

FORT COLLINS AMENDMENTS – 2003 IRC

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CHAPTER 1 – ADMINISTRATION

(1) *Section R101.2, Scope.*, is hereby amended to read as follows:

R101.2 Scope. The provisions of the International Residential Code for One and Two-family Dwellings shall apply to the construction, alteration, movement, enlargement, replacement, repair, equipment, use and occupancy, location, removal and demolition of **“detached” one- and two-family dwellings, which dwellings are completely separated from adjacent dwellings by unobstructed physical space, and multiple, attached single-family dwellings (townhouses) not more than three stories in height above grade and with each townhouse having its own separate means of egress.**

(2) *Section R102, APPLICABILITY*, is hereby amended in the following respects:

a) *Subsection R102.4, Referenced codes and standards*, is hereby amended by adding the following new subsections thereto reading as follows:

102.4.1 All references to the *International Building Code* shall mean the general building code currently in effect as enacted by the City.

102.4.2 All references to the *International Plumbing Code* shall mean the plumbing code currently in effect in the City.

102.4.3 All references to the *International Fire Code* shall mean the fire code currently in effect as enacted by the City.

102.4.4 All references to flood hazard shall refer to the *Code of the City, Chapter 10, Flood Prevention and Protection.*

b) *A new subsection, R102.8 Areas prone to flooding*, is hereby added, reading as follows:

R102.8 Areas prone to flooding. All references to areas prone to flooding in this code and appendices adopted therewith shall be in accordance with the *Code of the City, Chapter 10, Flood Prevention and Protection.*

(3) *Section R103*, is hereby amended in its entirety to read as follows:

SECTION R103 CODE ADMINISTRATION

R103.1 Entity charged with code administration. The Building and Zoning Department as established by the *Code of the City*, is hereby charged with the administration and enforcement of this code.

R103.2 Building official. The building official is charged with the administration of this code, and in the performance of said duties may delegate the necessary authority to the appropriate technical, administrative, and compliance staff under the supervision of the building official.

(4) *Section R105, PERMITS*, is hereby amended in the following respects:

- (a) *Subsection R105.2, Work exempt from permit.*, is hereby amended by revising the first paragraph and subsequent listed numbered items related to Building: to read as follows and the remainder of the subsection adopted as published:

R105.2 Work exempt from permit. Permits shall not be required for the following buildings, structures, or alterations thereto listed below. Exemption from the permit requirements of this code shall not be deemed to grant authorization for any work to be done in any manner in violation of the provisions of this code or any other laws or ordinances of the City.

Building:

1. **Detached one-story accessory buildings used for lawn and garden equipment storage, tool storage and similar uses provided such buildings do not exceed one hundred twenty (120) square feet (11.15 m²) of floor area nor eight (8) feet (2.438 m) in height, do not house flammable liquids in quantities exceeding ten (10) gallons (38 l) per building and are constructed entirely of noncombustible materials when located less than three (3) feet (0.914 m) from an adjoining property line.**
2. Fences not over 6 feet (1.829 m) high.
3. Retaining walls that are not over 4 feet (1.219 m) in height measured from the bottom of the footing to the top of the wall, unless supporting a surcharge.
4. Water tanks supported directly upon grade if the capacity does not exceed 5,000 gallons (18,927 L) and the ratio of height to diameter or width does not exceed 2 to 1.
5. **Platforms and decks intended for human occupancy or walking, which are not more than 30 inches (762 mm) above adjacent grade and are not over any basement or story below, and walks and driveways.**
6. Painting, papering, tiling, carpeting, cabinets, counter tops and similar finish work.
7. **Prefabricated and portable swimming or wading pools, hot tubs or spas when the walls are entirely above grade and which cannot contain water more than twenty-four (24) inches (610 mm) deep.**
8. Swings and other **play** or playground equipment, **including elevated playhouses not exceeding (120) square feet (11.15 m²) of floor area nor eight (8) feet (2.438 m) in height measured from the floor to the highest point of such structure, designed and used exclusively for play.**
9. **Window awnings on Group R, Division 3 and Group U Occupancies projecting not more than 54 inches (1372 mm), window replacement requiring no structural alteration and when such work is determined not to be historically significant, storm window, storm door and rain gutter installation.**
10. **Roofing repair or replacement work not exceeding one square of covering per building.**
11. **Replacement of nonstructural siding.**

12. Minor work valued at less than five hundred dollars (\$500.) when such minor work does not involve alteration of structural components, fire-rated assemblies, plumbing, electrical, mechanical or fire-extinguishing systems.

(b) Section R105.3.2, Time limitation of application., is hereby amended in its entirety to read as follows:

R105.3.2 Time limitation of application. Applications for which a permit has not been issued within 90 days following the date of application shall automatically expire and plans submitted for code-compliance review may thereafter be returned to the applicant or destroyed by the building official. The building official may extend the time for action by the applicant for a period not exceeding 90 days, upon receipt of a written request by the applicant showing that circumstances beyond the control of the applicant have prevented action from being taken. In order to renew action on an application after expiration, the applicant shall resubmit plans and plan review fee as provided in this Code.

Exception: For applications to construct affordable housing units as defined in Section 26-631 of the Code of the City, such expiration shall occur when a permit has not been issued within 180 days following the date of permit application.

(c) Section R105.5, Expiration., is hereby amended to read as follows:

R105.5 Permit expiration and incompleteness of authorized work. Every permit issued, both prior to and subsequent to the effective date of this code, shall become invalid unless the work authorized by such permit is commenced within 180 days after its issuance, or if the work authorized by such permit is suspended or abandoned for a period of 180 days after the time the work is commenced. The building official is authorized to grant, in writing, extensions of time, for periods not more than 180 days each. The extension shall be requested in writing and justifiable cause demonstrated. No more than two such extensions may be granted by the building official without the permit holder first requesting and being granted the additional extension(s) by the Building Review Board pursuant to Section R112.

Both prior to and subsequent to the effective date of this code, any work authorized by a permit regulated by this code or any other building construction code administered by the building official that involves the construction or alteration of an exterior building component, assembly or finish material, such as the foundation, wall and roof framing, sheathing, siding, fenestration, and roof covering, shall be fully finished and completed for permanent outdoor exposure within 24 months of date of this issuance of such permit, regardless of when then permit was issued. Failure to comply with the preceding specified time-period shall constitute a violation of this code, resulting in revocation of the permit and subject the permit holder and property owner to all penalties provided by the Code of the City. No such revoked permit may be reinstated or a new permit issued therefor without the property owner or permit holder first requesting and being granted such reinstatement or issuance of a new permit by the Building Review Board pursuant to Section R112.

- (d) Two new subsections, R105.9 Premises. and R105.10 Transfer of permits., are hereby added to read as follows:

R105.9 Premises Identification. The approved permit number and street address number shall be displayed and be plainly visible and legible from the public street or road fronting the property on which any new building is being constructed.

R105.10 Transfer of permits. A current valid building permit may be transferred from one party to another upon written application to the building official. When any changes are made to the original plans and specifications that substantially differ from the plans submitted with the permit, as determined by the building official, a new plan review fee shall be paid as calculated in accordance with Section R108. A fee of fifty dollars (\$50.) shall be paid to cover administrative costs for all building permit transfers. No change shall be made in the expiration date of the original permit.

- (5) *Section R106, SUBMITTAL DOCUMENTS.*, is hereby amended to read as follows:

SECTION R106 SUBMITTAL DOCUMENTS

R106.1 Submittal documents. Construction documents, special inspection and structural observation programs, and other data shall be submitted in one or more sets with each application for a permit. The construction documents shall be prepared by a registered design professional where required by the statutes of the jurisdiction in which the project is to be constructed. Where special conditions exist, the building official is authorized to require additional construction documents to be prepared by a registered design professional.

Exception: The building official is authorized to waive the submission of construction documents and other data not required to be prepared by a registered design professional if it is found that the nature of the work applied for is such that reviewing of construction documents is not necessary to obtain compliance with this code.

R106.1.1 Information on construction documents. Construction documents shall be drawn upon suitable material. Electronic media documents are permitted to be submitted when approved by the building official. Construction documents shall be of sufficient clarity to indicate the location, nature and extent of the work proposed and show in detail that it will conform to the provisions of this code and relevant laws, ordinances, rules and regulations, as determined by the building official.

R106.1.2 Manufacturer's installation instructions. Manufacturers installation instructions, as required by this code, shall be available on the job site at the time of inspection.

R106.1.3 Information for construction in areas prone to flooding. **For buildings or structures regulated under the scope of this code that are in whole or in part located in flood hazard areas, construction documents shall be submitted as established in accordance with the *Code of the City, Chapter 10, Flood Prevention and Protection.***

R106.1.4 Grading performance plans and certificate. Every building permit application for a new building regulated by this code shall be accompanied by a site drainage plan as prescribed by City standards.

R106.1.5 Exterior wall envelope. Construction documents for all buildings shall describe the exterior wall envelope in sufficient detail to determine compliance with this code and with Section N1111. When applicable as determined by the building official, construction documents submitted as part of the building permit application shall provide details of the exterior wall envelope as required, including flashing, intersections of dissimilar materials, corners, end details, control joints, intersections at roof, eaves, or parapets, means of drainage, water-resistive membrane, and details around openings. The construction documents shall include manufacturing installation instructions that provide supporting documentation that the proposed penetration and opening details described in the construction documents maintain the weather resistance of the exterior wall envelope. The supporting documentation shall fully describe the exterior wall system which was tested, where applicable, as well as the test procedure used.

R106.2 Site plan. The construction documents submitted with the application for permit shall be accompanied by a site plan showing the size and location of new construction and existing structures on the site and distances from lot lines. In the case of demolition, the site plan shall show construction to be demolished and the location and size of existing structures and construction that are to remain on the site or plot. **The site plan shall include a grading performance plan as specified in R106.1.4.**

(6) *Section R107, TEMPORARY STRUCTURES AND USES*, is deleted in its entirety.

(7) *Section R108, FEES*, is hereby amended in its entirety to read as follows:

SECTION 108 FEES

R108.1 Payment of fees. **No permit with any amendments and related construction plans therefor shall be valid until the fees prescribed by the City Manager pursuant to Chapter 7.5, ARTICLE I of the Code of the City, entitled, ADMINISTRATIVE FEES, have been paid.**

R108.2 Related fees. **The payment of the fee for the construction, alteration, removal or demolition for work done in connection with or concurrently with the work authorized by a building permit shall not relieve the applicant or holder of the permit from the payment of other fees that are prescribed by law.**

R108.3 Fee refunds. **Any fee paid hereunder that is erroneously paid or collected, shall be refunded. The building official may authorize the refunding of 90% of a plan review fee or building permit fee to the applicant who paid such fee pursuant to Sections R108.2 and R108.6, provided the plan review is withdrawn or cancelled and the plan review and/or work authorized under a permit issued in accordance with this Code has not commenced; and provided further such plan review or permit is valid and not expired as set forth in Sections R105.5 and R108.4. Prior to authorizing the refunding of any fee paid to the original applicant or permittee, a written request from such party must be submitted to the City within 180 days of the date of the fee payment.**

(8) Section 109, *INSPECTIONS*, is hereby amended to read as follows:

SECTION 109 INSPECTIONS

R109.1 Types of inspections. For on-site construction, from time to time the building official, upon notification from the permit holder or his agent, shall make or cause to be made any necessary inspections and shall either approve that portion of the construction as completed or shall notify the permit holder or his or her agent wherein the same fails to comply with this code.

R109.1.1 Foundation inspection. Inspection of the foundation shall be made after poles or piers are set or trenches or basement areas are excavated and any required forms erected and any required reinforcement is placed on approved supports prior to the placing of concrete. The foundation inspection shall include excavations for thickened slabs intended for the support of bearing walls, partitions, structural supports, or equipment and special requirements for wood foundations.

R109.1.2 Plumbing, mechanical, gas and electrical systems inspection. Preliminary inspection of plumbing, mechanical, gas and electrical systems shall be made prior to covering or concealment, before fixtures or appliances are set or installed, and prior to framing inspection.

Exception: Ground-source heat pump loop systems tested in accordance with Section M2105.1 shall be permitted to be backfilled prior to inspection.

R109.1.3 Floodplain inspections. Construction permitted in areas prone to flooding shall be regulated in accordance with the *Code of the City, Chapter 10, Flood Prevention and Protection*.

R109.1.4 Frame and masonry inspection. Inspection of framing and masonry construction shall be made after the roof, masonry, all framing, firestopping, draftstopping and bracing are in place and after the plumbing, mechanical and electrical rough inspections are approved.

R109.1.5 Fire-resistance-rated construction inspection. Where fire-resistance-rated construction is required between dwelling units or due to location on property, the building official shall require an inspection of such construction after all lath and/or wallboard is in place, but before any plaster is applied, or before wallboard joints and fasteners are taped and finished.

R109.1.6 Site Survey required. A survey or improvement location certificate of the site on which a new building or addition is to be constructed may be required by the building official to verify that the structure is located in accordance with the approved plans and any other regulations of the City.

R109.1.7 Final inspection. Final inspection shall be made after the permitted work is complete and prior to occupancy.

R109.1.8 Other inspections. In addition to the inspections above, the building official may make or require any other inspections to ascertain compliance with this code and other applicable laws enforced by the building official.

R109.2 Inspection agencies. The building official is authorized to accept reports of approved agencies, provided such agencies satisfy the requirements as to qualifications and reliability.

R109.3 Inspection requests. It shall be the duty of the permit holder or their agent to notify the building official that such work is ready for inspection. It shall be the duty of the person requesting any inspections required by this code to provide access to and means for inspection of such work.

R109.4 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 the portion of the construction that is satisfactory as completed, or shall notify the permit holder or an agent of the permit holder wherein the same fails to comply with this code. Any portions that do not comply shall be corrected and such portion shall not be covered or concealed until authorized by the building official.

(9) *Section R110, CERTIFICATE OF OCCUPANCY*, is hereby amended to read as follows:

SECTION R110 CERTIFICATE OF OCCUPANCY

R110.1 Use and occupancy. No building or structure shall be used or occupied, and no change in the existing occupancy classification of a building or structure or portion thereof shall be made until the building official has issued a certificate of occupancy therefor as provided herein. Issuance of a certificate of occupancy shall not be construed as an approval of a violation of the provisions of this code or of other ordinances of the jurisdiction. Certificates presuming to give authority to violate or cancel the provisions of this code or other ordinances of the jurisdiction shall not be valid.

Exception: Work exempt from permits under Section R105.2 and accessory buildings and structures as noted in Section R101.2.

R110.2 Change in use. Changes in the character or use of an existing structure shall not be made except in conformance with this code and the general building code enacted by the City.

R110.3 Certificate issued. After the building official inspects the building or structure and finds no violations of the provisions of this code or other laws that are enforced by the department of building safety, the building official shall issue a certificate of occupancy which shall contain the following:

1. The building permit number.
2. The address of the structure.
3. The name and address of the owner.
4. A description of that portion of the structure for which the certificate is issued.
5. A statement that the described portion of the structure has been inspected for compliance with the requirements of this code.
6. The name of the building official.
7. The edition of the code under which the permit was issued.
8. If an automatic sprinkler system is provided and whether such is required.
9. Any special stipulations and conditions of the building permit.

R110.4 Temporary occupancy. The building official is authorized to issue a temporary certificate of occupancy before the completion of the entire work covered by the permit, provided that such portion or portions shall be occupied safely. The building official shall set a time period during which the temporary certificate of occupancy is valid.

R110.5 Revocation. The building official shall, in writing, suspend or revoke a certificate of occupancy issued under the provisions of this code wherever the certificate is issued in error, or on the basis of incorrect information supplied, or where it is determined that the building or structure or portion thereof is in violation of any ordinance or regulation or any of the provisions of this code.

(10) Section R112, BOARD OF APPEALS, is hereby amended to read as follows:

SECTION R112 BOARD OF APPEALS

112.1 General. The Building Review Board (hereafter "Board") as established in Section 2-117 of the Code of the City is hereby empowered in accordance with the procedures set forth in this section to hear and to decide appeals of orders, decisions, or determinations made by the building official relative to the application and interpretation of this code; to the suitability of alternative materials or alternative methods of construction; and the granting of permit extensions and reinstatements as prescribed by Section R105.5. The building official shall be an ex officio member of the Board without vote and shall serve as the Secretary of the Board. The Board shall adopt rules of procedure for conducting its business, and shall render all decisions and findings in writing.

112.2 Applications/Hearings. When a building permit applicant or a holder of a building permit desires relief from any decision of the building official related to the enforcement of this code, except as is otherwise limited in Section R112.4, such building permit applicant, building permit holder, or representative thereof may appeal the decision of the building official to the Board stating that such decision by the building official was based on an erroneous interpretation of the building regulations or that an alternative design, alternative materials and/or the alternative methods of construction proposed by the appellant are equivalent to those prescribed by this code considering structural strength, effectiveness, fire resistance, durability, safety and any other pertinent factors.

The Board shall hear and decide all appeals made to it and shall have the authority to rule in favor of the appellant when the Board determines that the interpretation of the building regulations of the City by the building official was erroneous, or when the Board determines an alternative design, alternative materials and/or the alternative methods proposed by the appellant are equivalent to those prescribed by this code considering structural strength, effectiveness, fire resistance, durability, safety and any other pertinent factors. The Board shall require that sufficient evidence be submitted to substantiate any claims made regarding the proposed alternative design, alternative materials and/or alternative methods of construction. A quorum of four (4) members shall be necessary for any meeting of the Board.

112.3 Fees and Notification. Persons desiring to appeal to the Board any decision of the building official as provided in this section shall, at the time of filing such appeal, pay to the City a filing fee in the amount of fifty dollars (\$50.). Written notice of hearings shall be given to the Appellant and, with respect to requests for exceptions or variances authorized pursuant to Section R322 of this code and Section 1101.1 of the UNIFORM BUILDING CODE as

enacted by the City, to the secretary to the Commission on Disability, at least three (3) days prior to the hearing by mailing the same to such party's last known address by regular U.S. mail.

112.4 Limitations. The Building Review Board shall have no authority with respect to any of the following functions:

- 1. The administration of this code except as expressly provided otherwise;**
- 2. Waiving requirements of this code, except as provided for pursuant to this section;**
- 3. Modifying the applicable provisions of, or granting variances to, this code, or approving the use of alternative designs, alternative materials and/or alternative methods of construction except as provided for in this section and based upon a specific appeal from a determination or decision of the building official on an individual case basis; and**
- 4. Modifying, interpreting, or ruling on the applicability or intent of the zoning and land use regulations or other laws of the City except as expressly empowered otherwise.**

(11) *Section R113, VIOLATIONS.*, is hereby amended in the following respects:

(a) *Subsection R113.4, Violation penalties.*, is hereby amended to read as follows:

R113.4 Violation penalties. Persons who shall violate a provision of this code or shall fail to comply with any of the requirements thereof or who shall erect, install, alter or repair a building or structure in violation of the approved construction documents or directive of the code official, or of a permit or certificate issued under the provisions of this code, shall be guilty of a misdemeanor subject to the penalties and fines pursuant to Section 1-15 of the Code of the City, punishable by a fine of not more than \$1,000.00 dollars, or by imprisonment not exceeding 180 days, or both such fine and imprisonment. Each day that a violation continues after due notice has been served shall be deemed a separate offense.

(b) A new subsection, *R113.5, Work commencing before permit issuance.*, is hereby added to read as follows:

R113.5 Work commencing before permit issuance. In addition to penalties set forth in R113.4, any person or firm who, before obtaining the necessary permit(s), commences any construction of, or work on, a building, structure, electrical, gas, mechanical or plumbing system that is not otherwise exempted from obtaining a permit, shall be subject to a processing and penalty fee in addition to the standard prescribed permit fee. Such additional fee shall be equal to the permit fee, except that such fee shall not be less than fifty dollars (\$50) nor more than one thousand dollars (\$1,000) for the first such violation. A person or firm committing the same such violation repeatedly is subject to processing and penalty fees equal to double the amount of the permit fee or double the amount of the preceding violation, whichever is greater, for every same such subsequent violation committed thereafter within any 180-day period. The foregoing fees may be appealed to the City manager pursuant to Chapter 2, Article VI of the Code of the City.

CHAPTER 2 – DEFINITIONS

(12) Section R202, *DEFINITIONS*, is hereby amended in the following respects:

(a) The term, *APPROVED*, is hereby amended to read as follows:

APPROVED. Acceptable to the building official.

(b) The term, *BASEMENT*, is hereby amended to read as follows:

BASEMENT. That portion of a building located partly or completely below grade, wherein the underside of the floor system immediately above is 72 inches (1829 mm) or more above the surface of an approved permanent basement floor system.

(c) The term *BUILDING OFFICIAL*, is hereby amended to read as follows:

BUILDING OFFICIAL. The person designated by the City Manager and such person's authorized representative(s) charged with the administration and enforcement of this code.

(d) The term, *CITY* is hereby added in alphabetical sequence, to read as follows:

CITY. Is defined as set forth in the *Code of the City of Fort Collins*.

(e) The term, *CRAWLSPACE* is hereby added to read as follows:

CRAWLSPACE. That portion of a building that is conditioned or non-conditioned space located partly or completely below grade (excluding the under-floor space beneath below-grade structural floor systems), wherein the underside of the adjacent finished floor above is less than 72 inches (1829 mm) above the bottom surface of such crawlspace.

(f) The term, *DWELLING* is hereby amended to read as follows:

DWELLING. Is defined as set forth in the *Land Use Code*.

(g) The term, *DWELLING UNIT* is hereby amended to read as follows:

DWELLING UNIT. Is defined as set forth in the *Land Use Code*.

(h) The term, *EXTERIOR WALL*, is hereby revised to read as follows:

EXTERIOR WALL. An above grade wall that defines the exterior boundaries of a building, including walls between floor spandrels and peripheral edges of floors, roof and basement knee walls, dormer walls, gable end walls, walls enclosing a mansard roof, and basement walls with an average below grade wall area that is less than 50 percent of the total opaque and non-opaque area of that enclosing side.

- (i) The term, *FAMILY* is hereby added in alphabetical sequence, to read as follows:

FAMILY. Is defined as set forth in the *Land Use Code* .

- (j) The term, *FLOOR AREA* is hereby added in alphabetical sequence, to read as follows:

FLOOR AREA. The area included within the surrounding exterior walls of a building or portion thereof, exclusive of vent shafts and courts. The floor area of a building, or portion thereof, not provided with surrounding exterior walls shall be the usable area under the horizontal projection of the roof or floor above.

- (k) The term, *GRADE* is hereby amended to read as follows:

GRADE (ADJACENT GROUND ELEVATION). The lowest point of elevation of the finished surface of the ground, paving or sidewalk with the area between the building and the property line or, when the property line is more than 5 feet (1.524 m) from the building, between the building and a line 5 feet (1.524 m) from the building.

- (l) The term *HABITABLE SPACE*, is hereby amended to read as follows:

HABITABLE SPACE. A space in a building approved for living, sleeping, eating or cooking, bathing and personal hygiene. Closets, halls, crawlspaces, storage, laundry rooms, utility spaces and similar areas are not considered habitable spaces.

- (m) The term *ROOM, SLEEPING (BEDROOM)*, is hereby added in alphabetical sequence to read as follows:

ROOM, SLEEPING (BEDROOM). A habitable room within a dwelling unit designed primarily for the purpose of sleeping. Built-in features such as closets and similar storage facilities shall not be considered as relevant factors in determining whether or not a room is a sleeping room.

- (n) The term *SITE*, is hereby added in alphabetical sequence to read as follows:

SITE. A parcel of land bounded by a property line or a designated portion of a public right-of-way.

- (o) The term, *TOWNHOUSE*, is hereby amended to read as follows:

TOWNHOUSE: A single-family dwelling unit constructed in a group of ~~two~~ **three or more attached individual units, **each of which is separated from the other from the foundation to the roof and is located entirely on a separately recorded and platted parcel of land (site) bounded by property lines that is deeded exclusively for such single-family dwelling.****

- (p) The term *UNUSUALLY TIGHT CONSTRUCTION* is hereby amended to read as follows:

UNUSUALLY TIGHT CONSTRUCTION. Construction which results in a demonstrated interior air-infiltration rate of 0.40 air changes per hour (AHC) or less, or which meets the following standards:

- 1. Doors and openable windows meet the air-infiltration requirements Section N1111.9.2 of the FORT COLLINS RESIDENTIAL ENERGY CONSERVATION CODE.**
- 2. Caulking or sealant are applied to areas such as joints around window and door frames between sole plates and floors, between wall-ceiling joints, between wall panels, at penetrations for plumbing, electrical and gas lines, and at other openings.**

- (q) The new term, *WALL, RETAINING*, is hereby added to read as follows:

WALL, RETAINING. A wall not laterally supported at the top, that resists lateral soil load and other imposed loads.

CHAPTER 3 – BUILDING PLANNING

(13) Section 301.1.3, *Engineered Design*, is hereby amended to read as follows:

R301.1.3 Engineered design. When a building of otherwise conventional light-frame construction contains structural elements not conforming to this code, these elements shall be designed in accordance with accepted engineering practice. The extent of such design need only demonstrate compliance of nonconventional elements with other applicable provisions and shall be compatible with the performance of the conventional framed system. Engineered design, in accordance with the **general building code enacted by the City**, is permitted for all buildings, structures, and portions thereof included in the scope of this code.

(14) Table R301.2(1), Climatic and Geographic Design criteria, is hereby amended to read as follows:

GROUND SNOW LOAD	WIND SPEED ^b	SEISMIC DESIGN CATEGORY	SUBJECT TO DAMAGE FROM					WINTER DESIGN TEMP	AIR FREEZING INDEX ^f	MEAN ANNUAL TEMP. ^g	FLOOD ^e HAZARDS
			Weathering ^a	Roof Ice Damming ^c	Frost line depth	Termite	Decay ^d				
30psf (1436.4pa)	100mph (161 kph)	B	Severe	No	30 inches (762mm)	Slight to Moderate	None to Slight	+1° F (-17° C)	906	48.4	July 16, 1979

For SI: °C = [(°F)-32]/1.8.

- a. Weathering may require a higher strength concrete or grade of masonry than necessary to satisfy the structural requirements of this code. The weathering column is based on the weathering index (i.e., “severe”) for concrete as determined from the Weathering Probability Map [Figure R301.2 (3)]. The grade of masonry units shall be determined from ASTM C 34, C 55, C 62, C 73, C 90, C 129, C 145, C 216 or C 652.
- b. **Wind exposure category shall be determined on a site-specific basis in accordance with Section R301.2.1.4.**
- c. **Based on the average daily temperature in January greater than 25° F (-4° C) or where the history of local damage from the effects of ice damming is not substantial.**
- d. None to slight in accordance with Figure R301.2(7).
- e. **Date of the City’s entry into the National Flood Insurance Program (date of adoption of the first code or ordinance for management of flood hazard areas), or the date(s) of the currently effective FIRM and FBFM, or other flood hazard map adopted by the community.**
- f. 100-year return period air freezing index (BF-days) from Figure R403.3(2) or from the 100-year (99%) value on the National Climatic Data Center data table AAir Freezing Index- USA Method (Base 32° Fahrenheit) at www.ncdc.noaa.gov/fpsf.html.
- g. Mean annual temperature from the National Climatic Data Center data table “Air Freezing Index-USA Method (Base 32° Fahrenheit)” at www.ncdc.noaa.gov/fpsf.html.

A new *Section R301.2.1.5*, Basic Wind Speed, is hereby added, to read as follows:

R301.2.1.5 Basic Wind Speed. The Special Wind Region as indicated on Figure 301.2(4) of this Code shall apply using a Basic Wind Speed of 100 miles per hour (161 kph) based on the exposure category as described in Section 301.2.1.4, or the equivalent pressure thereto.

(15) *Section R302.1 Exterior walls*, is hereby amended to read as follows:

R302.1 Exterior walls. Exterior walls with a fire separation distance less than 3 feet (0.914 m) shall have not less than a one-hour fire-resistive rating with exposure from both sides. Projections shall not extend to a point closer than 2 feet (0.610 m) from the line used to determine the fire separation distance.

Exception: Detached garages accessory to a dwelling located within 2 feet (0.610 m) of a lot line may have roof eave projections not exceeding 4 inches (102 mm).

Projections extending into the fire separation distance shall have not less than one-hour fire-resistive construction on the underside. The above provisions shall not apply to walls which are perpendicular to the line used to determine the fire separation distance.

Exceptions:

1. Tool and storage sheds, playhouses and similar structures exempted from permits by Section R105.2 are not required to provide wall protection based on location on the lot. Projections beyond the exterior wall shall not extend over the lot line.
2. Separated buildings on the same property (site) may be considered as portions of one building provided that buildings or portions thereof which are classified as garages or carports, or buildings housing accessory uses that are not exempted from permits by the preceding exception, and which are located by a fire-separation distance of less than 36 inches (914 mm) from a dwelling, are separated from such dwelling as prescribed by Section R309.

(16) *Section R303.1, Habitable Rooms*, is hereby amended to read as follows:

R303.1 Habitable rooms. All habitable rooms shall be provided with aggregate glazing area of not less than 8 percent of the floor area of such rooms. Natural ventilation shall be through windows, doors, louvers or other approved openings to the outdoor air. Such openings shall be provided with ready access or shall otherwise be readily controllable by the building occupants. The minimum openable area to the outdoors shall be 4 percent of the floor area being ventilated.

Exceptions:

1. The glazed areas need not be openable where the opening is not required by Section R310 and an approved mechanical ventilation system is provided capable of producing 0.35 air change per hour in the room or a whole-house mechanical ventilation system is installed capable of supplying outdoor ventilation air of 15 cubic feet per minute (cfm) (7.08 L/s) per occupant computed on the basis of two occupants for the first bedroom and one occupant for each additional bedroom.
2. The glazed areas need not be provided in rooms where Exception 1 above is satisfied and artificial light is provided capable of producing an average illumination of 6 foot candles (6.46 lux) over the area of the room at a height of 30 inches (762 mm) above the floor level.
3. Sunroom additions, solariums, and open patio covers in which 40 percent or more of the exterior sunroom walls are open, or are enclosed only by insect screening, and the

ceiling height of the sunroom is not less than 7 feet (2.134 m), shall be permitted to be used for natural ventilation.

(17) *Section R303.2, Adjoining Rooms*, is hereby amended to read as follows:

R303.2 Adjoining rooms. For the purpose of determining light and ventilation requirements, any room shall be considered as a portion of an adjoining room when at least one-half of the area of the common wall is open and unobstructed and provides an opening of not less than one-tenth of the floor area of the interior room but not less than 25 square feet (2.32 m²).

Exceptions:

1. Light and ventilation for an interior room may be supplied from an adjoining exterior room, provided the following conditions are met:

a) The common wall is provided with permanent openings that permit the passage of light and free movement of air. Such openings when fully open shall provide an aggregate unobstructed area of not less than one-twentieth ($\frac{1}{20}$) of the floor area of the interior room.

b) The adjoining exterior room has exterior openings for light and ventilation as required in this section, plus additional such openings not less in area than the amount required for the interior room.

2. Openings required for light and/or ventilation shall be permitted to open into a thermally isolated sunroom addition or patio cover, provided that there is an openable area between the adjoining room and the sunroom addition or patio cover of not less than one-tenth of the floor area of the interior room but not less than 20 square feet (1.86 m²). The minimum openable area to the outdoors shall be based upon the total floor area being ventilated.

(18) A new section, *R303.7.2 Sunrooms, solariums, open patio covers*, is hereby added, to read as follows:

R303.7.2 Sunrooms, solariums, open patio covers. Required glazed openings shall be permitted to open into a sunroom addition, as defined in Section R202, a solarium, or an open patio cover that abut a street, yard or court, provided more than 40 percent of the exterior sunroom, solarium, or covered patio walls are open, or are enclosed only by insect screening, and the ceiling height of the sunroom is not less than 7 feet (2.134 m).

(19) *Section R303.8, Required Heating*, is hereby amended to read as follows:

R303.8 Required heating. Every dwelling unit shall be provided with **permanently installed** heating facilities capable of maintaining a minimum room temperature of 68°F (20°C) at a point 3 feet (0.914 m) above the floor and 2 feet (0.610 m) from exterior walls in all habitable rooms at the design temperature. The installation of one or more portable space heaters shall not be used to achieve compliance with this section.

(20) Section R304, *MINIMUM ROOM AREAS*, is hereby amended to read as follows:

SECTION R304 MINIMUM ROOM AREAS

R304.1 Minimum area. Every dwelling unit shall have at least one habitable room that shall have not less than 120 square feet (11.2 m²) of gross floor area.

R304.2 Other rooms. Other habitable rooms shall have a floor area of not less than 70 square feet (6.5 m²).

Exception: Toilet rooms, bathrooms, and kitchens.

R304.3 Minimum dimensions. Habitable rooms shall not be less than 7 feet (2.134 m) in any horizontal dimension.

Exception: Kitchens, toilet rooms and bathrooms.

R304.4 Height effect on room area. Portions of a room with a sloping ceiling measuring less than 5 feet (1.524 m) or a furred ceiling measuring less than 7 feet (2.134 m) from the finished floor to the finished ceiling shall not be considered as contributing to the minimum required habitable area for that room.

(21) The first paragraph of *Section R305.1 Minimum ceiling height.*, is hereby amended to read as follows:

R305.1 Minimum height. Habitable rooms, hallways, corridors, bathrooms, toilet rooms, laundry rooms and basements shall have a ceiling height of not less than 90 inches (2,286 mm). The required height shall be measured from the finish floor to the lowest projection from the ceiling.

(22) Section R309.2 *Separation Required*, is hereby amended to read as follows:

R309.2 Separation required. The garage shall be separated from the residence and its attic space above by not less than 1/2-inch (12.7 mm) gypsum board or 1/2-inch (12.7 mm) fire-retardant-treated wood applied to the garage side. Garages beneath habitable rooms shall be separated from all habitable rooms above by not less than 5/8-inch (15.9 mm) Type X gypsum board or equivalent. Where the separation is a floor-ceiling assembly, the structure supporting the separation shall also be protected by not less than (12.7 mm) gypsum board, 1/2-inch (12.7 mm) fire-retardant-treated wood or equivalent.

Garages located adjacent to a dwelling unit on the same property shall be protected with materials as prescribed in Section R309.2 applied to the interior side of exterior walls where such garage walls are less than 3 feet (0.914 m) from the adjacent dwelling unit. Openings in such walls shall be regulated by R309.1. This provision does not apply to garage walls that are perpendicular to an adjacent dwelling unit wall.

(23) Section R310 EMERGENCY ESCAPE AND RESCUE OPENINGS, is hereby amended to read as follows:

SECTION R310 EMERGENCY ESCAPE AND RESCUE OPENINGS

R310.1 Emergency escape and rescue required. Every basement and every sleeping room shall have at least one operable exterior window or door approved for emergency escape and rescue. Such opening shall open directly into a public street, public alley, yard or court. Where emergency escape and rescue openings are provided they shall have a sill height of not more than 44 inches (1118 mm) above the floor. Where a door opening having a threshold below the adjacent ground elevation serves as an emergency escape and rescue opening and is provided with a bulkhead enclosure, the bulkhead enclosure shall comply with Section 310.3. The net clear opening dimensions required by this section shall be obtained by the normal operation of the emergency escape and rescue opening from the inside. Emergency escape and rescue openings with a finished sill height below the adjacent ground elevation shall be provided with a window well in accordance with Section R310.2.

Exception: Basements used only to house mechanical equipment and not exceeding total floor area of 200 square feet (18.60 m²).

R310.1.1 Minimum opening area. All emergency escape and rescue openings shall have a minimum net clear opening of 5.7 square feet (0.530 m²).

Exception: Grade floor openings shall have a minimum net clear opening of 5 square feet (0.465 m²).

R310.1.2 Minimum opening height. The minimum net clear opening height shall be 24 inches (610 mm).

R310.1.3 Minimum opening width. The minimum net clear opening width shall be 20 inches (508 mm).

R310.1.4 Operational constraints. Emergency escape and rescue openings shall be operational from the inside of the room without the use of keys or tools or special knowledge.

R310.2 Window wells. The minimum horizontal area of the window well shall be 9 square feet (0.84 m²), with a minimum horizontal **unobstructed** projection and width of 36 inches (914 mm). The area of the window well shall allow the emergency escape and rescue **door or window** opening to be fully opened.

Exceptions:

1. The ladder or steps required by Section R310.2.1 shall be permitted to encroach a maximum of 6 inches (152 mm) into the required dimensions of the window well.
2. **With the window in the full open position, the bottom window well step may encroach a maximum of 12 inches (304 mm) into the minimum horizontal projection, provided the well meets the following criteria:**
 - 2.1 **The bottom of the well is not less than 36 inches wide (914 mm), centered horizontally on the operable portion of the emergency escape and rescue door or window, and**

2.2 An unobstructed clear horizontal projection of 36 inches (914 mm) is maintained at the centerline of the openable portion of the emergency escape and rescue door or window.

R310.2.1 Ladder and steps. Window wells with a vertical depth greater than 44 inches (1118 mm) shall be equipped with a permanently affixed ladder or steps usable with the window in the fully open position. Ladders or steps required by this section shall not be required to comply with Sections R311.5 and R311.6. Ladders or rungs shall have an inside width of at least 12 inches (305 mm), shall project at least 3 inches (76 mm) from the wall and shall be spaced vertically not more than 18 inches (457 mm) on-center for the full height of the window well.

R310.3 Bulkhead enclosures. Bulkhead enclosures shall provide direct access to the basement. The bulkhead enclosure with the door panels in the fully open position shall provide the minimum net clear opening required by Section R310.1.1. Bulkhead enclosures shall also comply with Section **R314.9**.

R310.4 Bars, grills, covers and screens. Bars, grills, covers, screens or similar devices are permitted to be placed over emergency escape and rescue openings, bulkhead enclosures, or window wells that serve such openings, provided the minimum net clear opening size complies with Sections R310.1.1 to R310.1.3, and such devices shall be releasable or removable from the inside without the use of a key, tool, special knowledge or force greater than that which is required for normal operation of the escape and rescue opening.

(24) *Section R311.2, Construction.*, is hereby amended to read as follows:

R311.2 Stair Construction.

R311.2.1 Attachment. **All exterior** exit balconies, stairs and similar exit facilities shall be positively anchored to the primary structure to resist both vertical and lateral forces. Such attachment shall not be accomplished by use of toenails or nails subject to withdrawal.

R311.2.2 Under stair protection. Enclosed accessible space under stairs shall have walls, under stair surface and any soffits protected on the enclosed side with 1/2-inch (12.7 mm) gypsum board.

(25) *Section R311.4, Doors*, is hereby amended to read as follows:

R311.4 Doors.

R311.4.1 Exit door required. Not less than one exit door conforming to this section shall be provided for each dwelling unit. The required exit door shall provide for direct access from the habitable portions of the dwelling to the exterior without requiring travel through a garage. Access to habitable levels not having an exit in accordance with this section shall be by a ramp in accordance with Section R311.6 or a stairway in accordance with Section R3311.5.

R311.4.2 Door type and size. The required exit door shall be a side-hinged door not less than 3 feet (0.914 m) in width and 6 feet 8 inches (2.032 m) in height. Other doors shall not be required to comply with these minimum-dimensions.

R311.4.3 Landings at doors. There shall be a floor or landing on each side of each exterior door. The landing shall be permitted to have a slope not to exceed 25 units vertically in 12 units horizontally (2 percent).

Exception. Where a stairway of **not more than two risers** is located on the exterior side of a door, other than the required exit door, a landing is not required for the exterior side of the door.

The floor or landing at the exit door required by Section R311.4.1 shall not be more than 1.5 inches (38 mm) lower than the top of the threshold. The floor or landing at exterior doors other than the exit door required by Section R311.4.1 shall not be required to comply with this requirement but shall have a rise no greater than that permitted in Section R311.5.3.

Exception: **In other than accessory buildings, the floor or** landing at an exterior doorway shall not be more than 7 inches (197 mm) below the top of the threshold, provided the door, other than an exterior storm or screen door does not swing over the landing.

The width of each landing shall not be less than the door served. Every landing shall have a minimum dimension of 36 inches (914 mm) measured in the direction of travel.

R311.4.4 Type of lock or latch. All egress doors shall be readily openable from the side from which egress is to be made without the use of a key or special knowledge or effort.

(26) *Section R311.5.3 Riser height*, is hereby amended to read as follows:

R311.5.3.1 Riser height. The riser height shall be **not less than 4 inches (102 mm) nor greater than 7³/₄ inches (197 mm)**. The riser shall be measured vertically between leading edges of the adjacent treads. The greatest riser height within any flight of stairs shall not exceed the smallest by more than 3/8 inch (9.5 mm).

(27) *Section R311.5.8.1 Spiral stairways*, is hereby amended to read as follows:

R311.5.8.1 Spiral stairways. Spiral stairways are permitted, provided the minimum width shall be 26 inches (660 mm) with each tread having a 7 1/2-inches (191 mm) minimum tread depth at 12 inches (305 mm) from the narrower edge. All treads shall be identical, and the rise shall be no more than 9 1/2 inches (241 mm). A minimum headroom of 6 feet 6 inches (1.981 m) shall be provided. **Such stairways may be used as a required means of the exit component where the area served is limited to 400 square feet (37.16 m²).**

(28) *Section R311.6.3.1, Handrail height*, is hereby amended to read as follows:

R311.6.3.1 Handrail height. Handrail height, measured **vertically** above the finished surface of the ramp slope, shall be not less than 34 inches (864 mm) and not more than 38 inches (965 mm).

(29) Section R312 GUARDS, is hereby amended to read as follows:

SECTION R312 GUARDS

R312.1 Guards required. Porches, balconies, ramps or raised floor surfaces located more than 30 inches (762 mm) above the floor or grade below shall have guards not less than 36 inches (914 mm) in height. Open sides of stairs with a total rise of more than 30 inches (762 mm) above the floor or grade below shall have guards not less than 34 inches (864 mm) in height measured vertically from the nosing of the treads. Porches and decks which are enclosed with insect screening shall be provided with guards where the walking surface is located more than 30 inches (762 mm) above the floor or grade below.

R312.1.1 Area well retaining walls. Where any area well wall, bulkhead enclosure wall or similar retaining wall or barrier is located less than 36 inches (914 mm) from the nearest intended walking surface, parking surface, or driveway and the surface elevation difference between the higher and lower side of the well wall, bulkhead enclosure wall, or retaining wall is greater than 36 inches, such wall shall be protected with guards conforming to this section or be provided with an equivalent barrier.

Exceptions:

- 1. The access side of stairways need not be barricaded.**
- 2. Area wells provided for emergency escape and rescue windows may be protected with approved grates or covers that comply with Section R310.4.**
- 3. Covers and grates may be used over stairways and other openings used exclusively for service access or for admitting light or ventilation.**
- 4. Area well walls, bulkhead enclosure walls, or retaining walls adjacent to a building that are located 24 inches (610 mm) or less measured perpendicular from the building.**
- 5. Locations where the slope of the embankment or the side of the enclosure or the opening adjacent to such walls does not exceed 2 horizontal to 1 vertical.**

R312.2 Guard opening limitations. Required guards on open sides of stairways, raised floor areas, balconies, porches, **area wells and other bulkhead enclosures protected as specified hereunder** shall have intermediate rails or ornamental closures that do not allow passage of a sphere 4 inches (102 mm) or more in diameter.

Exceptions:

- The triangular openings formed by the riser, tread and bottom rail of a guard at the open side of a stairway are permitted to be of such a size that a sphere 6 inches (152 mm) cannot pass through.
- Openings for required guards on the sides of stair treads shall not allow a sphere 4-3/8 inches (111 mm) to pass through.

(30) Section R313, *Smoke Alarms*. is hereby amended to read as follows:

SECTION R313 SMOKE ALARMS

R313.1 Smoke alarms. Smoke alarms shall be installed in the following locations:

1. In each sleeping room.
2. Outside each separate sleeping area in the immediate vicinity of the bedrooms.
3. On each additional story of the dwelling, including basements but not including crawl spaces and uninhabitable attics. In dwellings or dwelling units with split levels and without an intervening door between the adjacent levels, a smoke alarm installed on the upper level shall suffice for the adjacent lower level provided that the lower level is less than one full story below the upper level.
4. **In dwelling units where the ceiling height of a room open to the hallway serving the bedrooms exceeds that of the hallway by 24 inches (610 mm) or more, smoke alarms shall be installed in the hallway and in the adjacent room.**

When more than one smoke alarm is required to be installed within an individual dwelling unit the alarm devices shall be interconnected in such a manner that the actuation of one alarm will activate all of the alarms in the individual unit. The alarm shall be clearly audible in all bedrooms over background noise levels with all intervening doors closed. All smoke alarms shall be listed and installed in accordance with the provisions of this code and the household fire warning equipment provisions of NFPA 72.

R313.1.1 Alterations, repairs and additions. When interior alterations, repairs or additions requiring a permit occur, or when one or more sleeping rooms are added or created in existing dwellings, the individual dwelling unit shall be provided with smoke alarms located as required for new dwellings. All such smoke alarms shall be interconnected and permanently wired into the building electric system.

Exceptions:

1. Smoke alarms in existing areas shall not be required to be interconnected and permanently wired where the alterations or repairs do not result in the removal of interior wall or ceiling finishes exposing the structure, unless there is an attic, crawl space, or basement available which could provide access for permanent wiring and interconnection without the removal of interior finishes.
2. Repairs to the exterior surfaces of dwellings are exempt from the requirements of this section.

R313.2 Power source. In new construction, the required smoke alarms shall receive their primary power from the building wiring when such wiring is served from a commercial source, and when primary power is interrupted, shall receive power from a battery. Wiring shall be permanent and without a disconnecting switch other than those required for overcurrent protection. Smoke alarms shall be permitted to be battery operated when installed in buildings without commercial power or in buildings that undergo alterations, repairs or additions regulated by Section R313.1.1.

(31) New section, *R316.6, Glass and Mineral Wool Insulation*, is hereby added to read as follows:

R316.6 Glass and mineral fiber insulation. Glass and mineral fiber (wool) insulation installed on the conditioned side of basement foundation walls and in framed cavities or on interior surfaces less than 72 inches (1829 mm) above the floor below shall be protected from damage and releasing insulation fibers into the conditioned space by a permanent covering material securely fastened in place such that the insulation is maintained in substantial contact with the covering. The covering material shall be gypsum wallboard, wall paneling, wall sheathing, or similar durable materials conforming to Section R315, that provide equivalent physical protection as determined by the building official. See Section N1110.3.1.

(32) *Section R317.1, Two-family dwellings.*, through *Section R317.2, Townhouses*, inclusively, is hereby amended to read as follows:

R317.1 Two-family dwellings. Dwelling units in two-family dwellings shall be separated from each other by wall and/or floor assemblies having not less than 1-hour fire-resistance rating when tested in accordance with ASTM E 119. Fire-resistance-rated floor-ceiling and wall assemblies shall extend to and be tight against the exterior wall, and wall assemblies shall extend to the underside of the roof sheathing.

Exceptions:

- 1. In buildings equipped throughout with an automatic sprinkler system installed in accordance with NFPA 13R.**
- 2. Wall assemblies need not extend through attic spaces when the ceiling is protected by not less than 5/8-inch (15.9 mm) Type X gypsum board and an attic draft stop constructed as specified in section R502.12.1 is provided above and along the wall assembly separating the dwellings. The structural framing supporting the ceiling shall also be protected by not less than 1/2 -inch (12.7 mm) gypsum board or equivalent.**

R317.1.1 Supporting construction. When floor assemblies are required to be fire-resistance-rated by Section R317.1, the supporting construction of such assemblies shall have an equal or greater fire-resistive rating.

R317.2 Townhouses. Each townhouse shall be considered a separate building and shall be separated by fire-resistance-rated wall assemblies meeting the requirements of Section R302 for exterior walls.

R317.2.1 Continuity. The **adjoining walls along property lines in adjacent** townhouses shall be continuous from the foundation to the underside of the roof sheathing, deck or slab and shall extend the full length of the common wall including walls extending through and separating attached accessory structures.

R317.2.2 Parapets. Parapets constructed in accordance with Section R317.2.3 shall be provided for townhouses as an extension of **adjoining walls along property lines in adjacent townhouses** in accordance with the following:

1. Where roof surfaces adjacent to the wall or walls are at the same elevation, the parapet shall extend not less than 30 inches (762 mm) above the roof surfaces.

2. Where roof surfaces adjacent to the wall or walls are at different elevations and the higher roof is not more than 30 inches (762 mm) above the lower roof, the parapet shall extend not less than 30 inches (762 mm) above the lower roof surface.

The following alternative construction methods are permitted in lieu of a parapet provided openings in the roof are not located within 48 inches (1219 mm) of the 1-hour fire-resistance-rated, adjoining walls along property lines in adjacent townhouses.

1. **A parapet is not required when the roof decking or sheathing is of noncombustible materials or approved fire-retardant-treated wood for a distance of 48 inches (1219 mm) on each side of the wall or walls, or one layer of 5/8-inch (16 mm) Type X gypsum board is installed directly beneath the roof decking or sheathing, supported by a minimum of nominal 2-inch (51mm) ledgers attached to the sides of the roof framing members, for a minimum distance of 48 inches (1219 mm) on each side of the wall or walls.**
2. **A parapet is not required where roof surfaces adjacent to the wall or walls are at different elevations and the higher roof is more than 30 inches (762 mm) above the lower roof. The common wall construction from the lower roof to the underside of the higher roof deck shall not have less than a 1-hour fire-resistive rating. The wall shall be rated for exposure from both sides.**
3. **A parapet is not required when the roof is constructed entirely of noncombustible materials.**
4. **A parapet is not required when the dwelling unit has an area of not more than 1,000 square feet (93 m²) on any floor.**
5. **A parapet is not required where the roof-ceiling framing elements and supporting framing are constructed as follows:**
 - a) **Where the roof-ceiling framing is parallel to the adjoining walls along property lines in adjacent townhouses, the roof-ceiling framing and supporting framing are constructed as prescribed for a one-hour fire-resistance rating for a minimum distance of 48 inches (1219 mm) from either side of the adjoining walls and approved continuous draftstopping is installed vertically from the ceiling to the roof sheathing for a minimum distance of 48 inches (1219 mm) from both sides of the adjoining walls.**
 - b) **Where the roof-ceiling framing is not parallel to the adjoining walls along property lines in adjacent townhouses, the entire span of such roof-ceiling framing and supporting framing are constructed as prescribed for a one-hour fire-resistance rating.**

R317.2.3 Parapet construction. Parapets shall have the same fire-resistance rating as that required for the supporting wall or walls. On any side adjacent to a roof surface, the parapet shall have noncombustible faces for the uppermost 18 inches (457 mm), to include counter flashing and coping materials. Where the roof slopes toward a parapet at slopes greater than two units vertical in 12 units horizontal (16.7-percent slope), the parapet shall extend to the same height as any portion of the roof within a distance of 3 feet (0.914 m), but in no case shall the height be less than 30 inches (762 mm).

R317.2.4 Structural independence. Each individual townhouse shall be structurally independent.

Exceptions:

1. Foundations supporting exterior walls or common walls.
2. Structural roof and wall sheathing from each unit may fasten to the common wall framing.
3. Nonstructural wall coverings.
4. Flashing at termination of roof covering over common wall.

(34) *Section R318, MOISTURE VAPOR RETARDERS*, is hereby amended to read as follows:

SECTION R318 PROTECTION FROM MOISTURE

R318.1 Moisture control. The design of any building regulated by this code shall not create conditions hazardous to occupants or of accelerated deterioration due to the presence of excessive water vapor and condensation. Moisture control shall be provided in accordance with the applicable provisions of this code and as determined necessary by the building official where special conditions or construction methods are encountered, such as steam rooms and rooms containing spas or pools, or below grade sub-floor spaces, or other interior locations subject to excessive moisture.

R318.2 Moisture during construction. Under-floor spaces and building construction materials shall be protected from moisture during construction as follows:

1. Under-floor spaces shall be protected from moisture during construction and no water, snow, ice or other evidence of moisture in substantial amounts shall be present in any under-floor space upon approval for occupancy of the building.
2. Construction materials shall be protected from damaging moisture in accordance with the manufacturer's specifications.

(35) *Section R320.1, Subterranean termite control.*, is hereby amended to read as follows:

R320.1 Subterranean termite control. In locations subject to termite damage as established by Table R301.2(1), methods of protection shall be by chemical soil treatment, pressure- preservative treated wood in accordance with the AWPA standards listed in Section R319.1, naturally termite-resistant wood or physical barriers (such as metal or plastic termite shields), or any combination of these methods.

(36) *Section R322.1, Scope*, is hereby amended to read as follows:

R322.1 Scope. Where four or more dwelling units are constructed as a single structure and where dwelling units that are separated from adjacent dwelling units by a physical space of less than three feet (0.914 m) are constructed as part of a planned development containing a total of seven or more dwelling units, regardless of whether such units are separated by fire-resistance-rated assemblies, the applicable provisions of the general building code enacted by the City, Colorado Revised Statutes, and Federal regulations shall apply with respect to the construction of accessible dwelling units.

(37) *Section R323, FLOOD RESISTANT CONSTRUCTION*, is revised in the following respects:

(a) *Subsection R323.1, General*, is hereby revised to read as follows:

R323.1 General. In addition to complying with the provisions of this section, buildings and structures constructed in flood hazard areas shall be designed and constructed in accordance with the provisions of the Code of the City, Chapter 10, Flood Prevention and Protection.

(b) New *Subsection R323.1.3.1, Determination of cumulative impacts*, is hereby added, reading as follows:

R323.1.3.1 Determination of cumulative impacts. In riverine flood hazard areas where design flood elevations are specified but floodways have not been designated, the applicant shall demonstrate that the cumulative effect of the proposed buildings and structures on design flood elevations, including fill, when combined with all other existing and anticipated development, will not increase the design flood elevation more than one foot at any point within the City.

(c) *Subsection R323.1.7, Flood-resistant materials*, is hereby revised to read as follows:

R323.1.7 Flood Resistant Materials. Building materials used below the design flood elevation shall comply with the following:

1. All wood, including floor sheathing, shall be pressure-preservatively treated in accordance with AWWA **U1 for the species, product, preservative and end use or the decay-resistant heartwood of redwood, black locust, or cedars. Preservatives shall conform to AWWA P1/13, P2, P3 or P5.**
2. Materials and installation methods used for flooring and interior and exterior walls and wall coverings shall conform to the provisions of FEMA/FIA-TB-2.

(d) *Subsection R323.2.2, Enclosed areas below design flood elevation*, through *subparagraph 2.4*, is hereby revised as to read indicated below, with *subparagraphs 2.5 and 2.6* unchanged:

R323.2.2 Enclosed area below design flood elevation. Enclosed areas, including crawl spaces, that are below the design flood elevation shall:

1. Be used solely for parking of vehicles, building access or storage.
2. Be provided with flood openings which shall meet the following criteria:
 - 2.1. There shall be a minimum of two openings on different sides of each enclosed area.
When a building has more than one enclosed area below the design flood elevation, each area shall have openings on exterior walls.
 - 2.2. The total net area of all openings shall be at least 1 square inch (645 mm²) for each square foot (0.093 m²) of enclosed area, **or the openings shall be designed and the construction documents shall include a statement that the design and installation will provide for equalization of hydrostatic flood forces on exterior walls by allowing for the automatic entry and exit of floodwaters.**
 - 2.3. The bottom of each opening shall be 1 foot (305 mm) or less above the adjacent ground level.
 - 2.4. **The minimum dimension of such openings shall be 3 inches (76 mm).**

Subparagraphs 2.5 and 2.6, to remain unchanged.

CHAPTER 4 – FOUNDATIONS

(38) *Section R401.1, Application.*, is hereby amended to read as follows:

R401.1 General. The provisions of this chapter shall control the design and construction of the foundation and foundation spaces for all buildings. **In addition to the provisions of this chapter, the design and construction of foundations in areas prone to flooding as established by Table R301.2(1) shall meet the provisions of Section R323. All foundations shall be designed by a qualified professional licensed in the State of Colorado. Such designs shall be performed in accordance with accepted and approved engineering practices including considerations for soil load-bearing capacities, surface and subsurface water conditions, adequate foundation and floor drainage, adequate ventilation of enclosed interior foundation spaces, and foundation waterproofing and dampproofing.**

Exception: Foundations for accessory buildings and minor additions unlikely to be located on expansive, compressible, or shifting soils, soils of unknown characteristics, or for other valid reasons as determined by the building official, need not be designed by a licensed professional.

Wood foundations shall be designed and installed in accordance with AF&PA Report No. 7.

Exception:

The provisions of this chapter shall be permitted to be used for wood foundations only in the following situations:

- 1. In buildings that have no more than two floors and a roof.**
- 2. When interior basement and foundation walls are provided at intervals not exceeding 50 feet (15.24 m).**

(39) *Section R401.5, Compressible or shifting soil,* is renumbered and revised to read as follows:

R401.4.2 Compressible or shifting soil. **In lieu of a complete geotechnical evaluation,** when top or subsoils are compressible or shifting, such soils shall be removed to a depth and width sufficient to assure stable moisture content in each active zone and shall not be used as fill or stabilized within each active zone by chemical, dewatering, or pre-saturation.

(40) A new *Section, R401.6 Placement of backfill.*, is hereby added to read as follows:

R401.6 Backfill and placement. **The excavation outside the foundation, including utility trenches and excavation ramp, shall be backfilled with soil that is substantially free of organic material, construction debris and cobbles, boulders, and solid soil masses larger than 6 inches (152 mm) diameter; or of frozen soil. The backfill shall be placed in lifts and compacted as set forth in the engineering documents. The backfill shall be placed in a manner that does not damage the foundation or the waterproofing or dampproofing material. Excavation ramps shall be backfilled in such a manner that the ramp does not become a conduit for surface water to flow toward the foundation. Where excavations include more than one house, a specially engineered drainage system may be required by the building official.**

(41) Section R402.1.2 Wood treatment, is revised to read as follows:

R402.1.2 Wood Treatment. All lumber and plywood shall be pressure preservatively-treated and dried after treatment in accordance with AWWA **U1 (Commodity Specification A, Use Category 4B and section 5.2)**, and shall bear the label of an accredited agency. Where lumber and/or plywood is cut or drilled after treatment, the treated surface shall be field treated with copper naphthenate, the concentration of which shall contain a minimum of 2 percent copper metal, by repeated brushing, dipping or soaking until the wood absorbs no more preservative.

(42) Section R403.1.4, Minimum depth., is hereby amended to read as follows:

R403.1.4 Minimum depth. **All exterior footings shall be placed a minimum depth of 30 inches (762 mm) below the undisturbed ground or shall be placed a minimum depth of 12 inches (305 mm) below the undisturbed ground and be protected from frost by one or more of the following methods:**

- 1. Constructed in accordance with Section R403.3 for frost-protected shallow foundations;**
- 2. Constructed in accordance with ASCE 32-01; or**
- 3. Erected on solid rock.**

Exceptions:

- 1. Freestanding accessory structures with an area of 400 square feet (37 m²) or less and an eave height of 10 feet (3.048 m) or less shall not be required to be protected.**
- 2. Decks not supported by a dwelling need not be provided with footings that extend below the frost line. Footings shall not bear on frozen soil unless such frozen condition is of a permanent character.**

(43) Section R403.1.6 Foundation anchorage., is hereby amended by adding exceptions “2.” and “3.” in numerical sequence, reading as follows:

2. Walls 24 inches (610 mm) total length or shorter connecting offset braced wall panels shall be anchored to the foundation with a minimum of one anchor bolt located in the center third of the plate section and shall be attached to adjacent braced wall panels per Figure R602.10.5 at corners.

3. Walls 12 inches (305 mm) total length or shorter connecting offset braced wall panels shall be permitted to be connected to the foundation without anchor bolts. The wall shall be attached to adjacent braced wall panels per Figure R602.10.5 at corners.

(44) Section R404.1.5.1, Pier and curtain wall foundations., is hereby amended to read as follows:

R404.1.5.1 Pier and curtain wall foundations. Pier and curtain wall foundations shall be permitted to be used to support light-frame construction not more than two stories in height, provided the following requirements are met:

- All load-bearing walls shall be placed on continuous concrete footings placed integrally with the exterior wall footings.
- The minimum actual thickness of a load-bearing masonry wall shall be not less than 4 inches (102 mm) nominal or 3 3/8 inches (86 mm) actual thickness, and shall be bonded integrally with piers spaced in accordance with R606.8.

3. Piers shall be constructed in accordance with Section R606.5 and Section R606.5.1, and shall be bonded into the load-bearing masonry wall in accordance with Section R608.1.1 or Section R608.1.1.2.
4. The maximum height of a 4-inch (102 mm) load-bearing masonry foundation wall supporting wood framed walls and floors shall not be more than 4 feet (1.219 m) in height.
5. Anchorage shall be in accordance with Section R403.1.6 or as specified by engineered design accepted by the building official.
6. The unbalanced fill for 4-inch (102 mm) foundation walls shall not exceed 24 inches (610 mm) for solid masonry or 12 inches (305 mm) for hollow masonry.

(45) New section, *R404.5, Retaining walls.*, is hereby added in numerical sequence to read as follows:

R404.5 Retaining walls. Retaining walls that are not laterally supported at the top and that retain in excess of 24 inches (610mm) of unbalanced fill shall be designed to ensure stability against overturning, sliding, excessive foundation pressure and water uplift. Retaining walls shall be designed for a safety factor of 1.5 against lateral sliding and overturning.

(46) *Section R405.1, Concrete or masonry foundations.* is hereby amended to read as follows:

R405.1 Concrete or masonry foundations. Drains consisting of piping conforming with ASTM Designation D2729-89 shall be provided adjacent to the lowest concrete or masonry foundations that retain earth and enclose spaces that are partially or entirely located below grade. Unless perimeter drains are designed to daylight, they shall terminate in sump pits with an electrical power source permanently installed within 36 inches (914 mm) of the sump opening. Piping for sump pumps shall discharge at least 60 inches (1524 mm) away from foundations or as otherwise approved by the building official. Drains shall be installed in bedding materials that are of such size and installed in such manner to allow ground water to seep into the perimeter drain. Filter fabric or other measures to restrict the passage of fines shall be used to further protect the perimeter drain from blockage.

Exception: A drainage system is not required when the foundation is installed on well-drained ground or sand gravel mixture soils according to the Unified Soil Classification System, Group I Soils, as detailed in Table R405.1.

R405.1.1 Landscape irrigation. Landscape irrigation systems shall be installed such that the ground surface within 60 inches (1524 mm) , measured perpendicular from the foundation, is not irrigated.

(47) *Section R406.1, Concrete and masonry foundation dampproofing.*, is hereby amended to read as follows:

R406.1 Concrete and masonry foundation dampproofing. Except where required to be waterproofed by Section R406.1, foundation walls that retain earth and enclose interior spaces and floors located partially or entirely below grade shall be dampproofed from the top of the footing to the finished grade. Masonry walls shall have not less than 3/8 inch (9.5 mm) portland cement parging applied to the exterior of the wall. The parging shall be dampproofed in accordance with one of the following:

(a) Bituminous coating.

- (b) **3 pounds per square yard (1.63 kg/m²) of acrylic modified cement.**
- (c) **1/8-inch (3.2 mm) coat of surface-bonding cement complying with ASTM C 887.**
- (d) **Any material permitted for waterproofing in Section R406.2.**
- (e) **Other approved methods or materials.**

Concrete walls shall be dampproofed by applying any one of the above listed dampproofing materials or any one of the waterproofing materials listed in Section R406.2 to the exterior of the wall.

Exception: Parging of unit masonry walls is not required where a material is approved for direct application to the masonry.

(48) *Section R406.2, Concrete and masonry foundation waterproofing.*, is hereby amended to read as follows

R406.2 Concrete and masonry foundation waterproofing. In areas where a high water table or other severe soil-water conditions are known to exist, exterior foundation walls that retain earth and enclose interior spaces or floors located partially or entirely below grade shall be waterproofed extending from the top of the footing to the finished grade. Such walls shall be waterproofed with one of the following:

- (a) **Two-ply hot-mopped felts.**
- (b) **55 pound (25 kg) roll roofing.**
- (c) **6-mil (0.15 mm) polyvinyl chloride.**
- (d) **6-mil (0.15 mm) polyethylene.**
- (e) **40-mil (1 mm) polymer-modified asphalt.**
- (f) **60-mil (1.5 mm) flexible polymer cement.**
- (g) **1/8 inch cement-based, fiber-reinforced, waterproof coating.**

All joints in membrane waterproofing shall be lapped and sealed with an adhesive compatible with the membrane used.

(49) *Section R408, UNDER-FLOOR SPACE.* is hereby amended to read as follows:

SECTION R408 UNDER-FLOOR SPACE

R408.1 General. The under-floor space between the bottom of the structural floor sheathing and the earth under any portion of a building with living or conditioned space above shall be provided with ventilation **using the methods and materials as prescribed hereunder.**

R408.1.1 Spaces under above-grade floors. Spaces directly under floors that are located entirely above grade shall be ventilated by one of the methods as set forth hereunder. Exposed ground surface in such spaces shall be covered with an approved vapor and soil-gas retarder material. All joints in the retarder shall be overlapped by 6 inches (153 mm) and sealed or taped, with the retarder edges extending a minimum of 6 inches (153 mm) up the foundation wall and attached and sealed thereto in an approved manner.

R408.1.1.1 Non-conditioned under-floor spaces. Where thermally-isolated above-grade floor systems are insulated and sealed to reduce heat loss and air infiltration from non-conditioned spaces below, as prescribed by N1111.7.4, exterior ventilation openings may be used provided that such under-floor spaces do not contain HVAC appliances and the ventilation can be provided directly through openings in an exterior wall. The minimum total net free area of exterior ventilation openings shall not be less than 1/1,500 of the floor area of the under-floor space. Openings shall be placed so as to provide cross-ventilation of the space and shall be covered for their height and width with any of the following materials provided that the least dimension of the covering shall not exceed 1/4 inch (6.4 mm):

- 1. Perforated sheet metal plates not less than 0.070 inch (1.8 mm) thick.**
- 2. Expanded sheet metal plates not less than 0.047 inch (1.2 mm) thick.**
- 3. Cast iron grills or grating.**
- 4. Extruded load-bearing brick vents.**
- 5. Hardware cloth of 0.035 inch (0.89 mm) wire or heavier.**
- 6. Corrosion-resistant wire mesh, with the least dimension being 1/8 inch (3.2 mm).**

R408.1.1.2. Conditioned under-floor spaces. Where the perimeter walls enclosing conditioned under-floor spaces are thermally insulated and sealed to reduce air infiltration as prescribed by Table N1111.1, ventilation of the under-floor space shall be accomplished by approved methods including a continuously operated mechanical ventilation at the rate of 1.0 cfm (1.02 L/s) for each 50 square feet (4.65 m²) of under floor space floor area, or by conditioned air supplied from the building HVAC system either indirectly through air-transfer openings or directly through supply-air ducts.

R408.1.2 Spaces under below-grade floors. Spaces under floors which are located partially or entirely below the adjacent exterior ground level and under-floor spaces located such that ventilation cannot be provided directly through exterior wall openings shall comply with the following conditions:

The ground surface of the under floor space shall be covered with a vapor retarder material. The vapor retarder membrane shall be equivalent to minimum 10-mil (0.25 mm) non-reinforced or 6-mil (0.15 mm) cross-linked or reinforced polyethylene membrane when tested in accordance with ASTM E154-99. The sheet shall be continuously sealed in an approved manner to the foundation walls, to the interior caissons or footing pads, plumbing lines and at all laps of multiple sheets. See Figure 408.2.2(2).

Such spaces shall be provided with ventilation and space conditioning by a continuously operated electrically-powered system that provides ventilation at a rate of 7.5 cfm (3.5 L/s) per person plus 0.01 cfm per square foot (0.11 L/s/m²) of total conditioned floor area in the home, computed on the basis of two occupants for the first bedroom and one occupant for each additional bedroom.

The vent pipe served by the ventilation fan shall be constructed in accordance with Section AF103.4.3 for radon-resistant construction methods except that the intake inlet for such vent riser pipe may be located above the gas-retarder membrane in accordance with R408.7.3 and be at least 60 inches (1525 mm) from the nearest transfer floor opening. The intake inlet shall be covered with corrosion-resistant wire mesh having openings with the least dimension being 1/8 inch (3.2 mm).

Fuel-burning environmental or service-water heating equipment installed in the conditioned space on the floor directly above such spaces shall be power-vented or direct-vent appliances.

Exception: Open-combustion, naturally-vented appliances may be installed in such locations that are tested and verified to be compliance with M1501.2 and in accordance with the protocols established by the building official.

A minimum of one transfer floor opening shall be provided above the ventilated space for every 250 square feet (23.25 m²) of under-floor space or portion thereof. The openings shall be sized by dividing the fan ventilation rate by the total number of openings and determining the opening size based on Table R408.2.2. See Figure R408.2.2(1) for transfer floor detail.

Exceptions:

1. Engineered systems that maintain the relative humidity so that all surfaces in such under floor spaces have a surface humidity level no greater than 70%.

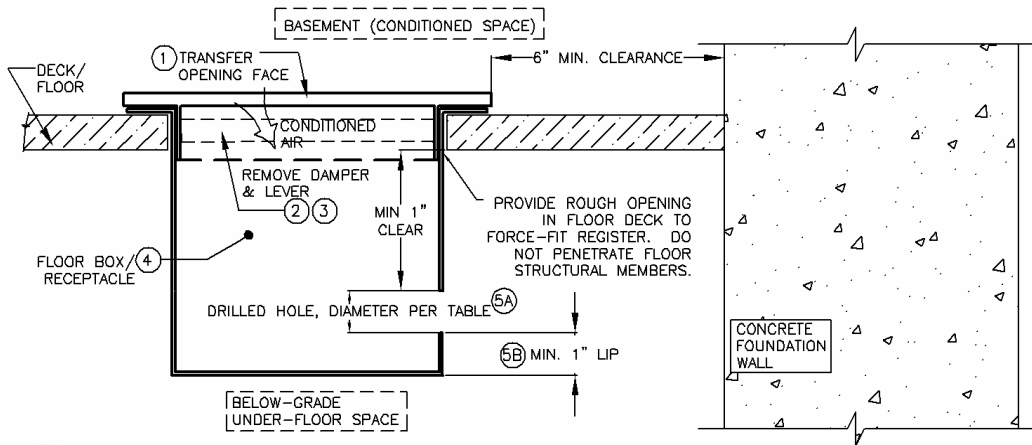
2. Engineered non-cellulose and other approved inorganic floor systems designed to be a sealed system shall not require ventilation when corrosion of the system components has been considered and mitigated, assuming that the minimum required structural integrity of such components is to be maintained for the life of the building.

R408.2 Mechanical ventilation. Where such spaces are ventilated by a dedicated, continuously operated electrically-powered ventilation system, the fans in such system shall be of the type specified in Section AF103.11 for radon-resistant construction methods. Sufficient make-up air shall be provided from the conditioned spaces in the building by outside-air inlets in the HVAC return-air system, heat recovery ventilators or by approved methods considering the impact of negative pressures created by exhaust fans, clothes dryers and similar appliances.

Table R408.2.2

Exhaust Rate/Transfer Opening (cfm)	Opening Size, net free area
0-10	1.5 to 2.4 sq. in. (1-3/8 to 1-3/4 dia. hole)
11-15	2.4 to 3.6 sq. in. (1-3/4 to 2-1/8 dia. hole)
16-20	3.6 to 4.4 sq. in. (2-1/8 to 2-3/8 dia. hole)

Figure R408.2.2 (1) Floor Transfer Detail



NOTES:

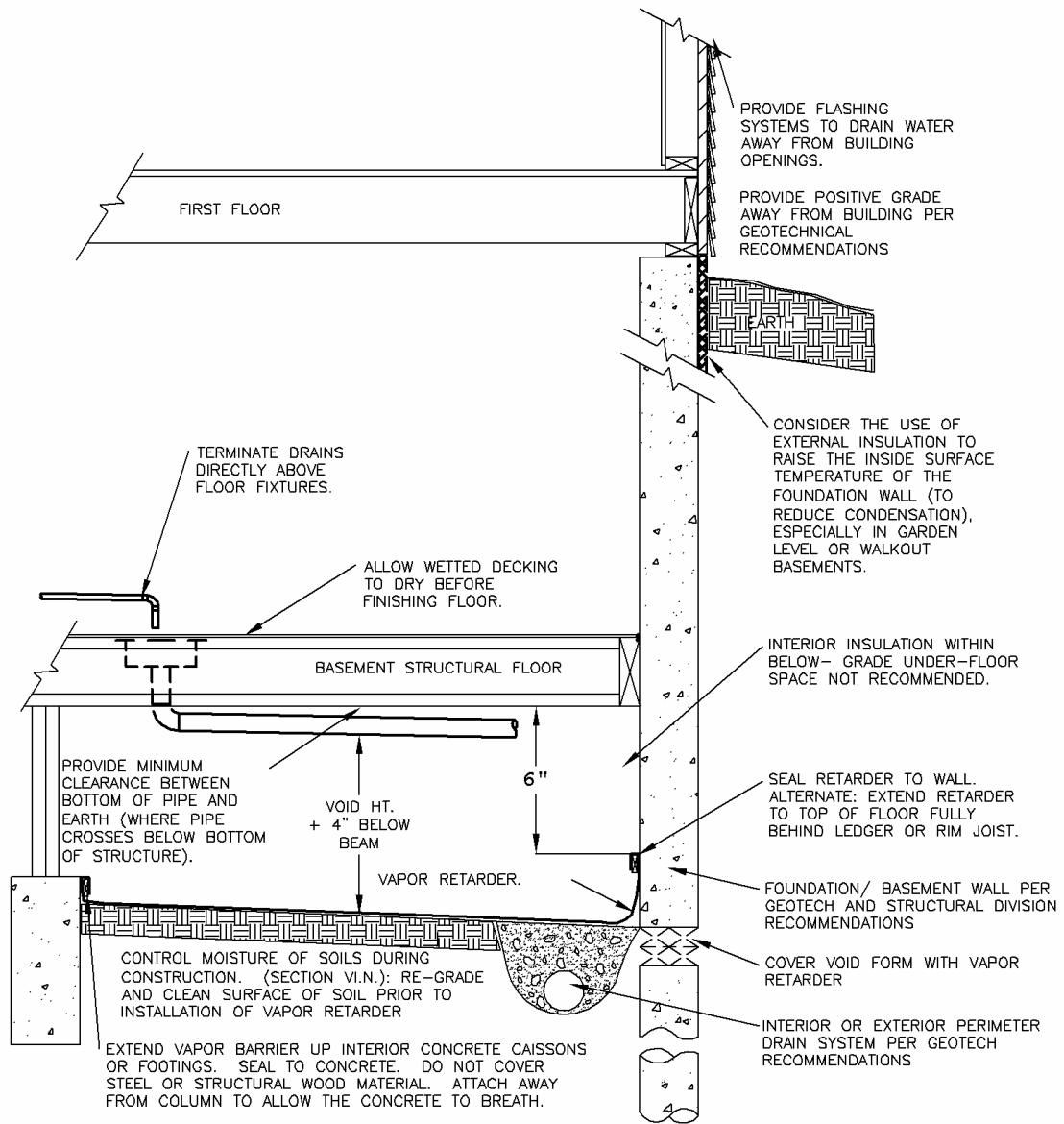
- ① FLOOR AIR TRANSFER ASSEMBLY: STANDARD FLOOR REGISTER OR GRILLE. MODIFY AS FOLLOWS:
- ② DAMPER LEVER: REMOVE DAMPER ACTUATION LEVER (IF PRESENT).
- ③ DAMPER: REMOVE DAMPER IF PRESENT.
- ④ PROVIDE SHEET METAL "BOX", SAME SIZE AS GRILLE OR REGISTER FLANGE.
- ⑤ PROVIDE CUT OR DRILLED SHARP EDGE HOLE IN SIDE OF BOX CLOSEST TO FOUNDATION WALL AS FOLLOWS:
 - ⑤A NET OPENING THROUGH TRANSFER: IN ACCORDANCE WITH TABLE IV.J.
 - ⑤B "BOX" SHALL PROVIDE CODE INTENT FOR NON-COMBUSTIBLE RECEPTACLE IN ACCORDANCE WITH UMC 607 & IRC M1601.4.3. RECEPTACLE SHALL HAVE MINIMUM 1" VERTICAL LIP.

ALL TRANSFER OPENINGS SHALL BE THE SAME CROSS-SECTIONAL AREA +/- 10%.

DETAIL SHOWN IS SUGGESTED MEANS OF ACHIEVING SPECIFIED NET TRANSFER OPENING AREA AND RECEPTACLE. ALTERNATE MEANS OF ACHIEVING THESE GOALS MAY BE USED AT DESIGNER'S OPTION.

EXHAUST RATE PER TRANSFER OPENING	NET FREE AREA/HOLE DIAMETER
0-9 CFM	NOT APPLICABLE - TRANSFER AT LEAST 10 CFM THROUGH EACH OPENING
10-15 CFM	1.7 TO 2.6 SQ. IN. FREE AREA / (1-5/8" Ø drilled hole)
16-20 CFM	2.6 TO 3.7 SQ. IN. FREE AREA / (2" Ø drilled hole)
21-25 CFM	3.7 TO 4.7 SQ. IN. FREE AREA / (2-1/4" Ø drilled hole)
26-30 CFM	4.7 TO 5.8 SQ. IN. FREE AREA / (2-1/2" Ø drilled hole)

Figure R408.2.2(2)



(50) Section R408.3, Access., is hereby amended to read as follows:

R408.3 Access. Access shall be provided to all under-floor spaces. Access openings through the floor shall be a minimum of 18 inches by 24 inches (457 mm by 610 mm). Openings through a perimeter wall shall be 16 inches by 24 inches (407 mm by 610 mm). When any portion of the through-wall access is below grade, an areaway of not less than 16 inches by 24 inches (407 mm by 610 mm) shall be provided. The bottom of the areaway shall be below the threshold of the access opening. Through-wall access openings shall not be located under a door to the building. See Section M1305.1.4 for access requirements where mechanical equipment is located under floors.

Exception: Engineered non-cellulose and other approved inorganic floor systems designed to be a sealed system shall not require ventilation when corrosion of the system components has been considered and adequately mitigated, assuming that the minimum required structural integrity of such components is to be maintained for the life of the building.

(51) A new section, R 408.7 Under-floor clearances., is hereby added, to read as follows:

R408.7 Under-floor clearances. In areas where expansive or collapsible soils are known to exist, under floor clearances shall be provided in accordance with Sections R408.7.1 through R408.7.3 unless specified otherwise by the soils report.

R408.7.1 Steel Framed Floors. A minimum clearance equal to the height of the void form plus four inches (102 mm) below the foundation shall be provided below steel beams and floor joists.

R408.7.2 Wood Framed Floors. A minimum clearance equal to the height of the void form plus four inches (102 mm) below the foundation shall be provided in addition to the requirements set forth in Section R323, item 1.

R408.7.3 Pipes, Conduits, and Ducts. A minimum clearance equal to the height of the void form plus four inches (102 mm) shall be provided below pipes, conduits and ducts installed in under-floor spaces, including those located below the foundation wall.

Exception: Where the building drain and water service pass under or through the foundation the clearance shall be as set forth in the engineering documents.

CHAPTER 5 – FLOORS

(52) New subsection, *R506.2.4, Reinforcement.*, is hereby added, reading as follows:

R506.2.4 Reinforcement. Slabs on ground must be reinforced with a minimum of welded wire mesh set on approved supports located in the center to upper one third of the slab, or equivalent reinforcement prior to inspection set forth in Section R109.1.

CHAPTER 6 – WALL CONSTRUCTION

(53) *Section R602.6, Drilling and notching studs.*, is hereby amended to read as follows:

R602.6 Drilling and notching – studs. Drilling and notching of studs shall be in accordance with the following:

1. Notching. Any stud in an exterior wall or bearing partition may be cut or notched to a depth not exceeding 25 percent of its width. Studs in nonbearing partitions may be notched to a depth not to exceed 40 percent of a single stud width.

2. Drilling. Any stud may be bored or drilled, provided that the diameter of the resulting hole is no greater than 60 percent of the stud width, the edge of the hole is no greater than 5/8 inch to the edge of the stud, and the hole is not located in the same section as a cut or notch. Studs located in exterior walls or bearing partitions drilled over 40 percent and up to 60 percent shall also be doubled with no more than two successive studs bored. See Figures R602.6(1) and R602.6(2).

Exception: Approved stud shoes may be used when installed in accordance with the manufacturer's recommendation

(54) *Section R613.1, General.*, is hereby revised to read as follows:

R613.1 General. This section prescribes performance and construction requirements for exterior window systems installed in wall systems. Windows shall be installed and flashed in accordance with the manufacturer's written installation instructions. Each window shall be provided with written installation instructions provided by the manufacturer detailing proper installation and flashing of their product.

(55) New *Section R613.2.1, Window sill placement.* is hereby added, reading as follows:

R613.2.1 Window location and sill height. In dwelling units, where the rough opening for the sill portion of an operable window is located more than 72 inches above the ground or other surface below, the rough opening for the sill portion of the window shall be a minimum of 24 inches above the finished floor of the room in which the window is located.

Exception: Windows whose openings will not allow a 4 inch diameter sphere to pass through the opening when the opening is in its largest opened position.

CHAPTER 7 – WALL COVERING

(56) New Section R702.3.7, *Horizontal gypsum board diaphragm ceilings.*, is added, reading as follows:

R702.3.7 Horizontal Gypsum Board Diaphragm Ceilings. Gypsum board shall be permitted to be used on wood joists to create a horizontal diaphragm in accordance with Table R702.3.7. Gypsum board shall be installed perpendicular to ceiling framing members. End joints of adjacent courses of board shall not occur on the same joist. The maximum allowable diaphragm proportions shall be 1 ½:1 between shear resisting elements. Rotation or cantilever conditions shall not be permitted. Gypsum board shall not be used in diaphragm ceilings to resist lateral forces imposed by masonry or concrete construction. All perimeter edges shall be blocked using wood members not less than 2-inch (51 mm) by 6-inch (159 mm) nominal dimension. Blocking material shall be installed flat over the top plate of the wall to provide a nailing surface not less than 2 inches (51 mm) in width for the attachment of the gypsum board.

(57) New Section, R702.4.4, *Cement, fiber-cement, composite backers.*, is hereby added, reading as follows:

R702.4.4 Cement, fiber-cement, and composite backers. Cement, fiber-cement, or composite backers in compliance with ASTM C 1288, C 1325 and installed in accordance with manufacturer recommendations shall be used as backers for wall tile in tub and shower areas and wall panels in shower areas.

(58) Section R703.1, *General.*, is hereby amended to read as follows:

R703.1 General. Exterior walls shall provide the building with a weather-resistant exterior wall envelope. The exterior wall envelope shall be designed and constructed in such a manner as to prevent the accumulation of water within the wall assembly by providing a water-resistant barrier behind the exterior veneer as required by Section R703.2 and a means of draining water that enters the assembly to the exterior of the veneer. Protection against condensation in the exterior wall assembly shall be provided in accordance with the International Energy Conservation Code.

Exceptions:

1. A weather-resistant exterior wall envelope shall not be required over concrete or masonry walls designed in accordance with Chapter 6 and flashed according to Section R703.7 or R703.8.

2. Compliance with the requirements for a means of drainage, and the requirements of Section 703.2 and Section 703.8, shall not be required for an exterior wall envelope that has been demonstrated to resist wind-driven rain through testing of the exterior wall envelope, including joints, penetrations and intersections with dissimilar materials, in accordance with ASTM E331 under the following conditions:

2.1 Exterior wall envelope test assemblies shall include at least one opening, one control joint, one wall/eave interface and one wall sill. All tested openings and penetrations shall be representative of the intended end use configuration.

2.2 Exterior wall envelope test assemblies shall be at least 4 feet by 8 feet in size.

2.3 Exterior wall assemblies shall be tested at a minimum differential pressure of 6.24 pounds per square foot.

2.4 Exterior wall envelope assemblies shall be subjected to a minimum test exposure duration of 2 hours.

The exterior wall envelope design shall be considered to resist wind-driven rain where the results of testing indicate that water did not penetrate control joints in the exterior wall envelope, joints at the perimeter of openings penetration, or intersections of terminations with dissimilar materials.

(59) Section R703.2, *Weather-resistant membrane.*, is hereby amended to read as follows:

R703.2 Weather-resistant membrane. One layer of No. 15 asphalt-saturated felt free from holes and breaks, complying with ASTM D 226 for Type 1 felt, or other approved weather-resistant material shall be applied over studs or sheathing of all exterior walls. Such felt or material shall be applied horizontally, with the upper layer lapped over the lower layer not less than 2 inches (51 mm). Where joints occur, felt shall be lapped not less than 6 inches (152 mm). All such materials shall be continuous to the top of walls and terminated at penetrations and building appendages in such a manner that meets the requirements of the exterior wall envelope as described in Section R703.1.

Exception: Such felt or material is permitted to be omitted in the following situations:

1. In detached accessory buildings.
2. Under exterior wall finish materials as permitted in Table R703.4.
3. Under paperbacked stucco lath **when the paper backing is an approved weather-resistant membrane.**

CHAPTER 8 ROOF – CEILING CONSTRUCTION

(60) *Section R801.3, Roof drainage.* Is hereby amended to read as follows:

R801.3 Roof drainage. All dwellings shall have a controlled method of water disposal from roofs that will collect and discharge all roof drainage to the ground surface at least 5 feet (1.524 m) from foundation walls or to an approved drainage system. **Devices shall not be installed that restrain in any way or that otherwise interfere with downspout extensions being fully extended. Landscape edging shall not interfere with the discharge of the roof drainage system. Downspout extensions shall terminate above ground or at an approved location.**

(61) *Section R802.11, Roof Tie-down.,* is hereby amended to read as follows:

R802.11 Roof tie-down. **Roof assemblies shall be connected to supporting walls with rafter or truss ties installed at bearing locations to provide a continuous load path for transmitting the uplift forces from the rafter or truss ties to the foundation in accordance with Table R802.11. Alternatively, wind uplift pressures on roof assemblies and roof tie-down requirements may be designed in accordance with Section R301.1.2**

CHAPTER 9 – ROOF ASSEMBLIES

(62) *Section R902.1, Roofing covering materials.*, is hereby amended to read as follows:

R902.1 Roofing covering materials. **Except as otherwise allowed, roofs shall be covered with Class A assemblies and with materials as set forth in Sections R904 and R905. Classes A, B and C roofing required to be listed by this section shall be tested in accordance with UL 790 or ASTM E 108. Roof assemblies with coverings of brick, masonry, slate, clay or concrete roof tile, exposed concrete roof deck, ferrous or copper shingles or sheets, and metal sheets and shingles, shall be considered Class A roof coverings.**

Exception: Any Class B or Class C roof covering may be applied on any new construction that is added to an existing building, provided the roof extremities of such existing building and new construction are located a minimum distance of five (5) feet (1.524 m) from the nearest adjacent property line and are a minimum distance of ten (10) feet (3.048 m) from another building.

(63) *Section R905.1, Roof covering application.* is hereby amended to read as follows:

R905.1 Roof covering application. Roof coverings shall be applied in accordance with the applicable provisions of this section and the manufacturer's installation instructions. **Unless otherwise specified in this section, roof coverings shall be installed to resist the component and cladding loads specified in Table R301.2(2), adjusted for height and exposure in accordance with Table R301.2(3).**

(64) *Section R905.2.6, Attachment* is hereby amended to read as follows:

R905.2.6 Attachment. **Asphalt shingles shall have the minimum number of fasteners required by the manufacturer. Where the roof slope exceeds 20 units vertical in 12 units horizontal (20:12) and where roof assemblies are subject to wind uplift pressures of 20 pounds per square foot (0.958 kN/m²) or greater, as established in Table R301.2(2), adjusted for height and exposure per Table R301.2(3), special methods of fastening are required. Special fastening methods shall be tested in accordance with ASTM D 3161, modified to use a wind speed of 110 mph (177 km/h). Where asphalt shingles are used in the forgoing applications, such shingle packaging shall bear a label indicating compliance with ASTM D 3161 at a wind speed of 110 mph (177 km/h).**

(65) *Section R907.1, General.*, is hereby amended to read as follows:

R907.1 General. Materials and methods of application used for recovering or replacing an existing roof covering shall comply with the requirements of Chapter 9. **No portion of an existing nonrated roof covering may be permanently replaced or covered with more than one square of nonrated roof covering.**

Exceptions:

1. Reroofing shall not be required to meet the minimum design slope requirement of one-fourth vertical in 12 units horizontal (2-percent slope) in Section R905 for roofs that provide positive roof drainage.

2. **Any existing roof covering system may be replaced with a roof covering of the same materials and classification, provided the replacement roof covering has a minimum rating of Class C.**

(66) *Section R907.3, Recovering versus replacement.*, is hereby amended by adding a third exception, reading as follows:

3. The application of new protective coating over existing spray polyurethane foam roofing systems shall be permitted without tear-off of existing roof coverings when applied in accordance with ASTM D-6705.

CHAPTER 10 – CHIMNEYS AND FIREPLACES

(67) *Section R1001.6.1, Spark arrestors.*, is hereby amended to read as follows:

R1001.6.1 Spark arrestors. Chimneys attached to any appliance or fireplace that burns solid fuel shall be equipped with an approved spark arrester meeting all of the following requirements:

1. The net free area of the arrester shall not be less than four times the net free area of the outlet of the chimney flue it serves.
2. The arrester screen shall have heat and corrosion resistance equivalent to 19-gage galvanized steel or 24-gage stainless steel.
3. Openings shall not permit the passage of spheres having a diameter greater than 1/2 inch (12.7 mm) nor block the passage of spheres having a diameter less than 3/8 inch (9.5 mm).
4. The spark arrester shall be accessible for cleaning and the screen or chimney cap shall be removable to allow for cleaning of the chimney flue.

(68) *Section R1004, FACTORY-BUILT FIREPLACES*, is hereby amended by adding new subsection, R1004.1.1 Solid fuel fireplaces and appliances., and deleting subsection, 1004.4, AUnvented gas log heaters., resulting in the entire section amended to read as follows:

SECTION R1004 FACTORY-BUILT FIREPLACES

R1004.1 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.

R1004.1.1 Solid fuel fireplaces and appliances. Solid fuel fireplaces, fireplace stoves and solid-fuel-type room heaters shall also comply with Section 5-110 of the Code of the City.

R1004.2 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.

R1004.3 Decorative shrouds. Decorative shrouds shall not be installed at the termination of chimneys for factory-built fireplaces except where such shrouds are listed and labeled for use with the specific factory-built fireplace system and installed in accordance with the manufacturer's installation instructions.

CHAPTER 11 – ENERGY EFFICIENCY

(69) *Part IV Energy Conservation, Chapter 11, Energy Efficiency* is deleted in its entirety and replaced with the following:

CHAPTER 11 – ENERGY EFFICIENCY

SECTION N1101 SCOPE AND GENERAL REQUIREMENTS

N1101.1 Title. This Chapter shall be also known as *Chapter 11, The 2005 Fort Collins Residential Energy Conservation Code*.

N1101.2 Intent. This chapter regulates the design and construction of buildings including building envelopes for adequate thermal resistance and low infiltration and the design and selection of mechanical, electrical, service water-heating, systems and equipment which will enable the effective use of energy in buildings regulated by this code. The provisions in this chapter are intended to provide flexibility to permit the use of innovative approaches and techniques to achieve effective utilization of energy. This chapter is not intended to abridge safety, health or environmental requirements under other applicable codes or ordinances.

N1101.3 Scope. This chapter establishes minimum prescriptive and performance-related regulations for the design of energy-efficient buildings and structures or portions thereof regulated by this code and their associated accessory uses. This chapter thereby addresses the design of energy-efficient building envelopes and the selection and installation of energy-efficient mechanical, service water-heating, electrical distribution and illumination systems and equipment for the effective use of energy in such buildings and structures.

N1101.3.1 Exempt buildings. The following buildings, or portions thereof separated by building envelope assemblies from the remainder of the building, shall be exempt from this chapter.

1. Buildings that have a peak design rate of energy usage less than 3.4 Btu/hAft² (10.7 W/m²) or 1.0 watt/ft² (10.7 W/m²) of floor area for space conditioning purposes.
2. Buildings that are neither mechanically heated nor mechanically cooled.

N1101.4 Applicability. This chapter shall apply to buildings as set forth in Section N1101. Where, in a specific case, different provisions of this chapter specify different requirements, the most restrictive requirements shall govern.

N1101.4.1 Existing installations. Except as otherwise provided for in this chapter, provisions of this chapter shall not require the removal, alteration or abandonment of, nor prevent the continued use and maintenance of, an existing building envelope, mechanical, service water-heating, electrical distribution, or illumination system lawfully in existence at the time of the adoption of this chapter.

Exception: Any portion of a non-insulated basement foundation wall enclosing conditioned space shall be insulated as prescribed in Table N1111.1 of this chapter prior to the foundation wall being authorized to contain living space or to being covered with permanent framing, wallboard, and similar finish materials, regardless of whether such wall was not originally insulated using the Alternative Minimum Insulation R-values in Table N1111.1 or the Simulated Performance Alternative pursuant to Section N1113 of this chapter.

N1101.4.2 Additions, alterations, renovations or repairs. Additions, alterations, renovations or repairs to a building envelope, mechanical, service water-heating, electrical distribution, or illumination system or portion thereof shall conform to the provisions of this chapter as they relate to new construction without requiring the unaltered portion(s) of the existing system to comply with this chapter. Additions, alterations or repairs shall not cause any one of the aforementioned and existing systems to become unsafe, hazardous or overloaded. In no case shall the energy efficiency of the building be decreased.

Exceptions: The following need not comply provided the energy use of the building is not increased.

1. Storm windows installed over existing fenestration.
2. Glass only replacements in an existing sash and frame.
3. Existing ceiling, wall or floor cavities exposed during construction provided that these cavities are filled with insulation.
4. Construction where the existing roof, wall or floor cavity is not exposed.

N1101.4.3 Change in occupancy. A change in building occupancy that would result in the new building occupancy being regulated by this chapter and an increase in demand for either fossil fuel or electrical energy shall require that the building be made to comply with this chapter unless otherwise approved by the building official.

Exception: The building official may in individual cases waive specific requirements when any such requirement is determined to be highly impractical in existing buildings, including buildings classified as historically significant by the state or local jurisdiction, listed in *The National Register of Historic Places* or determined to be eligible for such listing, when such waivers do not cause the energy efficiency of the building to be decreased.

N1101.4.4 Mixed occupancy. Where a building houses more than one occupancy classification as identified in the building code, each portion of the building shall conform to the requirements for the occupancy housed therein. Where an occupancy is less than 10 percent of the area of any floor of a building, the major occupancy shall be considered the building occupancy. Buildings, other than detached one- and two-family dwellings and townhouses and their accessory uses shall not be regulated under this chapter.

SECTION N1102 ALTERNATIVE MATERIALS AND METHODS OF CONSTRUCTION, DESIGN OR INSULATING SYSTEMS

N1102.1 General. This chapter is not intended to prevent the use of any material, method of construction, design or insulating system not specifically prescribed herein, provided that such construction, design or insulating system has been approved by the building official as meeting the intent of the code. Compliance with specific provisions of this chapter may be determined through the use of computer software, worksheets, compliance manuals and other similar materials when the building official has approved these materials as meeting the intent of this chapter.

SECTION N1103 CONSTRUCTION DOCUMENTS

N1103.1 General. Construction documents and other supporting data shall be submitted with each application for a permit. Where special conditions exist, the building official is authorized to require additional construction documents to be prepared by a registered design professional.

Exception: The building official is authorized to waive the requirements for construction documents or other supporting data if the building official determines such is not necessary to confirm compliance with this chapter.

N1103.2 Information on construction documents. Construction documents shall be drawn to scale upon suitable material and submitted in a format approved by the building official. Construction documents shall be of sufficient clarity to indicate the location, nature and extent of the work proposed, and show in sufficient detail pertinent data and features of the building, systems and equipment as herein governed or as determined by the building official. Details shall include, but are not limited to, insulation materials and their R-values; fenestration U-factors and SHGCs; the number of systems and equipment efficiencies, types, sizes and controls; duct sealing, insulation and location; and air sealing details.

SECTION N1104 INSPECTIONS

N1104.1 General. Construction or work for which a permit is required shall be subject to inspection as deemed necessary by the building official to determine compliance with this chapter.

N1104.2 Required approvals. No work shall be done on any part of the building or structure beyond the point indicated in each successive inspection without first obtaining the written approval of the building official. No construction shall be concealed without inspection approval.

N1104.3 Final inspection. The building shall have a final inspection and approval when completed and ready for occupancy.

N1104.4 Re-inspection. A building shall be re-inspected when determined necessary by the building official.

SECTION N1105 VALIDITY

N1105.1 General. If a portion of this chapter is held to be illegal or void, such a decision shall not affect the validity of the remainder of this chapter.

SECTION N1106 REFERENCED STANDARDS

N1106.1 General. The standards and provisions and portions thereof, referred to in this chapter and contained in the *2003 INTERNATIONAL ENERGY CONSERVATION CODE* (2003 IECC), the *2003 INTERNATIONAL RESIDENTIAL CODE* (2003 IRC), and the *2003 INTERNATIONAL MECHANICAL CODE* (2003 IMC) published by the International Code Council, Inc. shall be considered part of the requirements of this chapter to the extent of such reference.

N1106.2 Conflicting requirements. When a provision of this chapter and a provisions of a referenced standard or provision from the *2003 INTERNATIONAL RESIDENTIAL CODE* (2003 IRC) or the *2003 INTERNATIONAL MECHANICAL CODE* (2003 IMC) published by the International Code Council, Inc. specify different materials, methods of construction or other requirements, the provisions of this chapter shall apply.

SECTION N1107 DEFINITIONS

N1107.1 Scope. Unless stated otherwise, the following words and terms in this chapter shall have the meanings indicated in this chapter.

N1107.2 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 includes the singular.

N1107.3 Terms defined in other codes. Terms that are not defined in this chapter but are defined in the *International Building Code*, *ICC Electrical Code*, *International Fire Code*, *International Fuel Gas Code*, *International Mechanical Code*, *International Plumbing Code* or the *International Residential Code* shall have the meanings ascribed to them in those codes.

N1107.4 Terms not defined. Terms not defined by this chapter shall have ordinarily accepted meanings such as the context implies.

N1107.5 Specific definitions. The following words and terms in this chapter shall have the meanings indicated in this chapter:

ABOVE GRADE WALL. A wall more than 50% above grade and enclosing conditioned space. This includes between-floor spandrels, peripheral edges of floors, roof and basement knee walls, dormer walls, gable end walls, walls enclosing a mansard roof, and skylight shafts.

ACCESSIBLE. Admitting close approach because not guarded by locked doors, elevation or other effective means (see Readily accessible).

ADDITION. An extension or increase in floor area or height of a building or structure.

AIR TRANSPORT FACTOR. The ratio of the rate of useful sensible heat removal from the conditioned space to the energy input to the supply and return fan motor(s), expressed in consistent units and under the designated operating conditions.

ALTERATION. Any construction or renovation to an existing structure other than repair or addition that requires a permit. Also, a change in a mechanical system that involves an extension, addition or change to the arrangement, type or purpose of the original installation that requires a permit.

ANNUAL FUEL UTILIZATION EFFICIENCY (AFUE). The ratio of annual output energy to annual input energy which includes any non-heating season pilot input loss, and for gas or oil-fired furnaces or boilers, does not include electrical energy.

APPROVED. Acceptable to the building official.

AUTOMATIC. Self-acting, operating by its own mechanism when actuated by some impersonal influence, as, for example, a change in current strength, pressure, temperature or mechanical configuration (see Manual).

BASEMENT. That portion of a building located partly or completely below grade, wherein the underside of the floor system immediately above is 72 inches (1829 mm) or more above the surface of an approved permanent basement floor system.

BASEMENT WALL. A wall 50% or more of which is below grade and encloses conditioned space.

BTU (British thermal unit). The quantity of heat required to raise the temperature of 1 pound (0.454 kg) of water 1°F (0.56°C), (1 Btu = 1,055 J).

BUILDING. Any structure used or intended for supporting or sheltering any use or occupancy.

BUILDING THERMAL ENVELOPE. The elements of a building which enclose conditioned spaces and through which thermal energy is capable of being transferred: to or from the exterior; or to or from spaces exempted by the provisions of Section N1101.4.1

COEFFICIENT OF PERFORMANCE (COP)cCOOLING. The ratio of the rate of heat removal to the rate of energy input in consistent units, for a complete cooling system or factory-assembled equipment, as tested under a nationally recognized standard or designated operating conditions.

COEFFICIENT OF PERFORMANCE (COP)cHEAT PUMPcHEATING. The ratio of the rate of heat delivered to the rate of energy input, in consistent units, for a complete heat pump system under designated operating conditions. Supplemental heat shall not be considered when checking compliance with the heat pump equipment (COPs listed in the tables in Sections 503 and 803 of the *2003 INTERNATIONAL ENERGY CONSERVATION CODE*).

COMMERCIAL BUILDING. All buildings that are not included in the definition of Residential Buildings.

CONDITIONED FLOOR AREA. The horizontal projection of the floors associated with the conditioned space.

CONDITIONED SPACE. An area or room within a building being heated or cooled, containing non-insulated ducts, or with a fixed opening directly into an adjacent conditioned space.

CRAWLSPACE. That portion of a building that is conditioned or non-conditioned space located partly or completely below grade (excluding the under-floor space beneath below-grade structural floor systems), wherein the underside of the adjacent finished floor above is less than 72 inches (1829 mm) above the bottom surface of such crawlspace.

CRAWLSPACE WALL. The opaque portion of a wall that encloses a crawl space and is partially or totally below grade.

DEADBAND. The temperature range in which no heating or cooling is used.

DEGREE DAY, COOLING. A unit, based on temperature difference and time, used in estimating cooling energy consumption and specifying nominal cooling load of a building in summer. For any one day, when the mean temperature is more than 65°F (18°C), there are as many degree days as there are degrees Fahrenheit (Celsius) difference in temperature between the mean temperature for the day and 65°F (18°C). Annual cooling degree days (CDD) are the sum of the degree days over a calendar year.

DEGREE DAY, HEATING. A unit, based on temperature difference and time, used in estimating heating energy consumption and specifying nominal heating load of a building in winter. For any one day, when the mean temperature is less than 65°F (18°C), there are as many degree days as there are degrees Fahrenheit (Celsius) difference in temperature between the mean temperature for the day and 65°F (18°C). Annual heating degree days (HDD) are the sum of the degree days over a calendar year.

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 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.

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

ECONOMIZER, AIR. A duct and damper arrangement and automatic control system that allows a cooling system to supply outside air to reduce or eliminate the need for mechanical cooling during mild or cold weather.

ECONOMIZER, WATER. A system where the supply air of a cooling system is cooled indirectly with water that is itself cooled by heat or mass transfer to the environment without the use of mechanical cooling.

ENERGY. The capacity for doing work (taking a number of forms) which is capable of being transformed from one into another, such as thermal (heat), mechanical (work), electrical and chemical in customary units, measured in joules (J), kilowatt-hours (kWh) or British thermal units (Btu).

ENERGY ANALYSIS. A method for determining the annual (8,760 hours) energy use of the proposed design and standard reference design based on estimates of energy use.

ENERGY COST. The total estimated annual cost for purchased energy for the building functions regulated by this chapter, including any demand charges, fuel adjustment factors and delivery charges applicable to the building.

ENERGY SIMULATION TOOL. An approved software program or calculation-based methodology that projects the annual energy use of a building.

EXTERIOR WALL Any wall, including both above grade walls and foundation walls, enclosing conditioned space that is vertical or sloped at an angle of sixty (60) degrees or greater from the horizontal.

FENESTRATION. Skylights, roof windows, vertical windows (whether fixed or moveable), opaque doors, glazed doors, glass block, and combination opaque/glazed doors. Fenestration includes products with glass and non-glass glazing materials.

FURNACE, DUCT. A furnace normally installed in distribution ducts of air-conditioning systems to supply warm air for heating and which depends on a blower not furnished as part of the duct furnace for air circulation.

FURNACE, WARM AIR. A self-contained, indirect-fired or electrically heated furnace that supplies heated air through ducts to spaces that require it.

GLAZING AREA. Total area of the glazed fenestration measured using the rough opening and including sash, curbing or other framing elements that enclose conditioned space. Glazing area includes the area of glazed fenestration assemblies in walls bounding conditioned basements. For doors where the daylight opening area is less than 50 percent of the door area, the glazing area is the daylight opening area. For all other doors, the glazing area is the rough opening area for the door including the door and the frame.

GROSS AREA OF EXTERIOR WALLS. The normal projection of all exterior walls, including the area of all windows and doors installed therein (see Exterior wall).

GROSS FLOOR AREA. The sum of the areas of several floors of the building, including basements, cellars, mezzanine and intermediate floored tiers and penthouses of headroom height, measured from the exterior faces of exterior walls or from the centerline of walls separating buildings, but excluding:

1. Covered walkways, open roofed-over areas, porches and similar spaces.
2. Pipe trenches, exterior terraces or steps, chimneys, roof overhangs and similar features.

HEAT. The form of energy that is transferred by virtue of a temperature difference or a change in state of a material.

HEAT CAPACITY (HC). The amount of heat necessary to raise the temperature of a given mass by one degree. The heat capacity of a building element is the sum of the heat capacities of each of its components.

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 TRAP. An arrangement of piping and fittings, such as elbows, or a commercially available heat trap that prevents thermosyphoning of hot water during standby periods.

HEATED SLAB. Slab-on-grade construction in which the heating elements, hydronic piping or hot air distribution system is in contact with or placed within the slab or the subgrade.

HEATED SPACE. Space within a building which is provided with a positive heat supply (see Positive heat supply). Space within a basement with registers or heating devices designed to supply heat to a basement space shall automatically define that space as heated space and conditioned floor area.

HEATING SEASONAL PERFORMANCE FACTOR (HSPF). The total heating output of a heat pump during its normal annual usage period for heating, in Btu, divided by the total electric energy input during the same period, in watt hours, as determined by DOE 10 CFR Part 430, Subpart B, Test Procedures and based on Region 4.

HUMIDISTAT. A regulatory device, actuated by changes in humidity, used for automatic control of relative humidity.

HVAC. Heating, ventilating and air conditioning.

HVAC SYSTEM. The equipment, distribution network, and terminals that provide either collectively or individually the processes of heating, ventilating, or air conditioning to a building.

HVAC SYSTEM COMPONENTS. HVAC system components provide, in one or more factory-assembled packages, means for chilling or heating water, or both, with controlled temperature for delivery to terminal units serving the conditioned spaces of the building. Types of HVAC system components include, but are not limited to, water chiller packages, reciprocating condensing units and water source (hydronic) heat pumps (see HVAC system equipment).

HVAC SYSTEM EQUIPMENT. HVAC system equipment provides, in one (single package) or more (split system) factory-assembled packages, means for air circulation, air cleaning, air cooling with controlled temperature and dehumidification and, optionally, either alone or in combination with a heating plant, the functions of heating and humidifying. The cooling function is either electrically or heat operated and the refrigerant condenser is air, water or evaporative cooled. Where the equipment is provided in more than one package, the separate packages shall be designed by the manufacturer to be used together. The equipment shall be permitted to provide the heating function as a heat pump or by the use of electric or fossil-fuel-fired elements. (The word equipment used without a modifying adjective, in accordance with common industry usage, applies either to HVAC system equipment or HVAC system components.)

INFILTRATION. The uncontrolled inward air leakage into a building caused by the pressure effects of wind and pressure imbalances induced by mechanical systems; or the effect of differences in the indoor and outdoor air density or any combination of such effects.

INSULATED SHEATHING. An insulating board with a core material having a minimum R-value of R-2.

LABELED. Devices, equipment, appliances, assemblies or materials to which have been affixed a label, seal, symbol or other identifying mark of a nationally recognized testing laboratory, inspection agency or other organization concerned with product evaluation that maintains periodic inspection of the production of the above-labeled items and by whose label the manufacturer attests to compliance with applicable nationally recognized standards.

LISTED. Equipment, appliances, assemblies or materials included in a list published by a nationally recognized testing laboratory, inspection agency or other organization concerned with product evaluation that maintains periodic inspection of production of listed equipment, appliances, assemblies or material, and whose listing states either that the equipment, appliances, assemblies, or material meets nationally recognized standards or has been tested and found suitable for use in a specified manner.

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

LOW-VOLTAGE LIGHTING. Lighting equipment powered through a transformer such as a cable conductor, a rail conductor and track lighting.

MANUAL. Capable of being operated by personal intervention (see Automatic).

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

OPAQUE AREAS. All exposed areas of a building envelope which enclose conditioned space, except openings for windows, skylights, doors and building service systems.

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

OZONE DEPLETION FACTOR. A relative measure of the potency of chemicals in depleting stratospheric ozone. The ozone depletion factor potential depends on the chlorine and bromine content and the atmospheric lifetime of the chemical. The depletion factor potential is normalized such that the factor for CFC-11 is set equal to unity and the factors for the other chemicals indicate their potential relative to CFC-11.

PACKAGED TERMINAL AIR CONDITIONER (PTAC). A factory-selected wall sleeve and separate un-encased combination of heating and cooling components, assemblies or components (intended for mounting through the wall to serve a single room or zone). It includes heating capability by hot water, steam or electricity. (For the complete technical definition, see ARI 310/380.)

PACKAGED TERMINAL HEAT PUMP. A PTAC capable of using the refrigeration system in a reverse cycle or heat pump mode to provide heat. (For the complete technical definition, see ARI 310/380.)

POSITIVE COOLING SUPPLY. Mechanical cooling deliberately supplied to a space, such as through a supply register. Also, mechanical cooling indirectly supplied to a space through un-insulated surfaces of space-cooling components, such as evaporator coil cases and cooling distribution systems which continually maintain air temperatures within the space of 85°F (29°C) or lower during normal operation. To be considered exempt from inclusion in this definition, such surfaces shall comply with the insulation requirements of this chapter.

POSITIVE HEAT SUPPLY. Heat deliberately supplied to a space by design, such as a supply register, radiator or heating element. Also, heat indirectly supplied to a space through un-insulated surfaces of service water heaters and space-heating components, such as furnaces, boilers and heating and cooling distribution systems which continually maintain air temperature within the space of 50°F (10°C) or higher during normal operation. To be considered exempt from inclusion in this definition, such surfaces shall comply with the insulation requirements of this chapter.

PROPOSED DESIGN. A description of the proposed building used to estimate annual energy use for determining compliance based on total building performance.

READILY ACCESSIBLE. Capable of being reached quickly for operation, renewal or inspections, without requiring those to whom ready access is requisite, to climb over or remove obstacles or to use portable ladders or access equipment (see Accessible).

REPAIR. The reconstruction or renewal of any part of an existing building.

RESIDENTIAL BUILDING. One- and two-family dwellings, townhouses, R-2 residential buildings three stories or less in height above grade and R-4 residential buildings three stories or less in height above grade.

ROOF ASSEMBLY. A system designed to provide weather protection and resistance to design loads. The system consists of a roof covering and roof deck or a single component serving as both the roof covering and the roof deck. A roof assembly includes, the roof covering, underlayment, roof deck, vapor retarder, substrate or thermal barrier, insulation, and interior finish. For purposes of the building thermal envelope, a roof assembly shall be considered as all roof/ceiling components of the building envelope through which heat flows, thus creating a building transmission heat loss or gain, where such assembly is exposed to outdoor air and encloses conditioned space. The gross area of a roof assembly consists of the total interior surface of all roof/ceiling components, including opaque surfaces, dormer and bay window roofs, tray ceilings, overhead portions of an interior stairway to an unconditioned attic, doors and hatches, glazing and skylights exposed to conditioned space, that are horizontal or sloped at an angle less than 60 degrees (1.1 rad) from the horizontal (see Exterior wall). A roof assembly, or portions thereof, having a slope of 60 degrees (1.1rad) or greater from horizontal shall be considered in the gross area of exterior walls and thereby excluded from consideration in the roof assembly. Skylight shaft walls 12 inches (305 mm) in depth or greater (as measured from the ceiling plane to the roof deck) shall be considered in the gross area of exterior walls and are thereby excluded from consideration in the roof assembly.

ROOM AIR CONDITIONER. An encased assembly designed as a unit for mounting in a window or through a wall, or as a console. It is designed primarily to provide free delivery of conditioned air to an enclosed space, room or zone. It includes a prime source of refrigeration for cooling and dehumidification and means for circulating and cleaning air, and shall be permitted to also include means for ventilating and heating.

R-VALUE (THERMAL RESISTANCE). The inverse of the time rate of heat flow through a body from one of its bounding surfaces to the other surface for a unit temperature difference between the two surfaces, under steady state conditions, per unit area (hHft²H°F/Btu) [(m²HK)/W].

SASH CRACK. The sum of all perimeters of all window sashes, based on overall dimensions of such parts, expressed in feet. If a portion of one sash perimeter overlaps a portion of another sash perimeter, the overlapping portions are only counted once.

SCREW LAMP HOLDERS. A lamp base that requires a screw-in-type lamp such as an incandescent, compact florescent, or tungsten-halogen bulb.

SEASONAL ENERGY EFFICIENCY RATIO (SEER). The total cooling output of an air conditioner during its normal annual usage period for cooling, in Btu/h (W), divided by the total electric energy input during the same period, in watt-hours, as determined by DOE 10 CFR Part 430, Subpart B, Test Procedures.

SERVICE SYSTEMS. All energy-using systems in a building that are operated to provide services for the occupants or processes housed therein, including HVAC, service water heating, illumination, transportation, cooking or food preparation, laundering and similar functions.

SERVICE WATER HEATING. Supply of hot water for purposes other than comfort heating.

SIMULATION TOOL. An approved software program or calculation-based methodology that projects the annual hour-by-hour loads and energy use of a building.

SKYLIGHT. Glazing that is sloped more than fifteen degrees (0.26 rad) from the vertical.

SLAB-ON-GROUND FLOOR INSULATION. Insulation around the perimeter of the floor slab or its supporting foundation when the top edge of the floor perimeter slab is above the finished grade or 12 inches (305 mm) or less below the finished grade.

SOLAR ENERGY SOURCE. Source of natural day-lighting and of thermal, chemical or electrical energy derived directly from conversion of incident solar radiation.

SOLAR HEAT GAIN COEFFICIENT (SHGC). The ratio of the solar heat gain through a fenestration or glazing assembly to the incident solar radiation expressed as a number between 0.00 and 1.00 representing the fraction of incident solar radiation admitted, both directly transmitted and absorbed, then subsequently released inward and identified as such on the NFRC product label.

STANDARD REFERENCE DESIGN. A version of the Proposed design that meets the minimum requirements of this chapter and is used to determine the maximum annual energy use requirement for compliance based on total building performance.

STANDARD TRUSS. Any construction that does not permit the roof/ceiling insulation to achieve the required R-value over the exterior walls.

SUNROOM ADDITION. A one-story structure added to a dwelling, with a glazing area in excess of 40 percent of the gross area of the structure's exterior walls and roof.

SYSTEM. A combination of central or terminal equipment or components or controls, accessories, interconnecting means, and terminal devices by which energy is transformed so as to perform a specific function, such as HVAC, service water heating or illumination.

THERMAL CONDUCTANCE. Time rate of heat flow through a body (frequently per unit area) from one of its bounding surfaces to the other for a unit temperature difference between the two surfaces, under steady conditions (Btu/h \cong ft² \cong EF) [W/(m² \cong K)].

THERMAL ISOLATION. A separation of conditioned spaces, between a sunroom addition and a dwelling unit, consisting of existing or new wall(s), doors and/or windows. New wall(s), doors and/or windows shall meet the prescriptive envelope component criteria in Table N1111.1. The conditioned space(s) shall be controlled as a separate zone(s) for heating and cooling or conditioned by separate equipment.

THERMOSTAT. An automatic control device used to maintain temperature at a fixed or adjustable set point.

TOWNHOUSE. A single-family dwelling unit constructed in a group of two or more attached individual units, each of which is separated from the other from the foundation to the roof and is located entirely on a separately recorded and platted parcel of land (site) bounded by property lines that is deeded exclusively for such single-family dwelling.

U-FACTOR (THERMAL TRANSMITTANCE). The coefficient of heat transmission (air to air) through a building component or assembly, equal to the time rate of heat flow per unit area and unit temperature difference between the warm side and cold side air films (Btu/hHft²H°F) [W/(m²HK)]. The U-factor for fenestration products shall be as established by the NFRC.

UNITARY COOLING AND HEATING EQUIPMENT. One or more factory-made assemblies which include an evaporator or cooling coil, a compressor and condenser combination, and which shall be permitted to include a heating function as well. When heating and cooling equipment is provided in more than one assembly, the separate assemblies shall be designed to be used together.

UNITARY HEAT PUMP. One or more factory-made assemblies which include an indoor conditioning coil, compressor(s) and outdoor coil or refrigerant-to-water heat exchanger, including means to provide both heating and cooling functions. When heat pump equipment is provided in more than one assembly, the separate assemblies shall be designed to be used together.

VAPOR RETARDER. A vapor resistant material, membrane or covering such as foil, plastic sheeting, or insulation facing having a permeance rating of 1 perm or less, when tested in accordance with the desiccant method using Procedure A of ASTM E96. Vapor retarders limit the amount of moisture vapor that passes through a material or wall assembly.

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 outside (outdoors) plus any recirculated air that has been treated to maintain the desired quality of air within a designated space.

WATER HEATER, INSTANTANEOUS. A water heater with an input rating of at least 4,000 Btu/h per gallon (310 W/L) stored water and a storage capacity of less than 10 gallons (38 L).

WATER HEATER, STORAGE. A water heater with an input rating less than 4,000 Btu/h per gallon (310 W/L) of stored water or storage capacity of at least 10 gallons (38 L).

WINDOW PROJECTION FACTOR. A measure of the portion of glazing that is shaded by an eave or overhang. It is calculated as the ratio of an overhang's length (horizontal distance out from the glazing) to the vertical distance from the bottom of the glazing to the bottom of the overhang.

ZONE. A space or group of spaces within a building with heating or cooling requirements, or both, sufficiently similar so that comfort conditions can be maintained throughout by a single controlling device.

SECTION N1108 DESIGN CONDITIONS

N1108.1 Design criteria. The criteria specified in this chapter establishes design conditions.

SECTION N1109 THERMAL DESIGN PARAMETERS

N1109.1 Thermal design parameters. The following thermal design parameters in Table N1109.1 shall be used for calculations required under this chapter.

**TABLE N1109.1
THERMAL DESIGN PARAMETERS
CLIMATIC AND GEOGRAPHIC DESIGN CRITERIA**

Winter Outdoor, Design Dry-bulb (°F)	= 1
Winter Indoor, Design Dry-bulb (°F)	= 72
Summer, Outdoor Design Dry-bulb (°F)	= 91
Summer, Indoor Design Dry-bulb (°F)	= 78
Summer, Design Wet-bulb (°F)	= 59
Degree days heating	= 6368
Degree days cooling	= 479

For SI: °C = [(°F)-32]/1.8.

SECTION N1110 MATERIALS, SYSTEMS, EQUIPMENT AND ENERGY EFFICIENCY

N1110.1 Compliance. Compliance with the energy efficiency requirements of this chapter for residential buildings shall be demonstrated by any one of the methods provided in this chapter.

N1110.2 Identification. Materials, systems and equipment shall be identified in a manner that will allow a determination of compliance with the applicable provisions of this chapter.

N1110.3 Installation. All materials, systems and equipment required by this chapter shall be installed in accordance with the manufacturer's installation instructions and the conditions of any listing or required certifications.

N1110.3.1 Glass and mineral fiber insulation. Glass and mineral fiber (wool) insulation installed on the conditioned side of basement foundation walls and in framed cavities or on interior surfaces less than 72 inches (1829 mm) above the floor below shall be protected from damage and releasing insulation fibers into the conditioned space by a permanent covering material securely fastened in place such that the insulation is maintained in substantial contact with the covering. The covering material shall be gypsum wallboard, wall paneling, wall sheathing, or similar durable materials conforming to Section R315, that provide equivalent physical protection as determined by the building official. See Section R316.

N1110.4 Maintenance information. Instructions shall be furnished with the building for equipment and systems that require preventive maintenance. Required regular maintenance shall be clearly stated and incorporated on a readily accessible label affixed to the equipment. This label shall include the title or publication number for the operation and maintenance manual for that particular model and type of product.

N1110.5 Certification. A permanent certification shall be signed by the builder and be posted in the immediate vicinity of the building electrical distribution panel. Where there is more than one value for each component, the certification shall list the value covering the greatest area. Such certification shall verify the following:

1. The predominant R-values of the insulation for ceiling/roof, walls, foundation (slab, basement wall, frame floors, crawlspace wall and/or floor);
2. U-factors and the solar heat gain coefficient (SHGC) for each fenestration type;
3. The type and efficiency of heating, cooling and service water heating equipment, and R-values for ducts outside conditioned spaces; and
4. The insulation described thereon is installed in accordance with the applicable installation guidelines established by the building official.

A copy of the certification shall be submitted to the building official by the builder or general contractor of record prior to issuance of a Certificate of Occupancy.

SECTION N1111 BUILDING THERMAL ENVELOPE

N1111.1 Simplified Insulation and fenestration prescriptive criteria. The building envelope shall meet the requirements of Table N1111.1, except as stated in this Section.

N1111.2 Insulation installation and identification. Roof/ceiling, floor, wall cavity and duct distribution systems insulation shall be installed in a manner as set forth in the *Insulation Guidelines* established by the building official and such that the manufacturer's R-value identification mark is readily observable upon inspection.

N1111.2.1 Building thermal envelope insulation. An R-value identification mark shall be applied by the manufacturer to each piece of building envelope insulation 12 inches (305 mm) or greater in width. Alternatively, the insulation installer shall provide a certification listing the type, manufacturer and R-value of insulation installed in each element of the building thermal envelope. The certification shall list the type, manufacturer and R-value of insulation installed in each element of the building envelope. For blown or sprayed insulation, the initial installed thickness, settled thickness, settled R-value, installed density, coverage area and number of bags installed shall be listed on the certification. The insulation installer shall sign, date and post the certification in a conspicuous location within the building.

N1111.2.1.1 Blown or sprayed roof/ceiling insulation. The thickness of blown in or sprayed roof/ceiling insulation shall be observable by markers that measure thickness in inches and which are installed no less than one for every 300 ft² (28 m²) throughout the attic space. The markers shall be affixed to the trusses or joists and marked with the minimum initial installed thickness with numbers a minimum of 1 inch (25.4 mm) in height. Each marker shall face the attic access opening.

N1111.3 R-value computation. Insulation material used in layers, such as framing cavity insulation and insulating sheathing, shall be summed to compute the component R-value. The manufacturer's settled R-value shall be used for blown insulation. Computed R-values shall not include an R-value for other building materials or air films.

N1111.4 U-factor alternative. An assembly with a U-factor equal to or less than that specified in Table N1111.1 shall be permitted as an alternative to the R-value in Table N1111.1.

N1111.5 Total UA alternative. If the total building thermal envelope UA (sum of U-factor times assembly area) is less than or equal to the total UA resulting from using the U-factors in Table N1111.1, the building shall be considered in compliance with Table N1111.1. The UA calculation shall be done using a method consistent with the ASHRAE Handbook of Fundamentals and shall include the thermal bridging effects of framing materials. The SHGC requirements shall be met in addition to UA compliance.

N1111.6 Prescriptive tradeoffs. Alternative minimum insulation R-values shall be permitted as an alternative to the standard, "Insulation and Glazed Fenestration Requirements by Component" specified in Table N1111.1 provided the HVAC performance efficiencies are increased as indicated therein.

Table N1111.1 Insulation and Glazed Fenestration Requirements by Component^(a)									
Fenestration U-Factor	Fenestration SHGC	Skylight^(b) U-Factor	Ceiling^(c) R-Value	Frame Wall^(d) R-Value	Mass Wall R-Value	Floor^(h) R-Value	Basement Wall^(e) R-Value	Slab^(f) R-Value & Depth	Crawl Space^(g) Wall R-Value
0.35	0.55	0.60	38 / 49 ^(k)	18 / 21 ^(k) / 15 ^(l)	13 / 15 ^(k)	30	10 / 13	10, 2 ft / 10, 4 ft ^(k)	19/ 13
Equivalent Maximum U-Factors Insulated building envelope U-factors must be obtained from measurement or calculation.									
0.35	NA	0.60	0.030 / 0.026 ^(k)	0.065 / 0.057 ^(k)	0.082 / 0.077 ^(k)	0.033	0.060	NA	0.065
Alternative Minimum Insulation R-values⁽ⁱ⁾ When one or more of the following increased HVAC efficiencies is used: Minimum SEER 12 with minimum AFUE 90, or Minimum SEER 12 with minimum HSPF8.2, or Ground-source heat pump with minimum HSPF 16									
0.35	0.55	0.60	38	15	8	19	10/13/0 ^(j)	10, 2 ft	19/13

Footnotes for Table N1111.1. Insulation and Glazed Fenestration Requirements:

(a) R-values are minimums. U-factors and SHGC are maximums. Fenestration U-factor and SHGC refer to the whole fenestration unit. R-values in this table are uncompressed R-values, except that R-19 insulation may be compressed into 2x6 framing cavities. Steel-frame wall R-values are given in Table N1111.2. Fenestration includes doors. All heating, ventilating, and cooling equipment shall meet NAECA minimum efficiency standards except when specified otherwise.

(b) The fenestration U-factor column excludes skylights; this column applies only to skylights. The SHGC column applies to all glazed fenestration, including skylights, which are considered glazed fenestrations less than 60 degrees from horizontal.

(c) Insulation may be applied to the underside of the roof if the attic is air sealed and un-vented.

(d) Frame walls include between-floor spandrels, peripheral edges of floors, roof and basement knee walls, dormer walls, gable end walls, shaft walls enclosing conditioned spaces that adjoin unconditioned spaces, and walls enclosing a mansard roof. R-values are for the insulation materials only. When structural sheathing covers 25% or less of the exterior frame walls, the combined insulation R-value where the structural sheathing is used may be R-15. Where structural sheathing covers more than 25% of the exterior walls in which R-15 cavity insulation is installed, and

insulated sheathing of at least R-2 is applied to the structural sheathing, the exterior walls comply with Table N1111.1 .

(e) A basement wall is any individual exterior wall that is more than 50% below grade. The first R-value applies to continuous insulation and the second R-value applies to insulation in a framing cavity. Either R-value meets the basement requirement.

(f) R-5 shall be added to the required slab edge R-values for heated slabs.

(g) The first R-value applies to continuous insulation, the second to insulation that fills a framing cavity; either one meets the crawl space wall insulation requirement.

(h) Insulation must be sufficient to completely fill the framing cavity and no less than R-19.

(i) Bold type indicates requirements that differ from the standard requirements. Buildings with electric resistance as the primary heat source are not eligible to use alternative minimum insulation offset by increased HVAC efficiencies. All footnotes of Table N1111.1 apply. Air-handlers, furnaces and ducts shall be in conditioned space. Factory-sealed air handlers tested, certified and labeled by the manufacturer to have achieved a 2 percent or less leakage rate at 1.0 inch (25.4 mm) water gauge shall meet the requirement for the air handler being in conditioned space. After the year 2006 change: SEER increased from 12 to 14 and HSPF from 8.2 to 8.8. Evaporative cooling meets SEER requirement. Either the alternative minimum insulation for frame walls reduced to R-15, or the omission of basement wall insulation may be used by substituting a furnace with an AFUE ≥ 90 . Such substitution is not permitted for both conditions together within the same dwelling unit.

(j) When not already specified in order to utilize the alternative minimum insulation offset by increased HVAC efficiencies as noted under footnote (i), heating equipment meeting the one of the performance and efficiency standards may be substituted in lieu of installing the continuous insulation specified for exterior basement walls that do not contain or enclose living space at the time of their construction and approval for occupancy, provided that not more than 12 inches (305 mm) of the basement wall is above grade.

(k) The value indicating the greatest thermal efficiency applies to buildings with electric-powered equipment as the primary building heat source when such equipment is NOT supplied primarily by renewable energy sources or is NOT a ground-source heat pump.

(l) Frame walls noted in footnote (d) above of individual buildings that do not exceed 1,600 square feet (149 m²) in floor area above the foundation may be insulated to a minimum of R-15.

N1111.7 Insulation and thermal requirements for specific conditions.

N1111.7.1 Roof/Ceiling Assemblies and Attics. Where Section N1111.1 prescribes insulation levels above R-30 and the design of the roof/ceiling assembly does not allow sufficient space for the specified insulation, the minimum required insulation for such roof/ceiling assemblies shall be not less than R-30. Such reduction of insulation from the requirements of Section N1111.1 shall be limited to 500 square feet (46.5 m²) of ceiling area. The required ceiling insulation R-value above the exterior wall top plate shall not be less than the required R-value of the wall insulation.

N1111.7.2 Mass walls. Mass walls include concrete block, concrete, insulated concrete form (ICF), masonry cavity, brick (not brick veneer) and log walls. To use the mass wall provisions, greater than 50% of the insulation R-value shall be on the exterior of, or integral to, the mass wall. Mass walls that do not meet this criterion for insulation placement shall meet the frame wall insulation requirements.

N1111.7.3 Opaque doors. A door with a foam core shall be deemed to meet the required fenestration U-factor. One opaque door assembly is exempted from the U-factor requirement.

N1111.7.4 Floors. Cantilevered floors, floors over outside air (including floors over any garage when such garage does not meet the provisions of this chapter, and floors over crawl spaces that are vented to the outside), and dormer ceilings shall require a minimum of R-30 insulation installed to maintain permanent contact with the floor above and be sufficient to fill the framing cavity completely.

N1111.7.5 Basement walls. Walls containing conditioned basement spaces shall be insulated from the top of the basement wall downward to a point 120 inches (3.05 m) below grade or to the basement floor, whichever is less. Walls containing unconditioned basement spaces shall meet the preceding requirement unless the floor overhead is insulated in accordance with Sections N1111.1 and N1111.7.4, except when utilizing the alternative minimum insulation offset by increased HVAC efficiencies as permitted in Table N1111.1. Glass and mineral fiber (wool) insulation installed on the interior side of basement foundation walls shall be protected from damage as specified in Section N1110.3.1.

Exceptions:

1. Insulation applied to the exterior side of foundation walls enclosing conditioned space shall extend downward from the top of foundation walls and terminate a minimum of 48 inches (1219 mm) below the adjoining ground level.
2. Insulation may be eliminated when heating equipment is installed that meets efficiency criteria and conditions specified in Table N1111.1, Footnotes (i) and (j).

N1111.7.6 Slab-on-ground floors. The perimeters of slab-on-ground floors and below-grade structural floor systems with a floor surface less than 12 inches (305 mm) below grade shall be insulated in accordance with Table N1111.1. The insulation shall extend downward from the top of the slab on the outside or inside of the foundation wall. Insulation located below grade shall be extended the distance provided in Table N1111.1 by any combination of vertical insulation, insulation extending under the slab or insulation extending out from the building. Insulation extending away from the building shall be protected by pavement or by a minimum of 10 inches (254 mm) of soil. The top edge of the insulation installed between the exterior wall and the edge of the interior slab shall be permitted to be cut at a 45-degree angle away from the exterior wall. Approved frost-protected-shallow-foundations constructed in accordance with Section R403.3 shall be considered in compliance with this section.

N1111.7.7 Crawl space walls. Floors above crawl spaces that are vented to the outside (excluding such spaces with openings and ducts solely for the purpose of providing combustion air in accordance with M1703) shall be insulated in accordance with Sections N1111.1 and N1111.7.4. Crawl space walls shall be permitted to be insulated when the crawl space is not vented to the outside. Such insulation shall be permanently fastened to the crawl space wall and extend downward from the sill plate to the interior bottom surface. Where the interior bottom surface is less than 12 inches (305 mm) below the outside finish ground level, insulation shall extend from

the top of the crawl space wall to the top of the footing. The exposed earth in crawl spaces shall be covered with a continuous vapor retarder. All joints in the vapor retarder shall overlap by 6 inches (152 mm) and be sealed or taped. The edges of the vapor retarder shall extend at least 6 inches (152 mm) up the stem wall and shall be attached and sealed to the foundation wall in an approved manner.

N1111.7.8 Masonry veneer. Insulation shall not be required on the horizontal portion of the foundation that supports a masonry veneer.

N1111.7.9 Below-grade structural floors. Below-grade structural floors supporting conditioned spaces above shall be constructed in accordance with Section R408.2.2.

N1111.7.10 Protection of exposed foundation insulation. Insulation applied to the exterior of foundation walls and the perimeter of slab-on-grade floors shall have a rigid, opaque and weather-resistant protective covering to prevent the degradation of the insulation's thermal performance. The protective covering shall cover the exposed exterior insulation and extend a minimum of 6 inches (152 mm) below grade.

N1111.7.11 Thermally isolated sunroom insulation. The minimum ceiling insulation R-value shall be R-24 and the minimum wall R-value shall be R-13 in such rooms. New wall(s) separating the sunroom from conditioned space shall meet the building thermal envelope requirements. Thermally isolated sunrooms shall not be used as kitchens or sleeping rooms, and shall be served by a separate heating or cooling system.

N1111.7.12 Accessory buildings. Fully enclosed accessory buildings and attached garages not containing habitable space may be conditioned subject to the following thermal and envelope criteria:

1. Such spaces meet the criteria for thermal isolation and any HVAC equipment installed therein is sized for a peak design load assuming a maximum Winter Indoor Design DryBulb Temperature of 60°F(16 °C) and a minimum Summer Indoor Design DryBulb Temperature of 80°F (27 °C).
2. The walls are insulated with insulation having a minimum R-value of R-13.
3. The roof/ceiling is insulated in accordance with Section N1111.1.
4. Windows have a maximum U-factor of 0.45 and in total do not exceed 10% of the floor area.
5. Doors have a minimum R-value of 3 and are sealed to prevent infiltration to the extent practical as determined by the building official.
6. Slab-edges are insulated to R-5.

N1111.7.14 Steel-frame ceilings, walls and floors. Steel-frame ceilings, walls and floors shall meet the insulation requirements of Table N1111.2 or shall meet the U-factor requirements in Table N1111.1. The calculation of the U-factor for a steel-frame envelope assembly shall use a series-parallel path calculation method.

Table N1111.2 Steel-Frame Ceiling, Wall and Floor Insulation (R-Value)

Wood Frame R-Value Requirement	Cold-Formed Steel Equivalent R Value¹
Steel Truss Ceilings²	
R-30	R-38 or R-30+3 or R-26+5
R-38	R-49 or R-38+3
R-49	R-38+5
Steel Joist Ceilings²	
R-30	R-38 in 2x4 or 2x6 or 2x8 R-49 in any framing
R-38	R-49 in 2x4 or 2x6 or 2x8 or 2x10
Steel Framed Wall	
R-13	R-13+5 or R-15+4 or R-21+3
R-19	R-13+9 or R-19+8 or R-25+7
R-21	R-13+10 or R-19+9 or R-25+8
Steel Joist Floor	
R-13	R-19 in 2x6 R-19+R6 in 2x8 or 2x10
R-19	R-19+R-6 in 2x6 R-19+R-12 in 2x8 or 2x10
Notes: 1. Cavity insulation R-value is listed first, followed by continuous insulation R-value. 2. Insulation exceeding the height of the framing shall cover the framing.	

N1111.8 Fenestration.

N1111.8.1 Fenestration product rating. U-factors of fenestration products (windows, doors and skylights) shall be determined in accordance with NFRC 100 by an accredited, independent laboratory, and labeled and certified by the manufacturer. The solar heat gain coefficient (SHGC) of glazed fenestration products (windows, glazed doors and skylights) shall be determined in accordance with NFRC 200 by an accredited, independent laboratory, and labeled and certified by the manufacturer. Products lacking such a labeled U-factor shall be assigned a default U-factor from Tables N1111.3. and N1111.4. The solar heat gain coefficient (SHGC) of glazed fenestration products (windows, glazed doors and skylights) shall be determined in accordance with NFRC 200 by an accredited, independent laboratory, and labeled and certified by the manufacturer. Products lacking such a labeled SHGC shall be assigned a default SHGC from Table N1111.5.

Table N1111.3 Default Glazed Fenestration U-Factors

Frame Type	Single Pane	Double Pane	Skylight	
			Single	Double
Metal	1.20	0.80	2.00	1.30
Metal with Thermal Break	1.10	0.65	1.90	1.10
Non-Metal or Metal Clad	0.95	0.55	1.75	1.05
Glazed Block	0.60			

Table N1111.4 Default Door U-Factors

Door Type	U-factor
Uninsulated Metal	1.20
Insulated Metal	0.60
Wood	0.50
Insulated, non-metal edge, max 45% glazing, any glazing double pane	0.35

Table N1111.5 Default Glazed Fenestration SHGC

Single Glazed		Double Glazed		Glazed Block
Clear	Tinted	Clear	Tinted	
0.7	0.6	0.6	0.5	0.6

N1111.8.2 U-factor. An area-weighted average of fenestration products shall be permitted to satisfy the U-factor requirements.

N1111.8.3 Glazed fenestration SHGC. An area-weighted average of fenestration products more than 50% glazed shall be permitted to satisfy the SHGC requirements.

N1111.8.4 SHGC exemptions. Any fenestration facing within 45 degrees of true south with an overhang having a window projection factor of 0.3 or more is exempt from the SHGC requirements.

N1111.8.5 Fenestration exemption. Up to 15 ft² (1.4 m²) of glazed fenestration per dwelling unit is exempt from U-factor and SHGC requirements in Section N1111.

N1111.8.6 Thermally isolated sunrooms U-factor. Glazed fenestration in thermally isolated sunrooms and new windows separating sunrooms from conditioned space shall have a maximum U-factor of 0.50. Sunroom skylights shall have a maximum U-factor of 0.75. Sunrooms shall otherwise meet the requirements of this chapter.

Exception: Thermally isolated sunrooms that are neither heated nor cooled with non-renewable energy sources.

N1111.8.7 Replacement fenestration. Where some or all of an existing fenestration unit is replaced with a new replacement fenestration product, including frame, sash, and glazing, the replacement fenestration unit shall meet the requirements for U-factor and SHGC in Table N1111.1.

N1111.8.8 Impact resistant fenestration. Required impact resistant fenestration shall meet ASTM E-1886 or ASTM E-1996, and shall be so labeled by the manufacturer.

N1111.9 Air infiltration.

N1111.9.1 Building envelope. Exterior joints, seams or penetrations in the building envelope, that are sources of uncontrolled air infiltration, shall be sealed with durable caulking materials, closed with gasketing systems, taped or covered with moisture vapor-permeable house wrap as described in further detail in the air-sealing guidelines established by the building official. Such sealing methods shall be performed at locations such as around tubs and showers; at the attic and crawl space panels; at recessed lights and around all plumbing and electrical penetrations; at dropped ceilings or chases adjacent to the thermal envelope; at knee walls and shaft walls adjoining unconditioned space; and at similar openings located in the building envelope between conditioned space and unconditioned space or between the conditioned space and the outside. Sealing materials spanning joints between dissimilar construction materials shall allow for differential expansion and contraction of the construction materials.

An approved air-infiltration test performed by a qualified agency resulting in achieving the equivalent maximum air-infiltration provided in the air-sealing guidelines as determined by the building official, shall be considered an acceptable method of demonstrating compliance with RN1111.9.1.

N1111.9.2 Fenestration infiltration. Windows, skylights and sliding-glass doors shall have an air infiltration rate of no more than 0.3 cfm/ft² (1.52 L/s/m²) and swinging doors shall have an air infiltration rate of no more than 0.5 cfm/ft² (2.54 L/s/m²) when tested according to NFRC 400, 101/I.S.2, or 101/I.S.2 NAFS by an accredited, independent laboratory. All such fenestration products shall be certified according to the conditions of their listings and so labeled by the manufacturer.

Exemptions: Site-built windows, skylights and doors.

N1111.9.3 Recessed lighting. Where installed in the building thermal envelope, recessed lighting fixtures shall be sealed to limit infiltration between conditioned and unconditioned space. Such fixtures shall be one of the following types:

1. IC-rated and labeled with enclosures that are sealed or gasketed to prevent air leakage to the ceiling cavity or unconditioned space; or
2. IC-rated and labeled as meeting ASTM E 283 when tested at 1.57 psi (75 Pa) pressure differential with no more than 2.0 cfm (0.944 L/s) of air movement from the conditioned space to the ceiling cavity; or
3. located inside an airtight sealed box with clearances of at least 0.5 inches (12.7 mm) from combustible material and 3 inches (76 mm) from insulation.

N1111.10 Moisture control. The building design shall not create conditions hazardous to occupants or of accelerated deterioration due to the presence of excessive water vapor and condensation. Methods for moisture control shall be provided in accordance with the applicable provisions of this code and as determined necessary by the building official where special conditions or construction methods are encountered, such as steam rooms and rooms containing spas or pools, or below grade sub-floor spaces, or other interior locations subject to excessive moisture.

SECTION N1112 SYSTEMS

N1112.1 General. This section covers mechanical systems and equipment used to provide heating, ventilating and air-conditioning functions. This section assumes that residential buildings and dwelling units therein will be designed with individual HVAC systems. Where equipment not shown in Table 503.2 of the *2003 INTERNATIONAL ENERGY CONSERVATION CODE (2003 IECC)* published by the International Code Council, Inc. is specified, it shall meet the provisions of Sections 803.2.2 and 803.3.2. of such code.

N1112.2 HVAC equipment efficiency. Equipment shall meet the following minimum performance standards:

1. ANNUAL FUEL UTILIZATION EFFICIENCY (AFUE) of gas-fired or oil-fired furnace (< 225,000 Btu/h) $\geq 80\%$ and $E_t \geq 80\%$.
2. AFUE of Gas-fired or oil-fired steam and hot-water boilers (< 300,000 Btu/h) $\geq 80\%$.
3. HEATING SEASONAL PERFORMANCE FACTOR (HSPF) of air-cooled heat pumps in heating mode (<65,000 Btu/h cooling capacity) ≥ 7.9 .
4. SEASONAL ENERGY-EFFICIENCY RATIO (SEER) of air-cooled air conditioners and heat pumps in cooling mode (<65,000 Btu/h cooling capacity) ≥ 12 .

Data furnished by the equipment supplier, or certified under a nationally recognized certification procedure, shall be used to satisfy these requirements. All such equipment shall be installed in accordance with the manufacturer's instructions. Heating, cooling and service water heating equipment with equipment efficiency regulated as an AFUE, HSPF, SEER or EF shall have the efficiency specified on a label permanently attached to the equipment by the manufacturer; or such specified efficiencies shall be verified by the manufacturer's product literature and posted in the building as part of the certification pursuant to Section N1110.5.

N1112.3 Equipment sizing and testing. All heating and cooling equipment shall be sized and tested according to the provisions of Section M1401.3.

N1112.4 Controls. At least one thermostat shall be provided for each separate heating, cooling or combination heating and cooling system. Such controls when used to control comfort heating shall be capable of being set locally or remotely by adjustment or selection of sensors down to 55°F (13°C) or lower and when used to control comfort cooling shall be capable of being set locally or remotely by adjustment or selection of sensors up to 85°F (29°C) or higher. Where used to control both comfort heating and cooling, thermostatic controls shall be capable of providing a temperature range or deadband of at least 5°F (3°C) within which the supply of heating and cooling energy is shut off or reduced to a minimum.

Exceptions:

1. Special occupancy or special usage conditions approved by the code official.
2. Thermostats that require manual changeover between heating and cooling modes.

N1112.4.1 Humidistats. Humidistats used for comfort purposes shall be capable of being set to prevent the use of fossil fuel or electricity to reduce relative humidity below 60 percent or increase relative humidity above 30 percent.

N1112.5 Air-distribution duct systems. Air duct- distribution- systems shall be constructed and installed in accordance with this chapter, Section M1601 of this code, *ACCA Manual D*, *SMACNA*, or with other approved methods. Such duct systems shall be sized for whichever results in the greater system airBflow capacity requirement: either the heating load or the cooling load.

N1112.5.1 Insulation. The R-value identification mark shall be applied by the manufacturer in intervals of no greater than 3 feet (0.914 m) to insulated flexible duct products showing the thermal performance R-value for the duct insulation (excluding air films, vapor retarders or other duct components). All supply and return-air ducts and plenums installed as part of an HVAC air-distribution system in unconditioned spaces, such as unconditioned attics, vented crawl spaces, unconditioned basements, garages, spaces outside the building or spaces within a building envelope assembly, shall be thermally insulated. Supply ducts shall be insulated to a minimum of R-8. Ducts in floor trusses shall be insulated to a minimum of R-6. Return air ducts outside the building, in unconditioned spaces, and where used as plenums in exterior wall cavities shall be insulated to a minimum of R-6.

Exception: Portions of the air distribution system within appliances or equipment.

N1112.5.2 Sealing. All duct systems, air handlers, filter boxes, building cavities used to convey conditioned air, including all joints, longitudinal and transverse seams, and connections in ductwork thereof, shall be securely fastened and sealed in compliance with Section M1601.3.1.

N1112.5.3 Building cavities. Building framing cavities, such as the spaces between framing members in walls or floors, may be used as return air ducts provided all heating, ventilation, and cooling equipment and all related air-distribution systems and ductwork are pressure tested in accordance with approved procedures and which do not leak more than 25% of total system flow; and further provided that where framing cavities are used as air-distribution ducts, they are adequately sealed with approved sealants.

Exception: Building framing cavities used for passive air distribution and balancing that are not directly connected to heating, ventilation, and cooling equipment and such associated air-distribution ductwork.

N1112.6 Mechanical ventilation. Every mechanical ventilation system (supply or exhaust, or both) shall be equipped with a readily accessible switch or other means for shutoff, or volume reduction and shutoff, when ventilation is not required. Automatic or gravity dampers that close when the system is not in operation shall be provided for outdoor air intakes and exhausts.

N1112.7 Mechanical system piping insulation. Mechanical system piping capable of carrying fluids above 105 °F (41 °C) or below 55 °F (13 °F) shall be insulated to a minimum of R-2 for pipes 2-inch (12.7 mm) and less, and to a minimum of R-4 for pipes greater than 2-inch (12.7 mm).

N1112.8 Service water heating systems.

N1112.8.1 Water heaters, storage tanks and boilers. Water heaters and hot water storage tanks shall meet the minimum performance of water-heating equipment specified in Table 504.2.1 of the 2003 *INTERNATIONAL ENERGY CODE (IECC)*[®]. Where multiple criteria are listed, all criteria shall be met.

Exception: Storage water heaters and hot water storage tanks having more than 140 gallons (530 L) of storage capacity need not meet the standby loss (SL) or heat loss (HL) requirements of Table 504.2.1 of the *IECC* if the tank surface area is thermally insulated to R-12.5 and if a standing pilot light is not used.

N1112.8.2 Pipe insulation. Automatic circulating service hot water piping shall be insulated to a minimum of R-2 in conditioned spaces and to a minimum of R-3 in unconditioned spaces. In automatic-circulating hot water systems, piping heat loss shall be limited to a maximum of 17.5 Btu/h per linear foot (16.8 W/m) of pipe based on design external temperature no lower than 65°F (18°C). For external design temperatures lower than 65°F (18°C), all hot water piping shall be insulated to a minimum of R-3. Such circulating hot water systems shall include an automatic or readily accessible manual switch that can turn off the hot water circulating pump when the system is not in use.

Exception: Piping insulation is not required when the heat loss of the piping, without insulation, does not increase the annual energy requirements of the building.

N1112.8.3 Heat traps. Water heaters with vertical pipe risers shall have a heat trap on both the inlet and outlet of the water heater unless the water heater has an integral heat trap or is part of a circulating system.

N1112.8.4 Hot water system controls. Automatic-circulating hot water system pumps or heat trace shall be arranged to be conveniently turned off, automatically or manually, when the hot water system is not in operation.

N1112.8.5 Showers. Shower heads shall not exceed the flow rate of 2.5 gallons per minute (gpm) (9.5 l/m) at a pressure of 80 (psi) (551 kPa) when tested in accordance with ASME A112.18.1. Where multiple shower heads are installed in an individual shower compartment, the total combined flow of all heads shall not exceed 3 gpm (11.4 L/m).

N1112.9 Balancing. All comfort heating and cooling systems shall be provided with means for balancing air and water systems. Balancing mechanisms shall include, but not be limited to, dampers, temperature and pressure test connections, and balancing valves.

N1112.10 Transport energy. The air transport factor for each all-air system shall be not less than 5.5 when calculated in accordance with Equation 4-10. Energy for transfer of air through heat-recovery devices shall not be included in determining the air transport factor.

(Equation 4-10)

$$\text{Air Transport Factor} = \frac{\text{Space Sensible Heat Removal}^a}{\text{Supply} + \text{Return Fans(s) Power Input}^a}$$

a. Expressed in consistent units, either Btu/h or Watts.

For purposes of these calculations, space sensible heat removal is equivalent to the maximum coincident design sensible cooling load of all spaces served for which the system provides cooling. Fan power input is the rate of energy delivered to the fan prime mover.

Air and water, all-water and unitary systems employing chilled, hot, dual-temperature or condenser water-transport systems to space terminals shall not require greater transport energy (including central and terminal fan power and pump power) than an equivalent all-air system providing the same space sensible heat removal and having an air transport factor of not less than 5.5.

N1112.11 Combination service water-heating/space-heating boilers. Service water-heating equipment shall not be dependent on year-round operation of space-heating boilers; that is, boilers that have as another function winter space heating.

Exceptions:

1. Systems with service/space-heating boilers having a standby loss (Btu/h) (W) less than that calculated in equation 4-11 as determined by the fixture count method where:

(Equation 4-11)

$$\text{SL} \# \frac{(13.3 \cdot \text{pmd}) + 400}{n}$$

n

pmd = Probable maximum demand in gallons/hour as determined in accordance with the ASHRAE HVAC Applications Handbook.

n = Fraction of year when outdoor daily mean temperature exceeds 64.9°F (18°C).

The standby loss is to be determined for a test period of 24-hour duration while maintaining a boiler water temperature of 90°F (32°C) above an ambient of 60 to 90°F (16 to 32°C) and a 5-foot (1524 mm) stack on appliance.

2. For systems where the use of a single heating unit will lead to energy savings, such unit shall be utilized.

N1112.12 Swimming pools. Swimming pools shall be provided with energy-conserving measures in accordance with Sections 504.3.1 through 504.3.3. of the *2003 INTERNATIONAL ENERGY CONSERVATION CODE*.

N1112.12.1 On-off switch. All pool heaters shall be equipped with an ON-OFF switch mounted for easy access to allow shutting off the operation of the heater without adjusting the thermostat setting and to allow restarting without relighting the pilot light.

N1112.12.2 Pool covers. Heated swimming pools shall be equipped with a pool cover.

Exception: Outdoor pools deriving more than 20 percent of the energy for heating from renewable sources (computed over an operating season) are exempt from this requirement.

N1112.12.3 Time clocks. Swimming pool heater time clocks shall be installed so that the pump can be set to run in the off-peak electric demand period and can be set for the minimum time necessary to maintain the water in a clear and sanitary condition in keeping with applicable health standards.

SECTION N1113 SIMULATED PERFORMANCE ALTERNATIVE

N1113.1 Scope. This Section establishes design criteria in terms of the overall energy performance analysis of a residential building. Such analysis shall include heating, cooling, and service water heating energy only.

N1113.2 Equivalent energy performance.

N1113.2.1 Mandatory requirements. Compliance with this Section requires that the criteria of Section N1110, N1111.9, N1111.10, and N1112. be met. Verification of such compliance with Section N1111.9 shall be demonstrated by testing in accordance with the standards contained in Table N1113.5.2 (1).

N1113.2.2 Performance-based compliance. Compliance based on simulated energy performance requires that a proposed residence (proposed design) be shown to have an annual energy cost that is less than or equal to the annual energy cost of the standard reference design. Energy prices shall be taken from a source approved by the code official, such as the Department of Energy, Energy Information Administration's State Energy Price and Expenditure Report. The building official may require time-of-use pricing in energy cost calculations.

Exception: When site energy (1kWh = 3,413 Btu) is used rather than energy cost as the basis of comparison.

N1113.3 Documentation

N1113.3.1 Compliance software tools. Documentation verifying that the methods and accuracy of the compliance software tool conform to the provisions of this Section shall be provided to the code official.

N1113.3.2 Compliance report. Compliance software tools shall generate a report that documents that the proposed design has annual energy costs less than or equal to the annual energy costs of the standard reference design. The compliance documentation shall include the following information:

- a. Address of the residence;
- b. An inspection checklist documenting the building component characteristics of the proposed design as listed in Table N1113.5.2(1). The inspection checklist shall show the estimated annual energy cost for both the standard reference design and the proposed design;
- c. Name of individual completing the compliance report;
- d. Name and version of the compliance software tool.

N1113.3.3 Additional documentation. The building official is further authorized to require the following documents:

Documentation of the building component characteristics of the standard reference design.
A certification signed by the builder providing the building component characteristics of the proposed design as given in Table N1113.5.2(1).

N1113.4 Calculation procedure.

N1113.4.1 General. Except as specified by this Section, the standard reference design and proposed design shall be configured and analyzed using identical methods and techniques.

N1113.4.2 Residence specifications. The standard reference design and proposed design shall be configured and analyzed as specified by Table N1113.5.2(1). Table N1113.5.2(1) shall include by reference all notes contained in Table N1111.1.

N1113.5 Calculation and software tools.

N1113.5.1 Minimum capabilities. Calculation procedures used to comply with this section shall be software tools capable of calculating the annual energy consumption of all building elements that differ between the standard reference design and the proposed design and shall include the following capabilities:

- a. Computer generation of the standard reference design using only the input for the proposed design. The calculation procedure shall not allow the user to directly modify the building component characteristics of standard reference design.
- b. Calculation of whole-building (as a single zone) sizing for the heating and cooling equipment in the standard reference design residence in accordance with Section M1401.3 of the 2003 International Residential Code.
- c. Calculations that account for the effects of indoor and outdoor temperatures and part-load ratios on the performance of heating, ventilating and air conditioning equipment based on climate and equipment sizing.

- d. Printed approved inspection checklist listing each of the proposed design component characteristics from Table N1113.5.2(1) determined by the analysis to provide compliance along with their respective performance ratings (e.g. R-Value, U-Factor, SHGC, HSPF, AFUE, SEER, EF, etc.).

N1113.5.2 Approved tools. Performance analysis tools must be approved by the building official. Tools may be approved based on meeting a specified threshold such as a home-energy-rating tool (HERS) requiring a specified score. The building official is also authorized to approve tools for a specified application or limited scope; such as a tool approved only for building envelop tradeoffs or a tool that was not approved for SHGC tradeoffs.

N1113.5.3 Input values. When calculations require input values for building elements, other than those specified by Sections N1111, N1112, and N1113, those input values shall be taken from another approved source.

Table N1113.5.2(1) Specifications for the Standard Reference and Proposed Designs

Building Component	Standard Reference Design	Proposed Design
Above grade walls:	Type: wood frame Gross area: same as proposed U- Factor: from Table N1111.1 Solar absorptance = 0.75 Emittance = 0.90	As proposed As proposed As proposed As proposed As proposed
Basement and crawlspace walls:	Type: same as proposed Gross area: same as proposed U-Factor: from Table N1111.1 with insulation layer on interior side of walls	As proposed As proposed As proposed
Above grade floors:	Type: wood frame Gross area: same as proposed U- Factor: from Table N1111.1	As proposed As proposed As proposed
Ceilings:	Type: wood frame Gross area: same as proposed U-Factor: from Table N1111.1	As proposed As proposed As proposed
Roofs:	Type: composition shingle on wood sheathing Gross area: same as proposed Solar absorptance = 0.75 Emittance = 0.90	As proposed As proposed As proposed As proposed
Attics:	Type: vented with aperture = 1ft ² per 300 ft ² ceiling area	As proposed
Foundations:	Type: same as proposed	As proposed

Building Component	Standard Reference Design	Proposed Design
Doors:	Area: 40 ft ² Orientation: North U-factor: same as fenestration from Table N1111.1	As proposed As proposed As proposed
Glazing: ^(a)	Total area ^(b) = <u>proposed glazing area</u> Orientation: equally distributed to four cardinal compass orientations (N, E, S, &W) U-factor: from Table N1111.1 SHGC: from Table N1111.1 except that for climates with no requirement (NR) SHGC = 0.55 shall be used Interior shade fraction: Summer (all hours when cooling is required) = 0.70 Winter (all hours when heating is required) = 0.85 External shading: none	As proposed As proposed As proposed As proposed Same as standard reference design ^(c)
Skylights	None	As proposed
Thermally isolated sunrooms	None	As proposed
Air exchange rate	Specific Leakage Area (SLA) ^(d) = 0.00048 assuming no energy recovery	For residences without mechanical ventilation that are tested in accordance with ASHRAE Standard 119, Section 5.1, the measured air exchange rate ^(e) but not less than 0.35 ach. For residences with mechanical ventilation that are tested in accordance with ASHRAE Standard 119, Section 5.1, the measured air exchange rate ^(e) combined with the mechanical ventilation rate, ^(f) which shall not be less than $0.01 \times \text{CFA} + 7.5 \times (\text{N}_{\text{br}} + 1)$. where: CFA = conditioned floor area N _{br} = number of bedrooms
Mechanical	None, except where mechanical ventilation is	

Building Component	Standard Reference Design	Proposed Design
ventilation:	<p>specified by the proposed design, in which case:</p> <p>Annual vent fan energy use: $\text{kWh/yr} = 0.03942 \cdot \text{CFA} + 29.565 \cdot (N_{br} + 1)$</p> <p>where: CFA = conditioned floor area N_{br} = number of bedrooms</p>	As proposed
Internal gains:	$\text{IGain} = 17,900 + 23.8 \cdot \text{CFA} + 4104 \cdot N_{br}$ (Btu/day per dwelling unit)	Same as standard reference design
Internal mass:	An internal mass for furniture and contents of 8 pounds per square foot of floor area.	Same as standard reference design, plus any additional mass specifically designed as a thermal storage element ^(g) but not integral to the building envelope or structure.
Structural mass:	<p>For masonry floor slabs, 80% of floor area covered by R-2 carpet and pad, and 20% of floor directly exposed to room air;</p> <p>For masonry basement walls, as proposed, but with insulation required by Table N1111.1 located on the interior side of the walls;</p> <p>For other walls, for ceilings, floors, and interior walls, wood frame construction.</p>	<p>As proposed</p> <p>As proposed</p> <p>As proposed</p>
Heating systems (h),(i)	<p>Fuel type: same as proposed design</p> <p>Efficiencies:</p> <p>Electric: air-source heat pump with prevailing federal minimum efficiency</p> <p>Non electric furnaces: natural gas furnace with prevailing federal minimum efficiency</p> <p>Non electric boilers: natural gas boiler with prevailing federal minimum efficiency</p> <p>Capacity: sized in accordance with Section M1401.3 of the International Residential Code.</p>	<p>As proposed ⁽ⁱ⁾</p> <p>As proposed</p> <p>As proposed</p> <p>As proposed</p> <p>As proposed</p>
Cooling systems (h),(k)	<p>Fuel type: Electric</p> <p>Efficiency: in accordance with prevailing federal minimum standards</p> <p>Capacity: sized in accordance with Section M1401.3 of the International Residential Code.</p>	<p>As proposed ^(k)</p> <p>As proposed</p> <p>As proposed</p>
Service Water	Fuel type: same as proposed design	As proposed

Building Component	Standard Reference Design	Proposed Design
Heating	Efficiency: in accordance with prevailing Federal minimum standards Use (gal/day): $30 + 10 \cdot N_{br}$ Tank temperature: 120 F	As proposed Same as standard reference Same as standard reference
Thermal distribution systems:	A thermal distribution system efficiency (DSE) of 0.80 shall be applied to both the heating and cooling system efficiencies.	Same as standard reference design, except as specified by Table N113.5.2(2).
Thermostat	Type: manual, cooling temperature set point = 78 F; heating temperature set point = 68 F	Same as standard reference design

Notes:

- (a) Glazing shall be defined as sunlight-transmitting fenestration, including the area of sash, curbing or other framing elements, that enclose conditioned space. Glazing includes the area of sunlight-transmitting fenestration assemblies in walls bounding conditioned basements. For doors where the sunlight-transmitting opening is less than 50% of the door area, the glazing area is the sunlight transmitting opening area. For all other doors, the glazing area is the rough frame opening area for the door including the door and the frame.
- (b) For residences with conditioned basements, R-2 and R-4 residences, and townhouses, the following formula shall be used to determine glazing area:

$$A_F = 0.18 \times A_{FL} \times F_A \times F$$

where:

A_F = Total glazing area.

A_{FL} = Total floor area of directly conditioned space.

F_A = (Above grade thermal boundary gross wall area)/(above grade boundary wall area + 0.5 x below grade boundary wall area).

F = (Above grade thermal boundary wall area)/(above grade thermal boundary wall area + common wall area) or 0.56, whichever is greater.

And where:

Thermal boundary wall is any wall that separates conditioned space from unconditioned space or ambient conditions.

Above grade thermal boundary wall is any thermal boundary wall component not in contact with soil.

Below grade boundary wall is any thermal boundary wall in soil contact.

Common wall area is the area of walls shared with an adjoining dwelling unit.

- (c) For fenestrations facing within 15 degrees of true south that are directly coupled to thermal storage mass, the winter interior shade fraction shall be permitted to be increased to 0.95 in the proposed design.
- (d) Where Leakage Area (L) is defined in accordance with Section 5.1 of ASHRAE Standard 119 and where: $SLA = L / CFA$ where L and CFA are in the same units.
- (e) Tested envelope leakage shall be determined and documented by an independent party approved by the code official. Hourly calculations as specified in the 2001 ASHRAE Handbook of Fundamentals, Chapter 26, page 26.21, equation 40 (Sherman-Grimsrud model) or the equivalent shall be used to determine the energy loads resulting from infiltration.
- (f) The combined air exchange rate for infiltration and mechanical ventilation shall be determined in accordance with equation 43 of 2001 ASHRAE Handbook of Fundamentals page 26.24 and the “Whole-house Ventilation” provisions of 2001 ASHRAE Handbook of

Fundamentals, page 26.19 for intermittent mechanical ventilation.

- (g) Thermal Storage Element shall mean a component not part of the floors, walls or ceilings that is part of a passive solar system, and that provides thermal storage such as enclosed water columns, rock beds, or phase change containers. A thermal storage element must be in the same room as fenestration that faces within 15 degrees of true south, or must be connected to such a room with pipes or ducts that allow the element to be actively charged.
- (h) For a proposed design with multiple heating, cooling or water heating systems using different fuel types, then the applicable standard reference design system capacities and fuel types shall be weighted in accordance with their respective loads as calculated by accepted engineering practice for each equipment and fuel type present.
- (i) For a proposed design without a proposed heating system, a heating system with the prevailing federal minimum efficiency shall be assumed for both the standard reference design and proposed design. For electric heating systems the prevailing federal minimum efficiency air-source heat pump shall be used for the standard reference design.
- (j) For a proposed design home without a proposed cooling system, an electric air conditioner with the prevailing federal minimum efficiency shall be assumed for both the standard reference design and the proposed design.
- (k) For a proposed design with a non-storage type water heater, a 40-gallon storage-type water heater with the prevailing Federal minimum Energy Factor for the same fuel as the predominant heating fuel type shall be assumed. For the case of a proposed design without a proposed water heater, a 40-gallon storage-type water heater with the prevailing federal minimum efficiency for the same fuel as the predominant heating fuel type shall be assumed or both the proposed design and standard reference design.

Table N1113.5.2(2) Default Distribution System Efficiencies for Proposed Designs (a)		
Distribution System Configuration and Condition:	Forced Air Systems	Systems ^(b)
Distribution system components located in <i>unconditioned</i> space	0.80	0.95
Distribution systems entirely located in <i>conditioned</i> space ^(c)	0.88	1.00
<i>Proposed</i> reduced leakage with entire air distribution system located in the <i>conditioned</i> space ^(d)	0.96	
<i>Proposed</i> reduced leakage air distribution system with components located in the <i>unconditioned</i> space	0.88	
Ductless systems ^(e)	1.00	

Notes:

- (a) Default values given by this table are for untested distribution systems, which must still meet minimum requirements for duct system insulation.
- (b) Hydronic Systems shall mean those systems that distribute heating and cooling energy directly to individual spaces using liquids pumped through closed loop piping and that do not depend on ducted, forced air flows to maintain space temperatures.
- (c) Entire system in conditioned space shall mean that no component of the distribution system, including the air handler unit, is located outside of the conditioned space.
- (d) Proposed reduced leakage shall mean leakage to outdoors not greater than 3 cfm per 100 ft² of conditioned floor area and total leakage not greater than 9 cfm per 100 ft² of conditioned floor area at a pressure differential of 25 Pascal across the entire system, including the manufacturer's air handler enclosure. Total leakage of not greater than 3 cfm per 100 ft² of conditioned floor area at a pressure difference of 25 Pascal across the entire system, including the manufacturer's air handler enclosure, shall be deemed to meet this requirement without measurement of leakage to outdoors. This performance shall be specified as required in the construction documents and confirmed through field-testing of installed systems as documented by an approved independent party.
- (e) Ductless systems may have forced airflow across a coil but shall not have any ducted airflows external to the manufacturer's air handler enclosure.

PART IV – MECHANICAL

CHAPTER 13 – GENERAL REQUIREMENTS

(70) *Section M1301.1.1, Flood-resistant installation.,* is hereby amended to read as follows:

M1301.1.1 Flood-resistant installation. All references to areas prone to flooding in this chapter shall be **as established and regulated thereby in accordance with the Code of the City, Chapter 10, Flood Prevention and Protection.**

(71) *Section M1305.1, Appliance access.,* is hereby revised to read as follows:

M1305.1 Appliance access. Appliances shall be accessible for inspection, service, repair and replacement without removing permanent construction. **A level working space no less than 30 inches (762 mm) deep and 30 inches wide** shall be provided in front of the control side to service an appliance. Room heaters shall be permitted to be installed with at least an 18-inch (457 mm) working space. A platform shall not be required for room heaters.

(72) *Section, M1305.1.4.1 Ground clearance.,* is hereby amended to read as follows:

M1305.1.4.1 Ground clearance. Appliances supported from the ground shall be level and firmly supported on a concrete slab or other approved material extending above the adjoining ground **a minimum of 3 inches (76 mm).** Appliances suspended from the floor shall have a clearance of not less than 6 inches (152 mm) from the ground.

(73) *Section, M1401.3, Sizing.,* is hereby amended to read as follows:

M1401.3 Sizing and testing. **Heating and cooling equipment shall be sized based on building loads calculated in accordance with ACCA Manual J, 8th (or current) Edition or other approved heating and cooling calculation methodologies. The total sensible capacity of the cooling equipment shall not exceed the total sensible load by more than 15% for cooling-only applications; or by more than 25% for cold-climate applications in accordance with the procedures in ACCA Manual J, 8th (or current) Edition, using thermal design parameters in Table 302.1. All ducted air-distribution heating and cooling systems shall be sized using cooling loads. All heating and cooling equipment shall be tested to ensure such equipment is operating within the manufacturer's recommended operating parameters and standards, including within such parameters and standards for sufficient combustion, according to the applicable protocols established by the building official and in accordance with the mechanical code adopted by the City.**

(74) *Section , M1414.1 General.* is hereby amended to read as follows:

M1414.1 General. Fireplace stoves shall be listed, labeled and installed in accordance with the terms of the listing. Fireplace stoves shall be tested in accordance with UL 737. **Wood burning appliances shall meet the latest emission standards as stated by the State of Colorado and Federal Regulation 40 CFR Part 60, Subpart AAA.**

(75) Chapter 15, EXHAUST SYSTEMS, is hereby amended in the following respects:

(a) Section M1501, CLOTHES DRYER EXHAUST, is hereby revised to read as follows:

SECTION M1501 GENERAL

M1501.1 Outdoor discharge. The air removed by every ducted mechanical exhaust system shall be discharged to the outdoors such that the exhausted air is not returned indoors by mechanical ventilating systems. Indoor air shall not be exhausted into an attic, soffit, ridge vent or crawl space.

Exception: Whole-house ventilation-type attic fans that discharge into the attic space of dwelling units having private attics shall be permitted.

M1501.2 Indoor depressurization. Ducted exhaust systems shall not induce or create a negative pressure sufficient to cause backdrafting of naturally vented, open combustion-chamber, fuel-burning appliances, or create negative pressure in excess of negative 3 Pa. in the immediate proximity of combustion chambers of such appliances.

(b) Existing Section M1501 CLOTHES DRYERS EXHAUST, is hereby amended by renumbering the section and deleting the exception thereto, indicated in strikeout text, and adding new language to read as follows:

SECTION M1502 CLOTHES DRYERS EXHAUST

M1502.1 General. Clothes dryer exhaust systems shall be independent of all other systems, shall convey the moisture to the outdoors and shall terminate on the outside of the building. Exhaust duct terminations shall be in accordance with the dryer manufacturer's installation instructions. Screens shall not be installed at the duct termination. Exhaust ducts shall not be connected with sheet-metal screws or fastening means which extend into the duct. Exhaust ducts shall be equipped with a backdraft damper. Exhaust ducts shall be constructed of minimum 0.016-inch-thick (0.406 mm) rigid metal ducts, having smooth interior surfaces with joints running in the direction of air flow. Flexible transition ducts used to connect the dryer to the exhaust duct system shall be limited to single lengths, not to exceed 8 feet (2.438 m) in length and shall be listed and labeled in accordance with UL 2158A. Transition ducts shall not be concealed within construction.

M1502.2 Exhaust duct size. The diameter of the exhaust duct shall be as required by the clothes dryer's listing and the manufacturer's installation instructions.

M1502.3 Length limitation. The maximum length of a clothes dryer exhaust duct shall not exceed 25 feet (7.62 m) from the dryer location to the wall or roof termination. The maximum length of the duct shall be reduced 2.5 feet (0.762 m) for each 45-degree (0.79 rad) bend and 5 feet (1.524 m) for each 90-degree (1.6 rad) bend. The maximum length of the exhaust duct does not include the transition duct. **Dryer exhaust duct terminations shall not be located within 36 inches (914 mm) of exterior openings into conditioned spaces, crawl spaces, and attic spaces.**

Exception: Where the make and model of the clothes dryer to be installed is known and the manufacturer's installation instructions for such dryer are provided to the building official, the maximum length of the exhaust duct, including any transition duct, shall be permitted to be in accordance with the dryer manufacturer's installation instructions.

(c) Subsequent sections *M1502 through M1505* are retained intact except as necessary for sequential numerical consistency by renumbering them as follows:

1. **SECTION M1503 (et seq.) RANGE HOODS**
2. **SECTION M1504 (et seq.) INSTALLATION OF MICROWAVE OVENS**
3. **SECTION M1505 (et seq.) OVERHEAD EXHAUST HOODS**
4. **SECTION M1506 (et seq.) EXHAUST DUCTS**
5. **SECTION M1507 (et seq.) MECHANICAL VENTILATION**

(d) *Section M1506.2, Recirculation of air.*, is revised to read as follows:

M1507.2 Recirculation of air. Exhaust air from bathrooms and toilet rooms shall not be recirculated within a residence or to another dwelling unit. **Such exhaust air shall be conveyed directly to the outdoors and shall not discharge into an attic, crawl space, or other interior spaces.**

(76) *Section M1601.1, Duct design.*, is hereby amended to read as follows:

M1601.1 Duct design. Duct systems serving heating, cooling and ventilation equipment shall be fabricated **and sized** in accordance with the provisions of this section and *ACCA Manual D* or other approved methods.

M1601.1.1 Above-ground duct systems. Above-ground duct systems shall conform to the following:

1. Equipment connected to duct systems shall be designed to limit discharge air temperature to a maximum of 250F (121C).
2. Factory-made air ducts shall be constructed of Class 0 or Class 1 materials as designated in Table M1601.1.1(1).
3. Fibrous duct construction shall conform to the SMACNA Fibrous Glass Duct Construction Standards or NAIMA Fibrous Glass Duct Construction Standards.
4. Minimum thicknesses of metal duct material shall be as listed in Table M1601.1.1(2). Galvanized steel shall conform to ASTM A **653**.
5. Gypsum products are permitted to be used to construct return air ducts or plenums, provided that the air temperature does not exceed 125F(52C) and exposed surfaces are not subject to condensation.
6. Duct systems shall be constructed of materials having a flame-spread index not greater than 200.
7. Stud wall cavities and the spaces between solid floor joists to be utilized as air plenums shall comply with the following conditions:
 - 7.1. Such cavities or spaces shall not be utilized as a plenum for supply air.
 - 7.2. Such cavities or spaces shall not be part of a required fire-resistance-rated assembly.
 - 7.3. Stud wall cavities shall not convey air from more than one floor level.
 - 7.4. Stud wall cavities and joist space plenums shall be isolated from adjacent concealed spaces by tight-fitting fire blocking in accordance with Section R602.8.
 - 7.5 **Stud wall cavities utilized as air plenums shall be tested for air-tightness and installed in accordance with Section N1112.5.3.**

(77) Section M1601.3.1, *Joints and seams.*, is hereby amended to read as follows:

M1601.3.1 Joints, seams and connections. All longitudinal and transverse joints, seams and connections in metallic and nonmetallic ducts shall be constructed as specified in SMACNA HVAC Duct Construction Standards -- Metal and Flexible and NAIMA Fibrous Glass Duct Construction Standards. All joints, longitudinal and transverse seams and connections shall be securely fastened and sealed with welds, gaskets, mastics (adhesives), mastic-plus-embedded-fabric systems or tapes. Tapes and mastics used to seal ductwork shall be listed and labeled in accordance with UL 181A and shall be marked "181A-P" for pressure-activated tape, "181A-M" for mastic, or "181A-H" for heat-activated tape. Tapes and mastics used to seal flexible air ducts shall comply with UL 181B and shall be marked "181B-FX" for pressure-activated tape, "181B-M" for mastic. Duct connections to flanges of air distribution system equipment shall be sealed and mechanically fastened. Crimp joints for round ducts shall have a contact lap of at least 1.5 inches (38 mm) and shall be mechanically fastened by means of at least three sheet metal screws or rivets equally spaced around the joint. Tapes shall not be permitted as a sealant on any metal ducts unless such tapes are specifically listed for such purpose.

(78) Section M1601.3.8, *Flood hazard areas.*, is hereby amended to read as follows:

M1601.3.8 Flood hazard areas. In areas prone to flooding as established in accordance with the Code of the City, Chapter 10, Flood Prevention and Protection, duct systems shall be located or installed in accordance with Section R323.1.5.

(79) A new section, M1601.3.9, *System contamination.*, is hereby added to read as follows:

M1601.3.9 Construction debris and contamination. Mechanical air-handling systems and their related ducts shall be protected from the entrance of dirt, debris, and dust during the construction and installation process. Prior to passing final inspection or issuance of a Certificate of Occupancy, such systems shall be substantially free of construction-related contaminants.

(80) Section M1602.2, *Prohibited sources.*, location number "5"., is hereby amended to read as follows:

5. A room or space containing a fuel-burning appliance where such room or space serves as the sole source of return air.

Exceptions:

1. The fuel-burning appliance is a direct-vent appliance
2. The room or space complies with the following requirements:
 - 2.1. The return air shall be taken from a room or space having a volume exceeding 1 cubic foot for each 10 Btu/h (9.6 L/W) of combined input rating of all fuel-burning appliances therein.
 - 2.2. The volume of supply air discharged back into the same space shall be approximately equal to the volume of return air taken from the space.
 - 2.3. Return-air inlets shall not be located within 10 feet (3.048 m) of any appliance firebox or draft hood in the same room or space.
3. Rooms or spaces containing solid-fuel burning appliances, provided that return-air inlets are located not less than 10 feet (3.048 m) from the firebox of such appliances.

Part VI, CHAPTER 24 – FUEL GAS

(81) Section G2401.1 (101.2.), *Application.*, is hereby amended by deleting the exception to the first paragraph thereto, indicated by strikeout text, as follows:

~~Exception: As an alternative to the provisions of this code, fuel-gas piping systems, fuel-gas utilization equipment and related accessories in existing buildings that are undergoing repairs, alterations, changes in occupancy or construction of additions shall be permitted to comply with the provisions of the *International Existing Building Code*.~~

(82) Section G2403, *GENERAL DEFINITIONS*, is amended in the following respects:

(a) The term, *CONNECTOR.*, is hereby amended to read as follows:

CONNECTOR, APPLIANCE (fuel). Rigid metallic pipe and fittings, semi-rigid metallic tubing and fittings or a listed and labeled device that connects an appliance to the gas-piping system.

(b) A new term, *CONNECTOR, CHIMNEY OR VENT.*, is hereby added and inserted in alphabetical order, to read as follows:

CONNECTOR, CHIMNEY OR VENT. The pipe that connects an appliance to a chimney or vent.

(83) Section G2404.7 (301.11), *Flood Hazard.*, is hereby amended to read as follows:

G2404.7 (301.11) Flood Hazard. For structures and buildings regulated by this code that are located in **areas prone to flooding in accordance with the Code of the City, Chapter 10, Flood Prevention and Protection.** equipment and system installations regulated by this code shall be located at or above the design flood elevation and shall comply with the flood-resistant construction requirements of Section R323.

Exception: The appliance, equipment and system installations regulated by this code are permitted to be located below the design flood elevation 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 to the design flood elevation and shall comply with the flood-resistant construction requirements of Section R323.

(84) Section G2406.2 (303.3), *Prohibited locations.*, is hereby amended by deleting exceptions 3. and 4. thereto (indicated by the strikeout text below) with the remaining exceptions 1., 2., and 5. renumbered in numerical sequence.

~~3. A single wall mounted unvented room heater equipped with an oxygen depletion safety shutoff system and installed in a bathroom, provided that the input rating does not exceed 6,000 Btu/h (1.76kW) and the bathroom meets the required volume criteria of Section G2407.5.~~

~~4. A single wall mounted unvented room heater equipped with an oxygen depletion safety shutoff system and installed in a bedroom, provided that the input rating does not exceed 10,000 Btu/h (2.93 kW) and the bedroom meets the required volume criteria of Section G2407.5.~~

(85) Section G2407.5 (304.5), *Indoor combustion air.*, is hereby amended to read as follows:

G2407.5 (304.5) Indoor combustion air. The required volume of indoor air shall be determined in accordance with Section G2407.5.1 or G2407.5.2, **when the air infiltration rate is demonstrated to be 0.40 air changes per hour (ACH) or greater.** Where the air infiltration rate is demonstrated to be less than 0.40 ACH, Section G2407.5.2 shall be used. The total required volume shall be the sum of the required volume calculated for all appliances located within the space. Rooms communicating directly with the space in which the appliances are installed through openings not furnished with doors, and through combustion air openings sized and located in accordance with Section G2407.5.3, are considered to be part of the required volume.

(86) Section G2407.11 (304.11), *Combustion air ducts.*, is hereby amended in the following respects:

(a) *The exception to Item, 1.,* is hereby amended to read as follows:

Exception: Where the installation of galvanized steel ducts is not practical due to existing finish materials within dwelling units that are undergoing alteration or reconstruction, unobstructed stud and joist spaces shall not be prohibited from conveying combustion air, provided that not more than one required fireblock is removed.

(b) This section is hereby further amended by adding a new item, 9., thereto, to read as follows:

9.All combustion air openings or ducts shall be readily identifiable with an approved label or by other means warning persons that obstruction of such openings or ducts may cause fuel-burning equipment to release combustion products and dangerous levels of carbon monoxide into the building.

(87) Section G2408.2 (305.3), *Elevation of ignition source.*, is hereby amended by deleting the exception thereto as indicated by the strikethrough text below, to read as follows:

G2408.2 (305.3) Elevation of ignition source. Equipment and appliances having an ignition source shall be elevated such that the source of ignition is not less than 18 inches (457 mm) above the floor in hazardous locations and private garages. 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. Rooms or spaces that communicate directly with a parking garage through openings, and that contain fuel-gas-fired appliances, shall comply with this section.

~~Exception: Elevation of the ignition source is not required for appliances that are listed as flammable vapor resistant and for installation without elevation.~~

(88) Section G2408.4 (305.7), *Clearances from grade.*, is hereby amended to read as follows:

G2408.4 (305.7) Clearances from grade. Equipment and appliances installed at grade level shall be supported on a level concrete slab **a minimum of 3 inches (76 mm)** thick or other approved material extending above adjoining grade **a minimum of 3 inches (76 mm)** or shall be suspended a minimum of 6 inches (152 mm) above adjoining grade.

(89) Section G2409.4.5 (308.4.6), *Clearance from supply ducts.*, is hereby amended to read as follows:

G2409.4.5 (308.4.6) Clearance from supply ducts. Central-heating furnaces **where the bonnet temperature exceeds 150 °F (68 °C)**, shall have the clearance from supply ducts within 3 feet (0.914 m) of the furnace plenum be not less than that specified from the furnace plenum. No clearance is necessary beyond this distance.

(90) Section G2415 (404), *PIPING SYSTEM INSTALLATION*, is hereby amended in the following respects:

(a) Section G2415.7 (404.7), *Above-ground piping outdoors.*, is hereby amended to read as follows:

G2415.7 (404.7) Above-ground piping outdoors. All piping installed outdoors shall be elevated not less **than 6 inches (152 mm)** above ground and where installed across roof surfaces, shall be elevated not less than 3 1/2 inches (89 mm) above the roof surface. Piping installed above ground, outdoors, and installed across the surface of roofs shall be securely supported and located where it will be protected from physical damage. Where passing through an outside wall, the piping shall also be protected against corrosion by coating or wrapping with an inert material. Where piping is encased in a protective pipe sleeve, the annular space between the piping and the sleeve shall be sealed.

(b) Section G2415.9 (404.9), *Minimum burial depth.*, is hereby amended to read as follows:

G2415.9 (404.9) Minimum burial depth. Underground piping systems shall be installed a minimum depth of **18 inches (457 mm)** below grade, except as provided for in Section G2415.9.1.

G2415.9.1 (404.9.1) Individual outside appliances. Individual lines to outside lights, grills or other appliances shall be installed a minimum of **18 inches (457 mm)** below finished grade.

Exception: Approved materials installed a minimum of 6 inches (152 mm) below finished grade when covered with a concrete slab 4 inches (102 mm) in minimum thickness.

(c) *Section G2415.12 (404.12), Outlet closures.*, is hereby amended to read as follows:

G2415.12 (404.12) Outlet closures. Gas outlets **and fittings which allow for future gas line expansion** that do not connect to appliances shall be **provided with an approved gas shutoff valve with the end** capped gas tight.

Exception: Drip/Dirt legs installed at the floor level at appliances.

(91) *Section G2416 (405), Piping Bends and Changes in Direction* , is hereby amended in the following respects:

(a) *Section G2416.1 (405.1), General.* is hereby amended to read as follows:

G2416.1 (405.1) General. **Changes in direction of rigid metallic pipe specified in G2414.4 shall be made only by the use of fittings and factory bends.**

(b) *Section G2416.2 (405.2), Metallic pipe.* , is hereby amended to read as follows:

G2416.2 (405.2) Metallic pipe. **Only factory bends** in rigid metallic pipe specified in G2414.4 shall be permitted.

(92) *Section G2417.4.1 (406.4.1) Test pressure.* , is hereby amended to read as follows:

G2417.4.1 (406.4.1) Test pressure. The test pressure to be used shall be not less than one and one-half times the proposed maximum working pressure, but not less than **10 psig (67 kPa gauge)** irrespective of design pressure. Where the test pressure exceeds 125 psig (862 kPa gauge), the test pressure shall not exceed a value that produces a hoop stress in the piping greater than 50 percent of the specified minimum yield strength of the pipe.

(93) The exception to *Section G2420.5 (409.5), Equipment shutoff valve.*, is hereby amended to read as follows:

Exception: Shutoff valves for vented decorative appliances and decorative appliances for installation in vented fireplaces shall not be prohibited from being installed in an area remote from the appliance where such valves are provided with ready access. Such valves shall be permanently identified and shall serve no other equipment. **Remote valves shall be operable on the same floor as the appliance served and within 12 feet (3.658 m) of the appliance as measured along the floor line.** Piping from the shutoff valve to within 3 feet (0.914 m) of the appliance connection shall be sized in accordance with Section G2413.

(94) The first paragraph of *Section G2421.3 (410.3), Venting of regulators.*, is hereby amended to read as follows:

G2421.3 (410.3) Venting of regulators. Pressure regulators that require a vent shall have an independent vent to the outside of the building. The vent shall be designed to prevent the entry of water or foreign objects. **Vents shall not terminate within 3 feet (0.916 m) of openings into the building.**

(95) Section G2425.8 (501.8), *Equipment not required to be vented.*, is hereby amended by deleting item 7. from the list of appliances therein (indicated in strikeout text) as follows:

~~7. Room heaters listed for unvented use.~~

(96) Section G2427.5.5.1 (503.5.6.1), *Chimney lining.*, is hereby amended by deleting the exception thereto indicated in strikeout text, and reads as follows:

G2427.5.5.1 (503.5.6.1) Chimney lining. Chimneys shall be lined in accordance with Chapter 10.

~~**Exception:** Existing chimneys shall be permitted to have their use continued when an appliance is replaced by an appliance of similar type, input rating, and efficiency.~~

(97) Section G2439 (614), *CLOTHES DRYER EXHAUST*, is hereby amended in the following respects:

(a) Section G2439.1 (614.1), *Installation.*, is hereby amended to read as follows:

G2439.1 (614.1) 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.

Dryer exhaust duct terminations shall not be located within 36 inches (914 mm) of exterior openings into conditioned spaces, crawl spaces, and attic spaces

(b) Section G2439.5.1 (614.6.1), *Maximum length.*, is hereby amended by deleting the exception thereto, indicated in strikeout text, as follows:

G2439.5.1 (614.6.1) Maximum length. The maximum length of a clothes dryer exhaust duct shall not exceed 25 feet (7.620 m) from the dryer location to the outlet terminal. The maximum length of the duct shall be reduced 2.5 feet (0.762 m) for each 45-degree (0.79 rad) bend and 5 feet (1.524 m) for each 90-degree (1.6 rad) bend.

~~**Exception:** Where the make and model of the clothes dryer to be installed is known and the manufacturer's installation instructions for such dryer are provided to the building official, the maximum length of the exhaust duct, including any transition duct, shall be permitted to be in accordance with the dryer manufacturer's installation instructions.~~

(98) ~~Section G2445 (621), *UNVENTED ROOM HEATERS*, is hereby deleted in its entirety.~~

(99) Section G2447 (623), *COOKING APPLIANCES*, is hereby amended with revised language and by adding a new subsection, to read as follows:

SECTION G2447 (623) COOKING APPLIANCES

G2447.1 (623.1) Cooking appliances. Cooking appliances that are designed for permanent installation, including ranges, ovens, stoves, broilers, grills, fryers, griddles, hot plates and barbecues, shall be tested in accordance with ANSI Z21.1 or ANSI Z21.58 and shall be installed in accordance with the manufacturer's installation instructions.

G2447.2 (623.2) Prohibited location. Cooking appliances designed, tested, listed and labeled for use in commercial occupancies **may** be installed within dwelling units or within any area where domestic cooking operations occur, **when installed in accordance with manufacturer's listing regarding clearance to combustibles. Overhead cabinets shall not be located above such appliances.**

G2447.3 (623.3) Domestic appliances. Cooking appliances installed within dwelling units and within areas where domestic cooking operations occur shall be listed, labeled **and installed in accordance with manufacturer's listing for clearance to combustibles.**

G2447.4 (623.4) Range installation. Ranges installed on combustible floors shall be set on their own bases or legs and shall be installed with clearances of not less than that shown on the label.

G2447.5 Kitchens with gas ovens shall be supplied with an exhaust system vented to the outside. Ducts serving kitchen exhaust systems shall not terminate in an attic or crawl space or areas inside the building and shall not induce or create a negative pressure in excess of negative 3 Pa or adversely affect gravity-vented appliances.

(100) Section G2451 630, *INFRARED RADIANT HEATERS*, is hereby amended by adding a new subsection, G2451.3, Outdoor locations., to read as follows:

G2451.3 Outdoor locations. Infrared radiant heaters supplied by the premises fuel-gas piping systems shall not be used for heating spaces outside of a building thermal envelope as defined in Section N1107.5.

Part X, APPENDICES

(101) *APPENDIX E, MANUFACTURED HOUSING USED AS DWELLINGS*, is hereby adopted in its entirety.

(102) *Appendix F, RADON CONTROL METHODS*, is hereby adopted and amended in its entirety to read as follows:

Appendix F – RADON CONTROL METHODS

SECTION AF101 TITLE, SCOPE AND PURPOSE

AF101.1 Title. These provisions shall be known as *Appendix Chapter F, the FORT COLLINS RADON RESISTANT CONSTRUCTION CODE FOR ONE- AND TWO-FAMILY DWELLINGS*, and shall be cited as such and will be referred to herein as this appendix.

AF101.2 Scope. The provisions of this appendix shall apply to new one- and two-family dwellings completely separated from adjacent dwellings by unobstructed physical space (detached) and multiple, attached single-family dwellings (townhouses) not more than three stories in height and with each townhouse having its own separate means of egress.

AF101.3 Purpose. The purpose of this appendix is to provide minimum requirements to enhance the public safety, health and general welfare, through construction methods designed and installed to resist entry of radon gas into the occupied spaces of buildings regulated by this appendix.

SECTION AF102 DEFINITIONS

AF102.1 General. For the purpose of these requirements, the terms used shall be defined as follows:

DWELLING UNIT, SINGLE-FAMILY DETACHED. An independent, nonattached building completely separated from adjacent dwellings by unobstructed physical space, exclusively containing one dwelling unit located entirely on a separately recorded and platted parcel of land (site) bounded by property lines, and which parcel is deeded exclusively for such single-family dwelling.

DWELLING UNIT, TWO-FAMILY DETACHED. An independent, nonattached building completely separated from adjacent dwellings by unobstructed physical space, exclusively containing two dwelling units located entirely on a separately recorded and platted parcel of land (site) bounded by property lines, and which parcel is deeded exclusively for such two-family dwelling.

FOUNDATION DRAIN SYSTEM. A continuous length of drain tile, perforated pipe, or filter mat extending around all or part of the internal or external perimeter of a basement or crawl space footing designed to collect and drain away excess subsurface water.

RADON. A naturally-occurring, chemically inert, radioactive gas that is not detectable by human senses. As a gas, it can move readily through particles of soil and rock and can accumulate under the slabs and foundations of homes where it can easily enter the living space through construction cracks and openings.

SOIL-GAS-RETARDER. A continuous membrane of 3-mil (0.075 mm) cross-linked polyethylene or other equivalent material used to retard the flow of soil gases into a building.

SUBFLOOR. A concrete slab and other approved permanent floor system that directly contacts the ground and is within the walls of the living spaces of the building.

SUB-MEMBRANE DEPRESSURIZATION SYSTEM. A system designed to achieve lower sub-membrane air pressure relative to crawl space air pressure by use of a vent drawing air from beneath the soil-gas-retarder membrane.

SUB-SLAB DEPRESSURIZATION SYSTEM (Passive). A system designed to achieve lower sub-slab air pressure relative to indoor air pressure by use of a vent pipe routed through the conditioned space of a building and connecting the sub-slab area with outdoor air, thereby relying on the convective flow of air upward in the vent to draw air from beneath the slab.

TOWNHOUSE. A single-family dwelling unit constructed as part of a group of two or more attached individual dwelling units, each of which is separated from the other from the foundation to the roof and is located entirely on a separately recorded and platted parcel of land (site) bounded by property lines, and which parcel is deeded exclusively for such single-family dwelling.

SECTION AF103 REQUIREMENTS

AF103.1 General. The following required construction methods are intended to resist radon entry and prepare the building for post-construction radon mitigation (see Figure AF102).

AF103.2 Subfloor preparation. A layer of gas-permeable material shall be placed under all subfloors. The gas-permeable layer shall consist of one of the following methods except that where fills of aggregate size less than that described in Method 1 are used beneath a slab, Method 2,3, 4, or 5 must be used.

1. A uniform layer of clean aggregate, a minimum of 4 inches (102 mm) thick. The aggregate shall consist of material that will pass through a 2-inch (51 mm) sieve and be retained by a 1/4 -inch (6.4 mm) sieve. In buildings where interior footings or other barriers separate sub-grade areas, penetrations through the interior footing or barrier equal to a minimum of 12 square inches (0.094 m²) per 10 feet (3.048 m) of barrier length shall be provided. A minimum of two penetrations shall be provided per separation and be evenly spaced along the separation.

Exception: In buildings where interior footings or other barriers separate the sub-grade area, separate radon vent pipes may be installed for each sub-grade area as specified in Section AF103.5.2 in lieu of penetrations through the barrier.

2. A foundation drain pipe system installed under concrete floor slab areas less than 2,000 square feet (186 m²), consisting of a continuous loop of minimum 3-inch (76 mm.) diameter perforated pipe shall be laid in the sub-grade with the top of pipe located 1 inch (25.4 mm) below the concrete slab. The pipe may be rigid or flexible but shall have perforations fully around the circumference with a free air space equal to 1.83 square inches per square foot (127 cm²/ m²) of exterior pipe surface area. Such pipe shall be wrapped with approved filter material to prevent blocking of pipe perforations. The pipe loop shall be located inside of the exterior perimeter foundation walls not more than 12 inches (305 mm) from the perimeter foundation walls. In buildings where interior footings or other barriers separate the sub-grade area, the loop of pipe shall penetrate, or pass beneath such interior footings or barriers. For slab areas greater than 2,000 square feet (186 m²) but less than 4,000 square feet (372 m²), the preceding configuration may be used provided a minimum of 4-inch diameter (102 mm) pipe is installed. Slabs in excess of 4,000 square feet (372 m²) shall have under them separate loops for every additional 2,000

square feet (186 m²) of slab area when 3-inch (76 mm) diameter pipe is used; or, slabs may have separate loops provided for each additional increment in area between 2,000 square feet (186 m²) and 4,000 square feet (372 m²) when 4-inch (102 mm) diameter pipe is used.

3. A foundation drain soil gas collection mat system installed under concrete floor slab areas of 2,000 square feet (186 m²) or less, consisting of a continuous rectilinear loop of soil gas collection mat or drainage mat having minimum dimensions of 1 inch in height by 12 inches in width (25.4 mm in height x 305 mm in width) and a nominal cross-sectional air flow area of 12 square inches (0.0078 m²) may be laid on top of the sub-grade. The mat shall be constructed of a matrix that allows for the movement of air through it and be capable of supporting the concrete placed upon it. The matrix shall be covered by approved filter material on all four sides to prevent dirt or concrete from entering the matrix. All breaches and joints in the filter material shall be repaired prior to the placement of the slab. The loop shall be located inside the exterior perimeter foundation walls and within 12 inches (305 mm) from the perimeter foundation walls. In buildings where interior footings or other barriers separate the sub-grade area, the mat shall penetrate these interior footings or barriers to form a continuous loop around the exterior perimeter.

Slabs larger than 2,000 square feet (186 m²) but less than 4,000 square feet (372 m²) shall have under them an additional strip of mat that bisects the loop forming two areas approximately equally divided by the two halves of the rectilinear loop. Slabs larger than 4,000 square feet (372 m²) shall have separate loops for each 2,000 (186 m²) square feet; or, increased to 4,000 square feet (372 m²) when a loop is bisected as specified in the preceding configuration.

4. A uniform layer of sand (native or fill), a minimum of 4 inches (102 mm) thick, overlain by a layer or strips of geo-textile drainage matting designed to allow the lateral flow of soil gases.
5. Other materials, systems or floor designs with demonstrated capability to permit depressurization across the entire sub-floor area.

AF103.3 Entry routes. Potential radon entry routes shall be closed in accordance with Sections AF103.3.1 through AF103.3.11.

AF103.3.1 Floor openings. Openings around bathtubs, showers, water closets, pipes, wires or other objects that penetrate concrete slabs or other floor assemblies shall be filled with a polyurethane caulk or equivalent sealant applied in accordance with the manufacturer's recommendations.

AF103.3.2 Concrete joints. All control joints, isolation joints, construction joints and any other joints in concrete slabs or between slabs and foundation walls shall be sealed with a caulk or sealant. Gaps and joints shall be cleared of loose material and filled with polyurethane caulk or other elastomeric sealant applied in accordance with the manufacturer's recommendations.

AF103.3.3 Condensate drains. Condensate drains shall be trapped or routed through non-perforated pipe to daylight.

AF103.3.4 Sumps. Sump pits open to soil or serving as the termination point for sub-slab or exterior drain tile loops shall be covered with a gasketed or otherwise sealed lid. Sumps used as the suction point in a sub-slab depressurization system shall have a lid designed to accommodate the vent pipe. Sumps used as a floor drain shall have a lid equipped with a trapped inlet.

AF103.3.5 Foundation walls. Hollow block masonry foundation walls shall be constructed with either a continuous course of solid masonry, one course of masonry grouted solid, or a solid concrete beam at or above finished ground surface to prevent passage of air from the interior of the wall into the living space. Where a brick veneer or other masonry ledge is installed, the course immediately below that ledge shall be sealed. Joints, cracks or other openings around all penetrations of both exterior and interior surfaces of masonry block or wood foundation walls below the ground surface shall be filled with polyurethane caulk or equivalent sealant. Penetrations of concrete walls shall be filled.

AF103.3.6 Dampproofing. The exterior surfaces of portions of concrete and masonry block walls below the ground surface shall be damp-proofed in accordance with Section R406 of this appendix.

AF103.3.7 Air-handling units. Air-handling units in crawl spaces shall be sealed to prevent air from being drawn into the unit.

Exception: Units with gasketed seams or units that are otherwise sealed by the manufacturer to prevent leakage.

AF103.3.8 Ducts. Ductwork passing through or beneath a slab shall be of seamless material unless the air-handling system is designed to maintain continuous positive pressure within such ducting. Joints in such ductwork shall be sealed to prevent air leakage. Ductwork located in crawl spaces shall have all seams and joints sealed by closure systems in accordance with Section M1601.3.1.

AF103.4 Sub-membrane depressurization system. In buildings with interior structural floors directly above under-floor spaces containing exposed soil surfaces that are not protected by a sub-slab depressurization system, the following components of a sub-membrane depressurization system shall be installed during construction.

Exception: Buildings in which an approved mechanical ventilation system complying with Section R408 or such other equivalent system that provides equivalent depressurization across the entire sub-membrane area as determined by the building official is installed in the under-floor spaces.

AF103.4.1 Ventilation. Crawl spaces and similar under-floor spaces shall be provided with ventilation complying with Section R408.

AF103.4.2 Soil-gas-retarder. The exposed soil in under-floor spaces shall be covered with a continuous layer of soil-gas-retarder. Such ground cover joints shall overlap 6 inches (152 mm) and be sealed or taped. The edges of the ground cover shall extend a minimum of 6 inches (152 mm) up onto all foundation walls enclosing the under-floor space and shall be attached and sealed to foundation walls in an approved manner.

AF103.4.3 Vent pipe riser. A plumbing tee or other approved connection shall be inserted horizontally beneath the sheeting and connected to a 3- or 4-inch-diameter (76 mm or 102 mm) fitting with a vertical vent pipe installed through the sheeting. The vent pipe shall be extended up through the building floors, terminate at least 12 inches (305 mm) above the roof in a location at least 10 feet (3.048 m) away from any window or other opening into the conditioned spaces of the building that is less than 2 feet (0.610 m) below the exhaust point, and 10 feet (3.048 m) from any window or other opening in adjoining or adjacent buildings.

AF103.5 Sub-slab depressurization system. The following components of a sub-slab depressurization system shall be installed during construction under basement or slab-on-grade floors.

AF103.5.1 Vent pipe riser. A minimum 3-inch-diameter (76 mm) ABS or PVC DWV pipe,®or equivalent gas-tight pipe shall be embedded vertically into the sub-slab aggregate or other permeable material before the slab is cast. A “T” fitting or equivalent method shall be used to ensure that the pipe opening remains within the sub-slab permeable material. Alternatively, the 3-inch (76 mm) pipe shall be inserted directly into an interior perimeter drain tile loop or through a sealed sump cover where the sump is exposed to the sub-slab aggregate or connected to it through a drainage system.

All vent pipes shall be extended up through the building floors, terminate at least 12 inches (305 mm) above the surface of the roof in a location at least 10 feet (3.048 m) away from any window, air intake, or other opening into the conditioned spaces of the building that is less than 2 feet (0.610 m) below the exhaust point, and 10 feet (3.048 m) from any window or other opening in adjoining or adjacent buildings. The discharge end of vent pipe terminations shall be unobstructed and protected from small animal entry with a corrosion-resistant screen having openings between .25 inch (6.4 mm) and .5 inch (12.7 mm).

AF103.5.2 Multiple vent pipes. In buildings where interior footings or other barriers separate the sub-slab aggregate or other gas-permeable material, each area shall be fitted with an individual vent pipe. Vent pipes shall connect to a single vent that terminates above the roof or each individual vent pipe shall terminate separately above the roof.

AF103.6 Vent pipe drainage. All components of the radon vent pipe system shall be installed to provide positive drainage to the ground beneath the slab or soil-gas retarder.

AF103.7 Vent pipe accessibility. Radon vent pipes shall be accessible for fan installation through an attic or other area outside the habitable space.

Exception: The radon vent pipe need not be accessible in an attic space where an approved roof-top electrical supply is provided.

AF103.8 Vent pipe identification and notification. All exposed and visible interior radon vent pipes shall be conspicuously identified with at least one label on each floor and in attics provided with access openings. The label shall read substantially as follows: Radon Reduction System. In addition to the preceding label, a notice shall be placed in a conspicuous area near the vent pipe that states the following:

THIS RADON REDUCTION SYSTEM IS NOT REQUIRED TO BE TESTED AND IS A

(PASSIVE) SYSTEM, RELYING ENTIRELY ON NATURAL VENTILATION. OCCUPANTS ARE ADVISED TO TEST FOR RADON AND TAKE REMEDIAL ACTION AS NECESSARY BY INSTALLING A CONTINUOUSLY-OPERATING FAN LOCATED IN THE VENT PIPE (ACCESS TYPICALLY PROVIDED IN THE ATTIC) AND CONNECTED TO THE NEARBY PROVIDED ELECTRICAL OUTLET. Call 1-800-767-RADON FOR MORE INFORMATION.

AF103.9 Combination foundations. Combination basement/crawl space or slab-on-grade/crawl space foundations shall have separate radon vent pipes installed in each type of foundation area. Each radon vent pipe shall terminate above the roof or shall be connected to a single vent that terminates above the roof.

AF103.10 Building depressurization. Joints in air ducts and plenums in unconditioned spaces shall be substantially air tight and permanently sealed with an approved sealant, mastic, or other approved methods. Thermal envelope air infiltration requirements shall comply with the energy conservation provisions in the energy conservation code currently enacted by the City. Firestopping shall be in conformance with the most recent general building code enacted by the City or meet the requirements contained in Section R602.8.

AF103.11 Provisions for future depressurization fan installation. Permanent provisions shall be made for the future installation of an in-line fan to be connected to every radon vent pipe. Such designated fan locations shall be outside of the conditioned envelope of the building, such as in the attic, garage and similar locations, excluding crawl spaces and other interior under-floor spaces. Designated locations shall accommodate an unobstructed permanent cylindrical space with the following minimum dimensions: 12 inches (305 mm) measured radially around the radon vent pipe along a vertical distance of 30 inches (760 mm). Designated fan locations shall be permanently accessible for servicing and maintenance. An electrical circuit shall be provided within 4 feet (1.219 m) of and within sight from designated fan locations. Such circuit shall have a means of positive disconnection and be terminated in an approved electrical outlet in accordance with the applicable current electric code.

AF103.12 Depressurization fan system activation. When a passive system as constructed in accordance with this appendix is to be converted to an active system, an approved in-line fan shall be installed in a designated fan location as specified in Section AF103.11.1. Additionally, an approved permanent electric light fixture and in-line pipe couplings that facilitate fan replacement shall be provided. The in-line fan shall be designed to operate continuously for a period of not less than five years and have a minimum air-flow rating as established by the building official. A readily accessible manometer or other approved warning device that notifies occupants of a fan malfunction by a visible or audible signal shall be installed within the dwelling unit. A separate permit shall be required for installation of such fan when it is not installed at the time the building is originally approved for occupancy.

(103) APPENDIX G, SWIMMING POOLS, SPAS, AND HOT TUBS, is hereby adopted in its entirety.

(104) APPENDIX H, PATIO COVERS, is hereby adopted in its entirety.

(105) APPENDIX J, EXISTING BUILDINGS AND STRUCTURES, is hereby adopted in its entirety.

FINAL PASSAGE AND EFFECTIVE DATE

Section 4. That all of the foregoing changes enacted by this Ordinance shall become effective for implementation commencing January 1, 2005. Introduced, considered favorably on first reading on the 20th day of July A.D. 2004. Passed and adopted on final reading on the 17th day of August, A.D. 2004.