IMC

2024 GROUP A PROPOSED CHANGES TO THE I-CODES

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M2-24

IMC®: CHAPTER 2, SECTION 202, CHAPTER 4, SECTION 403, 403.3.2, 403.3.2.1, 403.3.2.3, TABLE 403.3.2.3

Proposed Change as Submitted

Proponents: Gayathri Vijayakumar, Steven Winter Associates, Inc., Steven Winter Associates, Inc. (gayathri@swinter.com); Dylan Martello, Steven Winter Associates, Inc., Steven Winter Associates, Inc. (dmartello@swinter.com)

2024 International Mechanical Code

CHAPTER 2
DEFINITIONS

SECTION 202
GENERAL DEFINITIONS

BALANCED VENTILATION SYSTEM. A ventilation system that simultaneously supplies outdoor air to and exhausts air from a space, where the mechanical supply airflow rate and the mechanical exhaust airflow rate are each within 10 percent of the average of the two airflow rates.

CHAPTER 4
VENTILATION

SECTION 403
MECHANICAL VENTILATION

403.3.2 Group R-2, R-3 and R-4 occupancies. The design of local exhaust systems and ventilation systems for outdoor air in Group R-2, R-3 and R-4 *occupancies* shall comply with Sections 403.3.2.1 through 403.3.2.5.

403.3.2.1 Outdoor air for dwelling units. An outdoor air ventilation system consisting of a mechanical exhaust system, supply system or combination thereof shall be installed for each *dwelling unit*. Local exhaust or supply systems, including outdoor air ducts connected to the return side of an air handler, are permitted to serve as such a system. The outdoor air ventilation system shall be designed to provide the required rate of outdoor air continuously during the period that the *building* is occupied. The minimum continuous outdoor airflow rate shall be determined in accordance with Equation 4-9.

$$Q_{OA} = 0.03A_{floor} + 7.5(N_{br} + 1)$$

where: Q_{OA} = outdoor airflow rate, cfm **(Equation 4-9)**

A_{floor} = conditioned floor area, ft^2

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

Exceptions:

1. The outdoor air ventilation system is not required to operate continuously where the system has controls that enable operation for not less than 1 hour of each 4-hour period. The average outdoor airflow rate over the 4-hour period shall be not less than that prescribed by Equation 4-9.

2. The minimum mechanical ventilation rate determined in accordance with Equation 4-9 shall be reduced by 30 percent provided that both of the following conditions apply:
   2.1. A ducted system supplies *ventilation air* directly to each bedroom and to one or more of the following rooms:
      2.1.1. Living room.
      2.1.2. Dining room.
      2.1.3. Kitchen.
   2.2. The whole-house ventilation system is a *balanced ventilation system*.

Revise as follows:

403.3.2.3 Local exhaust. Local exhaust systems shall be provided in kitchens, bathrooms and toilet rooms and shall have the capacity to exhaust the minimum airflow rate determined in accordance with Table 403.3.2.3.

Exception: Where the outdoor air ventilation system is a *balanced ventilation system*, the minimum continuous kitchen exhaust rate shall be reduced to 25 cfm and the minimum continuous bathroom exhaust rate shall be reduced to 20 cfm.

TABLE 403.3.2.3 MINIMUM REQUIRED LOCAL EXHAUST RATES FOR GROUP R-2, R-3 AND R-4 OCCUPANCIES

AREA TO BE EXHAUSTED	EXHAUST RATE CAPACITY
Kitchens	100 cfm intermittent or 50 cfm continuous
Bathrooms and toilet rooms	50 cfm intermittent or 25 cfm continuous

For SI: 1 cubic foot per minute = 0.0004719 m^3/s.

Reason: There is an exception 2.2 allowed in 403.3.2.1 which is impractical for use since there isn't a corresponding exception in 403.3.2.3. In a balanced system, if you reduce the supply air, you must also allow for a reduction in the exhaust air flows. This proposal creates that needed exception. The attached excel file demonstrates that these lower proposed continuous exhaust values (25cfm/kitchen and 20 cfm/bath) make the exception 2.2 more feasible.

Cost Impact: The change proposal is editorial in nature or a clarification and has no cost impact on the cost of construction

Justification for no cost impact:

There is no expected change in cost - maybe a cost decrease since it could reduce the capacity needed for the balanced ventilation system.

Attached Files

- **2027 IMC balanced dwelling unit ventilation examples.xlsx**
  https://www.cdpaccess.com/proposal/10566/30527/files/download/4344/

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Public Hearing Results (CAH1)

Committee Action: **Disapproved**

Committee Reason: The committee voted to disapprove this proposal by a vote of 12-2. The committee's decision was based on proposed reductions that conflict with other provisions in the code that address exhaust air flows and values.

Individual Consideration Agenda

Comment 1:

IMC®: 403.3.2.3, TABLE 403.3.2.3

Proponents: Gayathri Vijayakumar, Steven Winter Associates, Inc., Steven Winter Associates, Inc. (gvijayakumar@swinter.com) requests As Modified by Committee (AMC2)

Modify as follows:

2024 International Mechanical Code

Revise as follows:

403.3.2.3 Local exhaust. Local exhaust systems shall be provided in kitchens, bathrooms and toilet rooms and shall have the capacity to exhaust the minimum airflow rate determined in accordance with Table 403.3.2.3.

> **Exception:** Where the outdoor air ventilation system is a *balanced ventilation system*, the minimum continuous kitchen exhaust rate shall be reduced to 35 ~~25~~ cfm and the minimum continuous bathroom exhaust rate shall be reduced to 20 cfm.

TABLE 403.3.2.3 MINIMUM REQUIRED LOCAL EXHAUST RATES FOR GROUP R-2, R-3 AND R-4 OCCUPANCIES

AREA TO BE EXHAUSTED	EXHAUST RATE CAPACITY
Kitchens	100 cfm intermittent or 50 cfm continuous
Bathrooms and toilet rooms	50 cfm intermittent or 25 cfm continuous

For SI: 1 cubic foot per minute = 0.0004719 m^3/s.

Reason: This public comment is in support of the proposed change to allow the lower local exhaust rates previously allowed in the IMC, but limiting the reduction only when used with balanced ventilations systems.

The ROCAH indicates that the decision to Disapprove was partly based on CAH testimony that implied there was a 'conflict with other provisions in the code'.

The section referenced in the testimony was 501.4 (Pressure equalization) and actually does not pose any 'conflict'.

The language in 501.4 referenced in the testimony is the same text as when the local exhaust rates were 25 / 20 cfm in 2021 IMC. If it did not pose a conflict then, it does not pose a conflict if the rates return to those same values in 2027 IMC.

The reason to allow the lower rates for balanced provides consistency with the 30% lower rates currently allowed for balanced systems. This PC increases the 25 cfm to 35 cfm to match the 30% reduction already allowed in Exception 2 of 403.3.2.1.

Cost Impact: The change proposal is editorial in nature or a clarification and has no cost impact on the cost of construction

Justification for no cost impact:

Possible decrease in cost compared to 2024 IMC requirement.

Comment (CAH2)# 243

M3-24

IMC®: SECTION 202 (New), CHAPTER 4, SECTION 405, 405.1, 405.2 (New)

Proposed Change as Submitted

Proponents: Jonathan Flannery, Pandemic Task Force Code Development Working Group, PTF CDWG (jflannery@aha.org)

2024 International Mechanical Code

Add new definition as follows:

BUILDING READINESS PLAN. A plan that documents the engineering controls that the facility mechanical systems will use for the facility to achieve its goals in non-normal mode.

CHAPTER 4
VENTILATION

SECTION 405
SYSTEMS CONTROL

405.1 General. Mechanical ventilation systems shall be provided with manual or automatic controls that will operate such systems whenever the spaces are occupied. Air-conditioning systems that supply required *ventilation air* shall be provided with controls designed to automatically maintain the required outdoor air supply rate during occupancy.

Add new text as follows:

405.2 Alternate Operation Capabilities. Where facilities are designed to operate in various modes in response to natural or manmade threat to/exposure of the building, the following shall be documented through an approved Building Readiness Plan (BRP). The BRP shall include the operations and maintenance (O&M) procedures involved in this operating mode, the mechanical equipment affected, final design drawings, critical asset inventory management plan, maintenance schedules, the maintenance requirements, frequencies, and establish a return to normal mode review period.

Reason: The Pandemic has demonstrated that it may be required to change operating mode of building mechanical ventilation systems under certain circumstances. These circumstances may include natural disasters such as forest fire, hurricane, pandemic, etc. or manmade such as terrorism, civil unrest, etc.

Building mechanical ventilation systems are now being built with different operating modes to reduce economic impact on the building and its occupant activities.

When such mode is created, they shall be documented for building operator to be aware of the capabilities available to operate the building.

The code does not mandate the need for alternative operating mode.

The ICC/NEHA Pandemic Task Force (PTF) was organized and tasked with researching the effects of the COVID-19 pandemic on the built environment and developing a roadmap and proposing needed resources – including guidelines, recommended practices, publications and updates to the International Codes® (I-Codes®) – that are necessary to overcome the numerous challenges that may be faced during future pandemics and to construct and manage safe, sustainable and affordable occupancy of the built environment. The ICC Pandemic Task Force Code Development Work Group (PTF CDWG) has conducted a comprehensive review of current code requirements as they relate to the prevention of the transmission of diseases and other serious health concerns and suggested revisions to current code requirements based on this assessment.

Cost Impact: The change proposal is editorial in nature or a clarification and has no cost impact on the cost of construction

Justification for no cost impact:

This proposal documents alternate operational capabilities and does not impact construction.

M3-24

Public Hearing Results (CAH1)

Committee Action: **Disapproved**

Committee Reason: The committee voted to disapprove this proposal by a vote of 10-4. The committee's decision was based on the proposal's unclear expectations and the proponents suggestion that this proposal is editorial in nature. The consensus of the committee is that the proposed code language may belong in the IPMC. Another reason is that the cost impact statement is not correct. There is a concern that the cost impact will be substantial if there is a need to install a system with increased ventilation.

M3-24

Individual Consideration Agenda

Comment 1:

IMC®: SECTION 202, SECTION 408 (New), 408.1 (New)

Proponents: Bernard Clement, Johnson Controls, ICC/NEHA Pandemic Task Force (PTF) (bernard.p.clement@jci.com); Julius Ballanco, P.E., JB Engineering and Code Consulting, P.C., Self (jbengineer@aol.com); Jonathan Flannery, ASHE/AHA, PTF CDWG (jflannery@aha.org) requests As Modified by Committee (AMC2)

Modify as follows:

2024 International Mechanical Code

BUILDING READINESS PLAN. A plan that documents the engineering controls that the facility mechanical systems will use for the facility to achieve its goals in ~~non-normal mode~~ response to natural or man-made emergencies.

Add new text as follows:

SECTION 408 SYSTEM DESIGN IN RESPONSE TO NATURAL OR MAN-MADE EXCEPTIONAL EVENT

408.1 General. Alternate Operation Capabilities. Where the ventilation system(s) in facilities are designed to operate in operationalize various alternate modes in response to natural or man-made emergencies anticipated to be over 96 hours threat to/exposure of the building, the registered design professional following shall document the alternate modes in the be documented through an approved Building Readiness Plan (BRP).The BRP shall include the emergency and related risk assessment, operations, and maintenance (O&M) procedures involved in this operating mode, the mechanical equipment affected, final design drawings, critical asset inventory management plan, maintenance schedules, the maintenance requirements, frequencies, and establish a return to normal mode review period.

Reason: The changes to the original proposal address the concerns of the opponents and committee by:

1) Moving the proposal to a new section of Chapter 4 of the IMC.

2) Removed the term non-normal mode and modified the language to address emergencies anticipated to be over 96 hours. 96 hours is based on the current requirement by FEMA to address natural emergencies.

3) Removed the language regarding an approved BRP and added the language for a registered design professional

4) The PTF CDWG members and co-proponents agree with the committee that each condition will be unique. While this proposal does not require alternative modes to be implemented nor what or how those modes will be designed its requirement that these modes be documented in a usable plan will significantly assist owners in properly operating the alternative modes.

5) While the plan is about the operational alternative modes these are developed by the design engineer during the design process and need to be properly documented at this time such that the owner/operator can properly operate the system. Since this is a part of the design process it should be included within the IMC which governs the design of mechanical systems.

Cost Impact: The change proposal is editorial in nature or a clarification and has no cost impact on the cost of construction

Justification for no cost impact:

The decision to have various operational modes is not a requirement of this proposal. This proposal requires that if a building design includes alternate operational capabilities, these capabilities shall be documented in a building readiness plan (BRP). If an owner elects to have alternate modes of operations an operational sequence will be developed during the design process. This proposal only requires that this sequence be coordinated in a building readiness plan and since the sequence is already developed during the design process the cost of the plan will be negligible. Additionally, the plan does not require alternate modes to be implemented and any associated costs or savings with the implementation would be based on the owner's decision to implement the alternate modes and not the requirement to have a BRP.

Comment (CAH2)# 101

M5-24

IMC®: SECTION 202

Proposed Change as Submitted

Proponents: Andrew Bevis, Chair, Plumbing, Mechanical and Fuel Gas Code Action Committee (pmgcac@iccsafe.org)

2024 International Mechanical Code

Revise as follows:

BOILER.
A closed heating *appliance* intended to supply *hot water* or steam for space heating, processing or power purposes. Low-pressure boilers operate at pressures less than or equal to 15 pounds per square inch (psi) (103 kPa) for steam and 160 psi (1103 kPa) for water. High-pressure boilers operate at pressures exceeding those pressures. Multipurpose or combination boilers indirectly heat potable water through a heat exchanger.

WATER HEATER.
Any heating *appliance* or *equipment* other than a *boiler* that heats potable water and supplies such water to the potable *hot water* distribution system. Water heaters operate at pressures less than or equal to 150 pounds per square inch (psi) (1035 kPa) and 210°F (99°C). Multipurpose or combination water heaters provide space heating using the *hot water* supplied.

Reason: Clarify distinction between boilers and water heaters. Align with IMC 1002.2.2 which permits dual purpose water heaters using potable water hot water system, and IPC 608.17.3 which permits indirect heating of potable water by boilers.
The addition of water heater operating parameters provides distinction with the boiler definition which provides analogous parameters and aligns with the values in IPC 504.5.

These definitions are based on the appliance function which correlates to the standard(s) to which the appliance is listed. It is not uncommon for an appliance to be dual listed to as complying with more than one standard, and to be able to be configured for different uses. As an example, a commercial appliance may be simultaneously listed as conforming to a water heater standard, a boiler standard, and a pool and spa heater standard. The definition of this example appliance when installed would depend on how it is configured and utilized within the mechanical and plumbing system.

While some jurisdictions require compliance with ASME BPVC above certain vessel sizes and input capacities (e.g. 200,000 BTU/H input capacity and 120 gallon tank size), the distinction between a water heater and boiler is not dependent upon these parameters. The scope and requirements of the applicable product standards do not make these distinctions, and the function and requirements of the appliance within the mechanical and plumbing systems under scope of the IMC and IPC do not change based on these parameters.

Cost Impact: The change proposal is editorial in nature or a clarification and has no cost impact on the cost of construction

Justification for no cost impact:

This proposal only clarifies the distinction between boilers and WHs .

M5-24

Public Hearing Results (CAH1)

Committee Action: **Disapproved**

Committee Reason: A committee vote of 8–6 disapproved the proposal. The committee reasoning is that the proposal needs work. There is currently a technical requirement in the definition. The committee would like to see this proposal again at CAH2.

Individual Consideration Agenda

Comment 1:

IMC®: SECTION 202

Proponents: Andrew Bevis, Chair, Plumbing, Mechanical and Fuel Gas Code Action Committee (pmgcac@iccsafe.org) requests As Modified by Committee (AMC2)

Modify as follows:

2024 International Mechanical Code

BOILER.
A closed heating *appliance* intended to supply *hot water* or steam for space heating, processing or power purposes. Low-pressure boilers operate at pressures less than or equal to 15 pounds per square inch (psi) (103 kPa) for steam and 160 psi (1103 kPa) for water. High-pressure boilers operate at pressures exceeding those pressures. ~~Multipurpose or combination boilers indirectly heat potable water through a heat exchanger.~~

WATER HEATER.
Any heating *appliance* or *equipment* other than a *boiler* that heats potable water and supplies such water to the potable *hot water* distribution system. Water heaters operate at pressures less than or equal to 150 pounds per square inch (psi) (1035 kPa) and 210°F (99°C). ~~Multipurpose or combination water heaters provide space heating using the *hot water* supplied.~~

Reason: Based on feedback from the committee and from AHRI members, this revised version of M5-24 removes the language regarding multi-purpose boilers and water heaters. (As a result, the boiler definition does not change from the current code.) The concern with this language was that it may not be aligned with products available in the marketplace.

The remaining language from the original M5-24 proposal was retained. The intent is to better draw a clearer distinction between water heaters and boilers to improve code usability. The addition of water heater operating parameters provides distinction with the boiler definition which provides analogous parameters and aligns with the values in IPC 504.5. These definitions are based on the appliance function which correlates to the standard(s) to which the appliance is listed. It is not uncommon for an appliance to be dual listed to as complying with more than one standard, and to be able to be configured for different uses. As an example, a commercial appliance may be simultaneously listed as conforming to a water heater standard, a boiler standard, and a pool and spa heater standard. The definition of this example appliance when installed would depend on how it is configured and utilized within the mechanical and plumbing system.

While some jurisdictions require compliance with ASME BPVC above certain vessel sizes and input capacities (e.g. 200,000 BTU/H input capacity and 120 gallon tank size), the distinction between a water heater and boiler is not dependent upon these parameters. The scope and requirements of the applicable product standards do not make these distinctions, and the function and requirements of the appliance within the mechanical and plumbing systems under scope of the IMC and IPC do not change based on these parameters.

Cost Impact: The change proposal is editorial in nature or a clarification and has no cost impact on the cost of construction

Justification for no cost impact:

The revised definitions clarifies existing requirements in the code.

Comment (CAH2)# 169

M7-24

IMC®: SECTION 202; IFGC: SECTION 202

Proposed Change as Submitted

Proponents: Marcelo Hirschler, GBH International, GBH International (mmh@gbhint.com)

2024 International Mechanical Code

Revise as follows:

COMBUSTIBLE MATERIAL. Any material not classified as a noncombustible material. ~~defined as noncombustible~~.

2024 International Fuel Gas Code

Revise as follows:

[M] COMBUSTIBLE MATERIAL. Any material not classified as a noncombustible material ~~defined as noncombustible~~.

Reason: ICC definitions should not contain requirements. The present IMC definition of "noncombustible material" does actually contain the requirement that the material passes ASTM E136. Therefore, this proposal recommends a change in language so that a combustible material is one that is not "classified" (rather than "defined") as a noncombustible material.

Section 703.3.1 of the IBC determines how to classify a material as noncombustible. If a material does not comply with those requirements it is not noncombustible. However,. the IBC does not define a material as noncombustible. This proposal addresses both the IMC and the IFGC definitions because the IFGC definition is shown as being under the responsibility of the IMC (as it is preceded by [M]).

Alternate proposals recommend that the IMC and IFGC replace their definitions of a noncombustible material by referencing section 703.3.1 of the IBC, and moving the requirements to be placed in Chapter 3, on general requirements.

IBC language:

703.3.1 Noncombustible materials. Materials required to be noncombustible shall be tested in accordance with ASTM E136. Alternately, materials required to be noncombustible shall be tested in accordance with ASTM E2652 using the acceptance criteria prescribed by ASTM E136.

Exception: Materials having a structural base of noncombustible material as determined in accordance with ASTM E136, or with ASTM E2652 using the acceptance criteria prescribed by ASTM E136, with a surfacing of not more than 0.125 inch (3.18 mm) in thickness having a flame spread index not greater than 50 when tested in accordance with ASTM E84 or UL 723 shall be acceptable as noncombustible.

Cost Impact: The change proposal is editorial in nature or a clarification and has no cost impact on the cost of construction

Justification for no cost impact:

This simply changes a definition.

M7-24

Public Hearing Results (CAH1)

Committee Action: **Disapproved**

Committee Reason: The committee voted 9-5 to disapprove this proposal. The committee's reasoning is that the proposal appears to conflict with the IBC in determining whether something is combustible or not.

M7-24

Individual Consideration Agenda

Comment 1:

IMC®: SECTION 202; IFGC: SECTION 202

Proponents: Marcelo Hirschler, GBH International, GBH International (mmh@gbhint.com) requests As Modified by Committee (AMC2)

Modify as follows:

2024 International Mechanical Code

Delete without substitution:

~~**COMBUSTIBLE MATERIAL.** Any material not classified as a noncombustible material. .~~

2024 International Fuel Gas Code

Delete without substitution:

~~**[M] COMBUSTIBLE MATERIAL.** Any material not classified as a noncombustible material .~~

Reason: The only definition of "combustible material" in the ICC codes is the one in the IMC/IFGC and it is misleading. ICC definitions should not contain requirements and the definition of "noncombustible material" in the IMC is a requirement and it is proposed to be replaced by another proposal/comment.

Deleting this definition does not conflict with the IBC (nor with any other ICC code) since the IBC does not define a "noncombustible material" but contains, in section 703, a requirement as to how to assess whether a material is noncombustible.

Companion proposals to the IMC and IFGC send the user of the codes to the IBC for what is a noncombustible material. By default, if a material is not noncombustible, it is combustible.

Section 703.3.1 of IBC 2024 states as follows:

703.3.1 Noncombustible materials. Materials required to be noncombustible shall be tested in accordance with ASTM E136. Alternately, materials required to be noncombustible shall be tested in accordance with ASTM E2652 using the acceptance criteria prescribed by ASTM E136.
Exception: Materials having a structural base of noncombustible material as determined in accordance with ASTM E136, or with ASTM E2652 using the acceptance criteria prescribed by ASTM E136, with a surfacing of not more than 0.125 inch (3.18 mm) in thickness having a flame spread index not greater than 50 when tested in accordance with ASTM E84 or UL 723 shall be acceptable as noncombustible.

Cost Impact: The change proposal is editorial in nature or a clarification and has no cost impact on the cost of construction

Justification for no cost impact:

No cost impact as this simply deletes an unnecessary definition.

Comment (CAH2)# 194

M8-24

IMC®: SECTION 202 (New), 403.1, 403.3.2.1, 403.3.2.2 (New)

Proposed Change as Submitted

Proponents: Emily Toto, ASHRAE, ASHRAE (etoto@ashrae.org)

2024 International Mechanical Code

Add new definition as follows:

CORRIDOR. An enclosed *exit access* component that defines and provides a path of egress travel.

Revise as follows:

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

Exception: Systems that are designed and installed in accordance with Section 403.3.2.1 and Chapter 6.

403.3.2.1 Outdoor air for dwelling units. Where a *dwelling unit* of new construction opens to a corridor, *outdoor air* shall be mechanically supplied directly to the *dwelling unit*. For other *dwelling units*,~~An~~ outdoor air ~~ventilation system consisting of ashall be provided using a~~ mechanical exhaust system, mechanical supply system or combination thereof~~shall be installed for each *dwelling unit*~~. Local exhaust or supply systems, including outdoor air ducts connected to the return side of an air handler, are permitted to serve as components of such a system.

~~The outdoor air ventilation system shall be designed to provide the required rate of outdoor air continuously during the period that the *building* is occupied. The minimum continuous outdoor airflow rate shall be determined in accordance with Equation 4-9.~~

$$Q_{OA} = 0.03A_{floor} + 7.5(N_{br} + 1)$$

~~(Equation 4-9)~~

~~where: Q_{OA} = outdoor airflow rate, cfm~~

~~A_{floor} = conditioned floor area, ft^2~~

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

~~Exceptions:~~

1. ~~The outdoor air ventilation system is not required to operate continuously where the system has controls that enable operation for not less than 1 hour of each 4-hour period. The average outdoor airflow rate over the 4-hour period shall be not less than that prescribed by Equation 4-9.~~
2. ~~The minimum mechanical ventilation rate determined in accordance with Equation 4-9 shall be reduced by 30 percent provided that both of the following conditions apply:~~
   - ~~2.1. A ducted system supplies *ventilation air* directly to each bedroom and to one or more of the following rooms:~~
     - ~~2.1.1. Living room.~~
     - ~~2.1.2. Dining room.~~
     - ~~2.1.3. Kitchen.~~
   - ~~2.2. The whole-house ventilation system is a *balanced ventilation system*.~~

Add new text as follows:

403.3.2.2 Outdoor air rate for dwelling units. The *dwelling unit's* outdoor air ventilation system shall be designed to provide the required rate of outdoor air continuously during the period that the *building* is occupied. The minimum continuous outdoor air rate shall be determined in accordance with Equation 4-9.

$$Q_{OA} = 0.03A_{floor} + 7.5(N_{br} + 1)$$

(Equation 4-9)

where: Q_{OA} = outdoor airflow rate, cfm

A_{floor} = conditioned floor area, ft^2

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

Exceptions:

1. The outdoor air ventilation system is not required to operate continuously where the system has controls that enable operation for not less than 1 hour of each 4-hour period. The average outdoor airflow rate over the 4-hour period shall be not less than that prescribed by Equation 4-9.
2. The minimum *outdoor air* rate determined in accordance with Equation 4-9 shall be reduced by 30 percent provided that both of the following conditions apply:
   - 2.1. A ducted system supplies *outdoor air* directly to each bedroom and to one or more of the following rooms:
     - 2.1.1. Living room.
     - 2.1.2. Dining room.
     - 2.1.3. Kitchen.
   - 2.2. The *outdoor air* ventilation system is a *balanced ventilation system*.

Reason: Both ASHRAE 62.2 and the IMC require outdoor air to be provided to dwelling units. Research has demonstrated that a large percentage of the leakage area for attached dwelling units opening to enclosed corridors occurs across the corridor wall.[1] If an exhaust-only system is used to provide outdoor air for such units, we cannot realistically expect one unit of exhaust air to provide one unit of outdoor air. Increasing the exhaust airflow could potentially overcome the deficit, but this would also be expected to draw more air from the enclosed corridor, which is not permitted by IBC Section 1020.5 and IMC Section 601.2 (i.e., “Corridors shall not serve as supply, return, exhaust, relief or ventilation air ducts.”). To ensure that outdoor air is provided directly to dwelling units opening to corridors, 62.2 was recently amended to prohibit exhaust-only ventilation systems from providing the outdoor air required by the standard. Increasing the exhaust airflow rate could also draw more air from adjacent units. This proposal will align the IMC’s requirements for ventilation of dwelling units that open to a corridor with the requirements of ASHRAE 62.2. For clarity, this proposal cross-walks the IBC definition for corridor to the IMC. There is no need to reference an “enclosed corridor” because the enclosed nature is part of the proposed definition of corridor.

Bibliography: 1. Bohac D., and Sweeney L. 2020. Energy Code Field Studies: Low-Rise Multifamily Air Leakage Testing. Prepared by the Center for Energy and Environment, Ecotope, and The Energy Conservatory. Prepared for the U.S. Department of Energy Office of Energy Efficiency & Renewable Energy. https://www.energycodes.gov/sites/default/files/documents/LRMF_AirLeakageTesting_FinalReport_2020-07-06.pdf. [See Table 45, which shows average leakage to “common” area of 42% for 211 tightly- constructed dwelling units in 20 buildings of new construction located in 6 states. The report also notes, “for buildings in this study, “common areas” are made up almost completely of corridors and a few small rooms such as mechanical closets and elevator rooms. The 42% leakage did not include leakage around the door separating a dwelling unit from the corridor, which would have further increased this value.]

Cost Impact: The change proposal is editorial in nature or a clarification and has no cost impact on the cost of construction

Estimated Immediate Cost Impact:

$513

Estimated Immediate Cost Impact Justification (methodology and variables):

An entry-level supply fan serving a single unit would cost about $240 (retail pricing as of May 22, 2023 through www.supplyhouse.com). According to Gordian Mechanical Costs with RSMeans data, 6” insulated flex duct would cost about $10.29/linear foot (line 233346101940; price includes installed cost for material and labor with contractor O&P and builder markup of 10%). For 20 feet of duct (to carry the supply air from an exterior wall to a supply register above the dwelling unit entryway), the ductwork is estimated at $10.29*20 = $206. A supply register is $67: $33 for the part and $34 for labor, based on an average of two HVAC contractor estimates. This provides the combined cost of $240+$206+$67 = $513.

Estimated Life Cycle Cost Impact:

$961

Estimated Life Cycle Cost Impact Justification (methodology and variables):

Assumes the supply fan is replaced after 15 years and a discount factor of 3% for a net present value of $154, but the ductwork and register do not need to be replaced. Assumes filter replacement twice per year at $15 each, for a net present value of $294. Combining the immediate cost and replacement cost: $513 + $154+$294 = $961

Note, however, that IMC Section 601.2 prohibits corridors from serving as “ventilation air ducts.” Because the corridor is not permitted to provide the required volume of outdoor air to the dwelling unit, it is incumbent on the designer to demonstrate that an exhaust-only system has been engineered to deliver the volume of outdoor air required. The additional system components needed to do so (e.g., dedicated outdoor air inlets, exhaust fan with higher ventilation capacity and larger ducting, improved air sealing of the dwelling unit to the corridor, etc.) and associated energy costs to operate them, would help to offset the incremental cost incurred for the supply system. For example, a study (2025-T24-Final-CASE-Report-MF-IAQ.pdf (title24stakeholders.com) found that compartmentalizing dwelling units to 0.3 cfm50/sf was approximately $450 and to 0.23 cfm50/sf was approximately $900, for an incremental sealing cost of $450 to reach the tightness required for exhaust-only systems to pull air through passive vents. (Although 0.23 cfm50/sf may not be tight enough, as discussed in Copy-of-Passive-vent-calculator-to-post-to-CARB-siteMACRO.xlsm (live.com). Assuming four passive vents at $50 each ($25 per vent, $25 for labor), an exhaust-only system has an immediate cost of approximately $450 + 4 x $50 = $650, similar to the supply-only system. Furthermore, exhaust-only systems introduce unfiltered particulate matter which can worsen IAQ, and drafts which cause discomfort to occupants.

M8-24

Public Hearing Results (CAH1)

Committee Action: **As Modified by Committee**

Committee Modification:

403.3.2.1 Outdoor air for dwelling units. Where a *dwelling unit* of new construction opens to a ~~corridor~~ *corridor*, *outdoor air* shall be mechanically supplied directly to the *dwelling unit.* For other *dwelling units,* ~~outdoor air~~ *outdoor air* shall be provided using a mechanical ~~exhaust system~~ *exhaust system*, mechanical supply system or combination thereof. Local exhaust or supply systems, including ~~outdoor air~~ *outdoor air* ducts connected to the return side of an air handler, are permitted to serve as components of such a system.

403.3.2.2 *Outdoor air* rate for *dwelling units.* The *dwelling unit's* ~~outdoor air~~ *outdoor air* ventilation system shall be designed to provide the required rate of ~~outdoor air~~ *outdoor air* continuously during the period that the *building* is occupied. The minimum continuous ~~outdoor air~~ *outdoor air* rate shall be determined in accordance with Equation 4-9.

(Equation 4-9)

where:

Q_{OA} = ~~outdoor air~~<u>*outdoor air*</u> rate, cfm

A_{floor} = conditioned floor area, ft^2

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

Exceptions:

1. The ~~outdoor air~~ <u>*outdoor air*</u> ventilation system is not required to operate continuously where the system has controls that enable operation for not less than 1 hour of each 4-hour period. The average ~~outdoor air~~<u>*outdoor air*</u> rate over the 4-hour period shall be not less than that prescribed by Equation 4-9.
2. The minimum *outdoor air* rate determined in accordance with Equation 4-9 shall be reduced by 30 percent provided that both of the following conditions apply:
   - 2.1. A ducted system supplies *outdoor air* directly to each bedroom and to one or more of the following rooms:
     - 2.1.1. Living room.
     - 2.1.2. Dining room.
     - 2.1.3. Kitchen.
   - 2.2. The *outdoor air* ventilation system is a *balanced ventilation system*.

Committee Reason: By a vote of 14-0, the committee voted to approve the proposal with modifications. The committee justifies the proposal and modification with the reasoning that the proposal aligns the code language among the I codes. With the approval of this proposal as modified, the ventilation standards for dwelling units facing a corridor will align with ASHRAE 62.2. To provide clarity, this suggestion correlates the IBC definition of a corridor to the IMC. Since the enclosed aspect is included in the suggested corridor definition, there is no need to reference an "enclosed corridor."

M8-24

<u>*Individual Consideration Agenda*</u>

Comment 1:

IMC®: SECTION 202, 403.1, 403.3.2.1, 403.3.2.2

Proponents: Emily Toto, ASHRAE, ASHRAE (etoto@ashrae.org) requests As Modified by Committee (AMC2)

Modify as follows:

2024 International Mechanical Code

CORRIDOR. An enclosed *exit access* component that defines and provides a path of egress travel.

403.1 Ventilation system. Mechanical ventilation shall be provided by a method of supply air and return or *exhaust air.* The amount of supply air shall be approximately equal to the amount of return and *exhaust air*. The system shall not be prohibited from producing negative or positive pressure. The system to convey *ventilation air* shall be designed and installed in accordance with Chapter 6.

Exception: Systems that are designed and installed in accordance with Section 403.3.2.1 and Chapter 6.

403.3.2.1 Outdoor air for dwelling units. Where a *dwelling unit* ~~of new construction~~ opens to a *corridor*, *outdoor air* shall be mechanically supplied ~~directly~~ to the *dwelling unit* <u>through ducts or other equipment that terminate within the *dwelling unit*</u>. For other *dwelling units,* *outdoor air* shall be provided using a mechanical *exhaust system*, mechanical supply system or combination thereof. Local exhaust or supply systems, including *outdoor air* ducts connected to the return side of an air handler, are permitted to serve as components of such a system.

403.3.2.2 Outdoor air rate for dwelling units. The *dwelling unit's outdoor air* ventilation system shall be designed to provide the required rate of *outdoor air* continuously during the period that the *building* is occupied. The minimum continuous *outdoor air* rate shall be determined in accordance with Equation 4-9.

$$Q_{OA} = 0.03A_{floor} + 7.5(N_{br} + 1)$$

where: Q_{OA} = *outdoor air* rate, cfm **(Equation 4-9)**

A_{floor} = conditioned floor area, ft^2

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

Exceptions:

1. The o*utdoor air* ventilation system is not required to operate continuously where the system has controls that enable operation for not less than 1 hour of each 4-hour period. The average *outdoor air* rate over the 4-hour period shall be not less than that prescribed by Equation 4-9.
2. The minimum *outdoor air* rate determined in accordance with Equation 4-9 shall be reduced by 30 percent provided that both of the following conditions apply:
   - 2.1. A ducted system supplies *outdoor air* directly to each bedroom and to one or more of the following rooms:
     - 2.1.1. Living room.
     - 2.1.2. Dining room.
     - 2.1.3. Kitchen.
   - 2.2. The *outdoor air* ventilation system is a *balanced ventilation system*.

Reason: The reason for the proposed changes are:

1) We do not need to refer to "a dwelling unit of new construction," since the code is all about new construction, and the requirements for existing dwelling units are contained in 102.4 (additions, alterations, and repairs) and in the Existing Building Code.

2) To provide more precise language about how supply air is to be provided.

Cost Impact: The change proposal is editorial in nature or a clarification and has no cost impact on the cost of construction

Justification for no cost impact:

These suggestions for improving the language of M8 were provided through discussions at PMGCAC meetings after CAH #1. They are intended only to provide clarification and do not change the cost impact provided in our first proposal. The original cost impact statement is copied below.

Original cost impact (increase):
Estimated Immediate Cost Impact:
$513

Estimated Immediate Cost Impact Justification (methodology and variables):
An entry-level supply fan serving a single unit would cost about $240 (retail pricing as of May 22, 2023 through www.supplyhouse.com). According to Gordian Mechanical Costs with RSMeans data, 6" insulated flex duct would cost about $10.29/linear foot (line 233346101940; price includes installed cost for material and labor with contractor O&P and builder markup of 10%). For 20 feet of duct (to carry the supply air from an exterior wall to a supply register above the dwelling unit entryway), the ductwork is estimated at $10.29*20 = $206. A supply register is $67: $33 for the part and $34 for labor, based on an average of two HVAC contractor estimates. This provides the combined cost of $240+$206+$67 = $513.

Estimated Life Cycle Cost Impact:
$961

Estimated Life Cycle Cost Impact Justification (methodology and variables):
Assumes the supply fan is replaced after 15 years and a discount factor of 3% for a net present value of $154, but the ductwork and register do not need to be replaced. Assumes filter replacement twice per year at $15 each, for a net present value of $294. Combining the immediate cost and replacement cost: $513 + $154+$294 = $961.

Note, however, that IMC Section 601.2 prohibits corridors from serving as “ventilation air ducts.” Because the corridor is not permitted to provide the required volume of outdoor air to the dwelling unit, it is incumbent on the designer to demonstrate that an exhaust-only system has been engineered to deliver the volume of outdoor air required. The additional system components needed to do so (e.g., dedicated outdoor air inlets, exhaust fan with higher ventilation capacity and larger ducting, improved air sealing of the dwelling unit to the corridor, etc.) and associated energy costs to operate them, would help to offset the incremental cost incurred for the supply system. For example, a study (2025-T24-Final-CASE-Report-MF-IAQ.pdf (title24stakeholders.com) found that compartmentalizing dwelling units to 0.3 cfm50/sf was approximately $450 and to 0.23 cfm50/sf was approximately $900, for an incremental sealing cost of $450 to reach the tightness required for exhaust-only systems to pull air through passive vents. (Although 0.23 cfm50/sf may not be tight enough, as discussed in Copy-of-Passive vent-calculator-to-post-to-CARB-siteMACRO.xlsm (live.com). Assuming four passive vents at $50 each ($25 per vent, $25 for labor), an exhaust-only system has an immediate cost of approximately $450 + 4 x $50 = $650, similar to the supply-only system. Furthermore, exhaust-only systems introduce unfiltered particulate matter which can worsen IAQ, and drafts which cause discomfort to occupants.

Comment (CAH2)# 298

Comment 2:

IMC®: 403.3.2.1

Proponents: Greg Johnson, Johnson & Associates Consulting Services, National Multifamily Housing Council (gjohnsonconsulting@gmail.com) requests As Modified by Committee (AMC2)

Further modify as follows:

2024 International Mechanical Code

Revise as follows:

403.3.2.1 Outdoor air for dwelling units. Where a *dwelling unit*~~of new construction~~ opens to a *corridor*, one or more *ducts* shall supply *outdoor air* ~~shall~~ be ~~mechanically supplied directly~~ to the *dwelling unit*. For other *dwelling units, outdoor air* shall be provided using a mechanical *exhaust system*, mechanical supply system or combination thereof. Local exhaust or supply systems, including *outdoor air* ducts connected to the return side of an air handler, are permitted to serve as components of ~~such a~~ *ventilation* systems.

Reason: M8 is too prescriptive. There is no reason that the fan or fans moving outdoor air for corridor adjacent dwelling unit ventilation need to be located such that outdoor air is pushed into the unit versus located to pull outdoor air into the unit. What matters is that sufficient volume of outdoor air is ducted to the unit to mitigate potential draws from the corridor. Note that the building code prohibition on using corridors as plenums is intended to mitigate fire and smoke spread in a fire event. Until that fire event, any air movement between the dwelling unit and corridor has no significance. Ducting and appropriate fire resistive construction of penetrations and joints will address the fire event.

Also note that a parallel proposal to change ASHRAE 62.2 is being introduced at ASHRAE to remove this overly prescriptive requirement.

Cost Impact: Decrease

Estimated Immediate Cost Impact:

More design flexibility in fan location and selection should tend to reduce construction costs, but specific configurations of mechanical systems are difficult to anticipate to quantify potential benefits.

Estimated Immediate Cost Impact Justification (methodology and variables):

Variables would be the size and layout of of the affected dwelling units as well as the design of the ventilation systems serving those units. Given those variables it is impossible to estimate a specific cost reduction.

Estimated Life Cycle Cost Impact:

N/A

Estimated Life Cycle Cost Impact Justification (methodology and variables):

N/A

Comment (CAH2)# 198

M9-24

IMC®: SECTION 202 (New), 1104.2, 1106.3, 1106.4

Proposed Change as Submitted

Proponents: Emily Toto, ASHRAE, ASHRAE (etoto@ashrae.org)

2024 International Mechanical Code

Add new definition as follows:

EFFECTIVE DISPERSAL VOLUME. The volume of a space or connected spaces in which leaked *refrigerant* will disperse.

EFFECTIVE DISPERSAL VOLUME CHARGE (EDVC). The maximum *refrigerant* charge permitted for an *effective dispersal volume.*

Revise as follows:

1104.2 Machinery room. Except as provided in Sections 1104.2.1 and 1104.2.2, all components containing the refrigerant shall be located either outdoors or in a *machinery room* where the quantity of refrigerant in an independent circuit of a *refrigeration system* exceeds both of the following:

1. T ~~t~~he amounts shown in Table 1103.1 , and
2. The effective dispersal volume charge as calculated in accordance with ASHRAE 15.

For refrigerant blends not listed in Table 1103.1, the same requirement shall apply ~~where the amount for any blend component exceeds that indicated in Table 1103.1~~ for each~~that~~ component. ~~This~~These requirements shall also apply where the combined amount of the blend components exceeds a limit of 69,100 parts per million (ppm) by volume. *Machinery rooms* required by this section and containing only Group A1 or B1 refrigerants shall be constructed and maintained in accordance with Section 1105. ~~for Group A1 and B1 refrigerants and in accordance with Sections 1105 and 1106 for Group A2, B2, A3 and B3 refrigerants.~~ *Machinery rooms* required by this section and containing any Group A2, B2, A3, or B3 flammable refrigerants shall be constructed and maintained in accordance with Sections 1105 and 1106. *Machinery rooms* required by this section, containing any Group A2L or B2L flammable refrigerants and containing no Group A2, B2, A3, or B3 flammable refrigerants, shall be constructed and maintained in accordance with Section 1105 and Section 1106.4.1 through 1106.4.3.

Exceptions:

1. *Machinery rooms* are not required for *listed equipment* and *appliances* containing not more than 6.6 pounds (3 kg) of refrigerant, regardless of the refrigerant's safety classification, where installed in accordance with the *equipment's* or *appliance's* listing and the *equipment* or *appliance* manufacturer's installation instructions.
2. Piping in compliance with Section 1107 is allowed in other locations to connect components installed in a *machinery room* with those installed outdoors.

1106.3 Class 2 and 3 refrigerants. Where any flammable refrigerants of Groups A2, A3, B2 and B3 are used, the *machinery room* shall conform to the Class I, Division 2, *hazardous location* classification requirements of NFPA 70.

1106.4 Group A2L and B2L refrigerants. *Machinery rooms* ~~for~~containing any Group A2L ~~and~~or B2L refrigerants and containing no refrigerants of Group A2, A3, B2, or B3 shall comply with Sections 1106.4.1 through 1106.4.3.

Reason: This proposal harmonizes with Addendum q to ASHRAE 15-2019. The latest published language of ASHRAE 15-2022 was used as the basis for this update. The revisions clarify which requirements apply in cases where a machinery room contains refrigerants from multiple safety groups. The revisions also refer to ASHRAE 15 for EDVC calculations, with the updated requirements for refrigerant charge quantity limits, for determination of when a machinery room is required.

Cost Impact: The change proposal is editorial in nature or a clarification and has no cost impact on the cost of construction

Justification for no cost impact:

This proposal will have no impact on the cost of construction. These changes for clarity are largely editorial in nature to better align the IMC with ASHRAE 15.

M9-24

Public Hearing Results (CAH1)

Committee Action: **Disapproved**

Committee Reason: The committee voted 7–6 against the proposal, with one member abstaining. The committee argues that the idea is improper since it does not clarify how to parcel out sections of the code. The committee is especially concerned about flammability and dangerous areas.

M9-24

Individual Consideration Agenda

Comment 1:

IMC®: SECTION 202 (New), SECTION 202, 1104.2, 1106.3, 1106.4

Proponents: Emily Toto, ASHRAE, ASHRAE (etoto@ashrae.org) requests As Modified by Committee (AMC2)

Modify as follows:

2024 International Mechanical Code

Add new definition as follows:

CONNECTED SPACES (REFRIGERATION). Two or more spaces connected by natural ventilation, a ducted air distribution system, or mechanical ventilation.

EFFECTIVE DISPERSAL VOLUME.
The volume of a space or ~~connected spaces~~*connected spaces* in which leaked *refrigerant* will disperse.

EFFECTIVE DISPERSAL VOLUME CHARGE (EDVC).
The maximum *refrigerant* charge permitted for an *effective dispersal volume.*

1104.2 Machinery room. Except as provided in Sections 1104.2.1 and 1104.2.2, all components containing the refrigerant shall be located either outdoors or in a *machinery room* where the quantity of refrigerant in an independent circuit of a *refrigeration system* exceeds both of the following:

1. The amounts shown in Table 1103.1, and
2. The effective dispersal volume charge as calculated in accordance with ASHRAE 15.

For refrigerant blends not listed in Table 1103.1, the same requirement shall apply for each component. These requirements shall also apply where the combined amount of the blend components exceeds a limit of 69,100 parts per million (ppm) by volume. *Machinery rooms* required by this section and containing only Group A1 or B1 refrigerants shall be constructed and maintained in accordance with Section 1105. *Machinery rooms* required by this section and containing any Group A2, B2, A3, or B3 flammable refrigerants shall be constructed and maintained in accordance with Sections 1105 and 1106. *Machinery rooms* required by this section, containing any Group A2L or B2L flammable refrigerants and containing no Group A2, B2, A3, or B3 flammable refrigerants, shall be constructed and maintained in accordance with Section 1105 and Section 1106.4.1 through 1106.4.3.

Exceptions:

1. *Machinery rooms* are not required for *listed equipment* and *appliances* containing not more than 6.6 pounds (3 kg) of refrigerant, regardless of the refrigerant's safety classification, where installed in accordance with the *equipment's* or *appliance's* listing and the *equipment* or *appliance* manufacturer's installation instructions.
2. Piping in compliance with Section 1107 is allowed in other locations to connect components installed in a *machinery room* with those installed outdoors.

1106.3 Class 2 and 3 refrigerants. Where any flammable refrigerants of Groups A2, A3, B2 and B3 are used, the *machinery room* shall conform to the Class I, Division 2, *hazardous location* classification requirements of NFPA 70.

1106.4 Group A2L and B2L refrigerants. *Machinery rooms* containing any Group A2L or B2L refrigerants and containing no refrigerants of Group A2, A3, B2, or B3 shall comply with Sections 1106.4.1 through 1106.4.3.

Reason: In response to feedback from the Technical Committee, the definition of connected spaces is added for clarity. The effective dispersal volume for refrigeration systems is determined in accordance with ASHRAE Standard 15.

Cost Impact: The change proposal is editorial in nature or a clarification and has no cost impact on the cost of construction

Justification for no cost impact:

This proposal will have no impact on the cost of construction. These changes for clarity are largely editorial in nature and better align the IMC with ASHRAE 15.

Comment (CAH2)# 203

M11-24

IMC®: SECTION 202 (New), 1104.5 (New)

Proposed Change as Submitted

Proponents: Emily Toto, ASHRAE, ASHRAE (etoto@ashrae.org)

2024 International Mechanical Code

Add new definition as follows:

GROUP CONTROLLER. An electrical or electronic control system that monitors and responds to multiple distinct inputs from two or more appliances or refrigeration machinery units.

Add new text as follows:

1104.5 Group Controller Requirements. Utilization of a group controller for multiple refrigeration systems serving the same space or connected spaces shall comply with the following:

1. The refrigerant detection system for each refrigeration system shall provide a signal to notify the group controller when mitigation actions are required in accordance with ASHRAE 15.
2. Where a group controller determines that a signal comes from one or more specific refrigeration systems, it shall be permitted for the group controller to specify which refrigeration systems activate or deactivate mitigation actions in accordance with ASHRAE 15. Where a group controller cannot determine the specific source of a signal, the group controller shall require all of the refrigeration systems serving the same space or connected spaces to activate mitigation actions in accordance with ASHRAE 15.

Reason: This code change proposal is for correlation with proposed revisions within Addendum t, ASHRAE 15-2022. Addendum t has undergone three Publication Public Reviews (PPRs) and is expected to be published in advance of the Technical Committee meetings. The requirements around group controllers contained within Addendum t are vital for data center applications, and detail how group controllers interact with refrigeration system mitigation strategies.

Cost Impact: The change proposal is editorial in nature or a clarification and has no cost impact on the cost of construction

Justification for no cost impact:

These changes will have no impact on the cost of construction. Use of a group controller is optional for refrigeration systems.

M11-24

Public Hearing Results (CAH1)

Committee Action: **Disapproved**

Committee Reason: The committee voted to disapprove this proposal with a vote of 8-6. The reasoning given is that addendum T has not been approved and that the proponent needs to develop a more suitable cost impact statement.

M11-24

Individual Consideration Agenda

Comment 1:

IMC®: SECTION 202, 1104.5

Proponents: Emily Toto, ASHRAE, ASHRAE (etoto@ashrae.org) requests As Modified by Committee (AMC2)

Modify as follows:

2024 International Mechanical Code

GROUP CONTROLLER.
An electrical or electronic control system that monitors and responds to ~~multiple~~ distinct inputs from two or more appliances or refrigeration machinery units.

1104.5 Group Controller Requirements. Utilization of a *group controller* for multiple *refrigeration systems* serving the same space or connected spaces shall comply with the following:

1. The refrigerant detection system for each *refrigeration system* shall provide a signal to notify the *group controller* when mitigation actions are required in accordance with ASHRAE 15.
2. Where a *group controller* determines that a signal comes from one or more specific *refrigeration systems*, it shall be permitted for the *group controller* to specify which *refrigeration systems* activate or deactivate mitigation actions in accordance with ASHRAE 15.
3. Where a *group controller* cannot determine the specific source of a signal, the *group controller* shall require all of the *refrigeration systems* serving the same space or connected spaces to activate mitigation actions in accordance with ASHRAE 15.
4. <u>A *group controller* shall not deactivate mitigation actions where a refrigerant detection system outputs a signal to require *refrigerant* detector replacement.</u>

Reason: We are submitting this comment based on the latest requirements from ASHRAE 15-2022 Addendum t, which is now published. These requirements are vital for data center applications where it is important to have group controllers for refrigerant system mitigation actions.

Bibliography: ANSI/ASHRAE Addendum t to ANSI/ASHRAE Standard 15, Safety Standard for Refrigeration Systems.
Published online at:

https://www.ashrae.org/file%20library/technical%20resources/standards%20and%20guidelines/standards%20addenda/15_2022_t_202

Cost Impact: The change proposal is editorial in nature or a clarification and has no cost impact on the cost of construction

Justification for no cost impact:

This proposal addresses how data center controls should be operating. It is unlikely to require new equipment because data centers are already equipped with extensive control systems due to the importance of monitoring. Under current requirements, controls are going to exist - for example - to ensure that every cooling unit can be regulated simultaneously through the building management system (BMS) in response to server loads throughout the day. Hence, this proposal would only require some programming changes to have the BMS to do one more thing than it already does, e.g., to increase airflow of a specific unit or units if there is a leak event.

Comment (CAH2)# 206

M18-24

IMC®: 307.2.1.1; IPC: [M] 314.2.1.1

Proposed Change as Submitted

Proponents: James Richardson, City of Columbus (Ohio), City of Columbus (Ohio) (jarichardson@columbus.gov)

2024 International Mechanical Code

Revise as follows:

307.2.1.1 Condensate discharge. Condensate drains shall not directly connect to any plumbing drain, waste or vent pipe. Condensate drains shall not discharge into a plumbing fixture other than a floor sink, floor drain, trench drain, mop sink, hub drain, standpipe, utility sink or laundry sink. ~~Condensate drain connections to a lavatory wye branch tailpiece or to a bathtub overflow pipe shall not be considered as discharging to a plumbing fixture.~~ Condensate drains shall be installed in accordance with Section 802.1.5 of the International Plumbing Code. Except where discharging to grade outdoors, the point of discharge of condensate drains shall be located within the same occupancy, tenant space or dwelling unit as the source of the condensate.

2024 International Plumbing Code

Revise as follows:

[M] 314.2.1.1 Condensate discharge. Condensate drains shall not directly connect to any plumbing drain, waste or vent pipe. Condensate drains shall not discharge into a plumbing fixture other than a floor sink, floor drain, trench drain, mop sink, hub drain, standpipe, utility sink or laundry sink. ~~Condensate drain connections to a lavatory wye branch tailpiece or to a bathtub overflow pipe shall not be considered as discharging to a plumbing fixture.~~ Condensate drains shall be installed in accordance with Section 802.1.5.Except where discharging to grade outdoors, the point of discharge of condensate drains shall be located within the same occupancy, tenant space or dwelling unit as the source of the condensate.

Reason: This proposal is intended to correct an issue that was created by an approved proposal in the IMC. The IMC should never dictate what fixtures are permitted to receive waste or to supersede requirements already in place in the IPC. The allowance by the IMC to connect condensate discharge to a lavatory tailpiece or a bathtub overflow, this proposal was intended to get around requirements in the IPC. The IPC provides all direction necessary to deal with waste discharge including condensate. The stricken language allows for condensate discharge to connect to lavatory tailpiece as well as bathtub overflow connections, these are the two primary fixture to experience blockages due to hair clogs. Striking the language will prevent unintended flooding that would result from such a clog. A blockage wouldn't need to be a complete blockage, it would only need to be sufficient to keep the drain from keeping up with the4 condensate discharge produced by the equipment. Adding "**Condensate drains shall be installed in accordance with IPC 802.1.5."** provides a more correct path for compliance with the requirements in the IPC.

Bibliography: See reason statement.

Cost Impact: The change proposal is editorial in nature or a clarification and has no cost impact on the cost of construction

Justification for no cost impact:

Condensate disposal is already required, if anything this proposal will eliminate potential costs associated to damage that could be the result of the portion removed.

M18-24

Public Hearing Results (CAH1)

Committee Action: **Disapproved**

Committee Reason: The committee voted to disapprove of this proposal with a vote of 8-5. The reasoning given is that this drain type should be installed in accordance with the IPC. The adoption of the proposed code language would be an issue in multi-unit dwellings where tailpieces are regularly used for purposes such as condensation.

M18-24

Individual Consideration Agenda

Comment 1:

IPC: [M] 314.2.1.1; IMC®: 307.2.1.1

Proponents: James Richardson, City of Columbus (Ohio), City of Columbus (Ohio) (jarichardson@columbus.gov) requests As Modified by Committee (AMC2)

Modify as follows:

2024 International Plumbing Code

[M] 314.2.1.1 Condensate discharge. Condensate drains shall not directly connect to any plumbing drain, waste or vent pipe. Condensate drains shall not discharge into a plumbing fixture other than a floor sink, floor drain, trench drain, mop sink, hub drain, standpipe, utility sink or laundry sink. ~~Condensate drain connections to a lavatory wye branch tailpiece or to a bathtub overflow pipe shall not be considered as discharging to a plumbing fixture.~~Condensate drains shall be installed in accordance with Section 802.1.5. Except where discharging to grade outdoors, the point of discharge of condensate drains shall be located within the same *occupancy*, tenant space or *dwelling unit* as the source of the condensate.

2024 International Mechanical Code

307.2.1.1 Condensate discharge. Condensate drains shall not directly connect to any plumbing drain, waste or vent pipe. Condensate drains shall not discharge into a plumbing fixture other than a floor sink, floor drain, trench drain, mop sink, hub drain, standpipe, utility sink or laundry sink. ~~Condensate drain connections to a lavatory wye branch tailpiece or to a bathtub overflow pipe shall not be considered as discharging to a plumbing fixture.~~Condensate drains shall be installed in accordance with Section 802.1.5 of the International Plumbing Code. Except where discharging to grade outdoors, the point of discharge of condensate drains shall be located within the same *occupancy*, tenant space or *dwelling unit* as the source of the condensate.

Reason: This proposal is intended to correct an issue that was created by an approved proposal in the IMC. The IMC should never dictate what fixtures are permitted to receive waste or to supersede requirements already in place in the IPC. The allowance by the IMC to connect condensate discharge to a lavatory tailpiece or a bathtub overflow, this proposal was intended to get around requirements in the IPC. The IPC provides all direction necessary to deal with waste discharge including condensate. The stricken language allows for condensate discharge to connect to lavatory tailpiece as well as bathtub overflow connections, these are the two primary fixture to experience blockages due to hair clogs. Striking the language will prevent unintended flooding that would result from such a clog. A blockage wouldn't need to be a complete blockage, it would only need to be sufficient to keep the drain from keeping up with the4 condensate discharge produced by the equipment. Adding "Condensate drains shall be installed in accordance with IPC 802.1.5." provides a more correct path for compliance with the requirements in the IPC. Proposal P119-24, which was approved in CAH #1, clearly puts the authority within the plumbing code to deal with this waste. 802.1.5 Non-potable clear-water waste. Where devices and equipment such as process tanks, filters, drips, and boilers, plumbing appliances, or other mechanical equipment discharge non-potable water to the building drainage system, the discharge shall be through an indirect waste pipe by means of an air break or an air gap to an approved waste receptor.

Bibliography: See reason statement.

Cost Impact: The change proposal is editorial in nature or a clarification and has no cost impact on the cost of construction

Justification for no cost impact:

Condensate disposal is already required, if anything this proposal will eliminate potential costs associated to damage that could be the result of the current code.

Comment (CAH2)# 397

M21-24

IMC®: SECTION 202, SECTION 313 (New), 313.1 (New), 313.2 (New)

Proposed Change as Submitted

Proponents: Marcelo Hirschler, GBH International, GBH International (mmh@gbhint.com)

2024 International Mechanical Code

Delete without substitution:

~~**NONCOMBUSTIBLE MATERIAL.** A material that passes ASTM E136.~~

Add new text as follows:

SECTION 313
NONCOMBUSTIBLE MATERIALS

313.1 Testing. Noncombustible materials shall be those materials that comply with Section 703.3.1 of the International Building Code.

313.2 Inherently noncombustible materials. Inherently noncombustible materials, such as concrete and steel, shall not be required to be tested to be acceptable as noncombustible materials.

Reason: The definition contained in the 2024 IMC is actually a requirement rather than a definition and ICC definitions should not contain requirements.

In the area of material regulation, materials that pass ASTM E136 have long been considered to be those that are noncombustible materials, and that concept is consistent with the definition presently in the IMC but that "definition" is actually a requirement, which should be moved out of Chapter 2. Chapter 3 is the chapter for general requirements.

Note that ASTM E136 is one of the very few ASTM fire test standards that has acceptance criteria. The acceptance criteria are different from the theoretical definition of a noncombustible material.

Unless a requirement exists, experience indicates that some material manufacturers have claimed that their material is noncombustible when it simply exhibits improved fire performance. When searching the internet, multiple web sites offer materials or products that are alleged to be noncombustible when that claim is incorrect. There is often a confusion in the public mind when considering a material that performs better than typical combustible materials, but should not be considered noncombustible.

This proposal recommends including a correct requirement for what materials shall be considered noncombustible materials and it is to comply with the IBC section 703.3.1. A second section states that a requirement for what is a noncombustible material does not mean that clearly noncombustible materials, such as steel, concrete, or masonry, need to be tested, for example to ASTM E136.

Equivalent proposals are being submitted to the IFC (by FCAC), the IPC, and the IFGC, all of which use noncombustible materials.

Another proposal revises the definitions of "combustible material" in the IMC and IFGC to clarify that the whether a material is or is not noncombustible is the result of a classification. The IBC does not "define" a noncombustible material but contains requirements for such materials.

The language in section 703.3.1 of the IBC reads as follows:

703.3.1 Noncombustible materials. Materials required to be noncombustible shall be tested in accordance with ASTM E136. Alternately, materials required to be noncombustible shall be tested in accordance with ASTM E2652 using the acceptance criteria prescribed by ASTM E136.

Exception: Materials having a structural base of noncombustible material as determined in accordance with ASTM E136, or with ASTM E2652 using the acceptance criteria prescribed by ASTM E136, with a surfacing of not more than 0.125 inch (3.18 mm) in thickness having a flame spread index not greater than 50 when tested in accordance with ASTM E84 or UL 723 shall be acceptable as noncombustible.

Cost Impact: The change proposal is editorial in nature or a clarification and has no cost impact on the cost of construction

Justification for no cost impact:

This simply moves a requirement from a definition into a section where it can be actually applied, without changing the content.

M21-24

Public Hearing Results (CAH1)

Committee Action: **Disapproved**

Committee Reason: The committee voted for disapproval 14-0. The proponent recommended this proposal for disapproval with a goal to correct the proposal and bring it back to be heard during CAH2.

M21-24

Individual Consideration Agenda

Comment 1:

IMC®: SECTION 202, SECTION 313, 313.1, 313.2

Proponents: Marcelo Hirschler, GBH International, GBH International (mmh@gbhint.com) requests As Modified by Committee (AMC2)

Modify as follows:

2024 International Mechanical Code

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SECTION 313
NONCOMBUSTIBLE BUILDING MATERIALS

313.1 Testing. Noncombustible building materials shall be those materials that comply with Section 703.3.1 of the International Building Code.

Revise as follows:

313.2 ~~Inherently noncombustible materials~~ Testing not required. ~~Inherently noncombustible materials, such as concrete and steel,~~ The following building materials shall not be required to be tested to be acceptable as noncombustible building materials.

1. Steel,

2. Concrete, containing no combustible aggregates or fibers,
3. Masonry, containing no combustible aggregates or fibers,
4. Glass (excluding plastic glazing),
5. 5xxx and 6xxx series aluminum alloys.

Reason: As explained with the original proposal, the IMC definition is actually a requirement which is something that should not be included in ICC definitions. This change sends the requirements to the IBC where the testing requirements are included and takes them out of the definitions section.

Several materials can claim to be inherently noncombustible, in many cases without it being truly valid. For example, any plastic or wood materials are always combustible. This issue is an important consideration for building materials (see for example chapter 6 of the IMC where requirements are different depending on whether the materials are or are not noncombustible.

Some materials exist (often insulation materials) where it is not possible to determine without testing (normally to ASTM E136, as required in the IBC) whether they are truly noncombustible. For example, fiberglass insulation materials will always contain some combustible binder to be useful. The material can pass the ASTM E136 test (and be noncombustible) if it contains a small amount of binder but fail the test with larger amount of binder. That can only be determined by testing and is impossible to note visually.

It makes no sense to test steel, concrete or masonry (if they contain no combustible aggregates or fibers; this would have to be certified by the proponent. Therefore, as it has been shown by testing (and common sense) that testing steel, concrete or masonry to ASTM E136 is unnecessary, as they will pass the test they can be excluded from being required to be tested.

However, some new building materials are made with organic (such as foam plastics) components to lower the weight and make them easier to manipulate. In that case, it is unclear whether they are truly noncombustible materials, and they would need to be tested to know the answer for sure. That is why the requirement has been added that they contain no combustible aggregates or fibers.

Test results from at least two testing labs have been able to show that glass (whether ordinary glass or quartz) truly meets the requirements of ASTM E136 and is a noncombustible material. The same is not true for other glazing materials, which are typically plastic and are combustible; they must be excluded.

That brings up the question of aluminum. Typical building materials are, more often than not, alloys of aluminum and other metals. The Aluminum Association has published a report in Building Safety Journal (August 17th, 2020) where they discuss the “noncombustibility” of aluminum. It is of great interest that the 4 aluminum alloys that they tested “were selected for their widespread use in construction”. Those alloys tested all passed the ASTM E136 test. However, the same report also states that “Aluminum, just like many comparable metals, is not combustible in any general application other than when it is specifically made to be.” That suggests that there may be some aluminum alloys that may or may not be noncombustible. After considerable debate and investigation of test reports, consensus was reached that most of the aluminum alloys used as building materials belong to the 6xxx series of alloys, with less than 1.2% magnesium, and the main ones (such as 6063, 6061, 6005) have all been tested for noncombustibility. In terms of sheet aluminum products, the series 5xxx alloys (such as 5052, 5083, 5005) are often used in construction, with higher levels if magnesium (the highest being 5083, which contains 4.9% magnesium). This product has also been tested and shown to be noncombustible. Therefore, consensus was reached that it is safe to include “5xxx and 6xxx series aluminum alloys” to the list of building materials that do not require testing to be considered noncombustible materials.

Cost Impact: The change proposal is editorial in nature or a clarification and has no cost impact on the cost of construction

Justification for no cost impact:

This simply sends the user to the IBC for information on noncombustible materials and is consistent with what the requirements are now, in the definition.

Comment (CAH2)# 108

M22-24

IMC®: 401.1, 401.2, SECTION 403, 403.1, 403.3, 403.3.1, 403.3.2, 403.3.2.1, 403.3.2.2, 403.3.2.3, TABLE 403.3.2.3

Proposed Change as Submitted

Proponents: Mike Moore, Stator LLC, Broan-NuTone (mmoore@statorllc.com)

2024 International Mechanical Code

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

Revise as follows:

401.2 Ventilation required. ~~Every occupied space shall be ventilated by natural means in accordance with Section 402 or by mechanical means in accordance with Section 403.~~ *Dwelling units* complying with the air leakage requirements of the *International Energy Conservation Code* or ASHRAE 90.1 shall be ventilated by mechanical means in accordance with Section 403. Ambulatory care facilities and Group I-2 *occupancies* shall be ventilated by mechanical means in accordance with Section 407. Enclosed parking garages shall be ventilated by mechanical means in accordance with Section 404. Every other occupied space shall be ventilated by natural means in accordance with Section 402 or by mechanical means in accordance with Section 403.

SECTION 403
MECHANICAL VENTILATION

Revise as follows:

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

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

Exceptions:

1. Enclosed parking garages complying with Section 404.
2. Spaces in ambulatory care facilities and Group I-2 occupancies complying with Section 407.

403.3.1 Spaces other than dwelling units in Group R-2, R-3, and R-4 occupancies~~Other buildings intended to be occupied~~. The design of local exhaust systems and ventilation systems for outdoor air for spaces ~~*occupancies*~~other than *dwelling units* in Group~~s~~ R-2, R-3 and R-4 occupancies shall comply with Sections 403.3.1.1 through 403.3.1.4.

403.3.2 Dwelling units in Group R-2, R-3 and R-4 occupancies. The design of local exhaust systems and ventilation systems for outdoor air for *dwelling units* in Group R-2, R-3 and R-4 *occupancies* shall comply with Sections 403.3.2.1 through 403.3.2.5.

403.3.2.1 Outdoor air for dwelling units. An outdoor air ventilation system consisting of a mechanical exhaust system, supply system or combination thereof shall be installed for each *dwelling unit*. Local exhaust or supply systems, including outdoor air ducts connected to the return side of an air handler, are permitted to serve as such a system. The outdoor air ventilation system shall be designed to provide the required rate of outdoor air continuously during the period that the building is occupied. The minimum continuous outdoor airflow rate shall be determined in accordance with Equation 4-9.

$$Q_{OA} = 0.03A_{floor} + 7.5(N_{br} + 1)$$

where: Q_{OA} = outdoor airflow rate, cfm **(Equation 4-9)**

A_{floor} = conditioned floor area, ft^2

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

Exceptions:

1. The outdoor air ventilation system is not required to operate continuously where the system has controls that enable operation for not less than 1 hour of each 4-hour period. The average outdoor airflow rate over the 4-hour period shall be not less than that prescribed by Equation 4-9.
2. The minimum mechanical ventilation rate determined in accordance with Equation 4-9 shall be reduced by 30 percent provided that both of the following conditions apply:
   - 2.1. A ducted system supplies *ventilation air* directly to each bedroom and to one or more of the following rooms:
     - 2.1.1. Living room.
     - 2.1.2. Dining room.
     - 2.1.3. Kitchen.
   - 2.2. The ~~whole-house~~ outdoor air ventilation system is a *balanced ventilation system*.

Delete without substitution:

~~**403.3.2.2 Outdoor air for other spaces.** Corridors and other common areas within the conditioned space shall be provided with outdoor air at a rate of not less than 0.06 cfm per square foot [0.0003 $m^3/(s \times m^2)$] of floor area.~~

Revise as follows:

~~**403.3.2.3**~~ **403.3.2.2 Local exhaust.** Local exhaust systems shall be provided in kitchens, bathrooms and toilet rooms and shall have the capacity to exhaust the minimum airflow rate determined in accordance with Table 403.3.2.~~3~~2.

TABLE ~~403.3.2.3~~ 403.3.2.2 MINIMUM REQUIRED LOCAL EXHAUST RATES FOR DWELLING UNITS IN GROUP R-2, R-3 AND R-4 OCCUPANCIES

AREA TO BE EXHAUSTED	EXHAUST RATE CAPACITY
Kitchens	100 cfm intermittent or 50 cfm continuous
Bathrooms and toilet rooms	50 cfm intermittent or 25 cfm continuous

For SI: 1 cubic foot per minute = 0.0004719 m^3/s.

Reason: These modifications are needed to clarify ventilation requirements for sleeping units, dwelling units, and other spaces within Group R-2, R-3, and R-4 occupancies. A summary of the results of the proposed modifications is as follows:

1. All dwelling units in Group R-2, R-3, and R-4 occupancies shall comply with Section 403.3.2. This is consistent with the prior IMC cycle's action on proposal M19-21.

2. Where provided with mechanical ventilation, all spaces other than dwelling units in Group R-2, R-3, and R-4 occupancies shall comply with Section 403.3.1 (this is meant to parallel the scope divisions of ASHRAE 62.2 and ASHRAE 62.1), with the exception of enclosed parking garages, ambulatory care facilities, and Group I-2 occupancies are addressed elsewhere.

Section 403.3.2 should be restricted to dwelling units because it is based on ASHRAE 62.2 (whose scope is restricted to dwelling units) and is poorly equipped to address spaces in Group R-2, R-3, and R-4 occupancies that are not dwelling units (e.g., dormitory sleeping units, public bathrooms, public laundry rooms, exercise rooms, meeting rooms, etc.). There is currently a subsection to address outdoor air requirements for "corridors and other common areas" within Section 403.3.2, but it is not clear how to apply this section to the myriad of spaces that are better addressed in Section 403.3.1.

Cost Impact: The change proposal is editorial in nature or a clarification and has no cost impact on the cost of construction

Justification for no cost impact:

This proposal primarily clarifies existing requirements for ventilation.

M22-24

Public Hearing Results (CAH1)

Committee Action: **Disapproved**

Committee Reason: The committee voted 14-0 in disapproval of this proposal. The committee argues that, contrary to the proponent's suggestions, this proposal does not make clear the current ventilation requirements.

M22-24

Individual Consideration Agenda

Comment 1:

IMC®: SECTION 202 (New), 401.2, SECTION 403, 403.1, 403.3, 403.3.1, TABLE 403.3.1.1, 403.3.2, 403.3.2.1, 403.3.2.2, 403.3.2.3, TABLE 403.3.2.3

Proponents: Mike Moore, Stator LLC, The Home Ventilating Institute (mmoore@statorllc.com); Gayathri Vijayakumar, Steven Winter Associates, Inc., Steven Winter Associates, Inc. (gvijayakumar@swinter.com) requests As Modified by Committee (AMC2)

Replace as follows:

2024 International Mechanical Code

Add new definition as follows:

CORRIDOR. An enclosed exit access component that defines and provides a path of egress travel.

PRIVATE GARAGE. A building or portion of the building in which motor vehicles used by the owner or tenants of the building or buildings on the premises are stored or kept, without provisions for repairing or servicing such vehicles for profit.

401.2 Ventilation required. ~~Every occupied space shall be ventilated by natural means in accordance with Section 402 or by mechanical means in accordance with Section 403.~~ *Dwelling units* complying with the air leakage requirements of the *International Energy Conservation Code* or ASHRAE 90.1 shall be ventilated by mechanical means in accordance with Section 403. Ambulatory care facilities and Group I-2 *occupancies* shall be ventilated by mechanical means in accordance with Section 407. Enclosed parking garages shall be ventilated by mechanical means in accordance with Section 403. Every other occupied space shall be ventilated by natural means in accordance with Section 402 or by mechanical means in accordance with Section 403.

Exception: Ventilation by mechanical means shall not be required for an enclosed *private garage* serving a single *dwelling unit*.

SECTION 403
MECHANICAL VENTILATION

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

Exception: Systems that are designed and installed in accordance with Section 403.3.2.1 and Chapter 6.

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

403.3.1 Spaces other than dwelling units in Group R-2, R-3, and R-4 occupancies ~~Other buildings intended to be occupied~~. The design of local exhaust systems and *outdoor air* ventilation systems ~~for outdoor air~~ for spaces ~~*occupancies*~~other than *dwelling units* in Group~~s~~ R-2, R-3, and R-4 *occupancies* shall comply with Sections 403.3.1.1 through 403.3.1.4.

TABLE 403.3.1.1 MINIMUM VENTILATION RATES

Portions of table not shown remain unchanged.

OCCUPANCY CLASSIFICATION	OCCUPANT DENSITY #/1000 FT^{2} [a]	PEOPLE OUTDOOR AIRFLOW RATE IN BREATHING ZONE, R_p CFM/PERSON	AREA OUTDOOR AIRFLOW RATE IN BREATHING ZONE, R_a CFM/FT^{2} [a]	EXHAUST AIRFLOW RATE CFM/FT^{2} [a]
Hotels, motels, resorts and dormitories ; sleeping units and spaces in Group R-2, R-3, and R-4 occupancies other than dwelling units				
Bathrooms/toilet—private[g]	—	—	—	25/50[f]
Bedroom/living room	10	5	0.06	—
Conference/meeting	50	5	0.06	—
Dormitory sleeping areas	20	5	0.06	—
Kitchens, private[b]	—	—	—	50/100[f]
Gambling casinos	120	7.5	0.18	—
Laundry rooms, central	10	5	0.12	—
Laundry rooms within dwelling units	10	5	0.12	—
Lobbies/prefunction	30	7.5	0.06	—
Multipurpose assembly	120	5	0.06	—
~~**Private dwellings, single and multiple**~~				
~~Garages, common for multiple units[b]~~	—	—	—	~~0.75~~
~~Kitchens[b]~~	—	—	—	~~50/100[f]~~
~~Living areas[c]~~	~~Based on number of bedrooms. First bedroom, 2; each additional bedroom, 1~~	~~0.35 ACH but not less than 15 cfm/person~~	—	—
~~Toilet rooms and bathrooms[g]~~	—	—	—	~~25/50[f]~~
Public spaces				
Toilet rooms — public[g]	—	—	—	50/70[e]
Storage				
Repair garages, enclosed public parking garages[b,d], enclosed *private garages* serving multiple *dwelling units*[b]	—	—	—	0.75

b. Mechanical exhaust required and the recirculation of air from such spaces is prohibited. Recirculation of air that is contained completely within such spaces shall not be prohibited (see Section 403.2.1, Item 3).

d. Ventilation systems in enclosed public parking garages shall comply with Section 404.

403.3.2 Dwelling units in Group R-2, R-3 and R-4 occupancies. The design of local exhaust systems and *outdoor air* ventilation systems for ~~outdoor air~~ *dwelling units* in Group R-2, R-3 and R-4 *occupancies* shall comply with Sections 403.3.2.1 through 403.3.2.5.

403.3.2.1 Outdoor air for dwelling units. An *outdoor air* ventilation system shall be installed and shall comply with the following:1. For a *dwelling unit* opening to a *corridor*, *outdoor air* shall be mechanically supplied to the *dwelling unit* through ducts or other equipment that terminate within the *dwelling unit*.2. In Climate Zones 6 through 8, for a *dwelling unit* in a *building* not more than 3 stories in height above grade plane, the *outdoor air* ventilation system shall be a *balanced ventilation system* in compliance with the residential provisions of the *International Energy Conservation Code.* 3. For a *dwelling unit* not addressed by Item 1 or Item 2, *outdoor air* shall be provided using~~An outdoor air ventilation system consisting of~~ a mechanical ~~exhaust system~~ *exhaust system*, supply system or combination thereof~~ shall be installed for each *dwelling unit*~~. Local exhaust or supply systems, including ~~outdoor air~~ *outdoor air* ducts connected to the return side of an air handler, are permitted to serve as components of such a system.~~ The outdoor air ventilation system shall be designed to provide the required rate of outdoor air continuously during the period that the *building* is occupied. The minimum continuous outdoor airflow rate shall be determined in accordance with Equation 4-9.~~

$$Q_{OA} = 0.03A_{floor} + 7.5(N_{br} + 1)$$

~~**(Equation 4-9)**~~

~~where:Q_{OA} = outdoor airflow rate, cfmA_{floor} = conditioned floor area, ft^2N_{br} = number of bedrooms; not to be less than one~~

~~**Exceptions:**~~

1. ~~The outdoor air ventilation system is not required to operate continuously where the system has controls that enable operation for not less than 1 hour of each 4-hour period. The average outdoor airflow rate over the 4-hour period shall be not less than that prescribed by Equation 4-9.~~
2. ~~The minimum mechanical ventilation rate determined in accordance with Equation 4-9 shall be reduced by 30 percent provided that both of the following conditions apply:~~
   - 2.1. ~~A ducted system supplies *ventilation air*directly to each bedroom and to one or more of the following rooms:~~
     - 2.1.1. ~~Living room.~~
     - 2.1.2. ~~Dining room.~~
     - 2.1.3. ~~Kitchen.~~
   - 2.2. ~~The whole-house ventilation system is a *balanced ventilation system*.~~

403.3.2.2 Outdoor air ~~for other spaces~~ flow rate for dwelling units. ~~Corridors and other common areas within the conditioned space shall be provided with outdoor air at a rate of not less than 0.06 cfm per square foot [0.0003 m^3/(s × m^2)] of floor area.~~ The *dwelling unit's outdoor air* ventilation system shall be designed to provide the required rate of *outdoor air* continuously during the period that the *building* is occupied. The minimum continuous *outdoor air* flow rate shall be determined in accordance with Equation 4-9.

$$Q_{OA} = 0.03A_{floor} + 7.5(N_{br} + 1)$$

(Equation 4-9)

where:Q_{OA} = *outdoor air* flow rate, cfmA_{floor} = conditioned floor area, ft^2N_{br} = number of bedrooms; not to be less than one

Exceptions:

1. The *outdoor air* ventilation system is not required to operate continuously where the system has controls that enable operation for not less than 1 hour of each 4-hour period. The average *outdoor air* flow rate over the 4-hour period shall be not less than that prescribed by Equation 4-9.
2. The minimum mechanical ventilation rate determined in accordance with Equation 4-9 shall be reduced by 30 percent provided that both of the following conditions apply:
   - 2.1. A ducted system supplies *outdoor air* directly to each bedroom and to one or more of the following rooms:
     - 2.1.1. Living room.
     - 2.1.2. Dining room.
     - 2.1.3. Kitchen.
   - 2.2. The *outdoor air* ventilation system is a *balanced ventilation system*.

403.3.2.3 Local exhaust. Local exhaust systems shall be provided in kitchens, ~~bathrooms~~ *bathrooms,* and ~~toilet rooms~~ *toilet rooms* and shall have the capacity to exhaust the minimum airflow rate determined in accordance with Table 403.3.2.3.

TABLE 403.3.2.3 MINIMUM REQUIRED LOCAL EXHAUST RATES FOR DWELLING UNITS IN GROUP R-2, R-3 AND R-4 OCCUPANCIES

AREA TO BE EXHAUSTED	EXHAUST RATE CAPACITY
Kitchens	100 cfm intermittent or 50 cfm continuous
~~Bathrooms~~ *Bathrooms* and ~~toilet rooms~~ *toilet rooms*	50 cfm intermittent or 25 cfm continuous

For SI: 1 cubic foot per minute = 0.0004719 m^3/s.

Reason: These modifications are needed to clarify ventilation requirements for dwelling units and other spaces within Group R-2, R-3, and R-4 occupancies. Additionally, based on direction received from the mechanical committee at CAH#1, this proposal has been combined with M28 and the committee's action on M8, M14, and M30. The committee requested that such an omnibus proposal be developed to better align with their actions on these interrelated proposals. In an effort to develop consensus, this proposal has been shared with all parties who opposed M28 at the first committee hearings; no negative feedback was received.

A summary of the results of the public comment version of this proposal is as follows:

1. All dwelling units in Group R-2, R-3, and R-4 occupancies shall comply with Section 403.3.2. This is consistent with the prior IMC cycle's action on proposal M19-21.

2. Where provided with mechanical ventilation, all spaces other than dwelling units in Group R-2, R-3, and R-4 occupancies shall comply with Section 403.3.1 (this is meant to parallel the scope divisions of ASHRAE 62.2 and ASHRAE 62.1), with the exception of ambulatory care facilities and Group I-2 occupancies, which are addressed in Section 407.

3. To align with ASHRAE 62.2 and action taken by the committee at CAH#1 on M8, outdoor air shall be mechanically supplied to dwelling units opening to a corridor in Groups R-2, R-3, and R-4 occupancies.

4. To align with IBC Section 406.6.2 and action taken by the committee at CAH#1 on M14, enclosed private garages serving multiple dwelling units are required to have mechanical ventilation in accordance with IMC Section 403.

5. To align with Section 403.3.2.1 of the IECC-R and action taken by the committee at CAH#1 on M30, require a *balanced ventilation system* for low-rise dwelling units in Climate Zones 6, 7, and 8.

Cost Impact: The change proposal is editorial in nature or a clarification and has no cost impact on the cost of construction

Justification for no cost impact:

The change proposal is editorial in nature or is a clarification of existing requirements and has no cost impact on the cost of construction. The exception is the inclusion of the language from M8, the cost impact for which is located within that proposal.

Comment (CAH2)# 587

M28-24

IMC®: CHAPTER 4, SECTION 403, 403.3, 403.3.1, TABLE 403.3.1.1, 403.3.2, 403.3.2.1, 403.3.2.2, 403.3.2.3, TABLE 403.3.2.3, 403.3.2.4, 403.3.2.5

Proposed Change as Submitted

Proponents: Gayathri Vijayakumar, Steven Winter Associates, Inc., Steven Winter Associates, Inc. (gayathri@swinter.com)

2024 International Mechanical Code

CHAPTER 4
VENTILATION

SECTION 403
MECHANICAL VENTILATION

Revise as follows:

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

403.3.1 Other buildings intended to be occupied. The design of local exhaust systems and ventilation systems for outdoor air for *occupancies* other than Groups R-2, R-3 and R-4 shall comply with Sections 403.3.1.1 through 403.3.1.4.

Revise as follows:

TABLE 403.3.1.1 MINIMUM VENTILATION RATES

Portions of table not shown remain unchanged.

OCCUPANCY CLASSIFICATION	OCCUPANT DENSITY #/1000 FT^2 [a]	PEOPLE OUTDOOR AIRFLOW RATE IN BREATHING ZONE, R_p CFM/PERSON	AREA OUTDOOR AIRFLOW RATE IN BREATHING ZONE, R_a CFM/FT^2 [a]	EXHAUST AIRFLOW RATE CFM/FT^2 [a]
Hotels, motels, and resorts ~~and dormitories~~				
Bathrooms/toilet—private[g]	—	—	—	25/50[f]
Kitchens - private[b]	—	—	—	50/100[f]
Bedroom/living room	10	5	0.06	—
Conference/meeting	50	5	0.06	—
~~Dormitory sleeping areas~~	~~20~~	~~5~~	~~0.06~~	—
Gambling casinos	120	7.5	0.18	—
Laundry rooms, central	10	5	0.12	—
~~Laundry rooms within dwelling units~~	~~10~~	~~5~~	~~0.12~~	—
Lobbies/prefunction	30	7.5	0.06	—
Multipurpose assembly	120	5	0.06	—
~~**Private dwellings, single and multiple**~~				
~~Garages, common for multiple units[b]~~	—	—	—	~~0.75~~
~~Kitchens[b]~~	—	—	—	~~50/100[f]~~
~~Living areas[c]~~	~~Based on number of bedrooms. First bedroom, 2; each additional bedroom, 1~~	~~0.35 ACH but not less than 15 cfm/person~~	—	—
~~Toilet rooms and bathrooms[g]~~	—	—	—	~~25/50[f]~~

For SI: 1 cubic foot per minute = 0.0004719 m^3/s, 1 ton = 908 kg, 1 cubic foot per minute per square foot = 0.00508 $m^3/(s \times m^2)$, °C = [(°F) – 32]/1.8, 1 square foot = 0.0929 m^2.

a. Based on net occupiable floor area.

b. Mechanical exhaust required and the recirculation of air from such spaces is prohibited. Recirculation of air that is contained completely within such spaces shall not be prohibited (see Section 403.2.1, Item 3).

c. Spaces unheated or maintained below 50°F are not covered by these requirements unless the occupancy is continuous.

d. Ventilation systems in enclosed parking garages shall comply with Section 404.

e. Rates are per water closet , urinal or adult changing station. The higher rate shall be provided where the exhaust system is designed to operate intermittently. The lower rate shall be permitted only where the exhaust system is designed to operate continuously while occupied.

f. Rates are per room unless otherwise indicated. The higher rate shall be provided where the exhaust system is designed to operate intermittently. The lower rate shall be permitted only where the exhaust system is designed to operate continuously while occupied.

g. Mechanical exhaust is required and recirculation from such spaces is prohibited. For occupancies other than science laboratories, where there is a wheel-type energy recovery ventilation (ERV) unit in the exhaust system design, the volume of air leaked from the exhaust airstream into the outdoor airstream within the ERV shall be less than 10 percent of the outdoor air volume. Recirculation of air that is contained completely within such spaces shall not be prohibited (see Section 403.2.1, Items 2 and 4).

h. For nail salons, each manicure and pedicure station shall be provided with a source capture system capable of exhausting not less than 50 cfm per station. Exhaust inlets shall be located in accordance with Section 502.20. Where one or more required source capture systems operate continuously during occupancy, the exhaust rate from such systems shall be permitted to be applied to the exhaust flow rate required by Table 403.3.1.1 for the nail salon.

i. Outpatient facilities to which the rates apply are freestanding birth centers, urgent care centers, neighborhood clinics and physicians' offices, Class 1 imaging facilities, outpatient psychiatric facilities, outpatient rehabilitation facilities and outpatient dental facilities.

j. The requirements of this table provide for acceptable IAQ. The requirements of this table do not address the airborne transmission of airborne viruses, bacteria and other infectious contagions.

k. These rates are intended only for outpatient dental clinics where the amount of nitrous oxide is limited. They are not intended for dental operatories in institutional buildings where nitrous oxide is piped.

l. The occupiable floor area in warehouses shall not include the floor area of self-storage units, floor areas under rack storage or designated palletized storage floor areas.

403.3.2 Group R-2, R-3 and R-4 occupancies. The design of local exhaust systems and ventilation systems for outdoor air in Group R-2, R-3 and R-4 *occupancies* shall comply with Sections 403.3.2.1 through 403.3.2.5.

Revise as follows:

403.3.2.1 Outdoor air for dwelling units <u>and sleeping units</u>. An outdoor air ventilation system consisting of a mechanical exhaust system, supply system or combination thereof shall be installed for each *dwelling unit* <u>and *sleeping unit*</u>. Local exhaust or supply systems, including outdoor air ducts connected to the return side of an air handler, are permitted to serve as such a system. The outdoor air ventilation system shall be designed to provide the required rate of outdoor air continuously during the period that the *building* is occupied. The minimum continuous outdoor airflow rate shall be determined in accordance with Equation 4-9.

$$Q_{OA} = 0.03A_{floor} + 7.5(N_{br} + 1)$$

where: Q_{OA} = outdoor airflow rate, cfm **(Equation 4-9)**

A_{floor} = conditioned floor area, ft^2

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

Exceptions:

1. The outdoor air ventilation system is not required to operate continuously where the system has controls that enable operation for not less than 1 hour of each 4-hour period. The average outdoor airflow rate over the 4-hour period shall be not less than that prescribed by Equation 4-9.
2. The minimum mechanical ventilation rate determined in accordance with Equation 4-9 shall be reduced by 30 percent provided that both of the following conditions apply:
   2.1. A ducted system supplies *ventilation air* directly to each bedroom and to one or more of the following rooms:
      2.1.1. Living room.
      2.1.2. Dining room.
      2.1.3. Kitchen.
   2.2. The ~~whole-house~~ outdoor air ventilation system is a *balanced ventilation system*.

403.3.2.2 Outdoor air and local exhaust for other spaces. Spaces other than *dwelling units* and *sleeping units* shallcomply with Sections 403.3.1.1 through 403.3.1.4~~Corridors and other common areas within the conditioned space shall be provided with outdoor air at a rate of not less than 0.06 cfm per square foot [0.0003 $m^3/(s \times m^2)$] of floor area~~.

403.3.2.3 Local exhaust for dwelling units and sleeping units. Local exhaust systems shall be provided in kitchens, bathrooms and toilet rooms and shall have the capacity to exhaust the minimum airflow rate determined in accordance with Table 403.3.2.3.

TABLE 403.3.2.3 MINIMUM REQUIRED LOCAL EXHAUST RATES FOR GROUP R-2, R-3 AND R-4 OCCUPANCIES

AREA TO BE EXHAUSTED	EXHAUST RATE CAPACITY
Kitchens	100 cfm intermittent or 50 cfm continuous
Bathrooms and toilet rooms	50 cfm intermittent or 25 cfm continuous

For SI: 1 cubic foot per minute = 0.0004719 m^3/s.

Revise as follows:

403.3.2.4 System controls. Where provided within a *dwelling unit*or *sleeping unit*, controls for outdoor air ventilation systems shall include text or a symbol indicating the system's function.

403.3.2.5 Ventilating equipment. Fans providing exhaust or outdoor air shall be *listed* and *labeled* to provide the minimum required air flow in accordance with ANSI/AMCA 210-ANSI/ASHRAE 51.

Reason: For Residential Group R-2, R-3 and R-4, 2024 IMC made an important change to have the same ventilation and exhaust requirements, regardless of building height.

However, it is not clear by the charging language in R403.3 and R403.3.1 what ventilation requirements are if the building exceeds 3 stories. It seems that R403.3.2 is intended to apply to all R-2, R-3 and R-4, regardless of building height, so this proposal makes that intent more explicit.

Cost Impact: The change proposal is editorial in nature or a clarification and has no cost impact on the cost of construction

Justification for no cost impact:

This proposal is not intended to change stringency of requirements, but rather clarify the current requirements for all the occupancies within a multifamily building, regardless of building height.

M28-24

Public Hearing Results (CAH1)

Committee Action: **Disapproved**

Committee Reason: The committee voted 14-0 to disapprove of the proposal. The committee reasoning is that the proponent does not explicitly make it clear in the charging language in R403.3 and R403.3.1 what the ventilation requirements are if the building exceeds 3 stories. The committee suggests that the proponent work on the proposal and resubmit it to be heard at the CAH2.

M28-24

Individual Consideration Agenda

Comment 1:

IMC®: CHAPTER 4, SECTION 403, 403.3, 403.3.2

Proponents: Gayathri Vijayakumar, Steven Winter Associates, Inc., Steven Winter Associates, Inc. (gvijayakumar@swinter.com) requests As Modified by Committee (AMC2)

Replace as follows:

2024 International Mechanical Code

CHAPTER 4
VENTILATION

SECTION 403
MECHANICAL VENTILATION

Revise as follows:

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

403.3.2 Group R-2, R-3 and R-4 occupancies. The design of local exhaust systems and ventilation systems for outdoor air in Group R-2, R-3 and R-4 *occupancies* shall comply with Sections 403.3.2.1 through 403.3.2.5.

Reason: I submitted the original code change proposal to complete a code change proposal that was successful in 2024 IMC (which removed the 3 story language in 403.3.2).

This comment replaces the original code change proposal (M-28). It now just contains the same strikeout in 403.3 as was struck in

403.3.2 in the previous cycle.
This creates alignment with 403.3.1 and 403.3.2. Without this edit, there are no charging requirements for Group R-2, R-3, or R-4 occupancies greater than 3 stories, since they are not within the scope of either 403.3.1 or 403.3.2.

While the other changes originally proposed would provide better clarity in this section, those are being submitted as a separate comment and this is submitted as the "back-up" if that fails.

Cost Impact: The change proposal is editorial in nature or a clarification and has no cost impact on the cost of construction

Justification for no cost impact:

Editorial. Trying to maintain the intent from the prior code cycle that all Group R-2, R-3 and R-4 occupancies are required to meet 403.3.2.

Comment (CAH2)# 246

M37-24

IMC®: [F] 502.4, [F] 502.5

Proposed Change as Submitted

Proponents: Jeanne Rice, NYS DOS, NYS DOS (jeanne.rice@dos.ny.gov); Chad Sievers, NYS, NYS DOS (chad.sievers@dos.ny.gov); Kevin Duerr-Clark, NYS DOS, NYS DOS (kevin.duerr-clark@dos.ny.gov); China Clarke, New York State Dept of State, Manager Technical Support Unit (china.clarke@dos.ny.gov)

THIS PROPOSAL WILL BE HEARD BY THE IFC CODE COMMITTEE. SEE THE TENTATIVE HEARING ORDER FOR THIS COMMITTEE.

2024 International Mechanical Code

Revise as follows:

[F] 502.4 ~~Stationary storage battery~~ Energy storage systems. ~~Stationary storage battery~~ Energy storage systems (ESS) shall be regulated and ventilated in accordance with Section 1207.6.1 of the International Fire Code and the general requirements of this chapter.

Delete without substitution:

~~**[F] 502.5 Ventilation of battery systems in cabinets.** Stationary storage battery systems installed in cabinets shall be provided with ventilation in accordance with Section 502.4.~~

Reason: The terminology "battery storage systems" is outdated. This proposed change updates the language to utilize the current terminology found throughout the ICC code books - Energy Storage Systems (ESS). This change also removes section 502.5, as it is redundant - section 502.4 covers all ESS, including ones in cabinets.

Cost Impact: The change proposal is editorial in nature or a clarification and has no cost impact on the cost of construction

Justification for no cost impact:

The proposed change is editorial only - changing terminology and removing redundant provisions.

M37-24

Public Hearing Results (CAH1)

Committee Action: **Disapproved**

Committee Reason: This proposal was disapproved based upon the action on F4-24. (Vote 14-0)

M37-24

Individual Consideration Agenda

Comment 1:

IMC®: [F] 502.4

Proponents: Jeanne Rice, NYSDOS (jeanne.rice@dos.ny.gov); Chad Sievers, NYS, NYS DOS (chad.sievers@dos.ny.gov); Kevin Duerr-Clark, NYS DOS, NYS DOS (kevin.duerr-clark@dos.ny.gov); Stephen Van Hoose, NYS DOS, NYS DOS (stephen.vanhoose@dos.ny.gov); China Clarke, New York State Dept of State, Manager Technical Support Unit (china.clarke@dos.ny.gov) requests As Modified by Committee (AMC2)

Modify as follows:

2024 International Mechanical Code

[F] 502.4 Electrochemical energy storage systems. Electrochemical energy storage systems (ESS) shall be regulated and ventilated in accordance with Section 1207.6.1 of the International Fire Code and the general requirements of this chapter.

Reason: This modification incorporates committee comments on the original proposal - specifically, that the language as originally proposed was too broad and electrical energy should be specified. The modification changes the language to specify electrochemical energy storage systems, which conforms to the definitions included in the IBC and IFC, which include both battery and capacitor storage systems..

Cost Impact: The change proposal is editorial in nature or a clarification and has no cost impact on the cost of construction

Justification for no cost impact:

This modification simply changes the terminology slightly, and does not change any code provisions.

Comment (CAH2)# 455

M39-24

IMC®: 504.2, 504.2.1 (New)

Proposed Change as Submitted

Proponents: Tony Crimi, A.C. Consulting Solutions Inc., International Firestop Council (tcrimi@sympatico.ca)

2024 International Mechanical Code

Revise as follows:

504.2 Exhaust penetrations. Where a clothes dryer exhaust duct penetrates a non-fire-resistance rated wall or ceiling membrane, the annular space shall be sealed with noncombustible material, *approved* fire caulking or a noncombustible dryer exhaust duct wall receptacle. ~~Ducts that exhaust clothes dryers shall not penetrate or be located within any fireblocking, draftstops or any wall, floor/ceiling or other assembly required by the *International Building Code* to be fire-resistance rated, unless such duct is constructed of galvanized steel or aluminum of the thickness specified in Section 603.4 and the fire-resistance rating is maintained in accordance with the *International Building Code*.~~ *Fire dampers*, *combination fire/smoke dampers* and any similar devices that will obstruct the exhaust flow shall be prohibited in clothes dryer exhaust ducts.

Add new text as follows:

504.2.1 Ducts penetrating fire resistance rated assemblies, fireblocks or draftstops. Ducts that exhaust clothes dryers shall not penetrate or be located within any fireblocking, draft stopping or any wall, floor/ceiling or other assembly required by the *International Building Code* to be fire-resistance rated, unless it complies with one of the following:

1. The duct is constructed of galvanized steel or aluminum of the thickness specified in Section 603.4 and the fire-resistance rating of any wall, floor/ceiling or other assembly required by the International Building Code to be fire- resistance rated is*maintained in accordance with Chapter 7 of the International Building Code.*
2. Ducts that are continuously covered on all sides from the point at which the duct penetrates the membrane of a wall or ceiling to the outlet terminal with a classified, listed and labeled system specifically evaluated for such purpose, in accordance with nationally recognized standards. The required fire resistance-rating shall be equal to the fire-resistance rating of the assembly being penetrated.

Reason: This proposal does several things. First, it reformats the paragraph and separates the individual criteria for better clarity. It also better differentiates the requirements based on whether the wall or ceiling is fire resistance rated, or not. Lastly, the proposal provides an additional option for ducts that penetrate fire resistance rated walls and floors. Third-party certification organizations like UL and Intertek provide listing and labelling services for fire-resistant duct systems using a variety of nationally recognized Standards and applicable ICC-ES criteria. These Listings have been in the marketplace for many years and have proven their effectiveness.

Cost Impact: The change proposal is editorial in nature or a clarification and has no cost impact on the cost of construction

Justification for no cost impact:

This proposal adds an additional option for protection of ducts. It does not remove any existing provisions or mandate additional costs.

M39-24

Public Hearing Results (CAH1)

Committee Action: **Disapproved**

Committee Reason: The committee voted to disapprove of this proposal 12-2. The committee's reasoning was that the proponent only referenced the nationally recognized standards without being specific.

M39-24

Individual Consideration Agenda

Comment 1:

IMC®: 504.2, 504.2.1

Proponents: Tony Crimi, A.C. Consulting Solutions Inc., International Firestop Council (tcrimi@sympatico.ca) requests As Modified by Committee (AMC2)

Modify as follows:

2024 International Mechanical Code

504.2 Exhaust penetrations. Where a clothes dryer exhaust duct penetrates a non-fire-resistance rated wall or ceiling membrane, the annular space shall be sealed with noncombustible material, *approved* fire caulking or a noncombustible dryer exhaust duct wall receptacle. ~~Ducts that exhaust clothes dryers shall not penetrate or be located within any fireblocking, draftstops or any wall, floor/ceiling or other assembly required by the *International Building Code* to be fire-resistance rated, unless such duct is constructed of galvanized steel or aluminum of the thickness specified in Section 603.4 and the fire-resistance rating is maintained in accordance with the *International Building Code*.~~ *Fire dampers*, *combination fire/smoke dampers* and any similar devices that will obstruct the exhaust flow shall be prohibited in clothes dryer exhaust ducts.

504.2.1 Ducts penetrating fire resistance rated assemblies, fireblocks or draftstops. Ducts that exhaust clothes dryers shall not penetrate or be located within any fireblocking, draft stopping or any wall, floor/ceiling or other assembly required by the *International Building Code* to be fire-resistance rated, unless it complies with one of the following:

1. The duct is constructed of galvanized steel or aluminum of the thickness specified in Section 603.4 and the fire-resistance rating of any wall, floor/ceiling or other assembly required by the International Building Code to be fire- resistance rated is*maintained in accordance with Chapter 7 of the International Building Code.*
2. Ducts that are continuously covered on all sides from the point at which the duct penetrates the membrane of a wall or ceiling to the outlet terminal with a classified, listed and labeled system specifically evaluated for such purpose, tested ~~in accordance with nationally recognized standards.~~ using the standard time-temperature curve of ASTM E119 or UL 263. The required fire resistance-rating shall be equal to the fire-resistance rating of the assembly being penetrated.

Reason: During CAH#1, the committee indicated that the reason for disapproval was that the proposal was not specific enough because it did not reference a test Standard to be used. This updated text includes a specific reference to ASTM E119 and UL 263. This fire exposure has been used to evaluate the ability of a duct system to resist the spread of fire between vertical or horizontal compartments for many years.

Bibliography: [1]ASTM E2816-20a, Standard Test Methods for Fire Resistive Metallic HVAC Duct Systems.

Cost Impact: The change proposal is editorial in nature or a clarification and has no cost impact on the cost of construction

Justification for no cost impact:

This proposal adds an additional option for protection of ducts. It does not remove any existing provisions or mandate additional costs.

M40-24

IMC®: 506.3 (New), ASTM Chapter 15 (New)

Proposed Change as Submitted

Proponents: Tony Crimi, A.C. Consulting Solutions Inc., International Firestop Council (tcrimi@sympatico.ca)

2024 International Mechanical Code

Add new text as follows:

506.3.1 Special inspection and test requirements. Commercial kitchen grease ducts serving Type I hoods conforming to the provisions of Section 506.3.11 that are listed and labeled to the requirements of 506.3.11.2 or 506.3.11.3 shall undergo special inspection by an approved agency in accordance with ASTM WK70806.

Add new standard(s) as follows:

ASTM

ASTM International
100 Barr Harbor Drive, P.O. Box C700
West Conshohocken, PA 19428

ASTM WK70806 Standard Practice for On-Site Inspection of Fire Resistive Duct Systems

Reason: Commercial kitchen operations are consistently one of the leading causes of non-residential fires reported in the United States. Until recently, there has been no document produced in the industry that is a consensus of the manufacturers, installation contractors, and inspection agencies. The new ASTM Standard is a key document that provides a standard set of procedures for inspecting and reporting on the installed fire resistive duct systems. At the time of submission, the ASTM WK70806*, Standard Practice for On-Site Inspection of Fire Resistive Duct Systems* had not been published, but has gone through the full ASTM process and is awaiting final publication.

This Standard Practice provides a means to verify compliance of the installed fire resistive duct system to the inspection document, and requires all information contained in the inspection document to be submitted to the Authorizing Authority having jurisdiction. It establishes procedure to inspect products and systems, including methods for field verification and inspection.

Bibliography: ASTM WK70806, Standard Practice for On-Site Inspection of Fire Resistive Duct Systems, ASTM International, 100 Barr Harbor Drive, West Conshohocken, PA 19428.

Cost Impact: The change proposal is editorial in nature or a clarification and has no cost impact on the cost of construction

Estimated Immediate Cost Impact:

There are multiple jurisdictions that already require commercial grease duct inspections. The estimated cost is lower for instances where multiple duct inspections could be coordinated in the same time period, or for projects of low complexity. For those jurisdictions that already require duct inspection, the anticipated costs would be much lower as this proposal would be a replacement of existing requirements rather than an additional item.

Estimated Immediate Cost Impact Justification (methodology and variables):

For jurisdictions that do not currently require fire-resistant duct inspections, the anticipated cost increase for this proposal is between $1000 to $1500 per duct system inspected.

M40-24

Public Hearing Results (CAH1)

Committee Action: **Disapproved**

Committee Reason: The committee voted to disapprove of the proposal 12-2. The committee's reasoning is that this proposal does not establish procedures to inspect products and systems, including methods for field verification and inspection.

M40-24

Individual Consideration Agenda

Comment 1:

IMC®: 506.3.1, ASTM Chapter 15 (New)

Proponents: Tony Crimi, A.C. Consulting Solutions Inc., International Firestop Council (tcrimi@sympatico.ca) requests As Modified by Committee (AMC2)

Modify as follows:

2024 International Mechanical Code

506.3.1 Special inspection and test requirements. Commercial kitchen grease ducts serving Type I hoods conforming to the provisions of Section 506.3.11 that are listed and labeled to the requirements of 506.3.11.2 or 506.3.11.3 shall undergo special inspection by an approved agency in accordance with ASTM ~~WK70806~~ E3385..

Add new standard(s) as follows:

ASTM

ASTM International
100 Barr Harbor Drive, P.O. Box C700
West Conshohocken, PA 19428

E3385-24 Standard Practice for On-Site Inspection of Fire Resistive Duct Systems

Reason: During CAH#1, the Committee stated that the proposal does not establish procedures to inspect products and systems, including methods for field verification and inspection. However, referencing this new Standard Practice will establish those procedures. The scope of the practice states:1.1 This practice covers a standard set of procedures for inspecting and reporting on the installed fire resistive duct systems.1.2 This practice establishes procedures to inspect products and systems, including methods for field verification and inspection.1.3 This practice provides an inspector and inspection body, various methods to verify that required systems have been installed in accordance with the inspection document.

The Standard is a key document that provides a standard set of procedures for inspecting and reporting on the installed fire resistive duct systems and does provide a means to verify compliance of the installed fire resistive duct system to the inspection document.

At the time of submission to CAH#1, the Standard had been fully balloted, but ASTM had not assign a Standard number. The only change to this proposal is to update the number of the Standard to the published version. No other technical changes were made to what was reviewed in ASTM WK70806.

Cost Impact: Increase

Estimated Immediate Cost Impact:

There are multiple jurisdictions that already require commercial grease duct inspections. The estimated cost is lower for instances where multiple duct inspections could be coordinated in the same time period, or for projects of low complexity. For those jurisdictions that already require duct inspection, the anticipated costs would be much lower as this proposal would be a replacement of existing requirements rather than an additional item.

Estimated Immediate Cost Impact Justification (methodology and variables):

For jurisdictions that do not currently require fire-resistant duct inspections, the anticipated cost increase for this proposal is between $1000 to $1500 per duct system inspected.

Comment (CAH2)# 433

NOTE: M44-24 PART I DID NOT RECEIVE A COMMENT (CAH2) AND IS REPRODUCED FOR INFORMATIONAL PURPOSES ONLY

M44-24 Part I

IMC®: 513.1

Proposed Change as Submitted

Proponents: Jonathan Roberts, UL Solutions, UL Solutions (jonathan.roberts@ul.com)

2024 International Mechanical Code

Revise as follows:

513.1 General. Energy and heat recovery ventilation systems shall be installed in accordance with this section. Where required for purposes of energy conservation, energy and heat recovery ventilation systems shall also comply with the *International Energy Conservation Code* . Ducted energy and heat recovery ventilators shall be *listed* and *labeled* in accordance with UL 1812. Nonducted energy and heat recovery ventilators shall be *listed* and *labeled* in accordance with UL 1815.

Reason: The common industry terms for the equipment covered by these requirements are “Energy Recovery Ventilators (ERVs)” and “Heat Recovery Ventilators (HRVs)”. The primary difference is that ERVs have moisture permeable heat exchangers to facilitate both sensible and latent heat transfer between the air streams. HRV’s have nonpermeable heat exchangers, and thus only facilitate sensible heat transfer. Both ERVs and HRVs are in scope of the referenced standards. This proposal aligns the code terminology with industry, the IECC, and the IRC to improve clarity. This clarifies that safety requirements always apply independently of energy conservation requirements of IECC. This clarifies that this section does not mandate installation, but provides requirements where installed.

Correlates IRC with mechanical code requirements (Section 514). Chapter 11 of IRC contains energy efficiency related requirements for this equipment (see N1103.6.1), however the main body of code does not contain safety requirements for this equipment.

This equipment is becoming more common in construction. M1301.1 already requires that equipment not covered by this code refer to the IMC. This equipment is covered by 514.1 of the IMC. By also adding these requirements into the body of the IRC, it assists the user in applying code requirements.

Cost Impact: The change proposal is editorial in nature or a clarification and has no cost impact on the cost of construction

Justification for no cost impact:

Editorial, clarifies existing requirements in the IMC, and also incorporates the updated text into the IRC for ease of use.

For the IRC: E3403.3 already requires listing of electrical equipment, while this proposal clarifies the specific listing standards. IRC M1301.1 points to the IMC for requirements for equipment not covered, and the IMC already includes these requirements. Additionally the IRC, Section M1302.1, requires appliances regulated by the IRC be listed and labeled for the application.

M44-24 Part I

Public Hearing Results (CAH1)

Committee Action: **As Modified by Committee**

Committee Modification:
513.1 General.

Energy recovery ventilators (ERVs) and heat recovery ~~ventilation systems~~ ventilators (HRVs) shall be installed in accordance with this section. Where required for purposes of energy conservation, ~~energy and heat recovery ventilation systems~~ ERVS and HRVs shall also comply with the *International Energy Conservation Code* . Ducted ~~energy and heat recovery ventilators~~ ERVs and HRVs shall be *listed* and *labeled* in accordance with UL 1812. Nonducted ~~energy and heat recovery ventilators~~ ERVs and HRVs shall be *listed* and *labeled* in accordance with UL 1815.

Committee Reason: The committee voted to approve this proposal as modified by 14-0. The proposal further clarifies the relationship between energy and heat recovery ventilation systems. The IRC approved this proposal previously.

M44-24 Part I

M44-24 Part II

IRC: SECTION M1905 (New), M1905.1 (New), UL Chapter 44 (New)

Proposed Change as Submitted

Proponents: Jonathan Roberts, UL Solutions, UL Solutions (jonathan.roberts@ul.com)

2024 International Residential Code

Add new text as follows:

SECTION M1905
ENERGY AND HEAT RECOVERY VENTILATION SYSTEMS

M1905.1 General. Energy and heat recovery ventilation systems shall be installed in accordance with this section. Where required for purposes of energy conservation, energy and heat recovery ventilation systems shall also comply with Chapter 11. Ducted energy and heat recovery ventilators shall be *listed* and *labeled* in accordance with UL 1812. Nonducted energy and heat recovery ventilators shall be listed and labeled in accordance with UL 1815.

Add new standard(s) as follows:

UL

UL LLC
333 Pfingsten Road
Northbrook, IL 60062

1812-2013 Ducted Heat Recovery Ventilators - with revisions through May 3, 2022

1815-2012 Nonducted Heat Recovery Ventilators - with revisions December 7, 2021

Reason: The common industry terms for the equipment covered by these requirements are "Energy Recovery Ventilators (ERVs)" and "Heat Recovery Ventilators (HRVs)". The primary difference is that ERVs have moisture permeable heat exchangers to facilitate both sensible and latent heat transfer between the air streams. HRV's have nonpermeable heat exchangers, and thus only facilitate sensible heat transfer. Both ERVs and HRVs are in scope of the referenced standards. This proposal aligns the code terminology with industry, the IECC, and the IRC to improve clarity. This clarifies that safety requirements always apply independently of energy conservation requirements of IECC. This clarifies that this section does not mandate installation, but provides requirements where installed.

Correlates IRC with mechanical code requirements (Section 514). Chapter 11 of IRC contains energy efficiency related requirements for this equipment (see N1103.6.1), however the main body of code does not contain safety requirements for this equipment.

This equipment is becoming more common in construction. M1301.1 already requires that equipment not covered by this code refer to the IMC. This equipment is covered by 514.1 of the IMC. By also adding these requirements into the body of the IRC, it assists the user in applying code requirements.

Cost Impact: The change proposal is editorial in nature or a clarification and has no cost impact on the cost of construction

Justification for no cost impact:

Editorial, clarifies existing requirements in the IMC, and also incorporates the updated text into the IRC for ease of use.

For the IRC: E3403.3 already requires listing of electrical equipment, while this proposal clarifies the specific listing standards. IRC M1301.1 points to the IMC for requirements for equipment not covered, and the IMC already includes these requirements. Additionally the IRC, Section M1302.1, requires appliances regulated by the IRC be listed and labeled for the application.

M44-24 Part II

Public Hearing Results (CAH1)

Committee Action: **Disapproved**

Committee Reason: The committee voted to disapprove this proposal with a vote of 6-3. The committee argued that the 1st sentence of the proposal failed to meet the code requirements and does not properly list the specific area of the section.

M44-24 Part II

Individual Consideration Agenda

Comment 1:

IRC: M1905.1, M1905.2 (New), M1905.3 (New), UL Chapter 44

Proponents: Jonathan Roberts, UL Solutions, UL Solutions (jonathan.roberts@ul.com) requests As Modified by Committee (AMC2)

Modify as follows:

2024 International Residential Code

Revise as follows:

M1905.1 General. Energy recovery ventilators (ERVs) and heat recovery ventilators (HRVs) ~~ventilation systems~~ shall be installed in accordance with this section. ~~Where required for purposes of energy conservation, energy and heat recovery ventilation systems shall also comply with Chapter 11. Ducted energy and heat recovery ventilators shall be *listed* and *labeled* in accordance with UL 1812. Nonducted energy and heat recovery ventilators shall be listed and labeled in accordance with UL 1815.~~

Add new text as follows:

M1905.2 Installation. ERVs and HRVs shall be installed in accordance with the manufacturer's installation instructions. Where required for purposes of energy conservation, ERVs and HRVs shall also comply with Chapter 11.

M1905.3 Equipment listings. Ducted ERVs and HRVs shall be *listed* and *labeled* in accordance with UL 1812. Nonducted ERVs and HRVs shall be *listed* and *labeled* in accordance with UL 1815.

UL

UL LLC
333 Pfingsten Road
Northbrook, IL 60062

1812-2013	Ducted Heat Recovery Ventilators - with revisions through May 3, 2022
1815-2012	Nonducted Heat Recovery Ventilators - with revisions December 7, 2021

Reason: The original proposal has been adjusted based on committee feedback in CAH1 regarding editorial formatting. The original proposal referenced "this section" but the requirements were formatted as a single paragraph. This public comment shows a reformatting as a proper section, which improves code usability and addresses the editorial concerns. It also incorporates the changes from floor modification M44-24 Part II-Roberts MP2 to clarify ERV/HRV terminology. A reference to the manufacturer's installation instructions was added under M1905.2 to clarify the installation requirements.

Cost Impact: The change proposal is editorial in nature or a clarification and has no cost impact on the cost of construction

Justification for no cost impact:

Editorial, clarifies existing requirements. E3403.3 already requires listing of electrical equipment, while this proposal clarifies the specific listing standards. Additionally, IRC M1301.1 points to the IMC for requirements for equipment not covered, and the IMC already includes these requirements.

Comment (CAH2)# 481

NOTE: M47-24 PART I DID NOT RECEIVE A COMMENT (CAH2) AND IS REPRODUCED FOR INFORMATIONAL PURPOSES ONLY

M47-24 Part I

IMC®: 603.9.1 (New), UL Chapter 15 (New)

Proposed Change as Submitted

Proponents: Jonathan Roberts, UL Solutions, UL Solutions (jonathan.roberts@ul.com)

THIS IS A 2 PART CODE CHANGE. PART I WILL BE HEARD BY THE MECHANICAL CODE COMMITTEE. PART II WILL BE HEARD BY THE IRC-MP CODE COMMITTEE. SEE THE TENTATIVE HEARING ORDER FOR THESE COMMITTEES.

2024 International Mechanical Code

Add new text as follows:

603.9.1 Collars and sleeves. Nonmetallic collars and sleeves used to join or attach flexible air ducts and air connectors shall be *listed* and *labeled* in accordance with UL 181C

Add new standard(s) as follows:

UL

UL LLC
333 Pfingsten Road
Northbrook, IL 60062-2096

181C-2020 Outline of Investigation for Non-Metal Joining Accessories for Flexible Air Ducts and Air Connectors

Reason: UL 181C, Outline of Investigation for Non-Metal Joining Accessories for Flexible Air Ducts and Air Connectors, was developed to evaluate non-metal accessories, such as collars and sleeves, used to join or attach flexible air ducts and air connectors that comply with the requirements of UL 181, Factory-Made Air Ducts and Air Connectors.

As defined in UL 181C, a collar is a non-metal accessory used to join flexible air ducts and air connectors at their terminations to other portions of the air duct system. A sleeve is defined as a non-metal accessory used to join sections of flexible air ducts or air connectors.

The requirements for these collars and sleeves include all the applicable requirements that would be applied to factory-made air ducts (UL 181) and discrete products within plenums (UL 2043).

Cost Impact: The change proposal is editorial in nature or a clarification and has no cost impact on the cost of construction

Justification for no cost impact:

This does not increase of decrease cost. This does not mandate the use of these collars and sleeves. This is providing an alternative to existing methods for connecting flexible air ducts and air connectors. The proposal sets the base safety and performance requirements if these nonmetallic collars and sleeves are used.
Listing for heat pump heaters regulated by this section of the code is currently required by this code, so there is no cost impact. The proposal is a simple editorial revision to the correct (current) product standard.

M47-24 Part I

Public Hearing Results (CAH1)

Committee Action: **As Modified by Committee**

Committee Modification:
603.9.1 Collars and sleeves.

Nonmetallic collars and sleeves used to join or attach flexible air ducts and air connectors shall be *listed* and *labeled* in accordance with UL 181C.
Exception: Collars that are a component of a listed *appliance*.

Committee Reason: The committee voted 14-0 to approve of this proposal as modified. The proposal recognizes that an installed collar has already been tested per the manufacturer's outline of investigation for specific fire tests on collars and sleeves supplied for fire ducts. The purpose of UL 181C, the Outline of Investigation for Non-Metal Joining Accessories for Flexible Air Ducts and Air Connectors, is to assess non-metal accessories, like sleeves and collars, used to join or attach flexible air ducts and air connectors that meet UL 181 specifications. As described in UL 181C, a collar is a non-metal accessory that connects flexible air ducts and air connections to other system parts at their termination. Any non-metal attachment used to link segments of flexible air ducts or air connectors is called a sleeve.

M47-24 Part I

M47-24 Part II

IRC: M1601.1.1, UL Chapter 44 (New)

Proposed Change as Submitted

Proponents: Jonathan Roberts, UL Solutions, UL Solutions (jonathan.roberts@ul.com)

2024 International Residential Code

Revise as follows:

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 not greater than 250°F (121°C).
2. Factory-made ducts shall be *listed* and *labeled* in accordance with UL 181 and installed in accordance with the manufacturer's instructions.
3. Nonmetallic collars and sleeves used to join or attach flexible air ducts, shall be *listed* and *labeled* in accordance with UL 181C
4. Fibrous glass duct construction shall conform to the *SMACNA Fibrous Glass Duct Construction Standards or NAIMA Fibrous Glass Duct Construction Standards.*

~~4~~ 5. Field-fabricated and shop-fabricated metal and flexible duct constructions shall conform to the *SMACNA HVAC Duct Construction Standards—Metal and Flexible* except as allowed by Table M1601.1.1. Galvanized steel shall conform to ASTM A653.

~~5~~ 6. The use of gypsum products to construct return air ducts or plenums is permitted, provided that the air temperature does not exceed 125°F (52°C) and exposed surfaces are not subject to condensation.

~~6~~ 7. *Duct systems* shall be constructed of materials having a *flame spread index* of not greater than 200.

~~7~~ 8. Stud wall cavities and the spaces between solid floor joists to be used as air plenums shall comply with the following conditions:

   ~~7~~ 8.1. These cavities or spaces shall not be used as a plenum for supply air.

   ~~7~~ 8.2. These cavities or spaces shall not be part of a required fire-resistance-rated assembly.

   ~~7~~ 8.3. Stud wall cavities shall not convey air from more than one floor level.

   ~~7~~ 8.4. Stud wall cavities and joist-space plenums shall be isolated from adjacent concealed spaces by tight-fitting *fireblocking* in accordance with Section R302.11. *Fireblocking* materials used for isolation shall comply with Section R302.11.1.

   ~~7~~ 8.5. Stud wall cavities in the outside walls of building envelope assemblies shall not be utilized as air plenums.

   ~~7~~ 8.6. Building cavities used as plenums shall be sealed.

~~8~~ 9. Volume dampers, equipment and other means of supply, return and exhaust air adjustment used in system balancing shall be provided with access.

Add new standard(s) as follows:

UL

UL LLC
333 Pfingsten Road
Northbrook, IL 60062

181C-2020 Outline of Investigation for Non-Metal Joining Accessories for Flexible Air Ducts and Air Connectors

Reason: UL 181C, Outline of Investigation for Non-Metal Joining Accessories for Flexible Air Ducts and Air Connectors, was developed to evaluate non-metal accessories, such as collars and sleeves, used to join or attach flexible air ducts and air connectors that comply with the requirements of UL 181, Factory-Made Air Ducts and Air Connectors.

As defined in UL 181C, a collar is a non-metal accessory used to join flexible air ducts and air connectors at their terminations to other portions of the air duct system. A sleeve is defined as a non-metal accessory used to join sections of flexible air ducts or air connectors.

The requirements for these collars and sleeves include all the applicable requirements that would be applied to factory-made air ducts (UL 181) and discrete products within plenums (UL 2043).

Cost Impact: The change proposal is editorial in nature or a clarification and has no cost impact on the cost of construction

Justification for no cost impact:

This does not increase of decrease cost. This does not mandate the use of these collars and sleeves. This is providing an alternative to existing methods for connecting flexible air ducts and air connectors. The proposal sets the base safety and performance requirements if these nonmetallic collars and sleeves are used.

Listing for heat pump heaters regulated by this section of the code is currently required by this code, so there is no cost impact. The proposal is a simple editorial revision to the correct (current) product standard.

M47-24 Part II

Public Hearing Results (CAH1)

Committee Action: **As Modified by Committee**

Committee Modification: 2024 International Residential Code

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 not greater than 250°F (121°C).
2. Factory-made ducts shall be *listed* and *labeled* in accordance with UL 181 and installed in accordance with the manufacturer's instructions.
3. Where ~~N~~nonmetallic collars and sleeves are used to join or attach flexible air ducts, they shall be *listed* and *labeled* in accordance with UL 181C
4. Fibrous glass duct construction shall conform to the *SMACNA Fibrous Glass Duct Construction Standards or NAIMA Fibrous Glass Duct Construction Standards.*
5. Field-fabricated and shop-fabricated metal and flexible duct constructions shall conform to the *SMACNA HVAC Duct Construction Standards—Metal and Flexible* except as allowed by Table M1601.1.1. Galvanized steel shall conform to ASTM A653.
6. The use of gypsum products to construct return air ducts or plenums is permitted, provided that the air temperature does not exceed 125°F (52°C) and exposed surfaces are not subject to condensation.
7. *Duct systems* shall be constructed of materials having a *flame spread index* of not greater than 200.

8. Stud wall cavities and the spaces between solid floor joists to be used as air plenums shall comply with the following conditions:
    8.1. These cavities or spaces shall not be used as a plenum for supply air.
    8.2. These cavities or spaces shall not be part of a required fire-resistance-rated assembly.
    8.3. Stud wall cavities shall not convey air from more than one floor level.
    8.4. Stud wall cavities and joist-space plenums shall be isolated from adjacent concealed spaces by tight-fitting *fireblocking* in accordance with Section R302.11. *Fireblocking* materials used for isolation shall comply with Section R302.11.1.
    8.5. Stud wall cavities in the outside walls of building envelope assemblies shall not be utilized as air plenums.
    8.6. Building cavities used as plenums shall be sealed.
9. Volume dampers, equipment and other means of supply, return and exhaust air adjustment used in system balancing shall be provided with access.

Committee Reason: The committee approved this proposal as modified with a vote of 8-1. The committee reasons that this proposal adds another option for installers to use. The modification clarifies when it is mandatory or not.

M47-24 Part II

Individual Consideration Agenda

Comment 1:

IRC: M1601.1.1

Proponents: Mike Moore, Stator LLC, Broan-NuTone (mmoore@statorllc.com) requests As Modified by Committee (AMC2)

Further modify as follows:

2024 International Residential Code

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 not greater than 250°F (121°C).
2. Factory-made ducts shall be *listed* and *labeled* in accordance with UL 181 and installed in accordance with the manufacturer's instructions.
3. Where nonmetallic collars and sleeves are used to join or attach flexible air ducts, they shall be *listed* and *labeled* in accordance with UL 181C. **Exception:** Collars that are a component of a *listed appliance*.
4. Fibrous glass duct construction shall conform to the *SMACNA Fibrous Glass Duct Construction Standards or NAIMA Fibrous Glass Duct Construction Standards.*
5. Field-fabricated and shop-fabricated metal and flexible duct constructions shall conform to the *SMACNA HVAC Duct Construction Standards—Metal and Flexible* except as allowed by Table M1601.1.1. Galvanized steel shall conform to ASTM A653.
6. The use of gypsum products to construct return air ducts or plenums is permitted, provided that the air temperature does not exceed 125°F (52°C) and exposed surfaces are not subject to condensation.

7. *Duct systems* shall be constructed of materials having a *flame spread index* of not greater than 200.
8. Stud wall cavities and the spaces between solid floor joists to be used as air plenums shall comply with the following conditions:
    8.1. These cavities or spaces shall not be used as a plenum for supply air.
    8.2. These cavities or spaces shall not be part of a required fire-resistance-rated assembly.
    8.3. Stud wall cavities shall not convey air from more than one floor level.
    8.4. Stud wall cavities and joist-space plenums shall be isolated from adjacent concealed spaces by tight-fitting *fireblocking* in accordance with Section R302.11. *Fireblocking* materials used for isolation shall comply with Section R302.11.1.
    8.5. Stud wall cavities in the outside walls of building envelope assemblies shall not be utilized as air plenums.
    8.6. Building cavities used as plenums shall be sealed.
9. Volume dampers, equipment and other means of supply, return and exhaust air adjustment used in system balancing shall be provided with access.

Reason: The committee voted 14-0 to approve this same exception to Part 1 of this proposal, based on the rationale that collars that are a component of a listed appliance are already addressed by the fire testing required in accordance with the appliance's safety listing. For consistency, the same exception should be applied to Part 2 of this proposal.

Cost Impact: The change proposal is editorial in nature or a clarification and has no cost impact on the cost of construction

Justification for no cost impact:

The proposed exception clarifies that the requirement does not apply to collars that are a component of a listed appliance. There is no effect on the cost of construction.

Comment (CAH2)# 745

M50-24

IMC®: CHAPTER 6, SECTION 608, 608.1, CHAPTER 15, 15 SMACNA, SMACNA Chapter 15 (New)

Proposed Change as Submitted

Proponents: Eli Howard, SMACNA, SMACNA (ehoward@smacna.org)

2024 International Mechanical Code

CHAPTER 6
DUCT SYSTEMS

SECTION 608
BALANCING

Revise as follows:

608.1 Balancing. Air distribution, ventilation and exhaust systems shall be provided with means to adjust the system to achieve the design airflow rates and shall be balanced by an *approved* method in accordance with SMACNA HVAC Systems Testing, Adjusting, and Balancing Manual, or equivalent.. *Ventilation air* distribution shall be balanced by an *approved* method in accordance with SMACNA HVAC Systems Testing, Adjusting, and Balancing Manual, or equivalent. and such balancing shall verify that the air distribution system is capable of supplying and exhausting the airflow rates required by Chapter 4.

CHAPTER 15
REFERENCED STANDARDS

Revise as follows:

SMACNA

Sheet Metal and Air Conditioning Contractors' National Association, Inc.
4201 Lafayette Center Drive
Chantilly, VA 20151-1219

2023 HVAC SYSTEMS TESTING, ADJUSTING & BALANCING, FOURTH EDITION

Reason: Balancing is currently required by the IMC, and this document would provide proper procedures for compliance to the code requirements.

Bibliography: SMACNA HVAC Testing, Adjusting & Balancing Manual 4th edition 2023.

Cost Impact: The change proposal is editorial in nature or a clarification and has no cost impact on the cost of construction

Justification for no cost impact:

Balancing of HVAC Systems is currently required by the IMC, and this would just provide a specific standard of procedure to follow.

M50-24

Public Hearing Results (CAH1)

Committee Action: **Disapproved**

Committee Reason: The committee voted 9-4 to disapprove of this proposal. The committee believes that more thought needs to go into the arrangement of the proposed code language.

M50-24

Individual Consideration Agenda

Comment 1:

IMC®: SECTION 608, 608.1, RESNET (New)

Proponents: Eli Howard, SMACNA, SMACNA (ehoward@smacna.org); Mike Moore, Stator LLC, The Home Ventilating Institute (mmoore@statorllc.com) requests As Modified by Committee (AMC2)

Modify as follows:

2024 International Mechanical Code

SECTION 608 BALANCING

Revise as follows:

608.1 Balancing. Air distribution, ventilation and exhaust systems shall be provided with means to adjust the system to achieve the design airflow rates and shall be balanced by an *approved* method in accordance with the SMACNA HVAC Systems Testing, Adjusting, and Balancing Manual, ANSI/RESNET/ICC 380 or equivalent. ~~*Ventilation air* distribution shall be balanced by an *approved* method in accordance with SMACNA HVAC Systems Testing, Adjusting, and Balancing Manual, or equivalent. and such balancing~~ Balancing shall verify that the air distribution system is capable of supplying and exhausting the airflow rates required by Chapter 4.

RESNET

Residential Energy Services Network
P.O. Boc 4561
Oceanside, CA 92052-4561
United States

ANSI/RESNET/ICC 380-2022 Standard for Testing Airtightness of Building, Dwelling Unit and Sleeping Unit Enclosures; Airtightness of Heating and Cooling Air Distribution Systems, and Airflow of Mechanical Ventilation Systems

Reason: Based on Committee Action in CAH1, this has been modified to address those comments in accordance with the SMACNA HVAC Systems Testing, Adjusting, and Balancing Manual, ANSI/RESNET/ICC 380 or equivalent.

Bibliography: SMACNA HVAC Testing, Adjusting & Balancing Manual 4th edition 2023

ANSI/RESNET/ICC 380-2019 Standard for Testing Airtightness of Building, Dwelling Unite, and Sleeping Unit Enclosures: Airtightness of Heating and Colling Air Distribution Systems: and Airflow of Mechanical Systems

Cost Impact: The change proposal is editorial in nature or a clarification and has no cost impact on the cost of construction

Justification for no cost impact:

The IMC clearly mandates balancing of the HVAC Systems via Section 608.1 but does not provide the accepted Industry Standards to accomplish this requirement. The inclusion of the SMACNA & ANSI/RESNET/ICC standards provides the industry accepted methods for the adequate balancing of HVAC Systems.

Comment (CAH2)# 648

M51-24

IMC®: 801.20

Proposed Change as Submitted

Proponents: Abraham MURRA, Abraham Murra Consulting, Abraham Murra Consulting

2024 International Mechanical Code

Revise as follows:

801.20 Plastic vent joints. Plastic pipe and fittings used to vent *appliances* shall be installed in accordance with the *appliance* manufacturer's installation instructions and with the installation instructions of the manufacturer of the venting pipe and fittings.

Reason: As part of the certification process, venting piping systems must include installation instructions, as required by UL 1738. Therefore, the proposed new text is making users of the IMC, including tradespersons, aware that the pipe and fittings used for venting must be installed in accordance with the installation instructions of the piping manufacturer.

Cost Impact: The change proposal is editorial in nature or a clarification and has no cost impact on the cost of construction

Justification for no cost impact:

The proposal only adds a statement for clarity.

M51-24

Public Hearing Results (CAH1)

Committee Action: **Disapproved**

Committee Reason: The committee voted 9-5 to disapprove of this code proposal. The installation per UL 1738 is being proposed. The committee argues that this provision is between the manufacturer of the pipe and the manufacturer of the appliances.

M51-24

Individual Consideration Agenda

Comment 1:

Proponents: Michael Cudahy, PPFA Plastic Pipe and Fittings Association, PPFA Plastic Pipe and Fittings Association (mikec@cmservices.com) requests As Submitted

Reason: PPFA believes it is reasonable for this code to give pipe and fitting manufactures input on how their products are used in this application. Not all materials are suited and some instructions may be useful.

Cost Impact: The change proposal is editorial in nature or a clarification and has no cost impact on the cost of construction

Comment (CAH2)# 327

Comment 2:

Proponents: Abraham MURRA, Abraham Murra Consulting, Abraham Murra Consulting requests As Submitted

Reason: The committee reason for disapproving proposal M51-24 indicated that the vent installation is a matter between the manufacturer of the pipe and the manufacturer of the appliance. However, there is no relationship between the appliance and pipe manufacturers. Current practice is that the appliance manufacturer specifies the vent material when in fact they have no expertise in the manufacture and application of venting products and assume no liability for such products —venting products are manufactured by pipe and fittings manufacturers—.
The intent of the original M51 proposal was to require that the venting products be installed in accordance with the instructions of the manufacturer with the expertise for such products, which is of course the pipe and fittings manufacturer.
It is also important to note that there was no mention of UL 1738 in the original M51 proposal; UL 1738 was only mentioned in the supporting rationale.
We request that proposal M51-24 be approved as submitted.

Cost Impact: The change proposal is editorial in nature or a clarification and has no cost impact on the cost of construction

Comment (CAH2)# 409

M63-24

IMC®: 1101.1.1

Proposed Change as Submitted

Proponents: Emily Toto, ASHRAE, ASHRAE (etoto@ashrae.org)

2024 International Mechanical Code

Revise as follows:

1101.1.1 Refrigerants other than ammonia. *Refrigeration systems* using a refrigerant other than ammonia shall comply with this chapter, ASHRAE 15 and the *International Fire Code*. *Refrigeration systems* containing carbon dioxide as the refrigerant shall also comply with IIAR CO2 <u>or be part of listed and labeled equipment</u>.

Reason: The scope of IIAR CO2 specifically excludes “Listed equipment or systems.” There are many listed refrigeration systems using carbon dioxide as the refrigerant. Field erected systems may also be evaluated by NRTLs to existing industry safety standards, such as UL 60335-2-40, UL 60335-2-89, and UL 471.

Cost Impact: The change proposal is editorial in nature or a clarification and has no cost impact on the cost of construction

Justification for no cost impact:

This change is only meant to address an inconsistency in order to maintain the intent of the scope.

M63-24

Public Hearing Results (CAH1)

Committee Action: **Disapproved**

Committee Reason: The committee voted 13-1 to disapprove of this proposal. The committee's reasoning is that there is no need to add this proposed code language to this section of the IMC.

M63-24

Individual Consideration Agenda

Comment 1:

IMC®: 1101.1.1

Proponents: Emily Toto, ASHRAE, ASHRAE (etoto@ashrae.org) requests As Modified by Committee (AMC2)

Modify as follows:

2024 International Mechanical Code

1101.1.1 Refrigerants other than ammonia. *Refrigeration systems* using a refrigerant other than ammonia shall comply with this chapter, ASHRAE 15 and the *International Fire Code*. Where not listed and labeled, ~~R~~r*efrigeration systems* containing carbon dioxide as the refrigerant shall also comply with IIAR CO2 ~~or be part of listed and labeled equipment~~.

Reason: As written, the language in 1101.1.1 prohibits the use of listed CO2 systems, as the scope of IIAR CO2 excludes listed systems and equipment. Therefore, no listed equipment complies with IIAR CO2, and can not be installed based on the existing language. The proposed language is intended to correct this conflict.

Cost Impact: The change proposal is editorial in nature or a clarification and has no cost impact on the cost of construction

Justification for no cost impact:

This proposed change is simply to correctly distinguish between what is covered by the i-codes and ASHRAE 15 in contrast to IIAR CO2. It does not change anything about installation requirements that were not already established.

Comment (CAH2)# 299

M64-24

IMC®: TABLE 1103.1

Proposed Change as Submitted

Proponents: Emily Toto, ASHRAE, ASHRAE (etoto@ashrae.org)

2024 International Mechanical Code

Revise as follows:

TABLE 1103.1 REFRIGERANT CLASSIFICATION, AMOUNT AND OEL

CHEMICAL REFRIGERANT	FORMULA	CHEMICAL NAME OF BLEND	REFRIGERANT SAFETY GROUP CLASSIFICATION	AMOUNT OF REFRIGERANT PER OCCUPIED SPACE						OEL d	(F) DEGREES OF HAZARD[a]
				RCL			LFL[f]				
				lb/~~MCf~~ 1000 ft^3	ppm	g/m^3	lb/~~MCf~~ 1000 ft^3	ppm	g/m^3	ppm	
R-11[c]	CCl_3F	trichlorofluoromethane	A1	0.39	1,100	6.1	—	—	—	1,000	2-0-0[b]
R-12[c]	CCl_2F_2	dichlorodifluoromethane	A1	5.6	18,000	90	—	—	—	1,000	2-0-0[b]
R-13[c]	$CClF_3$	chlorotrifluoromethane	A1	—	—	—	—	—	—	1,000	2-0-0[b]
R-13B1[c]	$CBrF_3$	bromotrifluoromethane	A1	—	—	—	—	—	—	1,000	2-0-0[b]
R-13I1	CF_3I	trifluoroiodomethane	A1	1.0	2,000	16	—	—	—	500	—
R-14	CF_4	tetrafluoromethane (carbon tetrafluoride)	A1	25	110,000	400	—	—	—	1,000	2-0-0[b]
R-22	$CHClF_2$	chlorodifluoromethane	A1	13	59,000	210	—	—	—	1,000	2-0-0[b]
R-23	CHF_3	trifluoromethane (fluoroform)	A1	7.3	41,000	120	—	—	—	1,000	2-0-0[b]
R-30	CH_2Cl_2	dichloromethane (methylene chloride)	B1	—	—	—	—	—	—	—	—
R-31	CH_2ClF	chlorofluoromethane	—	—	—	—	—	—	—	—	—
R-32	CH_2F_2	difluoromethane (methylene fluoride)	A2L	4.8	36,000	77	19.1	144,000	306	1,000	1-4-0
R-40	CH_3Cl	chloromethane (methyl chloride)	B2	—	—	—	—	—	—	—	—
R-41	CH_3F	fluoromethane (methyl fluoride)	—	—	—	—	—	—	—	—	—
R-50	CH_4	methane	A3	—	—	—	—	50,000	—	1,000	—
R-113[c]	CCl_2FCClF_2	1,1,2-trichloro-1,2,2-trifluoroethane	A1	1.2	2,600	20	—	—	—	1,000	2-0-0[b]
R-114[c]	$CClF_2CClF_2$	1,2-dichloro-1,1,2,2-tetrafluoroethane	A1	8.7	20,000	140	—	—	—	1,000	2-0-0[b]
R-115	$CClF_2CF_3$	chloropentafluoroethane	A1	47	120,000	760	—	—	—	1,000	—
R-116	CF_3CF_3	hexafluoroethane	A1	34	97,000	550	—	—	—	1,000	1-0-0
R-123	$CHCl_2CF_3$	2,2-dichloro-1,1,1-trifluoroethane	B1	3.5	9,100	57	—	—	—	50	2-0-0[b]
R-124	$CHClFCF_3$	2-chloro-1,1,1,2-tetrafluoroethane	A1	3.5	10,000	56	—	—	—	1,000	2-0-0[b]
R-125	CHF_2CF_3	pentafluoroethane	A1	23	75,000	370	—	—	—	1,000	2-0-0[b]
R-134a	CH_2FCF_3	1,1,1,2-tetrafluoroethane	A1	13	50,000	210	—	—	—	1,000	2-0-0[b]
R-141b	CH_3CCl_2F	1,1-dichloro-1-fluoroethane	—	0.78	2,600	12	17.8	60,000	287	500	2-1-0
R-142b	CH_3CClF_2	1-chloro-1, 1-difluoroethane	A2	5.1	20,000	82	20.4	80,000	329	1,000	2-4-0
R-143a	CH_3CF_3	1,1,1-trifluoroethane	A2L	4.4	21,000	70	17.5	82,000	282	1,000	2-0-0[b]
R-152a	CH_3CHF_2	1,1-difluoroethane	A2	2.0	12,000	32	8.1	48,000	130	1,000	1-4-0
R-170	CH_3CH_3	ethane	A3	0.54	7,000	8.6	2.4	31,000	38	1,000	2-4-0
R-E170	CH_3OCH_3	Methoxymethane (dimethyl ether)	A3	1.0	8,500	16	4.0	34,000	64	1,000	—
R-218	$CF_3CF_2CF_3$	octafluoropropane	A1	43	90,000	690	—	—	—	1,000	2-0-0[b]
R-227ea	CF_3CHFCF_3	1,1,1,2,3,3,3-heptafluoropropane	A1	36	84,000	580	—	—	—	1,000	—
R-236fa	$CF_3CH_2CF_3$	1,1,1,3,3,3-hexafluoropropane	A1	21	55,000	340	—	—	—	1,000	2-0-0[b]
R-245fa	$CHF_2CH_2CF_3$	1,1,1,3,3-pentafluoropropane	B1	12	34,000	190	—	—	—	300	2-0-0[b]
R-290	$CH_3CH_2CH_3$	propane	A3	0.59	5,300	9.5	2.4	21,000	38	1,000	2-4-0
R-C318	$-(CF_2)_4-$	octafluorocyclobutane	A1	41	80,000	650	—	—	—	1,000	—
R-400[c]	zeotrope	R-12/114 (50.0/50.0)	A1	10	28,000	160	—	—	—	1,000	2-0-0[b]
R-400[c]	zeotrope	R-12/114 (60.0/40.0)	A1	11	30,000	170	—	—	—	1,000	—
R-401A	zeotrope	R-22/152a/124 (53.0/13.0/34.0)	A1	6.6	27,000	110	—	—	—	1,000	2-0-0[b]
R-401B	zeotrope	R-22/152a/124 (61.0/11.0/28.0)	A1	7.2	30,000	120	—	—	—	1,000	2-0-0[b]
R-401C	zeotrope	R-22/152a/124 (33.0/15.0/52.0)	A1	5.2	20,000	84	—	—	—	1,000	2-0-0[b]
R-402A	zeotrope	R-125/290/22 (60.0/2.0/38.0)	A1	17	66,000	270	—	—	—	1,000	2-0-0[b]
R-402B	zeotrope	R-125/290/22 (38.0/2.0/60.0)	A1	15	63,000	240	—	—	—	1,000	2-0-0[b]
R-403A	zeotrope	R-290/22/218 (5.0/75.0/20.0)	A2	7.6	33,000	120	—	—	—	1,000	2-0-0[b]
R-403B	zeotrope	R-290/22/218 (5.0/56.0/39.0)	A1	18	68,000	290	—	—	—	1,000	2-0-0[b]
R-404A	zeotrope	R-125/143a/134a (44.0/52.0/4.0)	A1	31	130,000	500	—	—	—	1,000	2-0-0[b]
R-405A	zeotrope	R-22/152a/142b/C318 (45.0/7.0/5.5/42.5)	—	16	57,000	260	—	—	—	1,000	—
R-406A	zeotrope	R-22/600a/142b (55.0/4.0/41.0)	A2	4.7	21,000	75	18.8[g]	82,000[g]	301.9[g]	1,000	—
R-407A	zeotrope	R-32/125/134a (20.0/40.0/40.0)	A1	19	83,000	300	—	—	—	1,000	2-0-0[b]
R-407B	zeotrope	R-32/125/134a (10.0/70.0/20.0)	A1	21	79,000	330	—	—	—	1,000	2-0-0[b]

CHEMICAL REFRIGERANT	FORMULA	CHEMICAL NAME OF BLEND	REFRIGERANT SAFETY GROUP CLASSIFICATION	AMOUNT OF REFRIGERANT PER OCCUPIED SPACE						OEL	(F) DEGREES OF HAZARD
				RCL			LFL				
				lb/~~MCf~~ 1000 ft	ppm	g/m	lb/~~MCf~~ 1000 ft	ppm	g/m	ppm	
R-407C	zeotrope	R-32/125/134a (23.0/25.0/52.0)	A1	18	81,000	290	—	—	—	1,000	2-0-0[b]
R-407D	zeotrope	R-32/125/134a (15.0/15.0/70.0)	A1	16	68,000	250	—	—	—	1,000	2-0-0[b]
R-407E	zeotrope	R-32/125/134a (25.0/15.0/60.0)	A1	17	80,000	280	—	—	—	1,000	2-0-0[b]
R-407F	zeotrope	R-32/125/134a (30.0/30.0/40.0)	A1	20	95,000	320	—	—	—	1,000	—
R-407G	zeotrope	R-32/125/134a (2.5/2.5/95.0)	A1	13	52,000	210	—	—	—	1,000	—
R-407H	zeotrope	R-32/125/134a (32.5/15.0/52.5)	A1	19	92,000	300	—	—	—	1,000	—
R-407I	zeotrope	R-32/125/124a (19.5/8.5/72.0)	A1	16	71,100	250	—	—	—	1,000	—
R-408A	zeotrope	R-125/143a/22 (7.0/46.0/47.0)	A1	21	94,000	330	—	—	—	1,000	2-0-0[b]
R-409A	zeotrope	R-22/124/142b (60.0/25.0/15.0)	A1	7.1	29,000	110	—	—	—	1,000	2-0-0[b]
R-409B	zeotrope	R-22/124/142b (65.0/25.0/10.0)	A1	7.3	30,000	120	—	—	—	1,000	2-0-0[b]
R-410A	zeotrope	R-32/125 (50.0/50.0)	A1	26	140,000	420	—	—	—	1,000	2-0-0[b]
R-410B	zeotrope	R-32/125 (45.0/55.0)	A1	27	140,000	430	—	—	—	1,000	2-0-0[b]
R-411A	zeotrope	R-127/22/152a (1.5/87.5/11.0)	A2	2.9	14,000	46	11.6[f]	55,000[f]	185.6[f]	970	—
R-411B	zeotrope	R-1270/22/152a (3.0/94.0/3.0)	A2	2.8	13,000	45	14.8[f]	70,000[f]	238.3[f]	940	—
R-412A	zeotrope	R-22/218/142b (70.0/5.0/25.0)	A2	5.1	22,000	82	20.5[f]	87,000[f]	328.6[f]	1,000	—
R-413A	zeotrope	R-218/134a/600a (9.0/88.0/3.0)	A2	5.8	22,000	93	23.4[f]	88,000[f]	374.9[f]	1,000	—
R-414A	zeotrope	R-22/124/600a/142b (51.0/28.5/4.0/16.5)	A1	6.4	26,000	100	—	—	—	1,000	—
R-414B	zeotrope	R-22/124/600a/142b (50.0/39.0/1.5/9.5)	A1	6.0	23,000	96	—	—	—	1,000	—
R-415A	zeotrope	R-22/152a (82.0/18.0)	A2	2.9	14,000	47	11.7[g]	56,000[g]	187.9[g]	1,000	—
R-415B	zeotrope	R-22/152a (25.0/75.0)	A2	2.1	12,000	34	—	—	—	1,000	—
R-416A	zeotrope	R-134a/124/600 (59.0/39.5/1.5)	A1	3.9	14,000	62	—	—	—	1,000	2-0-0[b]
R-417A	zeotrope	R-125/134a/600 (46.6/50.0/3.4)	A1	3.5	13,000	55	—	—	—	1,000	2-0-0[b]
R-417B	zeotrope	R-125/134a/600 (79.0/18.3/2.7)	A1	4.3	15,000	69	—	—	—	1,000	—
R-417C	zeotrope	R-125/134a/600 (19.5/78.8/1.7)	A1	5.4	21,000	87	—	—	—	1,000	—
R-418A	zeotrope	R-290/22/152a (1.5/96.0/2.5)	A2	4.8	22,000	77	19.2[g]	89,000[g]	308.4[g]	1,000	—
R-419A	zeotrope	R-125/134a/E170 (77.0/19.0/4.0)	A2	4.2	15,000	67	16.7[g]	60,000[g]	268.6[g]	1,000	—
R-419B	zeotrope	R-125/134a/E170 (48.5/48.0/3.5)	A2	4.6	17,000	74	18.5[g]	69,000[g]	297.3[g]	1,000	—
R-420A	zeotrope	R-134a/142b (88.0/12.0)	A1	12	44,000	180	—	—	—	1,000	2-0-0[b]
R-421A	zeotrope	R-125/134a (58.0/42.0)	A1	17	61,000	280	—	—	—	1,000	2-0-0[b]
R-421B	zeotrope	R-125/134a (85.0/15.0)	A1	21	69,000	330	—	—	—	1,000	2-0-0[b]
R-422A	zeotrope	R-125/134a/600a (85.1/11.5/3.4)	A1	18	63,000	290	—	—	—	1,000	2-0-0[b]
R-422B	zeotrope	R-125/134a/600a (55.0/42.0/3.0)	A1	16	56,000	250	—	—	—	1,000	2-0-0[b]
R-422C	zeotrope	R-125/134a/600a (82.0/15.0/3.0)	A1	18	62,000	290	—	—	—	1,000	2-0-0[b]
R-422D	zeotrope	R-125/134a/600a (65.1/31.5/3.4)	A1	16	58,000	260	—	—	—	1,000	2-0-0[b]
R-422E	zeotrope	R-125/134a/600a (58.0/39.3/2.7)	A1	16	57,000	260	—	—	—	1,000	—
R-423A	zeotrope	R-134a/227ea (52.5/47.5)	A1	19	59,000	300	—	—	—	1,000	2-0-0[b]
R-424A	zeotrope	R-125/134a/600a/600/601a (50.5/47.0/0.9/1.0/0.6)	A1	6.2	23,000	100	—	—	—	990	2-0-0[b]
R-425A	zoetrope	R-32/134a/227ea (18.5/69.5/12.0)	A1	16	72,000	260	—	—	—	1,000	2-0-0[b]
R-426A	zeotrope	R-125/134a/600a/601a (5.1/93.0/1.3/0.6)	A1	5.2	20,000	83	—	—	—	990	—
R-427A	zeotrope	R-32/125/143a/134a (15.0/25.0/10.0/50.0)	A1	18	79,000	290	—	—	—	1,000	2-1-0
R-428A	zeotrope	R-125/143a/290/600a (77.5/20.0/0.6/1.9)	A1	23	84,000	370	—	—	—	1,000	—
R-429A	zeotrope	R-E170/152a/600a (60.0/10.0/30.0)	A3	0.81	6,300	13	3.2	25,000	83.8	1,000	—
R-430A	zeotrope	R-152a/600a (76.0/24.0)	A3	1.3	8,000	21	5.2	32,000	44.0	1,000	—
R-431A	zeotrope	R-290/152a (71.0/29.0)	A3	0.68	5,500	11	2.7	22,000	38.6	1,000	—
R-432A	zeotrope	R-1270/E170 (80.0/20.0)	A3	0.13	1,200	2.1	2.4	22,000	39.2	550	—
R-433A	zeotrope	R-1270/290 (30.0/70.0)	A3	0.34	3,100	5.5	2.4	20,000	32.4	750	—
R-433B	zeotrope	R-1270/290 (5.0-95.0)	A3	0.39	3,500	6.3	2.0	18,000	32.1	950	—
R-433C	zeotrope	R-1270/290 (25.0-75.0)	A3	0.41	3,700	6.5	2.0	18,000	83.8	790	—
R-434A	zeotrope	R-125/143a/600a (63.2/18.0/16.0/2.8)	A1	20	73,000	320	—	—	—	1,000	—
R-435A	zeotrope	R-E170/152a (80.0/20.0)	A3	1.1	8,500	17	4.3	34,000	68.2	1,000	—
R-436A	zeotrope	R-290/600a (56.0/44.0)	A3	0.50	4,000	8.1	2.0	16,000	32.3	1,000	—
R-436B	zeotrope	R-290/600a (52.0/48.0)	A3	0.51	4,000	8.2	2.0	16,000	32.7	1,000	—
R-436C	zeotrope	R-290/600a (95.0/5.0)	A3	0.57	5,000	9.1	2.3	20,000	36.5	1,000	—
R-437A	zeotrope	R-125/134a/600/601 (19.5/78.5/1.4/0.6)	A1	5.1	19,000	82	—	—	—	990	—
R-438A	zeotrope	R-32/125/134a/600/601a (8.5/45.0/44.2/1.7/0.6)	A1	4.9	20,000	79	—	—	990	—	
R-439A	zeotrope	R-32/125/600a (50.0/47.0/3.0)	A2	4.7	26,000	76	18.9	104,000	303.3	1,000	—
R-440A	zeotrope	R-290/134a/152a (0.6/1.6/97.8)	A2	1.9	12,000	31	7.8[h]	46,000[h]	124.7[h]	1,000	—
R-441A	zeotrope	R-170/290/600a/600 (3.1/54.8/6.0/36.1)	A3	0.39	3,200	6.3	2.0	16,000	31.7	1,000	—
R-442A	zeotrope	R-32/125/134a/152a/227ea (31.0/31.0/30.0/3.0/5.0)	A1	21	100,000	330	—	—	1,000	—	
R-443A	zeotrope	R-1270/290/600a (55.0/40.0/5.0)	A3	0.19	1,700	3.1	2.2	20,000	35.6	640	—
R-444A	zeotrope	R-32/152a/1234ze(E) (12.0/5.0/83.0)	A2L	~~5.1~~5.0	21,000	~~81~~80	19.9	82,000	~~324.8~~ 319.4	850	—

CHEMICAL REFRIGERANT	FORMULA	CHEMICAL NAME OF BLEND	REFRIGERANT SAFETY GROUP CLASSIFICATION	AMOUNT OF REFRIGERANT PER OCCUPIED SPACE						OEL	(F) DEGREES OF HAZARD
				RCL			LFL				
				lb/~~MCf~~ 1000 ft	ppm	g/m	lb/~~MCf~~ 1000 ft	ppm	g/m	ppm	
R-444B	zeotrope	R-32/152a/1234ze(E) (41.5/10.0/48.5)	A2L	4.3	23,000	~~69~~70	17.3	93,000	~~277.3~~ 278.1	930	—
R-445A	zeotrope	R-744/134a/1234ze(E) (6.0/9.0/85.0)	A2L	~~4.2~~5.4	16,000	~~67~~87	~~2.7~~21.6	63,000	347.4	930	—
R-446A	zeotrope	R-32/1234ze(E)/600 (68.0/29.0/3.0)	A2L	~~2.5~~3.7	~~16,000~~ 23,000	~~39~~59	~~13.5~~14.8	~~62,000~~ 93,000	~~217.4~~ 237.7	960	—
R-447A	zeotrope	R-32/125/1234ze(E) (68.0/3.5/28.5)	A2L	~~2.6~~5.2	~~16,000~~ 32,000	~~42~~83	~~18.9~~20.6	~~65,000~~ 128,000	~~303.5~~ 331.4	960	—
R-447B	zeotrope	R-32/125/1234ze(E) (68.0/8.0/24.0)	A2L	~~2.6~~4.8	~~16,000~~ 30,000	~~42~~78	~~20.6~~19.5	121,000	312.7	970	—
R-448A	zeotrope	R-32/125/1234yf/134a/1234ze(E) (26.0/26.0/20.0/21.0/7.0)	A1	24	110,000	390	—	—	860	—	
R-449A	zeotrope	R-32/125/1234yf/134a (24.3/24.7/25.3/25.7)	A1	23	100,000	370	—	—	—	840	—
R-449B	zeotrope	R-32/125/1234yf/134a (25.2/24.3/23.2/27.3)	A1	23	100,000	370	—	—	—	850	—
R-449C	zeotrope	R-32/125/1234yf/134a (20.0/20.0/31.0/29.0)	A1	23	98,000	360	—	—	800	—	
R-450A	zeotrope	R-134a/1234ze(E) (42.0/58.0)	A1	20	72,000	320	—	—	—	880	—
R-451A	zeotrope	R-1234yf/134a (89.8/10.2)	A2L	~~5.0~~5.3	18,000	81	~~20.3~~21.3	~~70,000~~ 74,000	~~326.6~~ 341	530	—
R-451B	zeotrope	R-1234yf/134a (88.8/11.2)	A2L	5.0	18,000	81	~~20.3~~21.3	~~70,000~~ 74,000	~~326.6~~ 341.6	530	—
R-452A	zeotrope	R-32/125/1234yf (11.0/59.0/30.0)	A1	27	100,000	440	—	—	790	—	
R-452B	zeotrope	R-32/125/1234yf (67.0/7.0/26.0)	A2L	4.8	30,000	77	19.3	119,000	310.5	870	—
R-452C	zeotrope	R-32/125/1234yf (12.5/61.0/26.5)	A1	27	100,000	430	—	—	—	810	—
R-453A	zeotrope	R-32/125/134a/227ea/600/601a (20.0/20.0/53.8/5.0/0.6/0.6)	A1	7.8	34,000	120	—	—	1,000	—	
R-454A	zeotrope	R-32/1234yf (35.0/65.0)	A2L	~~3.2~~4.4	~~16,000~~ 21,000	~~52~~70	~~18.3~~17.5	~~63,000~~ 84,000	~~293.9~~ 281.4	690	—
R-454B	zeotrope	R-32/1234yf (68.9/31.1)	A2L	~~3.1~~4.6	~~19,000~~ 29,000	~~49~~74	~~22.0~~18.5	~~77,000~~ 115,000	~~352.6~~ 296.8	850	—
R-454C	zeotrope	R-32/1234yf (21.5/78.5)	A2L	~~4.4~~4.6	19,000	~~71~~73	~~18,0~~18.2	~~62,000~~ 77,000	~~289.5~~ 291.7	620	—
R-455A	zeotrope	R-744/32/1234yf (3.0/21.5/75.5)	A2L	~~4.9~~6.8	~~22,000~~ 30,000	~~79~~ 108	26.9	118,000	432.1	650	—
R-456A	zeotrope	R-32/134a/1234ze(E) (6.0/45.0/49.0)	A1	20	77,000	320	—	—	—	900	—
R-457A	zeotrope	R-32/1234yf/152a (18.0/70.0/12.0)	A2L	3.4	15,000	54	13.5	60,000	216.3	650	—
R-457B	zeotrope	R-32/1234yf/152a (35.0/55.0/10.0)	A2L	3.7	19,000	59	14.9	76,000	239	730	—
R-457C	zeotrope	R-32/1234yf/152a (7.5/78.0/14.5)	A2L	3.4	13,800	54	13.6	55,000	215	610	
R-457D	zeotrope	R-32/1234yf/152a (4.0/82.0/14.0)	A2L	3.6	14,000	58	14.9	57,000	235	580	
R-458A	zeotrope	R-32/125/134a/227ea/236fa (20.5/4.0/61.4/13.5/0.6)	A1	18	76,000	280	—	—	1,000	—	
R-459A	zeotrope	R-32/1234yf/1234ze(E) (68.0/26.0/6.0)	A2L	4.3	27,000	69	17.4	107,000	278.7	870	—
R-459B	zeotrope	R-32/1234yf/1234ze(E) (21.0/69.0/10.0)	A2L	~~30~~5.8	25,000	92	23.3	99,000	373.5	640	—
R-460A	zeotrope	R-32/125/134a/1234ze(E) (12.0/52.0/14.0/22.0)	A1	24	92,000	380	—	—	—	950	—
R-460B	zeotrope	R-32/125/134a/1234ze(E) (28.0/25.0/20.0/27.0)	A1	25	120,000	400	—	—	—	950	—
R-460C	zeotrope	R-32/125/134a/1234ze(E) (2.5/2.5/46.0/49.0)	A1	20	73,000	310	—	—	—	900	—
R-461A	zeotrope	R-125/143a/134a/227ea/600a (55.0/5.0/32.0/5.0/3.0)	A1	17	61,000	270	—	—	—	1,000	—
R-462A	zeotrope	R-32/125/143a/134a/600 (9.0/42.0/2.0/44.0/3.0)	A2	3.9	16,000	62	16.6 ~~f~~	105,000 f	265.8 ~~f~~	1,000	—
R-463A	zeotrope	R-744/32/125/1234yf/134a (6.0/36.0/30.0/14.0/14.0)	A1	19	98,000	300	—	—	—	990	—
R-464A	zeotrope	R-32/125/1234ze(E)/227ea (27.0/27.0/40.0/6.0)	A1	27	120,000	430	—	—	—	930	—

CHEMICAL REFRIGERANT	FORMULA	CHEMICAL NAME OF BLEND	REFRIGERANT SAFETY GROUP CLASSIFICATION	AMOUNT OF REFRIGERANT PER OCCUPIED SPACE							(F) DEGREES OF HAZARD
				RCL			LFL			OEL	
				lb/~~MCf~~ 1000 ft	ppm	g/m	lb/~~MCf~~ 1000 ft	ppm	g/m	ppm	
R-465A	zeotrope	R-32/290/1234yf (21.0/7.9/71.1)	A2	2.5	12,000	40	10.0	98,000	160.9	660	—
R-466A	zeotrope	R-32/125/13I1 (49.0/11.5/39.5)	A1	6.2	30,000	99	—	—	860	—	
R-467A	zeotrope	R-32/125/134a/600a (22.0/5.0/72.4/0.6)	A2L	6.7	31,000	110	—	—	1,000	—	
R-468A	zeotrope	R-1132a/32/1234yf (3.5/21.5/75.0)	A2L	4.1	18,000	66	—	—	—	610	—
R-468B	zeotrope	R-1132a/32/1234yf (6.0/13.0/81.0)	A2L	4.4	18,000	70	570				
R-468C	zeotrope	R-1132a/32/1234yf (6.0/42.0/52.0)	A2L	4.3	23,000	69	710				
R-469A	zeotrope	R-744/R-32/R-125 (35.0/32.5/32.5)	A1	8	53,000	—	—	—	1,600	—	
R-470A	zeotrope	R-744/32/125/134a/1234ze(E)/227ea (10.0/17.0/19.0/7.0/44.0/3.0)	A1	17	77,000	270	—	—	—	1,100	—
R-470B	zeotrope	R-744/32/125/134a/1234ze(E)/227ea (10.0/17.0/19.0/7.0/44.0/3.0)	A1	16	72,000	270	—	—	—	1,100	—
R-471A	zeotrope	R-1234ze(E)/227ea/1336mzz(E) (78.7/4.3/17.0)	A1	9.7	31,000	160	—	—	710	—	
R-472A	zeotrope	R-744/32/134a (69.0/12.0/19.0)	A1	4.5	35,000	72	—	—	—	2,700	—
R-472B	zeotrope	R-744/32/134a (58.0/10.0/32.0)	A1	5.0	36,000	80	2,400				
R-473A	zeotrope	R-1132a/23/744/125 (20.0/10.0/60.0/10.0)	A1	4.8	36,000	77	1,700				
R-474A	zeotrope	R-1132(E)/1234yf (23.0/77.0)	A2L	3.3	13,000	53	13	53,000	209	440	
R-475A	zeotrope	R-1234yf/134a/1234ze(E) (45.0/43.0/12.0)	A1	20.0	73,000	320	690				
R-476A	zeotrope	R-134a/1234ze(E)/1336mzz(E) (10.0/78.0/12.0)	A1	11	38,000	180	750				
R-477A	zeotrope	R-1270/600a (84.0/16.0)	A3	0.13	1,100	2.0	2.4	21,000	38	530	
R-477B	zeotrope	R-1270/600a (38.0/62.0)	A3	0.27	2,100	4.3	2.3	18,000	37	690	
R-478A	zeotrope	R-744/32/125/134a/152a/1234ze(E)/227ea (7.0/26.0/15.0/15.0/3.0/30.0/4.0)	A2L	4.8	24,000	77	17.1[f]	95,000[f]	270[f]	1,100	
R-479A	zeotrope	R-1132(E)/32/1234yf (28.0/21.5/50.5)	A2L	3.0	15,000	48	12.0	61,000	193	510	
R-480A	zeotrope	R-744/1234ze(E)/227ea (5.0/86.0/9.0)	A1	16	59,000	260	900				
R-481A	zeotrope	R-32/125/134a/1233zd(E)/601a (16.9/6.3/74.4/1.8/0.6)	A1	10	45,000	160	1,000				
R-482A	zeotrope	R-134a/1234ze(E)/1224yd(Z) (10.0/83.5/6.5)	A1	18	62,000	290	830				
R-484A	zeotrope	R-1270/600 (12.0/88.0)	A3	0.14	1,000	2.3	2.6	18,000	41	860	
R-500[~~d~~c]	azeotrope	R-12/152a (73.8/26.2)	A1	7.4	29,000	120	—	—	—	1,000	2-0-0[b]
R-501[c]	azeotrope	R-22/12 (75.0/25.0)	A1	13	54,000	210	—	—	—	1,000	—
R-502[~~d~~c]	azeotrope	R-22/115 (48.8/51.2)	A1	21	73,000	330	—	—	—	1,000	2-0-0[b]
R-503[~~d~~c]	azeotrope	R-23/13 (40.1/59.9)	—	—	—	—	—	—	—	1,000	2-0-0[b]
R-504[c]	azeotrope	R-32/115 (48.2/51.8)	—	28	140,000	450	—	—	—	1,000	—
R-507A	azeotrope	R-125/143a (50.0/50.0)	A1	32	130,000	510	—	—	—	1,000	2-0-0[b]
R-508A	azeotrope	R-23/116 (39.0/61.0)	A1	14	55,000	220	—	—	—	1,000	2-0-0[b]
R-508B	azeotrope	R-23/116 (46.0/54.0)	A1	13	52,000	200	—	—	—	1,000	2-0-0[b]
R-509A	azeotrope	R-22/218 (44.0/56.0)	A1	24	75,000	380	—	—	—	1,000	2-0-0[b]
R-510A	azeotrope	R-E170/600a (88.0/12.0)	A3	0.87	7,300	14	3.5	29,000	56.1	1,000	—
R-511A	azeotrope	R-290/E170 (95.0/5.0)	A3	0.59	5,300	9.5	2.4	21,000	38.0	1,000	—
R-512A	azeotrope	R-134a/152a (5.0/95.0)	A2	1.9	11,000	31	7.7	45,000	123.9	1,000	—
R-513A	azeotrope	R-1234yf/134a (56.0/44.0)	A1	20	72,000	320	—	—	—	650	—
R-513B	azeotrope	R-1234yf/134a (58.5/41.5)	A1	21	74,000	330	—	—	—	640	—
R-514A	azeotrope	R-1336mzz(S)/1130(E) (74.7/25.3)	B1	0.86	2,400	14	—	—	—	320	—
R-515A	azeotrope	R-1234ze(E)/227ea (88.0/12.0)	A1	19	63,000	300	—	—	—	810	—
R-515B	azeotrope	R-1234ze(E)/227ea (91.1/8.9)	A1	18	61,000	290	—	—	810		
R-516A	azeotrope	R-1234yf/134a/152a (77.5/8.5/14.0)	A2	3.2	13,000	52	13.1	50,000	210.1	590	—
R-600	$CH_3CH_2CH_2CH_3$	butane	A3	0.15	1,000	2.4	3.0	20,000	48	1,000	1-4-0
R-600a	$CH(CH_3)_2CH_3$	2-methylpropane (isobutane)	A3	0.59	4,000	9.5	2.4	16,000	38	1,000	2-4-0
R-601	$CH_3CH_2CH_2CH_2CH_3$	pentane	A3	0.18	1,000	2.9	2.2	12,000	35	600	—
R-601a	$(CH_3)_2CHCH_2CH_3$	2-methylbutane (isopentane)	A3	0.18	1,000	2.9	2.4	13,000	38	600	—
R-610	$CH_3CH_2OCH_2CH_3$	ethoxyethane (ethyl ether)	—	—	—	—	—	—	—	400	—
R-611	$HCOOCH_3$	methyl formate	B2	—	—	—	—	—	—	100	—
R-717	NH_3	ammonia	B2L	0.014	320	0.22	7.2	167,000	116	25	3-3-0[c]
R-718	H_2O	water	A1	—	—	—	—	—	—	—	0-0-0
R-744	CO_2	carbon dioxide	A1	~~4.5~~3.4	~~40,000~~ 30,000	~~72~~54	—	—	—	5,000	2-0-0[b]
R-1130(E)	CHCl=CHCl	trans-1,2-dichloroethene	B2	0.25	1,000	4	16	65,000	258	200	—
R-1132a	$CF_2=CH_2$	1,1-difluoro~~ethylene~~ethene	A2	2.0	13,000	33	8.1	50,000	131	500	—
R-1132(E)	(E)-CFH=CFH	Trans-1,2-difluoroethene	B2	1.8	11,000	28	7.0	43,000	113	350	
R-1150	$CH_2=CH_2$	ethene (ethylene)	~~A3~~B3	—	—	—	2.2	31,000	36	200	1-4-2
R-1224yd(Z)	$CF_3CF=CHCl$	(Z)-1-chloro-2,3,3,3-tetrafluoroethylene	A1	23	60,000	370	—	—	—	1,000	—
R-1233zd(E)	$CF_3CH=CHCl$	trans-1-chloro-3,3,3-trifluoro-1-propene	A1	5.3	16,000	85	—	—	—	800	—
R-1234yf	$CF_3CF=CH_2$	2,3,3,3-tetrafluoro-1-propene	A2L	4.5	16,000	75	18.0	62,000	289	500	—
R-1234ze(E)	$CF_3CH=CFH$	trans-1,3,3,3-tetrafluoro-1 -propene	A2L	4.7	16,000	76	18.8	65,000	303	800	—

CHEMICAL REFRIGERANT	FORMULA	CHEMICAL NAME OF BLEND	REFRIGERANT SAFETY GROUP CLASSIFICATION	AMOUNT OF REFRIGERANT PER OCCUPIED SPACE						OEL	(F) DEGREES OF HAZARD
				RCL			LFL				
				lb/~~MCf~~ <u>1000 ft</u>	ppm	g/m	lb/~~MCf~~ <u>1000 ft</u>	ppm	g/m	ppm	
R-1270	$CH_3CH{=}CH_2$	Propene (propylene)	A3	0.1<u>1</u>	1,000	1.7	—	—	—	500	1-4-1
R-1336mzz(E)	$CF_3CHCHCF_3$	trans 1,1,1,4,4,4-hexafluoro-2- butene	A1	3.0	7,200	48	—	—	—	400	
R-1336mzz(Z)	$CF_3CHCHCF_3$	cis-1,1,1,4,4,4-hexaflouro-2-butene	A1	5.2	13,000	84	—	—	—	500	—

For SI: 1 pound = 0.454 kg, 1 cubic foot = 0.0283 m^3.

a. Degrees of hazard are for health, fire, and reactivity, respectively, in accordance with NFPA 704.

b. Reduction to 1-0-0 is allowed if analysis satisfactory to the code official shows that the maximum concentration for a rupture or full loss of refrigerant charge would not exceed the IDLH, considering both the refrigerant quantity and room volume.

c. Class I ozone depleting substance; prohibited for new installations.

d. Occupational Exposure Limit based on the OSHA PEL, ACGIH TLV-TWA, the TERA WEEL or consistent value on a time-weighed average (TWA) basis (unless noted C for ceiling) for an 8 hr/d and 40 hr/wk.

<u>e. LFL is based on WCF @ 73.4°F (23°C) unless otherwise noted.</u>

<u>f. WCFF LFL @ 140°F (60°C).</u>

<u>g. WCFF LFL @ 73.4°F (23°C).</u>

<u>h. WCF LFL @ 212°F (100°C).</u>

Reason: The Refrigerant Classifications (except Degrees of Hazard) are determined by ASHRAE SSPC 34 and published in ASHRAE Standard 34. This proposal seeks to update the refrigerant table with the new refrigerants added to Standard 34 since the last code cycle. The reasons for the additions of new refrigerants can be found at https://www.ashrae.org/standards-research--technology/standards-addenda. All proposed changes are either incorporated into ASHRAE Standard 34-2022 or the published addenda to ASHRAE Standard 34-2022 located at the link above.

Bibliography: ASHRAE Standard 34-2022, Addenda a, b, c, d, e, f, g, h, j, k, m, ac, ah to ASHRAE Standard 34-2022 - https://www.ashrae.org/standards-research--technology/standards-addenda

Cost Impact: The change proposal is editorial in nature or a clarification and has no cost impact on the cost of construction

Justification for no cost impact:

Updating the table of refrigerants that could be used in systems does not add labor or material costs because the choice of refrigerant is up to the owner and designer.

M64-24

Public Hearing Results (CAH1)

Committee Action: **As Modified by Committee**

Committee Modification:

International Mechanical Code

TABLE 1103.1 REFRIGERANT CLASSIFICATION, AMOUNT AND OEL

CHEMICAL REFRIGERANT	FORMULA	CHEMICAL NAME OF BLEND	REFRIGERANT SAFETY GROUP CLASSIFICATION	AMOUNT OF REFRIGERANT PER OCCUPIED SPACE							(F) DEGREES OF HAZARD[a]
				RCL			LFL[f]			OEL[d]	
				lb/1000 ft^3	ppm	g/m^3	lb/1000 ft^3	ppm	g/m^3	ppm	
R-11[c]	CCl_3F	trichlorofluoromethane	A1	0.39	1,100	6.1	—	—	—	1,000	2-0-0[b]
R-12[c]	CCl_2F_2	dichlorodifluoromethane	A1	5.6	18,000	90	—	—	—	1,000	2-0-0[b]
R-13[c]	$CClF_3$	chlorotrifluoromethane	A1	—	—	—	—	—	—	1,000	2-0-0[b]
R-13B1[c]	$CBrF_3$	bromotrifluoromethane	A1	—	—	—	—	—	—	1,000	2-0-0[b]
R-13I1	CF_3I	trifluoroiodomethane	A1	1.0	2,000	16	—	—	—	500	—
R-14	CF_4	tetrafluoromethane (carbon tetrafluoride)	A1	25	110,000	400	—	—	—	1,000	2-0-0[b]
R-22	$CHClF_2$	chlorodifluoromethane	A1	13	59,000	210	—	—	—	1,000	2-0-0[b]
R-23	CHF_3	trifluoromethane (fluoroform)	A1	7.3	41,000	120	—	—	—	1,000	2-0-0[b]
R-30	CH_2Cl_2	dichloromethane (methylene chloride)	B1	—	—	—	—	—	—	—	—
R-31	CH_2ClF	chlorofluoromethane	—	—	—	—	—	—	—	—	—
R-32	CH_2F_2	difluoromethane (methylene fluoride)	A2L	4.8	36,000	77	19.1	144,000	306	1,000	1-4-0
R-40	CH_3Cl	chloromethane (methyl chloride)	B2	—	—	—	—	—	—	—	—
R-41	CH_3F	fluoromethane (methyl fluoride)	—	—	—	—	—	—	—	—	—
R-50	CH_4	methane	A3	—	—	—	—	50,000	—	1,000	—
R-113[c]	CCl_2FCClF_2	1,1,2-trichloro-1,2,2-trifluoroethane	A1	1.2	2,600	20	—	—	—	1,000	2-0-0[b]
R-114[c]	$CClF_2CClF_2$	1,2-dichloro-1,1,2,2-tetrafluoroethane	A1	8.7	20,000	140	—	—	—	1,000	2-0-0[b]
R-115	$CClF_2CF_3$	chloropentafluoroethane	A1	47	120,000	760	—	—	—	1,000	—
R-116	CF_3CF_3	hexafluoroethane	A1	34	97,000	550	—	—	—	1,000	1-0-0
R-123	$CHCl_2CF_3$	2,2-dichloro-1,1,1-trifluoroethane	B1	3.5	9,100	57	—	—	—	50	2-0-0[b]
R-124	$CHClFCF_3$	2-chloro-1,1,1,2-tetrafluoroethane	A1	3.5	10,000	56	—	—	—	1,000	2-0-0[b]
R-125	CHF_2CF_3	pentafluoroethane	A1	23	75,000	370	—	—	—	1,000	2-0-0[b]
R-134a	CH_2FCF_3	1,1,1,2-tetrafluoroethane	A1	13	50,000	210	—	—	—	1,000	2-0-0[b]
R-141b	CH_3CCl_2F	1,1-dichloro-1-fluoroethane	—	0.78	2,600	12	17.8	60,000	287	500	2-1-0
R-142b	CH_3CClF_2	1-chloro-1, 1-difluoroethane	A2	5.1	20,000	82	20.4	80,000	329	1,000	2-4-0
R-143a	CH_3CF_3	1,1,1-trifluoroethane	A2L	4.4	21,000	70	17.5	82,000	282	1,000	2-0-0[b]
R-152a	CH_3CHF_2	1,1-difluoroethane	A2	2.0	12,000	32	8.1	48,000	130	1,000	1-4-0
R-170	CH_3CH_3	ethane	A3	0.54	7,000	8.6	2.4	31,000	38	1,000	2-4-0
R-E170	CH_3OCH_3	Methoxymethane (dimethyl ether)	A3	1.0	8,500	16	4.0	34,000	64	1,000	—
R-218	$CF_3CF_2CF_3$	octafluoropropane	A1	43	90,000	690	—	—	—	1,000	2-0-0[b]
R-227ea	CF_3CHFCF_3	1,1,1,2,3,3,3-heptafluoropropane	A1	36	84,000	580	—	—	—	1,000	—
R-236fa	$CF_3CH_2CF_3$	1,1,1,3,3,3-hexafluoropropane	A1	21	55,000	340	—	—	—	1,000	2-0-0[b]
R-245fa	$CHF_2CH_2CF_3$	1,1,1,3,3-pentafluoropropane	B1	12	34,000	190	—	—	—	300	2-0-0[b]
R-290	$CH_3CH_2CH_3$	propane	A3	0.59	5,300	9.5	2.4	21,000	38	1,000	2-4-0
R-C318	$-(CF_2)_4-$	octafluorocyclobutane	A1	41	80,000	650	—	—	—	1,000	—
R-400[c]	zeotrope	R-12/114 (50.0/50.0)	A1	10	28,000	160	—	—	—	1,000	2-0-0[b]
R-400[c]	zeotrope	R-12/114 (60.0/40.0)	A1	11	30,000	170	—	—	—	1,000	—
R-401A	zeotrope	R-22/152a/124 (53.0/13.0/34.0)	A1	6.6	27,000	110	—	—	—	1,000	2-0-0[b]
R-401B	zeotrope	R-22/152a/124 (61.0/11.0/28.0)	A1	7.2	30,000	120	—	—	—	1,000	2-0-0[b]
R-401C	zeotrope	R-22/152a/124 (33.0/15.0/52.0)	A1	5.2	20,000	84	—	—	—	1,000	2-0-0[b]
R-402A	zeotrope	R-125/290/22 (60.0/2.0/38.0)	A1	17	66,000	270	—	—	—	1,000	2-0-0[b]
R-402B	zeotrope	R-125/290/22 (38.0/2.0/60.0)	A1	15	63,000	240	—	—	—	1,000	2-0-0[b]
R-403A	zeotrope	R-290/22/218 (5.0/75.0/20.0)	A2	7.6	33,000	120	—	—	—	1,000	2-0-0[b]
R-403B	zeotrope	R-290/22/218 (5.0/56.0/39.0)	A1	18	68,000	290	—	—	—	1,000	2-0-0[b]
R-404A	zeotrope	R-125/143a/134a (44.0/52.0/4.0)	A1	31	130,000	500	—	—	—	1,000	2-0-0[b]
R-405A	zeotrope	R-22/152a/142b/C318 (45.0/7.0/5.5/42.5)	—	16	57,000	260	—	—	—	1,000	—
R-406A	zeotrope	R-22/600a/142b (55.0/4.0/41.0)	A2	4.7	21,000	75	18.8[g]	82,000[g]	301.9[g]	1,000	—
R-407A	zeotrope	R-32/125/134a (20.0/40.0/40.0)	A1	19	83,000	300	—	—	—	1,000	2-0-0[b]
R-407B	zeotrope	R-32/125/134a (10.0/70.0/20.0)	A1	21	79,000	330	—	—	—	1,000	2-0-0[b]
R-407C	zeotrope	R-32/125/134a (23.0/25.0/52.0)	A1	18	81,000	290	—	—	—	1,000	2-0-0[b]
R-407D	zeotrope	R-32/125/134a (15.0/15.0/70.0)	A1	16	68,000	250	—	—	—	1,000	2-0-0[b]
R-407E	zeotrope	R-32/125/134a (25.0/15.0/60.0)	A1	17	80,000	280	—	—	—	1,000	2-0-0[b]
R-407F	zeotrope	R-32/125/134a (30.0/30.0/40.0)	A1	20	95,000	320	—	—	—	1,000	—
R-407G	zeotrope	R-32/125/134a (2.5/2.5/95.0)	A1	13	52,000	210	—	—	—	1,000	—
R-407H	zeotrope	R-32/125/134a (32.5/15.0/52.5)	A1	19	92,000	300	—	—	—	1,000	—
R-407I	zeotrope	R-32/125/124a (19.5/8.5/72.0)	A1	16	71,100	250	—	—	—	1,000	—
R-408A	zeotrope	R-125/143a/22 (7.0/46.0/47.0)	A1	21	94,000	330	—	—	—	1,000	2-0-0[b]
R-409A	zeotrope	R-22/124/142b (60.0/25.0/15.0)	A1	7.1	29,000	110	—	—	—	1,000	2-0-0[b]
R-409B	zeotrope	R-22/124/142b (65.0/25.0/10.0)	A1	7.3	30,000	120	—	—	—	1,000	2-0-0[b]
R-410A	zeotrope	R-32/125 (50.0/50.0)	A1	26	140,000	420	—	—	—	1,000	2-0-0[b]
R-410B	zeotrope	R-32/125 (45.0/55.0)	A1	27	140,000	430	—	—	—	1,000	2-0-0[b]
R-411A	zeotrope	R-127/22/152a (1.5/87.5/11.0)	A2	2.9	14,000	46	11.6[f]	55,000[f]	185.6[f]	970	—
R-411B	zeotrope	R-1270/22/152a (3.0/94.0/3.0)	A2	2.8	13,000	45	14.8[f]	70,000[f]	238.3[f]	940	—
R-412A	zeotrope	R-22/218/142b (70.0/5.0/25.0)	A2	5.1	22,000	82	20.5[f]	87,000[f]	328.6[f]	1,000	—
R-413A	zeotrope	R-218/134a/600a (9.0/88.0/3.0)	A2	5.8	22,000	93	23.4[f]	88,000[f]	374.9[f]	1,000	—
R-414A	zeotrope	R-22/124/600a/142b (51.0/28.5/4.0/16.5)	A1	6.4	26,000	100	—	—	—	1,000	—
R-414B	zeotrope	R-22/124/600a/142b (50.0/39.0/1.5/9.5)	A1	6.0	23,000	96	—	—	—	1,000	—
R-415A	zeotrope	R-22/152a (82.0/18.0)	A2	2.9	14,000	47	11.7[g]	56,000[g]	187.9[g]	1,000	—

CHEMICAL REFRIGERANT	FORMULA	CHEMICAL NAME OF BLEND	REFRIGERANT SAFETY GROUP CLASSIFICATION	AMOUNT OF REFRIGERANT PER OCCUPIED SPACE							(F) DEGREES OF HAZARD
				RCL			LFL			OEL	
				lb/1000 ft	ppm	g/m	lb/1000 ft	ppm	g/m	ppm	
R-415B	zeotrope	R-22/152a (25.0/75.0)	A2	2.1	12,000	34	—	—	—	1,000	—
R-416A	zeotrope	R-134a/124/600 (59.0/39.5/1.5)	A1	3.9	14,000	62	—	—	—	1,000	2-0-0[b]
R-417A	zeotrope	R-125/134a/600 (46.6/50.0/3.4)	A1	3.5	13,000	55	—	—	—	1,000	2-0-0[b]
R-417B	zeotrope	R-125/134a/600 (79.0/18.3/2.7)	A1	4.3	15,000	69	—	—	—	1,000	—
R-417C	zeotrope	R-125/134a/600 (19.5/78.8/1.7)	A1	5.4	21,000	87	—	—	—	1,000	—
R-418A	zeotrope	R-290/22/152a (1.5/96.0/2.5)	A2	4.8	22,000	77	19.2[g]	89,000[g]	308.4[g]	1,000	—
R-419A	zeotrope	R-125/134a/E170 (77.0/19.0/4.0)	A2	4.2	15,000	67	16.7[g]	60,000[g]	268.6[g]	1,000	—
R-419B	zeotrope	R-125/134a/E170 (48.5/48.0/3.5)	A2	4.6	17,000	74	18.5[g]	69,000[g]	297.3[g]	1,000	—
R-420A	zeotrope	R-134a/142b (88.0/12.0)	A1	12	44,000	180	—	—	—	1,000	2-0-0[b]
R-421A	zeotrope	R-125/134a (58.0/42.0)	A1	17	61,000	280	—	—	—	1,000	2-0-0[b]
R-421B	zeotrope	R-125/134a (85.0/15.0)	A1	21	69,000	330	—	—	—	1,000	2-0-0[b]
R-422A	zeotrope	R-125/134a/600a (85.1/11.5/3.4)	A1	18	63,000	290	—	—	—	1,000	2-0-0[b]
R-422B	zeotrope	R-125/134a/600a (55.0/42.0/3.0)	A1	16	56,000	250	—	—	—	1,000	2-0-0[b]
R-422C	zeotrope	R-125/134a/600a (82.0/15.0/3.0)	A1	18	62,000	290	—	—	—	1,000	2-0-0[b]
R-422D	zeotrope	R-125/134a/600a (65.1/31.5/3.4)	A1	16	58,000	260	—	—	—	1,000	2-0-0[b]
R-422E	zeotrope	R-125/134a/600a (58.0/39.3/2.7)	A1	16	57,000	260	—	—	—	1,000	—
R-423A	zeotrope	R-134a/227ea (52.5/47.5)	A1	19	59,000	300	—	—	—	1,000	2-0-0[b]
R-424A	zeotrope	R-125/134a/600a/600/601a (50.5/47.0/0.9/1.0/0.6)	A1	6.2	23,000	100	—	—	—	990	2-0-0[b]
R-425A	zoetrope	R-32/134a/227ea (18.5/69.5/12.0)	A1	16	72,000	260	—	—	—	1,000	2-0-0[b]
R-426A	zeotrope	R-125/134a/600a/601a (5.1/93.0/1.3/0.6)	A1	5.2	20,000	83	—	—	—	990	—
R-427A	zeotrope	R-32/125/143a/134a (15.0/25.0/10.0/50.0)	A1	18	79,000	290	—	—	—	1,000	2-1-0
R-428A	zeotrope	R-125/143a/290/600a (77.5/20.0/0.6/1.9)	A1	23	84,000	370	—	—	—	1,000	—
R-429A	zeotrope	R-E170/152a/600a (60.0/10.0/30.0)	A3	0.81	6,300	13	3.2	25,000	83.8	1,000	—
R-430A	zeotrope	R-152a/600a (76.0/24.0)	A3	1.3	8,000	21	5.2	32,000	44.0	1,000	—
R-431A	zeotrope	R-290/152a (71.0/29.0)	A3	0.68	5,500	11	2.7	22,000	38.6	1,000	—
R-432A	zeotrope	R-1270/E170 (80.0/20.0)	A3	0.13	1,200	2.1	2.4	22,000	39.2	550	—
R-433A	zeotrope	R-1270/290 (30.0/70.0)	A3	0.34	3,100	5.5	2.4	20,000	32.4	750	—
R-433B	zeotrope	R-1270/290 (5.0-95.0)	A3	0.39	3,500	6.3	2.0	18,000	32.1	950	—
R-433C	zeotrope	R-1270/290 (25.0-75.0)	A3	0.41	3,700	6.5	2.0	18,000	83.8	790	—
R-434A	zeotrope	R-125/143a/600a (63.2/18.0/16.0/2.8)	A1	20	73,000	320	—	—	—	1,000	—
R-435A	zeotrope	R-E170/152a (80.0/20.0)	A3	1.1	8,500	17	4.3	34,000	68.2	1,000	—
R-436A	zeotrope	R-290/600a (56.0/44.0)	A3	0.50	4,000	8.1	2.0	16,000	32.3	1,000	—
R-436B	zeotrope	R-290/600a (52.0/48.0)	A3	0.51	4,000	8.2	2.0	16,000	32.7	1,000	—
R-436C	zeotrope	R-290/600a (95.0/5.0)	A3	0.57	5,000	9.1	2.3	20,000	36.5	1,000	—
R-437A	zeotrope	R-125/134a/600/601 (19.5/78.5/1.4/0.6)	A1	5.1	19,000	82	—	—	—	990	—
R-438A	zeotrope	R-32/125/134a/600/601a (8.5/45.0/44.2/1.7/0.6)	A1	4.9	20,000	79	—	—	~~990~~	990	
R-439A	zeotrope	R-32/125/600a (50.0/47.0/3.0)	A2	4.7	26,000	76	18.9	104,000	303.3	1,000	—
R-440A	zeotrope	R-290/134a/152a (0.6/1.6/97.8)	A2	1.9	12,000	31	7.8[h]	46,000[h]	124.7[h]	1,000	—
R-441A	zeotrope	R-170/290/600a/600 (3.1/54.8/6.0/36.1)	A3	0.39	3,200	6.3	2.0	16,000	31.7	1,000	—
R-442A	zeotrope	R-32/125/134a/152a/227ea (31.0/31.0/30.0/3.0/5.0)	A1	21	100,000	330	—	—	1,000	—	
R-443A	zeotrope	R-1270/290/600a (55.0/40.0/5.0)	A3	0.19	1,700	3.1	2.2	20,000	35.6	640	—
R-444A	zeotrope	R-32/152a/1234ze(E) (12.0/5.0/83.0)	A2L	5.0	21,000	80	19.9	82,000	319.4	850	—
R-444B	zeotrope	R-32/152a/1234ze(E) (41.5/10.0/48.5)	A2L	4.3	23,000	70	17.3	93,000	278.1	930	—
R-445A	zeotrope	R-744/134a/1234ze(E) (6.0/9.0/85.0)	A2L	5.4	16,000	87	21.6	63,000	347.4	930	—
R-446A	zeotrope	R-32/1234ze(E)/600 (68.0/29.0/3.0)	A2L	3.7	23,000	59	14.8	93,000	237.7	960	—
R-447A	zeotrope	R-32/125/1234ze(E) (68.0/3.5/28.5)	A2L	5.2	32,000	83	20.6	128,000	331.4	960	—
R-447B	zeotrope	R-32/125/1234ze(E) (68.0/8.0/24.0)	A2L	4.8	30,000	78	19.5	121,000	312.7	970	—
R-448A	zeotrope	R-32/125/1234yf/134a/1234ze(E) (26.0/26.0/20.0/21.0/7.0)	A1	24	110,000	390	—	—	~~860~~	860	
R-449A	zeotrope	R-32/125/1234yf/134a (24.3/24.7/25.3/25.7)	A1	23	100,000	370	—	—	—	840	—
R-449B	zeotrope	R-32/125/1234yf/134a (25.2/24.3/23.2/27.3)	A1	23	100,000	370	—	—	—	850	—
R-449C	zeotrope	R-32/125/1234yf/134a (20.0/20.0/31.0/29.0)	A1	23	98,000	360	—	—	~~800~~	800	
R-450A	zeotrope	R-134a/1234ze(E) (42.0/58.0)	A1	20	72,000	320	—	—	—	880	—
R-451A	zeotrope	R-1234yf/134a (89.8/10.2)	A2L	5.3	18,000	81	21.3	74,000	341	530	—
R-451B	zeotrope	R-1234yf/134a (88.8/11.2)	A2L	5.0	18,000	81	21.3	74,000	341.6	530	—
R-452A	zeotrope	R-32/125/1234yf (11.0/59.0/30.0)	A1	27	100,000	440	—	—	~~790~~	790	
R-452B	zeotrope	R-32/125/1234yf (67.0/7.0/26.0)	A2L	4.8	30,000	77	19.3	119,000	310.5	870	—
R-452C	zeotrope	R-32/125/1234yf (12.5/61.0/26.5)	A1	27	100,000	430	—	—	—	810	—
R-453A	zeotrope	R-32/125/134a/227ea/600/601a (20.0/20.0/53.8/5.0/0.6/0.6)	A1	7.8	34,000	120	—	—	~~1,000~~	1,000	

CHEMICAL REFRIGERANT	FORMULA	CHEMICAL NAME OF BLEND	REFRIGERANT SAFETY GROUP CLASSIFICATION	AMOUNT OF REFRIGERANT PER OCCUPIED SPACE							(F) DEGREES OF HAZARD
				RCL			LFL			OEL	
				lb/1000 ft	ppm	g/m	lb/1000 ft	ppm	g/m	ppm	
R-454A	zeotrope	R-32/1234yf (35.0/65.0)	A2L	4.4	21,000	70	17.5	84,000	281.4	690	—
R-454B	zeotrope	R-32/1234yf (68.9/31.1)	A2L	4.6	29,000	74	18.5	115,000	296.8	850	—
R-454C	zeotrope	R-32/1234yf (21.5/78.5)	A2L	4.6	19,000	73	18.2	77,000	291.7	620	—
R-455A	zeotrope	R-744/32/1234yf (3.0/21.5/75.5)	A2L	6.8	30,000	108	26.9	118,000	432.1	650	—
R-456A	zeotrope	R-32/134a/1234ze(E) (6.0/45.0/49.0)	A1	20	77,000	320	—	—	—	900	—
R-457A	zeotrope	R-32/1234yf/152a (18.0/70.0/12.0)	A2L	3.4	15,000	54	13.5	60,000	216.3	650	—
R-457B	zeotrope	R-32/1234yf/152a (35.0/55.0/10.0)	A2L	3.7	19,000	59	14.9	76,000	239	730	—
R-457C	zeotrope	R-32/1234yf/152a (7.5/78.0/14.5)	A2L	3.4	13,800	54	13.6	55,000	215	610	
R-457D	zeotrope	R-32/1234yf/152a (4.0/82.0/14.0)	A2L	3.6	14,000	58	14.9	57,000	235	580	
R-458A	zeotrope	R-32/125/134a/227ea/236fa (20.5/4.0/61.4/13.5/0.6)	A1	18	76,000	280	—	—	~~1,000~~	1,000	
R-459A	zeotrope	R-32/1234yf/1234ze(E) (68.0/26.0/6.0)	A2L	4.3	27,000	69	17.4	107,000	278.7	870	—
R-459B	zeotrope	R-32/1234yf/1234ze(E) (21.0/69.0/10.0)	A2L	5.8	25,000	92	23.3	99,000	373.5	640	—
R-460A	zeotrope	R-32/125/134a/1234ze(E) (12.0/52.0/14.0/22.0)	A1	24	92,000	380	—	—	—	950	—
R-460B	zeotrope	R-32/125/134a/1234ze(E) (28.0/25.0/20.0/27.0)	A1	25	120,000	400	—	—	—	950	—
R-460C	zeotrope	R-32/125/134a/1234ze(E) (2.5/2.5/46.0/49.0)	A1	20	73,000	310	—	—	—	900	—
R-461A	zeotrope	R-125/143a/134a/227ea/600a (55.0/5.0/32.0/5.0/3.0)	A1	17	61,000	270	—	—	—	1,000	—
R-462A	zeotrope	R-32/125/143a/134a/600 (9.0/42.0/2.0/44.0/3.0)	A2	3.9	16,000	62	16.6[f]	105,000[f]	265.8[f]	1,000	—
R-463A	zeotrope	R-744/32/125/1234yf/134a (6.0/36.0/30.0/14.0/14.0)	A1	19	98,000	300	—	—	—	990	—
R-464A	zeotrope	R-32/125/1234ze(E)/227ea (27.0/27.0/40.0/6.0)	A1	27	120,000	430	—	—	—	930	—
R-465A	zeotrope	R-32/290/1234yf (21.0/7.9/71.1)	A2	2.5	12,000	40	10.0	98,000	160.9	660	—
R-466A	zeotrope	R-32/125/13I1 (49.0/11.5/39.5)	A1	6.2	30,000	99	—	—	~~860~~	860	
R-467A	zeotrope	R-32/125/134a/600a (22.0/5.0/72.4/0.6)	A2L	6.7	31,000	110	—	—	~~1,000~~	1,000	
R-468A	zeotrope	R-1132a/32/1234yf (3.5/21.5/75.0)	A2L	4.1	18,000	66	—	—	—	610	—
R-468B	zeotrope	R-1132a/32/1234yf (6.0/13.0/81.0)	A2L	4.4	18,000	70	~~570~~			570	
R-468C	zeotrope	R-1132a/32/1234yf (6.0/42.0/52.0)	A2L	4.3	23,000	69	~~710~~			710	
R-469A	zeotrope	R-744/R-32/R-125 (35.0/32.5/32.5)	A1	8	53,000	—	—	—	~~1,600~~	1,600	
R-470A	zeotrope	R-744/32/125/134a/1234ze(E)/227ea (10.0/17.0/19.0/7.0/44.0/3.0)	A1	17	77,000	270	—	—	—	1,100	—
R-470B	zeotrope	R-744/32/125/134a/1234ze(E)/227ea (10.0/17.0/19.0/7.0/44.0/3.0)	A1	16	72,000	270	—	—	—	1,100	—
R-471A	zeotrope	R-1234ze(E)/227ea/1336mzz(E) (78.7/4.3/17.0)	A1	9.7	31,000	160	—	—	~~710~~	710	
R-472A	zeotrope	R-744/32/134a (69.0/12.0/19.0)	A1	4.5	35,000	72	—	—	—	2,700	—
R-472B	zeotrope	R-744/32/134a (58.0/10.0/32.0)	A1	5.0	36,000	80	~~2,400~~			2400	
R-473A	zeotrope	R-1132a/23/744/125 (20.0/10.0/60.0/10.0)	A1	4.8	36,000	77	~~1,700~~			1700	
R-474A	zeotrope	R-1132(E)/1234yf (23.0/77.0)	A2L	3.3	13,000	53	13	53,000	209	440	
R-475A	zeotrope	R-1234yf/134a/1234ze(E) (45.0/43.0/12.0)	A1	20.0	73,000	320	~~690~~			690	
R-476A	zeotrope	R-134a/1234ze(E)/1336mzz(E) (10.0/78.0/12.0)	A1	11	38,000	180	~~750~~			750	
R-477A	zeotrope	R-1270/600a (84.0/16.0)	A3	0.13	1,100	2.0	2.4	21,000	38	530	
R-477B	zeotrope	R-1270/600a (38.0/62.0)	A3	0.27	2,100	4.3	2.3	18,000	37	690	
R-478A	zeotrope	R-744/32/125/134a/152a/1234ze(E)/227ea (7.0/26.0/15.0/15.0/3.0/30.0/4.0)	A2L	4.8	24,000	77	17.1[f]	95,000[f]	270[f]	1,100	
R-479A	zeotrope	R-1132(E)/32/1234yf (28.0/21.5/50.5)	A2L	3.0	15,000	48	12.0	61,000	193	510	
R-480A	zeotrope	R-744/1234ze(E)/227ea (5.0/86.0/9.0)	A1	16	59,000	260	~~900~~			900	
R-481A	zeotrope	R-32/125/134a/1233zd(E)/601a (16.9/6.3/74.4/1.8/0.6)	A1	10	45,000	160	~~1,000~~			1,000	
R-482A	zeotrope	R-134a/1234ze(E)/1224yd(Z) (10.0/83.5/6.5)	A1	18	62,000	290	~~830~~			830	
R-484A	zeotrope	R-1270/600 (12.0/88.0)	A3	0.14	1,000	2.3	2.6	18,000	41	860	
R-500[c]	azeotrope	R-12/152a (73.8/26.2)	A1	7.4	29,000	120	—	—	—	1,000	2-0-0[b]
R-501[c]	azeotrope	R-22/12 (75.0/25.0)	A1	13	54,000	210	—	—	—	1,000	—
R-502[c]	azeotrope	R-22/115 (48.8/51.2)	A1	21	73,000	330	—	—	—	1,000	2-0-0[b]
R-503[c]	azeotrope	R-23/13 (40.1/59.9)	—	—	—	—	—	—	—	1,000	2-0-0[b]
R-504[c]	azeotrope	R-32/115 (48.2/51.8)	—	28	140,000	450	—	—	—	1,000	—
R-507A	azeotrope	R-125/143a (50.0/50.0)	A1	32	130,000	510	—	—	—	1,000	2-0-0[b]
R-508A	azeotrope	R-23/116 (39.0/61.0)	A1	14	55,000	220	—	—	—	1,000	2-0-0[b]
R-508B	azeotrope	R-23/116 (46.0/54.0)	A1	13	52,000	200	—	—	—	1,000	2-0-0[b]
R-509A	azeotrope	R-22/218 (44.0/56.0)	A1	24	75,000	380	—	—	—	1,000	2-0-0[b]
R-510A	azeotrope	R-E170/600a (88.0/12.0)	A3	0.87	7,300	14	3.5	29,000	56.1	1,000	—
R-511A	azeotrope	R-290/E170 (95.0/5.0)	A3	0.59	5,300	9.5	2.4	21,000	38.0	1,000	—
R-512A	azeotrope	R-134a/152a (5.0/95.0)	A2	1.9	11,000	31	7.7	45,000	123.9	1,000	—
R-513A	azeotrope	R-1234yf/134a (56.0/44.0)	A1	20	72,000	320	—	—	—	650	—
R-513B	azeotrope	R-1234yf/134a (58.5/41.5)	A1	21	74,000	330	—	—	—	640	—
R-514A	azeotrope	R-1336mzz(S)/1130(E) (74.7/25.3)	B1	0.86	2,400	14	—	—	—	320	—
R-515A	azeotrope	R-1234ze(E)/227ea (88.0/12.0)	A1	19	63,000	300	—	—	—	810	—
R-515B	azeotrope	R-1234ze(E)/227ea (91.1/8.9)	A1	18	61,000	290	—	—	~~810~~	810	
R-516A	azeotrope	R-1234yf/134a/152a (77.5/8.5/14.0)	A2	3.2	13,000	5 2	13.1	50,000	210.1	590	—

CHEMICAL REFRIGERANT	FORMULA	CHEMICAL NAME OF BLEND	REFRIGERANT SAFETY GROUP CLASSIFICATION	AMOUNT OF REFRIGERANT PER OCCUPIED SPACE							(F) DEGREES OF HAZARD
				RCL			LFL			OEL	
				lb/1000 ft	ppm	g/m	lb/1000 ft	ppm	g/m	ppm	
R-600	$CH_3CH_2CH_2CH_3$	butane	A3	0.15	1,000	2.4	3.0	20,000	48	1,000	1-4-0
R-600a	$CH(CH_3)_2CH_3$	2-methylpropane (isobutane)	A3	0.59	4,000	9.5	2.4	16,000	38	1,000	2-4-0
R-601	$CH_3CH_2CH_2\ CH_2CH_3$	pentane	A3	0.18	1,000	2.9	2.2	12,000	35	600	—
R-601a	$(CH_3)_2CHCH_2CH_3$	2-methylbutane (isopentane)	A3	0.18	1,000	2.9	2.4	13,000	38	600	—
R-610	$CH_3CH_2OCH_2CH_3$	ethoxyethane (ethyl ether)	—	—	—	—	—	—	—	400	—
R-611	$HCOOCH_3$	methyl formate	B2	—	—	—	—	—	—	100	—
~~R-717~~	~~NH_3~~	~~ammonia~~	~~B2L~~	~~0.014~~	~~320~~	~~0.22~~	~~7.2~~	~~167,000~~	~~116~~	~~25~~	~~3-3-0~~[e]
R-718	H_2O	water	A1	—	—	—	—	—	—	—	0-0-0
R-744	CO_2	carbon dioxide	A1	3.4	30,000	54	—	—	—	5,000	2-0-0[b]
R-1130(E)	CHCl=CHCl	trans-1,2-dichloroethene	B2	0.25	1,000	4	16	65,000	258	200	—
R-1132a	$CF_2=CH_2$	1,1-difluoroethene	A2	2.0	13,000	33	8.1	50,000	131	500	—
R-1132(E)	(E)-CFH=CFH	Trans-1,2-difluoroethene	B2	1.8	11,000	28	7.0	43,000	113	350	
R-1150	$CH_2=CH_2$	ethene (ethylene)	B3	—	—	—	2.2	31,000	36	200	1-4-2
R-1224yd(Z)	$CF_3CF=CHCl$	(Z)-1-chloro-2,3,3,3-tetrafluoroethylene	A1	23	60,000	370	—	—	—	1,000	—
R-1233zd(E)	$CF_3CH=CHCl$	trans-1-chloro-3,3,3-trifluoro-1-propene	A1	5.3	16,000	85	—	—	—	800	—
R-1234yf	$CF_3CF=CH_2$	2,3,3,3-tetrafluoro-1-propene	A2L	4.5	16,000	75	18.0	62,000	289	500	—
R-1234ze(E)	$CF_3CH=CFH$	trans-1,3,3,3-tetrafluoro-1 -propene	A2L	4.7	16,000	76	18.8	65,000	303	800	—
R-1270	$CH_3CH=CH_2$	Propene (propylene)	A3	0.11	1,000	1.7	—	—	—	500	1-4-1
R-1336mzz(E)	$CF_3CHCHCF_3$	trans 1,1,1,4,4,4-hexafluoro-2- butene	A1	3.0	7,200	48	—	—	—	400	
R-1336mzz(Z)	$CF_3CHCHCF_3$	cis-1,1,1,4,4,4-hexaflouro-2-butene	A1	5.2	13,000	84	—	—	—	500	—

For SI: 1 pound = 0.454 kg, 1 cubic foot = 0.0283 m^3.

a. Degrees of hazard are for health, fire, and reactivity, respectively, in accordance with NFPA 704.

b. Reduction to 1-0-0 is allowed if analysis satisfactory to the code official shows that the maximum concentration for a rupture or full loss of refrigerant charge would not exceed the IDLH, considering both the refrigerant quantity and room volume.

c. Class I ozone depleting substance; prohibited for new installations.

d. Occupational Exposure Limit based on the OSHA PEL, ACGIH TLV-TWA, the TERA WEEL or consistent value on a time-weighed average (TWA) basis (unless noted C for ceiling) for an 8 hr/d and 40 hr/wk.

e. LFL is based on WCF @ 73.4°F (23°C) unless otherwise noted.

f. WCFF LFL @ 140°F (60°C).

g. WCFF LFL @ 73.4°F (23°C).

h. WCF LFL @ 212°F (100°C).

FLOOR MODIFICATION # 3958

Committee Reason:
The committee approved the proposal with modifications by a vote of 14-0. The refrigerant classifications are established by ASHRAE SSPC 34 and published in ASHRAE Standard 34. With the addition of additional refrigerants to Standard 34 during the last code cycle, this proposal aims to update the refrigerant table. See https://www.ashrae.org/standards-research-technology/standards-addenda for the rationale behind the incorporation of new refrigerants. The published addenda to ASHRAE Standard 34-2022, accessed via the URL above, incorporates revisions.

M64-24

Individual Consideration Agenda

Comment 1:

IMC®: TABLE 1103.1

Proponents: Emily Toto, ASHRAE, ASHRAE (etoto@ashrae.org) requests As Modified by Committee (AMC2)

Further modify as follows:

2024 International Mechanical Code

Revise as follows:

TABLE 1103.1 REFRIGERANT CLASSIFICATION, AMOUNT AND OEL

CHEMICAL REFRIGERANT	FORMULA	CHEMICAL NAME OF BLEND	REFRIGERANT SAFETY GROUP CLASSIFICATION	AMOUNT OF REFRIGERANT PER OCCUPIED SPACE							(F) DEGREES OF HAZARD[a]
				RCL			LFL[f]			OEL[d]	
				lb/1000 ft³	ppm	g/m³	lb/1000 ft³	ppm	g/m³	ppm	
R-11[c]	CCl_3F	trichlorofluoromethane	A1	0.39	1,100	6.1	—	—	—	1,000	2-0-0[b]
R-12[c]	CCl_2F_2	dichlorodifluoromethane	A1	5.6	18,000	90	—	—	—	1,000	2-0-0[b]
R-13[c]	$CClF_3$	chlorotrifluoromethane	A1	—	—	—	—	—	—	1,000	2-0-0[b]
R-13B1[c]	$CBrF_3$	bromotrifluoromethane	A1	—	—	—	—	—	—	1,000	2-0-0[b]
R-13I1	CF_3I	trifluoroiodomethane	A1	1.0	2,000	16	—	—	—	500	—
R-14	CF_4	tetrafluoromethane (carbon tetrafluoride)	A1	25	110,000	400	—	—	—	1,000	2-0-0[b]
R-22	$CHClF_2$	chlorodifluoromethane	A1	13	59,000	210	—	—	—	1,000	2-0-0[b]
R-23	CHF_3	trifluoromethane (fluoroform)	A1	7.3	41,000	120	—	—	—	1,000	2-0-0[b]
R-30	CH_2Cl_2	dichloromethane (methylene chloride)	B1	—	—	—	—	—	—	—	—
R-31	CH_2ClF	chlorofluoromethane	—	—	—	—	—	—	—	—	—
R-32	CH_2F_2	difluoromethane (methylene fluoride)	A2L	4.8	36,000	77	19.1	144,000	306	1,000	1-4-0
R-40	CH_3Cl	chloromethane (methyl chloride)	B2	—	—	—	—	—	—	—	—
R-41	CH_3F	fluoromethane (methyl fluoride)	—	—	—	—	—	—	—	—	—
R-50	CH_4	methane	A3	—	—	—	—	50,000	—	1,000	—
R-113[c]	CCl_2FCClF_2	1,1,2-trichloro-1,2,2-trifluoroethane	A1	1.2	2,600	20	—	—	—	1,000	2-0-0[b]
R-114[c]	$CClF_2CClF_2$	1,2-dichloro-1,1,2,2-tetrafluoroethane	A1	8.7	20,000	140	—	—	—	1,000	2-0-0[b]
R-115	$CClF_2CF_3$	chloropentafluoroethane	A1	47	120,000	760	—	—	—	1,000	—
R-116	CF_3CF_3	hexafluoroethane	A1	34	97,000	550	—	—	—	1,000	1-0-0
R-123	$CHCl_2CF_3$	2,2-dichloro-1,1,1-trifluoroethane	B1	3.5	9,100	57	—	—	—	50	2-0-0[b]
R-124	$CHClFCF_3$	2-chloro-1,1,1,2-tetrafluoroethane	A1	3.5	10,000	56	—	—	—	1,000	2-0-0[b]
R-125	CHF_2CF_3	pentafluoroethane	A1	23	75,000	370	—	—	—	1,000	2-0-0[b]
R-134a	CH_2FCF_3	1,1,1,2-tetrafluoroethane	A1	13	50,000	210	—	—	—	1,000	2-0-0[b]
R-141b	CH_3CCl_2F	1,1-dichloro-1-fluoroethane	—	0.78	2,600	12	17.8	60,000	287	500	2-1-0
R-142b	CH_3CClF_2	1-chloro-1, 1-difluoroethane	A2	5.1	20,000	82	20.4	80,000	329	1,000	2-4-0
R-143a	CH_3CF_3	1,1,1-trifluoroethane	A2L	4.4	21,000	70	17.5	82,000	282	1,000	2-0-0[b]
R-152a	CH_3CHF_2	1,1-difluoroethane	A2	2.0	12,000	32	8.1	48,000	130	1,000	1-4-0
R-170	CH_3CH_3	ethane	A3	0.54	7,000	8.6	2.4	31,000	38	1,000	2-4-0
R-E170	CH_3OCH_3	Methoxymethane (dimethyl ether)	A3	1.0	8,500	16	4.0	34,000	64	1,000	—
R-218	$CF_3CF_2CF_3$	octafluoropropane	A1	43	90,000	690	—	—	—	1,000	2-0-0[b]
R-227ea	CF_3CHFCF_3	1,1,1,2,3,3,3-heptafluoropropane	A1	36	84,000	580	—	—	—	1,000	—
R-236fa	$CF_3CH_2CF_3$	1,1,1,3,3,3-hexafluoropropane	A1	21	55,000	340	—	—	—	1,000	2-0-0[b]
R-245fa	$CHF_2CH_2CF_3$	1,1,1,3,3-pentafluoropropane	B1	12	34,000	190	—	—	—	300	2-0-0[b]
R-290	$CH_3CH_2CH_3$	propane	A3	0.59	5,300	9.5	2.4	21,000	38	1,000	2-4-0
R-C318	$-(CF_2)_4-$	octafluorocyclobutane	A1	41	80,000	650	—	—	—	1,000	—
R-400[c]	zeotrope	R-12/114 (50.0/50.0)	A1	10	28,000	160	—	—	—	1,000	2-0-0[b]
R-400[c]	zeotrope	R-12/114 (60.0/40.0)	A1	11	30,000	170	—	—	—	1,000	—
R-401A	zeotrope	R-22/152a/124 (53.0/13.0/34.0)	A1	6.6	27,000	110	—	—	—	1,000	2-0-0[b]
R-401B	zeotrope	R-22/152a/124 (61.0/11.0/28.0)	A1	7.2	30,000	120	—	—	—	1,000	2-0-0[b]
R-401C	zeotrope	R-22/152a/124 (33.0/15.0/52.0)	A1	5.2	20,000	84	—	—	—	1,000	2-0-0[b]
R-402A	zeotrope	R-125/290/22 (60.0/2.0/38.0)	A1	17	66,000	270	—	—	—	1,000	2-0-0[b]
R-402B	zeotrope	R-125/290/22 (38.0/2.0/60.0)	A1	15	63,000	240	—	—	—	1,000	2-0-0[b]
R-403A	zeotrope	R-290/22/218 (5.0/75.0/20.0)	A2	7.6	33,000	120	—	—	—	1,000	2-0-0[b]
R-403B	zeotrope	R-290/22/218 (5.0/56.0/39.0)	A1	18	68,000	290	—	—	—	1,000	2-0-0[b]
R-404A	zeotrope	R-125/143a/134a (44.0/52.0/4.0)	A1	31	130,000	500	—	—	—	1,000	2-0-0[b]
R-405A	zeotrope	R-22/152a/142b/C318 (45.0/7.0/5.5/42.5)	—	16	57,000	260	—	—	—	1,000	—
R-406A	zeotrope	R-22/600a/142b (55.0/4.0/41.0)	A2	4.7	21,000	75	18.8[g]	82,000[g]	301.9[g]	1,000	—
R-407A	zeotrope	R-32/125/134a (20.0/40.0/40.0)	A1	19	83,000	300	—	—	—	1,000	2-0-0[b]

CHEMICAL REFRIGERANT	FORMULA	CHEMICAL NAME OF BLEND	REFRIGERANT SAFETY GROUP CLASSIFICATION	AMOUNT OF REFRIGERANT PER OCCUPIED SPACE							(F) DEGREES OF HAZARD
				RCL			LFL			OEL	
				lb/1000 ft	ppm	g/m	lb/1000 ft	ppm	g/m	ppm	
R-407B	zeotrope	R-32/125/134a (10.0/70.0/20.0)	A1	21	79,000	330	—	—	—	1,000	2-0-0[b]
R-407C	zeotrope	R-32/125/134a (23.0/25.0/52.0)	A1	18	81,000	290	—	—	—	1,000	2-0-0[b]
R-407D	zeotrope	R-32/125/134a (15.0/15.0/70.0)	A1	16	68,000	250	—	—	—	1,000	2-0-0[b]
R-407E	zeotrope	R-32/125/134a (25.0/15.0/60.0)	A1	17	80,000	280	—	—	—	1,000	2-0-0[b]
R-407F	zeotrope	R-32/125/134a (30.0/30.0/40.0)	A1	20	95,000	320	—	—	—	1,000	—
R-407G	zeotrope	R-32/125/134a (2.5/2.5/95.0)	A1	13	52,000	210	—	—	—	1,000	—
R-407H	zeotrope	R-32/125/134a (32.5/15.0/52.5)	A1	19	92,000	300	—	—	—	1,000	—
R-407I	zeotrope	R-32/125/124a (19.5/8.5/72.0)	A1	16	71,100	250	—	—	—	1,000	—
R-408A	zeotrope	R-125/143a/22 (7.0/46.0/47.0)	A1	21	94,000	330	—	—	—	1,000	2-0-0[b]
R-409A	zeotrope	R-22/124/142b (60.0/25.0/15.0)	A1	7.1	29,000	110	—	—	—	1,000	2-0-0[b]
R-409B	zeotrope	R-22/124/142b (65.0/25.0/10.0)	A1	7.3	30,000	120	—	—	—	1,000	2-0-0[b]
R-410A	zeotrope	R-32/125 (50.0/50.0)	A1	26	140,000	420	—	—	—	1,000	2-0-0[b]
R-410B	zeotrope	R-32/125 (45.0/55.0)	A1	27	140,000	430	—	—	—	1,000	2-0-0[b]
R-411A	zeotrope	R-127/22/152a (1.5/87.5/11.0)	A2	2.9	14,000	46	11.6[f]	55,000[f]	185.6[f]	970	—
R-411B	zeotrope	R-1270/22/152a (3.0/94.0/3.0)	A2	2.8	13,000	45	14.8[f]	70,000[f]	238.3[f]	940	—
R-412A	zeotrope	R-22/218/142b (70.0/5.0/25.0)	A2	5.1	22,000	82	20.5[f]	87,000[f]	328.6[f]	1,000	—
R-413A	zeotrope	R-218/134a/600a (9.0/88.0/3.0)	A2	5.8	22,000	93	23.4[f]	88,000[f]	374.9[f]	1,000	—
R-414A	zeotrope	R-22/124/600a/142b (51.0/28.5/4.0/16.5)	A1	6.4	26,000	100	—	—	—	1,000	—
R-414B	zeotrope	R-22/124/600a/142b (50.0/39.0/1.5/9.5)	A1	6.0	23,000	96	—	—	—	1,000	—
R-415A	zeotrope	R-22/152a (82.0/18.0)	A2	2.9	14,000	47	11.7[g]	56,000[g]	187.9[g]	1,000	—
R-415B	zeotrope	R-22/152a (25.0/75.0)	A2	2.1	12,000	34	—	—	—	1,000	—
R-416A	zeotrope	R-134a/124/600 (59.0/39.5/1.5)	A1	3.9	14,000	62	—	—	—	1,000	2-0-0[b]
R-417A	zeotrope	R-125/134a/600 (46.6/50.0/3.4)	A1	3.5	13,000	55	—	—	—	1,000	2-0-0[b]
R-417B	zeotrope	R-125/134a/600 (79.0/18.3/2.7)	A1	4.3	15,000	69	—	—	—	1,000	—
R-417C	zeotrope	R-125/134a/600 (19.5/78.8/1.7)	A1	5.4	21,000	87	—	—	—	1,000	—
R-418A	zeotrope	R-290/22/152a (1.5/96.0/2.5)	A2	4.8	22,000	77	19.2[g]	89,000[g]	308.4[g]	1,000	—
R-419A	zeotrope	R-125/134a/E170 (77.0/19.0/4.0)	A2	4.2	15,000	67	16.7[g]	60,000[g]	268.6[g]	1,000	—
R-419B	zeotrope	R-125/134a/E170 (48.5/48.0/3.5)	A2	4.6	17,000	74	18.5[g]	69,000[g]	297.3[g]	1,000	—
R-420A	zeotrope	R-134a/142b (88.0/12.0)	A1	12	44,000	180	—	—	—	1,000	2-0-0[b]
R-421A	zeotrope	R-125/134a (58.0/42.0)	A1	17	61,000	280	—	—	—	1,000	2-0-0[b]
R-421B	zeotrope	R-125/134a (85.0/15.0)	A1	21	69,000	330	—	—	—	1,000	2-0-0[b]
R-422A	zeotrope	R-125/134a/600a (85.1/11.5/3.4)	A1	18	63,000	290	—	—	—	1,000	2-0-0[b]
R-422B	zeotrope	R-125/134a/600a (55.0/42.0/3.0)	A1	16	56,000	250	—	—	—	1,000	2-0-0[b]
R-422C	zeotrope	R-125/134a/600a (82.0/15.0/3.0)	A1	18	62,000	290	—	—	—	1,000	2-0-0[b]
R-422D	zeotrope	R-125/134a/600a (65.1/31.5/3.4)	A1	16	58,000	260	—	—	—	1,000	2-0-0[b]
R-422E	zeotrope	R-125/134a/600a (58.0/39.3/2.7)	A1	16	57,000	260	—	—	—	1,000	—
R-423A	zeotrope	R-134a/227ea (52.5/47.5)	A1	19	59,000	300	—	—	—	1,000	2-0-0[b]
R-424A	zeotrope	R-125/134a/600a/600/601a (50.5/47.0/0.9/1.0/0.6)	A1	6.2	23,000	100	—	—	—	990	2-0-0[b]
R-425A	zoetrope	R-32/134a/227ea (18.5/69.5/12.0)	A1	16	72,000	260	—	—	—	1,000	2-0-0[b]
R-426A	zeotrope	R-125/134a/600a/601a (5.1/93.0/1.3/0.6)	A1	5.2	20,000	83	—	—	—	990	—
R-427A	zeotrope	R-32/125/143a/134a (15.0/25.0/10.0/50.0)	A1	18	79,000	290	—	—	—	1,000	2-1-0
R-428A	zeotrope	R-125/143a/290/600a (77.5/20.0/0.6/1.9)	A1	23	84,000	370	—	—	—	1,000	—
R-429A	zeotrope	R-E170/152a/600a (60.0/10.0/30.0)	A3	0.81	6,300	13	3.2	25,000	83.8	1,000	—
R-430A	zeotrope	R-152a/600a (76.0/24.0)	A3	1.3	8,000	21	5.2	32,000	44.0	1,000	—
R-431A	zeotrope	R-290/152a (71.0/29.0)	A3	0.68	5,500	11	2.7	22,000	38.6	1,000	—
R-432A	zeotrope	R-1270/E170 (80.0/20.0)	A3	0.13	1,200	2.1	2.4	22,000	39.2	550	—
R-433A	zeotrope	R-1270/290 (30.0/70.0)	A3	0.34	3,100	5.5	2.4	20,000	32.4	750	—
R-433B	zeotrope	R-1270/290 (5.0-95.0)	A3	0.39	3,500	6.3	2.0	18,000	32.1	950	—
R-433C	zeotrope	R-1270/290 (25.0-75.0)	A3	0.41	3,700	6.5	2.0	18,000	83.8	790	—
R-434A	zeotrope	R-125/143a/600a (63.2/18.0/16.0/2.8)	A1	20	73,000	320	—	—	—	1,000	—
R-435A	zeotrope	R-E170/152a (80.0/20.0)	A3	1.1	8,500	17	4.3	34,000	68.2	1,000	—
R-436A	zeotrope	R-290/600a (56.0/44.0)	A3	0.50	4,000	8.1	2.0	16,000	32.3	1,000	—
R-436B	zeotrope	R-290/600a (52.0/48.0)	A3	0.51	4,000	8.2	2.0	16,000	32.7	1,000	—
R-436C	zeotrope	R-290/600a (95.0/5.0)	A3	0.57	5,000	9.1	2.3	20,000	36.5	1,000	—
R-437A	zeotrope	R-125/134a/600/601 (19.5/78.5/1.4/0.6)	A1	5.1	19,000	82	—	—	—	990	—
R-438A	zeotrope	R-32/125/134a/600/601a (8.5/45.0/44.2/1.7/0.6)	A1	4.9	20,000	79	—	—		990	
R-439A	zeotrope	R-32/125/600a (50.0/47.0/3.0)	A2	4.7	26,000	76	18.9	104,000	303.3	1,000	—
R-440A	zeotrope	R-290/134a/152a (0.6/1.6/97.8)	A2	1.9	12,000	31	7.8[h]	46,000[h]	124.7[h]	1,000	—
R-441A	zeotrope	R-170/290/600a/600 (3.1/54.8/6.0/36.1)	A3	0.39	3,200	6.3	2.0	16,000	31.7	1,000	—
R-442A	zeotrope	R-32/125/134a/152a/227ea (31.0/31.0/30.0/3.0/5.0)	A1	21	100,000	330	—	—	1,000	—	
R-443A	zeotrope	R-1270/290/600a (55.0/40.0/5.0)	A3	0.19	1,700	3.1	2.2	20,000	35.6	640	—
R-444A	zeotrope	R-32/152a/1234ze(E) (12.0/5.0/83.0)	A2L	5.0	21,000	80	19.9	82,000	319.4	850	—
R-444B	zeotrope	R-32/152a/1234ze(E) (41.5/10.0/48.5)	A2L	4.3	23,000	70	17.3	93,000	278.1	930	—

CHEMICAL REFRIGERANT	FORMULA	CHEMICAL NAME OF BLEND	REFRIGERANT SAFETY GROUP CLASSIFICATION	AMOUNT OF REFRIGERANT PER OCCUPIED SPACE							(F) DEGREES OF HAZARD
				RCL			LFL			OEL	
				lb/1000 ft	ppm	g/m	lb/1000 ft	ppm	g/m	ppm	
R-445A	zeotrope	R-744/134a/1234ze(E) (6.0/9.0/85.0)	A2L	5.4	16,000	87	21.6	63,000	347.4	930	—
R-446A	zeotrope	R-32/1234ze(E)/600 (68.0/29.0/3.0)	A2L	3.7	23,000	59	14.8	93,000	237.7	960	—
R-447A	zeotrope	R-32/125/1234ze(E) (68.0/3.5/28.5)	A2L	5.2	32,000	83	20.6	128,000	331.4	960	—
R-447B	zeotrope	R-32/125/1234ze(E) (68.0/8.0/24.0)	A2L	4.8	30,000	78	19.5	121,000	312.7	970	—
R-448A	zeotrope	R-32/125/1234yf/134a/1234ze(E) (26.0/26.0/20.0/21.0/7.0)	A1	24	110,000	390	—	—		860	
R-449A	zeotrope	R-32/125/1234yf/134a (24.3/24.7/25.3/25.7)	A1	23	100,000	370	—	—	—	840	—
R-449B	zeotrope	R-32/125/1234yf/134a (25.2/24.3/23.2/27.3)	A1	23	100,000	370	—	—	—	850	—
R-449C	zeotrope	R-32/125/1234yf/134a (20.0/20.0/31.0/29.0)	A1	23	98,000	360	—	—		800	
R-450A	zeotrope	R-134a/1234ze(E) (42.0/58.0)	A1	20	72,000	320	—	—	—	880	—
R-451A	zeotrope	R-1234yf/134a (89.8/10.2)	A2L	5.3	18,000	81	21.3	74,000	341	530	—
R-451B	zeotrope	R-1234yf/134a (88.8/11.2)	A2L	5.0	18,000	81	21.3	74,000	341.6	530	—
R-452A	zeotrope	R-32/125/1234yf (11.0/59.0/30.0)	A1	27	100,000	440	—	—		790	
R-452B	zeotrope	R-32/125/1234yf (67.0/7.0/26.0)	A2L	4.8	30,000	77	19.3	119,000	310.5	870	—
R-452C	zeotrope	R-32/125/1234yf (12.5/61.0/26.5)	A1	27	100,000	430	—	—	—	810	—
R-453A	zeotrope	R-32/125/134a/227ea/600/601a (20.0/20.0/53.8/5.0/0.6/0.6)	A1	7.8	34,000	120	—	—		1,000	
R-454A	zeotrope	R-32/1234yf (35.0/65.0)	A2L	4.4	21,000	70	17.5	84,000	281.4	690	—
R-454B	zeotrope	R-32/1234yf (68.9/31.1)	A2L	4.6	29,000	74	18.5	115,000	296.8	850	—
R-454C	zeotrope	R-32/1234yf (21.5/78.5)	A2L	4.6	19,000	73	18.2	77,000	291.7	620	—
R-454D	zeotrope	R-32/1234yf (43.0/57.0)	A2L	4.4	22,000	69	17.4	87,500	275	730	
R-455A	zeotrope	R-744/32/1234yf (3.0/21.5/75.5)	A2L	6.8	30,000	108	26.9	118,000	432.1	650	—
R-455B	zeotrope	R-744/32/1234yf (6.0/42.0/52.0)	A2L	5.2	28,000	81	20.6	110,000	324	800	
R-455C	zeotrope	R-744/32/1234yf (3.0/43.0/54.0)	A2L	4.8	25,000	76	19.3	100,000	305	770	
R-456A	zeotrope	R-32/134a/1234ze(E) (6.0/45.0/49.0)	A1	20	77,000	320	—	—	—	900	—
R-457A	zeotrope	R-32/1234yf/152a (18.0/70.0/12.0)	A2L	3.4	15,000	54	13.5	60,000	216.3	650	—
R-457B	zeotrope	R-32/1234yf/152a (35.0/55.0/10.0)	A2L	3.7	19,000	59	14.9	76,000	239	730	—
R-457C	zeotrope	R-32/1234yf/152a (7.5/78.0/14.5)	A2L	3.4	13,800	54	13.6	55,000	215	610	
R-457D	zeotrope	R-32/1234yf/152a (4.0/82.0/14.0)	A2L	3.6	14,000	58	14.9	57,000	235	580	
R-458A	zeotrope	R-32/125/134a/227ea/236fa (20.5/4.0/61.4/13.5/0.6)	A1	18	76,000	280	—	—		1,000	
R-459A	zeotrope	R-32/1234yf/1234ze(E) (68.0/26.0/6.0)	A2L	4.3	27,000	69	17.4	107,000	278.7	870	—
R-459B	zeotrope	R-32/1234yf/1234ze(E) (21.0/69.0/10.0)	A2L	5.8	25,000	92	23.3	99,000	373.5	640	—
R-460A	zeotrope	R-32/125/134a/1234ze(E) (12.0/52.0/14.0/22.0)	A1	24	92,000	380	—	—	—	950	—
R-460B	zeotrope	R-32/125/134a/1234ze(E) (28.0/25.0/20.0/27.0)	A1	25	120,000	400	—	—	—	950	—
R-460C	zeotrope	R-32/125/134a/1234ze(E) (2.5/2.5/46.0/49.0)	A1	20	73,000	310	—	—	—	900	—
R-461A	zeotrope	R-125/143a/134a/227ea/600a (55.0/5.0/32.0/5.0/3.0)	A1	17	61,000	270	—	—	—	1,000	—
R-462A	zeotrope	R-32/125/143a/134a/600 (9.0/42.0/2.0/44.0/3.0)	A2	3.9	16,000	62	16.6[f]	105,000[f]	265.8[f]	1,000	—
R-463A	zeotrope	R-744/32/125/1234yf/134a (6.0/36.0/30.0/14.0/14.0)	A1	19	98,000	300	—	—	—	990	—
R-464A	zeotrope	R-32/125/1234ze(E)/227ea (27.0/27.0/40.0/6.0)	A1	27	120,000	430	—	—	—	930	—
R-465A	zeotrope	R-32/290/1234yf (21.0/7.9/71.1)	A2	2.5	12,000	40	10.0	98,000	160.9	660	—
R-466A	zeotrope	R-32/125/13I1 (49.0/11.5/39.5)	A1	6.2	30,000	99	—	—		860	
R-467A	zeotrope	R-32/125/134a/600a (22.0/5.0/72.4/0.6)	A2L	6.7	31,000	110	—	—		1,000	
R-468A	zeotrope	R-1132a/32/1234yf (3.5/21.5/75.0)	A2L	4.1	18,000	66	—	—	—	610	—
R-468B	zeotrope	R-1132a/32/1234yf (6.0/13.0/81.0)	A2L	4.4	18,000	70				570	
R-468C	zeotrope	R-1132a/32/1234yf (6.0/42.0/52.0)	A2L	4.3	23,000	69				710	
R-469A	zeotrope	R-744/R-32/R-125 (35.0/32.5/32.5)	A1	8	53,000	—	—	—		1,600	

CHEMICAL REFRIGERANT	FORMULA	CHEMICAL NAME OF BLEND	REFRIGERANT SAFETY GROUP CLASSIFICATION	AMOUNT OF REFRIGERANT PER OCCUPIED SPACE							(F) DEGREES OF HAZARD
				RCL			LFL			OEL	
				lb/1000 ft	ppm	g/m	lb/1000 ft	ppm	g/m	ppm	
R-470A	zeotrope	R-744/32/125/134a/1234ze(E)/227ea (10.0/17.0/19.0/7.0/44.0/3.0)	A1	17	77,000	270	—	—	—	1,100	—
R-470B	zeotrope	R-744/32/125/134a/1234ze(E)/227ea (10.0/17.0/19.0/7.0/44.0/3.0)	A1	16	72,000	270	—	—	—	1,100	—
R-471A	zeotrope	R-1234ze(E)/227ea/1336mzz(E) (78.7/4.3/17.0)	A1	9.7	31,000	160	—	—		710	
R-472A	zeotrope	R-744/32/134a (69.0/12.0/19.0)	A1	4.5	35,000	72	—	—	—	2,700	—
R-472B	zeotrope	R-744/32/134a (58.0/10.0/32.0)	A1	5.0	36,000	80				2,400	
R-473A	zeotrope	R-1132a/23/744/125 (20.0/10.0/60.0/10.0)	A1	4.8	36,000	77				1,700	
R-474A	zeotrope	R-1132(E)/1234yf (23.0/77.0)	A2L	3.3	13,000	53	13	53,000	209	440	
R-474B	zeotrope	R-1132(E)/1234yf (31.5/68.5)	A2L	3.0	13,000	47	12.0	51,000	189	420	
R-475A	zeotrope	R-1234yf/134a/1234ze(E) (45.0/43.0/12.0)	A1	20.0	73,000	320				690	
R-476A	zeotrope	R-134a/1234ze(E)/1336mzz(E) (10.0/78.0/12.0)	A1	11	38,000	180				750	
R-477A	zeotrope	R-1270/600a (84.0/16.0)	A3	0.13	1,100	2.0	2.4	21,000	38	530	
R-477B	zeotrope	R-1270/600a (38.0/62.0)	A3	0.27	2,100	4.3	2.3	18,000	37	690	
R-478A	zeotrope	R-744/32/125/134a/152a/1234ze(E)/227ea (7.0/26.0/15.0/15.0/3.0/30.0/4.0)	A2L	4.8	24,000	77	17.1[f]	95,000[f]	270[f]	1,100	
R-479A	zeotrope	R-1132(E)/32/1234yf (28.0/21.5/50.5)	A2L	3.0	15,000	48	12.0	61,000	193	510	
R-480A	zeotrope	R-744/1234ze(E)/227ea (5.0/86.0/9.0)	A1	16	59,000	260				900	
R-481A	zeotrope	R-32/125/134a/1233zd(E)/601a (16.9/6.3/74.4/1.8/0.6)	A1	10	45,000	160				1,000	
R-482A	zeotrope	R-134a/1234ze(E)/1224yd(Z) (10.0/83.5/6.5)	A1	18	62,000	290				830	
R-483A	zeotrope	R-290/600 (15.0/85.0)	A3	0.17	1,200	2.8	2.6	18,000	41	1,000	
R-484A	zeotrope	R-1270/600 (12.0/88.0)	A3	0.14	1,000	2.3	2.6	18,000	41	860	
R-486A	zeotrope	R-1234yf/134a/13I1/1234ze(E)(21.9/6.3/38.0/33.8)	A1	2.5	7,300	40				620	
R-487A	zeotrope	R-170/1270 (20.0/80.0)	A3	0.13	1,300	2.1	2.2	22,000	35	570	
R-488A	zeotrope	R-32/1234yf/152a/1234ze(E) (6.0/50.0/3.0/41.0)	A2L	4.3	16,000	68	17.1	63,000	270	650	
R-489A	zeotrope	R-50/1150/600 (1.5/22.0/76.5)	A3	0.12	1,000	1.9	2.4	20,000	38	410	
R-490A	zeotrope	R-1150/1270 (7.9/92.1)	A3	0.1	1,000	1.7	2.4	22,000	37	430	
R-491A	zeotrope	R-1132(E)/152a (35.0/65.0)	A2	2.0	12,000	30.8	7.8	46,000	123	600	
R-500[c]	azeotrope	R-12/152a (73.8/26.2)	A1	7.4	29,000	120	—	—	—	1,000	2-0-0[b]
R-501[c]	azeotrope	R-22/12 (75.0/25.0)	A1	13	54,000	210	—	—	—	1,000	—
R-502[c]	azeotrope	R-22/115 (48.8/51.2)	A1	21	73,000	330	—	—	—	1,000	2-0-0[b]
R-503[c]	azeotrope	R-23/13 (40.1/59.9)	—	—	—	—	—	—	—	1,000	2-0-0[b]
R-504[c]	azeotrope	R-32/115 (48.2/51.8)	—	28	140,000	450	—	—	—	1,000	—
R-507A	azeotrope	R-125/143a (50.0/50.0)	A1	32	130,000	510	—	—	—	1,000	2-0-0[b]
R-508A	azeotrope	R-23/116 (39.0/61.0)	A1	14	55,000	220	—	—	—	1,000	2-0-0[b]
R-508B	azeotrope	R-23/116 (46.0/54.0)	A1	13	52,000	200	—	—	—	1,000	2-0-0[b]
R-509A	azeotrope	R-22/218 (44.0/56.0)	A1	24	75,000	380	—	—	—	1,000	2-0-0[b]
R-510A	azeotrope	R-E170/600a (88.0/12.0)	A3	0.87	7,300	14	3.5	29,000	56.1	1,000	—
R-511A	azeotrope	R-290/E170 (95.0/5.0)	A3	0.59	5,300	9.5	2.4	21,000	38.0	1,000	—
R-512A	azeotrope	R-134a/152a (5.0/95.0)	A2	1.9	11,000	31	7.7	45,000	123.9	1,000	—
R-513A	azeotrope	R-1234yf/134a (56.0/44.0)	A1	20	72,000	320	—	—	—	650	—
R-513B	azeotrope	R-1234yf/134a (58.5/41.5)	A1	21	74,000	330	—	—	—	640	—
R-514A	azeotrope	R-1336mzz(S)/1130(E) (74.7/25.3)	B1	0.86	2,400	14	—	—	—	320	—
R-515A	azeotrope	R-1234ze(E)/227ea (88.0/12.0)	A1	19	63,000	300	—	—	—	810	—
R-515B	azeotrope	R-1234ze(E)/227ea (91.1/8.9)	A1	18	61,000	290	—	—		810	
R-516A	azeotrope	R-1234yf/134a/152a (77.5/8.5/14.0)	A2	3.2	13,000	5 2	13.1	50,000	210.1	590	—
R-600	$CH_3CH_2CH_2CH_3$	butane	A3	0.15	1,000	2.4	3.0	20,000	48	1,000	1-4-0
R-600a	$CH(CH_3)_2CH_3$	2-methylpropane (isobutane)	A3	0.59	4,000	9.5	2.4	16,000	38	1,000	2-4-0
R-601	$CH_3CH_2CH_2CH_2CH_3$	pentane	A3	0.18	1,000	2.9	2.2	12,000	35	600	—
R-601a	$(CH_3)_2CHCH_2CH_3$	2-methylbutane (isopentane)	A3	0.18	1,000	2.9	2.4	13,000	38	600	—
R-610	$CH_3CH_2OCH_2CH_3$	ethoxyethane (ethyl ether)	—	—	—	—	—	—	—	400	—
R-611	$HCOOCH_3$	methyl formate	B2	—	—	—	—	—	—	100	—
R-718	H_2O	water	A1	—	—	—	—	—	—	—	0-0-0
R-744	CO_2	carbon dioxide	A1	3.4	30,000	54	—	—	—	5,000	2-0-0[b]
R-1130(E)	CHCl=CHCl	trans-1,2-dichloroethene	B2	0.25	1,000	4	16	65,000	258	200	—
R-1132a	CF_2=CH_2	1,1-difluoroethene	A2	2.0	13,000	33	8.1	50,000	131	500	—
R-1132(E)	(E)-CFH=CFH	Trans-1,2-difluoroethene	B2	1.8	11,000	28	7.0	43,000	113	350	
R-1150	CH_2=CH_2	ethene (ethylene)	B3	—	—	—	2.2	31,000	36	200	1-4-2
R-1224yd(Z)	CF_3CF=CHCl	(Z)-1-chloro-2,3,3,3-tetrafluoroethylene	A1	23	60,000	370	—	—	—	1,000	—
R-1233zd(E)	CF_3CH=CHCl	trans-1-chloro-3,3,3-trifluoro-1-propene	A1	5.3	16,000	85	—	—	—	800	—
R-1234yf	CF_3CF=CH_2	2,3,3,3-tetrafluoro-1-propene	A2L	4.5	16,000	75	18.0	62,000	289	500	—
R-1234ze(E)	CF_3CH=CFH	trans-1,3,3,3-tetrafluoro-1 -propene	A2L	4.7	16,000	76	18.8	65,000	303	800	—
R-1270	CH_3CH=CH_2	Propene (propylene)	A3	0.11	1,000	1.7	—	—	—	500	1-4-1
R-1336mzz(E)	$CF_3CHCHCF_3$	trans 1,1,1,4,4,4-hexafluoro-2- butene	A1	3.0	7,200	48	—	—	—	400	

CHEMICAL REFRIGERANT	FORMULA	CHEMICAL NAME OF BLEND	REFRIGERANT SAFETY GROUP CLASSIFICATION	AMOUNT OF REFRIGERANT PER OCCUPIED SPACE							(F) DEGREES OF HAZARD
				RCL			LFL			OEL	
				lb/1000 ft	ppm	g/m	lb/1000 ft	ppm	g/m	ppm	
R-1336mzz(Z)	$CF_3CHCHCF_3$	cis-1,1,1,4,4,4-hexaflouro-2-butene	A1	5.2	13,000	84	—	—	—	500	—

For SI: 1 pound = 0.454 kg, 1 cubic foot = 0.0283 m^3.

a. Degrees of hazard are for health, fire, and reactivity, respectively, in accordance with NFPA 704.

b. Reduction to 1-0-0 is allowed if analysis satisfactory to the code official shows that the maximum concentration for a rupture or full loss of refrigerant charge would not exceed the IDLH, considering both the refrigerant quantity and room volume.

c. Class I ozone depleting substance; prohibited for new installations.

d. Occupational Exposure Limit based on the OSHA PEL, ACGIH TLV-TWA, the TERA WEEL or consistent value on a time-weighed average (TWA) basis (unless noted C for ceiling) for an 8 hr/d and 40 hr/wk.

e. LFL is based on the Worst Case of Formulation for Flammability (WCF) @ 73.4°F (23°C) unless otherwise noted.

f. Worst Case of Fractionation for Flammability (WCFF) LFL @ 140°F (60°C).

g. WCFF LFL @ 73.4°F (23°C).

h. WCF LFL @ 212°F (100°C).

Reason: The additional 11 refrigerants in this update have been approved by ASHRAE's Standard 34 committee and published via addenda, which can be read here: https://www.ashrae.org/technical-resources/standards-and-guidelines/standards-addenda
This modification also provides a clarification to a footnote based on feedback from CAH #1. We have now stated the meaning of the acronyms WCF and WCFF.

Cost Impact: The change proposal is editorial in nature or a clarification and has no cost impact on the cost of construction

Justification for no cost impact:

Making the list of approved refrigerants from ASHRAE 34 available to users of the IMC does not impact cost.

Comment (CAH2)# 300

M65-24

IMC®: 1103.1

Proposed Change as Submitted

Proponents: Emily Toto, ASHRAE, ASHRAE (etoto@ashrae.org)

2024 International Mechanical Code

Revise as follows:

1103.1 Refrigerant classification. Refrigerants shall be classified in accordance with ASHRAE 34 as listed in Table 1103.1. Refrigerants without a refrigerant number designation or without a safety group classification in the referenced edition of ASHRAE Standard 34 shall be classified in accordance with the criteria in ASHRAE Standard 34 as a single-compound refrigerant blend of two or more compounds. Such safety classifications not assigned by ASHRAE Standard 34 shall be submitted for approval to the code official. Compliance with the requirements of this code is contingent upon use of approved safey classifications where not assigned by the referenced edition of ASHRAE Standard 34.

Reason: This change accounts for the fact that new refrigerants will be approved during continuous maintenance of ASHRAE 34 that cannot all be reflected in the latest edition of the IMC due to timing. It offers flexibility to use approved refrigerants even though they are not yet specified in the IMC.

Cost Impact: The change proposal is editorial in nature or a clarification and has no cost impact on the cost of construction

Justification for no cost impact:

This proposal will provide more choice to the user and, thus, direct costs could ultimately be lower. In general, this change is not expected to have a bearing on cost.

M65-24

Public Hearing Results (CAH1)

Committee Action: **Disapproved**

Committee Reason: The committee voted 14-0 to disapprove of this proposal. The committee's justification is based on the proposed code language's dependence on an authorized safety classification.

M65-24

Individual Consideration Agenda

Comment 1:

IMC®: 1103.1

Proponents: Emily Toto, ASHRAE, ASHRAE (etoto@ashrae.org) requests As Modified by Committee (AMC2)

Modify as follows:

2024 International Mechanical Code

1103.1 Refrigerant classification. Refrigerants shall be classified in accordance with ASHRAE 34 as listed in Table 1103.1. Refrigerants without a ~~refrigerant number designation~~*refrigerant designation* or without a refrigerant safety group classification in the referenced edition of ASHRAE Standard 34 shall be classified in accordance with the criteria in ASHRAE Standard 34 as a single-compound refrigerant or a refrigerant blend of two or more compounds. ~~Such safety classifications not assigned by ASHRAE Standard 34 shall be submitted for approval to the code official. Compliance with the requirements of this code is contingent upon use of approved safey classifications where not assigned by the referenced edition of ASHRAE Standard 34.~~ Documentation supporting the proposed classification shall be submitted to the *code official.*

Reason: This language provides the AHJ with instructions on how to use alternative means to approve refrigerants not listed in Table 1103.1 or the referenced edition of ASHRAE Standard 34. Many refrigerants are approved as addenda to the referenced edition of ASHRAE Standard 34 that are not captured in Table 1103.1. Additionally, refrigerants assigned a provisional safety group by ASHRAE Standard 34 might also be considered for field trials.This proposal would also make Section 11 better aligned with ASHRAE Standard 15-2022.

Cost Impact: The change proposal is editorial in nature or a clarification and has no cost impact on the cost of construction

Justification for no cost impact:

This proposal does not alter the cost associated with refrigeration systems. It merely provides additional flexibility for refrigerant classification as new options become available between code cycles.

Comment (CAH2)# 207

M69-24

IMC®: TABLE 1107.4, ASTM Chapter 15 (New)

Proposed Change as Submitted

Proponents: Lance MacNevin, Director of Engineering, The Plastics Pipe Institute, The Plastics Pipe Institute (lmacnevin@plasticpipe.org)

2024 International Mechanical Code

Revise as follows:

TABLE 1107.4 REFRIGERANT PIPE

PIPING MATERIAL	STANDARD
Aluminum tube	ASTM B210 , ASTM B491/B491M
Brass (copper alloy) pipe	ASTM B43
Copper linesets	ASTM B280, ASTM B1003
Copper pipe	ASTM B42, ASTM B302
Copper tube[a]	ASTM B68 , ASTM B75, ASTM B88, ASTM B280, ASTM B819
Polyethylene of Raised Temperature/ Aluminum/Polyethylene of Raised Temperature (PE-RT/AL/PE-RT)pipe	ASTM F3506
Steel pipe[b]	ASTM A53, ASTM A106 , ASTM A333
Steel tube	ASTM A254, ASTM A334

a. Soft annealed copper tubing larger than $1^3/_8$ inch (35 mm) O.D. shall not be used for field-assembled refrigerant piping unless it is protected from mechanical damage.

b. ASTM A53, Type F steel pipe shall only be permitted for discharge lines in pressure relief systems.

Add new standard(s) as follows:

ASTM

ASTM International
100 Barr Harbor Drive, P.O. Box C700
West Conshohocken, PA 19428

F3506-21e1 Standard Specification for Polyethylene of Raised Temperature/Aluminum/Polyethylene of Raised Temperature (PE-RT/AL/PE-RT) Composite Pressure Pipe based on Inner Diameter (ID) for use in Air Conditioning and Refrigeration Line Set Systems

Reason: Piping produced according to ASTM F3506 “Standard Specification for Polyethylene of Raised Temperature/Aluminum/Polyethylene of Raised Temperature (PE-RT/AL/PE-RT) Composite Pressure Pipe based on Inner Diameter (ID) for use in Air Conditioning and Refrigeration Line Set Systems” is intended specifically for the applications referred to in Section 1107.4 of the code and in Table 1107.4. It is proposed to add this piping material to Table 1107.4 to provide installers with a high-performance corrosion-resistant option for this application.

Cost Impact: The change proposal is editorial in nature or a clarification and has no cost impact on the cost of construction

Estimated Immediate Cost Impact:

Including PE-RT/AL/PE-RT piping produced according to ASTM F3506 in Table 1107.4 provides an alternative piping option for refrigerant applications. PE-RT/AL/PE-RT piping is less expensive than some of the existing materials (e.g., copper, brass, or steel), but may be more expensive than certain other piping materials. This code change proposal may decrease the cost of construction by 0% to 10% if PE-RT/AL/PE-RT piping is selected by users, or it may increase the cost of construction by 0% to 10% if selected, or it may have no impact on the cost of construction if PERT/ AL/PE-RT piping is not selected. It depends on which of the seven existing approved materials is used for this comparison.

To assign dollar values to this proposal, the use of PE-RT/AL/PE-RT piping could decrease construction costs over a range from $1 to $10,000, depending on the size of the project, size of piping, etc. or it could increase construction costs over a range from $1 to $10,000, depending on the size of the project, size of piping, etc., or it could have no effect on construction costs if users do not select to use PERT/AL/PE-RT piping. This proposal simply provides another material option.

Estimated Immediate Cost Impact Justification (methodology and variables):

Seven (7) piping materials produced according to seventeen (17) listed standards are already approved in Table 1107.4.. This proposal simply provides another material option. The amount of the cost decrease or increase is highly dependent on exact comparisons for specific piping materials and sizes plus assembly and construction costs which vary for each individual project. Therefore, only a range of cost decreases or increases can be provided in this format.

Estimated Life Cycle Cost Impact:

Seven (7) piping materials produced according to seventeen (17) listed standards are already approved in Table 1107.4. This proposal simply provides another material option. The impact to Life Cycle Cost is highly dependent on exact comparisons for specific piping materials and sizes plus assembly and construction costs which vary for each individual project. PE-RT/AL/PE-RT piping has a corrosion-resistant plastic inner and outer liner for long life.

Estimated Life Cycle Cost Impact Justification (methodology and variables):

Seven (7) piping materials produced according to seventeen (17) listed standards are already approved in Table 1107.4. This proposal simply provides another material option. The impact to Life Cycle Cost is highly dependent on exact comparisons for specific piping materials and sizes plus assembly and construction costs which vary for each individual project. PE-RT/AL/PE-RT piping has a corrosion-resistant plastic inner and outer liner for long life.

M69-24

Public Hearing Results (CAH1)

Committee Action: **Disapproved**

Committee Reason: The committee voted 13-1 to disapprove of this proposal. The committee argues that more testing is required for composite pressure pipe items contained in the proposed code language. Additional testing is necessary expressly for the uses mentioned in Table 1107.4 and Section 1107.4 of the code.

M69-24

Individual Consideration Agenda

Comment 1:

Proponents: Brad Campbell, Titeflex Corp Gastite, Titeflex Corp Gastite (brad.campbell@gastite.com) requests As Submitted

Reason: Reconsider M69-24 to add ASTM F3506 to Table 1107.4 because feedback from the IMC TC was heard. At the time of this submission, ASTM F3506 is being revised to include new requirements for UV resistance, flame and smoke resistance, and additional refrigerant exposure testing. A second ASTM F17 project to add crush and impact testing is being developed and is expected to be submitted for ASTM ballot and approval by the end of 2024.

Cost Impact: The change proposal is editorial in nature or a clarification and has no cost impact on the cost of construction

M85-24

IMC®: TABLE 1210.4, TABLE 1210.5, 1210.6.9

Proposed Change as Submitted

Proponents: Greg Kurtz Technical Director, The International Ground Source Heat Pump Association (IGSHPA), The International Ground Source Heat Pump Association (IGSHPA) (gkurtz@igshpa.org)

2024 International Mechanical Code

Revise as follows:

TABLE 1210.4 GROUND-SOURCE LOOP PIPE

MATERIAL	STANDARD (see Chapter 15)
Chlorinated polyvinyl chloride (CPVC)	ASTM D2846; ASTM F441; ASTM F442
Cross-linked polyethylene (PEX)	ASTM F876; ASTM F3253; CSA B137.5; CSA C448; NSF 358-3
Polyethylene/aluminum/polyethylene (PE-AL-PE) pressure pipe	ASTM F1282; CSA B137.9
High-density polyethylene (HDPE)	ASTM D2737; ASTM D3035; ASTM F714; AWWA C901; CSA B137.1; CSA C448; NSF 358-1
Polypropylene (PP-R)	ASTM F2389; CSA B137.11; NSF 358-2
~~Polyvinyl chloride (PVC)~~	~~ASTM D1785; ASTM D2241~~
Raised temperature polyethylene (PE-RT)	ASTM F2623; ASTM F2769; CSA B137.18; CSA C448; NSF 358-4

TABLE 1210.5 GROUND-SOURCE LOOP PIPE FITTINGS

PIPE MATERIAL	STANDARD (see Chapter 15)
Chlorinated polyvinyl chloride (CPVC)	ASTM D2846; ASTM F437; ASTM F438; ASTM F439; CSA B137.6
Cross-linked polyethylene (PEX)	ASTM F877; ASTM F1807; ASTM F1960; ASTM F2080; ASTM F2159; ASTM F2434; ASTM F3347; ASTM F3348; CSA B137.5; CSA C448; NSF 358-3
Polyethylene/aluminum/polyethylene (PE-AL-PE)	ASTM F1282; ASTM F2434; CSA B137.9
High-density polyethylene (HDPE)	ASTM D2683; ASTM D3261; ASTM F1055; CSA B137.1; CSA C448; NSF 358-1
Polypropylene (PP-R)	ASTM F2389; CSA B137.11; NSF 358-2
~~Polyvinyl chloride (PVC)~~	~~ASTM D2464; ASTM D2466; ASTM D2467; CSA B137.2; CSA B137.3~~
Raised temperature polyethylene (PE-RT)	ASTM D3261; ASTM F1807; ASTM F2098; ASTM F2159; ASTM F2735; ASTM F2769; ASTM F3347; ASTM F3348; CSA B137.1; CSA B137.18; CSA C448; NSF 358-4

Delete without substitution:

~~**1210.6.9 PVC plastic pipe.** Joints between PVC plastic pipe and fittings shall be solvent-cemented or threaded joints complying with Section 1203.3.~~

Reason: PVC is a rigid piping material supplied only in short lengths of 10-20 feet and joined via solvent cement or various types of mechanical fittings (e.g., flanges). This pipe is not suitable for ground loop piping because of its lack of flexibility and requirement for many joints over a typical pipe length of 400 or more feet in a ground loop piping system. In addition, the time required for solvent cement joints to cure is not suitable for installation of pipes in a vertical borehole, which often requires more than 400 feet of two vertical pipes to be installed as quickly as possible to prevent the drilled hole from collapsing. The International Ground Source Heat Pump Association (IGSHPA), founded in 1987, has never recommended PVC for ground source loop piping. Failures have occurred in the field when installers attempted to use PVC piping for these applications many years ago. The *ANSI / CSA / IGSHPA C448 Series 16 Bi-National Standard for the design and installation of ground source heat pump systems for commercial and residential buildings* does not list PVC rigid piping as an acceptable material for Geothermal ground loop installations. Additionally, the piping Task Force for the New Edition (2024) of the *ANSI / CSA / IGSHPA C448 Bi- National Standard* have reviewed all suitable piping materials for Geothermal ground loop installations and continue to NOT list PVC material as suitable piping material for Geothermal installations.

Cost Impact: The change proposal is editorial in nature or a clarification and has no cost impact on the cost of construction

Justification for no cost impact:

PVC is one of seven (7) piping materials listed in Table 1210.4 for ground loop piping and the user has several choices of better materials for this application, which are approved by IGSHPA or listed in the ANSI / CSA / IGSHPA Bi – National C448 Standard, and commonly used for this purpose. Because PVC is known in the industry to be not suitable for these applications and is not recommended for this purpose by IGSHPA, or the ANSI / CSA /

IGSHPA Bi – National C448 Standard it is rarely, if ever, used for this purpose. Therefore, the removal of PVC piping from Table 1210.4 will neither decrease nor increase the cost of construction.

M85-24

Public Hearing Results (CAH1)

Committee Action: **As Submitted**

Committee Reason: The committee voted 9-5 to approve this proposal as submitted. The committee's reasoning is that of the proponent's reason statement. Only 10 to 20-foot short lengths are available for PVC, a rigid piping material that can be linked using flanges or other mechanical connections. This pipe's lack of flexibility and the need for several joints over a typical pipe length of 400 feet or more make it unsuitable for ground-loop piping systems. Furthermore, placing pipes in a vertical borehole necessitates the faster installation of more than 400 feet of two vertical pipes to prevent the drilled hole from collapsing. Solvent cement joints take too long to cure. The International Ground Source Heat Pump Association (IGSHPA), established in 1987, has never advised PVC for ground source loop piping. Many years ago, there were field failures when installers tried to use PVC plumbing for similar applications. According to the ANSI, CSA, and IGSHPA C448 Series 16 Bi-National Standard for designing and installing ground source and heat pump systems for commercial and residential buildings, PVC rigid piping is inappropriate for geothermal ground loop installations [12]. Furthermore, after reviewing all acceptable pipe materials for geothermal ground loop installations, the piping task force for the New Edition (2024) of the ANSI, CSA, and IGSHPA C448 Bi-National Standard has decided to keep PVC off the list of acceptable piping materials for geothermal installations.

M85-24

Individual Consideration Agenda

Comment 1:

Proponents: Michael Cudahy, PPFA Plastic Pipe and Fittings Association, PPFA Plastic Pipe and Fittings Association (mikec@cmservices.com) requests Disapproved

Reason: PVC and CPVC should remain as options. While the majority of the piping in these systems would likely be coils of polyethylene, PEX or PE-RT, rigid pipe could have use in manifolds and other above ground piping.

There is also a lack of a definition of what the "GROUND-SOURCE LOOP PIPE" consists of, is it only the below ground loops themselves, or does it include all piping/valves and fittings associated with the working fluid?

Cost Impact: No change to code.

Cost Impact: The change proposal is editorial in nature or a clarification and has no cost impact on the cost of construction

Comment (CAH2)# 329

M87-24

IMC®: TABLE 1302.3

Proposed Change as Submitted

Proponents: Christopher Adam Smith, Viega, LLC, Codes and Standards Manager for Viega, LLC

2024 International Mechanical Code

Revise as follows:

TABLE 1302.3 FUEL OIL PIPING AND FITTINGS

MATERIAL	STANDARD (see Chapter 15)
Copper or copper-alloy pipe and fittings	ASTM B42; ASTM B43; ASTM B302; ASTM F3226
Copper or copper-alloy tubing and fittings (Type K, L or M)	~~ASME B16.51;~~ ASTM B75; ASTM B88; ~~ASTM B280;~~ ASTM F3226
Labeled pipe	(See Section 1302.4)
Nonmetallic pipe	ASTM D2996
Steel and stainless steel pipe and fittings	ASTM A53; ASTM A106; A312/A312M; ASTM F3226; UL 180
Steel and stainless steel tubing and fittings	ASTM A254; A269/A269M; ASTM A539; ASTM F3226; UL 180

Reason: This proposal adds UL 180 "Combustible Liquid Tank Accessories" is a standard for pipe, fittings, and accessories for use with fuel oil. This Standard has been revised since the IMC was last updated, and now includes press-connect fittings. Adding UL 180 to this table will allow press-connect fittings to be used for fuel oil applications, and inspectors will be able to verify that those fittings have been listed and labeled for the application.

This proposal will also remove the standards ASME B16.51 "Copper and Copper-Alloy Press-Connect Pressure Fittings" and ASTM B280 "Seamless Copper Tube for Air Conditioning and Refrigeration Field Service." ASME B16.51 has a scope which covers only "...pressure fittings for use with hard-drawn seamless copper water tube conforming to ASTM B88 for piping systems conveying water." ASTM B280 is a refrigerant tubing standard. It is our understanding that these standards were used in lieu of applicable standards available at the time. The Code will be more accurate and less confusing with these two inappropriate references removed from the Table. Removal of these standards from this table will decrease the likelihood of inappropriate products being used in a fuel oil application.

Cost Impact: The change proposal is editorial in nature or a clarification and has no cost impact on the cost of construction

Justification for no cost impact:

The addition of this standard does not increase the cost of construction. The addition of this standard allows for a wider selection of materials but does not make their use mandatory. By including this standard in the code, the options for installers will increase while the cost of construction should stay the same or even decrease.

M87-24

Public Hearing Results (CAH1)

Committee Action: **Disapproved**

Committee Reason: The committee voted 10-4 to disapprove of the proposal. The committee felt that the proposed code language included the wrong standard suggested for Table 1302.3 by the proponent.

M87-24

Individual Consideration Agenda

Comment 1:

Proponents: Christopher Adam Smith, Viega, LLC, Codes and Standards Manager for Viega, LLC (adam@hydrotech-h2o.com) requests As Submitted

Reason: This comment is to urge the committee to accept proposal M87-24 as submitted.

During Committee Action Hearing 1 a concern was raised about the applicability of UL 180 for inclusion in Table 1302.3 due to its title being "Combustible Liquid Tank Accessories." While the title of UL 180 seems to indicate otherwise, UL 180 does in fact include pipe and fittings within the scope of the Standard, as well as construction requirements for piping systems. During its last revision (2023) UL 180 had its scope greatly expanded specifically to cover pipe and fittings used to fill and vent fuel oil storage tanks, as well as pipe and fittings used to connect fuel oil tanks to their oil burning equipment. So while the title says "Tank Accessories" this standard covers significantly more than just accessories.

The scope of UL 180 includes Aboveground Piping Systems as seen in Claus 1.2, c):

1 Scope

1.1 This Standard covers construction and performance requirements for the tank accessories identified in Clause 1.2, for use on atmospheric aboveground tanks not exceeding 19,927 L (5,000 U.S. gal) which are intended for the storage and supply of heating fuels for oil burning equipment, diesel fuels for compression ignition engines, motor oils (new or used) for automotive service stations, and similar combustible liquid applications.

In addition to this Standard's traditional safety requirements for tank accessories that primarily evaluate functional operation, structural integrity, and mitigate fire and environmental hazards from loss of liquid containment under expected normal conditions; optional construction and/or performance requirements, and associated ratings, intended to address more severe conditions associated with the effects of Climate Change are included in Appendix B.

1.2 These requirements cover the following tank accessories intended for installation in, on or connected to the storage tank or supply tank in accordance with the manufacturer's instructions:

a) Liquid Level Gauges – mechanical float, low-voltage electric, or other types with integral or remote indicators;

b) Fill Signal Devices –indicating devices with audible and/or visual signals, including "whistle vent" alarms;

c) Aboveground Piping Systems – aboveground pipe and fittings for tank fill & venting and supply of utilization equipment, including flexible hose; and

d) Fill Pipe Covers & Vent Pipe Caps.

The definition of Aboveground Piping System used by UL 180 includes Fill & Vent Pipe, as well as Supply Pipe as seen in Clause 4.3, a) and 4.3, d):

4.3 ABOVEGROUND PIPING SYSTEMS – Combinations of small diameter pipe, tubing, or hose and their connection or termination fittings for containment and transfer of combustible liquids in applications identified in the scope of this Standard. Aboveground piping system may be of different containment designs for different application types:

a) Fill & Vent Pipe – Intended for transfer of liquids from a delivery truck to a supply tank and venting of displaced vapors in the tank during fill operations. Vent pipe also provides combined normal and emergency venting of the tank. These pipes are typically rigid types in the 25.4 mm to 101.6 mm (1.0 in to 4.0 in) size range;

b) Flexible Hose – Special highly flexible hose connectors of short length/small diameter intended for transfer of liquids typically from a supply pipe end to the utilization equipment, where tight bending and frequent disconnection for installation and maintenance is required. Flexible hose are typically elastomeric hose with metal braid sleeves in a 1/4" to 3/8" size range;

c) Special piping/tubing – Engineered piping or tubing that does not conform to common tubing standards (i.e. Schedule or SDR) for dimension or wall thickness as part of an engineered piping system for filling and venting of above ground combustible liquid tanks; or

d) Supply Pipe – Intended for transfer of liquids from a fuel storage tank or supply tank to utilization equipment, such as an oil burner or diesel generator. These pipes are typically flexible in the 9.5 mm to 25.4 mm (3/8 in to 1.0 in) size range.

There is even an entire Section of UL 180 (*6 Aboveground Piping System Construction*) dedicated to the construction of piping systems, the type of pipe and fittings that are approved, and their respective standards.

Proposal M87-24 also seeks to remove the standards ASME B16.51 "*Copper and Copper-Alloy Press-Connect Pressure Fittings*" and ASTM B280 "*Seamless Copper Tube for Air Conditioning and Refrigeration Field Service*."

ASME B16.51 has a scope which covers only "...pressure fittings for use with hard-drawn seamless copper water tube conforming to ASTM B88 for piping systems conveying water."

ASTM B280 has a scope which covers only "...copper tube intended for use in the connection, repairs, or alterations of air conditioning or refrigeration units in the field."

It is our understanding that these standards were used in lieu of applicable standards available at the time. The Code will be more accurate and less confusing with these two inappropriate references removed from the Table. Removal of these standards from this table will decrease the likelihood of inappropriate products being used in a fuel oil application.

Cost Impact: The change proposal is editorial in nature or a clarification and has no cost impact on the cost of construction

Comment (CAH2)# 469

M89-24

IMC®: SECTION 202 (New), 309.2 (New)

Proposed Change as Submitted

Proponents: Clayton Trevillyan, City of Tucson, City of Tucson (clayton.trevillyan@tucsonaz.gov); Pete Quintela, Miami-Dade County, Miami-Dade County; Jane Gilbert, Miami-Dade County, Miami-Dade County (jane.gilbert@miamidade.gov); Stefano Schiavon, University of California, Berkeley, Self (schiavon@berkeley.edu); Ali Frazzini, Los Angeles County Chief Sustainability Office (afrazzini@cso.lacounty.gov); Mary Wright, City of Phoenix/Office of Heat Response and Mitigation, self

2024 International Mechanical Code

Add new definition as follows:

DESIGN COOLING DAY. A design parameter where air conditioning loads are determined.

Add new text as follows:

309.2 Cooling systems. Interior spaces intended for human occupancy shall be capable of maintaining an indoor temperature at or below 80°F (27°C) in the occupied zone 3 feet (914 mm) above the floor and at least 2 feet (610 mm) from exterior walls on the *design cooling day.* Where permanently installed fans capable of generating 120 fpm (0.6 m/s) air speed within the occupied zone, the indoor temperature during the *design cooling day* shall be maintained at or below 85°F (29°C). The installation of one or more portable systems shall not be used to achieve compliance with this section. **Exception:** Cooling systems shall not be required for the following:

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

Reason: The building code requires minimum heating of spaces for the safety of the occupants. The code is silent on requirements for cooling, despite the negative impacts of elevated exterior thermal conditions on humans. The built environment is a safe haven from the effects of weather and climatic conditions, heat not being an exception for people to seek shelter from the elements. Media attention to heat-related health emergencies on the elderly and people in underserved communities demonstrates the need for improvements in the built environment[1]. As a result of increased summer temperatures, some jurisdictions have already mandated cooling be provided in new buildings and many others are considering extreme heat related ordinances. A coordinated application in the codes that can be consistently applied to new construction is warranted due to the trend in local agencies with differing requirements throughout the county.

The proposal is a performance specification to ensure safety in the built environment due to higher expected summer thermal conditions. The solution can either be active or passive systems, or a combination of these systems to provide relief from elevated thermal conditions. The active systems would include traditional central mechanical air conditioning systems that are provided in most modern homes and do not represent a significant change to how most buildings are constructed. Passive cooling systems utilize unique design features of the building that prevent heat from entering the building and/or removing heat from the building. Passive design applications include building orientation, insulation, solar control (shading and landscaping), ventilation and other methods that naturally, and without input energy, would provide and maintain thermal comfort. Passive systems could be more cost effective in both the short term and the long term as compared to active mechanical systems for circumstances where a few design changes could comply with specified interior temperature. The interior temperature of 80°F was selected as the maximum temperature for the thermal comfort of the interior environment based on ANSI/ASHRAE Standard 55-2020[2] and generally at, or above the temperature in most local ordinances.

The second sentence recognizes that air movement provides a cooling effect as experienced by the occupants of the building. ASHRAE Standard 55-2020 states that air movement of only 120 feet per minute results in the perception of 5°F cooler temperatures. Where permanent fans are installed, the resulting interior maximum temperature can be increased 5°F above the baseline temperature of 80°F that would be required for either the active or passive systems installed in accordance with the first sentence of the code change proposal. This is an additional cost-effective manner to provide the minimum cooling effect on human bodies where thermal comfort and safety is provided in the built environment. Permanently installed fans can include ceiling fans, wall-mounted fans, bladeless ceiling fans, or any permanently installed fan that can be verified at the time of final inspection that the equipment is installed.

The third sentence is a carryover from the heating requirement, where the expectation for compliance is permanently installed equipment that can be utilized by the occupant as needed for thermal comfort and lifesaving opportunities from dangerous heat related health considerations.

Bibliography: (1) Kenny, Glen P., Jane Yardley, Candice Brown, Ronald J. Sigal, and Ollie Jay. "Heat Stress in Older Individuals and Patients with Common Chronic Diseases." CMAJ 182, no. 10 (July 13, 2010): 1053–60. https://doi.org/10.1503/cmaj.081050.

(2) ANSI/ASHRAE 55-2020: Thermal Environmental Conditions for Human Occupancy. Atlanta, GA, US: ASHRAE, 2020.

(3) RSMeans https://www.businesshue.com/commercial-hvac-cost-per-square-foot/.

(4) Energy Trust https://www.energytrust.org/wp-content/uploads/2018/06/AC-Research_PhaseII_9MAR2018_Final.pdf.

(5) IEA https://www.iea.org/reports/sustainable-affordable-cooling-can-save-tens-of-thousands-of-lives-each-year.

Cost Impact: The change proposal is editorial in nature or a clarification and has no cost impact on the cost of construction

Estimated Immediate Cost Impact:

$0 - $31+ per square foot of new or renovated habitable buildings.
The immediate cost impact to construction is for newly constructed or renovated buildings. There is no immediate cost to existing buildings. This value ranges greatly depending on variables that include but are not limited to:

- If the proposed construction would include cooling regardless of this code change. Zero cost impact will apply to many regions and project scopes for new permits.
- If the project includes a system that can be further supplemented at relatively low cost due to other air handling equipment that would have otherwise been included in the project scope.
- The method of proposed cooling and quality of equipment.
- Level of efficiency and sustainability of system design.
- The climate zone of project area.

Estimated Immediate Cost Impact Justification (methodology and variables):

1. Estimation from major HVAC contractor (Watsco)

"There are a lot of variables (i.e. size of the building, type of system, region, needs, installation costs). Below are some rough estimates"

- For commercial buildings the average cost can range from $15 to $30 per sq ft for a basic system but can go up to $40+ for more complex or high efficiency systems.
- For multi-family buildings the average cost can range from $2,500-$5,000 per unit for a basic system increasing in price for high efficiency units. ($40 pf @ 2 units for 4000 sf)

Comparison necessary to isolate cost of heating systems alone (e.g. furnace/boiler systems) to identify cost differential.

2. RSMeans Data (remeansonline.com)

$8-30 per sf
https://www.businesshue.com/commercial-hvac-cost-per-square-foot/

3. AC cost report (page 28)

https://www.energytrust.org/wp-content/uploads/2018/06/AC-Research_PhaseII_9MAR2018_Final.pdf

4. Report from IEA, claiming that fans are the best affordable and available active cooling technology.

https://www.iea.org/reports/sustainable-affordable-cooling-can-save-tens-of-thousands-of-lives-each-year

M89-24

Public Hearing Results (CAH1)

Committee Action: **Disapproved**

Committee Reason: The committee voted 14-0 to disapprove of the proposal. The committee agreed that the proposal required more specificity, as the references are not correct. The committee would like to see this proposal come back at the CAH2 hearings.

M89-24

Individual Consideration Agenda

Comment 1:

IMC®: SECTION 202, 309.2

Proponents: Clayton Trevillyan, City of Tucson, City of Tucson (clayton.trevillyan@tucsonaz.gov) requests As Modified by Committee (AMC2)

Further modify as follows:

2024 International Mechanical Code

Delete without substitution:

~~**DESIGN COOLING DAY.** A design parameter where air conditioning loads are determined.~~

Revise as follows:

309.2 Cooling systems. Dwelling units and sleeping units located in Climate Zones 0, 1, 2, 3, 4, 5A, and 5B, where the summer dry-bulb temperature is greater than 85°F (29.4°C), ~~Interior spaces intended for human occupancy~~ shall be provided with cooling systems capable of maintaining an indoor temperature at or below 80°F (26.7°C) in the occupied space ~~zone 3 feet (914 mm) above the floor and at least 2 feet (610 mm) from exterior walls on the *design cooling day*~~. Where permanently installed fans capable of generating 120 fpm (0.6 m/s) air speed ~~within~~ inside the occupied ~~zone~~ space, the ~~indoor temperature during the *design cooling day*~~ required cooling system shall be capable of ~~maintained~~ maintaining indoor temperature at or below 85°F (29.4°C). The installation of one or more portable systems shall not be used to achieve compliance with this section.

Exception: Cooling systems shall not be required for ~~the following~~:

~~1.~~ Interior spaces where the primary purpose is not associated with human comfort.

~~2. Group F, H, S and U occupancies.~~

Reason: CAH2 Reason Statement:

Code proposal M89-24 has been revised in response to comments received before, during and after the first Committee Action Hearings. The Extreme Heat Working Group has reviewed all comments received and has directly engaged additional industry experts to provide the committee with the best possible revision.

The primary arguments opposing the initial code modification identified 1) the need to specify which occupancy groups this code would apply to 2) a lack of prescriptive climate zones that the code proposal includes and 3) a lack of design condition specificity that incorporates wet and/or dry bulb temperature ranges. The revised code language now focuses on the intended occupancies that must comply by specifying in the first sentence 'dwelling units and sleeping units' thereby exempting all other occupancies. This focused applicability is intended to provide a safe haven for the public seeking shelter from extreme heat events in the most functional location.

The proposed definition has been omitted altogether to reduce possible confusion. This definition was brought up by a committee member during the hearings as the definition was unclear. It was also identified that the term ‘air conditioning’ in the proposed definition contradicted the working group’s intent to allow a variety of cooling methods.Climate zones 0-5B and a dry bulb temperature threshold have also been added to the first sentence to provide explicit charging language to regions that will be most impacted by heat waves. A floor modification was proposed and approved by the committee to eliminate Climate Zones 5C, 6, 7, and 8. This was relocated from the exceptions to the beginning of the code section as suggest by a testifier at the hearings.

The working group acknowledges that relative humidity must also be considered and that regional differences should be considered by the adopting authority. The proposed temperature threshold is consistent with other regulations that consider heat index and relative humidity. The working group’s intent is to allow enough flexibility in the code language to support all reasonable methods of cooling appropriate for the local climatic conditions.

Clarity has also been provided by rewording the allowance for air movement inside the occupied space to eliminate possible confusion related to the location of air movement equipment, as noted by a committee member during discussion portion of the committee motion for disapproval. During this comment, it was also noted by the same committee member that this is an important point, which motivated the clarification. Another committee member noted that the heating requirement is in the IBC, implying it may not be in the IMC. The heating requirement is in the IBC, IRC and IMC Section 309. Placing this requirement in the IMC is appropriate since heating is also provided for. Please note, the working group has also proposed mandatory cooling in the International Building Code, the International Residential Code, and the Property Maintenance code in addition to the current proposal for the International Mechanical Code. Every effort will be made to provide consistent code proposals for the Group B Committee Action Hearings for volumes not included in Group A.

Bibliography: (1) Kenny, Glen P., Jane Yardley, Candice Brown, Ronald J. Sigal, and Ollie Jay. “Heat Stress in Older Individuals and Patients with Common Chronic Diseases.” CMAJ 182, no. 10 (July 13, 2010): 1053–60. https://doi.org/10.1503/cmaj.081050.

(2) ANSI/ASHRAE 55-2020: Thermal Environmental Conditions for Human Occupancy. Atlanta, GA, US: ASHRAE, 2020.

(3) RSMeans https://www.businesshue.com/commercial-hvac-cost-per-square-foot/.

(4) Energy Trust https://www.energytrust.org/wp-content/uploads/2018/06/AC-Research_PhaseII_9MAR2018_Final.pdf.

(5) IEA https://www.iea.org/reports/sustainable-affordable-cooling-can-save-tens-of-thousands-of-lives-each-year.

Cost Impact: Increase

Estimated Immediate Cost Impact:

$0 - $31+ per square foot of new or renovated habitable buildings.

The immediate cost impact to construction is for newly constructed or renovated buildings. There is no immediate cost to existing buildings. This value ranges greatly depending on variables that include but are not limited to:

- If the proposed construction would include cooling regardless of this code change. Zero cost impact will apply to many regions and project scopes for new permits.
- If the project includes a system that can be further supplemented at relatively low cost due to other air handling equipment that would have otherwise been included in the project scope.
- The method of proposed cooling and quality of equipment.
- Level of efficiency and sustainability of system design.
- The climate zone of project area.

Estimated Immediate Cost Impact Justification (methodology and variables):

1. Estimation from major HVAC contractor (Watsco)“There are a lot of variables (i.e. size of the building, type of system, region, needs, installation costs). Below are some rough estimates"

- For commercial buildings the average cost can range from $15 to $30 per sq ft for a basic system but can go up to $40+ for more complex or high efficiency systems.
- For multi-family buildings the average cost can range from $2,500-$5,000 per unit for a basic system increasing in price for high efficiency units. ($40 pf @ 2 units for 4000 sf)

Comparison necessary to isolate cost of heating systems alone (e.g. furnace/boiler systems) to identify cost differential.

2. RSMeans Data (remeansonline.com)

$8-30 per sf

https://www.businesshue.com/commercial-hvac-cost-per-square-foot/

3. AC cost report (page 28)

https://www.energytrust.org/wp-content/uploads/2018/06/AC-Research_PhaseII_9MAR2018_Final.pdf

4. Report from IEA, claiming that fans are the best affordable and available active cooling technology.

https://www.iea.org/reports/sustainable-affordable-cooling-can-save-tens-of-thousands-of-lives-each-year

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