the requirements of Sections 1402.8.1 through 1402.8.5.3.

1402.8.1 Collectors and panels. Solar collectors and panels shall comply with Sections 1402.8.1.1 through 1402.8.1.4.

1402.8.1.1 Design. Solar thermal collectors and panels shall be listed and labeled in accordance with ICC 901/SRCC 100 or other approved standards.

1402.8.1.2 Rooftop-mounted solar thermal collectors and systems. The roof shall be constructed to support the loads imposed by roof-mounted solar collectors. Where mounted on or above the roof covering, the collector array and supporting construction shall be constructed of noncombustible materials or fire-retardant-treated wood conforming to the *Jamaica Building Code* to the extent required for the type of roof construction of the building to which the collectors are accessory.

1402.8.1.3 Collectors as roof covering. Roof-mounted solar collectors that also serve as a roof covering shall conform to the requirements for roof coverings in accordance with the *Jamaica Building Code*.

Exception: The use of plastic solar collector covers shall be limited to those *approved* light-transmitting plastics meeting the requirements for plastic roof panels in Section 2609 of the *Jamaica Building Code*.

1402.8.1.4 Collector sensors. Collector sensor installation, sensor location and the protection of exposed sensor wires from degradation shall be in accordance with ICC 900/SRCC 300, [the Jamaica Electrical Code](#) and the collector manufacturer's instructions.

1402.8.2 Ducts. Ducts utilized in solar heating and cooling systems shall be constructed and installed in accordance with Chapter 6.

1402.8.2.1 Filtering. Air transported to occupied spaces through dust-producing materials by means other than natural convection shall be filtered before entering the occupied space in accordance with Section 605.

1402.8.3 Piping. Potable piping shall be installed in accordance with the *Jamaica Plumbing Code*. Hydronic piping shall be installed in accordance with Chapter 10 of this code. Mechanical system piping shall be

supported in accordance with Section 305.

Solar thermal piping shall be able to withstand hot fluids up to 120°C (280°F). Pipe fittings, controls and pump materials that are likely to come in contact with the hot fluids or conductive heat from this source shall be able to handle the heat without any negative impact on performance. Non-metallic materials shall not be negatively impacted from the use of additives or oils that may be added to the heat exchanger transfer fluid.

1402.8.3.1 Piping insulation. Piping that carries hot liquids including water shall be insulated in accordance with the requirements of the *Jamaica Energy Conservation Code*. Exterior insulation shall be protected from degradation. Pipes carrying liquids at ambient temperature may not be insulated. The entire solar loop shall be insulated. Where split-style insulation is used, the seam shall be sealed. Fittings shall be fully insulated. Insulation shall comply with Section 1204.1.

Exceptions:

1. Those portions of the piping that are used to help prevent the system from overheating shall not be required to be insulated.
2. Those portions of piping that are exposed to solar radiation, made of the same material as the solar collector absorber plate and covered in the same manner as the solar collector absorber, or that are used to collect additional solar energy, shall not be required to be insulated.
3. Piping in solar thermal systems using unglazed solar collectors to heat a swimming pool shall not be required to be insulated.

1402.8.4 Heat exchangers. Heat exchangers used in domestic water-heating systems shall be approved for the intended use. The system shall have adequate protection to ensure that the potability of the water supply and distribution system is properly safeguarded.

1402.8.4.1 Double-wall heat exchangers. Heat exchangers utilizing a non-food-grade fluid shall be

separated from the potable water by double-wall construction. An air gap open to the atmosphere shall be provided between the two walls. The discharge location from the double-wall heat exchanger shall be visible.

1402.8.4.2 Single-wall heat exchangers. Food-grade fluids shall be used as the heat transfer fluid in single-wall heat exchangers.

1402.8.5 Water heaters and hot water storage tanks. Auxiliary water heaters, boilers and water storage tanks associated with solar thermal systems shall comply with Chapter 10 and ICC 900/SRCC 300 or other approved standards.

1402.8.5.1 Hot water storage tank insulation. Hot water storage tanks shall be insulated and such insulation shall have an *R*-value of not less than *R*-12.5.

1402.8.5.2 Outdoor locations. Storage tanks and heating equipment installed in outdoor locations shall be designed for outdoor installation.

1402.8.5.3 Storage tank sensors. Storage tank sensors shall comply with ICC 900/SRCC 300.

1402.8.6 Solar loop. Solar loops shall be in accordance with Sections 1402.8.6.1 and 1402.8.6.2.

1402.8.6.1 Solar loop isolation. Valves shall be installed to allow the solar loop to be isolated from the remainder of the system.

1402.8.6.2 Drain and fill valve caps. Drain caps shall be installed on drain and fill valves.

1402.8.7 Expansion tanks. Liquid single-phase solar energy systems shall be equipped with expansion tanks sized in accordance with Section 1009, except that additional expansion tank acceptance volume equal to the total volume of liquid contained in the installed solar collectors and piping above the collectors shall be included.

SECTION 1403 HEAT TRANSFER FLUIDS

1403.1 Flash point. The flash point of the heat transfer fluid utilized in a solar system shall be not less than 28°C (50°F) above the design maximum nonoperating (no-flow) temperature of the fluid attained in the collector.

1403.2 Heat transfer fluids. Heat transfer gases and liquids shall be rated to withstand the system's maximum design temperature under operating conditions without degradation. Heat transfer fluids shall be in accordance with ICC 900/SRCC 300.

The heat transfer medium (liquid or gas) shall not introduce conditions likely to result in corrosion or the deposition of surface films if the medium operates within the specified conditions. If the medium is known to have a limited life then guidance shall be provided to enable the user to check its condition.

1403.3 Food-grade additives. Any food-grade fluid used as a heat transfer fluid containing additives shall be third-party listed by the BSI or BSI approved agency to the applicable governing food regulations and appropriate

SOLAR THERMAL SYSTEMS

standards

1403.4 Toxicity. The use of toxic fluids shall comply with applicable laws and regulations administered by the Ministry of Health and Wellness and Chapter 60 of the *Jamaica Fire Code*.

1403.5 Flammable gases and liquids. A flammable liquid or gas shall not be utilized as a heat transfer fluid. The flash

point of liquids used in occupancies classified in Group H or F shall not be lower unless *approved*.

SECTION 1404 LABELING

1404.1 Collectors. Factory-built collectors shall bear a label showing the manufacturer's name and address, model number and serial number.

Materials used shall be compatible with each other and capable of withstanding arduous weather conditions since this and mechanical strength are the two main characteristics influencing choice.

Selective coatings may be used for the maximum absorption on the exposed surface. Where collectors incorporate insulation to prevent heat loss from the back of the pane they must be watertight.

Corrosion of the external surfaces and the fluid flow paths must be prevented.

1404.2 Water storage tanks. Pressurized water storage tanks shall bear a label showing the manufacturer's name and address, model number, serial number, storage unit maximum and minimum allowable operating temperatures, and storage unit maximum and minimum allowable operating pressures. The label shall clarify that these specifications apply only to the water storage tanks.

1404.3 Fluid safety labeling. Drain and fill valves shall be labeled with a description and warning that identifies the fluid in that loop as "Potable Water," "Food-Grade Fluid," "Non-Food-Grade Fluid" or "Toxic." Labeling shall also be provided that reads as follows: "Fluid could be discharged at high temperature or pressure or both. Unauthorized alterations to this system could result in a health hazard or a hazardous condition."

1404.4 Heat exchangers. Heat exchangers shall be labeled to indicate the heat exchanger type with one of the following:

1. "Single-wall without leak protection."
2. "Double-wall without leak protection."
3. "Double-wall with leak protection."

CHAPTER 15 REFERENCED STANDARDS

User note:

About this chapter: This code contains numerous references to standards that are used to provide requirements for materials and methods of construction. This chapter contains a comprehensive list of all standards that are referenced in this code. These standards, in essence, are part of this code to the extent of the reference to the standard. This chapter lists the standards that are referenced in various sections of this document.

The standards are listed herein by the promulgating agency of the standard, the standard identification, the effective date and title, and the section or sections of this document that reference the standard. The application of the referenced standards shall be as specified in Section 102.8.

ACCA

Air Conditioning Contractors of America

2800 Shirlington Road, Suite 300
Arlington, VA 22206

ANSI/ACCA 1 Manual D—2016: Residential Duct Systems

601.4, 603.2

ANSI/ASHRAE/ACCA 183—2007 (reaffirmed 2014): Peak Cooling and Heating Load Calculations in Buildings Except Low-rise Residential Buildings

312.1

AHRI

Air-Conditioning, Heating & Refrigeration Institute

2111 Wilson Blvd., Suite 500
Arlington, VA 22201

700—2015 with Addendum 1: Specifications for Refrigerants

1102.2.2.3

AMCA

Air Movement and Control Association International

30 West University Drive
Arlington Heights, IL 60004

230-15: Laboratory Methods of Testing Air Circulating Fans for Rating and Certification

929.1

550—09: Test Method for High Velocity Wind Driven Rain Resistant Louvers

401.5, 501.3.2

ANSI/AMCA 210—ANSI/ASHRAE 51—07: Laboratory Methods of Testing Fans for Aerodynamic Performance Rating

403.3.2.4

ANSI

American National Standards Institute

25 West 43rd Street, 4th Floor
New York, NY 10036

Z21.1—2010: Household Cooking Gas Appliances

505.2

Z21.8—1994 (R2002): Installation of Domestic Gas Conversion Burners

919.1

ASHRAE

ASHRAE

1791 Tullie Circle NE
Atlanta, GA 30329

- ANSI/AMCA 210–ANSI/ASHRAE 51–07: Laboratory Methods of Testing Fans for Aerodynamic Performance Rating**
403.3.2.4
- ASHRAE—2017: ASHRAE Fundamentals Handbook**
603.2
- 15—2016: Safety Standard for Refrigeration Systems**
1101.6, 1105.8, 1108.1
- 34—2016: Designation and Safety Classification of Refrigerants**
202, 1102.2.1, 1103.1
- 62.1—2016: Ventilation for Acceptable Indoor Air Quality**
403.3.1.1.2.3.2
- 170—2017: Ventilation of Health Care Facilities**
407
- 180—2012: Standard Practice for Inspection and Maintenance of Commercial Building HVAC Systems**
102.3

ASME

American Society of Mechanical Engineers

Two Park Avenue
New York, NY 10016-5990

- A112.4.1—2009: Water Heater Relief Valve Drain Tubes**
1006.6
- B1.20.1—2013: Pipe Threads, General Purpose (Inch)**
1203.3.5, 1303.3.3
- B16.3—2016: Malleable Iron Threaded Fittings, Classes 150 & 300**
Table 1202.5
- B16.5—2015: Pipe Flanges and Flanged Fittings NPS 1/2 through NPS 24**
Table 1202.5
- B16.9—2012: Factory Made Wrought Steel Butt welding Fittings**
Table 1202.5
- B16.11—2016: Forged Fittings, Socket-welding and Threaded**
Table 1202.5
- B16.15—2013: Cast Alloy Threaded Fittings: Classes 125 and 250**
Table 1202.5
- B16.18—2012: Cast Copper Alloy Solder Joint Pressure Fittings**
513.13.1, Table 1202.5
- B16.22—2013: Wrought Copper and Copper Alloy Solder Joint Pressure Fittings**
513.13.1, Table 1202.5
- B16.24—2016: Cast Copper Alloy Pipe Flanges and Flanged Fittings: Class 150, 300, 400, 600, 900, 1500 and 2500**
Table 1202.5
- B16.26—2016: Cast Copper Alloy Fittings for Flared Copper Tubes**
Table 1202.5
- B16.28—1994: Wrought Steel Butt welding Short Radius Elbows and Returns**
Table 1202.5
- B16.51—2013: Copper and Copper Alloy Press-connect Pressure Fittings**
Table 1202.5
- B31.5—2016: Refrigeration Piping and Heat Transfer Components**
1107.1
- B31.9—2014: Building Services Piping**
1201.3

ASME—continued

BPVC—2015: ASME Boiler & Pressure Vessel Code—07 Edition
1009.2, 1003.1, 1004.1, 1011.1

CSD-1—2016: Controls and Safety Devices for Automatically Fired Boilers
1004.1

ASSE

American Society of Safety Engineers

520 N. Northwest Highway
Park Ridge, IL 60068

ANSI/ASSE Z359.1—2016: Requirements for ANSI/ASSE Z359 Fall Protection Code
304.11

ASSE

ASSE International

18927 Hickory Creek Drive, Suite 220
Mokena, IL 60448

1017—2010: Performance Requirements for Temperature Actuated Mixing Valves for Hot Water Distribution Systems
1002.2.2

1061—2015: Performance Requirements for Push Fit Fittings
Table 1202.5

ASTM

ASTM International

100 Barr Harbor Drive, P.O. Box C700
West Conshohocken, PA 19428

A53/A53M—12: Specification for Pipe, Steel, Black and Hot-dipped, Zinc-coated, Welded and Seamless
Table 1202.4, Table 1202.5, Table 1302.3

A106/A106M—14: Specification for Seamless Carbon Steel Pipe for High-temperature Service
Table 1302.3, Table 1202.5, Table 1202.4 Table 1302.3

A126—04(2014): Specification for Gray Iron Castings for Valves, Flanges and Pipe Fittings
Table 1202.5

A234/A234M—15: Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service
Table 1202.5

A254—12: Specification for Copper Brazed Steel Tubing
Table 1202.4, Table 1302.3

A395/A395M—99(2014): Standard Specification for Ferritic Ductile Iron Pressure-retaining Castings for Use at Elevated Temperatures
Table 1202.5, Table 1302.3

A420/A420M—14: Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Low-temperature Service
Table 1202.5

A536—84(2014): Standard Specification for Ductile Iron Castings
Table 1202.5

A539—99: Specification for Electric-resistance-welded Coiled Steel Tubing for Gas and Fuel Oil Lines
Table 1302.3

B32—08(2014): Specification for Solder Metal
1203.3.3

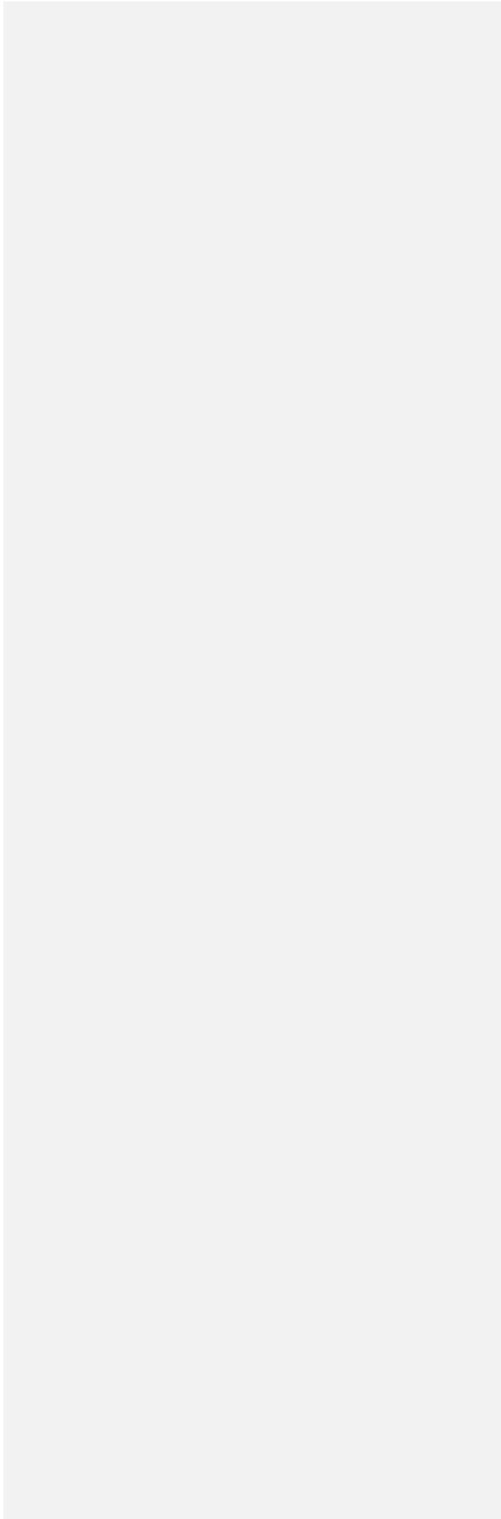
B42—15a: Specification for Seamless Copper Pipe, Standard Sizes
513.13.1, 1107.5.2, Table 1202.4, Table 1302.3

B43—15: Specification for Seamless Red Brass Pipe, Standard Sizes
513.13.1, 1107.5.2, Table 1202.4, Table 1302.3

B68/B58M—11: Specification for Seamless Copper Tube, Bright Annealed
513.13.1

B75/B75M—11: Specification for Seamless Copper Tube

Table 1302.3



ASTM—continued

- B88—14: Specification for Seamless Copper Water Tube**
513.13.1, 1107.5.3, Table 1202.4, Table 1302.3
- B135—10: Specification for Seamless Brass Tube**
Table 1202.4
- B251—10: Specification for General Requirements for Wrought Seamless Copper and Copper-alloy Tube**
513.13.1, Table 1202.4
- B280—13: Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service**
513.13.1, 1107.5.3, Table 1302.3
- B302—12: Specification for Threadless Copper Pipe, Standard Sizes**
Table 1202.4, Table 1302.3
- B813—10: Specification for Liquid and Paste Fluxes for Soldering of Copper and Copper Alloy Tube**
1203.3.3
- B819—00(R2011): Standard Specification for Seamless Copper Tube for Medical Gas Systems**
1107.5.3
- B828—02(2010): Practice for Making Capillary Joints by Soldering of Copper and Copper Alloy Tube and Fittings**
1203.3.3
- C315—07(2011): Specification for Clay Flue Liners and Chimney Pots**
801.16.1, Table 803.10.4
- C411—11: Test Method for Hot-surface Performance of High-temperature Thermal Insulation**
604.3
- D56—05(2010): Test Method for Flash Point by Tag Closed Cup Tester**
202
- D93—15: Test Method for Flash Point of Pensky-Martens Closed Cup Tester**
202
- D1527—99(2005): Specification for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe, Schedules 40 and 80**
Table 1202.4
- D1693—15: Test Method for Environmental Stress-cracking of Ethylene Plastics**
Table 1202.4
- D1785—15: Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80 and 120**
Table 1202.4, Table 1210.4
- D2235—04(2011): Specifications for Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings**
1203.3.4
- D2241—15: Specification for Poly (Vinyl Chloride) (PVC) Pressure-rated Pipe (SDR-Series)**
Table 1202.4, Table 1210.4
- D2282—99(2005): Specification for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe (SDR-PR)**
Table 1202.4
- D2412—11: Test Method for Determination of External Loading Characteristics of Plastic Pipe by Parallel-plate Loading**
603.8.3
- D2464—15: Standard Specification for Threaded Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80**
Table 1210.5
- D2466—15: Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40**
Table 1202.5, Table 1210.5
- D2467—15: Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80**
Table 1202.5, Table 1210.5
- D2564—12: Specification for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Piping Systems**
1203.3.4
- D2657—07: Standard Practice for Heat Fusion Joining of Polyolefin Pipe and Fittings**
Table 1210.5
- D2683—14: Specification for Socket-type Polyethylene Fittings for Outside Diameter-controlled Polyethylene Pipe and Tubing**
Table 1210.5, 1210.6.6.1
- D2737—12a: Standard Specification for Polyethylene (PE) Plastic Tubing**
Table 1210.4

ASTM—continued

- D2846/D2846M—14: Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Hot- and Cold-water Distribution Systems**
Table 1202.4, 1203.3.4, Table 1210.4
- D2996—01(2007)e01: Specification for Filament-wound Fiberglass (Glass Fiber Reinforced Thermosetting Resin) Pipe**
Table 1302.3
- D3035—15: Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside Diameter**
Table 1210.4
- D3261—12e1: Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing**
Table 1210.5, 1210.6.6.1
- D3278—96(2011): Test Methods for Flash Point of Liquids by Small Scale Closed-cup Apparatus**
202
- D3309—96a(2002): Specification for Polybutylene (PB) Plastic Hot- and Cold-water Distribution Systems**
Table 1202.4, 1203.10.1
- E84—2016: Standard Test Method for Surface Burning Characteristics of Building Materials**
202, 510.9, 602.2, 602.2.1, 602.2.1.6, 602.2.1.6.1, 602.2.1.6.2, 602.2.1.6.3, 602.2.1.7, 604.3, 1204.1
- E119—2016: Test Method for Fire Tests of Building Construction and Materials**
607.5.2, 607.5.5, 607.6.1, 607.2.1
- E136—16: Standard Test Method for Behavior of Materials in a Vertical Tube Furnace at 750 Degrees C**
202
- E814—13a: Standard Test Method for Fire Tests of Penetration Firestop Systems**
506.3.11.2, 506.3.11.3
- E1509—12: Specification for Room Heaters, Pellet Fuel-burning Type**
904.1
- E2231—15: Standard Practice for Specimen Preparation and Mounting of Pipe and Duct Insulation Materials to Assess Surface Burning Characteristics**
604.3, 1204.1
- E2336—16: Standard Test Methods for Fire Resistive Grease Duct Enclosure Systems**
506.3.6, 506.3.11.2
- F437—15: Specification for Threaded Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80**
Table 1210.5
- F438—15: Specification for Socket Type Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 40**
Table 1202.5, Table 1210.5
- F439—13: Specification for Socket Type Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80**
Table 1202.5, Table 1210.5
- F441/F441M—15: Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe, Schedules 40 and 80**
Table 1202.4, Table 1210.4
- F442/F442M—13e1: Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe (SDR-PR)**
Table 1202.4, Table 1210.4
- F493—14: Specification for Solvent Cements for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe and Fittings**
1203.3.4
- F714—13: Standard Specification for Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter**
Table 1210.4
- F876—15A: Specification for Cross-linked Polyethylene (PEX) Tubing**
Table 1202.4, Table 1210.4
- F877—11a: Specification for Cross-linked Polyethylene (PEX) Plastic Hot- and Cold-water Distribution Systems**
Table 1202.4, Table 1202.5, Table 1210.4
- F1055—13: Specification for Electrofusion Type Polyethylene Fittings for Outside Diameter Controlled Polyethylene and Cross-linked Polyethylene (PEX) Pipe and Tubing**
Table 1210.5, 1210.6.6.2
- F1281—11: Specification for Cross-linked Polyethylene/Aluminum/Crosslinked Polyethylene (PEX-AL-PEX) Pressure Pipe**
Table 1202.4
- F1282—10: Standard Specification for Polyethylene/Aluminum/Polyethylene (PE-AL-PE) Composite Pressure Pipe**
Table 1202.4, Table 1210.4, Table 1210.5

ASTM—continued

- F1476—07(2013): Specification for Performance of Gasketed Mechanical Couplings for Use in Piping Applications**
Table 1202.5, 1203.3.7
- F1548—01(2012): Standard Specification for the Performance of Fittings for Use with Gasketed Mechanical Couplings Used in Piping Applications**
Table 1202.5
- F1807—15: Standard Specification for Metal Insert Fittings Utilizing a Copper Crimp Ring for SDR9 Cross-linked Polyethylene (PEX) Tubing and SDR9 Polyethylene of Raised Temperature (PE-RT) Tubing**
Table 1202.5, Table 1210.5
- F1924—12: Standard Specification for Plastic Mechanical Fittings for Use on Outside Diameter Controlled Polyethylene Gas Distribution Pipe and Tubing**
1210.6.6.3
- F1960—15: Specification for Cold-expansion Fittings with PEX Reinforcing Rings for Use with Cross-linked Polyethylene (PEX) Tubing**
Table 1202.5
- F1974—09(2005): Standard Specification for Metal Insert Fittings for Polyethylene/Aluminum/Polyethylene and Cross-linked Polyethylene/Aluminum/Cross-linked Polyethylene Composite Pressure Pipe**
Table 1202.5
- F2080—15: Specification for Cold-expansion Fittings with Metal Compression-sleeves for Cross-linked Polyethylene (PEX) Pipe**
Table 1202.5
- F2098—08: Standard Specification for Stainless Steel Clamps for Securing SDR9 Cross-linked Polyethylene (PEX) Tubing to Metal Insert and Plastic Insert Fittings**
Table 1202.5
- F2159—14: Standard Specification for Plastic Insert Fittings Utilizing a Copper Crimp Ring for SDR9 Cross-linked Polyethylene (PEX) Tubing and SDR9 Polyethylene of Raised Temperature (PE-RT) Tubing**
Table 1202.5, Table 1210.5
- F2389—15: Specification for Pressure-rated Polypropylene Piping Systems**
Table 1202.4, Table 1202.5, 1203.15.1, Table 1210.4, Table 1210.5, 1210.6.7.1
- F2434—14: Standard Specification for Metal Insert Fittings Utilizing a Copper Crimp Ring for SDR9 Cross-linked Polyethylene (PEX) Tubing and SDR9 Cross-linked Polyethylene/Aluminum/Cross-linked Polyethylene (PEX-AL-PEX) Tubing**
Table 1210.5
- F2623—14: Standard Specification for Polyethylene of Raised Temperature (PE-RT) SDR9 Tubing**
Table 1202.4, Table 1210.4
- F2735—09: Standard Specification for Plastic Insert Fittings for SDR9 Cross-linked Polyethylene (PEX) and Polyethylene of Raised Temperature (PE-RT) Tubing**
Table 1202.5
- F2769—14: Polyethylene of Raised Temperature (PE-RT) Plastic Hot- and Cold-water Tubing and Distribution Systems**
Table 1202.4, Table 1210.5
- F2806—10(2015): Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe (Metric SDR-PR)**
Table 1202.4

AWS

American Welding Society

8669 NW 36 Street, #130
Miami, FL 33166

- A5.8M/A5.8—2011: Specifications for Filler Metals for Brazing and Braze Welding**
1203.3.1, 1303.3.1

AWWA

American Water Work Association

6666 West Quincy Avenue
Denver, CO 80235

C901—16: Polyethylene (PE) Pressure Pipe and Tubing, $\frac{3}{4}$ in. (19 mm) through 3 in. (76 mm) for Water Service
Table 1210.4

C110/A21.10—12: Standard for Ductile Iron & Gray Iron Fittings
Table 1202.5

C115/A21.15—11: Standard for Flanged Ductile-iron Pipe with Ductile Iron or Grey-iron Threaded Flanges
Table 1202.4

C151/A21.51—09: Standard for Ductile-iron Pipe, Centrifugally Cast for Water
Table 1202.4

C153/A21.53—11: Standard for Ductile-iron Compact Fittings for Water Service
Table 1202.5

CPSC

Consumer Product Safety Commission

4330 East West Highway
Bethesda, MD 20814

CPSC August 2011. Title 15 of the Federal Hazardous Substance Act
202, 1009.1

CSA

CSA Group

8501 East Pleasant Valley Road
Cleveland, OH 44131-5516

B137.2—16: Polyvinylchloride (PVC) Injection-moulded Gasketed Fittings for Pressure Applications
Table 1210.5

B137.3—16: Rigid Poly (Vinyl Chloride) (PVC) Pipe for Pressure Applications
Table 1210.5

B137.6—16: Chlorinated Polyvinylchloride (CPVC) Pipe, Tubing and Fittings for Hot- and Cold-water Distribution Systems
Table 1210.5

B137.9—16: Polyethylene/Aluminum/Polyethylene (PE-AL-PE) Composite Pressure-pipe Systems
Table 1202.4, Table 1210.4, Table 1210.5

B137.10—16: Cross-linked Polyethylene/Aluminum/Cross-linked Polyethylene (PEX-AL-PEX) Composite Pressure-pipe Systems
Table 1202.4

CSA C448 Series—16: Design and Installation of Earth Energy Systems
Table 1210.5

CSA C22.2 No. 218.1—M89(R2011): Spas, Hot Tubs and Associated Equipment
916.1

CSA C22.2 No. 236—11: Heating and Cooling Equipment
916.1

CSA B137.1—16: Polyethylene (PE) Pipe, Tubing and Fittings for Cold-water Pressure Services
Table 1210.4, Table 1210.5

CSA B137.5—16: Cross-linked Polyethylene (PEX) Tubing Systems for Pressure Applications
Table 1210.4, Table 1210.5

CSA B137.11—16: Polypropylene (PP-R) Pipe and Fittings for Pressure Applications
Table 1210.4, Table 1210.5

CSA B137.18—13: Polyethylene of Raised Temperature Resistance (PE-RT) Tubing Systems for Pressure Applications
Table 1202.4, Table 1202.5, Table 1210.5

America FC1—2012: Stationary Fuel Cell Power Systems
924.1

DOL

U.S. Department of Labor
Occupational Safety and Health Administration
c/o Superintendent of Documents
U.S. Government Printing Office
Washington, DC 20402-9325

29 CFR Part 1910.1000 (2015): Air Contaminants

502.6

29 CFR Part 1910.1025 (2015): Toxic and Hazardous Substances

502.19

FDA

U.S. Food and Drug Administration
10903 New Hampshire Avenue
Silver Springs, MD 20993

FDA Title 15: Federal Hazardous Substances Act

1403.4

FDA Title 21: Code of Federal Regulations, Title 21, Food and Drugs, Chapter 1, Food and Drug Administration, Parts 174–186 (revised as of April 1, 2015)

1403.3

FS

Federal Specifications*
General Services Administration
7th & D Streets
Specification Section, Room 6039
Washington, DC 20407

WW-P-325B (1976): Pipe, Bends, Traps, Caps and Plugs; Lead (for Industrial Pressure and Soil and Waste Applications)

Table 1202.4

*Standards are available from the Supt. of Documents, U.S. Government Printing Office, Washington, DC 20402-9325

ICC

International Code Council, Inc.
500 New Jersey Ave NW
6th Floor
Washington, DC 20001

IBC—18: International Building Code®

201.3, 202, 301.15, 301.16, 301.17, 301.18, 302.1, 302.2, 304.8, 304.11, 308.4.2.2, 308.4.2.4, 401.4, 401.5, 406.1, 501.3.1, 501.3.2, 501.10.2, 502.10, 502.10.1, 504.2, 504.10, 505.3, 506.3.3, 506.3.10, 506.3.12.2, 506.4.1, 509.1, 510.6, 510.6.3, 510.6.2, 510.7, 510.7.1.1, 510.7.2, 510.7.3, 510.8, 511.1.5, 513.1, 513.2, 513.3, 513.4.3, 513.5, 513.5.2, 513.5.2.1, 513.5.3, 513.5.3.2, 513.6.2, 513.10.5, 513.11.1, 513.12, 513.12.2, 513.20, 601.3, 602.2, 602.2.1.5.1, 602.2.1.5.2, 602.2.1.6.1, 602.2.1.6.2, 602.3, 602.4, 603.1, 603.10, 603.13, 603.18.2, 604.5.4, 607.1.1, 607.1.2, 607.3.2.1, 607.5.1, 607.5.2, 607.5.3, 607.5.4, 607.5.4.1, 607.5.5, 607.5.5.1, 607.5.6, 607.6, 607.6.1, 607.6.2, 607.6.2.1, 607.6.3, 701.2, 701.4.1, 701.4.2, 801.3, 801.16.1, 801.18.4, 801.18.4.1, 902.1, 908.3, 908.4, 910.3, 924.1, 925.1, 926.1, 927.2, 928.1, 1004.6, 1105.1, 1206.4, 1210.8.2, 1305.2.1, 1402.4, 1402.4.1

IECC—18: International Energy Conservation Code®

301.2, 303.3, 312.1, 401.2, 514.1, 604.1, 1204.1, 1204.2

IFC—18: International Fire Code®

201.3, 310.1, 311.1, 502.4, 502.5, 502.7.2, 502.8.1, 502.9.1, 502.9.5, 502.9.5.2, 502.9.5.3, 502.9.8.2, 502.9.8.3, 502.9.8.5, 502.9.8.6, 502.9.11, 502.10, 502.10.3, 502.16.2, 509.1, 510.2.1, 510.2.2, 510.5, 511.1.1, 513.1, 513.2, 513.6.3, 513.12.1, 513.12.3, 513.12.4, 513.15, 513.16, 513.17, 513.18, 513.19, 606.2.1, 606.4.1, 908.7, 924.1, 926.1, 1101.9, 1105.3, 1105.9, 1106.5, 1106.6, 1301.1, 1301.2, 1301.5

IFGC—18: International Fuel Gas Code®

101.2, 201.3, 301.6, 701.1, 801.1, 901.1, 906.1, 926.1, 1101.5

IPC—18: International Plumbing Code®

201.3, 301.11, 307.2.2, 512.2, 908.5, 928.1, 1002.1, 1002.2, 1002.3, 1005.2, 1006.6, 1008.2, 1009.3,

1101.4, 1201.1, 1206.2, 1206.3, 1210.8.1, 1401.2

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IRC—18: International Residential Code®
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ICC 900/SRCC Standard 300—15: Solar Thermal System Standard
1002.1, 1401.4, 1401.4.1, 1402.1, 1402.3.1, 1402.4, 1402.8.1.1, 1402.8.1.4, 1402.8.5, 1402.8.5.3,
1403.2

ICC 901/SRCC Standard 100—15: Solar Thermal Collector Standard
1401.4.1, 1402.8.1.1

IIAR

International Institute of Ammonia Refrigeration
1001 N. Fairfax Street, Suite 503
Arlington, VA 22314

IIAR 2—2014: Safe Design of Closed-circuit Ammonia Refrigerating Systems
1101.6, 1105.6.3

ANSI/IIAR 3—2012: Ammonia Refrigeration Valves
1101.6

ANSI/IIAR 4—2015: Installation of Closed-circuit Ammonia Mechanical Refrigerating Systems
1101.6

ANSI/IIAR 5—2013: Start-up and Commissioning of Closed-circuit Ammonia Refrigeration Systems
1101.6

MSS

Manufacturers Standardization Society of the Valve and Fittings Industry, Inc.
127 Park Street, NE
Vienna, VA 22180

SP 58—2009: Pipe Hangers and Supports—Materials Design and Manufacture, Selection, Application and Installation
305.4

NAIMA

North American Insulation Manufacturers
Association 11 Canal Center
Plaza, Suite 103
Alexandria, VA 22314

AH116—09: Fibrous Glass Duct Construction Standards
603.5, 603.9

NBBI

National Board of Boiler and Pressure Vessel Inspectors
1055 Crupper Avenue
Columbus, OH 43229-1183

NBIC—2011: National Board Inspection Code, Part 3
1003.3

NFPA

National Fire Protection Association
1 Batterymarch Park
Quincy, MA 02169-7471

2—16: Hydrogen Technologies Code
502.16.1

30A—18: Code for Motor Fuel-dispensing Facilities and Repair Garages
304.6

31—16: Standard for the Installation of Oil-burning Equipment
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- 37—18: Standard for the Installation and Use of Stationary Combustion Engines and Gas Turbines**
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- 58—17: Liquefied Petroleum Gas Code**
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- 69—14: Standard on Explosion Prevention Systems**
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- 70—17: National Electrical Code**
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- 72—16: National Fire Alarm and Signaling Code**
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- 82—14: Standard on Incinerators and Waste and Linen Handling Systems and Equipment**
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- 85—15: Boiler and Combustion Systems Hazards Code**
1004.1
- 91—15: Standard for Exhaust Systems for Air Conveying of Vapors, Gases, Mists and Noncombustible Particulate Solids**
502.9.5.1, 502.17
- 92—15: Standard for Smoke Control Systems**
513.7, 513.8
- 96—17: Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations**
507.1
- 211—16: Standard for Chimneys, Fireplaces, Vents and Solid Fuel-burning Appliances**
806.1
- 262—15: Standard Method of Test for Flame Travel and Smoke of Wires and Cables for Use in Air-handling Spaces**
602.2.1.1
- 286—15: Standard Methods of Fire Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth**
602.2.1.6.2
- 704—17: Standard System for Identification of the Hazards of Materials for Emergency Response**
502.8.4, 510.1, Table 1103.1
- 853—15: Standard on Installation of Stationary Fuel Power Plants**
924.1

NSF

NSF International

789 N. Dixboro Road
P.O. Box
130140 Ann Arbor,
MI 48105

NSF 358-1—2014: Polyethylene Pipe and Fittings for Water-based Ground-source “Geothermal” Heat Pump Systems
Table 1210.4, Table 1210.5

NSF 358-2—2012: Polypropylene Pipe and Fittings for Water-based Ground-source “Geothermal” Heat Pump Systems
Table 1210.4, Table 1210.5

SMACNA

Sheet Metal and Air Conditioning Contractors’ National Association,
Inc. 4201 Lafayette Center
Drive Chantilly, VA 20151-
1219

SMACNA 2015: Phenolic Duct Construction Standard
603.5.2

SMACNA/ANSI—2016: HVAC Duct Construction Standards-Metal and Flexible 4th Edition (ANSI) 2016
603.4, Table 603.4, 603.9, 603.10

SMACNA—10: Fibrous Glass Duct Construction Standards
603.5, 603.9

UL

UL LLC

333 Pfingsten Road
Northbrook, IL 60062-2096

- 17—2008: Vent or Chimney Connector Dampers for Oil-fired Appliances—with revisions through September 2013
803.6
- 103—2010: Factory-built Chimneys, Residential Type and Building Heating Appliance—with revisions through July 2012
805.2
- 127—2011: Factory-built Fireplaces—with revisions through May 2015
903.1, 903.3, 903.4
- 174—04: Household Electric Storage Tank Water Heaters—with revisions through April 2015
1002.1
- 180—2012: Liquid-level Indicating Gauges for Oil Burner Fuels and Other Combustible Liquids
1306.4
- 181—05: Factory-made Air Ducts and Air Connectors—with revisions through October 2008
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- 181A—2013: Closure Systems for Use with Rigid Air Ducts and Air Connectors
603.9
- 181B—2013: Closure Systems for Use with Flexible Air Ducts and Air Connectors
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- 197—10: Commercial Electric Cooking Appliances—with revisions through September 2014
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- 207—2009: Refrigerant-containing Components and Accessories, Nonelectrical—with revisions through June 2014
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- 263—2011: Standard for Fire Test of Building Construction and Materials—with revisions through June 2015
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- 268—2009: Smoke Detectors for Fire Alarm Systems
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- 268A—2008: Smoke Detectors for Duct Application—with revisions through October 2014
606.1
- 343—2008: Pumps for Oil-burning Appliances—with revisions through June 2013
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- 378—06: Draft Equipment—with revisions through June 12, 2014
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- 391—2010: Solid-fuel and Combination-fuel Central and Supplementary Furnaces—with revisions through June 2014
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- 412—2011: Refrigeration Unit Coolers—with revisions through September 2013
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- 471—2010: Commercial Refrigerators and Freezers—with revisions through December 2012
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- 499—05: Electric Heating Appliances—with revisions through November 2014
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- 507—2014: Standard for Electric Fans
505.2
- 508—99: Industrial Control Equipment—with revisions through October 2013
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- 536—97: Flexible Metallic Hose—with revisions through December 2014
1302.8
- 555—06: Fire Dampers—with revisions through May 2014
607.3.1
- 555C—06: Ceiling Dampers—with revisions through December 2014
607.3.1
- 555S—99: Smoke Dampers—with revisions through February 2014
607.3.1

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- 586—2009: High-efficiency, Particulate, Air Filter Units—with revisions through September 2014
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- 641—2010: Type L Low-temperature Venting Systems—with revisions through June 2013
802.1
- 705—2004: Standard for Power Ventilators—with revisions through December 2013
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- 710—2012: Exhaust Hoods for Commercial Cooking Equipment—with revisions through November 2013
507.1
- 710B—2011: Recirculating Systems—with revisions through August 2014
507.1, 507.2
- 723—2008: Standard for Test for Surface Burning Characteristics of Building Materials—with revisions through August 2013
510.9, 602.2, 602.2.1, 602.2.1.6, 602.2.1.6.2, 602.2.1.6.3, 602.2.1.7, 604.3, 1204.1
- 726—95: Oil-fired Boiler Assemblies—with revisions through October 2013
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- 727—06: Oil-fired Central Furnace—with revisions through October 2013
918.1
- 729—03: Oil-fired Floor Furnaces—with revisions through October 2013
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- 730—03: Oil-fired Wall Furnaces—with revisions through October 2013
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- 737—2011: Fireplace Stoves—with revisions through August 2015
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- 762—2010: Outline of Investigation for Power Ventilators for Restaurant Exhaust Appliances—with revisions through October 2013
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- 791—06: Residential Incinerators—with revisions through November 2014
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- 834—04: Heating, Water Supply and Power Boilers Electric—with revisions through December 2013
1004.1
- 842—07: Valves for Flammable Fluids—with revisions through May 2015
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- 858—05: Household Electric Ranges—with revisions through June 2015
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- 867—2011: Electrostatic Air Cleaners—with revisions through August 2013
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- 875—09: Electric Dry Bath Heater—with revisions through December 2013
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- 896—93: Oil-burning Stoves—with revisions through November 2013
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- 900—04: Air Filter Units—with revisions through April 2015
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- 907—94: Fireplace Accessories—with revisions through June 2014
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- 923—2013: Microwave Cooking Appliances—with revisions through June 2015
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- 1046—2010: Grease Filters for Exhaust Ducts—with revisions through January 2012
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- 1240—2012: Electric Commercial Clothes—Drying Equipment—with revisions through October 2012
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- 1261—01: Electric Water Heaters for Pools and Tubs—with revisions through July 2012
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- 1453—04: Electric Booster and Commercial Storage Tank Water Heaters—with revisions through July 2011
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- 1479—03 : Fire Tests of Through-penetration Firestops—with revisions through June 2015
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- 1563—2009: Standard for Electric Spas, Hot Tubs and Associated Equipment—with revisions through March 2015
916.1
- 1618—09: Wall Protectors, Floor Protectors and Hearth Extensions—with revisions through October 2015
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- 1777—2007: Chimney Liners—with revisions through October 2015
801.16.1, 801.18.4
- 1812—2013: Standard for Ducted Heat Recovery Ventilators—with revisions through April 2014
514.1
- 1815—2012: Standard for Nonducted Heat Recovery—with revisions through April 2014
514.1
- 1820—04: Fire Test of Pneumatic Tubing for Flame and Smoke Characteristics—with revisions through May 2013
602.2.1.3
- 1887—04: Fire Tests of Plastic Sprinkler Pipe for Visible Flame and Smoke Characteristics—with revisions through May 2013
602.2.1.2
- 1978—2010: Grease Ducts—with revisions through September 2013
506.3.2, 506.3.6
- 1995—2011: Heating and Cooling Equipment—with revisions through July 2015
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- 1996—2009: Electric Duct Heaters—with revisions through June 2014
911.1
- 2024—2011: Standard for Safety Optical-fiber and Communications Cable Raceway—with revisions through August 2015
602.2.1.1
- 2043—2008: Fire Test for Heat and Visible Smoke Release for Discrete Products and Their Accessories Installed in Air-handling Spaces—with revisions through October 2013
602.2.1.4.2
- 2075—2013: Standard for Gas and Vapor Detectors and Sensors
404.1
- 2158—97: Electric Clothes Dryers—with revisions through March 2009
913.1
- 2158A—2010: Outline of Investigation for Clothes Dryer Transition Duct
504.8.3
- 2162—01: Outline of Investigation for Commercial Wood-fired Baking Ovens-Refractory Type
917.1
- 2200—2012: Stationary Engine Generator Assemblies—with revisions through July 2015
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- 2221—2010: Tests of Fire Resistive Grease Duct Enclosure Assemblies
506.3.11.3
- 2518—05: Air Dispersion System Materials
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- 2523—09: Solid Fuel-fired Hydronic Heating Appliances—with revisions through February 2013
1002.1, 1004.1
- 2846—14: Fire Test of Plastic Water Distribution Plumbing Pipe for Visible Flame and Smoke Characteristics
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Appendix A

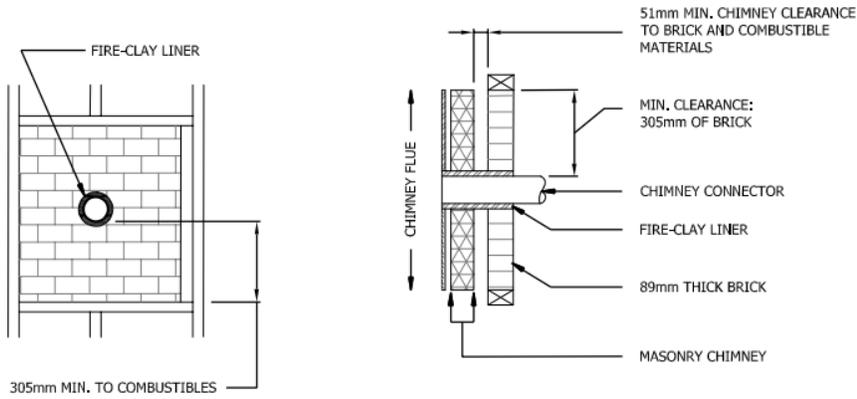
Chimney Connector Pass-Throughs

This appendix is informative and is not part of the code.

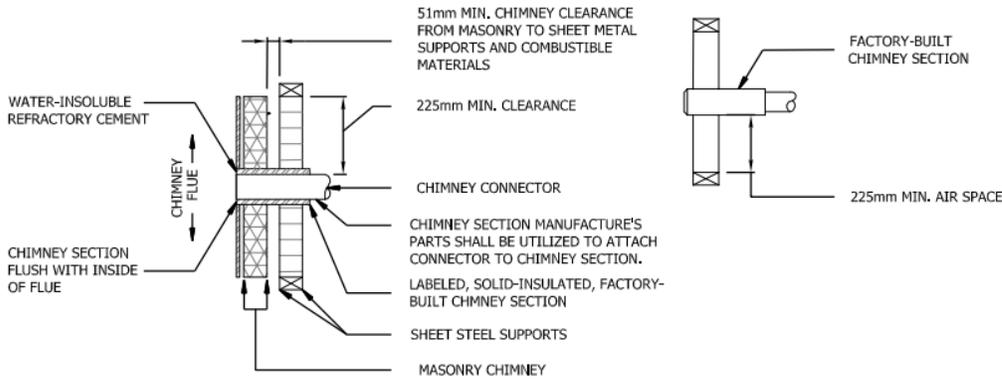
User note:

About this appendix: Appendix A is a depiction of what is prescribed in Table 803.10.4. See Section 803.10.4.

SYSTEM A



SYSTEM B



For Inch Pound Units: 1 mm = 0.03937 inch.

FIGURE A-1
CHIMNEY CONNECTOR SYSTEMS

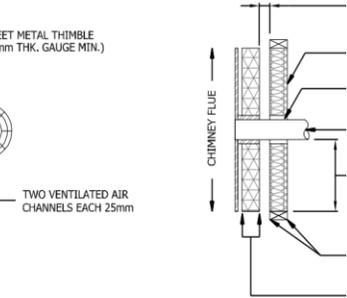
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APPENDIX A

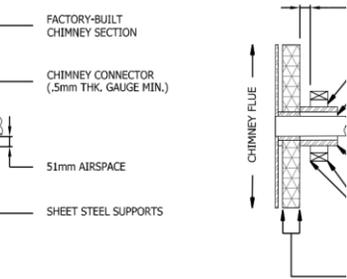
For Inch Pound Units: 1 mm = 0.03937 inch.

nued CHIMNEY CONNECTOR SYSTEMS

SYSTEM C



SYSTEM D



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Appendix B

Recommended Permit Fee Schedule

This appendix is informative and is not part of the code.

User note: _____
About this appendix: Appendix B is an example of or recommendation for a mechanical permit fee schedule that can be implemented by an authority having jurisdiction. See Section 106.5.

B101 MECHANICAL WORK, OTHER THAN GAS PIPING SYSTEMS

B101.1 Initial Fee

For issuing each permit \$ _____

B101.2 Additional Fees

B101.2.1 Fee for inspecting heating, ventilating, ductwork, air-conditioning, exhaust, venting, *combustion* air, pressure vessel, solar, fuel oil and refrigeration systems and *appliance* installations shall be \$----- for the first \$1,000.00, or fraction thereof, of valuation of the installation plus \$----- for each additional \$1,000.00 or fraction thereof.

B101.2.2 Fee for inspecting repairs, alterations and additions to an existing system shall be \$----- plus \$----- for each \$1,000.00 or fraction thereof.

B101.2.3 Fee for inspecting boilers (based upon W [Btu] input):

9,672 W to 48,361.5 W [33,000 Btu (1 bhp) to 165,000 (5 bhp)] \$ ____

48,362 W to 96,720 W [165,001 Btu (5 bhp) to 330,000 (10 bhp)] \$ ____

96,720 W to 341,462 [330,001 Btu (10 bhp) to 1,165,000 (52 bhp)] \$ ____

341,462 to 967,231 [1,165,001 Btu (52 bhp) to 3,300,000 (98 bhp)] \$ ____

Over 967,231 3,300,000 Btu (98 bhp) \$ ____

For Inch Pound Units: 1 W = 3.4118 British thermal unit, 1 W = 0.000102 bhpor 3.4118 Btu/hr

B102 FEE FOR REINSPECTION

If it becomes necessary to make a reinspection of a heating, ventilation, air-conditioning or refrigeration system, or boiler installation, the installer of such *equipment* shall pay a reinspection fee of \$-----.

B103

TEMPORARY OPERATION INSPECTION FEE

When preliminary inspection is requested for purposes of permitting temporary operation of a heating, ventilating, refrigeration, or air-conditioning system, or portion thereof, a fee of \$----- shall be paid by the contractor requesting such preliminary inspection. If the system is not *approved* for temporary operation on the first preliminary inspection, the usual reinspection fee shall be charged for each subsequent preliminary inspection for such purpose.

B104

SELF-CONTAINED UNITS LESS THAN 7.034 kW (2 TONS)

In all buildings, except one- and two-family dwellings, where self-contained air-conditioning units of less than 7.034 kW (2 tons) are to be installed, the fee charged shall be that for the total cost of all units combined (see B101.2.1 for rate).

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EDITORIAL CHANGES – SECOND PRINTING

Page 15, **LOW-PROBABILITY PUMP**: now reads . . . A pump that is designed to prevent atmospheric release of the pumped fluid by one of the following methods: 1. The pump is permanently sealed; 2. The pump incorporates a static seal; 3. The pump incorporates not less than two sequential dynamic shaft seals to isolate the pumped fluid from atmosphere at shaft penetrations and automatically shuts down upon failure of any seal.

Page 42, **Section 502.4**: now reads . . . **502.4 Stationary storage battery systems**. Stationary storage battery systems shall be regulated and ventilated in accordance with Section 1206.2.11.3 of the *International Fire Code* and the general requirements of this chapter.

Page 42, **Sections 502.4.1** through **502.4.3** have been deleted.

Page 42, **Section 502.5**: now reads . . . **502.5 Ventilation of battery systems in cabinets**. Stationary storage battery systems installed in cabinets shall be provided with ventilation in accordance with Section 502.4.

Page 54, **Section 506.3.11.1**: line 10 now reads . . . than 150mm (6 inches). Duct enclosures shall be

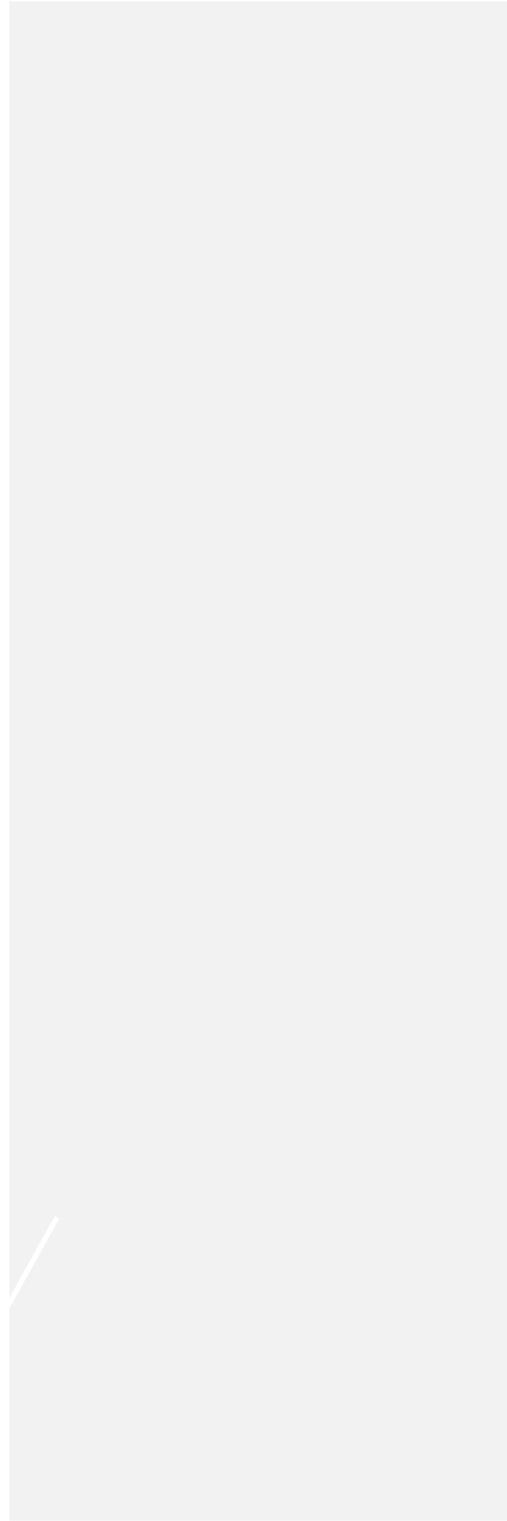
Page 100, **Section 1102.2.2.3**: line 4 now reads . . . requirements of AHRI 700. Contaminated

refrigerants Page 100, **Section 1102.2.2.3**: line 6 now reads . . . the purity requirements of AHRI 700.

Page 103, **TABLE 1103.1—continued**: column 9, row 13 now reads . . . 2-0-0^b

Page 129, Referenced Standard **ACCA: Manual D—2016: Residential Duct Systems** now reads . . . **ANSI/ACCA 1 Manual D—2016: Residential Duct Systems**

For the complete errata history of this code, please visit: <https://www.iccsafe.org/errata->



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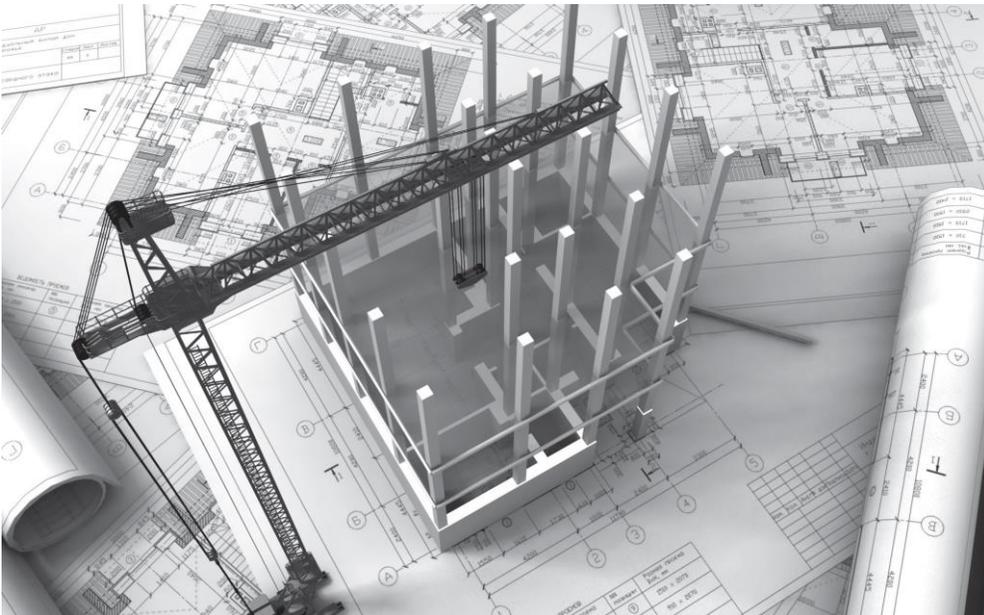


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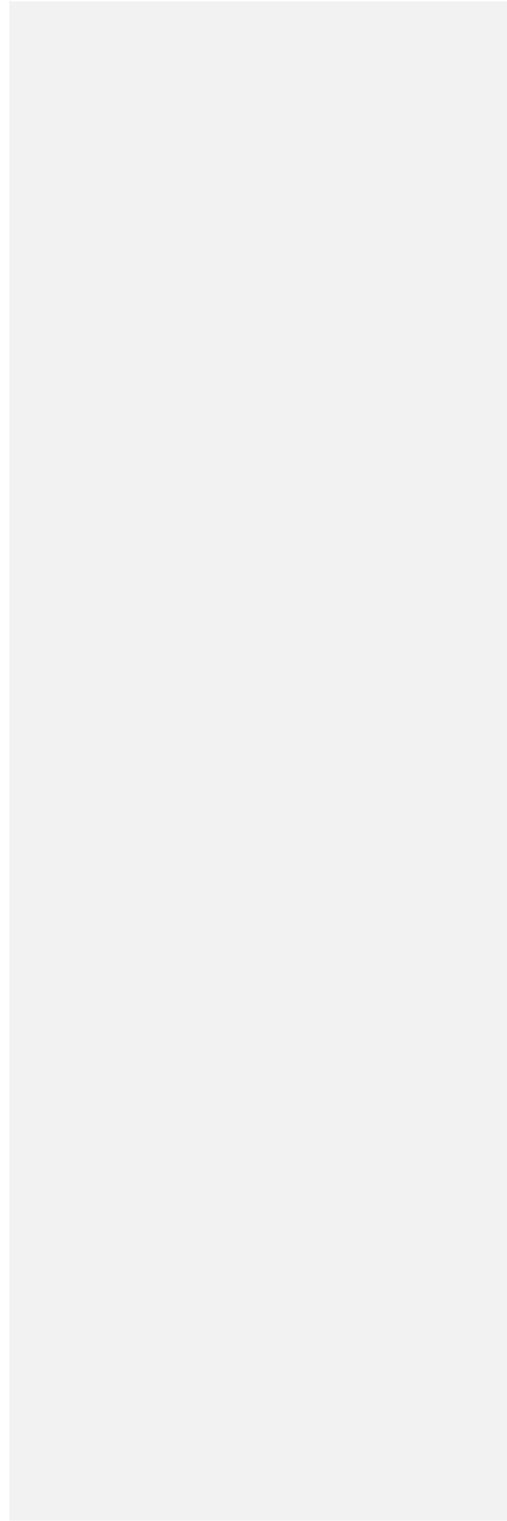
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