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III Uniform Mechanical Code Change
    Public Comments
AGENDA

I. Call to Order
II. Chairman Comments
III. Announcements
IV. Self-Introductions
V. Review and Approval of Agenda
VI. Approval of Minutes from Previous Meeting (Ontario, CA on May 15-16, 2018)
VII. Discussion of Public Comments to the Uniform Mechanical Code
VIII. Other business
IX. Next scheduled meeting
X. Adjournment
The following is the tentative order of discussion on which the proposed public comments will be discussed at the Technical Committee Meeting. Indented public comments are those being discussed out of numerical order.

Item # 003  Item # 004  Item # 005  Item # 006  Item # 007  Item # 008  Item # 009  Item # 015  Item # 017  Item # 019  Item # 020  Item # 022  Item # 023  Item # 025  Item # 026  Item # 027  Item # 029  Item # 032  Item # 033  Item # 034  Item # 035  Item # 036  Item # 037  Item # 040  Item # 041  Item # 042  Item # 044  Item # 045  Item # 046  Item # 048  Item # 049  Item # 050  Item # 051  Item # 052  Item # 053  Item # 054  Item # 061  Item # 063  Item # 064  Item # 066  Item # 068  Item # 069  Item # 070  Item # 072  Item # 073  Item # 076  Item # 077  Item # 083  Item # 086  Item # 087  Item # 089  Item # 091  Item # 092  Item # 093  Item # 094  Item # 096  Item # 099  Item # 103  Item # 105  Item # 109  Item # 117  Item # 119  Item # 127  Item # 133  Item # 134  Item # 142  Item # 143  Item # 145  Item # 149  Item # 150  Item # 151  Item # 152  Item # 153  Item # 155  Item # 158  Item # 159  Item # 164  Item # 177  Item # 178  Item # 180  Item # 181  Item # 183  Item # 185  Item # 186  Item # 188  Item # 189  Item # 190  Item # 191  Item # 193
Uniform Mechanical Code Public Comments
Item #: 003
UMC 2021 Section: 205.0

SUBMITTER: Randy Young
Sacramento JATC

RECOMMENDATION:
Revise text

CHAPTER 2
DEFINITIONS

205.0 – C –

Conditioned Space. An area, room, or space normally occupied and being heated or cooled for human comfort by any equipment.

SUBSTANTIATION:
The beginning of the sentence already explains it is a room normally occupied, the space or room is ultimately being conditioned for human comfort, makes this definition easier to read.

COMMITTEE ACTION: ACCEPT AS SUBMITTED

TOTAL ELIGIBLE TO VOTE: 26
VOTING RESULTS: AFFIRMATIVE: 26

Public Comment 1
Code Year: 2021 UMC Section #: 205.0
SUBMITTER: Mohomed Dano
Control Air Conditioning Corporation
Rep: Self

RECOMMENDATION:
Revise text

Request to accept the code change proposal as modified by this public comment.

CHAPTER 2
DEFINITIONS

205.0 – C –

Conditioned Space. An area, room, or space normally occupied and being heated or cooled for human comfort by any appliance or equipment.
SUBSTANTIATION:
The definition of “conditioned space” should be further revised as a conditioned space is not always "normally occupied" and is not always for "human comfort." For example, computer rooms or data rooms may be conditioned, but are not for human comfort, rather they are for maintaining suitable temperatures for the functionality of the computer equipment.
Item #: 004

UMC 2021  Section: 205.0

SUBMITTER: Randy Young
Sacramento JATC

RECOMMENDATION:
Revise text

CHAPTER 2
DEFINITIONS

205.0  – C –

Cooling System. All of the equipment, ducts and components, including refrigeration, intended or installed for the purpose of cooling air by mechanical means and discharging such air into any room or conditioned space. This definition shall not include an evaporative cooler.

SUBSTANTIATION:
Adding "ducts and components" clearly helps to identify the cooling system in its entirety.

COMMITTEE ACTION: ACCEPT AS SUBMITTED

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS:  AFFIRMATIVE: 26

Appended Comments

PUBLIC COMMENT 1

Code Year: 2021 UMC  Section #: 203.0, 205.0, 207.0, 218.0

SUBMITTER: Mohamed Dano
Control Air Conditioning Corporation
Rep: Self

RECOMMENDATION:
Revise text

Request to accept the code change proposal as modified by this public comment.
Air, Return. Air from the conditioned space area that is returned to the conditioning equipment for reconditioning.

Air, Supply. Air being conveyed to a conditioned space area through ducts or plenums from a heat exchanger of a heating, cooling, absorption, or evaporative cooling system.

Cooling System. All of the equipment, ducts and components, including refrigeration, intended or installed for the purpose of cooling air by mechanical means and discharging such air into any room or conditioned space. This definition shall not include an evaporative cooler.

Evaporative Cooling System, Evaporative. Equipment, ducts and components intended or installed for the purpose of environmental cooling by an evaporative cooler from which the conditioned air is distributed through ducts or plenums to the conditioned space area.

Portable Evaporative Cooler. An evaporative cooler that discharges the conditioned air directly into the conditioned space without the use of ducts and can be readily transported from place to place without dismantling any portion thereof.

SUBSTANTIATION:
In harmony with the action taken on UMC Item # 004, the definitions of "Evaporative Cooling System," "Air, Return," and "Air, Supply" should also be modified as the terms "ducts and components" and/or "conditioned space" also apply to these systems and to be consistent with the Committee action for the definition for “Cooling System.” Lastly, the definition for “Evaporative Cooling System” is being relocated from Section 207.0 to Section 205.0 below “Cooling System” for ease of use of the code.
Item #: 005
UMC 2021 Section: 206.0

SUBMITTER: Randy Young
Sacramento JATC

RECOMMENDATION:
Revise text

CHAPTER 2
DEFINITIONS

205.0 – C –

**Combination Fire and Smoke Damper.** A device that meets both the fire damper and smoke damper requirements. \[NFPA 5000:3.3.139.2\]

206.0 – D –

**Damper.** A valve or plate for controlling draft or the flow of gases, including air. \[NFPA 211:3.3.52\]

**Combination Fire-Smoke Damper.** An automatic-closing metal assembly consisting of one or more louvers, blades, slats, or vanes that closes upon detection of heat or smoke as to restrict the passage of heat and smoke and is listed to the applicable recognized standard.

SUBSTANTIATION:
To clearly define the materials used to construct and to clearly define it can be used in both fire control and smoke control.

COMMITTEE ACTION: ACCEPT AS AMENDED BY THE TC

Amend proposal as follows:

206.0 – D –

**Damper.** A valve or plate for controlling draft or the flow of gases, including air. \[NFPA 211:3.3.52\]

**Combination Fire-Smoke Damper.** An automatic-closing metal assembly consisting of one or more louvers, blades, slats, or vanes that closes upon detection of heat or smoke as to restrict the passage of heat and smoke and is listed to the applicable recognized standard.

COMMITTEE STATEMENT:
The definition is being modified as it contains specific requirements which are not in accordance with the Manual of Style.

TOTAL ELIGIBLE TO VOTE: 26
VOTING RESULTS: AFFIRMATIVE: 26

Appended Comments
PUBLIC COMMENT 1

Code Year: 2021 UMC  Section #: 206.0  Item #: 005
SUBMITTER: Danial Aldib  Varitec Solutions  Rep: Self
Comment #: 1

RECOMMENDATION:
Revise text

Request to accept the code change proposal as modified by this public comment.

CHAPTER 2
DEFINITIONS

206.0  - D -

**Damper.** A valve or plate for controlling draft or the flow of gases, including air. [NFPA 211:3.3.52]

**Combination Fire-/Smoke Damper.** An automatic-closing metal assembly consisting of one or more louvers, blades, slats, or vanes that closes upon detection of heat or smoke as to restrict the passage of heat and smoke.

SUBSTANTIATION:
The definition of "Combination Fire/Smoke Damper" should be further modified to clarify that these devices restrict the passage of flame, not only heat. This is consistent with the definition for "Fire Damper" in the UMC, which states, "to restrict the passage of flame."

PUBLIC COMMENT 2

Code Year: 2021 UMC  Section #: 206.0  Item #: 005
SUBMITTER: Danial Aldib  Varitec Solutions  Rep: Self
Comment #: 2

RECOMMENDATION:
Revise text

Request to accept the code change proposal as modified by this public comment.

CHAPTER 2
DEFINITIONS

206.0  - D -

**Damper.** A valve or plate for controlling draft or the flow of gases, including air. [NFPA 211:3.3.52]

**Fire Damper.** An automatic-closing metal assembly consisting of one or more louvers, blades, slats, or vanes that closes upon detection of heat so as to restrict the passage of flame and is listed to the applicable recognized standards.

**Smoke Damper.** A damper arranged to seal off airflow automatically through a part of an air duct system so as to restrict the passage of smoke and controlled by a smoke detection system and is listed to the applicable recognized standard.

SUBSTANTIATION:
Listing requirements do not belong in definitions. Listing requirements should only be in the body of the code and this will be consistent with the action taken for Item # 005. Furthermore, smoke dampers are controlled by the smoke detection system.
PUBLIC COMMENT 3

Code Year: 2021 UMC  Section #: 205.0, 206.0  Item #: 005

SUBMITTER: Danial Aldib  Varitec Solutions  Rep: Self

RECOMMENDATION:
Revise text

Request to accept the code change proposal as modified by this public comment.

CHAPTER 2
DEFINITIONS

205.0  - C -

Ceiling Radiation Damper. A listed device installed in a ceiling membrane of a fire-resistance-rated floor-ceiling or roof-ceiling assembly to automatically limit the radiative heat transfer through an air inlet/outlet opening. [NFPA 5000:3.3.139.1]

206.0  - D -

Damper. A valve or plate for controlling draft or the flow of gases, including air. [NFPA 211:3.3.52]

Ceiling Radiation Damper, A listed device installed in a ceiling membrane of a fire-resistance-rated floor-ceiling or roof-ceiling assembly to automatically limit the radiative heat transfer through an air inlet/outlet opening. [NFPA 5000:3.3.139.1]

SUBSTANTIATION:
The definition of "Ceiling Radiation Damper" needs to be relocated to below the rest of the "Damper" definitions for ease of use of the code.

PUBLIC COMMENT 4

Code Year: 2021 UMC  Section #: 606.3  Item #: 005

SUBMITTER: Danial Aldib  Varitec Solutions  Rep: Self

RECOMMENDATION:
Add new text

Request to accept the code change proposal as modified by this public comment.

606.0 Smoke Dampers, Fire Dampers, and Ceiling Dampers.

606.3 Combination Fire/Smoke Dampers. Combination fire/smoke dampers shall comply with the smoke damper and fire damper requirements in Section 606.1 and Section 606.2.

(renumber remaining sections)

SUBSTANTIATION:
The UMC currently does not have a section that addresses the requirements for combination fire/smoke dampers, therefore, a new section needs to be added to address such requirements. The new section follows the same format as the requirements for "smoke dampers" and "fire dampers" which are addressed in UMC Sections 606.1 and 606.2.
Item #: 006

UMC 2021  Section: 206.0

SUBMITTER: Phil Pettit
Control Air Conditioning Corporation

RECOMMENDATION:
Revise text

CHAPTER 2
DEFINITIONS

206.0   – D –

Duct. A tube or conduit passageway for transmission of air, fumes, vapors, or dust. This definition shall not include:
(1) A vent, vent connector, or chimney connector.
(2) A tube or conduit wherein the pressure of the air exceeds 1 psi (7 kPa).
(3) The air passages of listed self-contained systems.

SUBSTANTIATION:
The term “passageway” is consistent with the language found in the definition of “Duct System” and clearly describes the function and purpose of a duct, more so than the term “conduit”.

COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
The proposed change to the term “passageway” is vague and creates confusion.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 26

Appended Comments

PUBLIC COMMENT 1

Code Year: 2021 UMC  Section #: 206.0

SUBMITTER: Mohamed Dano
Control Air Conditioning Corporation
Rep: Self

RECOMMENDATION:
Revise text

Request to replace the code change proposal by this public comment.
Duct. A tube or conduit or passageway for transmission of air, fumes, vapors, or dust. This definition shall not include:

1. A vent, vent connector, or chimney connector.
2. A tube or conduit wherein the pressure of the air exceeds 1 psi (7 kPa).
3. The air passages of listed self-contained systems.

SUBSTANTIATION:
The term "conduit" would be better used in the definition for "duct" rather than the term "tube." Furthermore, NFPA 96 uses the term "conduit or passageway" to define "air duct" as shown below:

NFPA 96:3.3.5: "Air Duct. A conduit or passageway for conveying air to or from heating, cooling, air-conditioning, or ventilating equipment, but not including the plenum."
Item #: 007
UMC 2021 Section: 207.0

SUBMITTER: Randy Young
Sacramento JATC

RECOMMENDATION:
Revise text

CHAPTER 2
DEFINITIONS

207.0 – E –

Emergency Alarm System. A system intended to provide notification and warning of abnormal conditions and summon appropriate aid.

SUBSTANTIATION:
Removing "the indication" and adding "notification" makes this easier to read.

COMMITTEE ACTION: ACCEPT AS SUBMITTED

TOTAL ELIGIBLE TO VOTE: 26
VOTING RESULTS: AFFIRMATIVE: 26

Appended Comments

PUBLIC COMMENT 1

Code Year: 2021 UMC Section #: 207.0 Item #: 007
SUBMITTER: Phil Pettit Control Air Rep: Self

RECOMMENDATION:
Revise text

Request to accept the code change proposal as modified by this public comment.

CHAPTER 2
DEFINITIONS

207.0 – E –

Emergency Alarm System. A system intended to provide a visual or audible notification and warning of abnormal conditions and summon appropriate aid.

SUBSTANTIATION:
The proposed modification provides clarification that an Emergency Alarm System includes "a visual or audible warning". This language clearly defines what an emergency alarm system is and what it should do.
CHAPTER 2
DEFINITIONS

210.0  – H –

HPM Storage Room. A room used for the storage or dispensing of hazardous production material (HPM) and that is classified as a Group H, Division 1, Division 2, Division 3, or Division 4 Occupancy.

SUBSTANTIATION:
This is an update to the new potential Occupancies in the current Building and fire Codes.

COMMITTEE ACTION: ACCEPT AS SUBMITTED

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 26

Appended Comments

PUBLIC COMMENT 1

Code Year: 2021 UMC  Section #: 210.0  Item #: 008

SUBMITTER: Reinhard Hanselka
Menlo Park Fire Protection District

RECOMMENDATION:
Revise text

Request to accept the code change proposal as modified by this public comment.

CHAPTER 2
DEFINITIONS

210.0  – H –

HPM Storage Room. A room used for the storage or dispensing of hazardous production material (HPM) and that is classified as a Group H, Division 1, Division 2, Division 3, Division 4, or Division 5 Occupancy.
SUBSTANTIATION:
I am further modifying my original proposal. Division 5 Occupancy was not included in the original proposal and should be added to the definition of “HPM Storage Room” as it is part of Group H of the HPM (Hazardous Production Material) classifications. Division 5 covers semiconductor fabrication facilities and comparable research and development areas.
Proposals

Item #: 009
UMC 2021  Section: 212.0

SUBMITTER:  Mark Fasel
Viega LLC

RECOMMENDATION:
Revise text

CHAPTER 2
DEFINITIONS

212.0  – J –

Joint, Press-Connect. A permanent mechanical joint consisting of an elastomeric seal or an elastomeric seal and corrosion-resistant grip or bite ring. The joint is made with a pressing tool and jaw or ring approved by the fitting manufacturer.

SUBSTANTIATION:
We have discovered that the mechanical attaching grip "or bite" ring is referred to as a grip ring by some manufacturer's and a bite ring by others. The proposed addition of the words "or bite" are for clarification that a Press-Connect joint may incorporate a grip or a bite ring in the design. These terms are usually found in the dimensional drawings of the fittings. This revision will provide clarification for the Building Official and Installer so there are no misunderstandings on what may be considered a Press-Connect Joint.

COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
The proposed change is unnecessary and does not strengthen the code.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 20 NEGATIVE: 6

EXPLANATION OF AFFIRMATIVE:
MANN: There was no technical justification provided for the addition of "bite."

EXPLANATION OF NEGATIVE:
CUDAHY: I believe this language was accepted in another model code.
FEEHAN: The term bite is used in the industry and does not change the code, but gives more information to the end user
HOWARD: The additional language does provide clarification. The Committee rationale should not always be based on if it strengthens the code, but rather does it provide a benefit to the end users.
KOERGER: I do not see a problem with adding "bite ring" reference for clarification.
MACNEVIN: No technical objection to adding "bite."
A. TRAFTON: The term bite is used in submittals and in standard industry language.

Appended Comments
PUBLIC COMMENT 1

Code Year: 2021 UMC  Section #: 212.0  Item #: 009

SUBMITTER: Mark Fasel
Viega LLC

RECOMMENDATION:
Revise text

Request to accept the code change proposal as submitted by this public comment.

SUBSTANTIATION:
The proposed language is necessary and will strengthen the code since it has been discovered that the mechanical attaching grip "or bite" ring is referred to as a grip ring by some manufacturers and a bite ring by others. The proposed addition of the words "or bite" is for clarification that a Press-Connect joint may incorporate a "grip" or a "bite" ring in the design. These terms are usually found in the dimensional drawings of the fittings. This revision will provide clarification for the Building Official and Installer so there are no misunderstandings on what may be considered a Press-Connect Joint.
Item #: 015

UMC 2021 Section: 303.1, Table 1701.1

SUBMITTER: David C. Bixby
Air Conditioning Contractors of America

RECOMMENDATION:
Revise text

303.0 Installation.
303.1 Listed Appliances. The installation of equipment and appliances regulated by this code shall be in accordance with the conditions of the listing, the manufacturer’s installation instructions and this code. The manufacturer’s installation and operating instructions shall be attached to the appliance. Minimum criteria for the proper installation of HVAC systems shall comply with ACCA 5 QI. Clearances of listed equipment and appliances from combustible materials shall be as specified in the listing or on the rating plate.

TABLE 1701.1
REFERENCED STANDARDS

<table>
<thead>
<tr>
<th>STANDARD NUMBER</th>
<th>STANDARD TITLE</th>
<th>APPLICATION</th>
<th>REFERENCED SECTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>ANSI/ACCA 5 QI-2015</td>
<td>HVAC Quality Installation Specification</td>
<td>Equipment</td>
<td>303.1</td>
</tr>
</tbody>
</table>

(portion of table not shown remains unchanged)

Note: ACCA 5 QI meets the requirements for mandatory reference standards in accordance with Section 3-3.7.1 of IAPMO's Regulations Governing Committee Projects.

SUBSTANTIATION:
ACCA 5 QI details nationally-recognized minimum criteria for the proper installation of HVAC systems in new and existing residential and commercial buildings. This standard provides a universally accepted definition for quality installation across a broad spectrum of the HVAC industry (e.g., manufacturers, distributors, contractors, user groups, customers, utilities, efficiency advocates, trade associations, professional societies, and governmental agencies). In this Standard, the QI elements focus on the application and how well the system is selected and actually installed. ACCA 5 QI is also a consensus-based ANSI standard.

The addition of ACCA 5 QI is needed to support its proposed reference as a new requirement under 303.1. ACCA 5 QI is a consensus-based ANSI standard that meets the requirements for mandatory reference standards in accordance with Section 3-3.7.1 of IAPMO's Regulations Governing Projects.

COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
The proposed text is not needed as the manufacturer’s installation instructions already provide installation procedures and the manufacturer's installation instructions take precedence.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 24 NEGATIVE: 1 NOT RETURNED: 1 Howard
EXPLANATION OF NEGATIVE:

WHITE: ACCA 5 QI is an industry supported standard necessary for quality installations.

Appended Comments

PUBLIC COMMENT 1

Code Year: 2021 UMC  Section #: 303.1, Table 1701.1  Item #: 015

SUBMITTER: David Bixby
Air Conditioning Contractors of America  Comment #: 1

RECOMMENDATION:
Revise text

Request to replace the code change proposal by this public comment.

303.0 Installation.
303.1 Listed Appliances. The installation of equipment and appliances regulated by this code shall be in accordance with the conditions of the listing, the manufacturer's installation instructions and this code. The manufacturer's installation and operating instructions shall be attached to the appliance. Minimum criteria for the proper design, equipment selection, and installation of HVAC systems shall comply with ACCA 5 QI. Clearances of listed equipment and appliances from combustible materials shall be as specified in the listing or on the rating plate.

TABLE 1701.1
REFERENCED STANDARDS

<table>
<thead>
<tr>
<th>STANDARD NUMBER</th>
<th>STANDARD TITLE</th>
<th>APPLICATION</th>
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</tr>
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<tbody>
<tr>
<td>ACCA 5 QI-2015</td>
<td>HVAC Quality Installation Specification</td>
<td>Equipment</td>
<td>303.1</td>
</tr>
</tbody>
</table>

Note: ACCA 5 QI meets the requirements for mandatory reference standards in accordance with Section 3-3.7.1 of IAPMO's Regulations Governing Committee Projects.

SUBSTANTIATION:
In addition to referring to the manufacturer's instructions, ACCA 5 QI focuses how well the system is designed, selected, installed, and tested, which has a large impact on occupant satisfaction and energy savings. For this Standard, core areas that characterize a quality installation include:
(1) Design Aspects, such as heat gain/loss load calculations, equipment capacity selection;
(2) Distribution Aspects, such as duct leakage, airflow balance;
(3) Equipment Installation Aspects, such as electrical requirements, system controls, refrigerant charge, and System Documentation; and
(4) Owner Education Aspects for proper system documentation and owner/operator education. Those who are currently knowledgeable in performing such work are already using the same minimum core requirements that are outlined in ACCA 5 QI. The standard is also available to all interested stakeholders as a free download. (www.acca.org/quality)
Item #: 017

UMC 2021  Section: 303.8.4, Table 1701.1

SUBMITTER: David Dias
Sheet Metal Workers Local 104

RECOMMENDATION:
Revise text

303.0 Installation.

303.8 Appliances on Roofs. (remaining text unchanged)

303.8.4 Edge of Roof Clearance. Appliances shall be installed on a well-drained surface of the roof. At least 6 feet (1829 mm) of clearance shall be available between any part of the appliance and the edge of a roof or similar hazard. [*]

303.8.4.1 Guards. Where the clearance between the appliance and the edge of roof is not met as required in Section 303.8.4, rigidly fixed rails, guards, parapets, or other building structures at least 42 inches (1067 mm) in height shall be provided on the exposed side. [NFPA 54:9.4.2.2] Guards shall not be required where personnel fall protection in accordance with ASSE Z359.1 is installed.

<table>
<thead>
<tr>
<th>STANDARD NUMBER</th>
<th>STANDARD TITLE</th>
<th>APPLICATION</th>
<th>REFERENCED SECTIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASSE Z359.1-2016</td>
<td>The Fall Protection Code</td>
<td>Miscellaneous</td>
<td>303.8.4.1</td>
</tr>
</tbody>
</table>

(portion of table not shown remains unchanged)

Note: ASSE Z359.1 meets the requirements for mandatory reference standards in accordance with Section 3-3.7.1 of IAPMO's Regulations Governing Committee Projects.

SUBSTANTIATION:
Section 303.8.4 is being revised to separate the guards requirement in a separate location for ease of use of the document. Furthermore, guards are not necessary when there is a personnel fall protection provided in accordance with ASSE Z359 is installed. This is similar to the current OSHA requirements.

COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
The proposed language will create confusion and conflict with the NFPA 54 Extract.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 25 NEGATIVE: 1

EXPLANATION OF NEGATIVE:
SMITH: The monograph needs to be re-written to conform. The provisions for fall protection are needed in the code.
PUBLIC COMMENT 1

Code Year: 2021 UMC  Section #: 303.8.4, 303.8.4.1, Table 1701.1  Item #: 017

SUBMITTER: David Dias  
Sheet Metal Workers Local 104

RECOMMENDATION:
Revise text

Request to **replace** the code change proposal by this public comment.

303.0 Installation.

303.8 Appliances on Roofs. (remaining text unchanged)

303.8.4 **Edge of Roof Clearance.** Appliances shall be installed on a well-drained surface of the roof. At least 6 feet (1829 mm) of clearance shall be available between any part of the appliance and the edge of a roof or similar hazard, or rigidly fixed rails, guards, parapets, or other building structures at least 42 inches (1067 mm) in height shall be provided on the exposed side. [NFPA 54:9.4.2.2]

303.8.4.1 **Guards and Rails.** Guards or rails shall be required where the following exist:

(1) The clearance between the appliance and a roof edge or open end of an equipment platform is less than 6 feet (3048 mm).

(2) The open end of the equipment platform is located more than 30 inches (762 mm) above the roof, floor, or grade below.

Where guards or rails are installed, they shall be constructed so as to prevent the passage of a 21 inch (533 mm) diameter ball, resist the imposed loading conditions, and shall extend not less than 30 inches (7625 mm) beyond each side of the equipment or appliance.

**Exception:** Guards shall not be required where a permanent fall arrest anchorage connector system in accordance with ASSE Z359.1 is installed.

**TABLE 1701.1**

<table>
<thead>
<tr>
<th>STANDARD NUMBER</th>
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<th>APPLICATION</th>
<th>REFERENCED SECTION</th>
</tr>
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<td>The Fall Protection Code</td>
<td>Miscellaneous</td>
<td>303.8.4.1</td>
</tr>
</tbody>
</table>

(portion of table not shown remains unchanged)

**Note:** ASSE Z359.1 meets the requirements for a mandatory referenced standard in accordance with Section 3-3.7.1 of IAPMO's Regulations Governing Committee Projects.

**SUBSTANTIATION:**

The proposed language addresses the TC’s concern by keeping the NFPA extract and adding additional provisions to address “guards and rails.” The added language gives the end user clear guidance when guards and rails are required for safety, and the minimum requirements for physical characteristics. Furthermore, the proposed language addresses “fall arrest anchorage connectors systems” as an alternate method of ensuring the safety of inspectors and workers on platforms and roofs.
Item #: 019
UMC 2021  Section: 303.10.1, 303.10.1.1

SUBMITTER: Mohamed Dano
Control Air Conditioning Corporation

RECOMMENDATION:
Revise text

303.0 Installation.

303.10 Clearances. (remaining text unchanged)
303.10.1 Clearance Reduction. Reduce clearances to combustible construction for listed equipment and appliances shall comply with the listing and Table 303.10.1, except for specific applications and provision as stated in Section 303.10.1.1 through Section 303.10.1.3. Where permitted by the manufacturer, and not provided in this code, reduce clearances to combustible construction for unlisted equipment and appliances shall comply with Table 303.10.1.

303.10.1.1 Type I Hood Exhaust System, Commercial Kitchens. Reduce clearances for Type I exhaust systems used in commercial kitchens shall be in accordance with Section 507.4.2 through Section 507.4.2.3. Clearances from the duct or the exhaust fan to the interior surface of enclosures of combustible construction shall be in accordance with Section 510.7.3 and clearances shall not be reduced.

SUBSTANTIATION:
Section 303.10.1 and Section 303.10.1.1 is being revised for clarity. For example, Section 303.10.1 should be revised to include language which sends the end user for specific reduce clearances requirements. The current language seems to indicate that all reduce clearances must comply with Table 303.10.1 which is not the case.

Section 303.10.1.1 is being revised to clarify that the section is specific to commercial kitchens. Thought the term “Type 1” it is common language for those of us who deal with these types of systems in our daily lives, it is not is not common language for those contractors or installers who may come across with these systems.

COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
The proposed language is not necessary and does not enhance and strengthen the enforceability of the code.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 26

Appended Comments

PUBLIC COMMENT 1
Code Year: 2021 UMC  Section #: 303.10.1  Item #: 019
SUBMITTER: Keith Blazer
Rep: Self

RECOMMENDATION:
Revise text
Request to **replace** the code change proposal by this public comment.

**303.0 Installation.**

**303.10 Clearances.** (remaining text unchanged)

**303.10.1 Clearance Reduction.** Reduced clearances to combustible construction for listed equipment and appliances shall comply with the listing and Table 303.10.1. Where permitted by the manufacturer, and not provided in this code, reduced clearances to combustible construction for unlisted equipment and appliances shall comply with Table 303.10.1.  
Exception: Specific applications and provisions as stated in Section 303.10.1.1 through Section 303.10.1.3.

**SUBSTANTIATION:**
The proposed revision relocates language from the original proposal in Section 303.10.1 to an exception, where it makes more sense to have it. This is a simple relocation that would strengthen the code and add clarity for the end user.
Item #: 020

UMC 2021  Section: 303.10.1.3

SUBMITTER: Randy Young
Sacramento JATC

RECOMMENDATION:
Revise text

303.0 Installation.

303.10 Clearances. (remaining text unchanged)
303.10.1 Clearance Reduction. (remaining text unchanged)

303.10.1.3 Solid-Fuel Burning Appliances. For solid-fuel burning appliances, the clearance, after reduction, shall not be less than 12 inches (305 mm) to combustible walls and not less than 18 inches (457 mm) to combustible ceilings. The clearance, after reduction, shall be permitted to be less than 12 inches (305 mm) to combustible walls and less than 18 inches (457 mm) to combustible ceilings where the solid-fuel burning appliance is listed for lesser clearance. Solid-fuel burning appliances listed for lesser clearances shall be permitted to be installed in accordance with the manufacturer’s instructions and their listing.

SUBSTANTIATION:
This made no sense as written, with “after reduction” in the first sentence made this seem contradictory. Simple clean up.

COMMITTEE ACTION: ACCEPT AS SUBMITTED

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS:  AFFIRMATIVE: 26

Appended Comments

PUBLIC COMMENT 1

Code Year: 2021 UMC  Section #: 221.0  Item #: 020

SUBMITTER: Maria Yepremian
County of Los Angeles Building and Safety  Comment #: 1

RECOMMENDATION:
Add new text

Request to accept the code change proposal as modified by this public comment.
Solid-Fuel. Wood, charcoal, peat, biomass, coal, Hexamine fuel tablets, pellets made from wood, corn, wheat, rye and other grains, and other similar organic material and any combination of them that are used as fuel to produce energy, providing heat and light, usually released through the process of combustion.

Solid-Fuel Burning Appliance. A chimney-connected device that burns solid-fuel for the purpose of heating or cooking.

SUBSTANTIATION:
Definitions are being added for "Solid-Fuel" and "Solid-Fuel Burning Appliance." There are currently no definitions for these terms in the code. The definitions for "Solid Cooking Fuel" and "Solid-Fuel Cooking Equipment," which already in the code, are not covered by these new definitions. Solid Fuel can be used for purposes other than cooking, such as space heating. The addition of these definitions will assist the AHJ with enforceability.
Item #: 022

UMC 2021 Section: 304.4.4

SUBMITTER: Christopher Jensen
UL LLC

RECOMMENDATION: Delete text without substitution

304.0 Accessibility for Service.

304.4 Appliances in Attics and Under-Floor Spaces. (remaining text unchanged)

304.4.4 Lighting and Convenience Outlet. A permanent 120 volt receptacle outlet and a lighting fixture shall be installed near the appliance. The switch controlling the lighting fixture shall be located at the entrance to the passageway. [NFPA 54:9.5.3]

SUBSTANTIATION: The requirements for lighting and power for appliances installed in Attics and underfloor spaces are adequately covered in NFPA 70 Sections 210.63, 210.70(A)(3) and 210.70(C). There are conflicts with some of the terms used in this section and the corresponding requirements found in NFPA 70.

(1) The term “Lighting Fixture” has been replaced in the 2002 edition of NFPA 70 with the term “Luminaire”. The term luminaire is used internationally for lighting products. The NEC permits the required illumination for an appliance to be provided by either a lampholder or a luminaire.

(2) Receptacles are rated at 125 volt not 120 volt in accordance with UL 489. Branch circuits are rated at 120 volts nominal. Proposals are being submitted to NFPA to address this issue in NFPA 54 National Fuel Gas Code.

COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT: The proposed text deletion should remain in the code as the language is needed for enforcement of the code in regards to lighting and power for appliances.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 26

Appended Comments

PUBLIC COMMENT 1

Code Year: 2021 UMC Section #: 304.4.4 Item #: 022

SUBMITTER: Phil Pettit
Control Air
Rep: Self

RECOMMENDATION: Revise text

Request to replace the code change proposal by this public comment.
304.0 Accessibility for Service.

304.4 Appliances in Attics and Under-Floor Spaces. (remaining text unchanged)

304.4.4 Lighting and Convenience Outlet. A permanent 120 volt receptacle outlet and a lighting fixture luminaire shall be installed near the appliance. The switch controlling the lighting fixture shall be located at the entrance to the passageway. {NFPA 54:9.5.3}

SUBSTANTIATION:
The term "luminaire" should replace the term "lighting fixture" for consistency to correlate with the action taken on UMC Item # 067. Also, the NFPA 54 extract needs to be removed as the extracted language is being changed.
Item #: 023

UMC 2021  Section: 310.2

SUBMITTER: Randy Young
Sacramento JATC

RECOMMENDATION:
Revise text

310.0 Condensate Wastes and Control.

310.2 Condensate Control. Where an equipment or appliance is installed in a space where damage is capable of resulting from condensate overflow, other than damage to replaceable lay-in ceiling tiles, a drain line shall be provided and shall be drained in accordance with Section 310.1. An additional protection method for condensate overflow shall be provided in accordance with one of the following:

1. A water level detecting device that will shut off the equipment or appliance in the event the primary drain is blocked.
2. An additional watertight pan of corrosion-resistant material, with a separate drain line, installed beneath the cooling coil, unit, or the appliance to catch the overflow condensate due to a clogged primary condensate drain.
3. An additional drain line at a level that is higher than the primary drain line connection of the drain pan.
4. An additional watertight pan of corrosion-resistant material with a water level detection device installed beneath the cooling coil, unit, or the appliance to catch the overflow condensate due to a clogged primary condensate drain and to shut off the equipment.

The additional pan or the additional drain line connection shall be provided with a drain pipe of not less than 3/4 of an inch (20 mm) nominal pipe size, discharging at a point that is readily observed.

SUBSTANTIATION:
Where equipment or appliances are installed in any area and condensate has a potential of causing any damage, proper precautions should be taken to prevent such damage. Ceiling tiles are like sponges, they will accept and retain moisture which could lead to mold and mildew growth. Damage to items located below the ceiling such as files, computers, desks or whatever else the building owner decides to place under an area unknown to him/her if the ceiling is going to hiding a leaky hazard.

COMMITTEE ACTION: ACCEPT AS SUBMITTED

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 25 NOT RETURNED: 1 HOWARD

Appended Comments

PUBLIC COMMENT 1

Code Year: 2021 UMC  Section #: 310.2  Item #: 023

SUBMITTER: Randy Young
Sacramento JATC  Comment #: 1

RECOMMENDATION:
Revise text
Request to accept the code change proposal as modified by this public comment.

### 310.0 Condensate Wastes and Control.

### 310.2 Condensate Control. Where any equipment or appliance is installed in a space where damage is capable of resulting from condensate overflow, a drain line shall be provided and shall be drained in accordance with Section 310.1. An additional protection method for condensate overflow shall be provided in accordance with one of the following:

1. - (4) (remaining text unchanged)

**SUBSTANTIATION:**
The propose revision will correlate with similar change done to the UPC in regards to "any" equipment or appliance installed in a space where damage is capable of resulting from condensate overflow.

_____

**PUBLIC COMMENT 2**

**Code Year:** 2021 UMC  **Section #:** 310.5

**SUBMITTER:** Phillip H Ribbs

PHR Consultants

**RECOMMENDATION:**
Revise text

Request to accept the code change proposal as modified by this public comment.

### 310.0 Condensate Wastes and Control.

#### 310.5 Point of Discharge.

Air-conditioning condensate waste pipes shall connect indirectly, except where permitted in Section 310.6, to the drainage system through an air gap or air break to trapped and vented receptors, roof drains, dry wells, leach pits, or the tailpiece of plumbing fixtures. A condensate drain shall be trapped in accordance with the appliance manufacturer’s instructions or as approved.

**Exception:** Where permitted in Section 310.6.

#### 310.6 Condensate Waste From Air-Conditioning Coils.

Where the condensate waste from air-conditioning coils discharges by direct connection to a lavatory tailpiece or to an approved accessible inlet on a bathtub overflow, the connection shall be located in the area controlled by the same person controlling the air-conditioned space.

**SUBSTANTIATION:**
As written, the exception may be misinterpreted as pertaining to the described fixtures. However, the fixtures are not part of the exception. The proposed modification removes any ambiguity by adding the exception to the bottom. Furthermore, roof drains are being added as it is an appropriate location for air-conditioning condensate waste pipes to connect indirectly. This change will correlate with the action taken on UPC Item # 130.
Item #: 025
UMC 2021 Section: Chapter 3: 303.8.2

SUBMITTER: IAPMO Staff - Update Extracts NFPA 54 Extract Update

RECOMMENDATION:
Revise text

303.0 Installation.

303.8.2 Fasteners. All access locks, screws, and bolts shall be of corrosion-resistant material. [NFPA 54:9.4.1.3]

Notes:
1 A – Equals the clearance with no protection specified in Table 802.7.3.3 and Table 904.2.2 and in the sections applying to various types of appliances equipment.
2 B – Equals the reduced clearance permitted in accordance with Table 303.10.1.
3 The protection applied to the construction using combustible material shall extend far enough in each direction to make C equal to A.

FIGURE 303.10.1(1)\(^1, 2, 3\)
EXTENT OF PROTECTION NECESSARY TO REDUCE CLEARANCES FROM GAS APPLIANCES OR VENT CONNECTORS [NFPA 54: FIGURE 10.3.2.3(a)]

SUBSTANTIATION:
In accordance with IAPMO's Regulations Governing Committee Projects (Extract Guidelines), Section 303.8.2 and Figure 303.10.1(1) are being revised to the latest edition of NFPA 54-2018.

COMMITTEE ACTION: ACCEPT AS SUBMITTED

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 26
PUBLIC COMMENT 1

Code Year: 2021 UMC  Section #: Chapter 3  Item #: 025
SUBMITTER: IAPMO Staff - Update Extracts  NFPA 54 Extract Update  Comment #: 1

RECOMMENDATION:
Revise text

Request to accept the code change proposal as modified by this public comment.

304.0 Accessibility for Service.
304.1 General. All appliances shall be located with respect to building construction and other equipment so as to permit access to the appliance. Sufficient clearance shall be maintained to permit cleaning of heating surfaces; the replacement of filters, blowers, motors, burners, controls, and vent connections; the lubrication of moving parts where necessary; the adjustment and cleaning of burners and pilots; and the proper functioning of explosion vents, where provided. For attic installation, the passageway and servicing area adjacent to the appliance shall be floored. [NFPA 54:9.2.1]

Unless otherwise specified, not less than 30 inches (762 mm) in depth, width, and height of working space shall be provided.

Exception: A platform shall not be required for unit heaters or room heaters.

304.3.1 Access. Buildings exceeding of more than 15 feet (4572 mm) in height shall have an inside means of access to the roof, unless other means acceptable to the Authority Having Jurisdiction are used. [NFPA 54:9.4.3.2]

304.3.1.1 Access Type. The inside means of access shall be a permanent or foldaway inside stairway or ladder, terminating in an enclosure, scuttle, or trap door. Such scuttles or trapdoors shall be not less than at least 22 inches by 24 inches (559 mm by 610 mm) in size, shall open easily and safely under all conditions, especially snow, and shall be constructed so as to permit access from the roof side unless deliberately locked on the inside.

Not less than 6 feet (1829 mm) of clearance shall be available between the access opening and the edge of the roof or similar hazard, or rigidly fixed rails or guards not less than a minimum of 42 inches (1067 mm) in height shall be provided on the exposed side. Where parapets or other building structures are utilized in lieu of guards or rails, they shall be not less than a minimum of 42 inches (1067 mm) in height. [NFPA 54:9.4.3.3]

TABLE 303.10.1
REDUCTION OF CLEARANCES WITH SPECIFIED FORMS OF PROTECTION1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11
[NFPA 54: TABLE 10.2.3]

(portion of table not shown remain unchanged)

Notes:
1 Reduction of clearances from combustible materials shall not interfere with combustion air, draft hood clearance and relief, and accessibility of servicing.
2 All clearances shall be measured from the outer surface of the combustible material to the nearest point on the surface of the appliance, disregarding any intervening protection applied to the combustible material.
3 Spacers and ties shall be of noncombustible material. No spacer or tie shall be used directly opposite the appliance or connector.
4 Where all clearance reduction systems use a ventilated air space, an adequate provision for air circulation shall be provided as described. [See Figure 303.10.1(2) and Figure 303.10.1(3)]
5 There shall be not less than At least 1 inch (25.4 mm) shall be between clearance reduction systems and combustible walls and ceilings for reduction systems using a ventilated air space.
6 Where a wall protector is mounted on a single flat wall away from corners, it shall have not less than a minimum of 1 inch (25.4 mm) air gap. To provide adequate air circulation, the bottom and top edges, or only the side and top edges, or all edges shall be left open.
7 Mineral wool batts (blanket or board) shall have a minimum density of not less than 8 pounds per cubic foot (lb/ft$^3$) (128 kg/m$^3$) and a minimum melting point of 1500°F (816°C).
8 Insulation material used as part of a clearance reduction system shall have a thermal conductivity of 1 British thermal unit inch per hour square foot degree Fahrenheit [Btu•in/(h•ft$^2$•°F)] [0.1W/(m•K)] or less.
9 There shall be not less than At least 1 inch (25.4 mm) shall be between the appliance and the protector. In no case shall the clearance between the appliance and the combustible surface be reduced below that allowed in this table Table 303.10.1.
10 All clearances and thicknesses are minimum; larger clearances and thicknesses are acceptable.
11 Listed single-wall connectors shall be installed in accordance with the terms of their listing and the manufacturer’s installation instructions.

For SI units: 1 inch = 25.4 mm

Note: Masonry walls can be permitted to be attached to combustible walls using wall ties. Spacers shall not be used directly behind appliance or connector.

FIGURE 303.10.1(2)
WALL PROTECTOR CLEARANCE REDUCTION SYSTEM
[NFPA 54: FIGURE 10.3.2.3(b)]

SUBSTANTIATION:
In accordance with IAPMO’s Regulations Governing Committee Projects (Extract Guidelines), Chapter 3 is being revised to the latest edition of NFPA 54-2018.
Proposals
Edit Proposal
Item #: 026
UMC 2021 Section: 401.1, 405.0 - 405.5, 217.0, Table 1701.1, Table 1701.2

SUBMITTER: David Dias
Sheet Metal Workers Local 104

RECOMMENDATION:
Revise text

401.0 General.

401.1 Applicability. This chapter contains requirements for ventilation air supply, exhaust, and makeup air requirements for occupiable spaces within a building. Spaces within buildings, except those within dwelling unit in residential occupancies where occupants are nontransient, shall comply with Section 402.0 through Section 404.0. 402.1.2 Dwelling. Requirements for ventilation air rate for single-family dwellings units in residential occupancies, where the occupants are nontransient, shall be in accordance with this chapter or ASHRAE 62.2 Section 405.0.

405.0 Indoor Air Quality for Residential Occupancies.

405.1 General. Rooms or occupied spaces within residential occupancies, where the occupants are nontransient, shall be designed to have mechanical ventilation and exhaust air in accordance with Section 405.2 through Section 405.5.

405.1.1 Natural Ventilation. Where approved by the Authority Having Jurisdiction, natural ventilation shall be permitted for Climate Zone 1, Climate Zone 2; or for thermally conditioned buildings for less than 876 hours per year.

405.2 Ventilation Air Rate. The required mechanical ventilation outdoor air rate ($Q_{tot}$) shall be as calculated in accordance with Equation 405.2.

Exceptions: For existing buildings and where permitted by the Authority Having Jurisdiction, the total mechanical ventilation ($Q_{tot}$) is not required where $Q_{tot}$ is calculated to be not more than 15 ft$^3$/min (0.007 m$^3$/s).

$$Q_{tot} = 0.03A_{floor} + 7.5 (N_{br} + 1)$$  \hspace{1cm} \text{Equation 405.2}

Where:

$Q_{tot}$ = Total required ventilation outdoor air rate, cfm

$A_{floor}$ = Floor area, ft$^2$

$N_{br}$ = Number of bedrooms more than 1

For SI Units: 1 cubic foot per minute = 0.00047 m$^3$/s

405.2.1 Reduced Ventilation Air Rate. Where permitted by the Authority Having Jurisdiction, the mechanical ventilation air rate required in Section 405.2 shall be permitted to be reduced where an infiltration rate is determined in accordance with ASTM E779.

405.3 Bathroom Exhaust. A mechanical exhaust directly to the outdoors shall be provided in each room containing a bathtub, shower, or tub/shower combination. The fan shall run intermittently (on demand) or continuously. A readily accessible manual control designed to be operated as needed or an automatic control shall be provided for intermittent operations.

405.3.1 Exhaust Rate. The exhaust rate shall be not less than 50 ft$^3$/min (0.02 m$^3$/s) for intermittent operation and 20 ft$^3$/min (0.009 m$^3$/s) for continuous operation.

405.4 Kitchen Exhaust. A mechanical exhaust directly to the outdoors shall be provided in each kitchen. The fan shall run intermittently (on demand) or continuously. A readily accessible manual control designed to be operated as needed or an automatic control shall be provided for intermittent operations.
**405.4.1 Exhaust Rate.** For intermittent-controlled operations, the exhaust rate shall be not less than 100 ft³/m (0.047 m³/s) for range hoods or 300 ft³/m (0.141 m³/s) for mechanical exhaust fans including downdraft appliances. For continuous-operated ventilation, the exhaust rate shall be not less than 5 air changes per hour based on kitchen volume for enclosed kitchens.

**405.5 Ventilation Openings.** Occupiable spaces shall be provided with a readily accessible ventilation opening openable to the outdoors. The opening shall be not less than 5 square feet (0.464 m²) or 4 percent of the occupied floor area. The openable area shall be based on free, unobstructed area through the opening.

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**CHAPTER 2
DEFINITIONS**

**217.0 – O –

**Occupancy, Nontransient.** Occupancy of a dwelling unit or sleeping unit for more than 30 days. [ASHRAE 62.1:3]

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**TABLE 1701.1
REFERENCED STANDARDS**

<table>
<thead>
<tr>
<th>STANDARD NUMBER</th>
<th>STANDARD TITLE</th>
<th>APPLICATION</th>
<th>REFERENCED SECTIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASTM E779-2010</td>
<td>Determining Air Leakage Rate by Fan Pressurization</td>
<td>Air Ducts</td>
<td>405.2.1</td>
</tr>
<tr>
<td>ASHRAE 62.2-2016</td>
<td>Ventilation and Acceptable Indoor Air Quality</td>
<td>Ventilation</td>
<td>402.1.2</td>
</tr>
</tbody>
</table>

(portion of table not shown remains unchanged)

**Note:** ASTM E779 meets the requirements for mandatory reference standards in accordance with Section 3-3.7.1 of IAPMO’s Regulations Governing Committee Projects.

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**TABLE 1701.2
STANDARDS, PUBLICATIONS, PRACTICES, AND GUIDES**

<table>
<thead>
<tr>
<th>DOCUMENT NUMBER</th>
<th>DOCUMENT TITLE</th>
<th>APPLICATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASHRAE 62.2-2016</td>
<td>Ventilation and Acceptable Indoor Air Quality</td>
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</tr>
</tbody>
</table>

(portion of table not shown remains unchanged)

**SUBSTANTIATION:**

The current ventilation requirements are not consistent with current industry standards. For example, the ventilation air rates in Chapter 4 are only applicable to occupancies which are transient. Previously, it applied to occupancies for 3 stories or higher above ground; however, this was changed about 2 years ago. Therefore, provisions for transient and nontransient are required for consistency with current industry practices and standards. The current text in Chapter 4 is providing a disservice to the industry as it only provides partial requirements which are not consistent with industry standards.

The proposed language will provide the necessary minimum requirements for both transient and nontransient occupancies which are consistent with the current industry standards.

This proposal only addresses the proper ventilation requirements required for both transient and nontransient (dwelling units within residential occupancies) that are necessary in the field. It is easy to use. One of the issues experienced in the field is that ASHRAE 62.2 addresses requirements which are unenforceable. Not to mention, the standard not being user friendly.

It is proposed that only the enforceable provisions with the necessary edits be added to Chapter 4 for ease of use. If the exact requirements to ASHRAE 62.2 are necessary, then the jurisdiction can adopt Appendix E where the exact wording from ASHRAE 62.2 is addressed. However, as mentioned, the current ASHRAE 62.2 is difficult to apply and most of it is written in such a way that is unenforceable.

**COMMITTEE ACTION:** REJECT

**COMMITTEE STATEMENT:**
The Technical Committee agrees with the concept of this proposal, however, further research is needed to address the proposed language and equation in Section 405.2.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS:  AFFIRMATIVE: 25   NEGATIVE: 1

EXPLANATION OF NEGATIVE:

HOWARD: The inclusion of the ASTM document will conflict with existing code.

Appended Comments

PUBLIC COMMENT 1

Code Year: 2021 UMC  Section #: 217.0, 401.1 - 405.5, Table 1701.1, Table 1701.2

SUBMITTER: Michael Hyde
State of Idaho - Division of Building Safety

RECOMMENDATION:
Revise text

Request to replace the code change proposal by this public comment.

401.0 General.

401.1 Applicability. This chapter contains requirements for ventilation air supply, exhaust, and makeup air requirements for occupiable spaces within a building. Spaces within buildings, except those within dwelling unit in residential occupancies where occupants are nontransient, shall comply with Section 402.0 through Section 404.0. 402.1.2 Dwelling. Requirements for ventilation air rate for single-family dwellings units in residential occupancies, where the occupants are nontransient, shall be in accordance with this chapter or ASHRAE 62.2 Section 405.0.

405.0 Indoor Air Quality for Residential Occupancies.

405.1 General. Rooms or occupied spaces within residential occupancies where the occupants are nontransient, shall be designed to have mechanical ventilation and exhaust air in accordance with Section 405.2 through Section 405.5.

405.1.1 Natural Ventilation. Where approved by the Authority Having Jurisdiction, natural ventilation shall be permitted for Climate Zone 1, Climate Zone 2: or for thermally conditioned buildings for less than 876 hours per year.

405.2 Ventilation Air Rate. The required mechanical ventilation outdoor air rate ($Q_{tot}$) shall be as calculated in accordance with Equation 405.2.

Exceptions: For existing buildings and where permitted by the Authority Having Jurisdiction, the total mechanical ventilation ($Q_{tot}$) is not required where $Q_{tot}$ is calculated to be less than 15 ft³/min (0.007 m³/s).

$$Q_{tot} = 0.03A_{floor} + 7.5 (N_{br} + 1).$$  \hspace{1cm} \text{Equation 405.2}

Where:

$Q_{tot}$ = Total required ventilation outdoor air rate, cfm

$A_{floor}$ = Floor area, ft²

$N_{br}$ = Number of bedrooms more than 1

For SI Units: 1 cubic foot per minute = 0.00047 m³/s

405.2.1 Reduced Ventilation Air Rate. Where permitted by the Authority Having Jurisdiction, the mechanical ventilation air rate required in Section 405.2 shall be permitted to be reduced where an infiltration rate is determined in accordance with ASTM E779.

405.3 Bathroom Exhaust. A mechanical exhaust directly to the outdoors shall be provided in each room containing a bathtub, shower, or tub/shower combination. The fan shall run intermittently (on demand) or continuously. A readily accessible manual control designed to be operated as needed or an automatic control shall be provided for intermittent operations.
405.3.1 Exhaust Rate. The exhaust rate shall be not less than 50 ft³/min (0.02 m³/s) for intermittent operation and 20 ft³/min (0.009 m³/s) for continuous operation.

405.4 Kitchen Exhaust. A mechanical exhaust directly to the outdoors shall be provided in each kitchen. The fan shall run intermittently (on demand) or continuously. A readily accessible manual control designed to be operated as needed or an automatic control shall be provided for intermittent operations.

405.4.1 Exhaust Rate. For intermittent-controlled operations, the exhaust rate shall be not less than 100 ft³/min (0.047 m³/s) for range hoods or 300 ft³/min (0.141 m³/s) for mechanical exhaust fans including downdraft appliances. For continuous-operated ventilation, the exhaust rate shall be not less than 5 air changes per hour based on kitchen volume for enclosed kitchens.

405.5 Ventilation Openings. Occupiable spaces shall be provided with a readily accessible ventilation opening openable to the outdoors. The opening shall be not less than 5 square feet (0.464 m²) or 4 percent of the occupied floor area. The openable area shall be based on free, unobstructed area through the opening.

CHAPTER 2
DEFINITIONS

217.0 – O –

Occupancy, Nontransient. Occupancy of a dwelling unit or sleeping unit for more than 30 days. [ASHRAE 62.1:3]

TABLE 1701.1
REFERENCED STANDARDS

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(portion of table not shown remains unchanged)

Note: ASTM E779 meets the requirements for mandatory reference standards in accordance with Section 3-3.7.1 of IAPMO’s Regulations Governing Committee Projects.

TABLE 1701.2
STANDARDS, PUBLICATIONS, PRACTICES, AND GUIDES

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<td>Ventilation and Acceptable Indoor Air Quality in Residential Buildings</td>
<td>Ventilation</td>
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</tbody>
</table>

(portion of table not shown remains unchanged)

SUBSTANTIATION:
The Technical Committee agreed with the concept of the above public comment, however, further research was needed to address the proposed language and equation in Section 405.2. Sufficient time has passed to allow for further research. This public comment will be a beneficial addition for the AHJ and end user and will strengthen the code.
Proposals

Item #: 027
UMC 2021 Section: 402.2 - 404.3

SUBMITTER: Connor Barbaree
ASHRAE

RECOMMENDATION:
Revise text

402.0 Ventilation Air.

402.2 Natural Ventilation. Natural ventilation systems shall be designed in accordance with this section and shall include mechanical ventilation systems designed in accordance with Section 403.0, Section 404.0, or both.

Exceptions:
(1) An engineered natural ventilation system where approved by the Authority Having Jurisdiction need not comply with Section 402.2.
(2) The mechanical ventilation systems shall not be required where:
   (a) natural ventilation openings comply with the requirements of Section 402.2 and are permanently open or have controls that prevent the openings from being closed during periods of expected occupancy or
   (b) the zone is not served by heating or cooling equipment. [ASHRAE 62.1:6.4]

402.2.1 Floor Area to Be Ventilated. Spaces, or portions of spaces, to be naturally ventilated shall be located within a distance based on the ceiling height, as determined in accordance with Section 402.2.1.1, Section 402.2.1.2, or Section 402.2.1.3, from operable wall openings in accordance with the requirements of Section 402.2.2. For spaces with ceilings which are not parallel to the floor, the ceiling height shall be determined in accordance with Section 402.2.1.4. [ASHRAE 62.1:6.4.1]

402.2.1.3 Corner Openings. For spaces with operable openings on two adjacent sides of a space, such as two sides of a corner, the distance from the operable openings shall be not more than 5\(H\) along a line drawn between the two openings that are farthest apart. Floor area outside that line shall comply with Section 402.2.1.1. [ASHRAE 62.1:6.4.1.3]

402.2.2 Location and Size of Openings. Spaces, or portions of spaces, to be naturally ventilated shall be permanently open to operable wall openings directly to the outdoors, the openable area of which is a minimum of shall be not less than 4 percent of the net occupiable floor area. Where openings are covered with louvers or otherwise obstructed, openable area shall be based on the net free unobstructed area through the opening. Where interior rooms, or portions of rooms, without direct openings to the outdoors are ventilated through adjoining rooms, the opening between rooms shall be permanently unobstructed and shall have a free area of not less than 8 percent of the area of the interior room nor or less than 25 square feet (2.3 m\(^2\)). [ASHRAE 62.1:6.4.2]

403.0 Ventilation Rates.

403.2.1 Breathing Zone Outdoor Airflow. The outdoor airflow required in the breathing zone \(V_{bz}\) of the occupiable space or spaces in a ventilation zone, i.e., the breathing zone outdoor airflow \(V_{bz}\), shall be not less than the value determined in accordance with Equation 403.2.1.

\[
V_{bz} = R_p \cdot P_z + R_d \cdot A_z
\]

(Equation 403.2.1)

Where:
\(A_z\) = zone floor area, the net occupiable floor area of the ventilation zone, square feet (m\(^2\)).
\(P_z\) = zone population, The number of people in the ventilation zone during typical usage.
\( R_p = \) outdoor airflow rate required per person as determined from Table 402.1.
\( R_a = \) outdoor airflow rate required per unit area as determined from Table 402.1. [ASHRAE 62.1:6.2.2.1]

**403.2.3 Zone Outdoor Airflow.** The zone outdoor airflow \((V_{oz})\), i.e., the outdoor airflow rate that shall be provided to the ventilation zone by the supply air distribution system, shall be determined in accordance with Equation 403.2.3. [ASHRAE 62.1:6.2.2.3]

\[
V_{oz} = V_{bz}/E_z \quad \text{(Equation 403.2.3)}
\]

**403.5.1 Primary Outdoor Air Fraction.** The primary outdoor air fraction \((Z_{pz})\) shall be determined for ventilation zones in accordance with Equation 403.5.1. [ASHRAE 62.1:6.2.5.1]

\[
Z_{pz} = V_{oz}/V_{pz} \quad \text{(Equation 403.5.1)}
\]

Where:

- \( V_{pz} \) is the zone primary airflow, i.e., the primary airflow rate to the ventilation zone, from the air handler, including outdoor air and recirculated air.
- \( V_{oz} \) is the zone outdoor airflow.

For VAV-system design purposes, \( V_{pz} \) is the lowest zone primary airflow value expected at the design condition analyzed. It shall be permitted to determine these parameters for only selected zones as outlined in Section 404.0. [ASHRAE 62.1:6.2.5.1]

**403.6.1 Short-Term Conditions.** Where it is known that peak occupancy will be of short duration, or the ventilation will be varied or interrupted for a short period of time, or both, the design shall be permitted to be based on the average conditions over a time period \((T)\) determined in accordance with Equation 403.6.1.

\[
T = 3v/V_{bz} \quad \text{(Equation 403.6.1)}
\]

Where:

- \( T \) = averaging time period, minutes.
- \( v \) = the volume of the ventilation zone for which averaging is being applied, cubic foot \((\text{ft}^3)\).
- \( V_{bz} \) = the breathing zone outdoor airflow calculated in accordance with Equation 403.2.1 and design value of the zone population \((P_z)\), cubic foot per minute \((\text{cfm})\) \((\text{m}^3/\text{min})\).

Acceptable design adjustments based on this optional provision shall be in accordance with including the following:

1. Zones with fluctuating occupancy: The zone population \((P_z)\) shall be permitted to be averaged over time \((T)\).
2. Zones with intermittent interruption of supply air: The average outdoor airflow supplied to the breathing zone over time \((T)\) shall be not less than the breathing zone outdoor airflow \((V_{oz})\) calculated using Equation 403.2.1.
3. Systems with intermittent closure of the outdoor air intake: The average outdoor air intake over time \((T)\) shall be not less than the minimum outdoor air intake \((V_{ot})\) calculated using Equation 403.3, Equation 403.4, or Equation 403.5.4. [ASHRAE 62.1:6.2.6.2]

**403.8 Dynamic Reset.** The system shall be permitted to be designed to reset the outdoor air intake flow \((V_{ot})\), the space or ventilation zone airflow \((V_{oz})\) as operating conditions change, or both. [ASHRAE 62.1:6.2.7]

**403.9 Air Classification and Recirculation.** Air shall be classified, and the its recirculation or transfer shall be limited in accordance with Section 403.9.1 through Section 403.9.4. [ASHRAE 62.1:5.16] Recirculated air shall not be taken from prohibited locations in accordance with Section 311.3.

**403.9.4 Class 4 Air.** Class 4 air shall not be recirculated or transferred to any other spaces or be recirculated within the space of origin. [ASHRAE 62.1:5.16.3.4]

**404.0 Multiple-Zone Systems.**

**404.3 Zone Ventilation Efficiency.** The zone ventilation efficiency \((E_{vz})\) shall be the efficiency with which a system distributes outdoor air from the intake to an individual breathing zone, and shall be determined in accordance with Section 404.3.1 or Section 404.3.2. [ASHRAE 62.1:A1.2]
<table>
<thead>
<tr>
<th>OCCUPANCY CATEGORY</th>
<th>PEOPLE OUTDOOR Air Rate Rp (Cfm/Person)</th>
<th>AREA OUTDOOR Air Rate RA(Cfm/ft²)</th>
<th>DEFAULT OCCUPANT DENSITY (people/1000 ft²)</th>
<th>AIR CLASS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>EDUCATIONAL FACILITIES</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lecture classroom</td>
<td>7.5</td>
<td>0.06</td>
<td>65</td>
<td>1</td>
</tr>
<tr>
<td>Lecture hall (fixed seats)</td>
<td>7.5</td>
<td>0.06</td>
<td>150</td>
<td>1</td>
</tr>
<tr>
<td>Multi-use assembly</td>
<td>7.5</td>
<td>0.06</td>
<td>100</td>
<td>1</td>
</tr>
<tr>
<td>Music/theater/dance</td>
<td>10</td>
<td>0.06</td>
<td>35</td>
<td>1</td>
</tr>
<tr>
<td><strong>GENERAL</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Break rooms</td>
<td>5</td>
<td>0.06</td>
<td>25</td>
<td>1</td>
</tr>
<tr>
<td>Coffee stations</td>
<td>5</td>
<td>0.06</td>
<td>20</td>
<td>1</td>
</tr>
<tr>
<td>Conference/meeting</td>
<td>5</td>
<td>0.06</td>
<td>50</td>
<td>1</td>
</tr>
<tr>
<td>Corridors</td>
<td>–</td>
<td>0.06</td>
<td>–</td>
<td>1</td>
</tr>
<tr>
<td><strong>HOTELS, MOTELS, RESORTS, DORMITORIES</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Barracks sleeping areas</td>
<td>5</td>
<td>0.06</td>
<td>20</td>
<td>1</td>
</tr>
<tr>
<td>Bedroom/living room</td>
<td>5</td>
<td>0.06</td>
<td>10</td>
<td>1</td>
</tr>
<tr>
<td>Lobbies/pre-function</td>
<td>7.5</td>
<td>0.06</td>
<td>30</td>
<td>1</td>
</tr>
<tr>
<td>Multipurpose assembly</td>
<td>5</td>
<td>0.06</td>
<td>120</td>
<td>1</td>
</tr>
<tr>
<td><strong>OFFICE BUILDINGS</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Main entry lobbies</td>
<td>5</td>
<td>0.06</td>
<td>10</td>
<td>1</td>
</tr>
<tr>
<td>Office space</td>
<td>5</td>
<td>0.06</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td>Reception areas</td>
<td>5</td>
<td>0.06</td>
<td>30</td>
<td>1</td>
</tr>
<tr>
<td>Telephone/data entry</td>
<td>5</td>
<td>0.06</td>
<td>60</td>
<td>1</td>
</tr>
<tr>
<td><strong>MISCELLANEOUS SPACES</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bank or bank lobbies</td>
<td>7.5</td>
<td>0.06</td>
<td>15</td>
<td>1</td>
</tr>
<tr>
<td>Bank vaults/safe deposit</td>
<td>5</td>
<td>0.06</td>
<td>5</td>
<td>2</td>
</tr>
<tr>
<td>Computer (not printing)</td>
<td>5</td>
<td>0.06</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>Transportation waiting</td>
<td>7.5</td>
<td>0.06</td>
<td>100</td>
<td>1</td>
</tr>
<tr>
<td><strong>PUBLIC ASSEMBLY SPACES</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Auditorium seating area</td>
<td>5</td>
<td>0.06</td>
<td>150</td>
<td>1</td>
</tr>
<tr>
<td>Courtrooms</td>
<td>5</td>
<td>0.06</td>
<td>70</td>
<td>1</td>
</tr>
<tr>
<td>Legislative chambers</td>
<td>5</td>
<td>0.06</td>
<td>50</td>
<td>1</td>
</tr>
<tr>
<td>Lobbies</td>
<td>5</td>
<td>0.06</td>
<td>150</td>
<td>1</td>
</tr>
<tr>
<td>Museums/galleries</td>
<td>7.5</td>
<td>0.06</td>
<td>40</td>
<td>1</td>
</tr>
<tr>
<td>Places of religious worship</td>
<td>5</td>
<td>0.06</td>
<td>120</td>
<td>1</td>
</tr>
</tbody>
</table>
### RESIDENTIAL

<table>
<thead>
<tr>
<th>Occupancy</th>
<th>Volume (ft³/min)</th>
<th>Airflow Density (lbda/ft³)</th>
<th>Airflow Rate (ft³/min)</th>
<th>Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Common corridors</td>
<td>–</td>
<td>0.06</td>
<td>–</td>
<td>1</td>
</tr>
<tr>
<td>Dwelling unit</td>
<td>5</td>
<td>0.06</td>
<td>See footnote</td>
<td>1</td>
</tr>
</tbody>
</table>

### RETAIL

<table>
<thead>
<tr>
<th>Occupancy</th>
<th>Volume (ft³/min)</th>
<th>Airflow Density (lbda/ft³)</th>
<th>Airflow Rate (ft³/min)</th>
<th>Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Barber shop</td>
<td>7.5</td>
<td>0.06</td>
<td>25</td>
<td>2</td>
</tr>
<tr>
<td>Mall common areas</td>
<td>7.5</td>
<td>0.06</td>
<td>40</td>
<td>1</td>
</tr>
<tr>
<td>Supermarket</td>
<td>7.5</td>
<td>0.06</td>
<td>8</td>
<td>1</td>
</tr>
</tbody>
</table>

### SPORTS AND ENTERTAINMENT

<table>
<thead>
<tr>
<th>Occupancy</th>
<th>Volume (ft³/min)</th>
<th>Airflow Density (lbda/ft³)</th>
<th>Airflow Rate (ft³/min)</th>
<th>Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Disco/dance floors</td>
<td>20</td>
<td>0.06</td>
<td>100</td>
<td>2</td>
</tr>
<tr>
<td>Spectator areas</td>
<td>7.5</td>
<td>0.06</td>
<td>150</td>
<td>1</td>
</tr>
<tr>
<td>Stages, studios</td>
<td>10</td>
<td>0.06</td>
<td>70</td>
<td>1</td>
</tr>
</tbody>
</table>

For SI units: 1 cubic foot per minute = 0.0283 m³/min, 1 square foot = 0.0929 m²

(portion of table not shown remains unchanged)

**Notes:**

1. This table applies to no-smoking areas. Rates for smoking-permitted spaces shall be determined using other methods.
2. Volumetric airflow rates are based on dry air density of 0.075 pounds of dry air per cubic foot (lbda/ft³) (1.201 kgda/m³), which corresponds to dry air at a barometric pressure of 1 atm (101 kPa) and an air temperature of 70°F (21°C). Rates shall be permitted to be adjusted for actual density, but such adjustment is not required for compliance with this chapter.

(3) - (4) (text unchanged)

### ITEM-SPECIFIC NOTES FOR TABLE 402.1

- **a** For high school and college libraries, use the values shown for “Public Assembly Spaces – Libraries” shall be used.
- **b** Rate is capable of may not being be sufficient where stored materials include those having potentially harmful emissions.
- **c** Rate does not allow for humidity control. Additional ventilation or dehumidification shall be permitted to remove moisture.
- **d** “Deck area” refers to the area surrounding the pool that would be expected to be is capable of being wetted during normal pool use, i.e., where the pool is occupied. Deck area that is not expected to be wetted shall be designated as a space type (for example, “spectator area”) an occupancy category.
- **e** Rate does not include special exhaust for stage effects, e.g., such as dry ice vapors, and smoke.
- **f** Where combustion equipment is intended to be used on the playing surface or in the space, additional dilution ventilation, source control, or both shall be provided.
- **g** Default occupancy for dwelling units shall be two persons for studio and one-bedroom units, with one additional person for each additional bedroom.
- **h** Air from one residential dwelling shall not be recirculated or transferred to other spaces outside of that dwelling.

**Ventilation air for this occupancy category shall be permitted to be reduced to zero where the space is in occupied-standby mode.**

### TABLE 403.7

**MINIMUM EXHAUST RATES**

[ASHRAE 62.1: TABLE 6.5]

(portion of table not shown remains unchanged)

For SI units: 1 cubic foot per minute = 0.0283 m³/min, 1 square foot = 0.0929 m²

**Notes:**

(1) – (2) (text unchanged)
3 Exhaust rate is shall not be required for where two or more sides comprise walls that are at least 50 percent open parking garages as defined in accordance with to the building code outside.

4 Rate is per water closet, urinal, or both. Provide the higher rate where periods of heavy use are expected to occur, e.g., toilets in theatres, schools, and sports facilities. Otherwise the lower rate shall be permitted to be used otherwise.

(5) - (10) (text unchanged)

SUBSTANTIATION:
In accordance with IAPMO's Regulations Governing Committee Projects (Extract Guidelines), Chapter 4 has been revised to correlate with latest edition of ASHRAE 62.1.

COMMITTEE ACTION: ACCEPT AS SUBMITTED

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 26

Appended Comments

PUBLIC COMMENT 1
Code Year: 2021 UMC  Section #: 217.0
SUBMITTER: Connor Barbaree
ASHRAE

RECOMMENDATION:
Revise text

Request to accept the code change proposal as modified by this public comment.

CHAPTER 2
DEFINITIONS

217.0 – O –

Occupiable Space. An enclosed space intended for human activities, excluding those spaces that are intended primarily for other purposes such as storage rooms and equipment rooms that are only to be occupied occasionally and for short periods of time, such as storage rooms, equipment rooms, and emergency exitways. [ASHRAE 62.1:3]

SUBSTANTIATION:
In accordance with IAPMO's Regulations Governing Committee Projects (Extract Guidelines), Chapter 2 is being revised to correlate with Addendum g to ASHRAE 62.1-2016.

PUBLIC COMMENT 2
Code Year: 2021 UMC  Section #: 403.5.1 - 404.3.2
SUBMITTER: Connor Barbaree
ASHRAE

RECOMMENDATION:
Revise text

Request to accept the code change proposal as modified by this public comment.

403.5 Multiple-Zone Recirculating Systems. For ventilation systems where one or more air handlers supply a mixture of outdoor air and recirculated air to more than one ventilation zone, the outdoor air intake flow (Vot) shall be determined in
accordance with Section 403.5.1 through Section 403.5.4. [ASHRAE 62.1:6.2.5]

403.5.1 Primary Outdoor Air Fraction. The primary outdoor air fraction \( Zpz \) shall be determined for ventilation zones in accordance with Equation 403.5.1. [ASHRAE 62.1:6.2.5.1]

\[ Zpz = \frac{Voz}{Vpz} \]  
(Equation 403.5.1)

Where:
\( Vpz \) is the zone primary airflow to the ventilation zone, including outdoor air and recirculated air.

For VAV system design purposes, \( Vpz \) is the lowest zone primary airflow value expected at the design condition analyzed.

It shall be permitted to determine these parameters for only selected zones as outlined in Section 404.0. [ASHRAE 62.1:6.2.5.1]

403.5.2 System Ventilation Efficiency. The system ventilation efficiency \( Ev \) shall be determined in accordance with Table 403.5.2 or Section 404.0. [ASHRAE 62.1:6.2.5.2]

<table>
<thead>
<tr>
<th>MAX ( \text{Zp}_z )</th>
<th>( Ev )</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \leq 0.15 )</td>
<td>( \leq 0.0 )</td>
</tr>
<tr>
<td>( \leq 0.25 )</td>
<td>( 0.0 )</td>
</tr>
<tr>
<td>( \leq 0.35 )</td>
<td>( 0.8 )</td>
</tr>
<tr>
<td>( \leq 0.45 )</td>
<td>( 0.7 )</td>
</tr>
<tr>
<td>( \leq 0.55 )</td>
<td>( 0.6 )</td>
</tr>
<tr>
<td>( &gt; 0.55 )</td>
<td>Use Section 404.0</td>
</tr>
</tbody>
</table>

Notes:
1 “Max \( Zp_z \)” refers to the largest value of \( Zp_z \), calculated in accordance with Equation 403.5.1, among the ventilation zones served by the system.
2 For values of Max \( Zp_z \) between 0.15 and 0.55, the corresponding value of \( Ev \) shall be permitted to be determined by interpolating the values in the table.
3 The values of \( Ev \) in this table are based on a 0.15 average outdoor air fraction for the system (i.e., the ratio of the uncorrected outdoor air intake \( Vou \) to the total zone primary airflow for the zones served by the air handler). For systems with higher values of the average outdoor air fraction, this table is capable of resulting in unrealistically low values of \( Ev \) and the use of Section 404.0 is capable of yielding more practical results.

403.5.3 Uncorrected Outdoor Air Intake. The uncorrected outdoor air intake \( Vou \) shall be determined in accordance with Equation 403.5.3(1) 403.5.3: [ASHRAE 62.1:6.2.5.3 6.2.5.1]

\[ Vou = D \text{ (Sigma symbol) all zones (R}_p\text{P}_z) + \text{ (Sigma symbol) all zones (R}_a\text{A}_z) \]  
(Equation 403.5.3(1) 403.5.3)

403.5.3.1 Occupant Diversity. The occupant diversity ratio \( D \) shall be determined in accordance with Equation 403.5.3(2) 403.5.3.1 to account for variations in population within the ventilation zones served by the system.

\[ D = \frac{Ps}{\text{ (Sigma symbol) all zones P}_z} \]  
(Equation 403.5.3(2) 403.5.3.1)

Where the system population \( Ps \) is the total population in the area served by the system.

Exception: Alternative methods to account for occupant diversity shall be permitted, provided that the resulting \( Vou \) value is not less than that determined in accordance with Equation 403.5.3(1). [ASHRAE 62.1:6.2.5.3.4 6.2.5.1.1]

403.5.3.2 System Ventilation Efficiency. The system ventilation efficiency \( Ev \) shall be determined in accordance with Section 403.5.3.3 for the simplified procedure or Section 404.1 for the alternate procedure. These procedures also establish zone minimum primary airflow rates for VAV systems. [ASHRAE 62.1:6.2.5.2]
403.5.3.3 Simplified Procedure for System Ventilation Efficiency. System ventilation efficiency \( (E_v) \) shall be determined in accordance with Equation 403.5.3.3(1) or 403.5.3.3(2). [ASHRAE 62.1:6.2.5.3 - 6.2.5.3.1]

\[
E_v = \begin{cases} 
0.88 \times D + 0.22 & \text{for } D \leq 0.60 \\
0.75 & \text{for } D > 0.60 
\end{cases} \quad \text{[Equation 403.5.3.3(1)]}
\]

\[
E_v = 0.75 & \quad \text{for } D \geq 0.60 \quad \text{[Equation 403.5.3.3(2)]}
\]

403.5.3.4 Zone Minimum Primary Airflow. For each zone, the minimum primary airflow \( (V_{pz-min}) \) shall be determined in accordance with Equation 403.5.3.4. [ASHRAE 62.1:6.2.5.3.2]

\[
V_{pz-min} = V_{oz} \times 1.5 \quad \text{[Equation 403.5.3.4]}
\]

403.5.4 Outdoor Air Intake. The design outdoor air intake flow \( (V_{ot}) \) shall be determined in accordance with Equation 403.5.4. [ASHRAE 62.1:6.2.5.4]

\[
V_{ot} = \frac{V_{ou}}{E_v} \quad \text{[Equation 403.5.4]}
\]

404.0 Alternative Procedure for Multiple-Zone Systems Ventilation Efficiency.

404.1 General. This section presents an alternative procedure for calculating the system ventilation efficiency \( (E_v) \) for multiple zone recirculating systems that shall be used when where values in Table 403.5.2 are Section 403.5.3.3 is not used. The system ventilation efficiency shall equal the lowest zone ventilation efficiency among the ventilation zones served by the air handler in accordance with Equation 404.1. [ASHRAE 62.1:A1.3]

\[
E_v = \text{minimum } (E_{vz}) \quad \text{[Equation 404.1]}
\]

404.3.1 Single Supply Systems. For single supply systems, where the air supplied to a ventilation zone is a mixture of outdoor air and system-level recirculated air, zone ventilation efficiency \( (E_{vz}) \) shall be determined in accordance with Equation 404.3.1. Examples of single supply systems include constant-volume reheat, single-duct VAV, single-fan dual-duct, and multizone systems.

\[
E_{vz} = 1 + X_s - Z_{pz} \quad \text{[Equation 404.3.1]}
\]

The average outdoor air fraction for the system \( (X_s) \) shall be determined in accordance with Equation 404.2 and the primary outdoor air fraction for the zone \( (Z_{pz}) \) shall be determined in accordance with Section 403.5.1 Equation 404.3.1. [ASHRAE 62.1:A1.2.1]

\[
Z_{pz} = \frac{V_{pz}}{V_{dz}} \quad \text{[Equation 404.3.1]}
\]

For VAV systems, \( V_{dz} \) is the lowest zone primary airflow value expected at the design condition analyzed.

404.3.2 Secondary-Recirculation Systems. For secondary-recirculation systems where the supply air or a portion thereof to each ventilation zone is recirculated air (air that has not been directly mixed with outdoor air) from other zones, zone ventilation efficiency \( (E_{vz}) \) shall be determined in accordance with Equation 404.3.2(1). Examples of secondary-recirculation systems include dual-fan dual-duct and fan-powered mixing-box systems, and systems that include transfer fans for conference rooms.

\[
E_{vz} = \frac{(F_a + X_s \cdot F_b - Z_{pz} \cdot E_p \cdot F_c)}{F_a} \quad \text{[Equation 404.3.2(1)]}
\]

The system air fractions \( F_a, F_b, \) and \( F_c \) shall be determined in accordance with Equation 404.3.2(2), Equation 404.3.2(3), and Equation 404.3.2(4). The zone primary air fraction \( (E_p) \) shall be determined in accordance with Equation 404.3.2(5). For single-zone and single-supply systems \( E_p \) shall equal 1.0. The zone secondary recirculation fraction \( (E_r) \) shall be determined by the designer based on system configuration. The zone air distribution effectiveness \( (E_z) \) shall be determined in accordance with Section 403.2.2. [ASHRAE 62.1:A1.2.2]

\[
F_a = E_p + (1 - E_p) \cdot E_r \quad \text{[Equation 404.3.2(2)]}
\]

\[
F_b = E_p \quad \text{[Equation 404.3.2(3)]}
\]

\[
F_c = 1 - (1 - E_z) \cdot (1 - E_r) \cdot (1 - E_p) \quad \text{[Equation 404.3.2(4)]}
\]

\[
E_p = \frac{V_{pz}}{V_{dz}} \quad \text{[Equation 404.3.2(5)]}
\]

Where:

\( E_p \) - Primary air fraction: The fraction of primary air in the discharge air to the ventilation zone.
**Er** - Secondary recirculation fraction: In systems with secondary recirculation of return air, the fraction of secondary recirculated air to the zone that is representative of average system return air rather than air directly recirculated from the zone.

**Ev** - System ventilation efficiency: The efficiency with which the system distributes air from the outdoor air intake to the breathing zone in the ventilation-critical zone, which requires the largest fraction of outdoor air in the primary airstream.

**Evz** - Zone ventilation efficiency: The efficiency with which the system distributes air from the outdoor air intake to the breathing zone in any particular ventilation zone.

**Ez** - Zone air distribution effectiveness: A measure of the effectiveness of supply air distribution to the breathing zone. Ez is determined in accordance with Section 403.2.2.

**Fa** - Supply air fraction: The fraction of supply air to the ventilation zone from sources or air outside the zone.

**Fb** - Mixed air fraction: The fraction of supply air to the ventilation zone from fully mixed primary air.

**Fe** - Outdoor air fraction: The fraction of outdoor air to the ventilation zone from sources of air outside the zone.

**Vdz** - Zone discharge airflow: The expected discharge (supply) airflow to the zone that includes primary airflow and secondary recirculated airflow, cfm (m³/min).

**Vpz** - Zone primary airflow: Determine in accordance with Section 403.5.1 The zone primary airflow to the ventilation zone, including outdoor air and recirculated air.

**Xs** - Average outdoor air fraction: At the primary air handler, the fraction of outdoor air intake flow in the system primary airflow.

**Zpz** - Primary outdoor air fraction: The outdoor air fraction required in the primary air supplied to the ventilation zone prior to the introduction of secondary recirculation air. [ASHRAE 62.1:A3]

**SUBSTANTIATION:**
In accordance with IAPMO's Regulations Governing Committee Projects (Extract Guidelines), Chapter 4 is being revised to correlate with Addendum f to ASHRAE 62.1-2016.
Item #: 029

UMC 2021   Section: 502.2.1

SUBMITTER: Scott Wayland
ASHRAE

RECOMMENDATION:
Revise text

502.0 Termination.

502.2 Termination of Exhaust Ducts. (remaining text unchanged)

502.2.1 Environmental Air Ducts. Environmental air duct exhaust shall terminate not less than 3 feet (914 mm) from a property line, 10 feet (3048 mm) from a forced air inlet, and 3 feet (914 mm) from openings into the building. Environmental exhaust ducts shall not discharge onto a public walkway at an elevation less than 10 feet (3048 mm) above adjoining grade.

SUBSTANTIATION:
The code section is too prohibitive towards conventional design practice where the only place a tenant can discharge economizer air is out the front façade of a suite in a mixed use and/or multistory building.

Additionally, the statement is too ambiguous for a local AHJ to enforce. the elements in the statement are not defined anywhere in the UMC or the architectural code, nor do you cross reference.

COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
No technical substantiation was provided to merit such change.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 21   NEGATIVE: 4   NOT RETURNED: 1   HOWARD

EXPLANATION OF NEGATIVE:

KOERBER: The proposal attempts to address the issue by allowing exhaust at a height at least equal to the 10 foot distance to inlets.
P. TRAFTON: At 10’ above grade, environmental exhaust does not create any conditions that would affect those in a public walkway.
HEINE: No substation was provided.
SMITH: The proposed change provides the best effort at a usable height.

Appended Comments

PUBLIC COMMENT 1

Code Year: 2021 UMC   Section #: 502.2.1   Item #: 029
SUBMITTER: Ralph Koerber   Comment #: 1
ATCO Rubber Products, Inc.
Rep: Air Duct Council

RECOMMENDATION:
Revise text

Request to replace the code change proposal by this public comment.

502.0 Termination.

502.2 Termination of Exhaust Ducts. (remaining text unchanged)
502.2.1 Environmental Air Ducts. Environmental air duct exhaust shall terminate not less than 3 feet (914 mm) from a property line, 10 feet (3048 mm) from a forced air inlet, 10 feet (3048 mm) above a public walkway, and 3 feet (914 mm) from openings into the building. Environmental exhaust ducts shall not be directed discharge onto a public walkways.

SUBSTANTIATION:
I believe the original proposal had merit. The current text already places a minimum 10 feet discharge distance from a forced air inlet and from openings into the building. It seems the same distance limitation would be warranted above a walkway when the air is not directed specifically onto the walkway. I propose this text as alternative language. This would be consistent with comparable code language allowing exhaust discharge locations at "10 feet above adjoining grade" but still not directed onto a public walkway.

PUBLIC COMMENT 2

Code Year: 2021 UMC Section #: 502.2.1
SUBMITTER: Keith Blazer
Self

RECOMMENDATION:
Revise text

Request to accept the code change proposal as submitted by this public comment.

SUBSTANTIATION:
At 10 feet above grade, the environmental exhaust would not create any negative or harmful conditions that would affect those in a public walkway. This should be accepted as submitted.
Item #: 032

UMC 2021  Section: 505.6.1

SUBMITTER: Reinhard Hanselka
Menlo Park Fire Protection District

RECOMMENDATION:
Revise text

505.0 Product-Conveying Systems.

505.6 Fire Dampers. (remaining text unchanged)

505.6.1 Prohibited. Fire Dampers shall not be installed if the material being exhausted is Toxic, Highly Toxic, Unstable Reactive, Corrosive, Flammable, or a virulent Biologics and if a risk evaluation indicates that the hazard imposed is greater than the fire hazard.

SUBSTANTIATION:
This section was rewritten based on the Building and Fire Code hazard risk classes and the recognition that a closed damper will cause a potential great risk to the occupants within the room served by that specific exhaust system.

COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
The proposed language is vague and ambiguous. Furthermore, the proposed language does not improve the code.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 23  NEGATIVE: 3

EXPLANATION OF NEGATIVE:

HEINE: There is no improvement to the code and is very vague.

MACNEVIN: Proposed language included additional types of hazardous material descriptions that were substantiated; new language improves the section.

A. TRAFTON: New language improves the section.

Appended Comments

PUBLIC COMMENT 1

Code Year: 2021 UMC  Section #: 505.6.1

SUBMITTER: Keith Blazer
Self

RECOMMENDATION:
Revise text
Request to **replace** the code change proposal by this public comment.

**505.6.1 Prohibited.** Fire Dampers shall not be installed if the material being exhausted is toxic, reactive, corrosive, or flammable and if a risk evaluation indicates that the hazard imposed by the exhaust material is greater than the fire hazard. {NFPA 91:4.2.10}

**SUBSTANTIATION:**
Occupational Health & Safety states, “a substance is defined as hazardous if it has one or more of the following characteristics: flammable, corrosive, toxic, or reactive.” The original proposal has been modified to remove the unnecessary adjectives before the hazard type, only keeping the name of the specific hazard. This change improves the code by adding the specific exhaust types and characteristics where fire dampers are not to be installed. Toxic exhaust is not the only exhaust type that does not need a fire damper; reactive, corrosive, or flammable exhaust also do not need a fire damper. Listing these hazardous characteristics is beneficial and necessary for public health and safety and to determine when fire dampers must not be installed.
Item #: 033

UMC 2021 Section: 506.1, 506.2, Table 1701.1, Table 1701.2

SUBMITTER: David Dias
Sheet Metal Workers Local 104

RECOMMENDATION:
Revise text

506.0 Product-Conveying Ducts.
506.1 Materials. Materials used in product-conveying duct systems shall be suitable for the intended use and shall be of metal.

Exceptions:
(1) (remaining text unchanged)
(3) Ducts used in central vacuum cleaning systems within a dwelling unit shall be constructed of materials in accordance with the applicable standards referenced in Chapter 17 ASTM F2158. Penetrations of fire walls or floor-ceiling or roof-ceiling assemblies shall be in accordance with the building code.

(remaining text unchanged)

506.2 Construction. Ducts used for conveying products shall be airtight construction as approved by the Authority Having Jurisdiction, and shall not have openings other than those required for operation and maintenance of the system. Ducts constructed of steel shall comply with Table 506.2(1) or Table 506.2(2).

Exceptions:
(1) (remaining text unchanged)
(2) Ducts used in central vacuuming systems within a dwelling unit shall be constructed of materials in accordance with the applicable standards referenced in Chapter 17 ASTM F2158. Penetrations of fire-resistive walls or floor-ceiling or roof-ceiling assemblies shall be in accordance with the building code. Copper or ferrous pipes or conduit extending from within the separation between a garage and dwelling unit to the central vacuum unit shall be permitted to be used.

(remaining text unchanged)

<table>
<thead>
<tr>
<th>TABLE 1701.1</th>
</tr>
</thead>
<tbody>
<tr>
<td>REFERENCED STANDARDS</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>STANDARD NUMBER</th>
<th>STANDARD TITLE</th>
<th>APPLICATION</th>
<th>REFERENCED SECTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASTM F2158-2008 (R2016)</td>
<td>Residential Central-Vacuum Tube and Fittings</td>
<td>Exhaust Systems</td>
<td>506.1, 506.2</td>
</tr>
</tbody>
</table>

(portions of table not shown remain unchanged)

Note: ASTM F2158 meets the requirements for mandatory reference standards in accordance with Section 3-3.7.1 of IAPMO’s Regulations Governing Committee Projects.
TABLE 1701.2
STANDARDS, PUBLICATIONS, PRACTICES, AND GUIDES

<table>
<thead>
<tr>
<th>DOCUMENT NUMBER</th>
<th>DOCUMENT TITLE</th>
<th>APPLICATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASTM F2158-2008</td>
<td>Residential Central-Vacuum Tube and Fittings</td>
<td>Exhaust Systems</td>
</tr>
</tbody>
</table>

(portions of table not shown remain unchanged)

SUBSTANTIATION:
In the 2018 edition of the UMC, Table 1701.1 has been split into two separate tables. Therefore, the existing reference to those tables must be revised to provide the proper standard for the applications. Section 506.1 and Section 506.2 are being revised to address the proper standard for central vacuum systems. This is necessary as the standards in Table 1701.2 must be approved by the AHU prior to their use.

COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
The proposed text is being rejected as there may be other standards that may apply.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 25  NEGATIVE: 1

EXPLANATION OF NEGATIVE:
P. TRAFTON: I am in agreement with the Committee.

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PUBLIC COMMENT 1

Code Year: 2021 UMC   Section #: 506.1(3), 506.2(2), Table 1701.1, Table 1701.2   Item #: 033

SUBMITTER: David Dias
Sheet Metal Workers Local 104

Comment #: 1

RECOMMENDATION:
Revise text

Request to replace the code change proposal by this public comment.

506.0 Product-Conveying Duct.
506.1 Materials. Materials used in product-conveying duct systems shall be suitable for the intended use and shall be of metal. Exceptions:
(1) – (2) (remaining text unchanged)
(3) Ducts used in central vacuum cleaning systems within a dwelling unit shall be constructed of materials in accordance with ASTM F2158 or the applicable standards referenced in Chapter 17. Penetrations of fire walls or floor-ceiling or roof-ceiling assemblies shall be in accordance with the building code.

(remaining text unchanged)

506.2 Construction. Ducts used for conveying products shall be airtight construction as approved by the Authority Having Jurisdiction, and shall not have openings other than those required for operation and maintenance of the system. Ducts constructed of steel shall comply with Table 506.2(1) or Table 506.2(2). Exceptions:
(1) (remaining text unchanged)
(2) Ducts used in central vacuuming systems within a dwelling unit shall be constructed of materials in accordance with ASTM F2158 or the applicable standards referenced in Chapter 17. Penetrations of fire-resistive walls or floor-ceiling or roof-ceiling assemblies shall be in accordance with the building code. Copper or ferrous pipes or conduit extending from within the
separation between a garage and dwelling unit to the central vacuum unit shall be permitted to be used.

(remaining text unchanged)

**TABLE 1701.1**
**REFERENCED STANDARDS**

<table>
<thead>
<tr>
<th>STANDARD NUMBER</th>
<th>STANDARD TITLE</th>
<th>APPLICATION</th>
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<td>506.1, 506.2</td>
<td></td>
</tr>
</tbody>
</table>

(portions of table not shown remain unchanged)

**Note:** ASTM F2158 meets the requirements for mandatory reference standards in accordance with Section 3-3.7.1 of IAPMO's Regulations Governing Committee Projects.

**TABLE 1701.2**
**STANDARDS, PUBLICATIONS, PRACTICES, AND GUIDES**

<table>
<thead>
<tr>
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<th>APPLICATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASTM F2158-2008</td>
<td>Residential Central-Vacuum Tube and Fittings Exhaust Systems</td>
<td></td>
</tr>
</tbody>
</table>

(portions of table not shown remain unchanged)

**SUBSTANTIATION:**
The Committee rejected the original proposal on the basis that there may be other standards that may apply. By leaving the portion of the sentence that states other "applicable standards referenced in Chapter 17" may also be used would alleviate those concerns.
SUBMITTER: David Dias  
Sheet Metal Workers Local 104

RECOMMENDATION:  
Revise text

506.3 Penetrations. Exhaust ducts shall not pass through fire walls, as defined by NFPA 221. [NFPA 91:4.2.11]

SUBSTANTIATION:  
Section 506.3 should be revised as it is unnecessary to send the end user to NFPA 221 for a definition. The term “fire wall” is already defined in Chapter 2 of the UMC and it reads as follows:

Fire Wall. A wall separating buildings or subdividing a building to prevent the spread of the fire and having a fire resistance rating and structural stability. [NFPA 96:3.3.26]

The definition used in NFPA 221 for “fire wall” is as follows:

3.3.14.6* Fire Wall. A wall separating buildings or subdividing a building to prevent the spread of fire and having a fire resistance rating and structural stability.

Therefore, it is apparent that both definitions read the same and it is unnecessary to send the user to a different document.

COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:  
The proposed text deletion should remain as it is unnecessary to remove the NFPA 221 reference and NFPA 91 extract since they are needed for enforcement of the code.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 25 NEGATIVE: 1

EXPLANATION OF NEGATIVE:  
HEINE: It is unnecessary to remove the NFPA 221 reference as it is needed for enforcement.

Appended Comments

PUBLIC COMMENT 1

Code Year: 2021 UMC  Section #: 506.3  Item #: 034

SUBMITTER: David Dias  
Sheet Metal Workers Local 104  Comment #: 1

RECOMMENDATION:  
Revise text
Request to **replace** the code change proposal by this public comment.

**506.0 Product-Conveying Ducts.**

**506.3 Penetrations.** Exhaust ducts shall not pass through fire walls, as defined by NFPA 221. [NFPA 91:4.2.11]

**SUBSTANTIATION:**
The line stating “as defined by NFPA 221” is being deleted as it is not needed. There is no need to go to a definition to understand the intent of this section. The proposed change removes unnecessary language.
Item #: 035
UMC 2021  Section: 507.1, 519.3

SUBMITTER: Mohamed Dano  
Control Air Conditioning Corporation

RECOMMENDATION:
Revise text

507.0 General Requirements.
507.1 Type I Hood Exhaust System. Exhaust systems serving Type I hoods shall comply with Section 507.0 through Section 518.0. Exhaust systems serving Type II hoods shall comply with Section 519.0.

519.0 Type II Hood Exhaust System Requirements.

519.3 Type II Hood Exhaust System Net Airflow. The net airflow for Type II hoods shall be in accordance with Section 508.5.1.5 for light-duty cooking appliances. The net airflow for Type II hoods serving washing machines shall comply with Section 519.3.1.

519.3.1 Dishwashing Appliances. The net airflow for Type II hoods used for dishwashing equipment shall be not less than 200 cubic feet per minute (0.094 m$^3$/s) per linear foot (m) of hood length.

(renumber remaining sections)

SUBSTANTIATION:
Section 507.1 should be revised to clarify that Type II exhaust systems must comply with Section 519.0. Furthermore, Section 519.0 is being added as currently there is no guidance as to the required exhaust rate for Type II hoods. Section 508.5.1.5 applies to light-duty appliances.

Section 508.5.1.5 states: The minimum net airflow for hoods used for cooking appliances such as gas and electric ovens (including standard, bake, roasting, revolving, retherm, convection, combination convection/steamer, rotisserie, countertop conveyorized baking/finishing, deck, and pastr), discrete element ranges (with or without oven), electric and gas steam-jacketed kettles less than 20 gallons (76 L), electric and gas pasta cookers, electric and gas compartment steamers (both pressure and atmospheric), electric and gas cheese melters, electric and gas tilting skillets (braising pans) electric and gas rotisseries, and electric and gas salamanders shall be in accordance with Table 508.5.1.5.

COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
The proposed text does not assist the AHJ or installer in regards to Type II hoods.

TOTAL ELIGIBLE TO VOTE: 26
VOTING RESULTS: AFFIRMATIVE: 26

Appended Comments

PUBLIC COMMENT 1
519.0 Type II Hood Exhaust System Requirements.

519.3 Type II Hood Exhaust System Net Airflow. The net airflow for Type II hoods shall be in accordance with Section 508.5.1.5 for light-duty cooking appliances. The net airflow for Type II hoods serving washing machines shall comply with Section 519.3.1.

519.3.1 Dishwashing Appliances. The net airflow for Type II hoods used for dishwashing equipment shall be not less than 200 cubic feet per minute (0.094 m$^3$/s) per linear foot (m) of hood length.

SUBSTANTIATION:
The proposed change greatly assists the AHJ, designer, installer, and end user by clarifying the airflow requirements for Type II hood exhaust systems. I believe this change will be very beneficial in locating and determining Type II CFM airflow requirements that currently do not exist in the UMC. The location of this new Section fits well below Section 519.2 (Construction of Type II Hoods).
519.1 Where Required. Type II hoods shall be installed above equipment and dishwashers that generate steam, heat, and or products of combustion, and where grease or smoke is not present.

SUBSTANTIATION:
The current language in Section 519.1 creates confusion. The proposed change from “and” to “or” assists the AHJ, installer, and end user by clarifying where Type II hood exhaust systems are required; where either steam, heat, OR products of combustion are generated. The exhaust created under Type II hoods will not always have all of these characteristics at the same time. Therefore, Type II hoods are required where steam, heat, OR products of combustion are generated.
Item #: 036

UMC 2021  Section: 508.1

SUBMITTER: Christopher Jensen
UL LLC

RECOMMENDATION:
Revise text

508.0 Type I Hoods.
508.1 Where Required. Type I hoods shall be installed at or above commercial-type deep-fat fryers, broilers, grills, hot-top ranges, ovens, barbecues, rotisseries, and similar equipment that emits comparable amounts of smoke or grease in a food-processing establishment. For the purpose of this section, a food-processing establishment shall include a building or portion thereof used for the processing of food, but shall not include a dwelling unit.

Exceptions:
(1) Cooking appliance that is listed in accordance with UL 710B for reduced emissions where the grease discharge does not exceed 2.9 E-09 ounces per cubic inch (oz/in$^3$) (5.0E-06 kg/m$^3$) where operated with a total airflow of 500 cubic feet per minute (cfm) (0.236 m$^3$/s).
(2) Recirculating systems listed in accordance with UL 710B and installed in accordance with Section 516.0.
(3) Downdraft appliance ventilation system listed and installed in accordance with Section 518.0.

SUBSTANTIATION:
A downdraft appliance ventilation system that has been listed and installed in accordance with Section 518.0 is already provided the minimum safety requirements for the exhaust of the smoke and grease, and thus does not require an additional Type I hood above.

COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
Section 518.0 applies to downdraft appliances and it is not necessary to add downdraft appliances to Section 508.1 as an exception.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS:  AFFIRMATIVE: 25  NEGATIVE: 1

EXPLANATION OF NEGATIVE:
KOERBER: I believe the proposal provides clarity. Also, I believe products should be "listed" where applicable, not just "in accordance with."

Appended Comments

PUBLIC COMMENT 1

Code Year: 2021 UMC  Section #: 508.1  Item #: 036
SUBMITTER: Rudy B. Utulo, PE; Martin Espinosa  Comment #: 1
RECOMMENDATION:
Revise text
Request to **replace** the code change proposal by this public comment.

508.0 Type I Hoods

508.1 Where Required. Type I hoods shall be installed at or above commercial-type deep-fat fryers, broilers, grills, hot-top ranges, ovens, barbecues, rotisseries, and similar equipment that emits comparable amounts of smoke or grease in a food-processing establishment. For the purpose of this section, a food-processing establishment shall include a building or portion thereof used for the processing of food, but shall not include a dwelling unit.

Exceptions:
(1) Cooking appliances that is listed in accordance with UL 710B for reduced emissions where the grease discharge does not exceed 2.9E-09 ounces per cubic inch (oz/in$^3$) (5.0E-06 kg/m$^3$) where operated with a total airflow of 500 cubic feet per minute (cfm) (0.236 m$^3$/s).
(2) Recirculating systems listed in accordance with UL 710B and installed in accordance with Section 516.0.
(3) Downdraft appliance ventilation systems listed and installed in accordance with Section 518.0.

SUBSTANTIATION:
The addition of note (3) to the Exceptions clarifies that a downdraft appliance ventilation system that is listed and installed in accordance with Section 518.0 already provides the minimum safety requirements for removing smoke and grease, thus not requiring a Type I hood to be installed. This change assists the AHJ in the proper enforcement of Type I hoods.

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PUBLIC COMMENT 2

Code Year: 2021 UMC  Section #: 508.1  Item #: 036
SUBMITTER: Christopher Jensen  UL LLC  Comment #: 2

RECOMMENDATION:
Revise text
Request to accept the code change proposal **as submitted** by this public comment.

SUBSTANTIATION:
The committee statement for rejection was “Section 518.0 applies to downdraft appliances and it is not necessary to add downdraft appliances to Section 508.1 as an exception.” Section 508.1 specifies what type of commercial cooking appliances are required to be installed beneath a Type I hood. Listed Downdraft appliances installed in accordance with Section 518.0 do not need to be installed beneath a Type I hood. Section 518.0 does not clearly indicate that these appliances are not required to be installed beneath a Type I hood. Adding listed downdraft appliances to the exceptions for commercial cooking equipment that do not require installation beneath a Type I hood will provide clarity for code users.

Exception (1) permits cooking appliances that are in accordance with UL 710B for reduced emissions to be installed without a Type I hood. For the AHJ to verify that the cooking appliance is in accordance with UL 710B the appliance needs to be listed. This would be consistent with the other methods in the Exceptions to Section 508.1.

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PUBLIC COMMENT 3

Code Year: 2021 UMC  Section #: 508.1  Item #: 036
SUBMITTER: Ralph Koerber  ATCO Rubber Products, Inc.  Rep: Air Duct Council  Comment #: 3

RECOMMENDATION:
Revise text
Request to replace the code change proposal by this public comment.

508.0 Type I Hoods.
508.1 Where Required. Type I hoods shall be installed at or above commercial-type deep-fat fryers, broilers, grills, hot-top ranges, ovens, barbecues, rotisseries, and similar equipment that emits comparable amounts of smoke or grease in a food-processing establishment. For the purpose of this section, a food-processing establishment shall include a building or portion thereof used for the processing of food, but shall not include a dwelling unit.

Exceptions:
(1) Cooking appliances that is listed in accordance with UL 710B for reduced emissions where the grease discharge does not exceed 2.9 E-09 ounces per cubic inch (oz/in\(^3\)) (5.0 E-06 kg/m\(^3\)) where operated with a total airflow of 500 cubic feet per minute (cfm) (0.236 m\(^3\)/s).
(2) Recirculating systems listed in accordance with UL 710B and installed in accordance with Section 516.0.
(3) Ventilation systems in accordance with Section 518.0.

SUBSTANTIATION:
Using the language "listed in accordance with" for exception (1) brings clarity and consistency to the section. The addition of exception (3) provides clarity as listed systems covered under Section 518.0 do not require the use of Type I hoods.

PUBLIC COMMENT 4

Code Year: 2021 UMC  Section #: 508.2  Item #: 036

SUBMITTER: Rudy B. Utulo, PE; Martin Espinosa
M & P Consulting Engineers, Inc.

Comment #: 4

RECOMMENDATION:
Add new text

Request to replace the code change proposal by this public comment.

508.0 Type I Hoods.
508.1 Where Required. (remaining text unchanged)

508.2 Separate Grease Duct System. A separate grease duct system shall be provided for each Type I hood.

Exceptions: A separate grease duct system shall not be required where all of the following conditions are met:
(1) All interconnected hoods are located within the same story.
(2) All interconnected hoods are located within the same room or in adjoining rooms.
(3) Interconnecting ducts do not penetrate assemblies required to be fire-resistance rated.
(4) The grease duct system does not serve solid-fuel fired appliances.

(renumber remaining sections)

SUBSTANTIATION:
A section for separate grease ducts requirements does not currently exist in the UMC. There must be guidelines added to the code addressing when grease ducts are allowed to be combined together, and when they need have their own separate duct system. The new language would assist the AHJ and installers in the proper installation of grease duct systems for Type I hoods.
Item #: 037

UMC 2021  Section: 508.1

SUBMITTER: Kaveh Razavi  
County of Los Angeles Building and Safety

RECOMMENDATION:
Revise text

508.0 Type I Hoods.
508.1 Where Required. Type I hoods shall be installed at or above commercial-type deep-fat fryers, broilers, grills, hot-top ranges, ovens, barbecues, rotisseries, and similar equipment that emits comparable amounts of smoke or grease in a food-processing establishment. For the purpose of this section, a food-processing establishment shall include a building or portion thereof used for the processing of food, but shall not include a dwelling unit.

Exceptions:
(1) A Type I hood shall not be required for a cooking appliance that is listed in accordance with UL 710B for reduced emissions where the grease discharge does not exceed 2.9 E-09 ounces per cubic inch (oz/in$^3$) (5.0 E-06 kg/m$^3$) where operated with a total airflow of 500 cubic feet per minute (cfm) (0.236 m$^3$/s).
(2) Recirculating systems listed in accordance with UL 710B and installed in accordance with Section 516.0.

SUBSTANTIATION:
Section 508.1 (exception 1) is being revised as the exception 1 is creating confusion during plan check and in the field for Authority Having Jurisdictions. Many in the field are interpreting this section as exempting hoods altogether. However, this section only exempts the use of Type I hoods but not the use of Type II hoods. Type II hoods shall be required when excessive heat and/or steam is being emitted. UL 710B only tests hoods to be exempt from grease applications but not for excessive heat or steam such as bread ovens. In addition, exception 1 does not have language specifying that the cooking appliance must be "listed" in accordance with UL 710B, which is causing issues for Authority Having Jurisdictions. The words "listed in accordance with..." should be used in exception 1 just like they are in exception 2.

COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
The proposed change is unnecessary as Section 508.0 already applies to Type I hoods as indicated by the title and language within the section.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 25  NOT RETURNED: 1  HOWARD

Appended Comments

PUBLIC COMMENT 1

Code Year: 2021 UMC  Section #: 508.1(1)  Item #: 037

SUBMITTER: Maria Yepremian  
County of Los Angeles Building and Safety  Comment #: 1

RECOMMENDATION:
Revise text
Request to accept the code change proposal as submitted by this public comment.

SUBSTANTIATION:
The proposed change is necessary for clarification that the Section 508.1 exceptions apply only to Type I hoods. Section 508.1 exception (1) is being revised as this exception is creating confusion during plan check and in the field for AHJs. Many in the field are interpreting this section as excepting hoods altogether. However, this section only exempts the use of Type I hoods, not the use of Type II hoods. Type II hoods shall be required when excessive heat and/or steam is being emitted. UL 710B only tests hoods to be exempt from grease applications but not for excessive heat or steam such as bread ovens. In addition, exception (1) does not have language specifying that the cooking appliance must be "listed" in accordance with UL 710B, which is causing issues for AHJs. The phrase "listed in accordance with" should be used in exception (1) the same way as exception (2).

PUBLIC COMMENT 2

Code Year: 2021 UMC  Section #: 508.1, 508.5.1.4  Item #: 037
SUBMITTER: Rudy B. Utulo, PE; Martin Espinosa  M & P Consulting Engineers, Inc.  Comment #: 2
RECOMMENDATION: Revise text
Request to replace the code change proposal by this public comment.

508.0 Type I Hoods.
508.1 Where Required. Type I hoods shall be installed at or above commercial-type deep-fat fryers, broilers, grills, hot-top ranges, ovens (including pizza ovens), barbecues, rotisseries, and similar equipment that emits comparable amounts of smoke or grease in a food-processing establishment. For the purpose of this section, a food-processing establishment shall include a building or portion thereof used for the processing of food, but shall not include a dwelling unit.

(remaining text unchanged)

508.5.1.4 Medium-Duty Cooking Appliances. The minimum net airflow for hoods used for cooking appliances such as electric and gas hot-top ranges, gas open-burner ranges (with or without oven), electric and gas flat griddles, electric and gas double-sided griddles, electric and gas fryers (including open deep fat fryers, donut fryers, kettle fryers, and pressure fryers), and electric and gas conveyor pizza ovens shall be in accordance with Table 508.5.1.4.

SUBSTANTIATION:
I have had several discussions with local building jurisdictions regarding whether the term “ovens” includes pizza ovens as requiring Type I hoods. In the past, Type II hoods were acceptable for pizza ovens. Nowadays, building officials are requiring Type I hoods for commercial pizza ovens. Adding “pizza ovens” to the broad term “ovens” clarifies the intent of the section.

Furthermore, since commercial pizza ovens are considered as requiring a Type I hood as pizza since they are capable of emitting smoke and grease, Section 508.5.1.4 applies to not only to conveyor-type pizza ovens, but to all pizza ovens, including rotary- and stationary-type pizza ovens. Therefore, striking out the word “conveyor” will clarify the intent of the section to include all electric and gas pizza ovens.

PUBLIC COMMENT 3

Code Year: 2021 UMC  Section #: 508.5.1.4  Item #: 037
SUBMITTER: Rudy B. Utulo, PE; Martin Espinosa  M & P Consulting Engineers, Inc.  Comment #: 3
RECOMMENDATION: Revise text
Request to replace the code change proposal by this public comment.

508.0 Type I Hoods.

508.5 Hood Size. (remaining text unchanged)

508.5.1 Canopy Size and Location. (remaining text unchanged)

508.5.1.4 Medium-Duty Cooking Appliances. The minimum net airflow for hoods used for cooking appliances such as electric and gas hot-top ranges, gas open-burner ranges (with or without oven), electric and gas flat griddles, electric and gas double-sided griddles, electric and gas fryers (including open deep fat fryers, donut fryers, kettle fryers, tortilla chip fryers, and pressure fryers), and electric and gas conveyor pizza ovens shall be in accordance with Table 508.5.1.4.

SUBSTANTIATION:
An ongoing issue that has been occurring consistently in Los Angeles as well as in other states is the requirements for hoods used for tortilla chip deep fryers. There have been several individuals who have been sidestepping the Type I hood requirement, stating that a tortilla chip deep fryer is not a deep fryer because these devices are not specifically listed in the code. A deep fryer regardless of the capacity is still a deep fryer and still falls under the Type I hood requirement, and should be added to clarify the intention of code.
Item #: 040

UMC 2021 Section: 510.9.1.1, 511.1.3.1(2)

SUBMITTER: Maria Yepremian
County of Los Angeles Building and Safety

RECOMMENDATION:
Revise text

510.0 Exhaust Duct Systems.

510.9 Termination of Type I Hood Exhaust System. (remaining text unchanged)
510.9.1 Rooftop Terminations. (remaining text unchanged)
510.9.1.1 Listed Flexible Connectors. Listed flexible connectors shall be permitted to be used on exterior roof locations
where required for proper equipment vibration isolation.

(renumber remaining sections)

511.0 Air Movement.
511.1 Exhaust Fans for Commercial Cooking Operations. (remaining text unchanged)

511.1.3 Utility Set Exhaust Fans. (remaining text unchanged)
511.1.3.1 At the Rooftop. Fans installed at the rooftop termination point shall be in accordance with the following:
(1) Section 510.9.1 and Section 510.9.1.2.
(2) Flexible connectors shall be permitted-prohibited.
(3) A drain shall be directed to a readily accessible and visible grease receptacle not to exceed 1 gallon (4 L).

SUBSTANTIATION:
Section 510.9.1.1 is being deleted as there currently is no listing for flexible connectors applicable for grease duct
applications. Section 510.9.1.1 is creating problems for the AHJ as there currently is no guidance in the UMC as to what the
acceptable listing for such flexible connector is. NFPA 96, which is the source document for the majority of provisions for
commercial kitchen ventilation, prohibits the use of flexible connectors altogether per sections 8.1.3.3 and 8.1.4.5 of the 2017
dition. The UMC shall either provide the appropriate listing for flexible connectors or prohibit their use as they do in NFPA
96.

COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
The current language is needed for clarification and direction to the AHJ and installer.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 25 NOT RETURNED: 1 HOWARD

Appended Comments

PUBLIC COMMENT 1

Code Year: 2021 UMC Section #: 510.9.1.1, 511.1.3.1(2) Item #: 040
Request to accept the code change proposal as submitted by this public comment.

SUBSTANTIATION:
Section 510.9.1.1 (Listed Flexible Connectors) is being deleted as there currently is no listing for flexible connectors applicable for grease duct applications. Section 510.9.1.1 is creating problems for the AHJ as there currently is no guidance in the UMC as to what the acceptable listing for such flexible connector is. NFPA 96, which is the source document for the majority of provisions for commercial kitchen ventilation, prohibits the use of flexible connectors altogether per sections 8.1.3.3 and 8.1.4.5 of the 2017 edition. The UMC shall either provide the appropriate listing for flexible connectors or prohibit their use as they do in NFPA 96.
Item #: 041

UMC 2021  Section: 516.2.1

SUBMITTER: David Dias  
Sheet Metal Workers Local 104

RECOMMENDATION:
Revise text

516.0 Recirculating Systems.

516.2 Design Restrictions. (remaining text unchanged)
516.2.1 Gas/Electrically Fueled Cooking Appliances. Gas-fueled or electrically fueled cooking appliances shall be used. Listed gas-fueled equipment designed for use with specific recirculating systems shall have the flue outlets connected in the intended manner. Gas-fueled appliances shall have not less than 18 inches (457 mm) of clearance from the flue outlet to the filter inlet in accordance with Section 509.2.2 through Section 509.2.2.3 and shall be in accordance with the installation requirements of NFPA 54 this Code or NFPA 58. [NFPA 96:13.2.1–13.2.3]

SUBSTANTIATION:
It is not necessary to refer the end user to NFPA 54 as the UMC extracts the necessary requirements from NFPA 54 for gas and electric fueled cooking appliances. All the necessary appliances are addressed in Chapter 9 of the UMC. This currently creates confusion for inspectors.

COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
The proposed deletion of the NFPA 54 reference would create confusion for the end user as it is part of the language extracted from NFPA 96.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS:    AFFIRMATIVE: 26  

Appended Comments

PUBLIC COMMENT 1

Code Year: 2021 UMC  Section #: 516.2.1  
Item #: 041

SUBMITTER: David Dias  
Sheet Metal Workers Local 104

Comment #: 1

RECOMMENDATION:
Revise text

Request to replace the code change proposal by this public comment.

516.0 Recirculating Systems.

516.2 Design Restrictions. (remaining text unchanged)
516.2.1 Gas/Electrically Fueled Cooking Appliances. Gas-fueled or electrically fueled cooking appliances shall be used. Listed gas-fueled equipment designed for use with specific recirculating systems shall have the flue outlets connected in the intended manner. Gas-fueled appliances shall have not less than 18 inches (457 mm) of clearance from the flue outlet to the filter inlet in accordance with Section 509.2.2 through Section 509.2.2.3 and shall be in accordance with the installation requirements of this code, NFPA 54 or NFPA 58. (NFPA 96:13.2.1–13.2.3)

SUBSTANTIATION:
The UMC extracts the necessary requirements from NFPA 54 for gas and electric fueled cooking appliances. It is not necessary to refer the end user only to NFPA 54 or NFPA 58. All the necessary appliances are addressed in Chapter 9 of the UMC. This currently creates confusion for inspectors. Adding "this code" provides ease of use of the end user and the AHJ. Similar code changes were accepted on UMC Item #074 and #079.
519.5 Termination of Type II Hood Exhaust System. The exhaust system shall terminate as follows:
(1) Rooftop terminations shall terminate not less than 10 feet (3048 mm) from a property line, and the exhaust flow shall be directed away from the roof surface of the roof, not less than 40 inches (1016 mm)
(2) Horizontal terminations shall terminate not less than 10 feet (3048 mm) from adjacent buildings, property lines, operable openings, and from grade level.
(3) The termination outlet shall not be directed onto a public way.

SUBSTANTIATION:
Disallowing Type II exhaust to be onto a public way is onerous – urban restaurants often have only one wall and it is onto a public way so they have no other options. There is already a 10’ above grade limitation which is sufficient given Type II exhaust is generally just moist or hot air. Note that Type I exhaust terminations have no limitations relative to walkways and Type I exhaust is much more likely to be a nuisance due to odors and smoke.

COMMITTEE ACTION: ACCEPT AS SUBMITTED

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 26

PUBLIC COMMENT 1

Code Year: 2021 UMC  Section #: 519.5 (3)  Item #: 042
SUBMITTER: Keith Blazer  Self  Comment #: 1

RECOMMENDATION:
Revise text

Request to accept the code change proposal as modified by this public comment.

519.5 Termination of Type II Hood Exhaust System. The exhaust system shall terminate as follows:
(1) Rooftop terminations shall terminate not less than 10 feet (3048 mm) from a property line, and the exhaust flow shall be directed away from the roof surface of the roof, not less than 40 inches (1016 mm)
(2) Horizontal terminations shall terminate not less than 10 feet (3048 mm) from adjacent buildings, property lines, operable
openings, and from grade level.

(3) The termination outlet shall not be directed onto a public way at an elevation less than 10 feet (3048 mm) above adjoining grade.

**SUBSTANTIATION:**
Note (3) is being added back with an elevation requirement. It is more beneficial to add a height requirement for terminating Type II exhaust over public walkways rather than deleting the language and having no guidelines at all. At 10 feet above grade, the exhaust does not create unsafe conditions that would affect those on a public walkway. 10 feet is a practical height and does not create a negative environment.
Proposals

Item #: 044

UMC 2021  Section: Chapter 5: 507.2 - 518.3

SUBMITTER: IAPMO Staff - Update Extracts
NFPA 96 Extract Update

RECOMMENDATION:
Revise text

507.0 General Requirements.
507.2 Exhaust System. Cooking equipment used in processes producing smoke or grease-laden vapors shall be equipped with an exhaust system that is in accordance with all the equipment and performance requirements of this chapter. [NFPA 96:4.1.1] All such equipment and its performance shall be maintained in accordance with the requirements of this chapter during all periods of operation of the cooking equipment. [NFPA 96:4.1.2] The following equipment shall be kept in working condition:

(1) Cooking equipment
(2) Hoods
(3) Ducts (where applicable)
(4) Fans
(5) Fire-extinguishing equipment
(6) Special effluent or energy control equipment [NFPA 96:4.1.3] Maintenance and repairs shall be performed on all components at intervals necessary to maintain good working conditions, as follows: [NFPA 96:4.1.3.1]

(1) 507.2.1 Airflow. All airflows shall be maintained. [NFPA 96:4.1.4]
(2) 507.2.2 Responsibility. The responsibility for inspection, testing, maintenance, and cleanliness of the ventilation control and fire protection of the commercial cooking operations, including cooking appliances, shall ultimately be that of the owner of the system, provided that this responsibility has not been transferred in written form to a management company, tenant, or other party. [NFPA 96:4.1.5]
(3) 507.2.3 Solid-fuel Cooking Equipment. All solid-fuel cooking equipment shall comply with the requirements of Section 517.0. [NFPA 96:4.1.6]
(4) 507.2.4 Multitenant Applications. Multitenant applications shall require the concerted cooperation of design, installation, operation, and maintenance responsibilities by tenants and by the building owner. [NFPA 96:4.1.7]
(5) 507.2.5 Interior Surfaces. All interior surfaces of the exhaust system shall be accessible for cleaning and inspection purposes. [NFPA 96:4.1.8]
(6) 507.2.6 Used in Other Applications. Cooking equipment used in fixed, mobile, or temporary concessions, such as trucks, buses, trailers, pavilions, tents, or any form of roofed enclosure, shall be in accordance with this chapter unless otherwise exempted by the Authority Having Jurisdiction. [NFPA 96:4.1.9]

507.4 Factory Built. Factory-built grease duct enclosures shall be protected with a through-penetration firestop system classified in accordance with ASTM E814 or UL 1479 having an “F” and a “T” rating equal to the fire resistance rating of the assembly being penetrated from the point at which the duct penetrates a ceiling, wall, or floor to the outlet terminal. [NFPA 96:4.3.3]

507.4.4.1 Listing. The factory-built grease duct protection system shall be listed in accordance with UL 2221. [NFPA 96:4.3.3.1]

507.4.4.2 Single Wall. Listed single wall factory-built grease ducts shall be permitted to be enclosed with field-applied grease duct enclosure material where the material and the assembly of duct and material are listed for that application and installed in accordance with the grease duct manufacturer’s listing and their installation instructions. [NFPA 96:4.3.3.2]

507.4.4.3 Installation. The factory-built grease duct protection system shall be installed in accordance with the manufacturer’s installation instructions and the listing requirements. [NFPA 96:4.3.3.3]

508.0 Type I Hoods.
508.2 Listed Type I Hood Assemblies. Listed hood assemblies shall be installed in accordance with the terms of their listing and the manufacturer’s installation instructions. Listed hood assemblies shall be tested in accordance with UL 710 or equivalent. [NFPA 96:5.4.1, 5.4.2]
508.2.1 Listed Ultraviolet Hoods. Listed ultraviolet hoods shall be installed and maintained in accordance with the terms of their listing and the manufacturer's installation instructions. Duct systems connected to ultraviolet hoods shall comply with Section 510.0. Ultraviolet hoods shall be tested and listed in accordance with UL 710 and UL 710C. [NFPA 96:5.5.2-5.5.2]

507.4.4.3 Listed Ventilated Ceiling Technology. Listed ventilated ceiling technology shall be installed and maintained in accordance with the terms of its listing and the manufacturer's instructions. [NFPA 96:5.6]

(renumber remaining sections)

508.3 Construction of Type I Hoods. The hood or that portion of a primary collection means designed for collecting cooking vapors and residues shall be constructed of and be supported by steel shall be not less than 0.048 of an inch (1.219 mm) (No. 18 MSG), in thickness, stainless steel not less than 0.036 of an inch (0.914 mm) (No. 20 MSG) in thickness, or other approved material of equivalent strength and fire and corrosion resistance. [NFPA 96:5.1.1]

Exception: Listed exhaust hoods.

509.0 Grease Removal Devices in Hoods.

509.1 Grease Removal Devices. Listed grease filters or other listed grease removal devices intended for use with commercial cooking operations shall be provided. Listed grease filters and grease removal devices that are removable, but not an integral component of a specific listed exhaust hood, shall be listed in accordance with ANSI/UL 1046 and shall be designated on the filter. [NFPA 96:6.1.1, 6.1.2]

509.2.1 Vertical Distance. Where grease removal devices are used in conjunction with charcoal solid fuel or charcoal solid fuel-type broilers, including gas or electrically heated charbroilers, a minimum vertical distance of not less than 4 feet (1219 mm) shall be maintained between the lower edge of the grease removal device and the cooking surface. [NFPA 96:6.2.1.2]

Exceptions:
1) For cooking equipment without exposed flame and where flue gases bypass grease removal devices, the minimum vertical distance shall be permitted to be reduced to not less than 6 inches (152 mm). [NFPA 96:6.2.1.3]
2) Where a grease removal device is listed for separation distances less than those required in Section 509.2 and Section 509.2.1, the listing requirements shall be permitted. [NFPA 96:6.2.1.4]
3) Grease removal devices supplied as part of listed hood assemblies shall be installed in accordance with the terms of the listing and the manufacturer's installation instructions. [NFPA 96:6.2.1.5]

509.2.3.1 Arrangement. Grease filters shall be arranged so that all exhaust air passes through the grease filters. [NFPA 96:6.2.3.4]

509.2.4.1 Size and Pitch. Grease drip trays shall be kept to the minimum size needed to collect grease. Grease drip trays and shall be pitched to drain into an enclosed metal container having a capacity not exceeding 1 gallon (4 L). [NFPA 96:6.2.4.2, 6.2.4.3]

509.2.5 Grease Filter Orientation. Grease filters that require a specific orientation to drain grease shall be clearly so designated on the face of the filter as to be visible with the filter installed, or the hood or filter shall be constructed so that filters cannot be installed in the wrong orientation. [NFPA 96:6.2.5]

510.0 Exhaust Duct Systems.

510.1.2 Interconnection. Duct systems shall not be interconnected with any other building ventilation or exhaust system. [NFPA 96:7.1.3]

510.1.3 Duct Installation. All ducts shall be installed with not less than a minimum 2 percent slope on horizontal runs up to 75 feet (22 860 mm) and not less than a minimum 8 percent slope on horizontal runs more greater than 75 feet (22 860 mm). Factory-built grease ducts shall be permitted to be installed at a lesser slope in accordance with the listing and the manufacturer's installation instructions. All horizontal ducts shall be provided with access in accordance with Section 510.3.3.

Drains shall be provided at low points in horizontal ducts. Where provided, drains shall be continuously welded to the exhaust duct or listed grease duct drain in accordance with the terms of the listing and the manufacturer’s installation instructions manual. All ducts shall be installed without forming dips or traps. In manifold (common duct) systems, the lowest end of the main duct shall be connected flush on the bottom with the branch duct. [NFPA 96:7.1.4 – 7.1.4.5]

510.1.5 Sign. A sign stating the following shall be placed on all access panels stating the following:
ACCESS PANEL – DO NOT OBSTRUCT [NFPA 96:7.1.6]

510.1.7 Type I Exhaust Duct Systems. Listed grease ducts shall be installed in accordance with the terms of their listings and manufacturer’s installation instructions. [NFPA 96:7.1.7]

510.3.4.2 Safe Access and Work Platform. Where if not easily accessible from the floor or a 10 foot (3048 mm) stepladder, openings on vertical grease ducts shall be provided with safe access and a work platform. [NFPA 96:7.4.2.3]

510.3.6 Access Panels. Access panels shall be of the same material and thickness as the duct. Access panels shall have a gasket or sealant that is rated for 1500°F (816°C) and shall be grease-tight. Fasteners, such as bolts, weld studs, latches, or wing nuts, used to secure the access panels shall be carbon steel or stainless steel and shall not penetrate duct walls. [NFPA 96:7.4.3.1-7.4.3.3]
**510.4 Listed Grease Ducts.** Listed grease ducts shall be installed in accordance with the terms of the listing and the manufacturer’s instructions. [NFPA 96:7.1.7]

**510.5.5 Telescoping and Bell-Type Connections.** For telescoping and bell-type connections, the inside duct section shall always be uphill of the outside duct section. [NFPA 96:7.5.5.3]

**510.7 Interior Installations.** In all buildings more than one story in height, and in one-story buildings where the roof-ceiling assembly is required to have a fire resistance rating, the ducts shall be enclosed in a continuous enclosure extending from the lowest fire-rated ceiling or floor above the hood, through any concealed spaces, to or through the roof, to maintain the integrity of the fire separations required by the applicable building code provisions. The enclosure shall be sealed around the duct at the point of penetration of the first fire-rated barrier after the hood, to maintain the fire resistance rating of the enclosure. The enclosure shall be vented to the exterior of the building through weather-protected openings. [NFPA 96:7.7.1.2 – 7.7.1.4]

**Exception:** The continuous enclosure provisions shall not be required where a field-applied grease duct enclosure or a factory-built grease duct enclosure (see Section 507.4.4 through Section 507.4.6) is protected with a listed duct-through-penetration protection system equivalent to the fire resistance rating of the assembly being penetrated; and where the materials are installed in accordance with the conditions of the listings and the manufacturer’s instructions and are acceptable to the Authority Having Jurisdiction. [NFPA 96:7.7.1.5]

**510.7.3 Clearance.** Clearance from the duct or the exhaust fan to the interior surface of enclosures of combustible construction shall be not less than 18 inches (457 mm), and clearance from the duct to the interior surface of enclosures of noncombustible or limited-combustible construction shall be not less than 6 inches (152 mm). Provisions for reducing clearances as described in Section 507.4 through Section 507.4.3.3 shall not be applicable to enclosures. [NFPA 96:7.7.2.2.1 – 7.7.2.2.3]

**Exception:** Clearance from the outer surfaces of field-applied grease duct enclosures and factory-built grease duct enclosures to the interior surfaces of construction installed around them shall be permitted to be reduced where the field-applied grease duct enclosure materials and the factory-built grease duct enclosures are installed in accordance with the conditions of the listings and the manufacturer’s instructions and are acceptable to the Authority Having Jurisdiction. [NFPA 96:7.7.2.2.4]

**510.7.4 Mechanical and Structural Integrity.** Field-applied grease duct enclosures and factory-built grease duct enclosures shall provide mechanical and structural integrity, resiliency, and stability where subjected to expected building environmental conditions, duct movement under general operating conditions, and duct movement as a result of interior and exterior fire conditions. [NFPA 96:7.7.2.2.5]

**510.7.5 Protection from Physical Damage.** Measures shall be taken to prevent physical damage to a covering or enclosure material. Damage Any damage to the covering or enclosure shall be repaired, and the covering or enclosure shall be restored in accordance with its intended listing and fire-resistance rating, and to be acceptable to the Authority Having Jurisdiction. [NFPA 96:7.7.3.1, 7.7.3.2]

**510.7.5.2 Inspection.** In the event of a fire within a kitchen exhaust system, the duct, the enclosure, and the covering directly applied to the duct shall be inspected by qualified personnel to determine whether the duct, the enclosure, and the covering directly applied to the duct are structurally sound, capable of maintaining their fire protection functions, approved suitable for continued operation, and acceptable to the Authority Having Jurisdiction. [NFPA 96:7.7.3.3]

**510.7.7 Fire Doors.** Where openings in the enclosure walls are provided, they shall be protected by listed fire doors of proper rating. Fire doors shall be installed in accordance with NFPA 80. Openings on other listed materials or products shall be clearly identified and labeled according to the terms of the listing and the manufacturer’s instructions and shall be acceptable to the Authority Having Jurisdiction. [NFPA 96:7.7.4.1 – 7.7.4.3] The fire door shall be readily accessible, aligned, and of a sufficient size to allow access to the rated access panels on the ductwork. [NFPA 96:7.7.4.4]

**510.7.8 Ducts with Enclosure(s).** A Each duct system shall constitute an individual system serving only exhaust hoods in one fire zone on one floor. Multiple ducts shall not be permitted in a single enclosure unless acceptable to the Authority Having Jurisdiction. [NFPA 96:2.7.5 – 7.7.5.2]

**510.9.1 Rooftop Terminations.** Rooftop terminations shall be arranged with or provided with the following:

1. Not less than A minimum of 10 feet (3048 mm) of horizontal clearance from the outlet to adjacent buildings, property lines, and air intakes.
2. Not less than A minimum of 5 feet (1524 mm) of horizontal clearance from the outlet (fan housing) to a combustible structure.
3. A vertical separation of 3 feet (914 mm) below an exhaust outlet for air intakes within 10 feet (3048 mm) of the exhaust outlet.
4. The ability to drain grease out of traps or low points formed in the fan or duct near the termination of the system into a collection container that is noncombustible, closed, rainproof, and structurally sound for the service to which it is applied, and that will not sustain combustion.
5. A grease collection device that is applied to exhaust systems that does not inhibit the performance of a fan.
(6) A listed grease collection system in accordance with meet the requirements of Section 510.9.1(4) and Section 510.9.1(5).

(7) A listed grease duct in accordance complying with Section 507.4.7 or ductwork in accordance complying with Section 507.4.8.

(8) A hinged upblast fan supplied with flexible weatherproof electrical cable and service hold-open retainer to permit inspection and cleaning that is listed for commercial cooking equipment with the following conditions:
(a) Where the fan attaches to the ductwork, the ductwork is not less than a minimum of 18 inches (457 mm) away from the any roof surface, as shown in Figure 510.9.1.
(b) The fan discharges not less than a minimum of 40 inches (1016 mm) away from the any roof surface, as shown in Figure 510.9.1.

(9) Other approved fan, provided it is in accordance with meets all of the following criteria:
(a) The fan is in accordance with meets the requirements of Section 510.9.1(3) and Section 511.1.3.
(b) Its discharge or its extended duct discharge is in accordance meets with the requirements of Section 510.9.1(2). (See Section 511.1.3)
(c) Exhaust fan discharge is directed up and away from the roof surface. [NFPA 96:7.8.2.1]

For SI units: 1 inch = 25.4 mm, 1 foot = 304.8 mm

Notes:
1. Fresh air intake (FAI) applies to an air intake, including an operable door or window.
2. Example:
   (a) FAIs 1 and 5 are on the is same plane as of exhaust or lower: 10 feet (3048 mm) min. between closest edges.
   (b) FAIs 2, 3, and 4 are above plane of exhaust fan:
       10 feet + 3 inches 0.25 feet (3048 mm + 76 mm) per degree between closest edges.

FIGURE 510.9.2

EXHAUST TERMINATION DISTANCE FROM FRESH AIR INTAKE (FAI) OR OPERABLE DOOR OR WINDOW

[NFPA 96: FIGURE 7.8.3]

511.0 Air Movement.

511.1 Exhaust Fans for Commercial Cooking Operations. (remaining text unchanged)

511.1.2.1 Accessibility. Where the design or positioning of the fan allows grease to be trapped, a drain directed to a readily accessible and visible grease receptacle, not exceeding 1 gallon (4 L), shall be provided. In-line exhaust fans shall be located in an easily accessible area of approved adequate size to allow for service or removal. Where the duct system connected to the fan is in an enclosure, the space or room in which the exhaust fan is located shall have the same fire resistance rating as the enclosure. [NFPA 96:8.1.3.4 – 8.1.3.6]

511.2.3 Exhaust Fan Operation. A hood exhaust fan(s) shall continue to operate after the extinguishing system has been activated, unless fan shutdown is required by a listed component of the ventilation system, or by the design of the extinguishing system. The hood exhaust fan shall not be required to start upon activation of the extinguishing system where if the exhaust fan and all cooking equipment served by the fan have been shut down, unless fan shutdown is required by a listed component of the ventilation system or by the listing of the extinguishing system. The exhaust fan shall be provided with a means so that the fan is activated when any heat-producing cooking appliance under the hood is turned on. [NFPA 96:8.2.3.1–8.2.3.3]
512.0 Auxiliary Equipment.
512.2 Electrical Equipment. Wiring systems of any type shall not be installed in ducts. [NFPA 96:9.2.1]
512.2.1 Device Installation in Ducts. Motors, lights, and other electrical devices shall be permitted to be installed in ducts or hoods or to be located in the path of travel of exhaust products only where specifically listed for such use. [NFPA 96:9.2.2]
512.2.2 Lighting Units. Lighting units in hoods shall not be located in concealed spaces except as permitted by Section 512.2.3 and Section 512.2.4. [NFPA 96:9.2.3.2]

512.3 Other Equipment. Fume incinerators, thermal recovery units, air pollution control devices, or other devices shall be permitted to be installed in ducts or hoods or to be located in the path of travel of exhaust products where specifically listed for such use. [NFPA 96:9.3.1]
512.3.1 Access Required. Equipment shall have space provided to all access panels or doors for the safe removal and servicing of control devices, such as filters, electrostatic precipitator cells, and odor control media beds, and for cleaning of the equipment housing. [NFPA 96:9.3.1.3]
512.3.2 Downgrading. Downgrading other parts of the exhaust system due to the installation of approved devices, whether listed or not, shall not be permitted. [NFPA 96:9.3.3]
512.3.3 Fire-Extinguishing System. Any equipment, listed or otherwise, installed in the path of exhaust products that provides secondary filtration or air pollution control and that is installed in the path of travel of exhaust products shall be provided with an approved automatic fire-extinguishing system, installed in accordance with the fire-extinguishing system manufacturer's instructions. [NFPA 96:9.3.3.1]
512.3.1 Protection. The fire-extinguishing system required by Section 512.3.3 shall provide protection of the component sections of the equipment, and shall include protection of the ductwork downstream of the equipment, whether or not the equipment is provided with a damper. [NFPA 96:9.3.4]
512.3.3 Filter Media. Filter media used in secondary filtration or air pollution control units and not in accordance with Section 509.2.3 shall have fire protection that is adequate for the filter media being used in accordance with the fire-extinguishing system manufacturer's installation instructions. [NFPA 96:9.3.4]
512.3.4 Source of Ignition. Where the equipment provides a source of ignition, it shall be provided with a detection to operate the fire-extinguishing system protecting the equipment. [NFPA 96:9.3.5]
512.3.5 Air Recirculation. Where a cooking exhaust system employs an air pollution control device that recirculates air into the building, the requirements of Section 516.0 shall apply. [NFPA 96:9.3.6]
512.3.6 Carbon Monoxide Required. If the heat source is non-electric and open flames are used, a carbon monoxide detector shall be installed in both the kitchen and dining areas. [NFPA 96:9.3.7]

513.0 Fire-Extinguishing Equipment.
513.1 General. (remaining text unchanged)
513.1.1 Devices in Exhaust Ducts. Fume incinerators, thermal recovery units, air pollution control devices, or other devices installed in the exhaust duct shall be protected by an automatic fire-extinguishing system. [NFPA 96:10.1.3]
513.2.2 Lighting Units. A placard shall be conspicuously placed near the fire extinguisher that states that the fire protection system shall be activated prior to using the fire-extinguisher. [NFPA 96:10.2.2]
513.2.5 Fixed Baffle Hoods with Water Wash. Grease removal devices, hood exhaust plenums, and exhaust ducts Areas requiring protection in accordance with Section 513.1 shall be permitted to be protected by a listed fixed baffle hood containing a water-wash system that is listed and as a fire-extinguishing system in accordance with UL 300 or other equivalent standards and shall be installed in accordance with the requirements of the listed system. [NFPA 96:10.2.8.1]
513.2.5.1 Listed for the Purpose. Each such area not provided with a listed water-wash fire-extinguishing system shall be provided with a fire-extinguishing system listed for the purpose. [NFPA 96:10.2.8.2]
513.2.5.2 Control Valve. The water supply for water-wash fire-extinguishing systems shall be controlled by a supervised water supply control valve. [NFPA 96:10.2.8.3]
513.2.5.3 Activation. The water wash in the fixed baffle hood specifically listed to extinguish a fire shall be activated by the cooking equipment extinguishing system. Where a separate fire-extinguishing system is used for protection of cooking equipment only, a water-wash fire-extinguishing system listed for protection of the grease removal device(s), hood exhaust plenum(s), exhaust duct(s), or combination thereof shall be provided with instructions and appropriate means for electrical interface for simultaneous activation. [NFPA 96:10.2.8.5]
513.2.5.4 Water-Wash System. A water-wash system approved to be used for protection of the grease removal device(s), hood exhaust plenum(s), exhaust duct(s), or combination thereof shall include instructions and appropriate electrical interface for simultaneous activation of the water-wash system from an automatic fire-extinguishing system, where the automatic fire-
extinguishing system is used for cooking equipment protection only. [NFPA 96:10.2.8.6]

513.2.5.5 Exception. Where the automatic fire-extinguishing system in accordance with NFPA 17A provides protection for the cooking equipment, hood, and duct, activation of in a fixed baffle hood containing a water-wash system shall not be required made inoperable or delayed for a minimum of 60 seconds upon operation of the automatic fire-extinguishing system. [NFPA 96:10.2.8.7]

513.2.5.6 Water Supply. The water required for listed automatic fire-extinguishing systems shall be permitted to be supplied from the domestic water supply where the minimum water pressure and flow are provided in accordance with the terms of the listing. The water supply shall be controlled by a supervised water supply control valve. Where the water supply is from a dedicated fire protection water supply in a building with one or more fire sprinkler systems, separate indicating control valves and drains shall be provided and arranged so that the hood system and sprinkler system are capable of being controlled individually. [NFPA 96:10.2.9.1, 10.2.9.2]

513.2.6 Water Valve Supervision. Valves controlling the water supply to listed fixed baffle hood assemblies water-wash fire-extinguishing systems, automatic fire-extinguishing systems, or both shall be listed indicating type of valve and shall be supervised open by one of the following methods:

1. Central station, proprietary, or remote station alarm service.
2. Local alarm service that will cause the sounding of an audible signal at a constantly attended point.
3. Locking valves open.
4. Sealing of valves and approved weekly recorded inspection. [NFPA 96:10.2.10]

513.3 Simultaneous Operation. Fixed pipe extinguishing systems in a single hazard area shall be arranged for simultaneous automatic operation upon actuation of any one of the systems. [NFPA 96:10.3.1]

513.3.1 Hoods. Hoods installed end to end, back to back, or both, or sharing a common ductwork, not exceeding 75 feet (22 860 mm) in distance from the farthest hood, and having a grease producing appliance(s) located under one or more of the hoods, shall be considered a single hazard area requiring simultaneous automatic fire protection in all hoods and ducts. [NFPA 96:10.3.1.1]

513.3.1.1 Common Ductwork. Hoods that are installed end to end, back to back, or both, and that share a common ductwork, the ductwork beyond 75 feet (22 860 mm) from the farthest hood shall be protected by an independent fire-extinguishing system with its own detection system or by a fire-extinguishing system that activates simultaneously with the fire-extinguishing system(s) protecting the hoods. [NFPA 96:10.3.1.1.1]

513.3.2 Independent Systems. Hoods installed end to end, back to back, or both that do not share a common exhaust duct and are separated by a wall(s) or other means to ensure that grease-laden vapors exhausted under one hood cannot propagate to the other hoods, the hoods’ fire-extinguishing system(s) shall be independent and shall not be required to simultaneously discharge. [NFPA 96:10.3.1.2]

513.3.3 Exempt Equipment. Fume incinerators, thermal recovery units, air pollution control devices, or other devices installed in the exhaust duct shall not be required to comply with Section 513.3.1. [NFPA 96:10.3.1.3]

(renumber remaining sections)

513.3.1 Automatic Sprinkler System. Simultaneous operation shall not be required where the one fixed pipe extinguishing system is an automatic sprinkler system. Where an automatic sprinkler system is used in conjunction with a water-based fire-extinguishing system served by the same water supply, hydraulic calculations shall consider both systems operating simultaneously. [NFPA 96:10.3.2, 10.3.2.1]

513.3.2 Dry or Wet Chemical Systems. Simultaneous operation shall be required where a dry or wet chemical system is used to protect common exhaust ductwork by one of the methods specified in NFPA 17 or NFPA 17A. [NFPA 96:10.3.3]

513.4.1 Steam. Steam supplied from an external source shall not be required to automatically shut off. [NFPA 96:10.4.2]

513.5 Manual Activation. All systems shall have both automatic and manual methods of actuation. At least one manual actuation device shall be located in a means of egress or at a location acceptable to the Authority Having Jurisdiction.

The manual actuation device shall clearly identify the hazard protected. An automatic sprinkler system shall not require a method of manual actuation.

A readily accessible means for manual activation shall be located between 42 inches and 48 inches (1067 mm and 1219 mm) above the floor, be accessible in the event of a fire, be located in a path of egress, and clearly identify the hazard protected. Not less than one manual actuation device shall be located not less than 10 feet (3048 mm) and not more than 20 feet (6096 mm) from the protected exhaust system(s) within the path of egress or at an alternative location acceptable to the Authority Having Jurisdiction. Manual actuation using a cable operated pull station shall not require more than 30 pounds force (lb) (138 N) of force, with a pull movement not to exceed 14 inches (356 mm) to activate the automatic fire extinguishing system. The automatic and manual means of system activation external to the control head or releasing device shall be separate and independent of each other so that failure of one will not impair the operation of the other except as permitted in Section 513.5.1. [NFPA 96:10.5.1 – 10.5.2.10.5.3]

513.5.1 Location of Manual Activation Device. The manual means of system activation shall be permitted to be common with the automatic means where the manual activation device is located between the control head or releasing device and the first fusible link. [NFPA 96:10.5.2]

513.5.2 Automatic Sprinkler System. An automatic sprinkler system shall not require a manual means of system activation. [NFPA 96:10.5.4]
513.5.3 Manual Actuator(s). The means for manual activation shall be mechanical or rely on electrical power for activation in accordance with Section 513.5.4. [NFPA 96:10.5.5]

513.5.4 Standby Power Supply. Electrical power shall be permitted to be used for manual activation where a standby power supply is provided or where supervision is provided in accordance with Section 513.7. [NFPA 96:10.5.6]

513.7 System Supervision. Where electrical power is required to operate the fixed automatic fire-extinguishing system, the system shall be provided with a reserve power supply and be monitored by a supervisory alarm except as permitted in accordance with Section 513.7.1. [NFPA 96:10.7.1]

513.7.1 Automatic Fire-Extinguishing System. Where a fixed automatic fire-extinguishing system includes automatic mechanical detection and actuation as a backup detection system, electrical power monitoring, and reserve power supply shall not be required. [NFPA 96:10.7.2]

513.7.2 Supervision. System supervision shall not be required where a fire-extinguishing system(s) is interconnected or interlocked with the cooking equipment power source(s) so that where the fire-extinguishing system becomes inoperable due to power failure, sources of fuel or electric power that produce heat to cooking equipment serviced by that hood shall automatically shut off. [NFPA 96:10.7.3]

513.7.3 Listed Water Wash System. System supervision shall not be required where an automatic fire extinguishing system, including automatic mechanical detection and actuation, is electrically connected to a listed fire-actuated water-wash system for simultaneous operation of both systems. [NFPA 96:10.7.4]

513.8 Special Design and Application. Hoods containing automatic fire-extinguishing systems are protected areas; therefore, these hoods are shall not be considered obstructions to overhead sprinkler systems and shall not require floor additional sprinkler coverage underneath. [NFPA 96:10.8.1]

513.8.1 Single Device. A single detection device, listed with the extinguishing system, shall be permitted for more than one appliance where installed in accordance with the terms of the listing. [NFPA 96:10.8.2]

513.10 Installation Requirements. Installation of systems shall be performed only by persons properly trained and qualified to install the specific system being provided. The installer shall provide certification to the Authority Having Jurisdiction that the installation is in agreement with the terms of the listing and the manufacturer’s installation instructions and/or approved design, or both. [NFPA 96:10.9.2]

513.11 Portable Fire Extinguishers. Portable fire extinguishers shall be selected and installed in kitchen cooking areas in accordance with NFPA 10 and shall be specifically listed for such use. Class K fire extinguishers shall be provided for cooking appliances hazards that involve combustible cooking media such as (vegetable oils, and animal oils, and fats). [NFPA 96:10.9.2]

513.11.1 Other Fire Extinguishers. Portable fire extinguishers shall be provided for other hazards in kitchen areas and shall be selected and installed in accordance with NFPA 10. [NFPA 96:10.9.3]

513.11.2 Carbon Dioxide-Type. Carbon dioxide-type extinguishers shall not be permitted. [NFPA 96:10.9.4]

514.0 Procedures for the Use, Inspection, Testing, and Maintenance of Equipment.

514.1 Operating Procedures. Exhaust systems shall be operated where whenever cooking equipment is turned on. [NFPA 96:11.1.1]

514.1.6 Secondary Control Equipment. Secondary filtration and pollution control equipment shall be operated in accordance with the terms of its listing and the manufacturer’s instructions recommendations. [NFPA 96:11.1.7]

514.1.7 Inspection Frequency. Inspection and maintenance of “other equipment” as allowed in Section 512.3 shall be conducted by properly trained and qualified persons at a frequency determined by the manufacturer’s instructions or the equipment listing. [NFPA 96:11.1.8]

514.2 Inspection, Testing, and Maintenance. Maintenance of the fire-extinguishing systems and listed exhaust hoods containing a constant or fire-activated water system that is listed to extinguish a fire in the grease removal devices, hood exhaust plenums, and exhaust ducts shall be made by properly trained, qualified, and certified person(s) acceptable to the Authority Having Jurisdiction not less than at least every 6 months. [NFPA 96:11.2.1]

514.2.1 Requirements. Actuation All actuation and control components, including remote manual pull stations, mechanical and electrical devices, detectors, and actuators, shall be tested for proper operation during the inspection in accordance with the manufacturer’s instructions procedures. The specific inspection and maintenance requirements of the extinguishing system standards as well as the applicable installation and maintenance manuals for the listed system and service bulletins shall be followed. [NFPA 96:11.2.2, 11.2.3]

514.2.2 Fusible Links and Sprinklers. Fusible links of the metal alloy type and automatic sprinklers of the metal alloy type shall be replaced not less than at least semiannually except as permitted by Section 514.2.3 and Section 514.2.4. [NFPA 96:11.2.4]

514.2.4 Temperature-Sensing Elements. Fixed temperature-sensing elements other than the fusible metal alloy type shall be permitted to remain continuously in service, provided they are inspected and cleaned, or replaced proper operation of the system. [NFPA 96:11.2.7]

514.3 Inspection for Grease Buildup. The entire exhaust system shall be inspected for grease buildup by a properly trained, qualified, and certified person(s) acceptable to the Authority Having Jurisdiction and in accordance with Table 514.3. [NFPA 96:11.4]
TABLE 514.3
SCHEDULE OF INSPECTION FOR GREASE BUILDUP
[NFPA 96: TABLE 11.4]

<table>
<thead>
<tr>
<th>TYPE OR VOLUME OF COOKING</th>
<th>INSPECTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Systems serving solid-fuel cooking operations.</td>
<td>Monthly</td>
</tr>
<tr>
<td>1Systems serving high-volume cooking operations such as 24-hour cooking, charbroiling, or wok cooking.</td>
<td>Quarterly</td>
</tr>
<tr>
<td>Systems serving moderate-volume cooking operations.</td>
<td>Semiannually</td>
</tr>
<tr>
<td>2Systems serving low-volume cooking operations, such as churches, day camps, seasonal businesses, or senior centers.</td>
<td>Annually</td>
</tr>
</tbody>
</table>

Notes:
1. High-volume cooking operations include 24-hour cooking, charbroiling, and wok cooking.
2. Low-volume cooking operations include churches, day camps, seasonal businesses, and senior centers.

514.4 Cleaning of Exhaust Systems. Where If, upon inspection, the exhaust system is found to be contaminated with deposits from grease-laden vapors, the contaminated portions of the exhaust system shall be cleaned by a properly trained, qualified, and certified person(s) acceptable to the Authority Having Jurisdiction. [NFPA 96:11.6.1]

514.4.1 Measurement System. A measurement system of deposition shall be established to trigger a need to clean when the exhaust system is inspected at the frequencies in Table 514.3. [NFPA 96:11.6.1.1]

514.4.1.1 Combustible Contaminants. Hoods, grease removal devices, fans, ducts, and other appurtenances shall be cleaned to remove combustible contaminants to a minimum of 0.002 of an inch (50 μm). [NFPA 96:11.6.1.1.1]

514.4.1.2 Gauge Comb. A grease depth gauge comb as shown in Figure 514.4.1.2 shall be placed upon the surface to measure grease depth. [NFPA 96:11.6.1.1.2]
514.4.1.3 Cleaning Method. Where a measured depth of 0.078 of an inch (2000µm) is observed, the surfaces shall be cleaned in accordance with Section 514.4. [NFPA 96:11.6.1.1.3]

514.4.1.4 Combustible Contaminants. Where a measured depth of 0.125 of an inch (3175 µm) is observed in a fan housing, the surfaces shall be cleaned in accordance with Section 514.4. [NFPA 96:11.6.1.1.4]

514.4.8 Access Panels and Cover Plates. Where cleaning procedures are completed, all access panels (doors) and cover plates shall be restored to their normal operational condition. [NFPA 96:11.6.9]

514.4.9 Date of Inspection. When an access panel is removed, a service company label or tag preprinted with the name of the company and giving the date of inspection or cleaning shall be affixed near the affected access panels. [NFPA 96:11.6.10]

514.4.11 Operable State. When cleaning procedures are completed, all electrical switches and system components shall be returned to an operable state. [NFPA 96:11.6.12]

514.4.12 Certification of Service. When an exhaust cleaning service system is used, inspected or cleaned, a certificate showing the name of the servicing company, the name of the person performing the work, and the date of inspection or cleaning shall be maintained on the premises. [NFPA 96:11.6.13]

514.4.15 Metal Containers. Metal containers used to collect grease drippings shall be inspected or emptied at least weekly. [NFPA 96:11.6.16]

515.0 Minimum Safety Requirements for Cooking Equipment.
515.1 Cooking Equipment. Listed All listed appliances shall be installed in accordance with the terms of their listings and the manufacturer’s instructions. Solid fuel used for flavoring within a gas-operated appliance shall be in a solid fuel holder (smoker box) that is listed with the equipment. [NFPA 96:12.1.2.1, 12.1.2.1.1]

515.1.1.2 Prior Location. The fire-extinguishing system shall not require re-evaluation where the cooking appliances are moved for the purposes of maintenance and cleaning, provided the appliances are returned to approved design location prior to cooking operations, and any disconnected fire-extinguishing system nozzles attached to the appliances are reconnected in accordance with the manufacturer’s instructions and listing listed design manual. [NFPA 96:12.1.2.3]

516.0 Recirculating Systems.
516.1 General Requirements. Recirculating systems containing or for use with appliances used in processes producing smoke or grease-laden vapors shall be equipped with components in accordance complying with the following:

1. The clearance requirements of Section 507.4.
2. The A hood shall comply complying with the requirements of Section 508.0.
3. Grease removal devices shall comply complying with Section 509.0.
4. The air movement requirements of Section 511.2.1 and Section 511.2.2.
5. Auxiliary equipment (such as particulate and odor removal devices) shall comply complying with Section 512.0.
6. Fire-extinguishing equipment shall comply complying with the requirements of Section 513.0.

Exception: Fire-extinguishing equipment in accordance with Section 513.1 and Section 513.5.

7. The use and maintenance requirements of Section 514.0.
8. The minimum safety requirements of Section 515.0.
9. The All the requirements of Section 516.0. [NFPA 96:13.1]
10. Provisions shall be provided for latent heat and excessive moisture acceptable to the Authority Having Jurisdiction.

516.2.9 Listing Evaluation. Listing evaluation shall include the following:

1. Capture and containment of vapors at published and labeled airflows.
2. Grease discharge at the exhaust outlet of the system not to exceed an average of 2.9 E-09 (oz/in³) (5.0 E-06 kg/m³) of exhausted air sampled from that equipment at maximum amount of product that is capable of being processed over a continuous 8 hour test per EPA Test Method 202, with the system operating at its minimum listed airflow.
3. Listing and labeling of clearance to combustibles from the all sides, top, and bottom.
4. Electrical connection in the field in accordance with NFPA 70.
5. Interlocks on all removable components that lie in the path of airflow within the unit to ensure that they are in place during operation of the cooking appliance. [NFPA 96:13.2.12]

516.3.4 Airflow Switch or Transducer. An airflow switch or transducer shall be provided after the last filter component to ensure that a minimum airflow is maintained. The airflow switch or transducer shall open the interlock circuit when...
the airflow falls 25 percent below the system’s normal operating flow or 10 percent below its listed minimum rating, whichever is lower. The airflow switch or transducer shall be a manual reset device or circuit. [NFPA 96:13.3.5.1 – 13.3.5.3]

516.5 Additional Fire Safety Requirements. In addition to the appliance nozzle(s), a recirculating system shall be listed with the appropriate fire protection for grease filters, grease filtration, odor filtration units, and ductwork, where applicable. [NFPA 96:13.5.1]

516.6.2 Cleaning Schedule. All ESPs shall be cleaned a minimum of once per week and in accordance with according to the manufacturer’s cleaning instructions. [NFPA 96:13.6.3]

516.6.3 Hood Plenum and Blower Section Cleaning Schedule. The entire hood plenum and the blower section shall be cleaned not less than a minimum of once every 3 months. [NFPA 96:13.6.4]

516.6.4 Inspection of Safety Interlocks. Inspection and testing of the total operation and all safety interlocks in accordance with the manufacturer’s instructions shall be performed by qualified service personnel not less than a minimum of once every 6 months or more frequently where required. [NFPA 96:13.6.5]

517.0 Solid-Fuel Cooking Operations.
517.3 Hoods for Solid-Fuel Cooking. (remaining text unchanged)
517.3.1 Separation. (remaining text unchanged)

517.3.1.1 Equipment with Solid Fuel for Flavoring. Gas-operated equipment utilizing solid fuel for flavoring that is in accordance with meets all the following conditions shall not be required to have a separate exhaust system:

1. The solid fuel holder (smoker box) shall be listed with the gas-operated equipment.
2. The solid fuel holder shall be located underneath the gas burners.
3. Spark arresters that are in accordance conforming with Section 517.1.6 shall be provided.
4. The maximum quantity of solid fuel consumed shall not exceed 4.5 pounds 1 pound (2.04 0.45 kg) per hour per 100 000 Btu/hr (29 kW) of gas burner capacity.
5. The gas-operated equipment shall be protected by a fire suppression system listed for the equipment, including the solid fuel holder.
6. Gas-operated equipment with integral solid fuel holder(s) intended for flavoring, such as a radiant charbroiler(s), shall comply simultaneously with the requirements of ANSI/UL 300 that address the gas radiant charbroiler(s) and mesquite wood charbroiler(s).
7. A fire suppression system nozzle(s) shall be installed to protect the solid fuel holder.
8. The fire suppression system shall be designed and installed to protect the entire cooking operation.
9. Each solid fuel holder shall be limited to a size of 2000 150 cubic inches (2.5 L 0.0328 m³), with no dimension to exceed 20 inches (508 mm).
10. A maximum of one solid fuel holder for each 100 000 Btu/hr (29 kW), or portion thereof, of burner capacity shall be permitted.
11. Solid fuel shall be immersed in water for a continuous period of at least 24 hours immediately prior to being placed in the cooking equipment.
12. The inspection frequency shall be the same as for solid fuel cooking operations in Table 514.3. [NFPA 96:14.3.4]

517.6 Air Movement for Solid-Fuel Cooking. Exhaust system requirements shall comply with Section 511.0 for hooded operation or shall be installed in accordance with the manufacturer’s installation instructions recommendations for unhooded applications. [NFPA 96:14.6.1]

517.7.6 Fuel Storage. Fuel All fuel storage areas shall be provided with a sprinkler system in accordance with meeting the requirements of NFPA 13 except where as permitted in accordance with the following:

1. Where approved by acceptable to the Authority Having Jurisdiction, fuel storage areas shall be permitted to be protected with a fixed water pipe system with a hose capable of reaching all parts of the area.
2. In lieu of the sprinkler system outlined in Section 517.7.6, a listed 2-A rated water spray fire extinguisher or a 1.6 gallon (6.1 L) wet chemical fire extinguisher listed for Class K fires with a maximum travel distance of not more than 20 feet (6096 mm) to the solid fuel piles shall be permitted to be used for a solid fuel pile, provided that the fuel pile does not exceed 5 cubic feet (0.14 m³) volume. [NFPA 96:14.9.2.8 – 14.9.2.8.2]

518.0 Downdraft Appliances. 518.3 Fire-Extinguishing Equipment. For fire extinguishing equipment on a downdraft appliance ventilation system
shall comply with systems, the following shall apply:

1. Cooking surface, duct, and plenum protection shall be provided.
2. Not less than one fusible link or heat detector shall be installed within each exhaust duct opening in accordance with the manufacturer’s listing.
3. A fusible link or heat detector shall be provided above each protected cooking appliance and located in the plenum area of that appliance or in accordance with the extinguishing system manufacturer’s listing.
4. A manual activation device shall be provided as part of the appliance at a height acceptable to the Authority Having Jurisdiction.
5. Portable fire extinguishers shall be installed in accordance with Section 513.11. [NFPA 96:15.2]

**TABLE 1701.1 REFERENCED STANDARDS**

<table>
<thead>
<tr>
<th>STANDARD NUMBER</th>
<th>STANDARD TITLE</th>
<th>APPLICATION</th>
<th>REFERENCED SECTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>EPA Test Method 202-2016</td>
<td>Best Practices Handbook</td>
<td>Commercial Kitchens</td>
<td>516.2.9</td>
</tr>
</tbody>
</table>

Note: EPA Test Method 202 does not meet the requirements for a mandatory reference standard in accordance with Section 3-3.7.1 of IAPMO’s Regulations Governing Committee Projects.

(portion of table not shown remains unchanged)

**SUBSTANTIATION:**
In accordance with IAPMO’s Regulations Governing Committee Projects (Extract Guidelines), Section Chapter 5 is being revised to the latest edition of NFPA 96-2018.

**COMMITTEE ACTION:** ACCEPT AS AMENDED BY THE TC

Amend proposal as follows:

507.0 General Requirements.

507.2 Exhaust System. Cooking equipment used in processes producing smoke or grease-laden vapors shall be equipped with an exhaust system that complies with all the equipment and performance requirements of this chapter. [NFPA 96:4.1.1] All such equipment and its performance shall be maintained in accordance with the requirements of this chapter during all periods of operation of the cooking equipment. [NFPA 96:4.1.2] The following equipment shall be kept in working condition:

1. Cooking equipment
2. Hoods
3. Ducts (if applicable)
4. Fans
5. Fire-extinguishing equipment
6. Special effluent or energy control equipment [NFPA 96:4.1.3] Maintenance and repairs shall be performed on all components at intervals necessary to maintain good working conditions. [NFPA 96:4.1.3.1]

507.2.1 Airflow. All airflows shall be maintained. [NFPA 96:4.1.4]

507.2.2 Responsibility. The responsibility for inspection, testing, maintenance, and cleanliness of the ventilation control and fire protection of the commercial cooking operations, including cooking appliances, shall ultimately be that of the owner of the system, provided that this responsibility has not been transferred in written form to a management company, tenant, or other party. [NFPA 96:4.1.5]

507.2.3 Solid-fuel Cooking Equipment. All solid-fuel cooking equipment shall comply with the requirements of Section 517.0. [NFPA 96:4.1.6]

507.2.4 Multitenant Applications. Multitenant applications shall require the concerted cooperation of design, installation, operation, and maintenance responsibilities by tenants and by the building owner. [NFPA 96:4.1.7]

507.2.5 Interior Surfaces. All interior surfaces of the exhaust system shall be accessible for cleaning and inspection purposes. [NFPA 96:4.1.8]

507.2.6 Used in Other Applications. Cooking equipment used in fixed, mobile, or temporary concessions, such as trucks, buses, trailers, pavilions, tents, or any form of roofed enclosure, shall comply with this chapter. [NFPA 96:4.1.9]

507.4 Factory Built. Factory-built grease duct enclosures shall be protected with a through-penetration firestop system classified in accordance with ASTM E814 or UL 1479 having an “F” and a “T” rating equal to the fire resistance rating of the assembly being penetrated from the point at which the duct penetrates a ceiling, wall, or floor to the outlet terminal. [NFPA 96:4.3.3]

507.4.4 Factory Built. The factory-built grease duct protection system shall be listed in accordance with UL 2221. [NFPA 96:4.3.3.1]

507.4.4.2 Single Wall. Listed single wall factory-built grease ducts shall be permitted to be enclosed with field-applied grease
duct enclosure material where the material and the assembly of duct and material are listed for that application and installed in accordance with the grease duct manufacturer’s listing and their installation instructions. [NFPA 96:4.3.3.2]

**507.4.4.3 Installation.** The factory-built grease duct protection system shall be installed in accordance with the manufacturer’s installation instructions and the listing requirements. [NFPA 96:4.3.3.3]

**508.0 Type I Hoods.**

**508.2 Listed Type I Hood Assemblies.** Listed hood assemblies shall be installed in accordance with the terms of their listing and the manufacturer’s instructions. Listed hood assemblies shall be tested in accordance with UL 710 or equivalent. [NFPA 96:5.4.1, 5.4.2]

**508.2.1 Listed Ultraviolet Hoods.** Listed ultraviolet hoods shall be installed and maintained in accordance with the terms of their listing and the manufacturer’s instructions. Duct systems connected to ultraviolet hoods shall comply with Section 510.0. Ultraviolet hoods shall be listed and tested in accordance with UL 710 and UL 710C. [NFPA 96:5.5-5.5.2]

**507.4.4.3 Listed Ventilated Ceiling Technology.** Listed ventilated ceiling technology shall be installed and maintained in accordance with the terms of its listing and the manufacturer’s instructions. [NFPA 96:5.6]

(renumber remaining sections)

**508.3 Construction of Type I Hoods.** The hood or that portion of a primary collection means designed for collecting cooking vapors and residues shall be constructed of and be supported by steel not less than 0.048 of an inch (1.219 mm) (No. 18 MSG), in thickness, stainless steel not less than 0.036 of an inch (0.914 mm) (No. 20 MSG) in thickness, or other approved material of equivalent strength and fire and corrosion resistance. [NFPA 96:5.1.1]

Exception: Listed exhaust hoods.

**509.0 Grease Removal Devices in Hoods.**

**509.1 Grease Removal Devices.** Listed grease filters or other listed grease removal devices intended for use with commercial cooking operations shall be provided. Listed grease filters and grease removal devices that are removable but not an integral component of a specific listed exhaust hood shall be listed in accordance with ANSI/UL 1046 and shall be designated on the filter. [NFPA 96:6.1.1, 6.1.2]

**509.2.1 Vertical Distance.** Where grease removal devices are used in conjunction with solid fuel or solid fuel-type broilers, including gas or electrically heated charbroilers, a minimum vertical distance of 4 feet (1219 mm) shall be maintained between the lower edge of the grease removal device and the cooking surface. [NFPA 96:6.2.1.2]

Exceptions:

1. For cooking equipment without exposed flame and where flue gases bypass grease removal devices, the minimum vertical distance shall be permitted to be reduced to not less than 6 inches (152 mm). [NFPA 96:6.2.1.3]
2. Where a grease removal device is listed for separation distances less than those required in Section 509.2 and Section 509.2.1, the listing requirements shall be permitted. [NFPA 96:6.2.1.4]
3. Grease removal devices supplied as part of listed hood assemblies shall be installed in accordance with the terms of the listing and the manufacturer’s instructions. [NFPA 96:6.2.1.5]

**509.2.3.1 Arrangement.** Grease filters shall be arranged so that all exhaust air passes through the grease filters. [NFPA 96:6.2.3.4]

**509.2.4.1 Size and Pitch.** Grease drip trays shall be kept to the minimum size needed to collect grease. Grease drip trays shall be pitched to drain into an enclosed metal container having a capacity not exceeding 1 gallon (4 L). [NFPA 96:6.2.4.2, 6.2.4.3]

**509.2.5 Grease Filter Orientation.** Grease filters that require a specific orientation to drain grease shall be clearly so designated on the face of the filter as to be visible with the filter installed, or the hood or filter shall be constructed so that filters cannot be installed in the wrong orientation. [NFPA 96:6.2.5]

**510.0 Exhaust Duct Systems.**

**510.1.2 Interconnection.** Duct systems shall not be interconnected with any other building ventilation or exhaust system. [NFPA 96:7.1.3]

**510.1.3 Duct Installation.** All ducts shall be installed with a minimum 2 percent slope on horizontal runs up to 75 feet (22 860 mm) and a minimum 8 percent slope on horizontal runs greater than 75 feet (22 860 mm). Factory-built grease ducts shall be permitted to be installed at a lesser slope in accordance with the listing and the manufacturer’s instructions. All horizontal ducts shall be provided with access in accordance with Section 510.3.3. Drains shall be provided at low points in horizontal ducts. Where provided, drains shall be continuously welded to the exhaust duct in accordance with the terms of the listing and the manufacturer’s installation manual. All ducts shall be installed without forming dips or traps. In manifold (common duct) systems, the lowest end of the main duct shall be connected flush on the bottom with the branch duct. [NFPA 96:7.1.4 – 7.1.4.5]

**510.1.5 Sign.** A sign stating the following shall be placed on all access panels:

ACCESS PANEL – DO NOT OBSTRUCT [NFPA 96:7.1.6]
510.1.7 Type I Exhaust Duct Systems. Listed grease ducts shall be installed in accordance with the terms of their listings and manufacturer’s instructions. [NFPA 96:7.1.7]

510.3.4.2 Safe Access and Work Platform. If not easily accessible from the floor or a 10 foot (3048 mm) stepladder, openings on vertical grease ducts shall be provided with safe access and a work platform. [NFPA 96:7.4.2.3]

510.3.6 Access Panels. Access panels shall be of the same material and thickness as the duct. Access panels shall have a gasket or sealant that is rated for 1500°F (816°C) and shall be greasetight. Fasteners, such as bolts, weld studs, latches, or wing nuts, used to secure the access panels shall be carbon steel or stainless steel and shall not penetrate duct walls. [NFPA 96:7.4.3.1-7.4.3.3]

510.3.6.1 Listed Grease Ducts. Listed grease duct access door assemblies (access panels) shall be installed in accordance with the terms of the listing and the manufacturer’s instructions. [NFPA 96:7.4.3.4]

510.4 Listed Grease Ducts. Listed grease ducts shall be installed in accordance with the terms of the listing and the manufacturer’s instructions. [NFPA 96:7.1.7]

510.5.5 Telescoping and Bell-Type Connections. For telescoping and bell-type connections, the inside duct section shall always be uphill of the outside duct section. [NFPA 96:7.5.5.3] The overlap shall not exceed 2 inches (51 mm) as shown in Figure 510.5.3.2(1).

510.7 Interior Installations. In all buildings more than one story in height and in one-story buildings where the roof-ceiling assembly is required to have a fire resistance rating, the ducts shall be enclosed in a continuous enclosure extending from the lowest fire-rated ceiling or floor above the hood, through any concealed spaces, to or through the roof, to maintain the integrity of the fire separations required by the applicable building code provisions. The enclosure shall be sealed around the duct at the point of penetration of the first fire-rated barrier after the hood, to maintain the fire resistance rating of the enclosure. The enclosure shall be vented to the exterior of the building through weather-protected openings. [NFPA 96:7.7.1.2 – 7.7.1.4]

Exception: The continuous enclosure provisions shall not be required where a field-applied grease duct enclosure or a factory-built grease duct enclosure (see Section 507.4.4 through Section 507.4.6) is protected with a listed duct-through-penetration protection system equivalent to the fire resistance rating of the assembly being penetrated and where the materials are installed in accordance with the conditions of the listings and the manufacturer’s instructions and are acceptable to the Authority Having Jurisdiction. [NFPA 96:7.7.1.5]

510.7.3 Clearance. Clearance from the duct or the exhaust fan to the interior surface of enclosures of combustible construction shall be not less than 18 inches (457 mm). Clearance from the duct to the interior surface of enclosures of noncombustible or limited-combustible construction shall be not less than 6 inches (152 mm). Provisions for reducing clearances as described in Section 507.4 through Section 507.4.3.3 shall not be applicable to enclosures. [NFPA 96:7.7.2.2.1 – 7.7.2.2.3]

Exception: Clearance from the outer surfaces of field-applied grease duct enclosures and factory-built grease duct enclosures to the interior surfaces of construction installed around them shall be permitted to be reduced where the field-applied grease duct enclosure materials and factory-built grease duct enclosures are installed in accordance with the conditions of the listing and the manufacturer’s instructions and are acceptable to the Authority Having Jurisdiction. [NFPA 96:7.7.2.2.4]

510.7.4 Mechanical and Structural Integrity. Field-applied grease duct enclosures and factory-built grease duct enclosures shall provide mechanical and structural integrity, resiliency, and stability when subjected to expected building environmental conditions, duct movement under general operating conditions, and duct movement as a result of interior and exterior fire conditions. [NFPA 96:7.7.2.2.5]

510.7.5.1 Protection from Physical Damage. Measures shall be taken to prevent physical damage to any covering or enclosure material. Any damage to the covering or enclosure shall be repaired, and the covering or enclosure shall be restored to meet its intended listing and fire resistance rating and to be acceptable to the Authority Having Jurisdiction. [NFPA 96:7.7.3.1, 7.7.3.2]

510.7.5.2 Inspection. In the event of a fire within a kitchen exhaust system, the duct, the enclosure, and the covering directly applied to the duct shall be inspected by qualified personnel to determine whether the duct, the enclosure, and the covering directly applied to the duct are structurally sound, capable of maintaining their fire protection functions, suitable for continued operation, and acceptable to the Authority Having Jurisdiction. [NFPA 96:7.7.3.3]

510.7.7 Fire Doors. Where openings in the enclosure walls are provided, they shall be protected by listed fire doors of proper rating. Fire doors shall be installed in accordance with NFPA 80. Openings on other listed materials or products shall be clearly identified and labeled according to the terms of the listing and the manufacturer’s instructions and shall be acceptable to the Authority Having Jurisdiction. [NFPA 96:7.7.4.1 – 7.7.4.3] The fire door shall be readily accessible, aligned, and of sufficient size to allow access to the rated access panels on the ductwork. [NFPA 96:7.7.4.4]

510.7.8 Ducts with Enclosure(s). Each duct system shall constitute an individual system serving only exhaust hoods in one fire zone on one floor. Multiple ducts shall not be permitted in a single enclosure unless acceptable to the Authority Having Jurisdiction. [NFPA 96:7.7.5 – 7.7.5.2]
510.9.1 Rooftop Terminations. Rooftop terminations shall be arranged with or provided with the following:

1. A minimum of 10 feet (3048 mm) of horizontal clearance from the outlet to adjacent buildings, property lines, and air intakes.
2. A minimum of 5 feet (1524 mm) of horizontal clearance from the outlet (fan housing) to any combustible structure.
3. A vertical separation of 3 feet (914 mm) above any air intakes within 10 feet (3048 mm) of the exhaust outlet.
4. The ability to drain grease out of traps or low points formed in the fan or duct near the termination of the system into a collection container that is noncombustible, closed, rainproof, and structurally sound for the service to which it is applied and that will not sustain combustion.
5. A grease collection device that is applied to exhaust systems that does not inhibit the performance of any fan.
6. Listed grease collection systems that meet the requirements of Section 510.9.1(4) and Section 510.9.1(5).
7. A listed grease duct complying with Section 507.4.7 or ductwork complying with Section 507.4.8.
8. A hinged upblast fan supplied with flexible weatherproof electrical cable and service hold-open retainer to permit inspection and cleaning that is listed for commercial cooking equipment with the following conditions:
   a. Where the fan attaches to the ductwork, the ductwork is a minimum of 18 inches (457 mm) away from any roof surface, as shown in Figure 510.9.1.
   b. The fan discharges a minimum of 40 inches (1016 mm) away from any roof surface, as shown in Figure 510.9.1.
9. Other approved fans, provided it meets all of the following criteria:
   a. The fan meets the requirements of Section 510.9.1(3) and Section 511.1.3.
   b. Its discharge or its extended duct discharge meets with the requirements of Section 510.9.1(2). (See Section 511.1.3)
   c. Exhaust fan discharge is directed up and away from the roof surface. [NFPA 96:7.8.2.1]

Notes:
1. Fresh air intake (FAI) applies to an air intake, including an operable door or window.
2. Example:
   a. FAIs 1 and 5 are on the same plane of exhaust or lower: 10 feet (3048 mm) min. between closest edges.
   b. FAIs 2, 3, and 4 are above plane of exhaust fan:
      10 feet + 0.25 feet (3048 mm + 76 mm) per degree between closest edges.

FIGURE 510.9.2
EXHAUST TERMINATION DISTANCE FROM FRESH AIR INTAKE (FAI) OR OPERABLE DOOR OR WINDOW
[NFPA 96: FIGURE 7.8.3]

511.0 Air Movement.
511.1 Exhaust Fans for Commercial Cooking Operations. (remaining text unchanged)

511.1.2.1 Accessibility. Where the design or positioning of the fan allows grease to be trapped, a drain directed to a readily accessible and visible grease receptacle not exceeding 1 gallon (4 L), shall be provided. In-line exhaust fans shall be located in easily accessible areas of adequate size to allow for service or removal. Where the duct system connected to the fan is in an enclosure, the space or room in which the exhaust fan is located shall have the same fire resistance rating as the enclosure. [NFPA 96:8.1.3.4 – 8.1.3.6]

511.2.3 Exhaust Fan Operation. A hood exhaust fan(s) shall continue to operate after the extinguishing system has been activated unless fan shutdown is required by a listed component of the ventilation system or by the design of the extinguishing system. The hood exhaust fan shall start upon activation of the extinguishing system if the exhaust fan and all cooking equipment served by the fan have been shut down, unless fan shutdown is required by a listed component of the ventilation system or by the listing of the extinguishing system. The exhaust fan shall be provided with a means so that the fan is activated when any heat-
512.0 Auxiliary Equipment.
512.2 Electrical Equipment. Wiring systems of any type shall not be installed in ducts. [NFPA 96:9.2.1]
512.2.1 Device Installation in Ducts. Motors, lights, and other electrical devices shall be permitted to be installed in ducts or hoods or to be located in the path of travel of exhaust products only where specifically listed for such use. [NFPA 96:9.2.2]
512.2.2 Lighting Units. Lighting units on hoods shall not be located in concealed spaces except as permitted by Section 512.2.3 and Section 512.2.4. [NFPA 96:9.2.3.2]

512.3 Other Equipment. Fume incinerators, thermal recovery units, air pollution control devices, or other devices shall be permitted to be installed in ducts or hoods or to be located in the path of travel of exhaust products where specifically listed for such use. [NFPA 96:9.3.1]
512.3.1 Access Required. Equipment shall have space provided to all access panels or doors for the safe removal and servicing of control devices, such as filters, electrostatic precipitator cells, and odor control media beds, and for cleaning of the equipment housing. [NFPA 96:9.3.1.3]
512.3.2 Downgrading. Downgrading other parts of the exhaust system due to the installation of approved devices, whether listed or not, shall not be allowed. [NFPA 96:9.3.2]
512.3.3 Fire-Extinguishing System. Any equipment installed in the path of exhaust products that provides secondary filtration or air pollution control shall be provided with an approved automatic fire-extinguishing system, installed in accordance with the fire-extinguishing system manufacturer’s instructions. [NFPA 96:9.3.3]
512.3.3.1 Protection. The fire-extinguishing system required by Section 512.3.3 shall provide protection for the component sections of the equipment, and ductwork downstream of the equipment. [NFPA 96:9.3.3.1]
512.3.3.2 Filter Media. Filter media used in secondary filtration or air pollution control units and not complying with Section 509.2.3 shall have fire protection that is adequate for the filter media being used in accordance with the fire-extinguishing system manufacturer’s instructions. [NFPA 96:9.3.3.2]
512.3.4 Source of Ignition. If the equipment provides a source of ignition, it shall be provided with detection to operate the fire-extinguishing system protecting the equipment. [NFPA 96:9.3.4]
512.3.5 Air Recirculation. Where a cooking exhaust system employs an air pollution control device that recirculates air into the building, the requirements of Section 516.0 shall apply. [NFPA 96:9.3.5]
512.3.6 Carbon Monoxide Required. If the heat source is non-electric and open flames are used, a carbon monoxide detector shall be installed in both the kitchen and dining areas. [NFPA 96:9.3.7]

513.0 Fire-Extinguishing Equipment.
513.1 General. (remaining text unchanged)
513.1.1 Devices in Exhaust Ducts. Fume incinerators, thermal recovery units, air pollution control devices, or other devices installed in the exhaust duct, shall be protected by an automatic fire-extinguishing system. [NFPA 96:10.1.3]

513.2.1 Identification. A placard shall be conspicuously placed near each Class K extinguisher that states that the fire protection system shall be activated prior to using the fire extinguisher. [NFPA 96:10.2.2]
513.2.5 Baffle Hoods with Water Wash. Areas requiring protection in accordance with Section 513.1 shall be permitted to be protected by a water-wash system that is listed as a fire-extinguishing system in compliance with UL 300 or other equivalent standards and installed in accordance with the requirements of its listing. [NFPA 96:10.2.8.1]
513.2.5.1 Listed for the Purpose. Each such area not provided with a listed water-wash fire-extinguishing system shall be provided with a fire-extinguishing system listed for the purpose. [NFPA 96:10.2.8.2]

513.2.5.2 Control Valve. The water supply for water-wash fire-extinguishing systems shall be controlled by a listed indicating valve. [NFPA 96:10.2.8.4]
513.2.5.3 Activation. Where a separate fire-extinguishing system is used for protection of cooking equipment only, a water-wash fire-extinguishing system listed for protection of the grease removal device(s), hood exhaust plenum(s), exhaust duct(s), or combination thereof shall be provided with instructions and appropriate means for electrical interface for simultaneous activation. [NFPA 96:10.2.8.5]
513.2.5.4 Water-Wash System. A water-wash system approved to be used for protection of the grease removal device(s), hood exhaust plenum(s), exhaust duct(s), or combination thereof shall include instructions and appropriate electrical interface for simultaneous activation of the water-wash system from an automatic fire-extinguishing system, where the automatic fire-extinguishing system is used for cooking equipment protection only. [NFPA 96:10.2.8.6]
513.2.5.5 Exception. Where the automatic fire-extinguishing system in accordance with NFPA 17A provides protection for the
513.2.5.6 **Water Supply.** The water required for listed automatic fire-extinguishing systems shall be permitted to be supplied from the domestic water supply where the minimum water pressure and flow are provided in accordance with the terms of the listing. The water supply shall be controlled by a supervised water supply control valve. Where the water supply is from a dedicated fire protection water supply in a building with one or more fire sprinkler systems, separate indicating control valves and drains shall be provided and arranged so that the hood system and sprinkler systems can be controlled individually. [NFPA 96:10.2.9.1, 10.2.9.2]

513.2.6 **Water Valve Supervision.** Valves controlling the water supply to listed water-wash fire-extinguishing systems, automatic fire-extinguishing systems, or both shall be listed indicating type of valve and shall be supervised open by one of the following methods:

1. Central station, proprietary, or remote station alarm service.
2. Local alarm service that will cause the sounding of an audible signal at a constantly attended point.
3. Locking valves open.
4. Sealing of valves and approved weekly recorded inspection. [NFPA 96:10.2.10]

513.3 **Simultaneous Operation.** Fixed pipe extinguishing systems in a single hazard area shall be arranged for simultaneous automatic operation upon actuation of any one of the systems. [NFPA 96:10.3.1]

513.3.1 **Hoods.** Hoods installed end to end, back to back, or both, or sharing a common ductwork, not exceeding 75 feet (22 860 mm) in distance from the farthest hood, and having a grease producing appliance(s) located under one or more of the hoods, shall be considered a single hazard area requiring simultaneous automatic fire protection in all hoods and ducts. [NFPA 96:10.3.1.1]

513.3.1.1 **Common Ductwork.** In hoods that are installed end to end, back to back, or both, and that share a common ductwork, the ductwork beyond 75 feet (22 860 mm) from the farthest hood shall be protected by an independent fire-extinguishing system with its own detection system or by a fire-extinguishing system that activates simultaneously with the fire-extinguishing system(s) protecting the hoods. [NFPA 96:10.3.1.1.1]

513.3.2 **Independent Systems.** Hoods installed end to end, back to back, or both that do not share a common exhaust duct and are separated by a wall(s) or other means to ensure that grease-laden vapors exhausted under one hood cannot propagate to the other hoods, the hoods’ fire-extinguishing system(s) shall be independent and shall not be required to simultaneously discharge. [NFPA 96:10.3.1.2]

513.3.3 **Exempt Equipment.** Fume incinerators, thermal recovery units, air pollution control devices, or other devices installed in the exhaust duct shall not be required to comply with Section 513.3.1. [NFPA 96:10.3.1.3]

(renumber remaining sections)

513.3.1.1 **Automatic Sprinkler System.** Simultaneous operation shall not be required where the one fixed pipe extinguishing system is an automatic sprinkler system. Where an automatic sprinkler system is used in conjunction with a water-based fire-extinguishing system served by the same water supply, hydraulic calculations shall consider both systems operating simultaneously. [NFPA 96:10.3.2, 10.3.2.1]

513.3.2 **Dry or Wet Chemical Systems.** Simultaneous operation shall be required where a dry or wet chemical system is used to protect common exhaust ductwork by one of the methods specified in NFPA 17 or NFPA 17A. [NFPA 96:10.3.3]

513.4 **Steam.** Steam supplied from an external source shall not be required to automatically shut off. [NFPA 96:10.4.2]

513.5 **Manual Activation.** All systems shall have both automatic and manual methods of actuation. At least one manual actuation device shall be located in a means of egress or at a location acceptable to the Authority Having Jurisdiction.

The manual activation device shall clearly identify the hazard protected. An automatic sprinkler system shall not require a method of manual activation. [NFPA 96:10.5.1 – 10.5.3]

513.8 **Special Design and Application.** Hoods containing automatic fire-extinguishing systems are protected areas; therefore, these hoods shall not be considered obstructions to overhead sprinkler systems and shall not require floor additional sprinkler coverage underneath. [NFPA 96:10.7.1]

513.10 **Installation Requirements.** Installation of systems shall be performed only by persons properly trained and qualified to install the specific system being provided. The installer shall provide certification to the Authority Having Jurisdiction that the installation is in agreement with the terms of the listing and the manufacturer’s instructions and/or approved design. [NFPA 96:10.8.2.1, 10.8.2.2]

513.11 **Portable Fire Extinguishers.** Portable fire extinguishers shall be selected and installed in kitchen cooking areas in accordance with NFPA 10 and shall be specifically listed for such use. Class K fire extinguishers shall be provided for cooking appliance hazards that involve combustible cooking media (vegetable oils and animal oils and fats). [NFPA 96:10.9.1, 10.9.2]

513.11.1 **Other Fire Extinguishers.** Portable fire extinguishers shall be provided for other hazards in kitchen areas and shall be selected and installed in accordance with NFPA 10. [NFPA 96:10.9.3]

513.11.2 **Carbon Dioxide-Type.** Carbon dioxide-type extinguishers shall not be permitted. [NFPA 96:10.9.4]
514.0 Procedures for the Use, Inspection, Testing, and Maintenance of Equipment.

514.1 Operating Procedures. Exhaust systems shall be operated whenever cooking equipment is turned on. [NFPA 96:11.1.1]

514.1.6 Secondary Control Equipment. Secondary filtration and pollution control equipment shall be operated in accordance with the terms of its listing and the manufacturer’s recommendations. [NFPA 96:11.1.7]

514.1.7 Inspection Frequency. Inspection and maintenance of “other equipment” as allowed in Section 512.3 shall be conducted by properly trained and qualified persons at a frequency determined by the manufacturer’s instructions or the equipment listing. [NFPA 96:11.1.8]

514.2 Inspection, Testing, and Maintenance. Maintenance of the fire-extinguishing systems and listed exhaust hoods containing a constant or fire-activated water system that is listed to extinguish a fire in the grease removal devices, hood exhaust plenums, and exhaust ducts shall be made by properly trained, qualified, and certified person(s) acceptable to the Authority Having Jurisdiction at least every 6 months. [NFPA 96:11.2.1]

514.2.1 Requirements. All actuation and control components, including remote manual pull stations, mechanical and electrical devices, detectors, and actuators shall be tested for proper operation during the inspection in accordance with the manufacturer’s procedures. The specific inspection and maintenance requirements of the extinguishing system standards as well as the applicable installation and maintenance manuals for the listed system and service bulletins shall be followed. [NFPA 96:11.2.2, 11.2.3]

514.2.2 Fusible Links and Sprinklers. Fusible links of the metal alloy type and automatic sprinklers of the metal alloy type shall be replaced at least semiannually. [NFPA 96:11.2.4]

514.2.4 Temperature-Sensing Elements. Fixed temperature-sensing elements other than the fusible metal alloy type shall be permitted to remain continuously in service, provided they are inspected and cleaned, or replaced if necessary in accordance with the manufacturer’s instructions, every 12 months or more frequently to ensure proper operation of the system. [NFPA 96:11.2.7]

514.3 Inspection for Grease Buildup. The entire exhaust system shall be inspected for grease buildup by a properly trained, qualified, and certified person(s) acceptable to the Authority Having Jurisdiction and in accordance with Table 514.3. [NFPA 96:11.4]

<table>
<thead>
<tr>
<th>TYPE OR VOLUME OF COOKING</th>
<th>INSPECTION</th>
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<td>Systems serving high-volume cooking operations.</td>
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<tr>
<td>Systems serving low-volume cooking operations.</td>
<td>Annually</td>
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Notes:
1. High-volume cooking operations include 24-hour cooking, charbroiling, and wok cooking.
2. Low-volume cooking operations include churches, day camps, seasonal businesses, and senior centers.

514.4 Cleaning of Exhaust Systems. If, upon inspection, the exhaust system is found to be contaminated with deposits from grease-laden vapors, the contaminated portions of the exhaust system shall be cleaned by a properly trained, qualified, and certified person(s) acceptable to the Authority Having Jurisdiction. [NFPA 96:11.6.1]

514.4.1 Measurement System. A measurement system of deposition shall be established to trigger a need to clean when the exhaust system is inspected at the frequencies in Table 514.3. [NFPA 96:11.6.1.1]

514.4.1.1 Combustible Contaminants. Hoods, grease removal devices, fans, ducts, and other appurtenances shall be cleaned to remove combustible contaminants to a minimum of 0.002 of an inch (50 µm). [NFPA 96:11.6.1.1.1]

514.4.1.2 Gauge Comb. A grease depth gauge comb as shown in Figure 514.4.1.2 shall be placed upon the surface to measure grease depth. [NFPA 96:11.6.1.1.2]
514.4.1.3 **Cleaning Method.** Where a measured depth of 0.078 of an inch (2000 µm) is observed, the surfaces shall be cleaned in accordance with Section 514.4. [NFPA 96:11.6.1.1.3]

514.4.1.4 **Combustible Contaminants.** Where a measured depth of 0.125 of an inch (3175 µm) is observed in a fan housing, the surfaces shall be cleaned in accordance with Section 514.4. [NFPA 96:11.6.1.1.4]

(renumber remaining sections)

514.4.4 **Inoperable.** Fire-extinguishing systems shall be permitted to be rendered inoperable during the cleaning process where serviced by properly trained and qualified persons. [NFPA 96:11.6.5]

514.4.8 **Access Panels and Cover Plates.** When cleaning procedures are completed, all access panels (doors) and cover plates shall be restored to their normal operational condition. [NFPA 96:11.6.9]

514.4.9 **Date of Inspection.** When an access panel is removed, a service company label or tag preprinted with the name of the company and giving the date of inspection or cleaning shall be affixed near the affected access panels. [NFPA 96:11.6.10]

514.4.11 **Operable State.** When cleaning procedures are completed, all electrical switches and system components shall be returned to an operable state. [NFPA 96:11.6.12]

514.4.12 **Certification of Service.** When an exhaust system is inspected or cleaned, a certificate showing the name of the servicing company, the name of the person performing the work, and the date of inspection or cleaning shall be maintained on the premises. [NFPA 96:11.6.13]

514.4.15 **Metal Containers.** Metal containers used to collect grease drippings shall be inspected or emptied at least weekly. [NFPA 96:11.6.16]

515.0 **Minimum Safety Requirements for Cooking Equipment.**

515.1 **Cooking Equipment.** (remaining text unchanged)

515.1.1 **Installation.** All listed appliances shall be installed in accordance with the terms of their listings and the manufacturer’s instructions. Solid fuel used for flavoring within a gas-operated appliance shall be in a solid fuel holder (smoker box) that is listed with the equipment. [NFPA 96:12.1.2.1, 12.1.2.1.1]

515.1.1.2 **Prior Location.** The fire-extinguishing system shall not require re-evaluation where the cooking appliances are moved for the purposes of maintenance and cleaning, provided the appliances are returned to approved design location prior to cooking operations, and any disconnected fire-extinguishing system nozzles attached to the appliances are reconnected in accordance with the manufacturer’s listed design manual. [NFPA 96:12.1.2.3]

516.0 **Recirculating Systems.**

516.1 **General Requirements.** Recirculating systems containing or for use with appliances used in processes producing smoke or grease-laden vapors shall be equipped with components complying with the following:

1. The clearance requirements of Section 507.4.
2. A hood complying with the requirements of Section 508.0.
3. Grease removal devices complying with Section 509.0.
4. The air movement requirements of Section 511.2.1 and Section 511.2.2.
5. Auxiliary equipment (such as particulate and odor removal devices) complying with Section 512.0.
6. Fire-extinguishing equipment complying with the requirements of Section 513.0.

**Exception:** Fire-extinguishing equipment in accordance with Section 513.1 and Section 513.5.

7. The use and maintenance requirements of Section 514.0.
8. The minimum safety requirements of Section 515.0.
§ 516.2.9 Listing Evaluation. Listing evaluation shall include the following:
(1) Capture and containment of vapors at published and labeled airflows.
(2) Grease discharge at the exhaust outlet of the system not to exceed an average of 2.9 E-09 (oz/in$^3$) (5.0 E-06 kg/m$^3$) of exhausted air sampled from that equipment at maximum amount of product that is capable of being processed over a continuous 8 hour test per EPA Test Method 202, with the system operating at its minimum listed airflow.
(3) Listing and labeling of clearance to combustibles from all sides, top, and bottom.
(4) Electrical connection in the field in accordance with NFPA 70.
(5) Interlocks on all removable components that lie in the path of airflow within the unit to ensure that they are in place during operation of the cooking appliance.

§ 516.3.4 Airflow Switch or Transducer. An airflow switch or transducer shall be provided after the last filter component to ensure that a minimum airflow is maintained. The airflow switch or transducer shall open the interlock circuit when the airflow falls 25 percent below the system’s normal operating flow or 10 percent below its listed minimum rating, whichever is lower. The airflow switch or transducer shall be a manual reset device or circuit.

§ 516.5 Additional Fire Safety Requirements. In addition to the appliance nozzle(s), a recirculating system shall be listed with the appropriate fire protection for grease filters, grease filtration, odor filtration units, and ductwork, where applicable.

§ 516.6.2 Cleaning Schedule. All ESPs shall be cleaned a minimum of once per week and according to the manufacturer’s cleaning instructions.

§ 516.6.3 Hood Plenum and Blower Section Cleaning Schedule. The entire hood plenum and the blower section shall be cleaned a minimum of once every 3 months.

§ 516.6.4 Inspection of Safety Interlocks. Inspection and testing of the total operation and all safety interlocks in accordance with the manufacturer’s instructions shall be performed by qualified service personnel a minimum of once every 6 months or more frequently if required.

§ 517.0 Solid-Fuel Cooking Operations.

§ 517.3 Hoods for Solid-Fuel Cooking.

§ 517.3.1 Separation.

§ 517.3.1.1 Equipment with Solid Fuel for Flavoring. Gas-operated equipment utilizing solid fuel for flavoring that meets all the following conditions shall not be required to have a separate exhaust system:
(1) The solid fuel holder (smoker box) shall be listed with the gas-operated equipment.
(2) The solid fuel holder shall be located underneath the gas burners.
(3) Spark arresters conforming with Section 517.1.6 shall be provided.
(4) The maximum quantity of solid fuel consumed shall not exceed 1 pound (0.45 kg) per hour per 100 000 Btu/hr (29 kW) of gas burner capacity.
(5) The gas-operated equipment shall be protected by a fire suppression system listed for the equipment, including the solid fuel holder.
(6) Gas-operated equipment with integral solid fuel holder(s) intended for flavoring, such as radiant charbroiler(s), shall comply simultaneously with the requirements of ANSI/UL 300 that address the gas radiant charbroiler(s) and mesquite wood charbroiler(s).
(7) A fire suppression system nozzle(s) shall be installed to protect the solid fuel holder.
(8) The fire suppression system shall be designed and installed to protect the entire cooking operation.
(9) Each solid fuel holder shall be limited to a size of 150 cubic inches (2.5 L), with no dimension to exceed 20 inches (508 mm).
(10) A maximum of one solid fuel holder for each 100 000 Btu/hr (29 kW), or portion thereof, of burner capacity shall be permitted.
(11) Solid fuel shall be immersed in water for a continuous period of at least 24 hours immediately prior to being placed in the cooking equipment.
(12) The inspection frequency shall be the same as for solid fuel cooking operations in Table 514.3.

§ 517.6 Air Movement for Solid-Fuel Cooking. Exhaust system requirements shall comply with Section 511.0 for hooded operation or shall be installed in accordance with the manufacturer’s recommendations for unhooded applications.

§ 517.7 Fuel Storage. All fuel storage areas shall be provided with a sprinkler system meeting the requirements of NFPA 13 except as permitted in accordance with the following:
(1) Where acceptable to the Authority Having Jurisdiction, fuel storage areas shall be permitted to be protected with a fixed water pipe system with a hose capable of reaching all parts of the area.
(2) In lieu of the sprinkler system outlined in Section 517.7.6, a listed 2-A rated water spray fire extinguisher or a 1.6 gallon (6.1 L) wet chemical fire extinguisher listed for Class K fires with a maximum travel distance of 20 feet (6096 mm) to the solid fuel piles shall be permitted to be used for a solid fuel pile, provided that the fuel pile does not exceed 5 cubic feet (0.14 m$^3$) volume.
517.8.2 Additional Devices. Except for the spark arresters required in Section 517.1.6, there shall be no additional devices of any type in any portion of the appliance, flue pipe, and chimney of a natural draft solid fuel operation. [NFPA 96:14.9.4.4]

517.8.3 Prohibited. No solid fuel cooking device of any type shall be permitted for deep fat frying involving more than 1 quart (qt) (1 L) of liquid shortening, nor shall any solid fuel cooking device be permitted within 3 feet (914 mm) of any deep fat frying unit. [NFPA 96:14.9.4.5]

518.0 Downdraft Appliances.
518.3 Fire-Extinguishing Equipment. For fire-extinguishing equipment on downdraft appliance ventilation systems, the following shall apply:
(1) Cooking surface, duct, and plenum protection shall be provided.
(2) At least one fusible link or heat detector shall be installed within each exhaust duct opening in accordance with the manufacturer’s listing.
(3) A fusible link or heat detector shall be provided for each protected cooking appliance located in the plenum area of that appliance or in accordance with the extinguishing system manufacturer’s listing.
(4) A manual activation device shall be provided as part of each appliance at a height acceptable to the Authority Having Jurisdiction.
(5) Portable fire extinguishers shall be provided in accordance with Section 513.11. [NFPA 96:15.2]

<p>| TABLE 1701.1 |
| REFERENCED STANDARDS |</p>
<table>
<thead>
<tr>
<th>STANDARD NUMBER</th>
<th>STANDARD TITLE</th>
<th>APPLICATION</th>
<th>REFERENCED SECTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>EPA Test Method 202-2016</td>
<td>Best Practices Handbook</td>
<td>Commercial Kitchens</td>
<td>516.2.9</td>
</tr>
</tbody>
</table>

(portion of table not shown remains unchanged)

COMMITTEE STATEMENT:
The proposed text in Section 510.5.5 is being revised to correlate with Item # 39. Furthermore, the reference to EPA Test Method 202 is being removed from Section 516.2.9 as it is not an enforceable document.

TOTAL ELIGIBLE TO VOTE: 26
VOTING RESULTS: AFFIRMATIVE: 25  NOT RETURNED: 1  HOWARD

The TCC has the responsibility to resolve conflicts and achieve correlation among the recommendations of the Technical Committee. The TCC has the authority to choose between alternative text recommended by the Technical Committee, but only as necessary for correlation, consistency, and the correction of errors and omissions in accordance with Section 3-4 of the Regulations Governing Committee Projects.

Actions taken on UMC Item # 044, Section 509.1 (Grease Removal Devices) and Section 517.3.1.1 (Equipment with Solid Fuel for Flavoring) resulted in conflicting language between UPC Item # 157, Section 1211.3 (Arc-Resistant Jacketed CSST). In order to correlate the language, the Technical Correlating Committee proposed the following modifications to the UMC:

509.1 Grease Removal Devices. Listed grease filters or other listed grease removal devices intended for use with commercial cooking operations shall be provided. Listed grease filters and grease removal devices that are removable but not an integral component of a specific listed exhaust hood shall be listed in accordance with ANSI/UL 1046 and shall be designated on the filter. [NFPA 96:6.1.1, 6.1.2]

517.3.1.1 Equipment with Solid Fuel for Flavoring. Gas-operated equipment utilizing solid fuel for flavoring that meets all the following conditions shall not be required to have a separate exhaust system:
(1) The solid fuel holder (smoker box) shall be listed with the gas-operated equipment.
(2) The solid fuel holder shall be located underneath the gas burners.
(3) Spark arresters conforming with Section 517.1.6 shall be provided.
(4) The maximum quantity of solid fuel consumed shall not exceed 1 pound (0.45 kg) per hour per 100 000 Btu/hr (29 kW) of gas burner capacity.
(5) The gas-operated equipment shall be protected by a fire suppression system listed for the equipment, including the solid fuel holder.
(6) Gas-operated equipment with integral solid fuel holder(s) intended for flavoring, such as radiant charbroiler(s), shall comply simultaneously with the requirements of ANSI/UL 300 that address the gas radiant charbroiler(s) and mesquite wood charbroiler(s).
(7) A fire suppression system nozzle(s) shall be installed to protect the solid fuel holder.
(8) The fire suppression system shall be designed and installed to protect the entire cooking operation.

(9) Each solid fuel holder shall be limited to a size of 150 cubic inches (2.5 L), with no dimension to exceed 20 inches (508 mm).

(10) A maximum of one solid fuel holder for each 100 000 Btu/hr (29 kW), or portion thereof, of burner capacity shall be permitted.

(11) Solid fuel shall be immersed in water for a continuous period of at least 24 hours immediately prior to being placed in the cooking equipment.

(12) The inspection frequency shall be the same as for solid fuel cooking operations in Table 514.3. [NFPA 96:14.3.4]

TCC ACTION: ACCEPT AS SUBMITTED

TCC STATEMENT: The language in UMC Item #044, Section 509.1 (Grease Removal Devices) and Section 517.3.1.1 (Equipment with Solid Fuel for Flavoring) are being revised to correlate with the language approved by the UPC TC Item #157, Section 1211.3 (Arc-Resistant Jacketed CSST) with regards to the term "ANSI" not being part of the standard title as referenced throughout the UPC and UMC.

The action moves forward as approved by the TCC and supersedes the recommendation from the UMC TC for actions taken for Section 509.1 (Grease Removal Devices) and Section 517.3.1.1 (Equipment with Solid Fuel for Flavoring) with regard to the standard title reference within the codes.

Appended Comments

PUBLIC COMMENT 1

Code Year: 2021 UMC  Section #: Chapter 5  Item #: 044
SUBMITTER: IAPMO Staff - Update Extracts  NFPA 54 Extract Update
Comment #: 1

RECOMMENDATION:
Revise text
Request to accept the code change proposal as modified by this public comment.

504.4.1 Provisions for Makeup Air. Makeup air shall be provided in accordance with the following:

(1) Makeup air shall be provided for Type 1 clothes dryers in accordance with the manufacturer’s installation instructions. [NFPA 54:10.4.3.1] Where a closet is designed for the installation of a clothes dryer, an opening of not less than 100 square inches (0.065 m²) for makeup air shall be provided in the door or by other approved means.

(2) Provision for makeup air shall be provided for Type 2 clothes dryers, with a minimum free area of not less than 1 square inch (0.0006 m²) for each 1000 British thermal units per hour (Btu/h) (0.293 kW) total input rating of the dryer(s) installed. [NFPA 54:10.4.3.2]

SUBSTANTIATION:
In accordance with IAPMO's Regulations Governing Committee Projects (Extract Guidelines), the above sections are being revised to the latest edition of NFPA 54-2018.

PUBLIC COMMENT 2

Code Year: 2021 UMC  Section #: Chapter 5  Item #: 044
SUBMITTER: IAPMO Staff - Update Extracts  NFPA 91 Extract Update
Comment #: 2

RECOMMENDATION:
Revise text
Request to accept the code change proposal as modified by this public comment.

505.2 Incompatible Materials. Incompatible materials shall not be conveyed in the same system. [NFPA 91:4.2.2]

505.3 Flammability Limit. Unless the circumstances stipulated in Section 505.3.1, Section 505.3.2, or Section 505.3.3 exist, in systems conveying flammable vapors, gases, or mists, the concentration shall not exceed 25 percent of the lower flammability limit
**505.3.1 Higher Concentrations.** Higher concentrations shall be permitted where if the exhaust system is designed and protected in accordance with NFPA 69, using one or more of the following techniques:

1. Combustible concentration reduction
2. Oxidant concentration reduction
3. Deflagration suppression
4. Deflagration pressure containment [NFPA 91:4.2.3.1]

**505.5 Generating Flames, Sparks, or Hot Materials.** Operations generating flames, sparks, or hot material such as from grinding wheels and welding shall not be manifolded into any exhaust system that air conveys flammable or combustible materials. [NFPA 91:4.2.6]

**505.7 Fire Detection and Alarm Systems.** Unless the conditions circumstances stipulated in Section 505.7.1 or Section 505.7.2 exist, fire detection and alarm systems shall not be interlocked to shut down air-moving devices. [NFPA 91:4.2.14]

| TABLE 505.9
<table>
<thead>
<tr>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>RANGE OF MINIMUM DUCT DESIGN VELOCITIES*</td>
</tr>
<tr>
<td>[NFPA 91: TABLE A.4.1.5 TABLE A.4.2.5]</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>NATURE OF CONTAINMENT</th>
<th>EXAMPLES</th>
<th>DESIGN VELOCITY (feet per minute)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vapors, gases, smoke</td>
<td>All vapors Vapors, gases, and smoke</td>
<td>Any 1000 – 2000*</td>
</tr>
<tr>
<td>Fumes</td>
<td>Welding</td>
<td>2000 – 2500</td>
</tr>
<tr>
<td>Very fine Fine light dusts dust</td>
<td>Cotton lint, wood flour, litho powder</td>
<td>2500 – 3000</td>
</tr>
<tr>
<td>Dry dusts and powders</td>
<td>Fine rubber dust, molding powder dust, jute lint, cotton dust, shavings (light), soap dust, leather shavings</td>
<td>3000 – 4000</td>
</tr>
<tr>
<td>Average industrial dusts</td>
<td>Grinding dust, buffing lint (dry), wool jute dust (shaker waste), coffee beans, shoe dust, granite dust, silica flour, general material handling, brick cutting, clay dust, foundry (general), limestone dust, packaging and weighing asbestos dust in textile industries</td>
<td>3500 – 4000</td>
</tr>
<tr>
<td>Heavy dusts</td>
<td>Sawdust (heavy and wet), metal turnings, foundry tumbling barrels and shake-out, sandblast dust, wood blocks, hog waste, brass turning, cast-iron boring dust, lead dust</td>
<td>4000 – 4500</td>
</tr>
<tr>
<td>Heavy or moist dusts</td>
<td>Lead dust with chips, moist cement dust, asbestos chunks from transite pipe cutting machines, buffing lint (sticky), quick-lime dust</td>
<td>4500 and up</td>
</tr>
</tbody>
</table>

For SI units: 1 foot per minute = 0.005 m/s
* Systems that are handling combustible particulate solids shall be in accordance with NFPA 654. Any desired velocity (economic optimum velocity usually within this range).

**506.3.1 Fire Barriers.** Exhaust ducts passing through a fire barrier having a fire resistance rating of 2 hours or more greater shall meet one of the following specifications:

1. Wrapped or encased with listed or approved materials having a fire resistance rating equal to the fire barrier for 10 feet (3048 mm) of the duct on each side of the fire barrier including duct supports within this span.
2. Constructed of materials and supports having a minimum fire resistance rating equal to the fire barrier.
3. Enclosed with a shaft that is constructed of material having a fire resistance rating equal to the fire barrier for 10 feet (3048 mm) of the duct on each side of the fire barrier with no inlets to the duct within this distance, and the duct entry into and exit from the shaft is protected in accordance with Section 506.3.2. [NFPA 91:4.2.12]

**506.8.1 Loads.** Duct supports shall be designed to carry the weight of the duct half filled with material. Where sprinkler protection is provided or cleaning of the duct will be performed, the hanger's design shall include the weight of any expected liquid accumulation. Duct supports shall be designed to prevent placing loads on connected equipment. [NFPA 91:4.6.1 – 4.6.3]

**506.8.2 Corrosion.** Hangers and supports exposed to corrosive atmospheres shall be corrosion resistant to the corrosive atmospheres. [NFPA 91:4.6.4]

**506.8.3 Vibration and Stress.** To avoid vibration and stress on the duct, hangers and supports shall be securely fastened to the building or structure. [NFPA 91:4.6.5]
506.10 Duct Clearances. Unless the conditions stipulated in Section 506.10.1 or Section 506.10.2 exist, all duct systems and system components shall have a clearance of at least 6 inches (152 mm) from stored combustible materials, and not less than 1/2 of an inch (13 mm) clearance from combustible construction. [NFPA 91:4.7.1]

506.10.2 Systems Conveying Combustible Materials. Unless the conditions stipulated in Section 506.10.3 exist, all duct systems and system components handling combustible materials shall have a clearance of not less than 18 inches (457 mm) from combustible materials construction or a combustible material construction. [NFPA 91:4.7.2]

506.11.2 Wool Batts Insulation. Mineral wool batts (blanket or board) shall have a minimum density of not less than 8 pounds per cubic feet (lb/ft$^3$) (128 kg/m$^3$) and have a minimum melting point of not less than 1500°F (816°C). [NFPA 91:4.7.4.3]

506.11.4 Duct and Thermal Shield. With all clearance reduction systems, not less than at least 1 inch (25.4 mm) clear space shall be provided between the duct and the thermal shield. [NFPA 91:4.7.4.5]

506.11.5 Thermal Shield and Combustible Surface. When using clearance reduction systems that include an air gap, not less than at least 1 inch (25.4 mm) clear space shall be provided between the thermal shield and the combustible surface. [NFPA 91:4.7.4.6]

507.4 Clearance. Where enclosures are not required, hoods, grease removal devices, exhaust fans, and ducts shall have a clearance of at least not less than 18 inches (457 mm) to combustible material, 3 inches (76 mm) to limited-combustible material, and 0 inches (0 mm) to noncombustible material. [NFPA 96:4.2.1]

507.4.1 Listed. Where a hood, duct, or grease removal device is listed for clearances less than those required in accordance with Section 507.4, the listing requirements shall be permitted. [NFPA 96:4.2.2]

507.4.2 Clearance Reduction. Where a clearance reduction system consisting of 0.013 of an inch (0.33 mm) (28 gauge) sheet metal spaced out 1 inch (25.4 mm) on noncombustible spacers is provided, there shall be a minimum of not less than 9 inches (229 mm) clearance to combustible material. [NFPA 96:4.2.3.1]

507.4.2.1 Mineral Wool Batts or Ceramic Fiber Blanket. Where a clearance reduction system consisting of 0.027 of an inch (0.686 mm) (22 gauge) sheet metal on 1 inch (25.4 mm) mineral wool batts or ceramic fiber blanket reinforced with wire mesh or equivalent spaced out 1 inch (25.4 mm) on noncombustible spacers is provided, there shall be not less than a minimum of 3 inches (76 mm) clearance to combustible material. [NFPA 96:4.2.3.2]

507.4.3 Clearance Integrity. In the event of damage, the material or product shall be repaired and restored to meet its intended listing or clearance requirements and shall be approved by acceptable to the Authority Having Jurisdiction. [NFPA 96:4.2.4.1]

507.4.3.1 Fire. In the event of a fire within a kitchen exhaust system, the duct and its enclosure (rated shaft, factory-built grease
duct enclosure, or field-applied grease duct enclosure) shall be inspected by qualified personnel to determine whether the duct and protection method are structurally sound, capable of maintaining their fire protection function, and in accordance compliance with this chapter for continued operation. [NFPA 96:4.2.4.2]

507.4.4.3 Installation. The factory-built grease duct protection system shall be installed in accordance with the manufacturer’s installation instructions and the listing requirements. [NFPA 96:4.3.3.3]

507.4.5 Field Applied. Field-applied grease duct enclosures shall be protected with a through penetration firestop system classified in accordance with ASTM E814 or UL 1479 having an “F” and a “T” rating equal to the fire resistance rating of the assembly being penetrated. The surface of the field fabricated grease duct shall be continuously covered on all sides from the point at which the duct enclosure penetrates a ceiling, wall, or floor to the outlet terminal. The field-applied grease duct shall be listed in accordance with ASTM E2336 and installed in accordance with the manufacturer’s installation instructions and the listing requirements. [NFPA 96:4.3.1 – 4.3.1.2]

507.4.8 Clearance Between Duct and Interior Surfaces. Clearances between the duct and interior surfaces of enclosures shall meet the requirements of Section 507.4. [NFPA 96:4.5]

507.5 Drawings. A drawing(s) of the exhaust system installation along with a copy copies of operating instructions for subassemblies and components used in the exhaust system, including electrical schematics, shall be on the premises. [NFPA 96:4.6]

507.6 Notification of Change. Where required by the Authority Having Jurisdiction, notification in writing shall be given of any alteration, replacement, or relocation of any exhaust, or extinguishing system or part thereof or cooking equipment. [NFPA 96:4.7]

Satisfaction shall be provided to the Authority Having Jurisdiction that the complete exhaust system as addressed in this chapter is installed and operable in accordance with the approved design and the manufacturer’s installation instructions.

508.3.1 Grease Vapor. Wall-mounted exhaust hood assemblies shall be tight fitting against the back wall so as to not permit passage of grease vapor behind the hood, or between the back wall and the hood assembly. [NFPA 96:5.1.13]

508.3.2 Seams, Joints, and Penetrations. All seams, joints, and penetrations of the hood enclosure that direct and capture grease-laden vapors and exhaust gases shall have a liquid-tight continuous external weld to the hood’s lower outermost perimeter. [NFPA 96:5.1.2]

Exceptions:
(1) Seams, joints, and penetrations of the hood shall be permitted to be internally welded, provided that the weld is formed smooth or ground smooth, so as to not trap grease, and is cleanable. [NFPA 96:5.1.3]
(2) Penetrations shall be permitted to be sealed by devices that are listed for such use and whose presence does not detract from the hood’s or duct’s structural integrity. [NFPA 96:5.1.5]

508.3.4 Insulation. Insulation materials other than electrical insulation shall have a flame spread index of not more than 25 or less, where tested in accordance with ASTM E84 or UL 723. Adhesives or cements used in the installation of insulating materials shall comply with the requirements of this section where tested with the specific insulating material. [NFPA 96:5.1.9, 5.1.10]

508.3.5 Exhaust Hood Assemblies with Integrated Supply-Air Plenums. The construction and size of exhaust hood assemblies with integrated supply air plenums shall comply with the requirements of Section 508.1 through Section 508.5. [NFPA 96:5.3.1]

508.3.5.1 Outer Shell. The construction of the outer shell or the inner exhaust shell shall comply with Section 508.1 through Section 508.3.4. [NFPA 96:5.3.2]

508.3.5.2 Actuating Temperature. The actuation device shall have a maximum temperature rating not to exceed of 286°F (141°C). [NFPA 96:5.3.4.3]

509.2 Installation. The distance between the grease removal device and the cooking surface shall be as great as possible but not less than 18 inches (457 mm). [NFPA 96:6.2.1.1]

509.2.2.2 Size and Location. The baffle plate shall be sized and located so that flames or combustion gases shall travel a distance not less than 18 inches (457 mm) from the heat source to the grease removal device. [NFPA 96:6.2.2.3]

510.1.1 Fire Hazards. All Ducts shall lead directly to the exterior of the building, so as not to unduly increase any fire hazard. [NFPA 96:7.1.2]

510.1.7 Type I Exhaust Duct Systems. Listed grease ducts shall be installed in accordance with the terms of their listings and the manufacturer’s instructions. [NFPA 96:7.1.7]

510.3.3.2 Safe Access and Work Platform. Where not easily accessible from a 10 foot (3048 mm) stepladder, openings on horizontal grease duct systems shall be provided with safe access and a work platform. [NFPA 96:7.4.1.3]

510.3.3.3 Support. Support systems for horizontal grease duct systems 24 inches (610 mm) and larger in any cross-sectional dimension shall be designed for the weight of the ductwork plus 800 pounds (362.9 kg) at any point in the duct systems. [NFPA 96:7.4.1.4]
510.3.4.1 Access. Where personnel entry is not possible, an adequate access for cleaning shall be provided on each floor. [NFPA 96:7.4.2.2]

510.3.7 Fire Protection System Devices. Openings for installation, servicing, and inspection of listed fire protection system devices and for duct cleaning shall be provided in ducts and enclosures and shall be in accordance with the requirements of Section 510.3 through Section 510.3.2 and Section 510.7.7. Enclosure openings required to reach access panels in the ductwork shall be large enough for removal of the access panel through the enclosure opening. [NFPA 96:7.4.4 7.4.4.1 – 7.4.4.2]

510.5.3 Installation. All seams, joints, penetrations, and duct-to-hood collar connections shall have a liquid-tight continuous external weld. [NFPA 96:7.5.2.1]

Exceptions:
1. Factory-built grease ducts listed in accordance with UL 1978 shall be permitted to incorporate nonwelded joint construction in accordance with their listings. [NFPA 96:7.5.2.1.1]
2. Duct-to-hood collar connections as shown in Figure 510.5.3 shall not require a liquid-tight continuous external weld. [NFPA 96:7.5.2.2]
3. Penetrations shall be permitted to be sealed by other listed devices that are tested to be greasetight and are evaluated under the same conditions of fire severity as the hood or enclosure of listed grease extractors and whose presence does not detract from the hood’s or duct’s structural integrity. [NFPA 96:7.5.2.3]
4. Internal welding shall be permitted, provided the joint is formed or ground smooth and is readily accessible for inspection. [NFPA 96:7.5.2.4]

510.5.3.1 Duct Leakage Test. Prior to the use of or concealment of any portion of a grease duct system, a leakage test shall be performed to determine that all welded joints and seams are liquid tight. [NFPA 96:7.5.2.1.2]

510.5.3.2 Welded Duct Connection. Acceptable duct-to-duct connection shall be as follows:
1. Telescoping joint, as shown in Figure 510.5.3.2(1).
2. Bell-type joint, as shown in Figure 510.5.3.2(2).
3. Flange with edge weld, as shown in Figure 510.5.3.2(3).
4. Flange with filled weld, as shown in Figure 510.5.3.2(4). [NFPA 96:7.5.5.1]

510.6.1 Weather Protection. All ducts shall be protected on the exterior by paint or other suitable weather-protective coating. Ducts constructed of stainless steel shall not be required to have additional paint or weather-protective coatings. Ductwork subject to corrosion shall have minimal contact with the building surface. [NFPA 96:7.6.4 – 7.6.6]

510.7.8 Ducts with Enclosure(s). Each duct system shall constitute an individual system serving only exhaust hoods in one fire zone on one floor. Multiple ducts shall not be permitted in a single enclosure unless acceptable to the Authority Having Jurisdiction. [NFPA 96:7.7.5.1 – 7.7.5.2]

510.9 Termination of Type I Hood Exhaust System. The exhaust system shall terminate as follows:
1. Outside the building with a fan or duct.
2. Through the roof or to the roof from outside, in accordance with Section 510.9.1, or through a wall, in accordance with Section 510.9.2. [NFPA 96:7.8.1]

510.9.1 Rooftop Terminations. Rooftop terminations shall be arranged with or provided with the following:
1. A minimum of 10 feet (3048 mm) of horizontal clearance from the outlet to adjacent buildings, property lines, and air intakes.
2. A minimum of 5 feet (1524 mm) of horizontal clearance from the outlet (fan housing) to any combustible structure.
3. A vertical separation of 3 feet (914 mm) above any air intakes within 10 feet (3048 mm) of the exhaust outlet.
4. The ability to drain grease out of any traps or low points formed in the fan or duct near the termination of the system into a collection container that is noncombustible, closed, rainproof, and structurally sound for the service to which it is applied and that will not sustain combustion.
5. A grease collection device that is applied to exhaust systems that does not inhibit the performance of any fan.
6. Listed grease collection systems that meet the requirements of Section 510.9.1(4) and Section 510.9.1(5).
7. A listed grease duct complying with Section 507.4.7 or ductwork complying with Section 507.4.8.
8. A hinged upblast fan supplied with flexible weatherproof electrical cable and service hold-open retainer to permit inspection and cleaning that is listed for commercial cooking equipment with the following conditions:
   a. Where the fan attaches to the ductwork, the ductwork is a minimum of 18 inches (457 mm) away from any roof surface, as shown in Figure 510.9.1.
   b. The fan discharges a minimum of 40 inches (1016 mm) away from any roof surface, as shown in Figure 510.9.1.
9. Other approved fan, provided it meets all of the following criteria:
   a. The fan meets the requirements of Section 510.9.1(3) and Section 511.1.3.
   b. Its discharge or its extended duct discharge meets the requirements of Section 510.9.1(2). (See Section 511.1.3)
   c. Exhaust fan discharge is directed up and away from the roof surface. [NFPA 96:7.8.2.1]

510.9.2 Wall Terminations. Wall terminations shall be arranged with or provided with the following properties:
1. The termination shall be through a noncombustible wall with not less than a minimum of 10 feet (3048 mm) of clearance from the outlet to adjacent buildings, property lines, grade level, combustible construction, electrical equipment or lines, and with the closest point of any air intake or operable door or window at or below the plane of the exhaust termination. The closest point of any air intake or operable door or window above the plane of the exhaust termination shall be not less than a minimum of 10 feet (3048 mm) away. [NFPA 96:7.8.2.1]
mm) in distance, plus 3 inches (76 mm) for each 1 degree (0.017 rad) from horizontal, the angle of degree being measured from the center of the exhaust termination to the center of the air intake, or operable door or window, as indicated in Figure 510.9.2.

**Exception:** A wall termination in a secured area shall be permitted to be at a lower height above grade **where if** acceptable to the Authority Having Jurisdiction.

2. The exhaust flow shall be directed perpendicularly outward from the wall face or upward.

3. **All** the ductwork shall be pitched to drain the grease back into the hood(s) or with a drain provided to bring the grease back into a container within the building or into a remote grease trap.

4. A listed grease duct shall comply with Section 510.3.3 through Section 510.3.7; other ducts shall comply with Section 510.5.

5. An approved fan shall **comply with** meet the requirements of Section 510.9.2(3), and Section 511.1.1 or Section 511.1.3. [NFPA 96:7.8.3]

**511.1 Upblast Fans.** Upblast fans with motors surrounded by the airstream shall be hinged and supplied with flexible weatherproof electrical cable, and service hold-open retainers. Installation shall conform to the requirements of Section 510.9. Upblast fans shall have a drain directed to a readily accessible and visible grease receptacle not to exceed 1 gallon (4 L). [NFPA 96:8.1.2.1 – 8.1.2.3]

**511.1.2.1 Accessibility.** Where if the design or positioning of the fan allows grease to be trapped, a drain directed to a readily accessible and visible grease receptacle not exceeding 1 gallon (4 L), shall be provided. In-line exhaust fans shall be located in easily accessible areas of adequate size to allow for service or removal. Where the duct system connected to the fan is in an enclosure, the space or room in which the exhaust fan is located shall have the same fire resistance rating as the enclosure. [NFPA 96:8.1.3.4 – 8.1.3.6]
511.1.2 Exhaust-Air Volumes. Exhaust air volumes for hoods shall be of sufficient level to provide for capture and removal of grease-laden cooking vapors. Test data, performance tests, approved by acceptable to the Authority Having Jurisdiction, or both shall be displayed, provided on request, or both. [NFPA 96:8.2.2.1, 8.2.2.2] Lower exhaust air volumes shall be permitted during no-load and partial load cooking conditions, provided they are sufficient to capture and remove flue gases and cooking effluent from cooking equipment.

511.4.2 Fire Damper. The bleed-air duct shall have a fire damper not less than at least 12 inches (305 mm) from the exhaust duct connection. [NFPA 96:8.4.3]

511.4.3 Construction and Clearance. The bleed-air duct shall have the same construction and clearance requirements as the main exhaust duct from the connection to the exhaust duct to not less than at least 12 inches (305 mm) on both sides of the fire damper. [NFPA 96:8.4.4]

513.1.2 Protection. Cooking equipment that produces grease-laden vapors and is capable of being that might be a source of ignition of grease in the hood, grease removal device, or duct shall be protected by fire-extinguishing equipment. [NFPA 96:10.1.2]

513.2.2 Standard. Automatic fire-extinguishing systems shall comply with UL 300 or other equivalent standards and shall be installed in accordance with the requirements of the listing. In existing dry or wet chemical systems not in accordance compliance with UL 300, the fire-extinguishing system shall be made in accordance to comply with this section where one when any of the following occurs:

(1) The cooking medium is changed from animal oils and fats to vegetable oils.
513.2.4 Modification of Existing Hood Systems. Any abandoned pipe or conduit from a previous installation shall be removed from within the hood, plenum, and exhaust duct. [NFPA 96:10.2.7.1]

513.2.4.2 Obstructions. The addition of obstructions to spray patterns from the cooking appliance nozzle(s) such as baffle plates, shelves, or any modification shall not be permitted. [NFPA 96:10.2.7.3]

513.4 Fuel and Electric Power Shutoff. Upon activation of any fire-extinguishing system for a cooking operation, all sources of fuel and electrical power that produce heat to all equipment requiring protection by that system shall automatically shut off. [NFPA 96:10.4.1]

Exception: Solid-fuel cooking operations.

513.4.1 Steam. Steam supplied from an external source shall not be required to automatically shut off. [NFPA 96:10.4.2]

513.4.2 Protection Not Required. Any gas appliance not requiring protection— but located under ventilating equipment where protected appliances are located, shall be automatically shut off upon activation of the extinguishing system. [NFPA 96:10.4.3]

514.1.3 Posting of Instructions. Instructions for manually operating the fire-extinguishing system shall be posted conspicuously in the kitchen and shall be reviewed with employees by the management. [NFPA 96:11.4.3]

514.5.1 Cleaning. Cooking equipment that collects grease below the surface, behind the equipment, or in cooking equipment flue gas exhaust, such as griddles or charbroilers, shall be inspected and, where if found with grease accumulation, cleaned by a properly trained, qualified, and certified person(s) acceptable to the Authority Having Jurisdiction. [NFPA 96:11.7.2]

515.1.1.3 Minimum Space. All deep-fat fryers shall be installed with not less than at least a 16 inch (406 mm) space between the fryer and surface flames from adjacent cooking equipment. [NFPA 96:12.1.2.4]

515.1.1.4 Space Not Required. Where a steel or tempered glass baffle plate is installed not less than at a minimum 8 inches (203 mm) in height between the fryer and surface flames of the adjacent appliance, the requirement for a 16 inch (406 mm) space shall not apply. [NFPA 96:12.1.2.5]

515.1.1.5 Minimum Height. If the fryer and the surface flames are at different horizontal planes, a the minimum height of not less than 8 inches (203 mm) shall be measured from the higher of the two. [NFPA 96:12.1.2.5.1]

516.2 Design Restrictions. All recirculating systems shall comply with the requirements of Section 516.2.1 through Section 516.2.9. [NFPA 96:13.2]

516.2.1 Gas/Electrically Fueled Cooking Appliances. Only gas-fueled or electrically fueled cooking appliances shall be used. Listed gas-fueled equipment designed for use with specific recirculating systems shall have the flue outlets connected in the intended manner. Gas-fueled appliances shall have not less than a minimum 18 inches (457 mm) of clearance from the flue outlet to the filter inlet in accordance with Section 509.2.2 through Section 509.2.2.3 and shall be in accordance with meet the installation requirements of NFPA 54 or NFPA 58. [NFPA 96:13.2.1 – 13.2.3]

516.2.3 Protection. Cooking appliances that require protection and that are under a recirculating hood shall be protected by either the integral fire protection system in accordance with UL 710B or a system in accordance with Section 513.0. [NFPA 96:13.2.4.2]

516.2.8 Power Supply. The power supply of any electrostatic precipitator (ESP) shall be of the “cold spark,” ferroresonant type in which the voltage falls off as the current draw of a short increases. [NFPA 96:13.2.11]

516.3 Interlocks. The recirculating system shall be provided with interlocks of critical components and operations as indicated in Section 516.3.1 through Section 516.3.3.1 such that, where if any of these interlock is are interrupted, the cooking appliance shall will not be able to operate. [NFPA 96:13.3.1]

516.3.1 Airflow Sections. All closure panels encompassing airflow sections shall have interlocks to ensure that the panels are in place and fully sealed. [NFPA 96:13.3.2]

516.4 Location and Application Restrictions. The location of recirculating systems shall be approved by the Authority Having Jurisdiction. Items to be reviewed in the fire risk assessment shall include, but not be limited to, life safety, combustibility of surroundings, proximity to air vents, and total fuel load. [NFPA 96:13.4.1 – 13.4.2]

516.5.1 Installation Downstream. In addition to any other fire-extinguishing system activation device, there shall be a fire-extinguishing system activation device installed downstream of any ESP. [NFPA 96:13.5.2]

516.6.1 Manufacturer’s Instructions. All filters shall be cleaned or replaced in accordance with the manufacturer’s instructions. [NFPA 96:13.6.2]
517.1.1 Natural Draft. Where solid-fuel cooking equipment is required by the manufacturer to have a natural draft, the vent shall comply with Section 517.4. [NFPA 96:14.1.1]

517.1.2 System Compliance. Where the solid-fuel cooking equipment has a self-contained top, is the appliance to be vented in an isolated space (except for a single water heater with its own separate vent), has a separate makeup air system, and is provided with supply and return air (not supplied or returned from other spaces), the system shall comply with Section 517.4 and Section 517.6. [NFPA 96:14.1.2]

517.1.3 Makeup Air System. Where the solid-fuel cooking equipment is located in a space with other vented equipment, the all vented equipment shall have an exhaust system interlocked with a makeup air system for the space in accordance with Section 517.6. [NFPA 96:14.1.3]

517.2 Location of Appliances. Every appliance shall be located with respect to building construction and other equipment so as to permit access to the appliance. [NFPA 96:14.2.1]

517.2.1 Prohibited Location. Solid-fuel cooking appliances shall not be installed in confined spaces. [NFPA 96:14.2.2] Exception: Solid-fuel cooking appliances listed for installation in confined spaces such as alcoves shall be installed in accordance with the terms of the listing and the manufacturer’s installation instructions. [NFPA 96:14.2.3]

517.2.2 Flammable Vapors. Solid-fuel cooking appliances shall not be installed in any location where gasoline or any other flammable vapors or gases are present. [NFPA 96:14.2.4]

517.3 Hoods for Solid-Fuel Cooking. Hoods shall be sized and located in a manner capable of capturing and containing all the effluent discharging from the appliances. The hood and its exhaust system shall comply with the provisions of Section 508.0 through Section 513.0. [NFPA 96:14.3.1, 14.3.2]

517.3.1 Separation. Except as permitted in Section 517.3.1.1, exhaust systems serving solid-fuel cooking equipment, including gas or electrically operated equipment, shall be separate from all other exhaust systems. [NFPA 96:14.3.3] Exception: Cooking equipment not requiring automatic fire-extinguishing equipment (in accordance with Section 513.0) shall be permitted to be installed under a common hood with solid-fuel cooking equipment that is served by a duct system separate from all other exhaust systems. [NFPA 96:14.3.5]

517.4 Exhaust Systems for Solid-Fuel Cooking. Where a hood is not required, in buildings where the duct system is three stories or less in height, a duct complying with Section 510.0 shall be provided. [NFPA 96:14.4]

517.4.1 Hood. Where a hood is used in buildings where the duct system is three stories or less in height, the duct system shall comply with Section 510.0. [NFPA 96:14.4.1]

517.4.2 Building Exceeding Four Stories. A listed or approved grease duct system that is four stories in height or greater shall be provided for solid-fuel cooking exhaust systems. [NFPA 96:14.4.2]

517.4.3 Prohibited. Wall terminations of solid-fuel exhaust systems shall be prohibited. [NFPA 96:14.4.4]

517.5 Spark Arrester Devices. Where airborne sparks and embers can be generated by the solid fuel cooking operation, spark arrester devices shall be used prior to using the grease removal device, to minimize the entrance of these sparks and embers into the grease removal device and into the hood and the duct system. [NFPA 96:14.5.2]

517.5.2 Filters. Filters shall be not less than a minimum of 4 feet (1219 mm) above the appliance cooking surface. [NFPA 96:14.5.3]

517.6 Replacement Air. A replacement or makeup air system shall be provided to ensure a positive supply of replacement air at all times during cooking operations. [NFPA 96:14.6.2]

517.6.2 Operation. Makeup air systems serving solid-fuel cooking operations shall be interlocked with the exhaust air system and powered, where necessary, to prevent the space from attaining a negative pressure while the solid-fuel appliance is in operation. [NFPA 96:14.6.3]

517.7 Fire-Extinguishing Equipment for Solid-Fuel Cooking. Solid-fuel cooking appliances that produce grease-laden vapors shall be protected by listed fire-extinguishing equipment. Exception: Where acceptable to the Authority Having Jurisdiction, solid-fuel cooking appliances constructed of solid masonry or reinforced Portland or refractory cement concrete and vented in accordance with NFPA 211 shall not require fixed automatic fire-extinguishing equipment. [NFPA 96:14.7.1, 14.7.2]

517.7.1 Grease Removal Devices, Hoods, and Duct Systems. Listed fire-extinguishing equipment shall be provided for the protection of grease removal devices, hoods, and duct systems. [NFPA 96:14.7.3] Exception: Where acceptable to the Authority Having Jurisdiction, solid-fuel cooking appliances constructed of solid masonry or reinforced Portland or refractory cement concrete and vented in accordance with NFPA 211 shall not require automatic fire-extinguishing equipment for the protection of grease removal devices, hoods, and duct systems. [NFPA 96:14.7.4]

517.7.2 Listed Fire-Extinguishing Equipment. Listed fire-extinguishing equipment for solid-fuel-burning cooking appliances, where required, shall comply with Section 513.0 and shall use water-based agents. [NFPA 96:14.7.5]

517.7.3 Rating and Design. The fire-extinguishing equipment shall be rated and designed to extinguish solid-fuel cooking fires. The fire-extinguishing equipment shall be of sufficient size to totally extinguish fire in the entire hazard area and prevent reignition of the fuel. [NFPA 96:14.7.6, 14.7.7]

517.7.4 Listing/Class. All solid fuel appliances (whether or not under a hood or not) with fireboxes of 5 cubic feet (0.14 m³) volume or less shall have not less than a listed 2-A rated water-spray fire extinguisher or a 1.6 gallon (6.1 L) wet chemical fire extinguisher listed for Class K fires in accordance with NFPA 10 with a maximum travel distance of not more than 20 feet (6096 mm) to the appliance. [NFPA 96:14.7.8]

517.7.5 Fixed-Water Pipe System. Solid fuel appliances with fireboxes exceeding 5 cubic feet (0.14 m³) shall be provided with a
fixed-water pipe system with a hose in the kitchen capable of reaching the firebox. The hose shall be equipped with an adjustable nozzle capable of producing a fine to medium spray or mist. The nozzle shall be of the type that cannot produce a straight stream. The system shall have a minimum operating pressure of not less than 40 psi (276 kPa) and shall provide not less than a minimum of 5 gallons per minute (gpm) (0.3 L/s). [NFPA 96:14.7.9.1 – 14.7.9.2]

517.7.7 Auxiliary Fuel. In addition to the requirements of Section 517.7.4, Section 517.7.5 and Section 517.8, where any solid-fuel cooking appliance is also provided with auxiliary electric, gas, oil, or other fuel for ignition or supplemental heat and the appliance is also served by any portion of a fire-extinguishing system in accordance complying with Section 513.0, such auxiliary fuel shall be shut off up on actuation of the fire-extinguishing system. [NFPA 96:14.7.11]

517.8.1 Site-Built Solid Fuel Cooling Appliances. Site-built solid-fuel cooking appliances shall be submitted for approval to the Authority Having Jurisdiction before being considered for installation. All units submitted to the Authority Having Jurisdiction shall be installed, operated, and maintained in accordance with the approved terms of the manufacturer’s instructions and any additional requirements in accordance with set forth by the Authority Having Jurisdiction. [NFPA 96:14.9.4.3.1 – 14.9.4.3.2]

518.0 Downdraft Appliances.
518.1 General. A downdraft appliance ventilation system containing, or for use with appliances used in processes that produce, producing smoke or grease-laden vapors shall be equipped with components that are in accordance complying with the following:
1) The clearance requirements in accordance with of Section 507.4.
2) The primary collection means designed for collecting cooking vapors and residues in accordance complying with the requirements of Section 508.0.
3) Grease removal devices that comply complying with Section 509.0.
4) Special-purpose filters as listed in accordance with UL 1046.
5) Exhaust ducts that comply complying with Section 510.0.
6) The air movement requirements in accordance with of Section 511.2.1 and Section 511.2.2.
7) Auxiliary equipment (such as particulate and odor removal devices) are in accordance complying with Section 512.0.
8) Fire-extinguishing equipment that is in accordance complying with the requirements of Section 513.0, and as specified in Section 518.3.
9) The use and maintenance requirements in accordance with of Section 514.0.
10) The minimum safety requirements in accordance with of Section 515.0. [NFPA 96:15.1.2]

518.2 Ventilation System. The downdraft appliance ventilation system shall be capable of capturing and containing all the effluent discharge from the appliance(s) it is serving. [NFPA 96:15.1.2]

518.3.1 Integral Fire-Extinguishing System. A listed downdraft appliance ventilation system employing an integral fire-extinguishing system including detection systems that has been evaluated for grease and smoke capture, fire extinguishing, and detection shall be considered to be in accordance as complying with Section 518.3. [NFPA 96:15.2.1]

518.3.2 Interlocks. The downdraft appliance ventilation system shall be provided with interlocks such that the cooking fuel supply will not be activated unless the exhaust and supply air systems have been activated. [NFPA 96:15.2.2]

518.4.1 Interlocks. The airflow switch or transducer shall open the interlock circuit when the airflow is less than falls 25 percent below the system’s normal operating flow or less than 10 percent its listed minimum rating, whichever is less lower. [NFPA 96:15.3.2]

518.5 Surface Materials. Any surfaces located directly above the cooking appliance shall be of noncombustible or limited-combustible materials. [NFPA 96:15.4]

SUBSTANTIATION:
In accordance with IAPMO’s Regulations Governing Committee Projects (Extract Guidelines), the above sections are being revised to the latest edition of NFPA 96-2017.
Item #: 045

UMC 2021  Section: 601.1

SUBMITTER: Christopher Jensen  
UL LLC

RECOMMENDATION:
Revise text

601.0 General.
601.1 Applicability. Ducts and plenums that are portions of a heating, cooling, ventilation, or exhaust system shall comply with the requirements of this chapter, except as specified otherwise in Chapters 5 and 7.

SUBSTANTIATION:
Chapters 5 and 7 have specific requirements for specific types of ducts, such as grease ducts, product-conveying ducts, combustion air ducts, and laundry exhaust ducts. These specific requirements are critical for addressing the associated hazards involved with those types of systems. Several of the requirements included in Chapter 6 are not applicable to those installations, and, if followed, would result in an unsafe installation.

COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
The proposed change is not necessary as there are sections in Chapter 5 that require compliance with Chapter 6.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS:  AFFIRMATIVE: 23  NEGATIVE: 2  NOT RETURNED: 1  HOWARD

EXPLANATION OF NEGATIVE:

HYDE: I believe this clarification would further clarify that the duct construction identified within Chapter 6 does not take precedence over duct construction identified in Chapters 5 and 7.

KOERBER: Adding this language would provide clarity between the applicable requirements in Chapters 5, 6, and 7.

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Appended Comments

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PUBLIC COMMENT 1

Code Year: 2021 UMC  Section #: 601.1

SUBMITTER: Michael Hyde  
State of Idaho - Division of Building Safety

RECOMMENDATION:
Revise text

Request to replace the code change proposal by this public comment.
601.1 Applicability. Ducts and plenums that are portions of a heating, cooling, ventilation, or exhaust system shall comply with the requirements of this chapter and Chapter 5.

SUBSTANTIATION:
This modification will add “Chapter 5” to the applicable requirements for ducts and plenums as Chapter 5 provides specific requirements for specific ducts, such as grease ducts, product-conveying ducts, combustion air ducts, and laundry exhaust ducts.

PUBLIC COMMENT 2
Code Year: 2021 UMC Section #: 601.1 Item #: 045
SUBMITTER: Ralph Koerber ATCO Rubber Products, Inc.
Rep: Air Duct Council Comment #: 2
RECOMMENDATION:
Revise text
Request to accept the code change proposal as submitted by this public comment.

SUBSTANTIATION:
The current language in Section 601.1 indicates that ducts and plenums for heating, cooling, ventilation, and exhaust systems shall comply with Chapter 6 while specific sections in Chapters 5 and 7 for ducts serving unique ventilation and exhaust conditions have additional and/or conflicting requirements.

Revising the text to include this exception clarifies the intention for each chapter to be reviewed to ascertain the appropriate requirements specific to the duct system in question. Just as Chapter 5 refers back to Chapter 6 where appropriate, Chapter 6 should reciprocate. Chapter 7 should also be referenced for specific requirements for combustion air ducts that differ from Chapter 6.

This revision would bring clarity to the code sections.
Item #: 046
UMC 2021 Section: 601.2, Table 1701.1

SUBMITTER: David C. Bixby
Air Conditioning Contractors of America

RECOMMENDATION:
Revise text

601.0 General.

601.2 Sizing Requirements. Duct systems shall be sized in accordance with ACCA Manual D listed in Table 1701.1, or by other approved methods; zoned duct systems shall also comply with ACCA Manual Zr.

<table>
<thead>
<tr>
<th>STANDARD NUMBER</th>
<th>STANDARD TITLE</th>
<th>APPLICATION</th>
<th>REFERENCED SECTION</th>
</tr>
</thead>
</table>

(portion of table not shown remains unchanged)

Note: ACCA Manual Zr is a working draft and is not completed at the time of this monograph.

SUBSTANTIATION:
Currently there is no coverage in the UMC to address the design of zoned duct systems. ACCA Manual Zr provides procedures for designing zoned comfort systems for single family detached homes, duplex and triplex homes, row houses, town houses, and large multi-family structures that are compatible with ACCA Manual J procedures for residential load calculations. In addition, use of Manual Zr will avoid the potential for an improperly designed zoned duct system to adversely impact the safe operation and durability of the heating/cooling equipment. For code officials, Manual Zr has three normative sections to determine clear compliance. Manual Zr is also a consensus-based ANSI standard.

The addition of ACCA Manual Zr is needed to support its proposed reference as a new requirement under 601.2. Manual Zr is a consensus-based ANSI standard that meets the requirements for mandatory reference standards in accordance with Section 3-3.7.1 of IAPMO’s Regulations Governing Projects.

COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
The proposal is being rejected as ACCA Manual Zr is a working draft and is not completed at the time of this monograph.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 24 NEGATIVE: 1 NOT RETURNED: 1 HOWARD

EXPLANATION OF NEGATIVE:
HYDE: I believe this Standard should be a referenced standard in conjunction with ACCA Manual D for all residential duct design systems that choose to “zone” their systems.
PUBLIC COMMENT 1

Code Year: 2021 UMC  Section #: 601.2  Item #: 046

SUBMITTER: David C. Bixby
Air Conditioning Contractors of America

RECOMMENDATION: Revise text

Request to replace the code change proposal by this public comment.

601.2 Sizing Requirements. Duct systems shall be sized in accordance with applicable standards in Chapter 17 or by other approved methods.

   Exception: Residential duct systems shall be sized in accordance with ACCA Manual D listed in Table 1701.1, or by other approved methods; zoned duct systems shall also comply with ACCA Manual Zr.

   TABLE 1701.1
   REFERENCED STANDARDS

<table>
<thead>
<tr>
<th>STANDARD NUMBER</th>
<th>STANDARD TITLE</th>
<th>APPLICATION</th>
<th>REFERENCED SECTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACCA Manual Zr-2018</td>
<td>Residential Zoning</td>
<td>Ducts</td>
<td>601.2</td>
</tr>
</tbody>
</table>

(portion of table not shown remains unchanged)

Note: ACCA Manual Zr meets the requirements for mandatory reference standards in accordance with Section 3-3.7.1 of IAPMO's Regulations Governing Committee Projects.

SUBSTANTIATION:
ACCA Manual Zr, Residential HVAC System Zoning, was approved by ANSI on February 7, 2018 and published in April 2018. The final published version is identical to the draft submitted in our original proposal, and a copy was submitted to IAPMO staff with our public comment.

It should be noted that the 2018 edition of Manual Zr is formatted the same as ACCA Manual J (load calculations), Manual D (duct design), and Manual S (equipment selection & sizing), which are all currently referenced in the UMC. Like those referenced documents, Manual Zr contains upfront “Normative code language” sections which provide the necessary requirements in a format that is code-enforceable.

In addition, Manual Zr contains specific requirements for designing and installing a zone system which utilize zone dampers, including how the system handles excess air created when zone dampers close, for example. These zoning requirements are not found in ACCA Manual D for duct design and sizing and are exclusive to Manual Zr.

Furthermore, there is no need to mention in the body of the code that a standard is listed in the tables in Chapter 17 so it is, therefore, being stricken. This is already implied since all standards need to be listed in the Chapter 17 tables. Lastly, add ACCA Manual Q to Table 1701.1.

PUBLIC COMMENT 2

Code Year: 2021 UMC  Section #: Appendix A  Item #: 046

SUBMITTER: David Bixby
Air Conditioning Contractors of America (ACCA)

RECOMMENDATION: Revise text

Request to accept the code change proposal as modified by this public comment.
Residential Plans Examiner Review Form for HVAC System Design (Loads, Equipment, Ducts)

Contractor ________________________________

Mechanical License # ________________________________

Building Plan # ________________________________

Home Address (Street or Lot#, Block, Subdivision) ________________________________

REQUIRED ATTACHMENTS

Manual JB Form (and supporting worksheets):

or ASHRAE Form (and supporting worksheets):

OEM performance data (heating, cooling, blower):

Manual D Friction Rate Worksheet:

Duct distribution system sketch:

ATTACHED

Yes ☐ No ☐

Yes ☐ No ☐

Yes ☐ No ☐

Yes ☐ No ☐

Yes ☐ No ☐

HVAC LOAD CALCULATION (See Section 1105.1)

Design Conditions

Winter Design Conditions

Outdoor temperature ______ °F

Indoor temperature ______ °F

Total heat loss ______ Btu

Summer Design Conditions

Outdoor temperature ______ °F

Indoor temperature ______ °F

Grains difference ______ ΔGr @ ______ % Rh

Sensible heat gain ______ Btu

Latent heat gain ______ Btu

Total heat gain ______ Btu

Building Construction Information

Building

Orientation (Front door faces)

North, East, West, South, Northeast, Northwest, Southeast, Southwest

Number of bedrooms ______

Conditioned floor area ______ Sq Ft

Number of occupants ______

Windows

Eave overhang depth ______ Ft

Internal shade

Blinds, drapes, etc.

Number of skylights ______

HVAC EQUIPMENT SELECTION

Heating Equipment Data

Equipment type

Furnace, Heat pump, Boiler, etc.

Model ________________________________

Heating output capacity ______ Btu

Heat pumps - capacity at winter design outdoor conditions

Auxiliary heat output capacity ______ Btu

Cooling Equipment Data

Equipment type

Air Conditioner, Heat pump, etc.

Model ________________________________

Sensible cooling capacity ______ Btu

Latent cooling capacity ______ Btu

Total cooling capacity ______ Btu

Blower Data

Heating CFM ______ CFM

Cooling CFM ______ CFM

Static pressure ______ IWC

Fan's required external-static pressure for design airflow

HVAC DUCT DISTRIBUTION SYSTEM DESIGN (See Section 601.2)

Design airflow ______ CFM

Longest supply duct: ______ Ft

External Static Pressure (ESP) ______ IWC

Longest return duct: ______ Ft

Component Pressure Losses (CPL) ______ IWC

Total Effective Length (TEL) ______ Ft

Duct Materials Used (circle)

Branch Duct: Duct board, Flex, Sheet metal, Lined sheet metal, Other (specify)

100
SUBSTANTIATION:
This change will update the ACCA Residential Plans Examiner Review form to the latest version. A digital version of the form can be located at the following link:
Item #: 048
UMC 2021 Section: 601.2, 902.1, 1105.1, 1302.3

SUBMITTER: David Dias
Sheet Metal Workers Local 104

RECOMMENDATION:
Revise text

601.0 General.

601.2 Sizing Requirements. Duct systems shall be sized in accordance with ACCA Manual D listed in Table 1701.1, or by other approved methods.

Exception:
Residential duct systems shall be sized in accordance with ACCA Manual D listed in Table 1701.1, or by other approved methods.

902.0 General.
902.1 Nonindustrial Appliance. This chapter is applicable primarily to nonindustrial-type appliances and installations and, unless specifically indicated, does not apply to industrial-type appliances and installations. Listed appliances shall be installed in accordance with their listing and the manufacturer’s installation instructions or, as elsewhere specified in this chapter, as applicable to the appliance. Unlisted appliances shall be installed as specified in this part as applicable to the appliances. For additional information concerning particular appliances and accessories, including industrial types, reference can be made to the standards listed in Chapter 17.

1105.0 General Requirements.
1105.1 Human Comfort. Cooling systems used for human comfort shall be in accordance with the return-air and outside-air provisions for furnaces in Section 904.7 and Section 904.8. Cooling equipment used for human comfort in dwelling units shall be selected to satisfy the calculated loads determined in accordance with the reference standards in Chapter 17 or other approved methods. Refrigerants used for human comfort shall be in accordance with Section 1104.6.

1302.0 Coverage of Piping System.

1302.3 Applications. This code shall not apply to the following items (reference standards for some of which appear in Chapter 17):

(remaining text unchanged)

SUBSTANTIATION:
In the 2018 edition of the UMC, Table 1701.1 has been split into two separate tables. Therefore, the existing reference to those tables must be revised to provide the proper standard for the applications. Section 601.2, Section 902.1, 1105.1, and Section 1302.3 are being revised to remove the reference to Table 1701.1 as it is unnecessary. All standards referenced in the body of the code are listed in Table 1701.1.

COMMITTEE ACTION: ACCEPT AS AMENDED BY THE TC

Amend proposal as follows:

601.0 General.

601.2 Sizing Requirements. Duct systems shall be sized in accordance with applicable standards in Chapter 17 ACCA Manual D or by other approved methods.

Exception: Residential duct systems shall be sized in accordance with ACCA Manual D listed in Table 1701.1, or by other approved methods.

902.0 General.
902.1 Nonindustrial Appliance. This chapter is applicable primarily to nonindustrial-type appliances and installations and, unless specifically indicated, does not apply to industrial-type appliances and installations. Listed appliances shall be installed in accordance with their listing and the manufacturer’s installation instructions or, as elsewhere specified in this chapter, as applicable to the appliance. Unlisted appliances shall be installed as specified in this part as applicable to the appliances.

1105.0 General Requirements.
1105.1 Human Comfort. Cooling systems used for human comfort shall be in accordance with the return-air and outside-air provisions for furnaces in Section 904.7 and Section 904.8. Cooling equipment used for human comfort in dwelling units shall be selected to satisfy the calculated loads determined. Refrigerants used for human comfort shall be in accordance with Section 1104.6.

1302.0 Coverage of Piping System.

1302.3 Applications. This code shall not apply to the following items:

(remaining text unchanged)

COMMITTEE STATEMENT:
The modification clarifies the intent of the code in regards to residential unit duct systems that are sized to ACCA Manual D.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 25 NOT RETURNED: 1 HOWARD

Appended Comments

PUBLIC COMMENT 1: (Assembly Action)

Code Year: 2021 UMC Section #: 302.1.2 Item #: 048

SUBMITTER: David Mann Self Comment #: 1

RECOMMENDATION: Revise text

Request to accept the code change proposal as modified by this public comment.

302.0 Materials – Standards and Alternates.

302.1 Minimum Standards. (remaining text unchanged)

302.1.2 Standards. Standards listed or referred to in this chapter or other chapters cover materials that will conform to the requirements of this code, where used in accordance with the limitations imposed in this or other chapters thereof and their listing. Where a standard covers materials of various grades, weights, quality, or configurations, the portion of the listed standard that is applicable shall be used. Design and materials for special conditions or materials not provided for herein shall be permitted to be used by special permission of the Authority Having Jurisdiction after the Authority Having Jurisdiction has been satisfied as to their adequacy. A list of mechanical standards that appear in specific sections of this code is referenced in Table 1701.1. Standards referenced in Table 1701.1 shall be applied as indicated in the applicable referenced section. A list of additional approved standards, publications, practices and guides that are not referenced in specific sections of this code appear in Table 1701.2. The documents indicated in Table 1701.2 shall be permitted in accordance with Section 302.2.

SUBSTANTIATION:
Section 302.1.2 is being revised as the action taken on Item # 048 (Section 601.2) contradicts with Section 302.1.2. Furthermore, the revision allows the end user to use an applicable approved standard in Table 1701.2. The proposed modification will prevent confusion in the field and will prevent contradictions within the UMC. Section 302.1.2 must be revised as the approved standards in Table 1701.2 can be used, where applicable, without additional approval in accordance with Section 302.2.
Item #: 049

UMC 2021 Section: 602.2, Table 1701.1

SUBMITTER: Christopher Jensen
UL LLC

RECOMMENDATION:
Add new text

602.0 Material.

602.2 Combustibles Within Ducts or Plenums. (remaining text unchanged)

**602.2.6 Plastic Piping and Tubing in Plumbing Systems.** Plastic piping and tubing used in plumbing systems shall be permitted to be used within a plenum if it exhibits a flame spread index of 25 or less and a smoke developed index of 50 or less when tested in accordance with ASTM E84 or UL 723, at full width of the tunnel and with no water or any other liquid in the pipe during the test, unless otherwise permitted by Section 602.2.6.1. [NFPA 90A 4.3.11.5.5.7]

**602.2.6.1 Plastic Water Distribution Piping and Tubing.** Plastic water distribution piping and tubing listed as having a maximum peak optical density of 0.5 or less, an average optical density of 0.15 or less, and a maximum flame spread distance of 5 ft (1.5 m) or less when tested in accordance with UL 2846, and installed in accordance with its listing, shall be permitted to be used within a plenum. [NFPA 90A 4.3.11.5.5.8]

<table>
<thead>
<tr>
<th>STANDARD NUMBER</th>
<th>STANDARD TITLE</th>
<th>APPLICATION</th>
<th>REFERENCED SECTIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASTM E84-2016</td>
<td>Surface Burning Characteristics of Building Materials</td>
<td>Miscellaneous</td>
<td>508.3.4, 602.2, 602.2.6, 604.1.2, 1201.2</td>
</tr>
<tr>
<td>UL 723-2008</td>
<td>Test for Surface Burning Characteristics of Building Materials (with revisions through August 12, 2013)</td>
<td>Miscellaneous</td>
<td>508.3.4, 602.2, 602.2.6, 604.1.2, 1201.2</td>
</tr>
<tr>
<td>UL 2846-2014</td>
<td>Fire Test of Plastic Water Distribution Plumbing Pipe for Visible Flame and Smoke Characteristics (with revisions through December 20, 2016)</td>
<td>Miscellaneous</td>
<td>602.2.6.1</td>
</tr>
</tbody>
</table>

(portion of table not shown remains unchanged)

Note: ASTM E84, UL 723, and UL 2846 meet the requirements for mandatory reference standards in accordance with Section 3-3.7.1 of IAPMO’s Regulations Governing Committee Projects.

SUBSTANTIATION:
The 2018 edition of NFPA 90A, Standard for the Installation of Air-Conditioning and Ventilating Systems, which is an ANSI standard, provides specific requirements for the installation in plenums for plastic piping and tubing used in plumbing systems. NFPA 90A also permits the installation of plastic water distribution piping and tubing in plenums, where tested in accordance with UL 2846. This proposal is a direct extract from NFPA 90A.

UL 2846 is an ANSI standard that includes a test method for determining values of flame propagation distance and optical...
smoke density for individual pairs of plastic plumbing pipes for distribution of potable water that can be installed in ducts, plenums, and other spaces used for environmental air.
The scope of this standard can be viewed at http://ulstandards.ul.com/standard/?id=2846. The acceptance criteria specified (peak optical density not greater than 0.50, an average optical density not greater than 0.15, and a flame spread distance not greater than 5 feet) is consistent with values in Sections 602.2.1, 602.2.2 and 602.2.3.

COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
The proposed change is being rejected based on the action taken on Item # 051. Furthermore, the proposed language addresses requirements that belong in a standard rather than in the code.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 20  NEGATIVE: 5  NOT RETURNED: 1  HOWARD

EXPLANATION OF NEGATIVE:

CUDAHY: While I prefer the approach in Item # 050, at least this introduces UL 2846. Vote to overturn Item # 050.

EGG: It seems the new language improves the code.

KOERBER: I believe this proposal, placing into the code, the requirements from the NFPA standard makes sense.

MACNEVIN: The proposed new language improves the code. UL 2846 is the most appropriate test method for plastic pipes for mechanical or plumbing applications. This proposal accurately adds reference to UL 2846, and includes appropriate requirements for safe installation of these materials within plenums.

A. TRAFTON: The new language improves the code.

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**Appended Comments**

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**PUBLIC COMMENT 1**

**Code Year:** 2021 UMC  **Section #:** 602.2(5), 602.2.5, Table 1701.1  **Item #:** 049

**SUBMITTER:** Christopher Jensen  
UL LLC  **Comment #:** 1

**RECOMMENDATION:**

Revise text

Request to replace the code change proposal by this public comment.

**602.0 Material.**

**602.2 Combustibles Within Ducts or Plenums.** Materials exposed within ducts or plenums shall be noncombustible or shall have a flame spread index not to exceed 25 and a smoke-developed index not to exceed 50, where tested as a composite product in accordance with ASTM E84 or UL 723. Plastic piping installed in plenums shall be tested in accordance with all requirements of ASTM E84 or UL 723. Mounting methods, supports and sample sizes of materials for testing that are not specified in ASTM E84 or UL 723 shall be prohibited.

**Exceptions:**

(1) - (4) (remaining text unchanged)

(5) Products listed and labeled for installation within plenums in accordance with Section 602.2.1 through 602.2.3 602.2.5.

(6) - (8) (remaining text unchanged)

**602.2.5 Plastic Water Distribution Piping and Tubing.** Plastic water distribution piping and tubing listed as having a maximum peak optical density of 0.5 or less, an average optical density of 0.15 or less, and a maximum flame spread distance of 5 ft (1524 mm) or less when tested in accordance with UL 2846, and installed in accordance with its listing, shall be permitted to be used within a raised floor plenum. [NFPA 90A:4.3.11.5.5.8]
### TABLE 1701.1
**REFERENCED STANDARDS**

<table>
<thead>
<tr>
<th>STANDARD NUMBER</th>
<th>STANDARD TITLE</th>
<th>APPLICATION</th>
<th>REFERENCED SECTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>UL 2846-2014</td>
<td>Fire Test of Plastic Water Distribution Plumbing Pipe for Visible Flame and Smoke Characteristics (with revisions through December 20, 2016)</td>
<td>Miscellaneous</td>
<td>602.2.5</td>
</tr>
</tbody>
</table>

(portion of table not shown remain unchanged)

**Note:** UL 2846 meets the requirements for mandatory reference standards in accordance with Section 3-3.7.1 of IAPMO's Regulations Governing Committee Projects.

**SUBSTANTIATION:**
The original proposal is being modified to reflect the committee action taken on Proposal Item # 051. The action that the committee took on Proposal Item # 051 addressed plastic piping when tested in accordance with ASTM E84 and UL 723; however, did not fully address water distribution piping and tubing when tested and listed in accordance with UL 2846. The UMC already addresses other materials used in plenums tested to specific methods, such as electrical wiring and cables to NFPA 262, non-metallic fire sprinkler piping to UL 1887, pneumatic tubing to UL 1820, and discrete products to UL 2043. These specific methods address the unique nature of these different materials and intended installations. Similarly, UL 2846 specifically addresses individual pairs of plastic plumbing pipes for distributions of potable water. As directed several times by the committee that specific requirements should be addressed in a standard rather than a code, UL 2846 was developed under ANSI consensus process to determine values of flame propagation distance and optical smoke density for individual pairs of plastic plumbing pipes for distribution of potable water that can be installed in ducts, plenums, and other spaces used for environmental air.

The acceptance criteria specified (a flame spread distance not greater than 5 feet, peak optical density not greater than 0.50, and an average optical density not greater than 0.15) is consistent with values in Sections 602.2.1, 602.2.2 and 602.2.3. Furthermore, the language used in this proposal is a direct extract from NFPA 90A.

This modified proposal will introduce UL 2846 as a permitted method for evaluating plastic water distribution piping and tubing.

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**PUBLIC COMMENT 2**

**Code Year:** 2021 UMC  **Section #:** 602.2.5, Table 1701.1  **Item #:** 049

**SUBMITTER:** Ralph Koerber  
ATCO Rubber Products, Inc.  
Rep: Air Duct Council  
**Comment #:** 2

**RECOMMENDATION:**
Add new text

Request to replace the code change proposal by this public comment.

**602.0 Material.**

**602.2 Combustibles Within Ducts or Plenums.** (remaining text unchanged)

**602.2.5 Plastic Water Distribution Piping and Tubing.** Plastic water distribution piping and tubing listed as having a maximum peak optical density of 0.5 or less, an average optical density of 0.15 or less, and a maximum flame spread distance of 5 ft (1524 mm) or less when tested in accordance with UL 2846, and installed in accordance with its listing, shall be permitted to be used within a raised floor plenum. [NFPA 90A:4.3.11.5.5.8]
## TABLE 1701.1
**REFERENCED STANDARDS**

<table>
<thead>
<tr>
<th>STANDARD NUMBER</th>
<th>STANDARD TITLE</th>
<th>APPLICATION</th>
<th>REFERENCED SECTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>UL 2846-2014</td>
<td>Fire Test of Plastic Water Distribution Plumbing Pipe for Visible Flame and Smoke Characteristics (with revisions through December 20, 2016)</td>
<td>Miscellaneous</td>
<td>602.2.5</td>
</tr>
</tbody>
</table>

(portion of table not shown remains unchanged)

**Note:** UL 2846 meets the requirements for mandatory reference standards in accordance with Section 3-3.7.1 of IAPMO's Regulations Governing Committee Projects.

**SUBSTANTIATION:**

The UMC TC rejected this proposal in favor of accepting Item # 051. I voted in favor of accepting Item # 049 as submitted; however, the portion of Item # 049 referencing Plastic Water Distribution Piping and Tubing tested to UL 2846 should at least be reconsidered here or as Item # 050.

The 2018 edition of NFPA 90A permits the installation of plastic water distribution piping and tubing in plenums, where tested in accordance with UL 2846. UL 2846 is an ANSI standard that includes a test method for determining values of flame propagation distance and optical smoke density for individual pairs of plastic plumbing pipes for distribution of potable water that can be installed in ducts, plenums, and other spaces used for environmental air. The acceptance criteria specified (peak optical density not greater than 0.50, an average optical density not greater than 0.15, and a flame spread distance not greater than 5 feet) is consistent with values in Section 602.2.1, Section 602.2.2 and Section 602.2.3.
Item #: 050

UMC 2021 Section: 602.2, Table 1701.1

SUBMITTER: Michael Cudahy
Plastic Pipe and Fittings Association (PPFA)

RECOMMENDATION:
Add new text

602.0 Material.

602.2 Combustibles Within Ducts or Plenums. (remaining text unchanged)
(1) - (8) (remaining text unchanged)
(9) Plastic water distribution piping and tubing listed and labeled for use in plenums with a flame spread distance not exceeding 5 feet (1524 mm), an average optical density not exceeding 0.15, and a peak optical density not exceeding 0.5, where tested in accordance with UL 2846.

<table>
<thead>
<tr>
<th>STANDARD NUMBER</th>
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<th>APPLICATION</th>
<th>REFERENCED SECTIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>UL 2846-2014</td>
<td>Fire Test of Plastic Water Distribution Plumbing Pipe for Visible Flame and Smoke Characteristics (with revisions through December 20, 2016)</td>
<td>Plastic Piping</td>
<td>602.2(9)</td>
</tr>
</tbody>
</table>

Note: UL 2846 meets the requirements for mandatory reference standards in accordance with Section 3-3.7.1 of IAPMO’s Regulations Governing Committee Projects.

SUBSTANTIATION:
UL 2846 is a valid published consensus standard, already included in the IMC code in a similar manner. It should also be present in the UMC for consistency. UL 2846 is a testing standard separate, though similar to ASTM E84, and contains the required mounting requirements for distribution piping, similar to fire sprinkler piping. There are no issues or conflicts between the standards. ANSI/UL2846 was developed by experts in this area through an ANSI consensus process. This included Authorities Having Jurisdiction, Manufacturers, Testing Organizations, and Supply Chain. Relative to other Standards development efforts, there was little “controversy” over the creation of ANSI/UL 2846. In fact, the Standard successfully passed the ANSI balloting process on the first process attempt with a final vote of 83 percent affirmative - well in excess of the required 2/3 vote. Many products have alternative standards in this section of the code, including NFPA 70, NFPA 262, UL 1887, UL 1820, and UL 2043.

PPFA recommends that this item be accepted as submitted.

COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
The proposed change is being rejected based on the action taken on Item # 051.

TOTAL ELIGIBLE TO VOTE: 26
VOTING RESULTS:  
AFFIRMATIVE: 20  
NEGATIVE: 5  
NOT RETURNED: 1  
HOWARD

EXPLANATION OF NEGATIVE:

CUDAHY: I am voting AGAINST the committee action to reject on this item from the meeting. The UL 2846 standard is a consensus standard by UL, and is already in another model mechanical code a full cycle. Codes should adopt testing standards made specifically for items that follow the required process. ASTM E84 is a general test for any product and, therefore, there are alternative standards designed for testing many products with morphologies similar to pipe – such as wire, pneumatic tubing, and fire sprinklers already in the codes. This item does not conflict with any other proposal items. There was some confusing discussion during the item, but UL 2846 is a dry test, no water. Therefore, vote AGAINST the committee action on Item # 050 to overturn.

EGG: The new language improves the code.

KOERBER: Reference to the standard should be included.

MACNEVIN: The proposed new language improves the code. UL 2846 is the most appropriate test method for plastic pipes for mechanical or plumbing applications. This proposal accurately adds reference to UL 2846, and includes appropriate requirements for safe installation of these materials within plenums.

A. TRAFTON: Reference to the standard should be included.

Appended Comments

PUBLIC COMMENT 1

Code Year: 2021 UMC  
Section #: 602.2(9)  
Item #: 050

SUBMITTER: Ralph Koerber (ATCO Rubber Products, Inc., Air Duct Council); Forest Hampton III (Lubrizol Advanced Materials, Inc.); Michael Cudahy (PPFA)  
Comment #: 1

RECOMMENDATION:

Add new text

Request to accept the code change proposal as submitted by this public comment.

SUBSTANTIATION:

Ralph Koerber:
The UMC TC rejected this proposal in favor of accepting Item # 051. I voted in favor of accepting Item # 050 as submitted (or accepting the corresponding portion of Item # 049). This standard is the proper test method for testing of plastic water distribution piping and tubing.

UL 2846 is an ANSI standard that includes a test method for determining values of flame propagation distance and optical smoke density for individual pairs of plastic plumbing pipes for distribution of potable water that can be installed in ducts, plenums, and other spaces used for environmental air. The acceptance criteria specified (peak optical density not greater than 0.50, an average optical density not greater than 0.15, and a flame spread distance not greater than 5 feet) is consistent with values in Sections 602.2.1, 602.2.2 and 602.2.3.

Forest Hampton III:
The UL 2846 standard is a consensus standard written by UL and describes how to mount and test plastic water distribution plumbing pipe. ASTM E84 was written originally for flat products and in the UMC there are alternative standards referenced for testing products with morphologies similar to water distribution pipe – such as wire, pneumatic tubing, and fire sprinkler pipe. The Committee Statement of, “The proposed change is being rejected based on the action taken on Item # 051” is not relevant as the proposed changes in item # 051 do not have anything to do with mounting and testing water distribution pipe. Therefore, it is not a sufficient technical justification for rejecting this proposal. There were some confusing discussions during testimony as to if the standard allowed pipe to be tested with water. It does not. UL 2846 Section 4.1 states, “…There shall be no water or any other liquid in the pipe during the test.”

Michael Cudahy:
PPFA recommends approval as submitted of Item # 050. The UL 2846 standard is a consensus standard by UL, and is already in another model mechanical code over a full cycle. Codes should adopt testing standards made specifically for items that follow the required process. ASTM E84 is a general test for any product and, therefore, there are alternative standards designed for testing many products with morphologies similar to pipe - such as wire, pneumatic tubing, and fire sprinklers already in the codes. This item does not conflict with any other proposal items. UL 2846 is a dry test, no water.
Item #: 051
UMC 2021  Section: 602.2

SUBMITTER: Brian Helms
Charlotte Pipe and Foundry

RECOMMENDATION:
Revise text

602.0 Material.

602.2 Combustibles Within Ducts or Plenums. Materials exposed within ducts or plenums shall be noncombustible or shall have a flame spread index not to exceed 25 and a smoke-developed index not to exceed 50, where tested as a composite product in accordance with ASTM E84 or UL 723. Plastic piping installed in plenums shall be tested in accordance with all requirements of ASTM E84 or UL723. Mounting methods, supports and sample sizes of materials for testing that are not specified in ASTM E84 or UL 723 shall be prohibited.

Note: ASTM E84 and UL 723 meet the requirements for mandatory reference standards in accordance with Section 3-3.7.1 of IAPMO’s Regulations Governing Committee Projects.

SUBSTANTIATION:
A growing issue in the plumbing industry is that the ASTM E 84 test protocol is being modified to test combustible piping materials. At the direction of plastics manufacturers, test labs will modify mounting methods, supports and test specimen dimensions to achieve results that are in compliance with the 25/50 benchmarks the code requires. These results are then used to secure a listing by third party certifiers to serve as proof to code officials of compliance to the flame spread and smoke developed index requirements found in the code.

The question of whether a piping material is in compliance to the flame spread and smoke developed requirements of the code is often further blurred as third party certifiers provide listings indicating that materials meet the 25/50 requirements using modified test methods. Third party certifiers disclose this information in their full listing or report, but this is not always easily identified or even accessible to officials. An inspector seeing ASTM E 84 on a pipe would likely assume that it meets the requirement of the code without fully knowing or understanding the restrictions that exist in the listing. In fact, listing agencies assume that the inspector will analyze the listing and make their own determination on compliance. This code change proposal provides notice to the official that simply adding the ASTM E 84 or UL 723 marking to the wall of the pipe does not necessarily mean that the product was tested in full compliance with the standard in the manner that the code intends.

Charlotte Pipe has conducted ASTM E 84 tests at two different test facilities and found that results below the 25/50 flame spread and smoke developed index are not achievable when performed to the full requirements of ASTM E 84. Our testing has shown that CPVC and PVC piping will not consistently pass the ASTM E 84 without modification of the mounting method, supports or test specimen dimensions.

If the practice of accepting modified test results is allowed to continue, then the requirements of the code will not be achieved. ASTM E 84 is a comparison test, and the 25/50 flame spread and smoke developed index is not a requirement of the standard, but of the code itself. If the 25/50 requirement is too restrictive, then an effort should be made to change the code. If the ASTM E 84 test method is flawed, change the standard. However, we can no longer allow the use of modified tests and third party listings to circumvent the requirements of the code which exist to preserve the health and safety of the public.

COMMITTEE ACTION: ACCEPT AS SUBMITTED
TOTAL ELIGIBLE TO VOTE: 26
VOTING RESULTS:  AFFIRMATIVE: 20  NEGATIVE: 5  ABSTAIN: 1

EXPLANATION OF NEGATIVE:

CUDAHY: This is poor code language and should not be specific to only plastic pipe or it would need to be repeated after every standard for every product. Urge rejection.

KOERBER: I agree with the intent of this proposal - to stop the potential "gaming" of the test standard in order to achieve the required values. Perhaps the wording is not the best and may not be enforceable but without spelling it out, what mechanism is in place to prevent this practice? If my memory serves, NFPA specifically indicates plastic piping tested across the full width of the tunnel and without water or other liquid in the piping. This indicates there is a concern for this happening.

MACNEVIN: The proposed new language is duplicative, redundant and confusing. The requirements for all materials, including plastic pipes, are already stated clearly in proper code language.

A. TRAFTON: This is poor code language. It does not help the code.

P. TRAFTON: In accordance with the committee.

EXPLANATION OF ABSTAIN:

HOWARD: The referenced standard should be sufficient for enforcement. If the manufacturer opts to run contrary to the referenced standard then their product should be denied use by the AHJ.

Appended Comments

PUBLIC COMMENT 1

Code Year: 2021 UMC  Section #: 602.2  Item #: 051
SUBMITTER: Keith Blazer
          Self
RECOMMENDATION:
Revise text
Request to accept the code change proposal as modified by this public comment.

602.0 Material.
602.1 General. (remaining text unchanged)
602.2 Combustibles Within Ducts or Plenums. Materials exposed within ducts or plenums shall be noncombustible or shall have a flame spread index not to exceed 25 and a smoke-developed index not to exceed 50, where tested as a composite product in accordance with ASTM E84 or UL 723. Plastic piping installed in plenums shall be tested in accordance with all requirements of ASTM E84 or UL723. Mounting methods, supports and sample sizes of materials for testing that are not specified in ASTM E84 or UL 723 shall be prohibited.

(remaining text unchanged)

SUBSTANTIATION:
The phrase "all requirements of" is being stricken as it does not add value to the code. The code already indicates that you must comply with ASTM E84 and UL 723 and it is not necessary to indicate "all requirements of." The AHJ would not be able to determine how the manufacturer's third-party certifier tests products prior to passing the product and adding the standard specified markings onto the piping. Furthermore, the last sentence is being stricken as it is not enforceable and should be added to the standard, not in the code. This language belongs as part of the product standard and is therefore unenforceable.

PUBLIC COMMENT 2
RECOMMENDATION:
Delete text without substitution
Request to reject the code change proposal by this public comment.

SUBSTANTIATION:

Michael Cudahy:
PPFA recommends disapproval of Item # 051. This is poor code language and should not be specific to only plastic pipe or the new language would need to be repeated after every standard for every product. Mounting methods and other requirements can be outside of ASTM E84.

Forest Hampton III:
This is poor code language and unenforceable. Standards writing should be left to ASTM.
Item #: 052

UMC 2021  Section: 602.2(5)

SUBMITTER: Christopher Jensen
UL LLC

RECOMMENDATION:
Revise text

602.0 Material.

602.2 Combustibles Within Ducts or Plenums. Materials exposed within ducts or plenums shall be noncombustible or shall have a flame spread index not to exceed 25 and a smoke-developed index not to exceed 50, where tested as a composite product in accordance with ASTM E84 or UL 723.

Exceptions:
(1) - (4) (text unchanged)
(5) Products listed and labeled for installation within plenums in accordance with Section 602.2.1 through Section 602.2.3 602.2.4.
(6) - (8) (text unchanged)

SUBSTANTIATION:
The requirements of discrete products listed and labeled in accordance with UL 2043 as indicated in Section 602.2.4 (Discrete Products in Plenums) are also an exception to the requirement for these products to be noncombustible, or have a flame spread index not more than 25 and a smoke developed index not more than 50 where tested in accordance with ASTM E84 or UL 723.

COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
The proposed change lacks technical reasoning to merit such a change.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 24  NEGATIVE: 1  NOT RETURNED: 1  HOWARD

EXPLANATION OF NEGATIVE:
KOERBER: This proposal should be accepted as it properly refers to materials that should be allowed as they are listed to the appropriate standard.

Appended Comments

PUBLIC COMMENT 1

Code Year: 2021 UMC  Section #: 602.2(5)  Item #: 052

SUBMITTER: Christopher Jensen
UL LLC

RECOMMENDATION:
Revise text

Request to accept the code change proposal as submitted by this public comment.

SUBSTANTIATION:
The committee rejected this proposal with the statement "The proposed change lacks technical reasoning to merit such a change". This proposal was submitted to correct an editorial error. The Committee Action taken during the 2018 UMC Technical Committee Meeting on Proposal Item # 050 was to include 602.2.5 (Discrete Products in Plenums) to Section 602.2, exception (5). Additionally Proposal Item # 052 in the same cycle removed the existing Section 602.2.4 Loudspeakers and Recessed Lighting and resulted in 602.2.5 being renumbered to Section 602.2.4. The results of the Technical Committee actions on the 2018 UMC was to add Section 602.2.4 (Discrete Products in Plenums) to Section 602.2, exception (5). There were no Public Comments that were acted on that resulted in a modification of the committee actions taken at the Technical Committee meeting on Proposals. Discrete products listed and labeled to UL 2043 are no different than electrical wiring listed to NFPA 262, fire sprinkler pipes listed to UL 1887, or pneumatic tubing listed to UL 1820 and should be included in Section 602.2, exception (5).
Proposals

Item #: 053
UMC 2021  Section: 602.2.5, Table 1701.1

SUBMITTER: Christopher Jensen
UL LLC

RECOMMENDATION:
Add new text

602.0 Material.

602.2 Combustibles Within Ducts or Plenums. (remaining text unchanged)

602.2.5 Communications Raceways. Communications raceways shall be listed as having a maximum peak optical density of 0.50 or less, an average optical density of 0.15 or less, and a maximum flame spread distance of 5 feet (1524 mm) or less when tested in accordance with UL 2024.  [NFPA 90A: 4.3.11.2.6.4]

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<tr>
<th>STANDARD NUMBER</th>
<th>STANDARD TITLE</th>
<th>APPLICATION</th>
<th>REFERENCED SECTIONS</th>
</tr>
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<tbody>
<tr>
<td>UL 2024-2014</td>
<td>Cable Routing Assemblies and Communications Raceways (with revisions through January 9, 2015)</td>
<td>Miscellaneous</td>
<td>602.2.5</td>
</tr>
</tbody>
</table>

(portion of table not shown remains unchanged)

Note: UL 2024 meets the requirements for mandatory reference standards in accordance with Section 3-3.7.1 of IAPMO’s Regulations Governing Committee Projects.

SUBSTANTIATION:
The 2018 edition of NFPA 90A, Standard for the Installation of Air-Conditioning and Ventilating Systems, which is an ANSI standard, also permits the installation of communication raceways in plenums, where tested in accordance with UL 2024. This proposal is a direct extract from NFPA 90A. The acceptance criteria specified (peak optical density not greater than 0.50, an average optical density not greater than 0.15, and a flame spread distance not greater than 5 feet) is consistent with values in Sections 602.2.1, 602.2.2 and 602.2.3.

COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
The proposed change is being rejected as communication raceways are not within the scope of the UMC.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS:  AFFIRMATIVE: 22  NEGATIVE: 3  NOT RETURNED: 1  HOWARD

EXPLANATION OF NEGATIVE:

HYDE: I believe that this would provide further clarity to the specific combustibles within the ducts/plenums for inspectors and installers.
KOERBER: I disagree with the committee action and statement. This requirement for communication cable raceways should be added to the chapter.

MACNEVIN: This addition is technically accurate and improves the code with additional requirements for polymer raceways.

Appended Comments

PUBLIC COMMENT 1

Code Year: 2021 UMC  Section #: 602.2.5, Table 1701.1  Item #: 053

SUBMITTER: Keith Blazer  Self  Comment #: 1

RECOMMENDATION:
Add new text

Request to replace the code change proposal by this public comment.

602.0 Material.

602.2 Combustibles Within Ducts or Plenums. (remaining text unchanged)

602.2.5 Communications Raceways. Communications raceways shall be listed and tested in accordance with UL 2024 and shall have a peak optical density not more than 0.50, an average optical density not more than 0.15, and a flame spread distance not more than 5 feet (1524 mm).

TABLE 1701.1
REFERENCED STANDARDS

<table>
<thead>
<tr>
<th>STANDARD NUMBER</th>
<th>STANDARD TITLE</th>
<th>APPLICATION</th>
<th>REFERENCED SECTIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>UL 2024-2014</td>
<td>Cable Routing Assemblies and Communications Raceways (with revisions through January 9, 2015)</td>
<td>Miscellaneous</td>
<td>602.2.5</td>
</tr>
</tbody>
</table>

(portion of table not shown remains unchanged)

Note: UL 2024 meets the requirements for mandatory reference standards in accordance with Section 3-3.7.1 of IAPMO's Regulations Governing Committee Projects.

SUBSTANTIATION:
UMC proposal Item # 053 has been rewritten with enforceable code language. Communications raceways should be included in the UMC under Section 602.2 (Combustibles Within Ducts or Plenums). These provisions will improve the code and assist the AHJ in the enforcement of communications raceways.

PUBLIC COMMENT 2

Code Year: 2021 UMC  Section #: 602.2.1.1, Table 1701.1  Item #: 053

SUBMITTER: Christopher Jensen  UL LLC  Comment #: 2

RECOMMENDATION:
Add new text

Request to replace the code change proposal by this public comment.
602.0 Material.

602.2 Combustibles Within Ducts or Plenums. (remaining text unchanged)

602.2.1 Electrical. Electrical wiring in plenums shall comply with NFPA 70. Electrical wires and cables and optical fiber cables shall be listed and labeled for use in plenums and shall have a flame spread distance not exceeding 5 feet (1524 mm), and average optical density not exceeding 0.15, and a peak optical density not exceeding 0.5, where tested in accordance with NFPA 262. 

602.2.1.1 Communications Raceways. Communications raceways shall be listed as having a maximum peak optical density of 0.50 or less, an average optical density of 0.15 or less, and a maximum flame spread distance of 5 feet (1524 mm) or less when tested in accordance with UL 2024. [NFPA 90A: 4.3.11.2.6.4]

<table>
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</tr>
</tbody>
</table>

(Note: UL 2024 meets the requirements for mandatory reference standards in accordance with Section 3-3.7.1 of IAPMO's Regulations Governing Committee Projects.

SUBSTANTIATION:
The committee statement on the rejection of this proposal indicated that communications raceways are outside the scope of the UMC. Combustible material installed within plenums are within the scope of the UMC in Section 602.2 and it’s sub-sections. Section 602.2.1 covers electrical wiring including communications and optical fiber cables installed within plenums. This public comment has been modified to include communications raceways in Section 602.2.1.1 as they are a specific type of electrical raceway used to contain communications and optical fiber cables. The Scope of NFPA 262 indicates that the standard covers insulated, jacketed or both, electrical wires and cables, but does not cover communications raceways. Communications raceways are listed and labeled in accordance with UL 2024. UL 2024 contains specific flame propagation and smoke density tests for plenum rated communications raceways. As directed several times by the committee that specific requirements should be addressed in a standard rather than a code, UL 2024 was developed under ANSI consensus process to determine values of flame propagation distance and optical smoke density for communications raceways that can be installed in ducts, plenums, and other spaces used for environmental air. The acceptance criteria specified (a flame spread distance not greater than 5 feet, peak optical density not greater than 0.50, and an average optical density not greater than 0.15) is consistent with values in Sections 602.2.1, 602.2.2 and 602.2.3. Furthermore, the language used in this proposal is a direct extract from NFPA 90A.

PUBLIC COMMENT 3

Code Year: 2021 UMC  Section #: 602.2.5  Item #: 053

SUBMITTER: Ralph Koerber  
ATCO Rubber Products, Inc.  
Rep: Air Duct Council  
Comment #: 3

RECOMMENDATION:
Add new text
Request to accept the code change proposal as submitted by this public comment.

SUBSTANTIATION:
I disagree with the TC statement that communication raceways are not within the scope of the UMC. They can be combustible and they can be within ducts and plenums and therefore should be included in this section, same as the other items in Section 602.2.1 through Section 602.2.4. This proposal should be accepted as submitted.
CHAPTER 6
DUCT SYSTEMS

602.0 Material.

602.3 Metallic. Ducts, plenums, or fittings of metal shall comply with SMACNA HVAC Duct Construction Standards – Metal and Flexible. Flexible metallic ducts shall comply with UL 181.

602.4 Nonmetallic Ducts. Nonmetallic ducts shall comply with Section 602.4.1, Section 602.4.2, Section 602.4.3 or Section 602.4.4.

602.4.1 Phenolic. Phenolic duct, plenum, or fitting material shall comply with UL 181. Ducts, plenums, or fittings of phenolic shall be constructed in accordance with SMACNA Phenolic Duct Construction Standards or the conditions of its listing.

602.4.2 Gypsum. Where gypsum products are exposed in ducts or plenums, the air temperature shall be restricted to a range from 50°F (10°C) to 125°F (52°C), and moisture content shall be controlled so that the material is not adversely affected. All gypsum products shall have a mold or mildew resistant surface. For the purpose of this section, gypsum products shall not be exposed in supply ducts.

602.4.3 Air Dispersion Systems. Air dispersion systems shall be listed and labeled in accordance with UL 2518.

602.4.4 Other Materials. Flexible and rigid ducts, plenums, or fittings for use in heating, ventilation, and air conditioning systems of other nonmetallic materials listed and labeled to UL 181 shall be permitted.

Exception: Plastic ducts shall comply with Section 603.6.

602.6 Factory-Made Air Ducts. Factory-made air ducts shall be approved for the use intended or shall be in accordance with the requirements of UL 181. Each portion of a factory-made air duct system shall be identified by the manufacturer with a label or other identification indicating compliance with its class designation.

(renumber remaining sections)

603.0 Installation of Ducts.

603.1 General. Air ducts shall be installed in accordance with this Chapter and the installation instructions. The pressure classification of ducts shall be not less than the design operating pressure of the air distribution in which the duct is utilized.

603.1.1 Pressure Classification. The pressure classification of ducts shall be not less than the design operating pressure of the air distribution in which the duct is utilized.

603.1.2 Air Temperature. The temperature of the air to be conveyed in a duct shall not exceed 250°F (121°C).

603.1.3 Protection. Air ducts, other than plastic ducts, shall be installed with not less than 4 inches (102 mm) of separation from earth, except where installed as a liner inside of concrete, tile, or metal pipe and shall be protected from physical damage.

603.1.4 Vertical Risers. Ducts listed and labeled to UL 181 shall not be used for vertical risers in air-duct systems serving more than two stories.
603.1.5 Penetrations. Ducts listed and labeled to UL 181 shall not penetrate a fire-resistance-rated assembly or construction.

603.3 Metal Ducts. Ducts shall be supported at each change of direction and in accordance with SMACNA HVAC Duct Construction Standards – Metal and Flexible. Riser ducts shall be held in place by means of metal straps or angles and channels to secure the riser to the structure. Metal ducts shall be installed with not less than 4 inches (102 mm) separation from earth. Ducts shall be installed in a building with clearances that will retain the full thickness of fireproofing on structural members.

603.4 Factory-Made Air Ducts. Factory-made air ducts shall be listed and labeled in accordance with UL 181 and installed in accordance with the terms of their listing, the manufacturer’s installation instructions, and SMACNA HVAC Duct Construction Standards – Metal and Flexible. Factory-made air ducts shall not be used for vertical risers in air duct systems serving more than two stories and shall not penetrate a fire-resistance-rated assembly or construction. Factory-made air ducts shall be installed with not less than 4 inches (102 mm) of separation from earth, except where installed as a liner inside of concrete, tile, or metal pipe and shall be protected from physical damage. The temperature of the air to be conveyed in a duct shall not exceed 250°F (121°C). Flexible air connectors shall not be permitted.

603.4.1 Length Limitation. Factory-made flexible air ducts and connectors shall be not more than 5 feet (1524 mm) in length and shall not be used in lieu of rigid elbows or fittings. Flexible air ducts shall be permitted to be used as an elbow at a terminal device.

Exception: Residential occupancies.

(renumber remaining sections)

603.5 Flexible Air Ducts. Flexible air ducts shall comply with UL 181, and shall be installed in accordance with the manufacturer’s installation instructions and SMACNA HVAC Duct Construction Standards – Metal and Flexible. Flexible air duct installations shall comply with the following:

1. Ducts shall be installed using the minimum required length to make the connection.
2. Horizontal duct runs shall be supported at not more than 4 feet (1219 mm) intervals.
3. Vertical risers shall be supported at not more than 6 feet (1829 mm) intervals.
4. Sag between support hangers shall not exceed \( \frac{1}{2} \) inch (12.7 mm) per foot (305 mm) of support spacing.
5. Supports shall be rigid and shall be not less than \( \frac{1}{12} \) inches (38 mm) wide at point of contact with the duct surface.
6. Pipe bends shall be not less than one duct diameter bend radius.
7. Screws shall not penetrate the inner liner of non-metallic flexible ducts unless permitted in accordance with the manufacturer’s installation instructions.
8. Fittings for attaching non-metallic ducts shall be beaded and have a collar length of not less than 2 inches (51 mm) for attaching the duct.

Exception: A bead shall not be required where metal worm-gear clamps are used or where attaching metallic ducts using screws in accordance with the manufacturer’s installation instructions.
9. Duct inner liner shall be installed at not less than 1 inch (25.4 mm) on the collar and past the bead prior to the application of the tape and mechanical fastener. Where mastic is used instead of tape, the mastic shall be applied in accordance with the manufacturer’s installation instructions.
10. Duct outer vapor barriers shall be secured using two wraps of approved tape. A mechanical fastener shall be permitted to be used in place of, or in combination with, the tape.
11. Flexible air ducts shall not penetrate a fire-resistance-rated assembly or construction.
12. The temperature of the air to be conveyed in a flexible air duct shall not exceed 250°F (121°C).
13. Flexible Air ducts shall be sealed in accordance with Section 603.10.

603.5.1 Length Limitation. Flexible air ducts shall be not more than 5 feet (1524 mm) in length and shall not be used in lieu of rigid elbows or fittings. Flexible air ducts shall be permitted to be used as an elbow at a terminal device.

Exception: Residential occupancies.

603.5.2 Flexible Air Connectors. Flexible air connectors shall not be permitted.

603.8 Support of Ducts. Installers shall provide the manufacturer’s field fabrication and installation instructions. Factory-made air ducts that are in accordance with UL 181 shall be supported in accordance with the manufacturer’s installation instructions. Other ducts shall comply with SMACNA HVAC Duct Construction Standards – Metal and Flexible or the manufacturer’s installation instructions.

603.10 Joints and Seams of Ducts. Joints and seams for duct systems shall comply with SMACNA HVAC Duct Construction Standards – Metal and Flexible. Joints of duct systems shall be made substantially airtight by means of tapes, mastics, gasketing, or other means. Crimp joints for round ducts shall have a contact lap of not less than \( \frac{1}{12} \) inches (38 mm) and shall be mechanically fastened by means of not less than three sheet-metal screws equally spaced around the joint, or an equivalent fastening method.

603.10.1 Closure Systems. Joints and seams and reinforcements, for factory made air ducts and plenums listed and labeled to
UL 181, shall comply with the conditions of prior approval be in accordance with the manufacturer’s installation instructions that shall accompany the product. Closure systems for sealing factory-made air ducts and plenums shall be listed and labeled in accordance with UL 181A or UL 181B, and marked in accordance with Table 603.10.1.

(renumber remaining sections)

604.0 Insulation of Ducts.
604.1 General. Air ducts conveying air at temperatures exceeding 140°F (60°C) shall be insulated to maintain an insulation surface temperature of not more than 140°F (60°C). Factory-made air ducts and insulations intended for installation Insulation material on the exterior of ducts shall be legibly printed with the name of the manufacturer, the thermal resistance (R) value at installed thickness, flame-spread index, and smoke developed index of the composite material. Internal duct liners and insulation shall be installed in accordance with SMACNA HVAC Duct Construction Standards – Metal and Flexible.

(remaining text unchanged)

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<td>UL 181-2013</td>
<td>Factory-Made Air Ducts and Air Connectors</td>
<td>Air Connectors, Air Ducts</td>
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<tr>
<td>UL 2518-2005</td>
<td>Outline of Investigation for Air Dispersion Systems Materials</td>
<td>Duct Systems</td>
<td>602.4.3, 603.13</td>
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<tr>
<td>SMACNA-2006</td>
<td>HVAC Duct Construction Standards Metal and Flexible, 3rd Edition</td>
<td>Ducts, Metal and Flexible</td>
<td>504.4.5, 506.2, 602.3, 603.3, 603.4, 603.5, 603.8, 603.10, 603.12, 604.1</td>
</tr>
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</table>

(portion of table not shown remains unchanged)

Note: UL 181 and UL 2518 meet the requirements for mandatory reference standards in accordance with Section 3-3.71 of IAPMO’s Regulations Governing Committee Projects.

SUBSTANTIATION:
The term “factory-made air ducts” is vague and ambiguous in regard to which products are included within the category. Therefore, the appropriate materials have been added to Section 602.3-602.4, and the specific installation requirements have been added to Section 603.1 for clarity.

Section 603.4 (Factory Made Air Ducts) has been split into two categories; Section 602.3 (Metallic) and Section 602.4 (Nonmetallic). Section 602.3 will provide the minimum requirements for metallic ducts. Section 602.4 specifies the requirements for phenolic, gypsum and other materials.

The phrase “Metal ducts shall be installed with not less than 4 inches (102 mm) separation from earth” is being removed from Section 603.3, since this requirement is already stated under the new general Section 603.1.3 (Protection), which applies to all duct materials except plastic ducts.

Section 603.4.1 (Length Limitation) has been relocated under the “Flexible Air Ducts” section, as this requirement only applies to flexible air ducts.

Section 603.8 (Support of Ducts) is being modified for clarity as all air ducts are supported in accordance SMACNA or the manufacturer’s installation instructions, not only air ducts that are in accordance with UL 181.

Section 603.10 (Joints and Seams of Ducts) was separated into its own respective section, 603.10.1 (Closure Systems), as closure systems have unique requirements that do not necessarily apply to joints and seams.

Under Section 604.1, the term “factory-made air ducts” is being removed, as these insulation requirements apply to all air ducts.

COMMITTEE ACTION: ACCEPT AS SUBMITTED
TOTAL ELIGIBLE TO VOTE: 26
VOTING RESULTS: AFFIRMATIVE: 26

Appended Comments

PUBLIC COMMENT 1

Code Year: 2021 UMC   Section #: 603.4.1   Item #: 054
SUBMITTER: Ralph Koerber   Comment #: 1
ATCO Rubber Products, Inc.
Rep: Air Duct Council

RECOMMENDATION:
Revise text

Request to accept the code change proposal as modified by this public comment.

603.0 Installation of Ducts.

603.4 Flexible Air Ducts. (remaining text unchanged)
603.4.1 Length-Limitation. Flexible air ducts shall be not more than 5 feet (1524 mm) in length and shall not be used in lieu of rigid elbows or fittings. Flexible air ducts shall be permitted to be used as an elbow at a terminal device.

Exception: Residential occupancies.

SUBSTANTIATION:
Flexible air ducts in commercial applications that are installed per the requirements of Section 603.5 should not have an arbitrary maximum length limitation. Properly installed flexible ducts perform satisfactorily without the need for this limit. Since ducts are but an integral part of a total system, all factors need to be considered relative to air flow performance.

In substantiation, The Air Duct Council (ADC) initiated third-party laboratory testing conducted at Tennessee Technical University which demonstrated comparable performance when flexible ducts are installed per Section 603.5 that brings into question the need for a limitation in the code.

Tests were performed to measure total system pressure losses in three different variations of light-commercial duct systems comprised of a combination of various lengths of flexible and rigid sheet metal ducts. The tests were conducted in compliance with ANSI/ASHRAE Standard 120-2017, “Method of Testing to Determine Flow Resistance of HVAC Ducts and Fittings”.

System A - flex limited to 5 feet as in the code
System B - flex doubled in length
System C - flex tripled in length & properly sized

The results of the study demonstrated that flexible duct systems can exhibit equivalent performance to rigid duct systems, even when flex duct length exceeds the 5 foot limitation currently in the UMC. In fact, the total system pressure was actually reduced when the longest flex length was used by appropriately sizing the flex duct and correspondingly, the fittings (System C).

When the air flow characteristics of all of the components in the total system are considered, an arbitrary length limitation for flexible duct is shown to be misdirected.

I have included a supporting document of the study report for review and consideration.

Supporting document(s) has been provided to the Technical Committee for review.
Item #: 061
UMC 2021  Section: 603.5

SUBMITTER: David Dias
Sheet Metal Workers Local 104

RECOMMENDATION:
Revise text

603.0 Installation of Ducts.

603.5 Flexible Air Ducts. Flexible air ducts shall comply with UL 181, and shall be installed in accordance with the manufacturer’s installation instructions and SMACNA HVAC Duct Construction Standards – Metal and Flexible. Flexible air duct installations shall comply with the following:

(1) - (7) (remaining text unchanged)

(8) Fittings for attaching non-metallic ducts shall be beaded and have a collar length of not less than 2 inches (51 mm) for attaching the duct. Metal worm-gear clamps shall be used.

Exception: A bead shall not be required where metal worm-gear clamps are used or where attaching metallic ducts using screws in accordance with the manufacturer’s installation instructions.

SUBSTANTIATION:
Beads should always be used to prevent the flexible duct from slipping off the metal fitting. Metal clamps should be required because there are too many nonmetallic clamps being installed that are not UL listed which makes it very hard for a building official to catch and enforce.

COMMITTEE ACTION: ACCEPT AS SUBMITTED

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 24 NEGATIVE: 1 NOT RETURNED: 1 HOWARD

EXPLANATION OF NEGATIVE:
KOERBER: Requiring use of beaded fittings and metallic clamps is overly restrictive.

Appended Comments

PUBLIC COMMENT 1
Code Year: 2021 UMC  Section #: 603.4(8)  Item #: 061

SUBMITTER: Ralph Koerber (ATCO Rubber Products, Inc., Rep: Air Duct Council);
Kenneth A Christian (HellermannTyton); Randal Denney (American Elite Molding, LLC);
Charles McGaughy (ABB); Teru Chen (Hua Wei Industrial, Co., Ltd.)

RECOMMENDATION:
Revise text

Request to accept the code change proposal as modified by this public comment.
603.4 Flexible Air Ducts. Flexible air ducts shall comply with UL 181, and shall be installed in accordance with the manufacturer’s installation instructions and SMACNA HVAC Duct Construction Standards – Metal and Flexible. Flexible air duct installations shall comply with the following:

(1) - (7) (remaining text unchanged)

(8) Fittings for attaching non-metallic ducts shall be beaded and have a collar length of not less than 2 inches (51 mm) for attaching the duct. **Metal worm-gear clamps shall be used.**

Exception: Where attaching metallic ducts using screws in accordance with the manufacturer’s installation instructions.

(9) - (13) (remaining text unchanged)

**SUBSTANTIATION:**

Ralph Koerber:
Non-metallic mechanical fasteners listed and labeled to the UL 181B Standard and labeled UL 181B-C have been in use for more than 15 years since the addition of Part III to the UL 181B Standard. And for many years prior to that time, non-metallic straps were used; however, approval to the was maintained by the individual flexible duct manufacturers.

Flexible duct manufacturer's installation instructions require the use of UL 181B-C non-metallic mechanical fasteners when plastic straps are chosen. UMC Chapter 6 does as well.

No data was provided to substantiate that the use of UL 181B-C labeled non-metallic mechanical fasteners, as currently referenced in Section 603.9.1 (Closure Systems) cannot be validated and enforced by building officials. **Requiring the use of only metal worm-gear clamps for flexible duct is overly restrictive.**

Kenneth A Christian:
I disagree about not allowing "non-metallic clamps". Inspectors should be inspecting the clamps, metal or plastic, before they get installed. The packaging of UL listed products should appear on the packaging. I don't understand why the products with UL listing can't be caught on non-metallic clamps yet is caught on metallic clamps? What's the difference with UL ID on metal vs non-metallic? It's also hard to believe that having non-metallic would be a cost savings. Using non-metallic clamps are easier on the installer, which is also an important if your installing all day, day after day.

Randal Denney:
As a USA manufacturer of non-metallic Duct Straps, we oppose the changes to UMC 2021, Section 603.4 note (8), i.e. the insertion of the verbiage: “Metal worm-gear clamps shall be used.” We currently manufacture and sell over 50 million 36” duct straps within the HVAC industry, all of which are UL-181 approved. We have spent millions of dollars at our factory in Crestview, Florida to assure our product meets or exceeds all aspects of UL181 B-C for flex duct attachment over the past few years, while employing over 100 manufacturing workers in the USA. This change would ultimately destroy and devastate part of the USA manufacturing economy dedicated to providing UL181 B-C nonmetallic duct straps to the HVAC industry.

I believe, working together, we can find solutions that will help the inspectors better identify nonmetallic UL181 B-C approved nylon duct straps within the industry. I believe the forcing of the usage of metal clamps is too restrictive.

According to UL 181 B, page 28, Section 36: “36.1 Each non-metallic mechanical fastener product or optionally, each smallest unit container of the non-metallic fasteners shall have a durable, legible, distinctive marking identifying the following:
(a) The marking “181B-C”;
(b) The manufacturer’s or private labeler’s name or identifying symbol; and
(c) The distinctive type or model designation;”

If the problem is the inspectors are not able catch or enforce non-UL listed strap, they could require the contractors to maintain the strap packaging. The package would contain all of the required information. We will be happy to be as involved, or provide any information, as needed.

Charles McGaughy:
We oppose this change because of the restrictive nature of only allowing metallic clamps for securement. We have no opposition to require beaded fittings when installing flexible duct. To help resolve the issue on how a building official can enforce the use of UL listed nonmetallic clamps the installer can provide packaging or listing information to the inspection authority. The packaging contains all the technical data including the listing information needed to confirm that the clamps are UL listed for that application.

Teru Chen:
Requiring use of metallic clamps is overly restrictive and will narrow the market for plastic clamps. Relative spec and certification should be considered and clearly determined to solve this issue instead of limiting the material to metal.

**PUBLIC COMMENT 2**

**Code Year:** 2021 UMC  **Section #: 603.4**  **Item #: 061**

**SUBMITTER:** Christopher Jensen (UL LLC); Rick Estano (Avery Dennison); Amit Somani (Blackburn & Co.pvt.ltd)  **Comment #: 2**

**RECOMMENDATION:**
Revise text
Request to reject the code change proposal by this public comment.

SUBSTANTIATION:

Christopher Jensen:
UMC Section 603.4 requires flexible air ducts to comply with UL 181 and be installed in accordance with the manufacturer’s installation instructions and SMACNA HVAC Duct Construction Standards-Metal and Flexible. UL 181B “Closure Systems for Use With Flexible Air Ducts and Air Connectors” is the standard used to evaluate mechanical fasteners for use with flexible air ducts. This standard is referenced in multiple places within the UMC. Both UL 181B and the SMACNA Standard permit the use of non-metallic draw band type mechanical fasteners. Requiring metal worm-gear clamps as the only means for attaching non-metal flexible air ducts is in conflict with the SMACNA HVAC Duct Construction Standards-Metal and Flexible, UL 181B and the manufacturer’s installation instructions. The substantiation for prohibiting the use of non-metallic draw band type mechanical fasteners is that many of the clamps being used are not UL listed. UL 181B requires mechanical fasteners for use with flexible air ducts to be marked with a product designation of “181B-C” on the product or the smallest unit packaging. This modified proposal would replace the new language with the existing language in the 2018 UMC Section 603.5(8).

Rick Estano:
Avery Dennison opposes proposal as written.

Amit Somani:
Proposal for using metal clamps instead of cable ties doesn’t solve the problem.
1. The metal clamps will also need to be identified as they will require UL 181B/C approval. How will one ensure if it is coming from a UL approved source? What will prevent the supposed issue with cable ties not occurring with metal clamps?
2. It can be mandated that the UL 181 B/C file number of the manufacturer be engraved on the cable tie. This will allow the inspector to search for the relevant file number in the UL database on their phone immediately and verify if the cable ties are produced by a UL 181 B/C approved source. Below is a picture with UL 181 B/C and relevant file number engraved on the body of the cable tie making it easily visible for the inspector.
Item #: 063
UMC 2021  Section: 603.10.1

SUBMITTER: Jeremy Martinez
Golden Gate Chapter ASHRAE
Rep: ASHRAE

RECOMMENDATION:
Revise text

603.0 Installation of Ducts.

603.10 Joints and Seams of Ducts. (remaining text unchanged)
603.10.1 Duct Leakage Tests. Ductwork that is designed to operate at static pressures in excess of 3 inches of water column (0.7 kPa) and all ductwork located outdoors shall be leak-tested in accordance with the SMACNA HVAC Air Duct Leakage Test Manual. Representative sections totaling not less than 10 percent of the total installed duct area shall be tested. Where the tested 10 percent fail to comply with the requirements of this section, then 40 percent of the total installed duct area shall be tested. Where the tested 40 percent fail to comply with the requirements of this section, then 100 percent of the total installed duct area shall be tested. Sections shall be selected by the building owner or designated representative of the building owner. Positive pressure leakage testing shall be permitted for negative pressure ductwork. The permitted duct leakage shall be not more than the following:

(remaining text unchanged)

SUBSTANTIATION:
The current requirement calls for leakage testing of all ductwork. This is onerous and not cost effective. The proposed wording is to make the requirement consistent with ASHRAE Standard 90.1.

COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
All ductwork should be tested, not only ductwork located outdoors or in excess of three inches of water column.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 25  NOT RETURNED: 1  HOWARD

Appendied Comments

PUBLIC COMMENT 1

Code Year: 2021 UMC  Section #: 603.9.2  Item #: 063
SUBMITTER: Vanessa Lasseson
Western Allied Mechanical Inc  Comment #: 1

RECOMMENDATION:
Revise text

Request to replace the code change proposal by this public comment.
603.0 Installation of Ducts.

603.9 Joints and Seams of Ducts. (remaining text unchanged)

603.9.2 Duct Leakage Tests. Ductwork that is designed to operate at static pressures in excess of 1 inch of water column (0.2 kPa) shall be leak-tested in accordance with the SMACNA HVAC Air Duct Leakage Test Manual. Representative sections totaling not less than 10 percent of the total installed duct area shall be tested. Where the tested 10 percent fail to comply with the requirements of this section, then 40 percent of the total installed duct area shall be tested. Where the tested 40 percent fail to comply with the requirements of this section, then 100 percent of the total installed duct area shall be tested. Sections shall be selected by the building owner or designated representative of the building owner. Positive pressure leakage testing shall be permitted for negative pressure ductwork. The permitted duct leakage shall be not more than the following:

(remaining text unchanged)

SUBSTANTIATION:
The current requirement calls for leakage testing of all ductwork. The proposed wording is to remove ductwork conveying transfer air from the duct leakage requirement.

Duct leakage testing should not apply to transfer air ductwork. The purpose of leakage testing is to minimize or eliminate the amount of conditioned air lost to the space, as duct leakage wastes energy and negatively affects building performance. However, transfer air is not conditioned and will have a minimal effect on building performance.

Ductwork conveying transfer air is typically designed for less than 1 inch of water column to prevent overpressurizing the space. The proposed wording amends the previous recommendation to apply to ductwork conveying transfer air only.
Item #: 064

UMC 2021 Section: 603.11, Table 1701.1

SUBMITTER: Jeremy Martinez
Golden Gate Chapter ASHRAE
Rep: ASHRAE

RECOMMENDATION:
Revise text

603.0 Installation of Ducts.

603.11 Cross Contamination. Exhaust ducts that convey Class 4 air shall be negatively pressurized relative to ducts, plenums, or occupiable spaces through which the ducts pass. Exhaust ducts and venting systems under positive pressure that convey Class 2 or Class 3 air shall not extend into or pass through ducts, or plenums, or occupiable spaces other than the space from which the exhaust air is drawn. Exception: Exhaust ducts conveying Class 2 air and exhaust ducts conveying air from residential kitchen hoods that are sealed in accordance with SMACNA Seal Class A. [ASHRAE 62.1:5.2.1, 5.2.2]

<table>
<thead>
<tr>
<th>STANDARD NUMBER</th>
<th>STANDARD TITLE</th>
<th>APPLICATION</th>
<th>REFERENCED SECTIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>SMACNA-2012</td>
<td>HVAC Air Duct Leakage Test Manual, 2nd Edition</td>
<td>Ducts</td>
<td>603.10.1, 603.11</td>
</tr>
</tbody>
</table>

(portion of table not shown remains unchanged)

Note: SMACNA HVAC Air Duct Leakage Test Manual, 2nd Edition meets the requirements for mandatory reference standards in accordance with Section 3-3.7.1 of IAPMO's Regulations Governing Committee Projects.

SUBSTANTIATION:
To make wording consistent with Section 5.2 of ASHRAE Standard 62.1-2016.

COMMITTEE ACTION: ACCEPT AS SUBMITTED

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 25 NOT RETURNED: 1 HOWARD

Appended Comments

PUBLIC COMMENT 1

Code Year: 2021 UMC Section #: 603.10
SUBMITTER: Randy Young
Sacramento JATC

Item #: 064

Comment #: 1
RECOMMENDATION:
Revise text

Request to accept the code change proposal as modified by this public comment.

603.10 Cross Contamination. Exhaust ducts that convey Class 4 air shall be negatively pressurized relative to ducts, plenums, or occupiable spaces through which the ducts pass. Exhaust duct systems under positive pressure that convey Class 2 or Class 3 air shall not extend into or pass through ducts, plenums, or occupiable spaces other than the space from which the exhaust air is drawn. Exception: Exhaust ducts conveying Class 2 air and exhaust ducts conveying air from residential kitchen hoods that are sealed in accordance with SMACNA Seal Class A of the SMACNA HVAC Air Duct Leakage Test Manual. {ASHRAE 62.1:5.2.1, 5.2.2}

SUBSTANTIATION:
The SMACNA standard title needs to be included, not only the section name within the standard, because there are many SMACNA standards. Additionally, the term “systems” should be deleted.
Proposal

Item #: 066

UMC 2021 Section: 604.1.1, Table 1701.1

SUBMITTER: Jay Peters
Codes and Standards International
Rep: Copper Development Association

RECOMMENDATION:
Revise text

604.0 Insulation of Ducts.
604.1 General. (remaining text unchanged)
604.1.1 Within Ducts or Plenums. Materials installed within ducts and plenums for insulating, sound deadening, or other purposes shall have a mold, humidity, and erosion-resistant surface where tested in accordance with UL 181. Duct liners in systems operating with air velocities exceeding 2000 feet per minute (10.16 m/s) shall be fastened with both adhesive and mechanical fasteners, and exposed edges shall have approved treatment to withstand the operating velocity. Where the internal insulation is capable of being in contact with condensates or other liquids, the material shall be water-resistant. Pipe and duct insulation shall not be used to reduce the maximum flame and smoke requirements in Section 602.2 unless tested in accordance with ASTM E84 or UL 723 as a composite assembly of the duct or pipe and its associated insulation, coatings and adhesives.

<table>
<thead>
<tr>
<th>STANDARD NUMBER</th>
<th>STANDARD TITLE</th>
<th>APPLICATION</th>
<th>REFERENCED SECTIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASTM E84-2016</td>
<td>Surface Burning Characteristics of Building Materials</td>
<td>Miscellaneous</td>
<td>508.3.4, 602.2, 604.1.1, 604.1.2, 1201.2</td>
</tr>
<tr>
<td>UL 723-2008</td>
<td>Test for Surface Burning Characteristics of Building Materials (with revisions through December 21, 2017)</td>
<td>Miscellaneous</td>
<td>508.3.4, 602.2, 604.1.1, 604.1.2, 1201.2</td>
</tr>
</tbody>
</table>

Note: ASTM E84 and UL 723 meet the requirements for mandatory reference standards in accordance with Section 3-3.7.1 of IAPMO’s Regulations Governing Committee Projects.

SUBSTANTIATION:
Fire walls, partitions, and similar protective assemblies are tested as composite assemblies, not as individual components. It is critical to have the best understanding possible of how an installed system will perform in the field which equates to replicating those conditions, especially in a plenum. This proposal clarifies that when materials do not meet minimum plenum safety requirements, simply covering them with plenum rated insulation may not be adequate protection, depending on the properties of the material being protected. Some insulation manufacturers market insulation materials for plenums, utilizing a "modified" E84 test, yet the code does not have provisions to use modified tests. Although there are insulation products that meet the flame and smoke requirements for plenums, the materials wrapped within them may begin to degrade, deteriorate and off-gas toxic fumes and substances into plenum spaces due to the high heat, even when protected. This off-gas could result in potential health and life-safety issues for occupants and first responders. All materials within plenums must meet the minimum plenum criteria and the code specifically identifies the proper tests. The IMC does not currently allow for "modified" test procedures in plenums. insulation materials for plenums, utilizing a "modified" E84 test, yet the code does not have provisions to use modified tests. Although there are insulation products that meet the flame and smoke requirements for plenums, the materials wrapped within them may begin to degrade, deteriorate and off-gas toxic fumes and substances into
plenum spaces due to the high heat, even when protected. This off-gas could result in potential health and life-safety issues for occupants and first responders. All materials within plenums must meet the minimum plenum criteria and the code specifically identifies the proper tests. The UMC does not currently allow for "modified" test procedures in plenums.

COMMITTEE ACTION: ACCEPT AS SUBMITTED

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 26

Appended Comments

PUBLIC COMMENT 1

Code Year: 2021 UMC  Section #: 605.1.1  Item #: 066

SUBMITTER: Mohamed Dano  Comment #: 1
Control Air Conditioning Corporation  Rep: Self

RECOMMENDATION: Revise text

Request to accept the code change proposal as modified by this public comment.

605.1.1 Where Ducts or Plenums. Materials installed within ducts and plenums for insulating, sound deadening, or other purposes shall have a mold, humidity, and erosion-resistant surface where tested in accordance with UL 181. Duct liners in systems operating with air velocities exceeding 2000 feet per minute (10.16 m/s) shall be fastened with both adhesive and mechanical fasteners, and exposed edges shall have approved treatment to withstand the operating velocity. Where the internal insulation is capable of being in contact with condensates or other liquids, the material shall be water-resistant. Pipe and duct insulation shall not be used to reduce the maximum flame and smoke requirements in Section 602.2 unless listed for application in plenums and tested in accordance with ASTM E84 or UL 723 as a composite assembly of the duct or pipe and its associated insulation, coatings and adhesives.

SUBSTANTIATION: The added language clarifies that along with being tested in accordance with ASTM E84 or UL 723, the composite pipe and duct insulation shall also be listed for application within plenums.

PUBLIC COMMENT 2

Code Year: 2021 UMC  Section #: 605.1.2  Item #: 066

SUBMITTER: Danial Aldib  Comment #: 2
Varitec Solutions  Rep: Self

RECOMMENDATION: Revise text

Request to accept the code change proposal as modified by this public comment.

605.1.2 Duct Coverings and Linings. Insulation applied to the surface of ducts, including duct coverings, linings, polyurethane foam, tapes, and adhesives, located in buildings shall have a flame-spread index not to exceed 25 and a smoke-developed index not to exceed 50, where tested in accordance with ASTM E84 or UL 723. The specimen preparation and mounting procedures of ASTM E2231 shall be used. Air duct coverings and linings shall not flame, glow, smolder, or smoke where tested in accordance with ASTM C411 at the temperature to which they are exposed in service. In no case shall the test temperature be less than 250°F (121°C). Coverings shall not penetrate a fire-resistance-rated assembly.

SUBSTANTIATION: This modification adds provisions for spray-applied polyurethane foam insulation to the list of insulation types covered in Section 605.1.2. The current list does not indicate that polyurethane foam should have a flame-spread index not to exceed
25 and a smoke-developed index not to exceed 50 when tested against ASTM E84 or UL 723. Therefore, it is necessary to add it to the code for clarity.
Item #: 068

UMC 2021 Section: Chapter 7: 701.5, 701.7.3, 702.1

SUBMITTER: IAPMO Staff - Update Extracts
NFPA 54 Extract Update

RECOMMENDATION:
Revise text

701.0 General.

701.5 Indoor Opening Size and Location. Openings used to connect indoor spaces shall be sized and located in accordance with the following:

(1) Combining spaces on the same story. Each opening shall have a minimum free area of not less than 1 square inch per 1000 Btu/h (0.002 m²/kW) of the total input rating of all appliances in the space, but not less than 100 square inches (0.065 m²). One permanent opening shall commence within 12 inches (305 mm) of the top of the enclosure, and one permanent opening shall commence within 12 inches (305 mm) of the bottom of the enclosure (see Figure 701.5). The minimum dimension of air openings shall not be less than 3 inches (76 mm).

(2) Combining spaces in different stories. The volumes of spaces in different stories shall be considered as communicating spaces where such spaces are connected by one or more permanent openings in doors or floors having a total minimum free area of not less than 2 square inches per 1000 Btu/h (0.004 m²/kW) of total input rating of all appliances. [NFPA 54:9.3.2.3]

701.7 Combination Indoor and Outdoor Combustion Air. (remaining text unchanged)

701.7.3 Outdoor Opening(s) Size. The outdoor opening(s) size shall be calculated in accordance with the following:

(1) The ratio of the interior spaces shall be the available volume of all communicating spaces divided by the required volume.
(2) The outdoor size reduction factor shall be one minus the ratio of interior spaces.
(3) The minimum size of outdoor opening(s) shall be the full size of outdoor opening(s) calculated in accordance with Section 701.6, multiplied by the reduction factor. The minimum dimension of air openings shall not be less than 3 inches (76 mm). [NFPA 54:9.3.4(3)]

702.0 Extra Device or Attachment.

702.1 General. No device or attachment shall be installed on any appliance that could in any way impair the combustion of gas. [NFPA 54:9.1.15]

SUBSTANTIATION:
In accordance with IAPMO's Regulations Governing Committee Projects (Extract Guidelines), Section 701.5, Section 701.7.3, and Section 702.1 are being revised to the latest edition of NFPA 54-2018.

COMMITTEE ACTION: ACCEPT AS SUBMITTED

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 25 NOT RETURNED: 1 HOWARD

Appended Comments
Public Comment 1

SUBMITTER: IAPMO Staff - Update Extracts
NFPA 54 Extract Update

RECOMMENDATION:
Revise text

Request to accept the code change proposal as modified by this public comment.

701.2 Pressure Difference. Where used, a draft hood or a barometric draft regulator shall be installed in the same room or enclosure as the appliance served so as to prevent any difference in pressure between the hood or regulator and the combustion-air supply. [NFPA 54:9.3.1.4]

701.4.1 Standard Method. The minimum required volume shall be not less than 50 cubic feet per 1000 British thermal units per hour (Btu/h) (4.83 m³/kW). [NFPA 54:9.3.2.1]

701.6 Outdoor Combustion Air. Outdoor combustion air shall be provided through opening(s) to the outdoors in accordance with the methods in Section 701.6.1 or Section 701.6.2. The minimum dimension of air openings shall be not less than 3 inches (76 mm). [NFPA 54:9.3.3]

701.6.1 Two Permanent Openings Method. Two permanent openings, one commencing within 12 inches (305 mm) of the top of the enclosure and one commencing within 12 inches (305 mm) of the bottom of the enclosure, shall be provided. The openings shall communicate directly, or by ducts, with the outdoors or spaces that freely communicate with the outdoors as follows:

(1) Where directly communicating with the outdoors or where communicating to the outdoors through vertical ducts, each opening shall have a minimum free area of not less than 1 square inch per 4000 Btu/h (0.0005 m²/kW) of total input rating of all appliances in the enclosure. [See Figure 701.6.1(1) and Figure 701.6.1(2)]

(2) Where communicating with the outdoors through horizontal ducts, each opening shall have a minimum free area of not less than 1 square inch per 2000 Btu/h (0.001 m²/kW) of total input rating of all appliances in the enclosure. [See Figure 701.6.1(3)]

701.7.1 Indoor Openings. Where used, openings connecting the interior spaces shall be in accordance with Section 701.5. [NFPA 54:9.3.4(1)]

701.7.2 Outdoor Opening(s) Location. Outdoor opening(s) shall be located in accordance with Section 701.6. [NFPA 54: 9.3.4(2)]

701.7.3 Outdoor Opening(s) Size. The outdoor opening(s) size shall be calculated in accordance with the following:

(1) The ratio of the interior spaces shall be the available volume of all communicating spaces divided by the required volume.

(2) The outdoor size reduction factor shall be 1 minus the ratio of interior spaces.

(3) The minimum size of outdoor opening(s) shall be the full size of outdoor opening(s) calculated in accordance with Section 701.6, multiplied by the reduction factor. The minimum dimension of air openings shall not be less than 3 inches (76 mm). [NFPA 54:9.3.4(3)]
701.9 Mechanical Combustion Air Supply. Where all combustion air is provided by a mechanical air supply system, the combustion air shall be supplied from outdoors at the minimum rate of not less than 0.35 cubic feet per minute per 1000 Btu/h \[0.034 \text{ (m}^3/\text{min)/kW}\] for all appliances located within the space. [NFPA 54:9.3.6]

FIGURE 701.6.2
ALL COMBUSTION AIR FROM OUTDOORS THROUGH SINGLE COMBUSTION AIR OPENING
[NFPA 54: FIGURE A.9.3.3.2]

701.10.1 Minimum Screen Mesh Size. Screens shall be not less smaller than 1/4 of an inch (6.4 mm) mesh. [NFPA 54:9.3.7.2]

701.10.2 Motorized Louvers. Motorized louvers shall be interlocked with the appliance so they are proven in the full open position prior to main burner ignition and during main burner operation. Means shall be provided to prevent the main burner from igniting where should the louver fail to open during burner startup and to shut down the main burner where if the louvers close during burner operation. [NFPA 54:9.3.7.3]

SUBSTANTIATION:
In accordance with IAPMO's Regulations Governing Committee Projects (Extract Guidelines), the above sections are being revised to the latest edition of NFPA 54-2018.
802.0 Venting of Appliances.

802.2.1 Appliances Not Required to be Vented. The following appliances shall not be required to be vented:

1. Listed ranges.
2. Built-in domestic cooking units listed and marked for optional venting.
3. Listed hot plates and listed laundry stoves.
4. Listed Type 1 clothes dryers exhausted in accordance with Section 504.4.
5. A single listed booster-type (automatic instantaneous) water heater, when designed and used solely for the sanitizing rinse requirements of a dishwashing machine, provided that the appliance is installed with a draft hood in place and unaltered, if a draft hood is required, in a commercial kitchen having a mechanical exhaust system. Where installed in this manner, the draft hood outlet shall not be less than 36 inches (914 mm) vertically and 6 inches (152 mm) horizontally from any surface other than the appliance.
7. Counter appliances.
8. Room heaters listed for unvented use.
10. Other appliances listed for unvented use and not provided with flue collars.
11. Specialized appliances of limited input such as laboratory burners or gas lights. [NFPA 54:12.3.2]

802.2.4 Ventilating Hoods. The use of ventilating hoods and exhaust systems shall be limited to industrial appliances and appliances installed in commercial applications and to vent industrial appliances, particularly where the process itself requires fume disposal. [NFPA 54:12.3.3]

802.2.5 Well-Ventilated Spaces. The operation of flue gases from industrial-type appliances shall not be required to be vented to the outdoors where such that its flue gases are discharged directly into a large and well-ventilated industrial space shall be permitted. [NFPA 54:12.3.4]

802.3 Design and Construction. Venting systems shall be designed and constructed to convey all flue and vent gases to the outdoors. [NFPA 54:12.1]

802.3.3 Mechanical Draft Systems. Mechanical draft systems shall be listed in accordance with UL 378 and installed in accordance with both the appliance and the mechanical draft system manufacturer’s installation instructions. [NFPA 54:12.4.3.1]

802.3.3.2 Leakage. Forced draft systems and all portions of induced draft systems under positive pressure during operation shall be designed and installed so as to prevent leakage of flue or vent gases into a building. [NFPA 54:12.4.3.3]

802.3.4.1 Ventilating Hoods and Exhaust Systems. Ventilating hoods and exhaust systems shall be permitted to be used to vent appliances installed in commercial applications. [NFPA 54:12.4.4.1]

802.3.4.4 Automatically Operated Appliances. Where automatically operated appliances, other than commercial cooking appliances, are vented through a ventilating hood or exhaust system equipped with a damper or with a power means of exhaust, provisions shall be made to allow the flow of gas to the main burners where only when the damper is open to a position to properly vent the appliance and where when the power means of exhaust is in operation. [NFPA 54:12.4.4.21]
### 802.3.5 Circulating Air Ducts and Furnace Plenums

Venting systems shall not extend into or pass through any fabricated air duct or furnace plenum. [NFPA 54:12.4.5.1]

### 802.4 Type of Venting System to be Used

The type of venting system to be used shall be in accordance with Table 802.4. [NFPA 54:12.5.1]

#### 802.4.1 Plastic Piping

Where plastic piping is used to vent an appliance, the appliance shall be listed for use with such venting materials and the appliance manufacturer’s installation instructions shall identify the specific plastic piping material. The plastic pipe venting materials shall be labeled in accordance with the product standards specified by the appliance manufacturer or shall be listed and labeled in accordance with UL 1738. [NFPA 54:12.5.2]

#### 802.4.2 Plastic Vent Joints

Plastic pipe and fittings used to vent appliances shall be installed in accordance with the appliance manufacturer’s installation instructions. Plastic pipe venting materials listed and labeled in accordance with UL 1738 shall be installed in accordance with the vent manufacturer's installation instructions. Where primer is required, it shall be of a contrasting color. [NFPA 54:12.5.3]

#### 802.4.3 Special Gas Vent

Special gas vents shall be listed and labeled in accordance with UL 1738 and installed in accordance with the special gas vent manufacturer’s installation instructions. [NFPA 54:12.5.4]

### TABLE 802.4

#### TYPE OF VENTING SYSTEM TO BE USED

[NFPA 54: Table 12.5.1]

<table>
<thead>
<tr>
<th>APPLIANCES</th>
<th>TYPE OF VENTING SYSTEM</th>
<th>LOCATION OF REQUIREMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Listed Category I appliances</td>
<td>Type B gas vent</td>
<td>Section 802.6</td>
</tr>
<tr>
<td>Listed appliances equipped with draft hood</td>
<td>Chimney</td>
<td>Section 802.5</td>
</tr>
<tr>
<td>Appliances listed for use with Type B gas vent</td>
<td>Single-wall metal pipe</td>
<td>Section 802.7</td>
</tr>
<tr>
<td></td>
<td>Listed chimney lining system for gas vent</td>
<td>Section 802.5.3</td>
</tr>
<tr>
<td></td>
<td>Special gas vent listed for these appliances</td>
<td>Section 802.4.3</td>
</tr>
<tr>
<td>Listed vented wall furnaces</td>
<td>Type B-W gas vent</td>
<td>Section 802.6, Section 907.0</td>
</tr>
<tr>
<td>Category II appliances, Category III appliances, and Category IV appliances</td>
<td>As specified or furnished by manufacturers of listed appliances</td>
<td>Section 802.4.1 and Section 802.4.3</td>
</tr>
<tr>
<td><strong>Incinerators</strong></td>
<td>Single-wall metal pipe</td>
<td>NFPA 82</td>
</tr>
<tr>
<td>Incinerators</td>
<td>In accordance with NFPA 82</td>
<td></td>
</tr>
<tr>
<td>Appliances that can be converted to use of solid fuel</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unlisted combination gas- and oil-burning appliances</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Combination gas- and solid-fuel-burning appliances</td>
<td>Chimney</td>
<td>Section 802.5</td>
</tr>
<tr>
<td>Appliances listed for use with chimneys only</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unlisted appliances</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Listed combination gas- and oil-burning appliances</td>
<td>Type L vent</td>
<td>Section 802.6</td>
</tr>
<tr>
<td></td>
<td>Chimney</td>
<td>Section 802.5</td>
</tr>
<tr>
<td>Decorative appliances in vented fireplace</td>
<td>Chimney</td>
<td>Section 911.2</td>
</tr>
<tr>
<td>Gas-fired toilets</td>
<td>Single-wall metal pipe</td>
<td>Section 802.7, Section 929.3</td>
</tr>
<tr>
<td>Direct-vent appliances</td>
<td></td>
<td>Section 802.2.6</td>
</tr>
<tr>
<td>Appliances with integral vents</td>
<td></td>
<td>Section 802.2.7</td>
</tr>
</tbody>
</table>
802.5.3 Masonry Chimneys. Masonry chimneys shall be built and installed in accordance with NFPA 211 and lined with approved one of the following:

1. Approved clay flue lining, a listed,
2. A listed chimney lining system, or other listed and labeled in accordance with UL 1777,
3. Other approved material that resists corrosion, erosion, softening, or cracking from vent gases at temperatures not exceeding up to 1800°F (982°C).

Exception: Masonry chimney flues lined with a chimney lining system specifically listed for use with listed appliances with draft hoods, Category I appliances, and other appliances listed for use with Type B vents shall be permitted. The liner shall be installed in accordance with the liner manufacturer’s installation instructions. A permanent identifying label shall be attached at the point where the connection is to be made to the liner. The label shall read: “This chimney liner is for appliances that burn gas only. Do not connect to solid-or liquid-fuel-burning appliances or incinerators.” [NFPA 54:12.6.1.3]

802.5.7.2 Cleanouts. Cleanouts shall be examined to determine that and where they will do not remain tightly closed when not in use, they shall be repaired or replaced. [NFPA 54:12.6.4.3]

802.5.7.3 Existing Chimney. Where inspection reveals that an existing chimney is not safe for the intended application, it shall be repaired, rebuilt, lined, relined, or replaced with a vent or chimney in accordance with to conform to NFPA 211, and shall be approved suitable for the appliances to be attached. [NFPA 54:12.6.4.4]

802.5.8.3 Combination Gas- and Oil-Burning Appliances. A single chimney flue serving a listed combination gas- and oil-burning appliance shall be sized to properly vent in accordance with the appliance manufacturer’s instructions. [NFPA 54:12.6.5.4]

802.6.1 Termination Requirements Gas Vent Termination. A The termination of gas vents shall terminate in accordance with one of comply with the following requirements:

1. A gas vent shall terminate in accordance with one of the following:
   1a) Gas vents that are 12 inches (300 mm) or less in size and located not less than 8 feet (2438 mm) from a vertical wall or similar obstruction shall terminate above the roof in accordance with Figure 802.6.1 and Table 802.6.1.
   1b) Gas vents that are over 12 inches (300 mm) in size or are located less than 8 feet (2438 mm) from a vertical wall or similar obstruction shall terminate not less than 2 feet (610 mm) above the highest point where they pass through the roof and not less than 2 feet (610 mm) above a portion of a building within 10 feet (3048 mm) horizontally.
   1c) Industrial appliances as provided in Section 802.2.5.
   1d) Direct-vent systems as provided in Section 802.2.6.
   1e) Appliances with integral vents as provided in Section 802.2.7.
   1f) Mechanical draft systems as provided in Section 802.3.3 through Section 802.3.3.5.
   1g) Ventilating hoods and exhaust systems as provided in Section 802.3.4 and Section 802.3.4.1. [NFPA 54:12.7.2(1)]

2. 802.6.1.1 Type B and L Vents. A Type B or a Type L gas vent shall terminate not less than at least 5 feet (1524 mm) in vertical height above the highest connected appliance draft hood or flue collar. [NFPA 54:12.7.2(2)]

3. 802.6.1.2 Type B-W Vents. A Type B-W gas vent shall terminate not less than at least 12 feet (3658 mm) in vertical height above the bottom of the wall furnace. [NFPA 54:12.7.2(3)]

4. 802.6.1.3 Exterior Wall Termination. A gas vent extending through an exterior wall shall not terminate adjacent to the wall or below eaves or parapets, except as provided in Section 802.2.6 and Section 802.3.3 through Section 802.3.3.5. [NFPA 54:12.7.2(4)]

5. 802.6.1.4 Decorative Shrouds. Decorative shrouds shall not be installed at the termination of gas vents except where such shrouds are listed for use with the specific gas venting system and are installed in accordance with the manufacturer’s installation instructions. [NFPA 54:12.7.2(5)]

6. 802.6.1.5 Termination Cap. All gas vents shall extend through the roof flashing, roof jack, or roof thimble and terminate with a listed cap or listed roof assembly. [NFPA 54:12.7.2(6)]

7. 802.6.1.6 Forced Air Inlet. A gas vent shall terminate not less than at least 3 feet (914 mm) above a forced air inlet located within 10 feet (3048 mm). [NFPA 54:12.7.2(7)] [NFPA 54:12.7.3]
802.6.2 Size of Gas Vents. Venting systems shall be sized and constructed in accordance with Section 802.6.2.1 through Section 802.6.2.3, Section 803.0 or other approved engineering methods and the gas vent and the appliance manufacturer’s instructions. [NFPA 54: 12.7.4]

802.7.3.1 Limitations. Single-wall metal pipe shall be used only for runs directly from the space in which the appliance is located through the roof or exterior wall to the outer air. A pipe passing through a roof shall extend without interruption through the roof flashing, roof jacket, or roof thimble. [NFPA 54: 12.8.4.2]

802.7.3.2 Attic or Concealed Space. Single-wall metal pipe shall not originate in any unoccupied attic or concealed space and shall not pass through any attic, inside wall, concealed space, or floor. [NFPA 54: 12.8.4.3]

802.7.3.5 Roof Thimble. Where a single-wall metal pipe passes through a roof constructed of combustible material, a noncombustible, nonventilating thimble shall be used at the point of passage. The thimble shall extend not less than at least 18 inches (457 mm) above and 6 inches (152 mm) below the roof with the annular space open at the bottom and closed only at the top. The thimble shall be sized in accordance with Section 802.7.3.4. [NFPA 54: 12.8.4.5]

802.7.4 Size of Single-Wall Metal Pipe. Single-wall metal piping shall comply with the following requirements: Section 802.7.4.1 through Section 802.7.4.3. [NFPA 54: 12.8.5]

(1) 802.7.4.1 Sizing of Venting System. A venting system of a single-wall metal pipe shall be sized in accordance with one of the following methods and the appliance manufacturer’s instructions:
(a) For a draft hood-equipped appliance, in accordance with Section 803.0.
(b) For a venting system for a single appliance with a draft hood, the areas of the connector and the pipe each shall not be less than the area of the appliance flue collar or draft hood outlet, whichever is smaller. The vent area shall not exceed be greater than seven times the draft hood outlet area.
(c) Other approved engineering methods. [NFPA 54:12.8.5(1)]

(2) 802.7.4.2 Non-Round Metal Pipe. Where a single-wall metal pipe is used and has a shape other than round, it shall have an equivalent effective area equal to the effective area of the round pipe for which it is substituted, and the minimum internal dimension of the pipe shall be not less than 2 inches (51 mm). [NFPA 54:12.8.5(2)]

(3) 802.7.4.3 Venting Capacity. The vent cap or a roof assembly shall have a venting capacity not less than that of the pipe to which it is attached. [NFPA 54:12.8.5(3)]

802.7.5 Support of Single-Wall Metal Pipe. All portions of single-wall metal pipe shall be supported for the design and weight of the material employed. [NFPA 54: 12.8.6]

802.8.2 Direct-Vent Appliances. The vent terminal of a direct-vent appliance with an input of 10 000 Btu/h (3 kW) or less vent terminals shall be located at least 6 inches (152 mm) from any air opening into a building, an appliance with an input over 10 000 Btu/h (3 kW) but not over 50 000 Btu/h (14.7 kW) shall be installed with a 9 inch (229 mm) vent termination clearance, and an appliance with an input exceeding 50 000 Btu/h (14.7 kW) shall have at least a 12-inch (305 mm) vent termination clearance in accordance with Table 802.8.2. The bottom of the vent terminal and the air intake shall be located at least not less than 12 inches (305 mm) above finished ground level. [NFPA 54: 12.9.3]
TABLE 802.8.2
THROUGH-THE-WALL DIRECT VENT TERMINATION CLEARANCES
[NFPA 54: TABLE 12.9.3]

<table>
<thead>
<tr>
<th>DIRECT VENT APPLIANCE INPUT RATING</th>
<th>THROUGH THE WALL VENT TERMINAL CLEARANCE FROM ANY AIR OPENING INTO A BUILDING (inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 000 Btu/hr and less</td>
<td>6</td>
</tr>
<tr>
<td>Greater than 10 000 Btu/hr and not exceeding 50 000 Btu/hr</td>
<td>9</td>
</tr>
<tr>
<td>Greater than 50 000 Btu/hr and not exceeding 150 000 Btu/hr</td>
<td>12</td>
</tr>
<tr>
<td>&gt; 150 000 Btu/hr</td>
<td>In accordance with the appliance manufacturer’s instructions and in no case less than the clearances specified in Section 802.8.1.</td>
</tr>
</tbody>
</table>

For SI Units: 1 inch = 25.4 mm, 1000 British thermal units per hour=0.293 kW

802.10.2.2 Size. Where two or more appliances are connected to a common vent or chimney, each vent connector shall be sized in accordance with Section 803.0 or other approved engineering methods. [NFPA 54:12.11.3.3]

As an alternative method applicable only where all of the appliances are draft hood-equipped, each vent connector shall have an effective area not less than the area of the draft hood outlet of the appliance to which it is connected. [NFPA 54:12.11.3.4]

802.10.3.2 Pressure. Vent connectors serving Category I appliances shall not be connected to any portion of a mechanical draft system operating under positive static pressure, such as those serving Category III or Category IV appliances. [NFPA 54:12.11.4.3]

802.10.4 Clearance. Minimum clearances from vent connectors to combustible material shall comply be in accordance with Table 802.7.3.3.

Exception: The clearance between a vent connector and combustible material shall be permitted to be reduced where the combustible material is protected as specified for vent connectors in Table 303.10.1. [NFPA 54:12.11.5]

802.12.3 Additional Devices. Appliances requiring controlled chimney draft shall be permitted to be equipped with listed double-acting barometric draft regulators installed and adjusted in accordance with the manufacturer’s installation instructions. [NFPA 54:12.13.4]

802.12.4 Location. Draft hoods and barometric draft regulators shall be installed in the same room or enclosure as the appliance in such a manner as to prevent any difference in pressure between the hood or regulator and the combustion air supply. [NFPA 54:12.13.5]

802.12.5 Positioning. Draft hoods and draft regulators shall be installed in the position for which they were designed with reference to the horizontal and vertical planes and shall be located so that the relief opening is not obstructed by a any part of the appliance or adjacent construction. The appliance and its draft hood shall be located so that the relief opening is accessible for checking vent operation. [NFPA 54:12.13.6]

802.12.6 Clearance. A draft hood shall be located so that its relief opening is not less than 6 inches (152 mm) from any surface except that of the appliance it serves and the venting system to which the draft hood is connected. Where a greater or lesser clearance is indicated on the appliance label, the clearance shall not be less than that specified on the label. Such clearances shall not be reduced. [NFPA 54:12.13.7]

802.13 Manually Operated Dampers. A manually operated damper shall not be placed in any appliance vent connector.

Fixed baffles shall not be classified as manually operated dampers. [NFPA 54:12.14]

802.14 Obstructions. Devices that retard the flow of vent gases shall not be installed in a vent connector, chimney, or vent. The following shall not be considered as obstructions:

(1) Draft regulators and safety controls specifically listed for installation in venting systems and installed in accordance with the manufacturer’s installation instructions.

(2) Approved draft regulators and safety controls designed and installed in accordance with approved engineering methods.

(3) Listed heat reclaimers and automatically operated vent dampers installed in accordance with the manufacturer’s installation instructions.

(4) Vent dampers serving listed appliances installed in accordance with Section 803.1 or Section 803.2 or other approved engineering methods.
(5) Approved economizers, heat reclaimers, and recuperators installed in venting systems of appliances not required to be equipped with draft hoods, provided the appliance manufacturer’s installation instructions cover the installation of such a device in the venting system and performance in accordance with Section 802.3 and Section 802.3.1 is obtained. [NFPA 54:12.16]

803.0 Sizing of Category I Venting Systems.
803.1 Single Appliance Vent Table 803.1.2(1) through Table 803.1.2(6). Venting Table 803.1.2(1) through Table 803.1.2(6) shall not be used where obstructions are installed in the venting system. The installation of vents serving listed appliances with vent dampers shall be in accordance with the appliance manufacturer’s installation instructions or in accordance with the following:
(1) The maximum capacity of the vent system shall be determined using the “NAT Max” column.
(2) The minimum capacity shall be determined as though the appliance were a fan-assisted appliance, using the “FAN Min” column to determine the minimum capacity of the vent system. Where the corresponding “FAN Min” is “NA”, the vent configuration shall not be permitted and an alternative venting configuration shall be utilized. [NFPA 54:13.1.1]

803.1.14 Single Run of Vent. In a single run of vent or vent connector, more than one diameter and type shall be permitted to be used, provided that all the sizes and types are permitted by the tables. [NFPA 54:13.1.14]

803.2.10 High-Altitude Installations. Sea level input ratings shall be used when determining maximum capacity for high-altitude installation. Actual input (derated for altitude) shall be used for determining minimum capacity for high-altitude installation. [NFPA 54:13.2.11]

803.2.12 Vent Height. For multiple appliances all located on one floor, the available total height (H) shall be measured from the highest draft hood outlet or flue collar up to the level of the outlet of the common vent. [NFPA 54:13.2.13]
803.2.13 Multistory Installations. For multistory installations, the available total height (H) for each segment of the system shall be the vertical distance between the highest draft hood outlet or flue collar entering that segment and the centerline of the next higher interconnection tee. (See Figure 803.2.13) [NFPA 54:13.2.14] (See Figure 803.2.13)

99% Winter Design Temperatures for the Contiguous United States

This map is a necessarily generalized guide to temperatures in the contiguous United States. Temperatures shown for areas such as mountainous regions and large urban centers may not be accurate. The climate data used to develop this map are from the 1993 ASHRAE Handbook — Fundamentals (Chapter 24, Table 1: Climate Conditions for the United States).

For 99% winter design temperatures in Alaska, consult the ASHRAE Handbook — Fundamentals.

99% winter design temperatures for Hawaii are greater than 37°F

For SI units: °C = (°F-32)/1.8
FIGURE 803.1.2(6)
RANGE OF WINTER DESIGN TEMPERATURES USED IN ANALYZING EXTERIOR MASONRY CHIMNEYS IN THE UNITED STATES
[NFPA 54: FIGURE F.2.4]

TABLE 1701.1
REFERENCED STANDARDS

<table>
<thead>
<tr>
<th>STANDARD NUMBER</th>
<th>STANDARD TITLE</th>
<th>APPLICATION</th>
<th>REFERENCED SECTIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>UL 378-2006</td>
<td>Draft Equipment (with revisions through September 17, 2013)</td>
<td>Fuel Gas, Appliances</td>
<td>802.15.1, 802.3.3</td>
</tr>
<tr>
<td>UL 1738-2010</td>
<td>Venting Systems for Gas-Burning Appliances, Categories II, III, and IV (with revisions through November 7, 2014)</td>
<td>Fuel Gas, Appliances</td>
<td>802.4.1, 802.4.2, 802.4.3</td>
</tr>
<tr>
<td>NFPA 82-2014</td>
<td>Incinerators and Waste and Linen Handling Systems and Equipment</td>
<td>Incinerator Chutes</td>
<td>802.2.8, Table 802.4, 925.1</td>
</tr>
<tr>
<td>UL 1777-2015</td>
<td>Chimney Liners</td>
<td>Chimneys, Liners</td>
<td>802.5.3(2), 803.11.2</td>
</tr>
</tbody>
</table>

(portion of table not shown remains unchanged)

Note: UL 378, UL 1738, and UL 1777 meet the requirements for mandatory reference standards in accordance with Section 3-3.7.1 of IAPMO’s Regulations Governing Committee Projects.

SUBSTANTIATION:
In accordance with IAPMO’s Regulations Governing Committee Projects (Extract Guidelines), Chapter 8 is being revised to the latest edition of NFPA 54-2018.

COMMITTEE ACTION: ACCEPT AS SUBMITTED

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 25  NOT RETURNED: 1  HOWARD

Appended Comments

PUBLIC COMMENT 1

Code Year: 2021 UMC  Section #: Chapter 8  Item #: 069

SUBMITTER: IAPMO Staff - Update Extracts  NFPA 54 Extract Update  Comment #: 1

RECOMMENDATION:
Revise text

Request to accept the code change proposal as modified by this public comment.

802.2.2 Maximum Input Rating. Where any or all of the appliances in Section 802.2.1(5) through Section 802.2.1(11) are installed so the aggregate input rating exceeds 20 Btu/hr/ft³ (207 W/m³) of room or space in which it is installed, one or more shall be provided with venting systems or other approved means for conveying the vent gases to the outdoors so that the aggregate input rating of the remaining unvented appliances does not exceed 20 Btu/hr/ft³ (207 W/m³). [NFPA 54:12.3.2.1]

802.5.1 Factory-Built Chimneys. Factory-built chimneys shall be listed in accordance with UL 103, UL 959, or UL 2561. Factory-built chimneys shall be installed in accordance with the manufacturer’s installation instructions. Factory-built chimneys used to vent appliances that operate at positive vent pressure shall be listed for such application. [NFPA 54:12.6.1.1]

802.5.4 Termination. A chimney for a residential-type or low-heat appliances shall extend not less than at least 3 feet (914 mm)
above the highest point where it passes through a roof of a building and not less than at least 2 feet (610 mm) higher than a portion of any building within a horizontal distance of 10 feet (3048 mm). [NFPA 54:12.6.2.1] (See Figure 802.5.4)

802.5.4.1 Medium-Heat Gas Appliances. A chimney for medium-heat appliances shall extend at least less than 10 feet (3048 mm) higher than any portion of any building within 25 feet (7620 mm). [NFPA 54:12.6.2.2]

802.5.4.2 Chimney Height. A chimney shall extend not less than at least 5 feet (1524 mm) above the highest connected appliance draft hood outlet or flue collar. [NFPA 54:12.6.2.3]

<table>
<thead>
<tr>
<th>Appliances</th>
<th>TYPE OF VENTING SYSTEM</th>
<th>LOCATION OF REQUIREMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Listed Category I appliances</td>
<td>Type B-gas vent</td>
<td>Section 802.6</td>
</tr>
<tr>
<td>Listed appliances equipped with draft hood</td>
<td>Chimney</td>
<td>Section 802.5</td>
</tr>
<tr>
<td>Appliances listed for use with Type B-gas vent</td>
<td>Single-wall metal pipe</td>
<td>Section 802.7</td>
</tr>
<tr>
<td></td>
<td>Listed chimney lining system for gas venting</td>
<td>Section 802.5.3</td>
</tr>
<tr>
<td></td>
<td>Special gas vent listed for these appliances</td>
<td>Section 802.4.3</td>
</tr>
<tr>
<td>Listed Category I appliances Listed appliances equipped with draft hood Appliances listed for use with Type B gas vent</td>
<td>Type B gas vent</td>
<td>Section 802.6</td>
</tr>
<tr>
<td></td>
<td>Chimney</td>
<td>Section 802.5</td>
</tr>
<tr>
<td></td>
<td>Single-wall metal pipe</td>
<td>Section 802.7</td>
</tr>
<tr>
<td></td>
<td>Listed chimney lining system for gas venting</td>
<td>Section 802.5.3</td>
</tr>
<tr>
<td></td>
<td>Special gas vent listed for these appliances</td>
<td>Section 802.4.3</td>
</tr>
<tr>
<td>Listed vented wall furnaces</td>
<td>Type B-W gas vent</td>
<td>Section 802.6, Section 907.0</td>
</tr>
<tr>
<td>Category II appliances, Category III appliances, Category IV appliances</td>
<td>As specified or furnished by manufacturers of listed appliances</td>
<td>Section 802.4.1 and Section 802.4.3</td>
</tr>
<tr>
<td>Incinerators</td>
<td>In accordance with NFPA 82</td>
<td></td>
</tr>
<tr>
<td>Appliances that can be converted to use of solid fuel Unlisted combination gas- and oil-burning appliances Combination gas- and solid-fuel-burning appliances Appliances listed for use with chimneys only Unlisted appliances</td>
<td>Chimney</td>
<td>Section 802.5</td>
</tr>
<tr>
<td>Listed combination gas- and oil-burning appliances</td>
<td>Type L vent Chimney</td>
<td>Section 802.6</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Section 802.5</td>
</tr>
<tr>
<td>Decorative appliances in vented fireplace</td>
<td>Chimney</td>
<td>Section 911.2</td>
</tr>
<tr>
<td>Gas-fired toilets</td>
<td>Single-wall metal pipe</td>
<td>Section 802.7, Section 929.3</td>
</tr>
<tr>
<td>Direct-vent appliances</td>
<td>—</td>
<td>Section 802.2.6</td>
</tr>
<tr>
<td>Appliances with integral vents</td>
<td>—</td>
<td>Section 802.2.7</td>
</tr>
</tbody>
</table>
802.5.7 Inspection of Chimneys. Before replacing an existing appliance or connecting a vent connector to a chimney, the chimney passageway shall be examined to ascertain that it is clear and free of obstructions and shall be cleaned where it previously used for venting solid- or liquid-fuel-burning appliances or fireplaces. [NFPA 54:12.6.4.1]

802.5.8.1 Gas and Liquid Fuel-Burning Appliances. Where one chimney serves gas appliances and liquid fuel-burning appliances, the appliances shall be connected through separate openings or shall be connected through a single opening where joined by a suitable fitting located as close as practical to the chimney. Where two or more openings are provided into one chimney flue, they shall be at different levels. Where the gas appliance is automatically controlled, it shall be equipped with a safety shutoff device. [NFPA 54:12.6.5.2]

802.5.10 Cleanouts. Where a chimney that formerly carried flue products from liquid or solid fuel-burning appliances is used with an appliance using fuel gas, an accessible cleanout shall be provided. The cleanout shall have a tight-fitting cover and be installed so its upper edge is not less than at least 6 inches (152 mm) below the lower edge of the lowest chimney inlet opening. [NFPA 54:12.6.7]

<table>
<thead>
<tr>
<th>ROOF PITCH SLOPE</th>
<th>H (minimum) (feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flat to 6/12</td>
<td>1.0</td>
</tr>
<tr>
<td>Over 6/12 to 7/12</td>
<td>1.25</td>
</tr>
<tr>
<td>Over 7/12 to 8/12</td>
<td>1.5</td>
</tr>
<tr>
<td>Over 8/12 to 9/12</td>
<td>2.0</td>
</tr>
<tr>
<td>Over 9/12 to 10/12</td>
<td>2.5</td>
</tr>
<tr>
<td>Over 10/12 to 11/12</td>
<td>3.25</td>
</tr>
<tr>
<td>Over 11/12 to 12/12</td>
<td>4.0</td>
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<tr>
<td>Over 12/12 to 14/12</td>
<td>5.0</td>
</tr>
<tr>
<td>Over 14/12 to 16/12</td>
<td>6.0</td>
</tr>
<tr>
<td>Over 16/12 to 18/12</td>
<td>7.0</td>
</tr>
<tr>
<td>Over 18/12 to 20/12</td>
<td>7.5</td>
</tr>
<tr>
<td>Over 20/12 to 21/12</td>
<td>8.0</td>
</tr>
</tbody>
</table>

For SI Units: 1 inch = 25.4 mm, 1 foot = 304.8 mm

802.6.2.1 Category I Appliances. The sizing of natural draft venting systems serving one or more listed appliances equipped with a draft hood or appliances listed for use with a Type B gas vent, installed in a single story of a building, shall be in accordance with one of the following:
(1) The provisions of Section 803.0.
(2) Vents serving fan-assisted combustion system appliances, or combinations of fan-assisted combustion system and draft hood-equipped appliances, shall be sized in accordance with Section 803.0 or other approved engineering methods.
(3) For sizing an individual gas vent for a single, draft hood-equipped appliance, the effective area of the vent connector and the gas vent shall be not less than the area of the appliance draft hood outlet or exceeding greater than seven times the draft hood outlet area.
(4) For sizing a gas vent connected to two appliances, with draft hoods, the effective area of the vent shall be not less than the area of the larger draft hood outlet plus 50 percent of the area of the smaller draft hood outlet or exceeding greater than seven times the smaller draft hood outlet area.
(5) Other approved engineering practices. [NFPA 54:12.7.4.1]

802.6.2.3 Category II, Category III, and Category IV Appliances. The sizing of gas vents for Category II, Category III, and Category IV appliances shall be in accordance with the appliance manufacturer’s instructions. The sizing of plastic pipe specified by the appliance manufacturer as a venting material for Category II, Category III, and Category IV appliances shall be in accordance
802.6.3.1 Occupiable Space. All appliances connected to the common vent shall be located in rooms separated from an occupiable space. Each of these rooms shall have provisions for an adequate supply of combustion, ventilation, and dilution air that is not supplied from an occupiable space. [NFPA 54:12.7.5.2] (See Figure 802.6.3.1)

802.7.3.3 Clearances. Minimum clearances from single-wall metal pipe to combustible material shall be in accordance with Table 802.7.3.3. Reduced clearances from single-wall metal pipe to combustible material shall be as specified for vent connectors in Table 303.10.1. [NFPA 54:12.8.4.4]

802.7.3.4 Combustible Exterior Wall. Single-wall metal pipe shall not pass through a combustible exterior wall unless guarded at the point of passage by a ventilated metal thimble not smaller than the following:

1. For listed appliances with draft hoods and appliances listed for use with Type B gas vents, the thimble shall be a minimum of 4 inches (102 mm) larger in diameter than the metal pipe. Where there is a run of not less than 6 feet (1829 mm) of metal pipe in the opening between the draft hood outlet and the thimble, the thimble shall be a minimum of 2 inches (51 mm) larger in diameter than the metal pipe.
2. For unlisted appliances having draft hoods, the thimble shall be a minimum of 6 inches (152 mm) larger in diameter than the metal pipe.
3. For residential and low-heat appliances, the thimble shall be a minimum of 12 inches (305 mm) larger in diameter than the metal pipe.

Exception: In lieu of thimble protection, all combustible material in the wall shall be removed a sufficient distance from the metal pipe to provide the specified clearance from such metal pipe to combustible material. Any material used to close up such opening shall be noncombustible. [NFPA 54:12.8.4.6]

802.8.1 Mechanical Draft Venting System. A mechanical draft venting system of other than direct-vent type shall terminate not less than 4 feet (1219 mm) below, 4 feet (1219 mm) horizontally from, or 1 foot (305 mm) above a any door, operable window, or gravity air inlet into a any building. The bottom of the vent terminal shall be located not less than at least 12 inches (305 mm) above finished ground level. [NFPA 54:12.9.2]

802.10.1 Materials. A vent connector shall be made of noncombustible, corrosion-resistant material capable of withstanding the vent gas temperature produced by the appliance and of a sufficient thickness to withstand physical damage. [NFPA 54:12.11.2.1]

802.10.9 Chimney Connection. Where entering a flue in a masonry or metal chimney, the vent connector shall be installed above the extreme bottom to avoid stoppage. Where a thimble or slip joint is used to facilitate removal of the connector, the connector shall be firmly attached to or inserted into the thimble or slip joint to prevent the connector from falling out. Means shall be employed to prevent the connector from entering so far as to restrict the space between its end and the opposite wall of the chimney flue. [NFPA 54:12.11.10]

802.12 Draft Hoods and Draft Controls. Vented appliances shall be installed with draft hoods.

Exception: Dual oven-type combination ranges; incinerators; direct-vent appliances; fan-assisted combustion system appliances; appliances requiring chimney draft for operation; single-firebox boilers equipped with conversion burners with inputs exceeding 400 000 Btu/h (117 kW); appliances equipped with blast, power, or pressure burners that are not listed for use with draft hoods; and appliances designed for forced venting. [NFPA 54:12.13.1]

802.12.1 Installation. A draft hood supplied with or forming a part of a listed vented appliance shall be installed without alteration, exactly as furnished and specified by the appliance manufacturer. [NFPA 54:12.13.2]

Exception: If a draft hood is not supplied by the appliance manufacturer where one is required, a draft hood shall be installed, be of a listed or approved type, and, in the absence of other instructions, be of the same size as the appliance flue collar. Where a draft hood is required with a conversion burner, it shall be of a listed or approved type. [NFPA 54:12.13.2.1]

Where a draft hood of special design is needed or preferable, the installation shall be approved and in accordance with the recommendations of the appliance manufacturer. [NFPA 54:12.13.2.2]

803.1.1 Vent Downsizing. Where the vent size determined from the tables is smaller than the appliance draft hood outlet or flue collar, the use of the smaller size shall be permitted provided that the installation is in accordance complies with all of the following requirements:

1. The total vent height (H) is not less than at least 10 feet (3048 mm).
2. Vents for appliance draft hood outlets or flue collars 12 inches (305 mm) in diameter or smaller are not reduced more than one table size.
3. Vents for appliance draft hood outlets or flue collars exceeding larger than 12 inches (305 mm) in diameter are not reduced more than two table sizes.
4. The maximum capacity listed in the tables for a fan-assisted appliance is reduced by 10 percent (0.90 x maximum table capacity).
5. The draft hood outlet exceeds is greater than 4 inches (102 mm) in diameter. A 3 inch (76 mm) diameter vent shall not be connected to a 4 inch (102 mm) diameter draft hood outlet. This provision shall not apply to fan-assisted appliances. [NFPA 54:13.1.2]
803.1.2 Elbows. Single-appliance venting configurations with zero (0) lateral lengths in Table 803.1.2(1), Table 803.1.2(2), and Table 803.1.2(5) shall not have elbows in the venting system. Single-appliance venting with lateral lengths, include two 90 degree elbows. For each additional elbow up to and including 45 degrees, the maximum capacity listed in the venting tables shall be reduced by 5 percent. For each additional elbow greater than 45 degrees up to and including 90 degrees, the maximum capacity listed in the venting tables shall be reduced by 10 percent. Where multiple offsets occur in a vent, the total lateral length of all offsets combined shall not exceed that specified in Table 803.1.2(1) through Table 803.1.2(5). [NFPA 54:13.1.3]

803.1.3 Zero Lateral. Zero (0) lateral (L) shall apply only to a straight vertical vent attached to a top outlet draft hood or flue collar. [NFPA 54:13.1.4]

803.1.4 High-Altitude Installations. Sea level input ratings shall be used when determining maximum capacity for high-altitude installation. Actual input (derated for altitude) shall be used for determining minimum capacity for high-altitude installation. [NFPA 54:13.1.5]

803.1.5 Multiple Input Ratings. For appliances with more than one input rate, the minimum vent capacity (FAN Min) determined from the Tables 803.1.2(1) through Table 803.2(9) shall be lesser than the lowest appliance input rating, and the maximum vent capacity (FAN Max/NAT Max) determined from the tables shall exceed be greater than the highest appliance rating input. [NFPA 54:13.1.6]

803.1.13 Upsizing. Vent connectors shall not be upsized more than two sizes exceeding greater than the listed appliance categorized vent diameter, flue collar diameter, or draft hood outlet diameter. [NFPA 54:13.1.13]

803.1.17 Engineering Methods. For vent heights lower than 6 feet (1829 mm) and higher than shown in the Tables 803.1.2(1) through Table 803.2(9), engineering methods shall be used to calculate vent capacities. [NFPA 54:13.1.17]

803.2.4 Vent Offsets. Where the common vertical vent is offset, the maximum capacity of the common vent shall be reduced in accordance with Section 803.2.5, and the horizontal length of the common vent offset shall not exceed 18 inches per inch (18 mm/mm) of common vent diameter (D). Where multiple offsets occur in a common vent, the total horizontal length of all offsets combined shall not exceed 18 inches per inch (18 mm/mm) of the common vent diameter. [NFPA 54:13.2.5]

803.2.5 Elbows in Vents. For each elbow up to and including 45 degrees (0.79 rad) in the common vent, the maximum common vent capacity listed in the venting tables shall be reduced by 5 percent. For each elbow exceeding greater than 45 degrees (0.79 rad) up to and including 90 degrees (1.57 rad), the maximum common vent capacity listed in the venting tables shall be reduced by 10 percent. [NFPA 54:13.2.6]

803.2.13 Multistory Installations. For multistory installations, available total height (H) for each segment of the system shall be the vertical distance between the highest draft hood outlet or flue collar entering that segment and the centerline of the next higher interconnection tee. [NFPA 54:13.2.14] (See Figure 803.2.13)

803.2.14 Size of Vents for Multistory Installations. The size of the lowest connector and of the vertical vent leading to the lowest interconnection of a multistory system shall be in accordance with Table 803.1.2(1) or Table 803.1.2(2) for available total height (H) up to the lowest interconnection. (See Figure 803.2.13) [NFPA 54:13.2.15]
803.2.15 Vent Type Multistory Installation. Where used in multistory systems, vertical common vents shall be Type B double-wall and shall be installed with a listed vent cap. [NFPA 54:13.2.16]

803.2.16 Offsets in Multistory Installations. Offsets in multistory common vent systems shall be limited to a single offset in each system, and systems with an offset shall comply with all of the following:
1. The offset angle shall not exceed 45 degrees (0.79 rad) from vertical.
2. The horizontal length of the offset shall not exceed 18 inches per inch (18 mm/mm) of common vent diameter of the segment in which the offset is located.
3. For the segment of the common vertical vent containing the offset, the common vent capacity listed in the common venting tables shall be reduced by 20 percent (0.80 x maximum common vent capacity).
4. A multistory common vent shall not be reduced in size above the offset. [NFPA 54:13.2.17]

803.2.23 Multiple Connector and Vent Sizes. Where a Table 803.1.2(1) through Table 803.2(9) permits more than one diameter of pipe to be used for a connector or vent, all the permitted sizes shall be permitted to be used. [NFPA 54:13.2.26]

803.2.27 Height Entries. Where the actual height of a vent falls between entries in the height column of the applicable table in Table 803.2(1) through Table 803.2(9), either one of the following shall be used:
1. Interpolation.
2. The lower appliance input rating shown in the table entries, for FAN MAX and NAT MAX column values; and the higher appliance input rating for the FAN MIN column values. [NFPA 54:13.2.30]
99% Winter Design Temperatures for the Contiguous United States

This map is a necessarily generalized guide to temperatures in the contiguous United States. Temperatures shown for areas such as mountainous regions and large urban centers may not be necessarily accurate. The climate data used to develop this map are from the ASHRAE Handbook – Fundamentals (Climate Conditions for the United States).

For 99% winter design temperatures in Alaska, consult the ASHRAE Handbook — Fundamentals. 99% winter design temperatures for Hawaii are greater than 37°F
For SI units: °C = (°F-32)/1.8

FIGURE 803.1.2(6)
RANGE OF WINTER DESIGN TEMPERATURES USED IN ANALYZING EXTERIOR MASONRY CHIMNEYS IN THE UNITED STATES
[NFPA 54: FIGURE F.2.4]

SUBSTANTIATION:
In accordance with IAPMO’s Regulations Governing Committee Projects (Extract Guidelines), the above sections are being revised to the latest edition of NFPA 54-2018.
Item #: 070
UMC 2021  Section: 802.5.1.2, Table 1701.1

SUBMITTER: David Dias
Sheet Metal Workers Local 104

RECOMMENDATION:
Revise text

802.0 Venting of Appliances.
802.5 Masonry, Metal, and Factory-Built Chimneys. (remaining text unchanged)

802.5.1 Factory-Built Chimneys. (remaining text unchanged)

802.5.1.2 Listing Requirements. Factory-built chimneys shall comply with the requirements of UL 103, or UL 959 or UL 2561. Factory-built chimneys for use with wood-burning appliances shall comply with the Type HT requirements of UL 103. [NFPA 211:6.1.3.1, 6.1.3.2]

TABLE 1701.1
REFERENCED STANDARDS

<table>
<thead>
<tr>
<th>STANDARD NUMBER</th>
<th>STANDARD TITLE</th>
<th>APPLICATION</th>
<th>REFERENCED SECTIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>UL 2561-2016</td>
<td>1400 Degree Fahrenheit Factory-Built Chimneys</td>
<td>Chimneys</td>
<td>802.5.1.2</td>
</tr>
</tbody>
</table>

(Note: UL 2561 meets the requirements for mandatory reference standards in accordance with Section 3-3.7.1 of IAPMO's Regulations Governing Committee Projects.)

SUBSTANTIATION:
Section 802.5.1.2 is being revised to include the correct standard for factory-built chimneys. This is consistent with current industry standards.

COMMITTEE ACTION: ACCEPT AS SUBMITTED

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 25  NOT RETURNED: 1  HOWARD

The TCC has the responsibility to resolve conflicts and achieve correlation among the recommendations of the Technical Committee. The TCC has the authority to choose between alternative text recommended by the Technical Committee, but only as necessary for correlation, consistency, and the correction of errors and omissions in accordance with Section 3-4 of the Regulations Governing Committee Projects.

Actions taken on UMC Item # 070, Section 802.5.1.2 (Listing Requirements) resulted in conflicting language between UPC Item # 048, Section 509.5.1.2 (Listing Requirements). In order to correlate the language, the Technical Correlating Committee proposed the following modifications to the UMC:

802.0 Venting of Appliances.
802.5 Masonry, Metal, and Factory-Built Chimneys. (remaining text unchanged)

802.5.1 Factory-Built Chimneys. (remaining text unchanged)

802.5.1.2 Listing Requirements. Factory-built chimneys shall comply with the requirements of UL 103, or UL 959 or UL 2561. Factory-built chimneys for use with wood-burning appliances shall comply with the Type HT requirements of UL 103. [NFPA 211:6.1.3.1, 6.1.3.2]

TCC ACTION: ACCEPT AS SUBMITTED

TCC STATEMENT: The language in UMC Item # 070, Section 802.5.1.2 (Listing Requirements) is being revised to correlate with the action taken by the UPC TC for Item # 048, Section 509.5.1.2 (Listing Requirements) regarding listing requirements for factory-built chimneys.

The action moves forward as approved by the TCC and supersedes the recommendation from the UMC TC for actions taken for Section 802.5.1.2 (Listing Requirements) with regards to listing requirements for factory-built chimneys.

APPENDED COMMENTS

PUBLIC COMMENT 1

Code Year: 2021 UMC Section #: 802.5.1, 802.5.1.2, Table 1701.1 Item #: 070

SUBMITTER: David Dias
Sheet Metal Workers Local 104 Comment #: 1

RECOMMENDATION:
Revise text

Request to accept the code change proposal as modified by this public comment.

802.0 Venting of Appliances.

802.5 Masonry, Metal, and Factory-Built Chimneys. (remaining text unchanged)

802.5.1 Factory-Built Chimneys. Factory-built chimneys shall be listed in accordance with UL 103, UL 959, or UL 2561. Factory-built chimneys shall be installed in accordance with the manufacturer’s installation instructions. Factory-built chimneys used to vent appliances that operate at positive vent pressure shall be listed for such application. [NFPA 54:12.6.1.1]

802.5.1.2 Listing Requirements. Factory-built chimneys shall comply with the requirements of UL 103 or UL 959. Factory-built chimneys for use with wood-burning appliances shall comply with the Type HT requirements of UL 103. [NFPA 211:6.1.3.1, 6.1.3.2]

TABLE 1701.1

<table>
<thead>
<tr>
<th>STANDARD NUMBER</th>
<th>STANDARD TITLE</th>
<th>APPLICATION</th>
<th>REFERENCED SECTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>UL 103-2010</td>
<td>Factory-Built Chimneys for Residential Type and Building Heating Appliances (with revisions through March 15, 2017)</td>
<td>Fuel Gas, Appliances</td>
<td>802.5.1.1, 802.5.1.2 802.5.1</td>
</tr>
<tr>
<td>UL 959-2010</td>
<td>Medium Heat Appliance Factory-Built Chimneys (with revisions through June 12, 2014)</td>
<td>Fuel Gas, Appliances</td>
<td>802.5.1.2 802.5.1</td>
</tr>
<tr>
<td>UL 2561-2016</td>
<td>1400 Degree Fahrenheit Factory-Built Chimneys (with revisions through April 19, 2018)</td>
<td>Chimneys</td>
<td>802.5.1</td>
</tr>
</tbody>
</table>

(portion of table not shown remains unchanged)
Note: UL 103, UL 959, and UL 2561 meet the requirements for mandatory reference standards in accordance with Section 3-3.7.1 of IAPMO’s Regulations Governing Committee Projects.

SUBSTANTIATION:
The proposed code change updates the NFPA 54 extract in Section 802.5.1 (Factory-Built Chimneys) to the latest edition of NFPA 54-2018.

Furthermore, Section 802.5.1.2 (Listing Requirements) is being stricken as the language addresses the same standards as Section 802.5.1 with the addition of UL 2561 for factory-built chimneys. The stricken language is redundant and not needed.
Item #: 072

UMC 2021 Section: Chapter 9: 902.11 - 938.1, Table 1701.1

SUBMITTER: IAPMO Staff - Update Extracts
NFPA 54 Extract Update

RECOMMENDATION:
Revise text

902.0 General.
902.11 Combination of Appliances and Equipment. A Any combination of appliances, equipment, attachments, or devices used together in a any manner shall be in accordance comply with the standards that apply to the individual appliance and equipment. [NFPA 54:9.1.21]

911.0 Decorative Appliances for Installation in Vented Fireplaces.

| TABLE 911.2 |
| FREE OPENING AREA OF CHIMNEY DAMPER FOR VENTING FLUE GASES FROM UNLISTED DECORATIVE APPLIANCES FOR INSTALLATION IN VENTED FIREPLACES [NFPA 54: TABLE 10.6.2.3] |

<table>
<thead>
<tr>
<th>CHIMNEY HEIGHT (feet)</th>
<th>8</th>
<th>13</th>
<th>20</th>
<th>29</th>
<th>39</th>
<th>51</th>
<th>64</th>
</tr>
</thead>
<tbody>
<tr>
<td>APPLIANCE INPUT RATING (Btu/h)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>7800</td>
<td>14 000</td>
<td>23 200</td>
<td>34 000</td>
<td>46 400</td>
<td>62 400</td>
<td>80 000</td>
</tr>
<tr>
<td>8</td>
<td>8400</td>
<td>15 200</td>
<td>25 200</td>
<td>37 000</td>
<td>50 400</td>
<td>68 000</td>
<td>86 000</td>
</tr>
<tr>
<td>10</td>
<td>9000</td>
<td>16 800</td>
<td>27 600</td>
<td>40 400</td>
<td>55 800</td>
<td>74 400</td>
<td>96 400</td>
</tr>
<tr>
<td>15</td>
<td>9800</td>
<td>18 200</td>
<td>30 200</td>
<td>44 600</td>
<td>62 400</td>
<td>84 000</td>
<td>108 800</td>
</tr>
<tr>
<td>20</td>
<td>10 600</td>
<td>20 200</td>
<td>32 600</td>
<td>50 400</td>
<td>68 400</td>
<td>94 000</td>
<td>122 200</td>
</tr>
<tr>
<td>30</td>
<td>11 200</td>
<td>21 600</td>
<td>36 600</td>
<td>55 200</td>
<td>76 800</td>
<td>105 800</td>
<td>138 600</td>
</tr>
</tbody>
</table>

For SI units: 1 foot = 304.8 mm, 1000 British thermal units per hour = 0.293 kW, 1 square inch = 0.000645 m²

* The first six minimum permanent free openings [8 square inches (0.005 m²) to 51 square inches (0.03 m²)] correspond approximately to the cross-sectional areas of chimneys having diameters of 3 inches (76 mm) through 8 inches (203 mm), respectively. The 64 square inch (0.04 m²) opening corresponds to the cross-sectional area of a standard 8 inch (203 mm) by 8 inch (203 mm) chimney tile.

914.0 Non-Recirculating Direct Gas-Fired Industrial Air Heaters.

914.3 Installation. Non-recirculating direct gas-fired industrial air heaters shall be installed in accordance with the manufacturer’s instructions. [NFPA 54:10.8.3.1]
914.3.1 Industrial or Commercial Occupancies. Non-recirculating direct gas-fired industrial air heaters shall be installed only in industrial or commercial occupancies. [NFPA 54:10.8.3.2]

(renumber remaining sections)

914.4 Clearance from Combustible Materials. Non-recirculating direct gas-fired industrial air heaters shall be installed with a clearance from combustible materials of not less than that shown on the rating plate and the manufacturer’s installation instructions. [NFPA 54:10.8.4]

915.0 Recirculating Direct Gas-Fired Industrial Air Heaters.

915.3 Installation. Installation of direct gas-fired industrial air heaters shall comply with the following requirements:
1. Recirculating direct gas-fired industrial air heaters shall be installed in accordance with the manufacturer’s installation instructions. [NFPA 54:10.9.3]

915.8 Purging. Inlet ducting, where used, shall be purged with not less than four air changes prior to an ignition attempt. [NFPA 54:10.9.8]

918.0 Food Service Appliance, Floor Mounted.

918.8 Ventilation. Means shall be provided to ventilate the space in which a food service appliance is installed to permit combustion of the gas. [NFPA 54:10.12.8]

920.0 Household Cooking Appliances.

920.4.3 Horizontal Clearance. The horizontal distance from the center of the burner head(s) of a listed top (or surface) cooking appliance to vertical combustible walls extending above the top panel shall be not less than that distance specified by the permanent marking on the appliance. [NFPA 54:10.15.2.3]

(renumber remaining sections)

920.4.4 Level Installation. Built-in household cooking appliances shall be installed so that the cooking top, broiler pan, or oven racks are level. [NFPA 54:10.15.2.4]

938.0 Compressed Natural Gas (CNG) Vehicular Fuel Systems.

938.1 General. The installation of compressed natural gas (CNG) fueling (dispensing) systems shall conform to NFPA 52. Residential CNG fueling appliances shall be listed in accordance with CSA NGV 5.1 and installed in accordance to the appliance manufacturer’s installation instructions. [NFPA 54:10.28]

## TABLE 1701.1 REFERENCED STANDARDS

<table>
<thead>
<tr>
<th>STANDARD NUMBER</th>
<th>STANDARD TITLE</th>
<th>APPLICATION</th>
<th>REFERENCED SECTIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>CSA NGV 5.1-2016</td>
<td>Residential Fueling Appliances</td>
<td>Appliances</td>
<td>938.1</td>
</tr>
</tbody>
</table>

(portion of table not shown remains unchanged)

Note: CSA NGV 5.1 meets the requirements for mandatory reference standards in accordance with Section 3-3.7.1 of IAPMO’s Regulations Governing Committee Projects.

**SUBSTANTIATION:**
In accordance with IAPMO’s Regulations Governing Committee Projects (Extract Guidelines), Section Chapter 9 is being revised to the latest edition of NFPA 54-2018.

**COMMITTEE ACTION:** ACCEPT AS SUBMITTED

**TOTAL ELIGIBLE TO VOTE:** 26

**VOTING RESULTS:** AFFIRMATIVE: 26

Appended Comments
PUBLIC COMMENT 1

Code Year: 2021 UMC  Section #: Chapter 9  Item #: 072

SUBMITTER: IAPMO Staff - Update Extracts  NFPA 54 Extract Update  Comment #: 1

RECOMMENDATION:
Revise text

Request to accept the code change proposal as modified by this public comment.

902.4 Type of Gas(es). The appliance shall be connected to the fuel gas for which it was designed. No attempt shall be made to convert the appliance from the gas specified on the rating plate for use with a different gas without consulting the manufacturer’s installation instructions, the serving gas supplier, or the appliance manufacturer for complete instructions. [NFPA 54:9.1.3]

904.6.1 Discharge. Relief valves shall be piped to discharge near the floor. [NFPA 54:10.3.6.1]
904.6.2 Size. The entire discharged piping shall be not less than at least the same size as the relief valve discharge piping. [NFPA 54:10.3.6.2]
904.6.3 End Connections. Discharge piping shall not contain a threaded end connection at its termination point. [NFPA 54:10.3.6.3]
904.7 Refrigeration Coils. The installation of refrigeration coils shall comply with the following requirements:
(1) A refrigeration coil shall not be installed in conjunction with a forced-air furnace where circulation of cooled air is provided by the furnace blower, unless the blower has the sufficient capacity to overcome the external static pressure resistance imposed by the duct system and refrigeration coil at the air flow rate for heating or cooling, whichever is greater.
(2) Furnaces shall not be located upstream from refrigeration coils, unless the refrigeration coil is designed or equipped so as not to develop excessive temperature or pressure.
(3) Refrigeration coils shall be installed in parallel with or on the downstream side of central furnaces to avoid condensation in the heating element, unless the furnace has been specifically listed for downstream installation. With a parallel flow arrangement, the dampers or other means used to control flow of air shall be sufficiently tight to prevent any circulation of cooled air through the furnace.
(4) Means shall be provided for disposal of condensate and to prevent dripping of condensate on the heating element. [NFPA 54:10.3.8]

<table>
<thead>
<tr>
<th>TABLE 904.2.2</th>
</tr>
</thead>
<tbody>
<tr>
<td>CLEARANCES TO COMBUSTIBLE MATERIAL FOR UNLISTED FURNACES AND BOILER *</td>
</tr>
<tr>
<td>[NFPA 54: TABLE 10.3.2.2]</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>APPLIANCE</th>
<th>ABOVE AND SIDES OF FURNACE PLENUM</th>
<th>TOP OF BOILER</th>
<th>JACKET SIDES AND REAR</th>
<th>FRONT</th>
<th>DRAFT HOOD AND BAROMETRIC DRAFT REGULATOR</th>
<th>SINGLE-WALL VENT CONNECTOR</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Automatically fired, forced air or gravity system, equipped with temperature limit control that is not capable of being set to exceed higher than 250°F.</td>
<td>6</td>
<td>–</td>
<td>6</td>
<td>18</td>
<td>6</td>
<td>18</td>
</tr>
<tr>
<td>2. Automatically fired heating boilers – steam boilers operating at not over 15 pounds-force per square inch (psi) and hot water boilers operating at 250°F or less.</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>18</td>
<td>18</td>
<td>18</td>
</tr>
<tr>
<td>3. Central heating boilers and furnaces, other than in 1 or 2.</td>
<td>18</td>
<td>18</td>
<td>18</td>
<td>18</td>
<td>18</td>
<td>18</td>
</tr>
</tbody>
</table>
For SI units: 1 inch = 25.4 mm, °C = (°F-32)/1.8, 1 pound-force per square inch = 6.8947 kPa

*See Section 904.1 for additional requirements for central heating boilers and furnaces.

905.2 Installation of Duct Furnaces. Duct furnaces shall be installed in accordance with the manufacturer’s installation instructions. [NFPA 54:10.10.2]

906.8 Access. The space in which a any floor furnace is installed shall be accessible by an opening in the foundation not less than 24 inches by 18 inches (610 mm by 457 mm) or by a trap door not less than 24 inches by 24 inches (610 mm by x 610 mm) in any cross-section thereof, and a passageway not less than 24 inches by 18 inches (610 mm by 457 mm) in any cross-section thereof. [NFPA 54:10.11.8]

906.9 Seepage Pan. Where the excavation exceeds 12 inches (305 mm) in depth or water seepage is likely to collect, a watertight copper pan, concrete pit, or other approved suitable material shall be used, unless adequate drainage is provided or the appliance is sealed by the manufacturer to meet this condition. A copper pan shall be made of not less than 16 ounces per square foot (oz/ft²) (4.9 kg/m²) sheet copper. The pan shall be anchored in place so as to prevent floating, and the walls shall extend at least 4 inches (102 mm) above the ground level with at least a 6 inches (152 mm) clearance on all sides, except on the control side, which shall have at least an 18 inch (457 mm) clearance. [NFPA 54:10.11.9]

908.2.3 Multiple-Family or Public Use. All clothes dryers installed for multiple-family or public use shall be equipped with approved safety shutoff devices and shall be installed as specified for a Type 2 clothes dryer in accordance with under Section 504.4.3.1. [NFPA 54:10.4.6]

909.0 Conversion Burners.
909.1 General. Installation of conversion burners shall comply with conform to CSA Z21.8. [NFPA 54:10.5]

914.8 Purging. Inlet ducting, when used, shall be purged with at least than four air changes prior to an ignition attempt. [NFPA 54:10.8.8]

915.4 Clearance from Combustible Materials. Recirculating direct gas-fired industrial air heaters shall be installed with a clearance from combustible materials of not less than that shown on the rating plate and the manufacturer’s installation instructions. [NFPA 54:10.9.4]

919.1 Vertical Clearance. A vertical distance of not less than 48 inches (1219 mm) shall be provided between the top of all food service hot plates and griddles and combustible material. [NFPA 54:10.13.1]

919.4 Mounting of Unlisted Appliances. Unlisted food service counter appliances shall not be set on combustible material unless they have legs that provide not less than 4 inches (102 mm) of open space below the burners and the combustible surface is protected with insulating millboard not less than at least 1/4 of an inch (6 mm) thick covered with sheet metal not less than 0.0122 of an inch (0.3099 mm) thick, or with equivalent protection. [NFPA 54:10.13.4]

SUBSTANTIATION:
In accordance with IAPMO's Regulations Governing Committee Projects (Extract Guidelines), the above sections are being revised to the latest edition of NFPA 54-2018.
Proposals

Edit Proposal

Item #: 073

UMC 2021 Section: 903.1, 1101.2, 220.0, Table 1701.1

SUBMITTER: David Dias
Sheet Metal Workers Local 104

RECOMMENDATION:
Revise text

903.0 Air-Conditioning Appliances.

903.1 Electric Air Conditioners. Electric air conditioning systems designed for permanent installation shall comply with UL 1995, UL 60335-2-24, or UL 60335-2-40.

1101.0 General.( remaining text unchanged)

1101.2 Equipment. Equipment for refrigerant recovery, recycling, or both shall comply with UL 1963. Group A2L refrigerants shall only be used in equipment that is listed and labeled in accordance with Section 903.1 for the specific A2L refrigerant.

CHAPTER 2
DEFINITIONS

220.0 – R –

Flammability Classification. Refrigerants shall be classified for flammability in accordance with one of the following:

Class 1. Refrigerants that do not show flame propagation where tested in air at 14.7 pound-force per square inch absolute (psia) (101 kPa) and 140°F (60°C).

Class 2. Refrigerants having a lower flammability limit (LFL) of more than 0.00625 pound per cubic foot (lb/ft³) (0.10012 kg/m³) at 140°F (60°C), 14.7 psia (101 kPa), and a heat of combustion of less than 8169 British thermal units per pound (Btu/lb) (1.8988 E+07 J/kg).

Class 2L. Indicates a refrigerant with lower flammability and a burning velocity of not more than 3.9 inches per second (0.099 m/s).

<table>
<thead>
<tr>
<th>STANDARD NUMBER</th>
<th>STANDARD TITLE</th>
<th>APPLICATION</th>
<th>REFERENCED SECTIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>UL 60335-2-89-2017</td>
<td>Household and Similar Electrical Appliances – Safety – Part 2-89: Particular Requirements for Commercial Refrigerating Appliances with an Incorporated or Remote Refrigerant Unit or Compressor</td>
<td>Appliances</td>
<td>903.1</td>
</tr>
</tbody>
</table>

(portion of table not shown remains unchanged)
Note: UL 60335-2-24 and UL 60335-2-89 meet the requirements for mandatory reference standards in accordance with Section 3-3.7.1 of IAPMO's Regulations Governing Committee Projects.

**SUBSTANTIATION:**
Section 903.1 should be revised as only specific appliances can be used for refrigeration systems. UL 60335-2-24 and UL 60335-2-89 are appropriate for the application. Furthermore, 1101.2 should be revised to indicate that only those equipment listed for use with A2L refrigerants should be used. Lastly, a definition for 2L is required as it is currently not defined; the proposed definition will correlate with ASHRAE 34.

**COMMITTEE ACTION:** REJECT

**COMMITTEE STATEMENT:**
The proposed text is outside the scope of the UMC and further research is needed with regards to A2L refrigerants before adding this provision to the code.

**TOTAL ELIGIBLE TO VOTE:** 26

**VOTING RESULTS:**
- AFFIRMATIVE: 24
- ABSTAIN: 1
- NOT RETURNED: 1 HOWARD

**EXPLANATION OF ABSTAIN:**
MACNEVIN: I am abstaining as the basis of rejection is not fully understood.

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**Appended Comments**

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**PUBLIC COMMENT 1**

**Code Year:** 2021 UMC  **Section #:** 220.0, Table 1102.3  **Item #:** 073

**SUBMITTER:** Connor Barbaree  **ASHRAE**

**RECOMMENDATION:**
Revise text

Request to accept the code change proposal **as modified** by this public comment.

---

**CHAPTER 2**

**DEFINITIONS**

220.0  – R –

**Refrigerant Safety Classifications.** (remaining text unchanged)

**Flammability Classification.** (remaining text unchanged)

**Class 2.** Refrigerants **having** that exhibit a flame propagation at 140°F (60°C), 14.7 psia (101 kPa) and lower flammability limit (LFL) of more than 0.00625 pound per cubic foot (lb/ft³) (0.10012 kg/m³) at 140°F (60°C), 14.7 psia (101 kPa), and a heat of combustion of less than 8169 British thermal units per pound (Btu/lb) (1.8988 E+07 J/kg).

**Class 2L.** Refrigerants that exhibit a flame propagation at 140°F (60°C), 14.7 psia (101 kPa) and lower flammability limit (LFL) of more than 0.0062 pound per cubic foot (lb/ft³) (0.10012 kg/m³), a heat of combustion of less than 8169 British thermal units per pound (Btu/lb) (1.8988 E+07 J/kg), and has a maximum burning velocity of 3.9 inches per second (in/s) (10 cm/s) when tested at 73.4°F (23°C), 14.7 psia (101 kPa) of dry air.

**Class 3.** Refrigerants that **exhibit a flame propagation at 140°F (60°C), 14.7 psia (101 kPa); and** are highly flammable having a LFL of not more than 0.00625 lb/ft³ (0.10012 kg/m³) at 140°F (60°C) and 14.7 psia (101 kPa) or a heat of combustion not less than 8169 Btu/lb (1.8988 E+07 J/kg).
### TABLE 1102.3
**REFRIGERANT GROUPS, PROPERTIES, AND ALLOWABLE QUANTITIES**

[ASHRAE 34: TABLE 4-1, TABLE 4-2]

<table>
<thead>
<tr>
<th>REFRIGERANT</th>
<th>CHEMICAL FORMULA</th>
<th>CHEMICAL NAME(^1) (COMPOSITION FOR BLENDS)</th>
<th>SAFETY GROUP(^7)</th>
<th>OEL(^2)(ppm)</th>
<th>POUNDS PER 1000 CUBIC FEET OF SPACE</th>
</tr>
</thead>
</table>

(portion of table not shown remains unchanged)

**Notes:**
1. (1) – (6) (remaining text unchanged)
2. (7) Refrigerant flammability classification of Class 2L shall comply with the requirements for flammability classification of Class 2 (\(\#2\)) (remaining text unchanged)

**SUBSTANTIATION:**
In accordance with IAPMO’s Regulations Governing Committee Projects (Extract Guidelines), Chapter 2 has been revised to correlate with Addendum g of ASHRAE 34-2016 (published June 28, 2018).

Table 1102.3 is being revised to strike out Note (7) since the definition for "Class 2" has been added by addendum g of ASHRAE 34-2016. Therefore, Note (7) is no longer needed.

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**PUBLIC COMMENT 2**

**Code Year:** 2021 UMC  **Section #:** 903.1, 1101.2, Table 1701.1  **Item #:** 073

**SUBMITTER:** David Dias  
Sheet Metal Workers Local 104

**RECOMMENDATION:**
Revise text

Request to accept the code change proposal as modified by this public comment.

**903.0 Air-Conditioning Appliances.**

**903.1 Electric Air Conditioners.** Electric air conditioning systems designed for permanent installation shall comply with **UL 412, UL 474, UL 484, UL 1995, UL 60335-2-24, or UL 60335-2-40, or UL 60335-2-89**.

**1101.0 General.** (remaining text unchanged)

**1101.2 Equipment.** Equipment for refrigerant recovery, recycling, or both shall comply with UL 1963. **Group A2L refrigerants shall only be used in equipment that is listed and labeled in accordance with Section 903.1 for the specific A2L refrigerant.**

---

**TABLE 1701.1**
**REFERENCED STANDARDS**

<table>
<thead>
<tr>
<th>STANDARD NUMBER</th>
<th>STANDARD TITLE</th>
<th>APPLICATION</th>
<th>REFERENCED SECTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>UL 412-2011</td>
<td>Refrigeration Unit Coolers (with revisions through January 9, 2017 August 28, 2018)</td>
<td>Refrigeration</td>
<td>903.1, 934.2</td>
</tr>
<tr>
<td>UL 474-2015</td>
<td>Dehumidifiers (with revisions through June 24, 2015)</td>
<td>Appliances</td>
<td>903.1</td>
</tr>
<tr>
<td>UL 484-2014</td>
<td>Room Air Conditioners (with revisions through September 6, 2018)</td>
<td>HVAC</td>
<td>903.1</td>
</tr>
<tr>
<td>UL 60335-2-24-</td>
<td>Household and Similar Electrical Appliances – Safety – Part</td>
<td>Appliances</td>
<td>903.1</td>
</tr>
</tbody>
</table>
2017 2-24: Particular Requirements for Refrigerating Appliances, Ice-Cream Appliances and Ice-Makers

UL 60335-2-89-2017 Household and Similar Electrical Appliances – Safety – Part 2-89: Particular Requirements for Commercial Refrigerating Appliances with an Incorporated or Remote Refrigerant Unit or Compressor

Note: UL 412, UL 474, UL 484, UL 60335-2-24, and UL 60335-2-89 meet the requirements for mandatory reference standards in accordance with Section 3-3.7.1 of IAPMO’s Regulations Governing Committee Projects.

SUBSTANTIATION:
Section 903.1 is being revised as only specific appliances can be used for refrigeration systems. UL 60335-2-24 and UL 60335-2-89 are appropriate for the application. In addition, UL 412, UL 474, and UL 484 are basic standards used for products in this category that also apply.

Furthermore, 1101.2 should be revised to indicate that only those equipment listed for use with A2L refrigerants should be used.

PUBLIC COMMENT 3

Code Year: 2021 UMC Section #: 935.0, 935.1, Table 1701.1 Item #: 073

SUBMITTER: Christopher Jensen
UL LLC

RECOMMENDATION:
Revise text

Request to accept the code change proposal as modified by this public comment.

935.0 Ductless Mini-Split Systems Installation.
935.1 General. Ductless mini-split system installation shall comply with UL 484, UL 1995, or UL 60335-2-40, and shall be installed in accordance with the manufacturer’s installation instructions and Section 310.2 for condensate control.

<table>
<thead>
<tr>
<th>STANDARD NUMBER</th>
<th>STANDARD TITLE</th>
<th>APPLICATION</th>
<th>REFERENCED SECTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>UL 484-2014</td>
<td>Room Air Conditioners (with revisions through September 6, 2018)</td>
<td>HVAC, Appliances</td>
<td>935.1</td>
</tr>
<tr>
<td>UL 1995-2015</td>
<td>Heating and Cooling Equipment</td>
<td>HVAC, Electric</td>
<td>903.1, 904.13, 935.1</td>
</tr>
</tbody>
</table>

(portions of table not shown remain unchanged)

Note: UL 484, UL 1995, and UL 60335-2-40 meet the requirements for a mandatory referenced standard in accordance with Section 3-3.7.1 of IAPMO’s Regulations Governing Committee Projects.

SUBSTANTIATION:
Referencing the appropriate product safety standard for ductless mini-split systems in the UMC will aid the code official in verifying a safe installation. This proposal references the appropriate standards for these appliances similar to numerous existing UMC Sections such as Section 934.1 for Self-Contained Refrigerators and Freezers, Section 934.2 for Unit Coolers, and Section 934.3 for Self-Contained Mechanical Refrigeration Systems.
SUBMITTER: Maria Yepremian  
County of Los Angeles Building and Safety

RECOMMENDATION:  
Revise text

911.0 Decorative Appliances for Installation in Vented Fireplaces.  

911.1 Prohibited Installations in Vented Fireplaces. Decorative appliances for installation in vented fireplaces shall not be installed in bathrooms or bedrooms unless the appliance is listed and the bedroom or bathroom has the required volume in accordance with Section 701.4. [NFPA 54:10.6.1]

911.2.911.1.1 Installation. A decorative appliance for installation in a vented fireplace shall be installed only in a vented fireplace having a working chimney flue and constructed of noncombustible materials. These appliances shall not be thermostatically controlled. [NFPA 54:10.6.2]

911.2.1911.1.2 Listed Decorative Appliance. A listed decorative appliance for installation in a vented fireplace shall be installed in accordance with its listing and the manufacturer’s installation instructions.

911.2.2 911.1.3 In Manufactured Homes. A decorative appliance for installation in a vented fireplace, where installed in a manufactured home, shall be listed for installation in manufactured homes. [NFPA 54:10.6.2.2]

911.2.3 911.1.4 Unlisted Decorative Appliance. An unlisted decorative appliance for installation in a vented fireplace shall be installed in a fireplace having a permanent free opening, based on appliance input rating and chimney height, equal to or greater than that specified in Table 911.2. [NFPA 54:10.6.2.3]

911.3 911.1.5 Fireplace Screens. A fireplace screen shall be installed with a decorative appliance for installation in a vented fireplace. [NFPA 54:10.6.3]

911.2.1 Alcohol Fuel Burning. Factory-built unvented liquid or gelled alcohol based intended to be fixed shall comply with UL 1370. No combustible material shall be within 18 inches (457 mm) of the appliance.

911.2.2 Prohibited Use. Factory-built unvented decorative appliances shall be used for decorative purposes and shall not be used as a primary heat source, a cooking appliance, or in conjunction with a blower assembly.

Unvented decorative appliances shall not be installed in spaces in which flammable vapors or gases may be present.

Unvented decorative appliances shall not be installed in bathrooms or bedrooms unless the appliance is listed for such purpose, and the bedroom or bathroom has the required volume of indoor air in accordance with Section 701.4.

### TABLE 1701.1

<table>
<thead>
<tr>
<th>STANDARD NUMBER</th>
<th>STANDARD TITLE</th>
<th>APPLICATION</th>
<th>REFERENCED SECTIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>UL 1370-2011</td>
<td>Unvented Alcohol Fuel Burning Decorative Appliances (with revisions through March 25, 2016)</td>
<td>Unvented Appliances</td>
<td>911.2.1</td>
</tr>
</tbody>
</table>

(portions of table not shown remain unchanged)
Note: UL 1370 meets the requirements for mandatory reference standards in accordance with Section 3-3.7.1 of IAPMO's Regulations Governing Committee Projects.

SUBSTANTIATION:
The existing code does not provide any information for unvented decorative appliances such as alcohol base space heaters. These systems are being installed more and more everyday and the UMC does not provide guidance as to what are the appropriate requirements for the safe installation for such systems. UL 1370 is the appropriate standards for such application. However, Section 911.2 will clarify that such systems shall be installed in accordance with the manufacturer’s installation instructions and its listing. This is necessary because there have been instances where the manufacture’s installation instructions conflict the listing. In such case where the installation instructions conflict the listing, the more stringent provisions shall prevail in accordance with Section 102.1 of the UMC.

COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
The proposed change raises grave safety concerns as to public health and safety.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 25 NOT RETURNED: 1 HOWARD

Appended Comments

PUBLIC COMMENT 1

Code Year: 2021 UMC Section #: 911.0 - 911.2.2, Table 1701.1 Item #: 076

SUBMITTER: Maria Yepremian County of Los Angeles Building and Safety Comment #: 1

RECOMMENDATION:
Revise text

Request to accept the code change proposal as submitted by this public comment.

SUBSTANTIATION:
The existing code does not provide any information for unvented decorative appliances such as alcohol-based space heaters. These systems are being installed more and more every day and the UMC does not provide guidance as to what are the appropriate requirements for the safe installation of such systems. UL 1370 is the appropriate standard for such application. Section 911.2 will clarify that such systems shall be installed in accordance with the manufacturer’s installation instructions and its listing.

This is necessary because there have been instances where the manufacturer's installation instructions conflict with the listing. In such case, where the installation instructions conflict with the listing, the more stringent provisions shall prevail in accordance with Section 102.1 of the UMC.
Item #: 077
UMC 2021 Section: 911.0 - 911.2.3, Table 1701.1, Table 1701.2

SUBMITTER: Mohamed Dano
Control Air Conditioning Corporation

RECOMMENDATION:
Revise text

911.0 Decorative Appliances for Installation in Vented Fireplaces.
911.1 Prohibited Installations in Vented Fireplaces. Decorative appliances for installation in vented fireplaces shall not be installed in bathrooms or bedrooms unless the appliance is listed and the bedroom or bathroom has the required volume in accordance with Section 701.4. [NFPA 54:10.6.1]

911.2 911.1.1 Installation. A decorative appliance for installation in a vented fireplace shall be installed only in a vented fireplace having a working chimney flue and constructed of noncombustible materials. These appliances shall not be thermostatically controlled. [NFPA 54:10.6.2]

911.2.1 Listed Decorative Appliance. A listed decorative appliance for installation in a vented fireplace shall be installed in accordance with its listing and the manufacturer’s installation instructions.

911.2.2 911.1.3 In Manufactured Homes. A decorative appliance for installation in a vented fireplace, where installed in a manufactured home, shall be listed for installation in manufactured homes. [NFPA 54:10.6.2.2]

911.2.3 911.1.4 Unlisted Decorative Appliance. An unlisted decorative appliance for installation in a vented fireplace shall be installed in a fireplace having a permanent free opening, based on appliance input rating and chimney height, equal to or greater than that specified in Table 911.2. [NFPA 54:10.6.2.3]

911.3 911.1.5 Fireplace Screens. A fireplace screen shall be installed with a decorative appliance for installation in a vented fireplace. [NFPA 54:10.6.3]

911.2 In Solid Fuel-Burning Fireplaces. Decorative gas appliances for installation in solid fuel-burning fireplace and having an input rating of not more than 400 000 Btu/hr (117 kW) shall comply with CSA Z21.60 and shall be installed in accordance with the manufacturer’s installation instructions. Manually lighted, natural gas decorative appliances shall comply with CSA Z21.84.

911.2.1 Natural Log. Decorative appliances used in a solid fuel-burning fireplace shall be comply with CSA Z21.60 and shall be installed in accordance with the manufacturer’s installation instructions.

911.2.2 Thermostatic Control. The decorative gas appliance shall not be thermostatically controlled.

911.2.3 Automatic Shutoff. The decorative gas appliance shall be provided with a flame safeguard device that will automatically shut off the gas supply to the main burner when the flame or ignition source is not provided.

<table>
<thead>
<tr>
<th>STANDARD NUMBER</th>
<th>STANDARD TITLE</th>
<th>APPLICATION</th>
<th>REFERENCED SECTIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>CSA Z21.60-2017</td>
<td>Decorative Gas Appliances for Installation in Solid-Fuel Burning Fireplaces (same as CSA 2.26)</td>
<td>Decorative Gas Appliances</td>
<td>911.2, 911.2.1</td>
</tr>
</tbody>
</table>

(portions of table not shown remain unchanged)
Note: CSA Z21.60 and CSA Z21.84 meet the requirements for mandatory reference standards in accordance with Section 3-3.7.1 of IAPMO's Regulations Governing Committee Projects.

<table>
<thead>
<tr>
<th>DOCUMENT NUMBER</th>
<th>DOCUMENT TITLE</th>
<th>APPLICATION</th>
</tr>
</thead>
</table>

(portions of table not shown remain unchanged)

SUBSTANTIATION:
Section 911.0 has been revised to include standards for decorative appliances. The UMC currently does not have the minimum requirements for solid-fuel burning fireplaces and natural logs. Such requirements are needed for enforceable purposes.

COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
The proposed new language is already addressed in the current code language. Furthermore, the term "solid-fuel burning fireplaces" is not defined.

TOTAL ELIGIBLE TO VOTE: 26
VOTING RESULTS: AFFIRMATIVE: 25  NOT RETURNED: 1  HOWARD

PUBLIC COMMENT 1
Code Year: 2021 UMC  Section #: 911.0 - 911.2.3  Item #: 077
SUBMITTER: Mohamed Dano  Control Air Conditioning Corporation  Rep: Self
RECOMMENDATION:
Revise text
Request to accept the code change proposal as submitted by this public comment.

SUBSTANTIATION:
This change adds necessary provisions for solid-fuel-burning fireplaces that do not currently exist in the UMC. Section 911.0 has been revised to include standards for decorative appliances. The UMC currently does not have the minimum requirements for solid-fuel-burning fireplaces and natural logs. Such requirements are needed for enforceable purposes by AHJ.

PUBLIC COMMENT 2
Code Year: 2021 UMC  Section #: 221.0, 911.0 - 911.2.3, Table 1701.1, Table 1701.2  Item #: 077
SUBMITTER: Maria Yepremian  County of Los Angeles Building and Safety  Comment #: 2
RECOMMENDATION:
Revise text
Request to replace the code change proposal by this public comment.

CHAPTER 2
DEFINITIONS

221.0 – S –
Solid Fuel-Burning Fireplace. A vented fireplace that burns solid fuel and derives all or part of its heat source from the burning of solid fuel.

911.0 Decorative Appliances for Installation in Vented Fireplaces.
911.1 Prohibited Installations in Vented Fireplaces. Decorative appliances for installation in vented fireplaces shall not be installed in bathrooms or bedrooms unless the appliance is listed and the bedroom or bathroom has the required volume in accordance with Section 701.4. [NFPA 54:10.6.1]

911.2.1 Installation. A decorative appliance for installation in a vented fireplace shall be installed only in a vented fireplace having a working chimney flue and constructed of noncombustible materials. These appliances shall not be thermostatically controlled. [NFPA 54:10.6.2]

911.2.2 Listed Decorative Appliance. A listed decorative appliance for installation in a vented fireplace shall be installed in accordance with its listing and the manufacturer’s installation instructions.

911.2.3 In Manufactured Homes. A decorative appliance for installation in a vented fireplace, where installed in a manufactured home, shall be listed for installation in manufactured homes. [NFPA 54:10.6.2.2]

911.2.4 Unlisted Decorative Appliance. An unlisted decorative appliance for installation in a vented fireplace shall be installed in a fireplace having a permanent free opening, based on appliance input rating and chimney height, equal to or greater than that specified in Table 911.2. [NFPA 54:10.6.2.3]

911.3 Fireplace Screens. A fireplace screen shall be installed with a decorative appliance for installation in a vented fireplace. [NFPA 54:10.6.3]

911.2 In Solid Fuel-Burning Fireplaces. Decorative gas appliances for installation in solid fuel-burning fireplace and having an input rating of not more than 400 000 Btu/hr (117 kW) shall comply with CSA Z21.60 and shall be installed in accordance with the manufacturer’s installation instructions. Manually lighted, natural gas decorative appliances shall comply with CSA Z21.84.

911.2.1 Natural Log. Decorative appliances used in a solid fuel-burning fireplace shall comply with CSA Z21.60 and shall be installed in accordance with the manufacturer’s installation instructions.

911.2.2 Thermostatic Control. The decorative gas appliance shall not be thermostatically controlled.

911.2.3 Automatic Shutoff. The decorative gas appliance shall be provided with a flame safeguard device that will automatically shut off the gas supply to the main burner when the flame or ignition source is not provided.

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<td>Decorative Gas Appliances</td>
<td>911.2, 911.2.1</td>
</tr>
</tbody>
</table>

(portion of table not shown remain unchanged)

Note: CSA Z21.60 and CSA Z21.84 meet the requirements for mandatory reference standards in accordance with Section 3-3.7.1 of IAPMO’s Regulations Governing Committee Projects.
SUBSTANTIATION:
There was concern that “Solid Fuel-Burning Fireplaces” is not defined in the UMC, therefore, a definition for “Solid Fuel-Burning Fireplaces” is being added. This definition is consistent with the way the term is applied throughout the code. The addition of this definition will assist the AHJ with the enforcement of Solid Fuel-Burning Fireplaces. Furthermore, differentiation will be made between a “Solid Fuel-Burning Fireplace” and a "Fireplace Stove" which is already defined in the UMC.
SUBMITTER: Bo Manalo
EcoSmart Inc.

RECOMMENDATION:
Revise text

939.0 Unvented Alcohol Fuel-Burning Decorative Appliances.
939.1 General. Unvented alcohol fuel burning decorative appliances shall be listed and labeled in accordance with UL1370 and shall be installed in accordance with the conditions of the listing and manufacturer’s installation instructions.
939.2 Marking. Unvented alcohol fuel-burning decorative appliances shall have a permanent factory-applied marking showing the manufacturer’s name, model, thermal output (BTU/hr),(kW), approved fuel type, minimum room volume requirement for installation, and required clearances to combustibles.

CHAPTER 2
DEFINITIONS

223.0 – U –
Unvented Alcohol Fuel Burning Decorative Appliance. An unvented, self-contained fire feature appliance fueled by alcohol whose only function is providing an aesthetic effect of flames; intended to be directly or indirectly secured to the wall or floor and not for duct connection.

TABLE 1701.1
REFERENCED STANDARDS

<table>
<thead>
<tr>
<th>STANDARD NUMBER</th>
<th>STANDARD TITLE</th>
<th>APPLICATION</th>
<th>REFERENCED SECTIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>UL 1370-2011</td>
<td>Unvented Alcohol Fuel Burning Decorative Appliances (with revisions through March 25, 2016)</td>
<td>Decorative Appliances</td>
<td>939.1</td>
</tr>
</tbody>
</table>

(portion of table not shown remains unchanged)

Note: UL 1370 meets the requirements for mandatory reference standards in accordance with Section 3-3.7.1 of IAPMO's Regulations Governing Committee Projects.

SUBSTANTIATION:
This proposal adds a provision for a newer type of decorative appliance. It provides clear and specific requirements for the installation of unvented, self-contained alcohol fuel burning appliances. The requisite ANSI consensus Standard UL1370 includes performance-based criteria that provide a consistent application of requirements and best practices to ensure safe installation and operation. The Standard includes combustion testing for carbon dioxide and carbon monoxide emission limits, oxygen depletion, materials and construction requirements. The Standard also tests for user abuse, stability, temperature, and wind tests. There is also a requirement for markings and instruction manual content.

These appliances are intended for decorative purposes and not intended to be utilized as a primary heat source. Denatured alcohol is formulated for the application and limited to a maximum input rate of 0.25 gallons of fuel per hour (0.95 liters per hour). They are not provided with means for duct connection nor is there electric/mechanical assist of heated air movement,
such as a fan-blower assembly. The appliances are also labeled with minimum room volume requirements for installation.

The proposal improves the Code by providing installers and building officials with a clear path on the specifications that pertain to these products. Installation is intended to be in accordance with local codes, the manufacturer’s installation instructions and markings on the appliance.

**COMMITTEE ACTION:** REJECT

**COMMITTEE STATEMENT:**
The proposed change raises safety concerns as to public health and safety. If the AHJ would like to approve these appliances, they can do so by the Alternate Materials and Methods approval process in accordance with Section 302.2 of the UMC.

**TOTAL ELIGIBLE TO VOTE:** 26

**VOTING RESULTS:**

- **AFFIRMATIVE:** 24
- **NEGATIVE:** 1
- **NOT RETURNED:** 1
  
  **HOWARD**

**EXPLANATION OF NEGATIVE:**

**HYDE:** As an enforcing agency, we are starting to see more and more of these types of appliances and nothing in any code regulates the installation of these types of appliances.

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**Appended Comments**

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**PUBLIC COMMENT 1**

**Code Year:** 2021 UMC  
**Section #:** 223.0, 939.0 - 939.2, Table 1701.1  
**SUBMITTER:** Maria Yepremian  
County of Los Angeles Building and Safety  
**Item #:** 083  
**Comment #:** 1

**RECOMMENDATION:**
Add new text

Request to accept the code change proposal as submitted by this public comment.

**SUBSTANTIATION:**

A section and definition for "Unvented Alcohol Fuel Burning Decorative Appliances" is needed in the code. The proposed change adds a definition for "Unvented Alcohol Fuel Burning Decorative Appliances." This definition clarifies that such decorative appliances are not intended to be connected to ductwork. The addition of this section and definition will assist the AHJ with the enforceability of Unvented Alcohol Fuel Burning Decorative Appliances.
Item #: 086

UMC 2021 Section: 1102.2, Table 1701.1

SUBMITTER: Jeffrey Shapiro
International Code Consultants
Rep: IIAR

RECOMMENDATION:
Revise text

1102.0 Refrigeration Systems.

1102.2 Ammonia Refrigeration Systems. Refrigeration systems using ammonia as the refrigerant shall comply with IIAR 2, IIAR 3, IIAR 4, and IIAR 5, and IIAR 6 and shall not be required to comply with this chapter.

<table>
<thead>
<tr>
<th>STANDARD NUMBER</th>
<th>STANDARD TITLE</th>
<th>APPLICATION</th>
<th>REFERENCED SECTIONS</th>
</tr>
</thead>
</table>

(portions of table not shown remain unchanged)

Note: IIAR 6 meets the requirements for mandatory reference standards in accordance with Section 3-3.7.1 of IAPMO's Regulations Governing Committee Projects.

SUBSTANTIATION:
IIAR 6 is a new standard for maintenance and inspection of closed-circuit ammonia refrigeration systems that is part of the suite of IIAR standards regulating ammonia refrigeration systems. Because this standard addresses system maintenance, which is part of the UMC scope in Section 101.2, it is important to have the standard referenced by the UMC to provide for proper compliance and enforcement of ammonia system regulations.

COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
The proposed standard is being rejected as it is a maintenance manual and is a draft standard that is not yet completed at the time of this monograph.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 25 NOT RETURNED: 1 HOWARD

Appended Comments
PUBLIC COMMENT 1

Code Year: 2021 UMC  Section #: 1102.2  Item #: 086

SUBMITTER: Jeffrey Shapiro  Comment #: 1
International Code Consultants
Rep: IIAR

RECOMMENDATION:
Revise text

Request to accept the code change proposal as modified by this public comment.

1102.0 Refrigeration Systems.

1102.2 Ammonia Refrigeration Systems. Refrigeration systems using ammonia as the refrigerant shall comply with IIAR 2, IIAR 3, IIAR 4, and IIAR 5, and IIAR 6 and shall not be required to comply with this chapter.

<table>
<thead>
<tr>
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<th>REFERENCED SECTION</th>
</tr>
</thead>
</table>

Note: IIAR 6-2019 is a working draft and is not completed at the time of this monograph.

SUBSTANTIATION:
This public comment is requesting that approval of the original proposal. At the ROP meeting, the committee correctly rejected the original proposal because the standard had not yet been completed. It is anticipated that the standard will be finalized prior to the ROC meeting.

IIAR 6 is a brand new standard covering inspection, testing, and maintenance of closed-circuit ammonia refrigeration systems and is part of the suite of IIAR standards regulating ammonia refrigeration systems referenced by the UMC and NFPA 1.

Because this standard addresses system maintenance, which is part of the UMC scope in Section 101.2, it is important to have the standard referenced by the UMC to give inspectors the needed tool ensuring compliance of ammonia system regulations. If this comment is not accepted, there will be no mandatory system maintenance regulations covering ammonia refrigeration in the UMC, which is a safety concern.

Processing of IIAR 6 is down to a single unresolved commenter and the 4th public review cycle to resolve remaining comments closed in mid-January. The balance should be wrapped up by April. A copy of the most recent consensus draft is being provided with this comment, and a final copy will be provided in advance of the ROC meeting. For reference, ICC has given final approval to referencing IIAR 6 in the 2021 codes.
**Item #: 087**  
UMC 2021  Section: Table 1102.3  

**SUBMITTER:** Connor Barbaree  
ASHRAE  

**RECOMMENDATION:**  
Revise text  

### TABLE 1102.3  
REFRIGERANT GROUPS, PROPERTIES, AND ALLOWABLE QUANTITIES  
[ASHRAE 34: TABLE 4-1, TABLE 4-2]  

<table>
<thead>
<tr>
<th>REFRIGERANT</th>
<th>CHEMICAL FORMULA</th>
<th>CHEMICAL NAME¹ (COMPOSITION FOR BLENDS)</th>
<th>SAFETY GROUP⁷</th>
<th>OEL² (ppm)</th>
<th>POUNDS PER 1000 CUBIC FEET OF SPACE</th>
</tr>
</thead>
<tbody>
<tr>
<td>R-407H</td>
<td>zeotrope</td>
<td>R-32/125/134a (32.5/15.0/52.5)</td>
<td>A1</td>
<td>1000</td>
<td>19</td>
</tr>
<tr>
<td>R-407I</td>
<td>zeotrope</td>
<td>R-32/125/124a (19.5/8.5/72.0)</td>
<td>A1</td>
<td>1000</td>
<td>16.0</td>
</tr>
<tr>
<td>R-459A</td>
<td>zeotrope</td>
<td>R-32/1234yf/1234ze(E) (68.1/26.0/6.0)</td>
<td>A2L</td>
<td>870</td>
<td>23</td>
</tr>
<tr>
<td>R-459B</td>
<td>zeotrope</td>
<td>R-32/1234yf/1234ze(E) (21.0/69.0/10.0)</td>
<td>A2L</td>
<td>640</td>
<td>30</td>
</tr>
<tr>
<td>R-460A</td>
<td>zeotrope</td>
<td>R-32/125/134a/1234ze(E) (12.0/52.0/14.0/22.0)</td>
<td>A1</td>
<td>650</td>
<td>24</td>
</tr>
<tr>
<td>R-460B</td>
<td>zeotrope</td>
<td>R-32/125/134a/1234ze(E) (28.0/25.0/20.0/27.0)</td>
<td>A1</td>
<td>950</td>
<td>25</td>
</tr>
<tr>
<td>R-460C</td>
<td>zeotrope</td>
<td>R-32/125/134a/1234ze(E) (2.5/2.5/46.0/49.0)</td>
<td>A1</td>
<td>900</td>
<td>20.0</td>
</tr>
<tr>
<td>R-461A</td>
<td>zeotrope</td>
<td>R-125/143a/134a/227ea/600a (55.0/5.0/32.0/5.0/3.0)</td>
<td>A1</td>
<td>1000</td>
<td>17</td>
</tr>
<tr>
<td>R-462A</td>
<td>zeotrope</td>
<td>R-32/125/143a/134a/600 (9.0/42.0/2.0/44.0/3.0)</td>
<td>A2</td>
<td>1000</td>
<td>3.9</td>
</tr>
<tr>
<td>R-464A</td>
<td>zeotrope</td>
<td>R-32/125/1234ze(E)/227ea (27.0/27.0/40.0/6.0)</td>
<td>A1</td>
<td>930</td>
<td>27.0</td>
</tr>
<tr>
<td>R-465A</td>
<td>zeotrope</td>
<td>R-32/290/1234yf (21.0/7.9/71.1)</td>
<td>A2</td>
<td>660</td>
<td>2.5</td>
</tr>
</tbody>
</table>
R-516A  azotrope
R-1132a  CF₂=CH₂
R-1224yd(Z) CF₃CF=CHCl

(portions of table not shown remain unchanged)

SUBSTANTIATION:
In accordance with IAPMO's Regulations Governing Committee Projects (Extract Guidelines), Table 1102.3 has been revised to correlate with Addendums ak, al, am, and an (published January 28, 2017), Addendum w (published on February 1, 2017), Addendums a, b, c and d (published June 23, 2017), Addendums f and c (published October 3, 2017); and Addendums j, k, l and m (published on January 20, 2018) of ASHRAE 34.

COMMITTEE ACTION: ACCEPT AS AMENDED BY THE TC

Amend proposal as follows:

<table>
<thead>
<tr>
<th>REFRIGERANT</th>
<th>CHEMICAL FORMULA</th>
<th>CHEMICAL NAME¹ (COMPOSITION FOR BLENDS)</th>
<th>SAFETY GROUP²</th>
<th>OEL² (ppm)</th>
<th>POUNDS PER 1000 CUBIC FEET OF SPACE</th>
</tr>
</thead>
<tbody>
<tr>
<td>R-407H zeotrope</td>
<td></td>
<td>R-32/125/134a (32.5/15.0/52.5)</td>
<td>A1</td>
<td>1000</td>
<td>19</td>
</tr>
<tr>
<td>R-407I zeotrope</td>
<td></td>
<td>R-32/125/124a (19.5/8.5/72.0)</td>
<td>A1</td>
<td>1000</td>
<td>16.0</td>
</tr>
<tr>
<td>R-459A zeotrope</td>
<td></td>
<td>R-32/1234yf/1234ze(E) (68.1/26.0/6.0)</td>
<td>A2L</td>
<td>870</td>
<td>23</td>
</tr>
<tr>
<td>R-459B zeotrope</td>
<td></td>
<td>R-32/1234yf/1234ze(E) (21.0/69.0/10.0)</td>
<td>A2L</td>
<td>640</td>
<td>30</td>
</tr>
<tr>
<td>R-460A zeotrope</td>
<td></td>
<td>R-32/125/134a/1234ze(E) (12.0/52.0/14.0/22.0)</td>
<td>A1</td>
<td>650</td>
<td>24</td>
</tr>
<tr>
<td>R-460B zeotrope</td>
<td></td>
<td>R-32/125/134a/1234ze(E) (28.0/25.0/20.0/27.0)</td>
<td>A1</td>
<td>950</td>
<td>25</td>
</tr>
<tr>
<td>R-460C zeotrope</td>
<td></td>
<td>R-32/125/134a/1234ze(E) (2.5/2.5/46.0/49.0)</td>
<td>A1</td>
<td>900</td>
<td>20.0</td>
</tr>
<tr>
<td>R-461A zeotrope</td>
<td></td>
<td>R-125/143a/134a/227ea/600a (55.0/5.0/32.0/5.0/3.0)</td>
<td>A1</td>
<td>1000</td>
<td>17</td>
</tr>
<tr>
<td>R-462A zeotrope</td>
<td></td>
<td>R-32/125/143a/134a/600 (9.0/42.0/2.0/44.0/3.0)</td>
<td>A2</td>
<td>1000</td>
<td>3.9</td>
</tr>
<tr>
<td>R-463A zeotrope</td>
<td></td>
<td>R-744/32/125/1234yf/134a (6.0/36.0/30.0/14.0/14.0)</td>
<td>A1</td>
<td>990</td>
<td>19</td>
</tr>
<tr>
<td>R-464A zeotrope</td>
<td></td>
<td>R-32/125/1234ze(E)/227ea (27.0/27.0/40.0/6.0)</td>
<td>A1</td>
<td>930</td>
<td>27.0</td>
</tr>
<tr>
<td>R-465A zeotrope</td>
<td></td>
<td>R-32/290/1234yf (21.0/7.9/71.1)</td>
<td>A2</td>
<td>660</td>
<td>2.5</td>
</tr>
</tbody>
</table>
R-516A  azotrope  R-1234yf/134a/152a (77.5/8.5/14.0)  A2L  590  7.0
R-1132a  CF₂ = CH₂  1, 1-difluoroethylene  A2  500  2.0
R-1224yd(Z)  CF₃C=CHCl  (Z)-1-chloro-2,3,3,3-tetrafluoropropen  A1  1000  23
(Portions of table not shown remain unchanged)

COMMITTEE STATEMENT:
Refrigerant R-463A has been added to ASHRAE 34-2016 through addendum (i) and it is appropriate to include it in Table 1102.3 of the UMC.

TOTAL ELIGIBLE TO VOTE: 26
VOTING RESULTS: AFFIRMATIVE: 25  NOT RETURNED: 1  HOWARD

Appended Comments

PUBLIC COMMENT 1
Code Year: 2021 UMC  Section #: Table 1102.3  Item #: 087
Submitter: Connor Barbaree  ASHRAE  Comment #: 1

RECOMMENDATION:
Revise text

Request to accept the code change proposal as modified by this public comment.

TABLE 1102.3
REFRIGERANT GROUPS, PROPERTIES, AND ALLOWABLE QUANTITIES
[ASHRAE 34: TABLE 4-1, TABLE 4-2]

<table>
<thead>
<tr>
<th>REFRIGERANT</th>
<th>CHEMICAL FORMULA</th>
<th>CHEMICAL NAME¹ (COMPOSITION FOR BLENDS)</th>
<th>SAFETY GROUP⁷</th>
<th>OEL²(ppm)</th>
<th>POUNDS PER 1000 CUBIC FEET OF SPACE</th>
</tr>
</thead>
<tbody>
<tr>
<td>R-459A</td>
<td>zeotrope</td>
<td>R-32/1234yf/1234ze(E) (68.4/68.0/26.0/6.0)</td>
<td>A2L</td>
<td>870</td>
<td>23</td>
</tr>
</tbody>
</table>

(Portion of table not shown remains unchanged)

SUBSTANTIATION:
In accordance with IAPMO’s Regulations Governing Committee Projects (Extract Guidelines), the above table is being revised to correlate with addendum ak to ASHRAE 34-2016.
<table>
<thead>
<tr>
<th>OCCUPANCY GROUP</th>
<th>HIGH-PROBABILITY SYSTEM</th>
<th>LOW PROBABILITY SYSTEM</th>
<th>MACHINERY ROOM</th>
</tr>
</thead>
<tbody>
<tr>
<td>A-1</td>
<td>Group A1 or A2L.4 only</td>
<td>Any</td>
<td>Any</td>
</tr>
<tr>
<td>A-2</td>
<td>Group A1 or A2L.4 only</td>
<td>Any</td>
<td>Any</td>
</tr>
<tr>
<td>A-3</td>
<td>Group A1 or A2L.4 only</td>
<td>Any</td>
<td>Any</td>
</tr>
<tr>
<td>A-4</td>
<td>Group A1 or A2L.4 only</td>
<td>Any</td>
<td>Any</td>
</tr>
<tr>
<td>B</td>
<td>Group A1^2 or A2L.4 only</td>
<td>Any</td>
<td>Any</td>
</tr>
<tr>
<td>E</td>
<td>Group A1 or A2L.4 only</td>
<td>Any</td>
<td>Any</td>
</tr>
<tr>
<td>F-1</td>
<td>Group A1^2 or A2L only</td>
<td>Any</td>
<td>Any</td>
</tr>
<tr>
<td>F-2</td>
<td>Any^2</td>
<td>Any</td>
<td>Any</td>
</tr>
<tr>
<td>H-1</td>
<td>Any</td>
<td>Any</td>
<td>Any</td>
</tr>
<tr>
<td>H-2</td>
<td>Any</td>
<td>Any</td>
<td>Any</td>
</tr>
<tr>
<td>H-3</td>
<td>Any</td>
<td>Any</td>
<td>Any</td>
</tr>
<tr>
<td>H-4</td>
<td>Group A1 or A2L.4 only</td>
<td>Any</td>
<td>Any</td>
</tr>
<tr>
<td>H-5</td>
<td>Group A1 or A2L.4 only</td>
<td>Any</td>
<td>Any</td>
</tr>
<tr>
<td>I-1</td>
<td>None</td>
<td>Any</td>
<td>Any</td>
</tr>
<tr>
<td>I-2</td>
<td>Group A1 or A2L.4 only</td>
<td>Any</td>
<td>Any</td>
</tr>
<tr>
<td>I-3</td>
<td>None</td>
<td>Any</td>
<td>Any</td>
</tr>
<tr>
<td>I-4</td>
<td>Group A1 or A2L.4 only</td>
<td>Any</td>
<td>Any</td>
</tr>
</tbody>
</table>
Notes:
1 See Section 1104.0.
2 A refrigerant shall be permitted to be used within a high-probability system where the room or space is in accordance with Section 1104.4.
3 Occupancy classifications are defined in the building code.
4 See Section 1104.6 for requirements applicable to A2L equipment.

SUBSTANTIATION:
This change clarifies the acceptance of Group A2L refrigerants in high probability systems used for human comfort. Section 1104.6 already permits Group A2L refrigerants to be used for human comfort in direct systems provided the equipment is listed for A2L refrigerants. Note 4 identifies the requirements in Section 1104.6 for A2L refrigerants. This will assure that the equipment meets the listing and safety requirements of Section 1104.6.

COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
The proposed text is being rejected based on the action taken on Item # 091.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 24 ABSTAIN: 1 NOT RETURNED: 1 HOWARD

EXPLANATION OF ABSTAIN:
KOERBER: Warrants further review of Item # 089 and Item # 091.

Appendixed Comments

PUBLIC COMMENT 1

Code Year: 2021 UMC  Section #: Table 1104.1  Item #: 089

SUBMITTER: Julius Ballanco  Comment #: 1
JB Engineering and Code Consulting, P.C.
Rep: Daikin US

RECOMMENDATION:
Revise text

Request to replace the code change proposal by this public comment.
# TABLE 1104.1
## PERMISSIBLE REFRIGERATION SYSTEMS

<table>
<thead>
<tr>
<th>OCCUPANCY GROUP&lt;sup&gt;3&lt;/sup&gt;</th>
<th>HIGH-PROBABILITY SYSTEM</th>
<th>LOW PROBABILITY SYSTEM</th>
<th>MACHINERY ROOM</th>
</tr>
</thead>
<tbody>
<tr>
<td>A-1</td>
<td>Group A1 or A2L&lt;sup&gt;4&lt;/sup&gt; only</td>
<td>Any</td>
<td>Any</td>
</tr>
<tr>
<td>A-2</td>
<td>Group A1 or A2L&lt;sup&gt;4&lt;/sup&gt; only</td>
<td>Any</td>
<td>Any</td>
</tr>
<tr>
<td>A-3</td>
<td>Group A1 or A2L&lt;sup&gt;4&lt;/sup&gt; only</td>
<td>Any</td>
<td>Any</td>
</tr>
<tr>
<td>A-4</td>
<td>Group A1 or A2L&lt;sup&gt;4&lt;/sup&gt; only</td>
<td>Any</td>
<td>Any</td>
</tr>
<tr>
<td>B</td>
<td>Group A1&lt;sup&gt;2&lt;/sup&gt; or A2L&lt;sup&gt;2,4&lt;/sup&gt; only</td>
<td>Any</td>
<td>Any</td>
</tr>
<tr>
<td>E</td>
<td>Group A1 or A2L&lt;sup&gt;4&lt;/sup&gt; only</td>
<td>Any</td>
<td>Any</td>
</tr>
<tr>
<td>F-1</td>
<td>Group A1&lt;sup&gt;2&lt;/sup&gt; or A2L&lt;sup&gt;2,4&lt;/sup&gt; only</td>
<td>Any</td>
<td>Any</td>
</tr>
<tr>
<td>F-2</td>
<td>Any&lt;sup&gt;2&lt;/sup&gt;</td>
<td>Any</td>
<td>Any</td>
</tr>
<tr>
<td>H-1</td>
<td>Any</td>
<td>Any</td>
<td>Any</td>
</tr>
<tr>
<td>H-2</td>
<td>Any</td>
<td>Any</td>
<td>Any</td>
</tr>
<tr>
<td>H-3</td>
<td>Any</td>
<td>Any</td>
<td>Any</td>
</tr>
<tr>
<td>H-4</td>
<td>Group A1 or A2L&lt;sup&gt;4&lt;/sup&gt; only</td>
<td>Any</td>
<td>Any</td>
</tr>
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<td>H-5</td>
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<td>Any</td>
<td>Any</td>
</tr>
<tr>
<td>I-1</td>
<td>None</td>
<td>Any</td>
<td>Any</td>
</tr>
<tr>
<td>I-2</td>
<td>Group A1 or A2L&lt;sup&gt;4&lt;/sup&gt; only</td>
<td>Any</td>
<td>Any</td>
</tr>
<tr>
<td>I-3</td>
<td>None</td>
<td>Any</td>
<td>Any</td>
</tr>
<tr>
<td>I-4</td>
<td>Group A1 or A2L&lt;sup&gt;4&lt;/sup&gt; only</td>
<td>Any</td>
<td>Any</td>
</tr>
<tr>
<td>M</td>
<td>Group A1&lt;sup&gt;2&lt;/sup&gt; or A2L&lt;sup&gt;2,4&lt;/sup&gt; only</td>
<td>Any</td>
<td>Any</td>
</tr>
<tr>
<td>R-1</td>
<td>Group A1 or A2L&lt;sup&gt;4&lt;/sup&gt; only</td>
<td>Any</td>
<td>Any</td>
</tr>
<tr>
<td>R-2</td>
<td>Group A1 or A2L&lt;sup&gt;4&lt;/sup&gt; only</td>
<td>Any</td>
<td>Any</td>
</tr>
<tr>
<td>R-3</td>
<td>Group A1 or A2L&lt;sup&gt;4&lt;/sup&gt; only</td>
<td>Any</td>
<td>Any</td>
</tr>
<tr>
<td>R-4</td>
<td>Group A1 or A2L&lt;sup&gt;4&lt;/sup&gt; only</td>
<td>Any</td>
<td>Any</td>
</tr>
<tr>
<td>S-1</td>
<td>Group A1&lt;sup&gt;2&lt;/sup&gt; or A2L&lt;sup&gt;2,4&lt;/sup&gt; only</td>
<td>Any</td>
<td>Any</td>
</tr>
<tr>
<td>S-2</td>
<td>Any&lt;sup&gt;2&lt;/sup&gt;</td>
<td>Any</td>
<td>Any</td>
</tr>
<tr>
<td>U</td>
<td>Any</td>
<td>Any</td>
<td>Any</td>
</tr>
</tbody>
</table>

**Notes:**

1. See Section 1104.0.
2. A refrigerant shall be permitted to be used within a high-probability system where the room or space is in accordance with Section 1104.4.
3. Occupancy classifications are defined in the building code.
4. See Section 1104.6 for requirements applicable to A2L equipment.
SUBSTANTIATION:
Note 2 appears following Group A1 refrigerants for Occupancy Groups B, F-1, F-2, M, S-1, and S-2. When adding Group A2L, the Note 2 should also appear with Note 4 for these Occupancy Groups. This is the modification to the original proposal.

It was also noticed that Note 4 did not appear under the use Group F. This was an editorial error that is also corrected by this modification.

This change was rejected based on the action taken on Item # 091. A Public Comment has been submitted to Item # 091 to approve the change with modifications. The modification would allow the use of Group A2L refrigerants in high-probability direct systems. This change is needed for consistency with Item # 089.
1104.0 Requirements for Refrigerant and Refrigeration System Use.

1104.6 Applications for Human Comfort and for Nonindustrial Occupancies. In nonindustrial occupancies, Group A2, A3, B1, B2L, B2, and B3 refrigerants shall not be used in high-probability systems for human comfort. Systems using Group A2L refrigerant in high-probability systems for human comfort shall comply with Section 1104.6.1 through Section 1104.6.3.

1104.6.1 A2L Refrigerant Equipment. The refrigeration equipment using A2L refrigerant shall be listed and comply with Section 903.1. The equipment shall be installed in accordance with the manufacturer's instructions. The nameplate shall include a flammable refrigerant symbol. A label indicating that a flammable refrigerant is used shall be placed adjacent to service ports and other locations where service involving components containing refrigerant is performed.

1104.6.2 Refrigerant Detection System. A refrigerant detection system shall be provided in accordance with Section 1104.6.4 where one or more of the following conditions are met:

(1) Where the refrigerant charge of any independent circuit exceeds 22 pounds (10 kg) for commercial, public assembly and large mercantile occupancies,
(2) Where the refrigerant charge of any independent circuit exceeds 6.6 pounds (3 kg) for residential and institutional occupancies,
(3) Where using the provisions of Section 1104.6.3,
(4) Where a refrigerant detection system is required by the equipment listing.

1104.6.2.1 Refrigerant Detection System Performance. Refrigerant detection systems shall comply with the following:

(1) The refrigerant detection system set point to activate the functions in accordance with Section 1106.2.2.1 and Section 1106.2.2.2 shall be at a value not exceeding the RCL value specified in Table 1102.3 or 25 percent of the lower flammable limit (LFL) of the refrigerant.
(2) One or more refrigerant detection systems shall be located such that refrigerant will be detected if the refrigerating system is operating or not operating. For refrigerating systems that are connected to the occupied space through a duct system, the refrigerant detection system shall be located within the listed equipment. For refrigerating systems that are directly connected to the occupied space without ducts, the refrigerant detection system shall be located in the equipment or in the occupied space at a height of not more than 12 inches (305 mm) above the floor within a horizontal distance of not more 3.3 feet (1007 mm) with a direct line of sight of the unit.
(3) The refrigerant detection system, including any sampling tubes, shall cause the functions required by Section 1104.6.2.2 within 10 seconds, after sensing the refrigerant concentration identified.
(4) The refrigerant detection system shall provide a means for automatic operational self-test as required by the equipment listing. If a failure of the refrigerant detection system is identified, a trouble alarm shall be activated, and requirements of Section 1104.6.2.2 shall be initiated.
(5) The refrigerant detection system shall be tested during installation to verify the alarm set point and response time as required in Section 1104.6.2.1(1) and Section 1104.6.2.1(3). After installation, the refrigerant detection system shall be tested annually or at an interval not exceeding the manufacturer's installation instructions, whichever is less to verify the alarm set point and response time.

1104.6.2.2 Refrigerant Detection System Activation. When the refrigerant detection system senses a refrigerant concentration above the RCL value specified in Table 1102.3, all of the following shall occur:

(1) A minimum flow rate of supply air shall be provided in accordance with Equation 1104.6.2.2:

\[ Q = \frac{1001 \times M}{LFL} \]  
[Equation 1104.6.2.2]
Where:
\( Q \) is the supply air flow rate, cubic foot per minute (ft³/min).
\( M \) is the refrigerant charge, pounds (lb).
\( LFL \) is the lower flammability limit, pounds per 1000 cubic foot (lb/1000 ft³).

For SI units: \( Q = \frac{60000 \times M}{LFL} \), where \( Q \) is the supply air flow rate (m³/h), \( M \) is the refrigerant charge (kg), \( LFL \) is the lower flammability limit (g/m³).

(2) The compressor and all other electrical devices shall de-energize, excluding the control power transformers, control systems, and the supply air fan. The supply air fan shall continue to operate for a minimum of 5 minutes after the refrigerant detection system activates the fan.

(3) Devices that control air flow located within the equipment or in the duct system that supplies air to the occupied space shall be fully opened.

(4) Heaters and electrical devices located in the ductwork shall be de-energized.

**1104.6.3 Ignition Source Prohibited.** Open flame-producing devices shall not be permanently installed in the duct system for the space served by A2L refrigeration equipment. Continuously operating hot surfaces exceeding 1292°F (700°C) shall not be located within the duct system.

**SUBSTANTIATION:**
An error during the last cycle resulted in the allowance of Group B2L refrigerants for high probability systems for human comfort. Toxic refrigerants have never been permitted for high probability systems. The addition of B2L to the list of prohibited refrigerants corrects this error.

While Section 1104.6 allows the use of Group A2L refrigerants in high probability systems for human comfort, the additional safety requirements in ASHRAE 15 and UL/CSA 60335-2-40 draft of the 3rd edition are not included. The last sentence of Section 1104.6 will require conformance with the safety requirements of 1104.6.1 through 1104.6.3 for equipment using A2L refrigerants. These safety requirements are consistent with ASHRAE 15, Addendum d (draft). The requirements identify when a refrigerant detection system is required and what the system must activate.

**COMMITTEE ACTION:** ACCEPT AS AMENDED BY THE TC

Amend proposal as follows:

**1104.0 Requirements for Refrigerant and Refrigeration System Use.**

**1104.6 Applications for Human Comfort and for Nonindustrial Occupancies.** In nonindustrial occupancies, Group A2, A2L, A3, B1, B2L, B2, and B3 refrigerants shall not be used in high-probability systems for human comfort. Systems using Group A2L refrigerant in high probability systems for human comfort shall comply with Section 1104.6.1 through Section 1104.6.3.

**1104.6.1 A2L Refrigerant Equipment.** The refrigeration equipment using A2L refrigerant shall be listed and comply with Section 903.1. The equipment shall be installed in accordance with the manufacturer's instructions. The nameplate shall include a flammable refrigerant symbol. A label indicating that a flammable refrigerant is used shall be placed adjacent to service ports and other locations where service involving components containing refrigerant is performed.

**1104.6.2 Refrigerant Detection System.** A refrigerant detection system shall be provided in accordance with Section 1104.6.4 where one or more of the following conditions are met:

1. Where the refrigerant charge of any independent circuit exceeds 22 pounds (10 kg) for commercial, public assembly and large mercantile occupancies.
2. Where the refrigerant charge of any independent circuit exceeds 6.6 pounds (3 kg) for residential and institutional occupancies.
3. Where using the provisions of Section 1104.6.3.
4. Where a refrigerant detection system is required by the equipment listing.

**1104.6.2.1 Refrigerant Detection System Performance.** Refrigerant detection systems shall comply with the following:

1. The refrigerant detection system set point to activate the functions in accordance with Section 1106.2.2.1 and Section 1106.2.2.2 shall be at a value not exceeding the RCL value specified in Table 1102.3 or 25 percent of the lower flammable limit (LFL) of the refrigerant.
2. One or more refrigerant detection systems shall be located such that refrigerant will be detected if the refrigerating system is operating or not operating. For refrigerating systems that are connected to the occupied space through a duct system, the refrigerant detection system shall be located within the listed equipment. For refrigerating systems that are directly connected to the occupied space without ducts, the refrigerant detection system shall be located in the equipment or in the occupied space at a height of not more than 12 inches (305 mm) above the floor within a horizontal distance of not more than 33 feet (1007 mm) with a direct line of sight of the unit.
3. The refrigerant detection system, including any sampling tubes, shall cause the functions required by Section 1104.6.2.2 within 10 seconds, after sensing the refrigerant concentration identified.
4. The refrigerant detection system shall provide a means for automatic operational self-test as required by the equipment listing. If a failure of the refrigerant detection system is identified, a trouble alarm shall be activated, and requirements of Section 1104.6.2.2...
shall be initiated.

(5) The refrigerant detection system shall be tested during installation to verify the alarm set point and response time as required in Section 1104.6.2.1(1) and Section 1104.6.2.1(3). After installation, the refrigerant detection system shall be tested annually or at an interval not exceeding the manufacturer's installation instructions, whichever is less to verify the alarm set point and response time.

1104.6.2.2 Refrigerant Detection System Activation. When the refrigerant detection system senses a refrigerant concentration above the RCL value specified in Table 1102.3, all of the following shall occur:

(1) A minimum flow rate of supply air shall be provided in accordance with Equation (1104.6.2.2):

\[ Q = 1001 \times \frac{M}{LFL} \]  

Where:
- \( Q \) is the supply air flow rate, cubic foot per minute (\( \text{ft}^3/\text{min} \)).
- \( M \) is the refrigerant charge, pounds (lb).
- \( LFL \) is the lower flammability limit, pounds per 1000 cubic foot (lb/1000 ft\(^3\)).

For SI units: \( Q = 60000 \times \frac{M}{LFL} \), where \( Q \) is the supply air flow rate (m\(^3\)/h), \( M \) is the refrigerant charge (kg), \( LFL \) is the lower flammability limit (g/m\(^3\)).

(2) The compressor and all other electrical devices shall de-energize, excluding the control power transformers, control systems, and the supply air fan. The supply air fan shall continue to operate for a minimum of 5 minutes after the refrigerant detection system activates the fan.

(3) Devices that control air flow located within the equipment or in the duct system that supplies air to the occupied space shall be fully opened.

(4) Heaters and electrical devices located in the ductwork shall be de-energized.

1104.6.3 Ignition Source Prohibited. Open flame-producing devices shall not be permanently installed in the duct system for the space served by A2L refrigeration equipment. Continuously operating hot surfaces exceeding 1292°F (700°C) shall not be located within the duct system.

COMMITTEE STATEMENT:
The proposed text is being modified as ASHRAE 15 Addendum d was still under public review and not yet finalized at the time that this monograph was published.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 24  NEGATIVE: 1  NOT RETURNED: 1  HOWARD

EXPLANATION OF NEGATIVE:
KOERBER: I believe the entire proposal needs further consideration without modification.

Appended Comments

PUBLIC COMMENT 1

Code Year: 2021 UMC  Section #: 1104.5 - 1112.11.1  Item #: 091

SUBMITTER: Connor Barbaree  ASHRAE

RECOMMENDATION:
Revise text

Request to accept the code change proposal as modified by this public comment.

1104.0 Requirements for Refrigerant and Refrigeration System Use.

1104.5 Flammable Refrigerants. The total of Group A2, B2, A3, and B3 refrigerants, other than Group A2L and B2L refrigerants shall not exceed 1100 pounds (498.9 kg) without approval by the Authority Having Jurisdiction. Institutional Occupancies shall comply with Section 1104.3. Machinery rooms required in accordance with Section 1106.0 based on flammability shall be constructed and maintained in accordance with Section 1106.2.1 through Section 1106.2.6 and Section 1106.13 for Group A2L and B2L refrigerants other than R-717(ammonia).
1106.0 Refrigeration Machinery Rooms.

1106.1 Where Required. (remaining text unchanged)

1106.2 Refrigeration Machinery Room, General Requirements. Where a refrigeration system is located indoors and a machinery room is required in accordance with Section 1106.1, the machinery room shall be in accordance with Section 1106.2.1 through Section 1106.2.5.2.

1106.2.1 Access. Machinery rooms shall not be prohibited from housing other mechanical equipment unless specifically prohibited elsewhere in this chapter. A machinery room shall be so dimensioned that parts are accessible with space for service, maintenance, and operations. There shall be a clear head room of not less than 7.25 feet (2210 mm) below equipment situated over passageways. [ASHRAE 15:8.11.1]

1106.2.2 Openings. Each refrigeration machinery room shall have a tight-fitting door or doors opening outward, self-closing where they open into the building and adequate in number to ensure freedom for persons to escape in an emergency. With the exception of access doors and panels in air ducts and air-handling units in accordance with Section 1106.6, there shall be no openings that will permit passage of escaping refrigerant to other parts of the building. [ASHRAE 15: 8.11.2]

1106.2.3 Airflow. There shall be no airflow to or from an occupied space through a machinery room unless the air is ducted and sealed in such a manner as to prevent a refrigerant leakage from entering the airstream. Access doors and panels in ductwork and air-handling units shall be gasketed and tight fitting. [ASHRAE 15:8.11.3]

1106.2.4 Restricted Access. Access to the refrigeration machinery room shall be restricted to authorized personnel. Doors shall be clearly marked or permanent signs shall be posted at each entrance to indicate this restriction. [ASHRAE 15:8.11.8]

1106.2.5 Detectors and Alarms. Each refrigeration machinery room shall contain one or more refrigerant detectors in accordance with Section 1106.2.6, located in areas where refrigerant from a leak will concentrate, that actuate an alarm and mechanical ventilation in accordance with Section 1106.2.2.1 or Section 1107.1.7 at a set point not more than the corresponding Occupational Exposure Limit, OEL, in accordance with Table 1102.3, a set point determined in accordance with the OEL as defined in Chapter 2 shall be approved by the Authority Having Jurisdiction. The alarm shall annunciate visual and audible alarms inside the refrigeration machinery room and outside each entrance to the refrigeration machinery room. The alarms required in this section shall be of the manual reset type with the reset located inside the refrigeration machinery room. Alarms set at other levels, such as IDLH, and automatic reset alarms shall be permitted in addition to those required in accordance with this section. The meaning of each alarm shall be clearly marked by signage near the annunciator.

Exception: Refrigerant detectors are not required where only systems using R-718 (water) are located in the refrigeration machinery room. For Group A2L and B2L, other than ammonia, refrigerant detectors shall comply with Section 1106.13.

1106.2.6 Refrigerant Detectors. Refrigerant detectors required in accordance with Section 1106.2.2.1 or Section 1106.2.5 or Section 1107.1.7 shall meet all of the following conditions:

(1) The refrigerant detector shall perform automatic self-testing of sensors. Where a failure is detected, a trouble signal shall be activated.

(2) The refrigerant detector shall have one or more set points to activate responses in accordance with Section 1106.2.2.1 or Section 1107.1.7.

(3) The refrigerant detector as installed, including any sampling tubes, shall activate responses within a time not to exceed 30 seconds after exposure to refrigerant concentration exceeding the set point value specified in Section 1106.2.2.1 or Section 1107.1.7.

(renumber remaining sections)

1106.2.5 Emergency Ventilation-Required Airflow. An emergency ventilation system shall be required to exhaust an accumulation of refrigerant due to leaks or a rupture of the system. The emergency ventilation required shall be capable of removing air from the machinery room in not less than the airflow quantity in Section 1106.2.5.1 or Section 1106.2.5.2. Where multiple refrigerants are present, the highest airflow quantity shall apply.

1106.2.5.1 Ventilation - A1, A2, A3, B1, B2L, B2 and B3 refrigerants. The emergency ventilation for A1, A2, A3, B1, B2L, B2 and B3 refrigerants shall have the capacity to provide mechanical exhaust at a rate as determined in accordance with Equation 1106.2.5.1:

\[ Q = 100 \sqrt{G} \]  

(Equation 1106.2.5.1)

Where:
\[ Q \] = Air flow rate, cubic feet per minute.
\[ G \] = Refrigerant mass in largest system, pounds.

For SI units: 1 cubic foot per minute = 0.00047 m³/s, 1 pound = 0.453 kg
1106.2.5.2 Ventilation - Group A2L Refrigerants. The emergency ventilation for A2L refrigerants shall have the capacity to provide mechanical exhaust at a rate determined in accordance with Table 1106.2.5.2:

**TABLE 1106.2.5.2**

**REQUIRED AIRFLOW FOR GROUP A2L REFRIGERANTS**

\[ Q_{A2L} = \frac{P \cdot V \cdot A}{(LFL \cdot 0.50)} \]  (Equation 1106.2.5.2)

Where:

- \( P \) = Refrigerant density, pounds per cubic feet (kg/m\(^3\)).
- \( V \) = Refrigerant velocity equal to the refrigerant acoustic velocity (speed of sound), feet per second (m/s).
- \( A \) = Cross section flow area of refrigerant leak, square feet (m\(^2\)), \( A = 0.00136 \text{ ft}^2 (0.000126 \text{ m}^2) \).
- \( LFL \) = Lower Flammability Limit, or ETFL\(_G\), where no LFL exist, published value in accordance with ASHRAE 34.

\( Q_{A2L} \) = Minimum required airflow rate, conversion to other units of measures is permitted, cubic feet per second (m\(^3\)/s).

For exact ventilation rates and for refrigerants not listed, the ventilation rate shall be calculated using this equation.

1106.4 Natural Ventilation. Where a refrigerating system is located outdoors more than 20 feet (6096 mm) from buildings opening and is enclosed by a penthouse, lean-to, or other open structure, natural or mechanical ventilation shall be provided. The requirements for such natural ventilation shall be in accordance with the following:

(1) The free-aperture cross section for the ventilation of a machinery room shall be not less than as determined in accordance with Equation 1106.4.

\[ F = \sqrt{G} \]  (Equation 1106.4)

Where:

- \( F \) = The free opening area, square feet.
- \( G \) = The mass of refrigerant in the largest system, any part of which is located in the machinery room, pounds.

For SI units: 1 cubic foot per minute = 0.00047 m\(^3\)/s, 1 pound = 0.453 kg

(2) The location of the gravity ventilation openings shall be based on the relative density of the refrigerant to air. [ASHRAE 15:8.11.5(a), (b)8.14]

1106.13 Machinery Room, A2L and B2L Other than R-717 (Ammonia). When required by Section 1106.1, machinery rooms shall comply with Sections 1106.13.1 through Section 1106.13.6. [ASHRAE 15:8.13]

1106.13.1 Flame-Producing Device. There shall be no flame-producing device or hot surface over 1290°F (700°C) in the room, other than that used for maintenance or repair, unless installed in accordance with Section 1106.5. [ASHRAE 15:8.13.1]

1106.13.2 Communicating Spaces. Doors communicating with the building shall be approved, self-closing, tight-fitting fire doors. [ASHRAE 15:8.13.2]

1106.13.3 Noncombustible Construction. Walls, floor, and ceiling shall be tight and of noncombustible construction. Walls, floor, and ceiling separating the refrigerating machinery room from other occupied spaces shall be of at least one-hour fire-resistive construction. [ASHRAE 15:8.13.3]

1106.13.4 Exterior Openings. Exterior openings, if present, shall not be under any fire escape or any open stairway. [ASHRAE 15:8.13.4]

1106.13.5 Pipe Penetrations. All pipes piercing the interior walls, ceiling, or floor of such rooms shall be tightly sealed to the walls, ceiling, or floor through which they pass. [ASHRAE 15:8.13.5]

1106.13.6 Machinery Room Designation. When any refrigerant of Groups A2, A3, B2, or B3 are used, the machinery room shall be designated as Class I, Division 2 hazardous (classified) electrical location in accordance with the NFPA 70. When the only flammable refrigerants used are from Group A2L or B2L other than R-717 (ammonia), the machinery room shall comply with both Section 1106.13.6.1 for ventilation and Section 1106.13.6.2 for refrigerant detection, or shall be designated as Class I, Division 2 hazardous (classified) electrical location in accordance with the NFPA 70. [ASHRAE 15:8.13.6]

1106.13.6.1 Mechanical Ventilation. The machinery room shall have a mechanical ventilation system in accordance with Section 1106.13.11. The mechanical ventilation system shall:

(1) run continuously, and failure of the mechanical ventilation system actuates an alarm, or
(2) be activated by one or more refrigerant detectors, conforming to requirements of Section 1106.13.8. [ASHRAE 15:8.13.6.1]

1106.13.6.2 Detection System. Detection of refrigerant concentration that exceeds 25 percent of the LFL or the upper
**1106.13.10 Alarms.** Alarms required by Section 1106.13.8 shall comply with Section 1106.13.10.1 through Section 1106.13.10.4.

**1106.13.10.1 Visual and Audio.** The alarm shall have visual and audible annunciation inside the refrigerating machinery room and outside each entrance to the refrigerating machinery room. [ASHRAE 15:8.13.10.1]

**1106.13.10.2 Detector Activation.** The refrigerant detector set points shall activate an alarm in accordance with the type of reset in Table 1106.13.10.2. Manual reset type alarms shall have the reset located inside the refrigerating machinery room. [ASHRAE 15:8.13.10.2]

**1106.13.10.3 Alarm Levels.** Alarms set at levels other than Table 1106.13.10.2 (such as IDLH) and automatic reset alarms are permitted in addition to those required by Section 1106.13.10. The meaning of each alarm shall be clearly marked by signage near the annunciators. [ASHRAE 15:8.13.10.3]

**1106.13.10.4 Emergency.** In the event of a failure during a refrigerant detector self-test in accordance with Section 1106.13.9(5), a trouble alarm signal shall be transmitted to an approved monitored location. [ASHRAE 15:8.13.10.4]

**1106.13.11 Mechanical Ventilation.** Machinery rooms, in accordance with Section 1106.13, shall be vented to the outdoors, using mechanical ventilation in accordance with Section 1106.13.11.1, Section 1106.13.11.2, and Section 1106.13.11.3. [ASHRAE 15:8.13.11.3]

**1106.13.11.1 Mechanical Ventilation Requirements.** Mechanical ventilation referred to in Section 1106.13.11 shall be in accordance with all of the following:

1. Include one or more power-driven fans capable of exhausting air from the machinery room; multispeed fans shall be permitted.
2. Electric motors driving fans shall not be placed inside ducts; fan rotating elements shall be nonferrous or non-sparking, or the casing shall consist of or be lined with such material.
3. Include provision to supply make-up air to replace that being exhausted; ducts for supply to and exhaust from the machinery room shall serve no other area; the makeup air supply locations shall be positioned relative to the exhaust air locations to avoid short circuiting.
4. Inlets to the exhaust ducts shall be located in an area where refrigerant from a leak will concentrate, in consideration
of the location of the replacement supply air paths, refrigerating machines, and the density of the refrigerant relative to

(5) Inlets to exhaust ducts shall be within 1 foot (0.3 m) of the lowest point of the machinery room for refrigerants that

are heavier than air and shall be within 1 foot (0.3 m) of the highest point for refrigerants that are lighter than

air. [ASHRAE 15:8.13.11.1]

(6) The discharge of the exhaust air shall be to the outdoors in such a manner as not to cause a nuisance or danger.

1106.13.11.2 Level 1 Ventilation. The refrigerating machinery room mechanical ventilation in Section 1106.13.11.1

shall exhaust at an airflow rate not less than shown in Table 1106.13.11.2. [ASHRAE 15:8.13.11.2]

1106.13.11.3 Level 2 Ventilation. A part of the refrigerating machinery room mechanical ventilation referred to in

Section 1106.13.11.1 shall exhaust an accumulation of refrigerant due to leaks or a rupture of a refrigerating system or

portion thereof in the machinery room. The refrigerant detectors required in accordance with Section 1106.13.8 shall

activate ventilation at a set point and response time in accordance with Table 1106.13.10.2, at an airflow rate not less than

the value determined in accordance with Section 1106.13.11.4. When multiple refrigerant designations are in the

machinery room, evaluate the required airflow according to each refrigerating system, and the highest airflow quantity

shall apply. Ventilation reset shall be in accordance with the type of reset in Table 1106.13.10.2. Manual-type ventilation

reset shall have the reset located inside the refrigerating machinery room. [ASHRAE 15:8.13.11.3]

1106.13.11.4 Safety group A2L, B2L Other than Ammonia. When required by Section 1106.13.11.3, the total airflow

for Level 2 Ventilation shall be not less than the airflow rate determined by Figure 1106.13.11.4. [ASHRAE

15:8.13.11.4]

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**TABLE 1106.13.10.2**

SAFETY GROUPS: A2L, B2L OTHER THAN R-717 (AMMONIA)

[ASHRAE 15:Table 8.13.10.2]

<table>
<thead>
<tr>
<th>LIMIT VALUE</th>
<th>RESPONSE TIME (seconds)</th>
<th>ALARM TYPE</th>
<th>ALARM RESET TYPE</th>
<th>VENTILATION RATE</th>
<th>VENTILATION RESET TYPE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Set point &lt;= OEL</td>
<td>&lt;= 300</td>
<td>Troubled Alarm</td>
<td>Automatic</td>
<td>Level 1</td>
<td>Automatic</td>
</tr>
<tr>
<td>Set point &lt;= RCL</td>
<td>&lt;= 15</td>
<td>Emergency Alarm</td>
<td>Manual</td>
<td>Level 2</td>
<td>Manual</td>
</tr>
</tbody>
</table>

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**TABLE 1106.13.11.2**

LEVEL 1 VENTILATION RATE FOR CLASS 2L REFRIGERANTS

[ASHRAE 15: Table 8.13.11.2]

<table>
<thead>
<tr>
<th>STATUS</th>
<th>AIRFLOW</th>
</tr>
</thead>
</table>
| Operated when occupied and operated when activated in accordance with Section 1106.13.10.2 and Table 1106.13.10.2 | The greater of the following:
1. 0.5 ft³/min per ft³ (2.54 L/s per m³) of machinery room area, or
2. 20 ft³/min (9.44 L/s) per person |
| Operable when occupied | With or without mechanical cooling of the machinery room, the greater of:
1. The airflow rate required to not exceed a temperature rise of 18°F (10°C) above inlet air temperature or
2. The airflow rate required to not exceed a maximum air temperature of 122°F (50°C) in the machinery room. |

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1107.1.7 Group A2L and B2L Refrigerants. Where refrigerant of Groups A2L or B2L are used, the requirements of Class 1,

Division 2, of NFPA 70, shall not apply to the machinery room provided that the conditions in Section 1107.1.7.1 through

Section 1107.1.7.3 are met.

1107.1.7.1 Mechanical Ventilation. The mechanical ventilation system in the machinery room is run continuously in

accordance with Section 1106.2.5 1106.13.6.1 and failure of the mechanical ventilation system actuates an alarm, or the
mechanical ventilation system in the machinery room is activated by one or more refrigerant detectors, in accordance with the requirements of Section 1106.2.2.1 and Section 1106.2.2.2. 

1107.1.7.2 Refrigeration Detectors. For the refrigerant detection required in Section 1106.2.2.1, detection of refrigerant concentration that exceeds 25 percent of the LFL or the upper detection limit of the refrigerant detector, whichever is lower, shall automatically de-energize the following equipment in the machinery room:
(a) refrigerant compressors
(b) refrigerant pumps
(c) normally-closed automatic refrigerant valves

1107.1.7.3 Machinery Rooms. The machinery room shall comply with Section 1107.4.8 and 1106.13.

1112.11 Discharge from Pressure-Relief Devices. Pressure-relief systems designed for vapor shall comply with Section 1112.11.1 through Section 1112.11.4.

1112.11.1 Discharging Location Interior to Building. Pressure-relief devices, including fusible plugs, serving refrigeration systems shall be permitted to discharge to the interior of a building where in accordance with the following:
(1) The system contains less than 110 pounds (49.9 kg) of a Group A1 or A2L refrigerant.
(2) The system contains less than 6.6 pounds (2.99 kg) of a Group A2, B1, or B2 or B2L refrigerant.
(3) The system does not contain any quantity of a Group A3 or B3 refrigerant.
(4) The system is not required to be installed in a machinery room in accordance with Section 1106.0.
(5) The refrigerant concentration limits in Section 1104.0 are not exceeded. Refrigeration systems that do not comply with the above requirements shall comply with the requirements of Section 1112.11.2 through Section 1112.11.4. [ASHRAE 15:9.7.8.1]
FIGURE 1106.13.11.4
LEVEL 2 VENTILATION RATE FOR CLASS 2L REFRIGERANTS
[ASHRAE 15: FIGURE 8.13.11.4-1]

SUBSTANTIATION:
In accordance with IAPMO's Regulations Governing Committee Projects (Extract Guidelines), Chapter 11 has been revised to correlate with Addendum h of ASHRAE 15-2016 (published October 9, 2018).

This public comment adds the requirements from Addendum h to the code so that the Uniform Mechanical Code remains consistent with ASHRAE 15. This public comment and Addendum h address the safe use of Group A2L refrigerants which fall into the category of lower global warming potential refrigerants.

These requirements are needed for advancing the use of environmentally friendly refrigerants. Many states, including the State of California, are requiring a switch to lower global warming potential refrigerants. Without these requirements, states will not have the proper tools for the code enforcement community to regulate lower global warming potential refrigerants that fall within Group A2L.

Within the safety requirements of this public comment are limitations on the charge size of refrigerating systems based on their location, as well as, detector requirements. It should be noted that the requirements rely on the equipment being listed. The standard regulating refrigerant equipment is UL/CSA 60335-2-40 which is currently referenced in the UMC.
PUBLIC COMMENT 2

Code Year: 2021 UMC  Section #: 1104.6 - 1115.5

SUBMITTER: Connor Barbaree
ASHRAE

RECOMMENDATION:
Revise text

Request to accept the code change proposal as modified by this public comment.

1104.0 Requirements for Refrigerant and Refrigeration System Use.

1104.6 Group A2L Refrigerants for Human Comfort. High-probability systems using Group A2L refrigerants for human comfort applications shall comply with this section. [ASHRAE 15:7.6]

1104.6.1 Refrigerant Concentration Limits. Occupied spaces shall comply with Section 1104.2. Unoccupied spaces with refrigerant containing equipment, including but not limited to piping or tubing, shall comply with Section 1104.2 except as permitted by Section 1104.6.4. [ASHRAE 15:7.6.1-7.6.1.2.1]

1104.6.2 Listing and Installation Requirements. Refrigeration systems shall be listed and shall be installed in accordance with listing, the manufacturer’s instructions, and any markings on the equipment restricting the installation. [ASHRAE 15:7.6.2]

1104.6.2.1 Nameplate. The nameplate required by Section 1115.5 shall include a symbol indicating that a flammable refrigerant is used, as specified by the product listing. [ASHRAE 15:7.6.2.1]

1104.6.2.2 Labeling. A label indicating a flammable refrigerant is used shall be placed adjacent to service ports and other locations where service involving components containing refrigerant is performed, as specified by the product listing. [ASHRAE 15:7.6.2.2]

1104.6.2.3 Refrigerant Detectors. A refrigerant detector shall be provided in accordance with Section 1104.6.5 where any of the following apply:

1. For commercial, public assembly, and large mercantile occupancies, when the refrigerant charge of any independent circuit exceeds 0.212 × \(LFL\) (lb), where \(LFL\) is in pounds per 1000 ft\(^3\) (6 × \(LFL\) [kg] where \(LFL\) is in kg/m\(^3\)), unless the concentration of refrigerant in a complete discharge from any independent circuit will not exceed 50 percent of the RCL.
2. For residential occupancies, when the refrigerant charge of any independent circuit exceeds 0.212 × \(LFL\) (lb), where \(LFL\) is in pounds per 1000 ft\(^3\) (6 × \(LFL\) [kg] where \(LFL\) is in kg/m\(^3\)).
3. When the occupancy classification is institutional.
4. When required by the product listing.
5. When using the provisions of Section 1104.6.4. [ASHRAE 15:7.6.2.3]

1104.6.2.4 Refrigerant Concentration Above Limit. When the refrigerant detector senses a rise in refrigerant concentration above the value specified in Section 1104.6.5(2), the following actions shall be taken:

1. The minimum airflow rate of the supply air fan shall be in accordance with the following equation,

\[
Q_{\text{min}} = 1000 \times \frac{M}{LFL} \quad \text{[Equation 1104.6.2.4]}
\]

Where:
- \(Q_{\text{min}}\) = minimum airflow rate, ft\(^3\)/min
- \(M\) = refrigerant charge of the largest independent refrigerating circuit of the system, lb
- \(LFL\) = lower flammability limit, lb per 1000 ft\(^3\)

For SI units: \(Q = 60000 \times \frac{M}{LFL}\), where \(Q\) is the supply air flow rate (m\(^3\)/h), \(M\) is the refrigerant charge (kg), \(LFL\) is the lower flammability limit (g/m\(^3\)).

2. Turn off the compressor and all other electrical devices, excluding the control power transformers, control systems, and the supply air fan. The supply air fan shall continue to operate for at least five minutes after the refrigerant detector has sensed a drop in the refrigerant concentration below the value specified in Section 1104.6.5(2).

3. Any device that controls airflow located within the product or in ductwork that supplies air to the occupied space shall be fully open. Any device that controls airflow shall be listed.

4. Turn off any heaters and electrical devices located in the ductwork. The heaters and electrical devices shall remain off for at least
five minutes after the refrigerant detector has sensed a drop in the refrigerant concentration below the value specified in Section 1104.6.5(2). [ASHRAE 15:7.6.2.4]

1104.6.3 Ignition Sources Located in Ductwork. Open-flame producing devices shall not be permanently installed in the ductwork that serves the space. Unclassified electrical devices shall not be located within the ductwork that serves the space. Devices containing hot surfaces exceeding 1290°F (700°C) shall not be located in the ductwork that serves the space unless there is a minimum airflow of 200 ft/min (1.0 m/s) across the heating device(s) and there is proof of airflow before the heating device(s) is energized. [ASHRAE 15:7.6.3-7.6.3.3]

1104.6.4 Compressors and Pressure Vessel Located Indoors. For refrigeration compressors and pressure vessels located in an indoor space that is accessible only during service and maintenance, it shall be permissible to exceed the RCL if all of the following provisions are met:

(1) The refrigerant charge of largest independent refrigerating circuit shall not exceed:
   (a) 6.6 lb (3 kg) for residential and institutional occupancies and
   (b) 22 lb (10 kg) for commercial and public/large mercantile occupancies.

(2) The space where the equipment is located shall be provided with a mechanical ventilation system in accordance with Section 1104.6.4(3) and a refrigerant detector in accordance with Section 1104.6.5. The mechanical ventilation system shall be started when the refrigerant detector senses refrigerant in accordance with Section 1104.6.5. The mechanical ventilation system shall continue to operate for at least five minutes after the refrigerant detector has sensed a drop in the refrigerant concentration below the value specified in Section 1104.6.5(2).

(3) A mechanical ventilation system shall be provided that will mix air with leaked refrigerant and remove it from the space where the equipment is located. The space shall be provided with an exhaust fan. The exhaust fan shall remove air from the space where the equipment is located in accordance with the following equation.

\[ Q_{\text{min}} = 1000 \times \frac{M}{LFL} \]

Where:

\[ Q_{\text{min}} \] = minimum airflow rate, ft³/min
\[ M \] = refrigerant charge of the largest independent refrigerating circuit of the system, lb
\[ LFL \] = lower flammability limit in lb per 1000 ft³

For SI units: \[ Q = 60000 \times \frac{M}{LFL} \], where \( Q \) is the supply air flow rate (m³/h), \( M \) is the refrigerant charge (kg), \( LFL \) is the lower flammability limit (g/m³).

(4) The exhaust air inlet shall be located where refrigerant from a leak is expected to accumulate. The bottom of the air inlet elevation shall be within 12 in. (30 cm) of the lowest elevation in the space where the compressor or pressure vessel is located. Provision shall be made for make-up air to replace that being exhausted. Openings for the make-up air shall be positioned such that air will mix with leaked refrigerant.

(5) Air that is exhausted from the ventilation system shall be either:
   (a) discharged outside of the building envelope or
   (b) discharged to an indoor space, provided that the refrigerant concentration will not exceed the limit specified in Section 1104.6.1.

(6) In addition to the requirements of Section 1104.6.3, there shall be no open-flame producing devices that do not contain a flame arrestor, or hot surfaces exceeding 1290°F (700°C) that are installed within space where the equipment is located. [ASHRAE 15:7.6.4]

1104.6.5 Refrigerant Detectors. Refrigerant detectors required by Section 1104.6.2 shall meet the following requirements:

(1) Refrigerant detectors that are part of the listing shall be evaluated by the testing laboratory as part of the equipment listing.

(2) Refrigerant detectors as installed shall activate the functions required by Section 1104.6.2.4 within a time not to exceed 15 seconds when the refrigerant concentration reaches 25 percent of the lower flammability limit (LFL).

(3) Refrigerant detectors shall be installed such that refrigerant will be detected if the refrigerating system is operating or not operating. Use of more than one refrigerant detector shall be permitted.

(a) For refrigerating systems that are connected to the occupied space through ductwork, refrigerant detectors shall be located within the listed equipment.

(b) For refrigerating systems that are directly connected to the occupied space without ductwork, the refrigerant detector shall be located in the equipment, or shall be located in the occupied space at a height of not more than 12 inches (30 cm) above the floor and within a horizontal distance of not more 3.3 feet (1.0 m) with a direct line of sight of the unit.

(4) Refrigerant detectors shall provide a means for an automatic operational self-test as provided in the product listing. Use of a refrigerant test gas is not required. If a failure is detected, a trouble alarm shall be activated, and the actions required by Section 1104.6.2.4 shall be initiated.

(5) Refrigerant detectors shall be tested during installation to verify the set point and response time as required by Section 1104.6.5(2). After installation, the refrigerant detector shall be tested to verify the set point and response time annually or at an interval not exceeding the manufacturer’s installation instructions, whichever is less. [ASHRAE 15:7.6.5]

1104.7 Applications for Human Comfort and for Nonindustrial Occupancies. In nonindustrial occupancies, Group A2, A2L, A3, B1, B2L, B2, and B3 refrigerants shall not be used in high-probability systems for human comfort. Use of Group
A2L refrigerants shall be in accordance with Section 1104.6.

(renumber remaining sections)

**1115.5 Nameplate.** Each unit system and each separate condensing unit, compressor, or compressor unit sold for field assembly in a refrigerating system shall carry a nameplate marked with the manufacturer’s name, nationally registered trademark or trade name, identification number, design pressures, and refrigerant for which it is designed. The refrigerant shall be designated by the refrigerant number (R number) as shown in Table 1102.3. [ASHRAE 15-9.15]

**SUBSTANTIATION:**
In accordance with IAPMO’s Regulations Governing Committee Projects (Extract Guidelines), Chapter 11 has been revised to correlate with Addendum d of ASHRAE 15-2016 (published October 23, 2018).

This public comment adds the requirements from Addendum d to the code so that the Uniform Mechanical Code remains consistent with ASHRAE 15. This public comment and Addendum d address the safe use of Group A2L refrigerants which fall into the category of lower global warming potential refrigerants.

These requirements are needed for advancing the use of environmentally friendly refrigerants. Many states, including the State of California, are requiring a switch to lower global warming potential refrigerants. Without these requirements, states will not have the proper tools for the code enforcement community to regulate lower global warming potential refrigerants that fall within Group A2L.

Within the safety requirements of this public comment are limitations on the charge size of refrigerating systems based on their location, as well as, detector requirements. It should be noted that the requirements rely on the equipment being listed. The standard regulating refrigerant equipment is UL/CSA 60335-2-40 which is currently referenced in the UMC.

**PUBLIC COMMENT 3**

**Code Year:** 2021 UMC  **Section #:** 1104.6 - 1104.6.1.5  **Item #:** 091

**SUBMITTER:** Connor Barbaree  
ASHRAE  **Comment #:** 3

**RECOMMENDATION:**
Add new text

Request to accept the code change proposal as modified by this public comment.

**1104.0 Requirements for Refrigerant and Refrigeration System Use.**

**1104.6 Applications for Human Comfort and for Nonindustrial Occupancies.** In nonindustrial occupancies, Group A2, A2L, A3, B1, B2L, B2, and B3 refrigerants shall not be used in high-probability systems for human comfort. Systems using Group A2L refrigerant in high-probability systems for human comfort shall comply with Section 1104.6.1 through Section 1104.6.3.

**1104.6.1 Group A2L Refrigerants.** The refrigeration equipment using A2L refrigerant shall be listed and comply with Section 903.1. The equipment shall be installed in accordance with the manufacturer's instructions. The nameplate shall include a flammable refrigerant symbol. A label indicating that a flammable refrigerant is used shall be placed adjacent to service ports and other locations where service involving components containing refrigerant is performed. High-probability systems using Group A2L refrigerants for human comfort applications shall comply with Sections 1104.6.1.1 through 1104.6.1.5. Nonoccupiable spaces with refrigerant containing equipment, including piping, shall comply with the amounts indicated in Table 1102.3, except as permitted by Section 1104.6.1.4.

**1104.6.1.1 Installation Requirements.** A refrigerant detector shall be provided in accordance with Section 1104.6.1.5 where any of the following conditions apply:

1. For Commercial, Public Assembly and Large Mercantile occupancies where the refrigerant charge of any independent circuit exceeds 0.212 x LFL (lb) where LFL is in lb/1000 ft$^3$ (6 x LFL(kg) where LFL is in kg/m$^3$) unless the concentration of refrigerant in a complete discharge from any independent circuit will not exceed 50 percent of the RCL.
2. For Institutional occupancies.
3. For residential occupancies, when the refrigerant charge of any independent circuit exceeds 0.212 x LFL where LFL is in lb/1000 ft$^3$(6 x LFL where LFL is in kg/m$^3$).
4. Where using the provisions of Section 1104.6.1.4.
5. Where a refrigerant detector is required by the product listing.
### 1104.6.1.2 Detector Activation

When the refrigerant detector senses a rise in refrigerant concentration above the value specified in Section 1104.6.1.5, all of the following shall apply:

1. A minimum flow rate of supply air shall be provided in accordance with the following equation:

   \[ Q = 1001 \times \frac{M}{LFL} \]  
   \[ {\text{[Equation 1104.6.1.2]}} \]

   Where:
   \( Q \) = the supply air flow rate \( \text{ft}^3/\text{min} \) (\( \text{m}^3/\text{h} \)),
   \( M \) = the refrigerant charge \( \text{lb} \) (\( \text{kg} \)), and
   \( LFL \) = the lower flammability limit \( \text{lb per 1000 ft}^3 \) (\( \text{g/m}^3 \)).

   For SI units: \( Q = 60000 \times \frac{M}{LFL} \), where \( Q \) is the supply air flow rate \( \text{m}^3/\text{h} \), \( M \) is the refrigerant charge \( \text{kg} \), and \( LFL \) is the lower flammability limit \( \text{g/m}^3 \).

2. The compressor and all other electrical devices shall be turned off, excluding the control power transformers, control systems, and the supply air fan. The supply air fan shall continue to operate for not less than 5 minutes after the refrigerant detector has sensed a drop in the refrigerant concentration below the value specified in Section 1104.6.1.5.

3. Any device that controls air flow located within the product or in duct work that supplies air to the occupied space shall be fully opened. Any device that controls air flow shall be listed.

4. Heaters and electrical devices located in the ductwork shall be turned off. The heaters and electrical devices shall remain off for at least 5 minutes after the refrigerant detector has sensed a drop in the refrigerant concentration below the value specified in Section 1104.6.1.5.

### 1104.6.1.3 Ignition Sources

Open flame-producing devices shall not be permanently installed in the ductwork that serves the space. Continuously operating hot surfaces exceeding 1292°F (700°C) shall not be located within the ductwork that serves the space. Unclassified electrical devices shall not be located within the ductwork that serves the space.

### 1104.6.1.4 Refrigerant Containing Equipment Located Indoors

For refrigeration compressors and pressure vessels located in an indoor space that is accessible only during service and maintenance it shall be permissible to exceed the amounts indicated in Table 1102.3 where all of the following conditions apply:

#### Exceptions:

1. The largest single circuit charge does not exceed 6.6 lb (3 kg) for Residential and Institutional occupancies, and does not exceed 22 lb (10 kg) for C.

2. The space where compressors and pressure vessels are located is provided with an air distribution system in accordance with the following equation:

   \[ Q = 1001 \times \frac{M}{LFL} \]  
   \[ {\text{[Equation 1104.6.1.4]}} \]

   Where:
   \( Q \) = the supply air flow rate \( \text{ft}^3/\text{min} \) (\( \text{m}^3/\text{h} \)),
   \( M \) = the refrigerant charge \( \text{lb} \) (\( \text{kg} \)), and
   \( LFL \) = the lower flammability limit \( \text{lb per 1000 ft}^3 \) (\( \text{g/m}^3 \)).

   For SI units: \( Q = 60000 \times \frac{M}{LFL} \), where \( Q \) is the supply air flow rate \( \text{m}^3/\text{h} \), \( M \) is the refrigerant charge \( \text{kg} \), and \( LFL \) is the lower flammability limit \( \text{g/m}^3 \).

3. Exhaust air is removed from the air distribution system at a minimum rate of 4 air changes per hour and the system has provisions for makeup air. Exhaust air that is removed from the air distribution system is either discharged outside of the building envelope, or discharged to an indoor space, provided that the refrigerant concentration will not exceed the amount indicated in Table 1102.3.

4. The air distribution system is started when the refrigerant detector senses refrigerant in accordance with Section 1104.6.1.5. The air distribution system continues to operate for not less than 5 minutes after the refrigerant detector has sensed a drop in the refrigerant concentration below the value specified in Section 1104.6.1.5.

5. The inlet for return air to the air distribution system is located where refrigerant from a leak is expected to accumulate. The inlet elevation is within 12 inches (30 cm) of the lowest elevation in the space where the compressor or pressure vessel is located.

6. In addition to the requirements of Section 1104.6.1.3 there are no open flame producing devices or continuously operating hot surfaces exceeding 1292°F (700°C) that are located within space where the equipment is installed.

### 1104.6.1.5 Refrigerant Detectors

Refrigerant detectors shall comply with all of the following:

1. The refrigerant detector set point to activate the functions required by Section 1104.6.1.2 shall be at a value not exceeding 25% of the lower flammable limit (LFL).

2. One or more refrigerant detectors shall be located such that refrigerant will be detected if the refrigerating system is operating, or not operating. For refrigerating systems that are connected to the occupied space through ductwork, refrigerant detectors shall be located within the listed equipment. For refrigerating systems that are directly connected to the occupied space without ductwork, the refrigerant detector shall be located in the equipment, or shall be located in the occupied space at a height of not more than 12 inches (30 cm) above the floor and within a horizontal distance of not more 3.3 feet (1.0 m) with a direct line of sight of the unit.

3. The refrigerant detector as installed, including any sampling tubes, shall cause the functions required by Section 1104.6.1.2 within...
a time not to exceed 10 seconds, after exposure to a refrigerant concentration exceeding 25 percent of the LFL.

4. The refrigerant detector shall provide a means for automatic operational self-test as provided in the product listing. Use of a refrigerant test gas is not required. If a failure is detected, a trouble alarm shall be activated and the actions required by Section 1104.6.1.2 shall be initiated.

5. The refrigerant detector shall be tested during installation to verify the alarm set point and response time as required by Section 1104.6.1.5 items 1 and 3. After installation, the refrigerant detector shall be tested to verify the alarm set point and response time annually or at an interval not exceeding the manufacturer's installation instructions, whichever is less.

SUBSTANTIATION:
The original change was modified during the first hearing by deleting the text applying to A2L refrigerants. The reason for the modification was that the ASHRAE 15 Committee had not completed Addendum d. Since that time, Addendum d has been completed and published. Additionally, the changes from Addendum d will appear in the 2019 edition of ASHRAE 15.

This public comment adds the requirements from Addendum d to the code so that the Uniform Mechanical Code remains consistent with ASHRAE 15. This public comment and Addendum d address the safe use of Group A2L refrigerants which fall into the category of lower global warming potential refrigerants.

These requirements are needed for advancing the use of environmentally friendly refrigerants. Many states, including the State of California, are requiring a switch to lower global warming potential refrigerants. Without these requirements, states will not have the proper tools for the code enforcement community to regulate lower global warming potential refrigerants that fall within Group A2L.

Within the safety requirements of this public comment are limitations on the charge size of refrigerating systems based on their location, as well as, detector requirements. It should be noted that the requirements rely on the equipment being listed. The standard regulating refrigerant equipment is UL/CSA 60335-2-40 which is currently referenced in the UMC.
4. Where using the provisions of Section 1104.6.1.4.
5. Where a refrigerant detector is required by the product listing.

### 1104.6.1.2 Detector Activation

When the refrigerant detector senses a rise in refrigerant concentration above the value specified in Section 1104.6.1.5, all of the following shall apply:

1. A minimum flow rate of supply air shall be provided in accordance with the following equation:

\[ Q = 1000 \times \frac{M}{LFL} \quad \text{(Equation 1104.6.1.2)} \]

Where:
- \( Q \) = the supply air flow rate \( \text{ft}^3/\text{min} \) \( \text{m}^3/\text{h} \),
- \( M \) = the refrigerant charge \( \text{lb} \) \( \text{kg} \), and
- \( LFL \) = the lower flammability limit \( \text{lb per 1000 ft}^3 \) \( \text{g/m}^3 \).

For SI units: \( Q = \frac{60000 \times M}{LFL} \), where \( Q \) is the supply air flow rate \( \text{m}^3/\text{h} \), \( M \) is the refrigerant charge \( \text{kg} \), \( LFL \) is the lower flammability limit \( \text{g/m}^3 \).

2. The compressor and all other electrical devices shall be turned off, excluding the control power transformers, control systems, and the supply air fan. The supply air fan shall continue to operate for not less than 5 minutes after the refrigerant detector has sensed a drop in the refrigerant concentration below the value specified in Section 1104.6.1.5.
3. Any device that controls air flow located within the product or in duct work that supplies air to the occupied space shall be fully opened. Any device that controls air flow shall be listed.
4. Heaters and electrical devices located in the ductwork shall be turned off. The heaters and electrical devices shall remain off for at least 5 minutes after the refrigerant detector has sensed a drop in the refrigerant concentration below the value specified in Section 1104.6.1.5.

### 1104.6.1.3 Ignition Sources

Open flame-producing devices shall not be permanently installed in the ductwork that serves the space. Continuously operating hot surfaces exceeding 1292°F \( (700^\circ\text{C}) \) shall not be located within the ductwork that serves the space. Unclassified electrical devices shall not be located within the ductwork that serves the space.

### 1104.6.1.4 Refrigerant Containing Equipment Located Indoors

For refrigeration compressors and pressure vessels located in an indoor space that is accessible only during service and maintenance it shall be permissible to exceed the amounts indicated in Table 1102.3 where all of the following conditions apply:

**Exceptions:**
1. The largest single circuit charge does not exceed 6.6 lb \( (3 \text{ kg}) \) for Residential and Institutional occupancies, and does not exceed 22 lb \( (10 \text{ kg}) \) for C.
2. The space where compressors and pressure vessels are located is provided with an air distribution system in accordance with the following equation:

\[ Q = 1000 \times \frac{M}{LFL} \quad \text{(Equation 1104.6.1.4)} \]

Where:
- \( Q \) = the supply air flow rate \( \text{ft}^3/\text{min} \) \( \text{m}^3/\text{h} \),
- \( M \) = the refrigerant charge \( \text{lb} \) \( \text{kg} \), and
- \( LFL \) = the lower flammability limit \( \text{lb per 1000 ft}^3 \) \( \text{g/m}^3 \).

For SI units: \( Q = \frac{60000 \times M}{LFL} \), where \( Q \) is the supply air flow rate \( \text{m}^3/\text{h} \), \( M \) is the refrigerant charge \( \text{kg} \), \( LFL \) is the lower flammability limit \( \text{g/m}^3 \).

3. Exhaust air is removed from the air distribution system at a minimum rate of 4 air changes per hour and the system has provisions for makeup air. Exhaust air that is removed from the air distribution system is either discharged outside of the building envelope, or discharged to an indoor space, provided that the refrigerant concentration will not exceed the amount indicated in Table 1102.2.
4. The air distribution system is started when the refrigerant detector senses refrigerant in accordance with Section 1104.6.1.5. The location of the refrigerant detector is in accordance with Section 1104.6.1.5. The air distribution system continues to operate for not less than 5 minutes after the refrigerant detector has sensed a drop in the refrigerant concentration below the value specified in Section 1104.6.1.5 (1).
5. The inlet for return air to the air distribution system is located where refrigerant from a leak is expected to accumulate. The inlet elevation is within 12 inches \( (30 \text{ cm}) \) of the lowest elevation in the space where the compressor or pressure vessel is located.
6. In addition to the requirements of Section 1104.6.1.3 there are no open flame producing devices or continuously operating hot surfaces exceeding 1292°F \( (700^\circ\text{C}) \) that are located within space where the equipment is installed.
1104.6.1.5 Refrigerant Detectors. Refrigerant detectors shall comply with all of the following:

1. The refrigerant detector set point to activate the functions required by Section 1104.6.1.2 shall be at a value not exceeding 25 percent of the lower flammable limit (LFL).

2. One or more refrigerant detectors shall be located such that refrigerant will be detected if the refrigerating system is operating, or not operating. For refrigerating systems that are connected to the occupied space through ductwork, refrigerant detectors shall be located within the listed equipment. For refrigerating systems that are directly connected to the occupied space without ductwork, the refrigerant detector shall be located in the equipment, or shall be located in the occupied space at a height of not more than 12 inches (30 cm) above the floor and within a horizontal distance of not more 3.3 feet (1.0 m) with a direct line of sight of the unit.

3. The refrigerant detector as installed, including any sampling tubes, shall cause the functions required by Section 1104.6.1.2 within a time not to exceed 15 seconds, after exposure to a refrigerant concentration exceeding 25 percent of the LFL.

4. The refrigerant detector shall provide a means for automatic operational self-test as provided in the product listing. Use of a refrigerant test gas is not required. If a failure is detected, a trouble alarm shall be activated and the actions required by Section 1104.6.1.2 shall be initiated.

5. The refrigerant detector shall be tested during installation to verify the alarm set point and response time as required by Section 1104.6.1.5 items 1 and 3. After installation, the refrigerant detector shall be tested to verify the alarm set point and response time annually or at an interval not exceeding the manufacturer's installation instructions, whichever is less.

SUBSTANTIATION:
The original change was modified during the first hearing by deleting the text applying to A2L refrigerants. The reason for the modification was that the ASHRAE 15 Committee had not completed Addendum d. Since that time, Addendum d has been completed and published. Additionally, the changes from Addendum d will appear in the 2019 edition of ASHRAE 15.

This public comment adds the requirements from Addendum d to the code so that the Uniform Mechanical Code remains consistent with ASHRAE 15. This public comment and Addendum d address the safe use of Group A2L refrigerants which fall into the category of lower global warming potential refrigerants.

These requirements are needed for advancing the use of environmentally friendly refrigerants. Many states, including the State of California, are requiring a switch to lower global warming potential refrigerants. Without these requirements, states will not have the proper tools for the code enforcement community to regulate lower global warming potential refrigerants that fall within Group A2L.

Within the safety requirements of this public comment are limitations on the charge size of refrigerating systems based on their location, as well as, detector requirements. It should be noted that the requirements rely on the equipment being listed. The standard regulating refrigerant equipment is UL/CSA 60335-2-40 which is currently referenced in the UMC.

PUBLIC COMMENT 5

Code Year: 2021 UMC  Section #: 1104.6 - 1104.6.1.5  Item #: 091

SUBMITTER: Andrew Klein  Comment #: 5
A S Klein Engineering, PLLC
Rep: The Chemours Company

RECOMMENDATION:
Revise text

Request to accept the code change proposal as modified by this public comment.

1104.6 Requirements for Refrigerant and Refrigeration System Use.

1104.6 Applications for Human Comfort and for Nonindustrial Occupancies. In nonindustrial occupancies, Group A2, A2L, A3, B1, B2L, B2, and B3 refrigerants shall not be used in high-probability systems for human comfort. Systems using Group A2L refrigerant in high-probability systems for human comfort shall comply with Section 1104.6.1 through Section 1104.6.1.5.

1104.6.1 Group A2L Refrigerants. The refrigeration equipment using A2L refrigerant shall be listed and comply with Section 903.1. The equipment shall be installed in accordance with the manufacturer's instructions. The nameplate shall include a flammable refrigerant symbol. A label indicating that a flammable refrigerant is used shall be placed adjacent to service ports and other locations where service involving components containing refrigerant is performed. High-probability systems using Group A2L refrigerants for human comfort applications shall comply with Sections 1104.6.1.1 through 1104.6.1.5. Nonoccupiable spaces with
Refrigerant containing equipment, including piping, shall comply with the amounts indicated in Table 1102.3, except as permitted by Section 1104.6.1.4.

**1104.6.1.1 Installation Requirements.** A refrigerant detector shall be provided in accordance with Section 1104.6.1.5 where any of the following conditions apply:

1. For commercial, public assembly and large mercantile occupancies where the refrigerant charge of any independent circuit exceeds 0.212 \times LFL (lb) where \( LFL \) is in lb/1000 ft\(^3\) (6 \times LFL (kg)) where \( LFL \) is in kg/m\(^3\), unless the concentration of refrigerant in a complete discharge from any independent circuit will not exceed 50 percent of the RCL.
2. For Institutional occupancies.
3. For Residential occupancies, when the refrigerant charge of any independent circuit exceeds 0.212 \times LFL where \( LFL \) in lb/1000 ft\(^3\) (6 \times LFL) where \( LFL \) is in kg/m\(^3\).
4. Where using the provisions of Section 1104.6.1.4.
5. Where a refrigerant detector is required by the product listing.

**1104.6.1.2 Detector Activation.** When the refrigerant detector senses a rise in refrigerant concentration above the value specified in Section 1104.6.1.5, all of the following shall apply:

1. A minimum flow rate of supply air shall be provided in accordance with the following equation:

\[
Q = 1001 \times M / LFL. \quad [\text{Equation 1104.6.1.2}]
\]

(for SI: \( Q = 60000 \times M / LFL \)).

Where: \( Q \) is the supply air flow rate ft\(^3\)/min (m\(^3\)/h), \( M \) is the refrigerant charge lb (kg), and \( LFL \) is the lower flammability limit lb per 1000 ft\(^3\) (g/m\(^3\)).

2. The compressor and all other electrical devices shall be turned off, excluding the control power transformers, control systems, and the supply air fan. The supply air fan shall continue to operate for not less than 5 minutes after the refrigerant detector has sensed a drop in the refrigerant concentration below the value specified in Section 1104.6.1.5.
3. Any device that controls air flow located within the product or in duct work that supplies air to the occupied space shall be fully opened. Any device that controls air flow shall be listed.
4. Heaters and electrical devices located in the ductwork shall be turned off. The heaters and electrical devices shall remain off for at least 5 minutes after the refrigerant detector has sensed a drop in the refrigerant concentration below the value specified in Section 1104.6.1.5.

**1104.6.1.3 Ignition Sources.** Open flame-producing devices shall not be permanently installed in the ductwork that serves the space. Continuously operating hot surfaces exceeding 1292°F (700°C) shall not be located within the ductwork that serves the space. Unclassified electrical devices shall not be located within the ductwork that serves the space.

**1104.6.1.4 Refrigerant Containing Equipment Located Indoors.** For refrigeration compressors and pressure vessels located in an indoor space that is accessible only during service and maintenance it shall be permissible to exceed the amounts indicated in Table 1102.3 where all of the following conditions apply:

**Exceptions:**

1. The largest single circuit charge does not exceed 6.6 lb (3 kg) for Residential and Institutional occupancies, and does not exceed 22 lb (10 kg) for a C.
2. The space where compressors and pressure vessels are located is provided with an air distribution system in accordance with the following equation:

\[
Q = 1001 \times M / LFL. \quad [\text{Equation 1104.6.1.4}]
\]

(for SI: \( Q = 60000 \times M / LFL \)).

Where: \( Q \) is the supply air flow rate ft\(^3\)/min (m\(^3\)/h), \( M \) is the refrigerant charge lb (kg), and \( LFL \) is the lower flammable limit lb per 1000 ft\(^3\) (g/m\(^3\)).

3. Exhaust air is removed from the air distribution system at a minimum rate of 4 air changes per hour and the system has provisions for makeup air. Exhaust air that is removed from the air distribution system is either discharged outside of the building envelope, or discharged to an indoor space, provided that the refrigerant concentration will not exceed the amount indicated in Table 1102.2.
4. The air distribution system is started when the refrigerant detector senses refrigerant in accordance with Section 1104.6.1.5. The air distribution system continues to operate for not less than 30 minutes after the refrigerant detector has sensed a drop in the refrigerant concentration below the value specified in Section 1104.6.1.5.
5. The inlet for return air to the air distribution system is located where refrigerant from a leak is expected to accumulate. The inlet elevation is within 12 inches (30 cm) of the lowest elevation in the space where the compressor or pressure vessel is located.
6. In addition to the requirements of Section 1104.6.1.3 there are no open flame producing devices or continuously operating hot surfaces exceeding 1292°F (700°C) that are located within space where the equipment is installed.

**1104.6.1.5 Refrigerant Detectors.** Refrigerant detectors shall comply with all of the following:

1. The refrigerant detector set point to activate the functions required by Section 1104.6.1.2 shall be at a value not exceeding 25
percent of the lower flammable limit (LFL).

2. One or more refrigerant detectors shall be located such that refrigerant will be detected if the refrigerating system is operating, or not operating. For refrigerating systems that are connected to the occupied space through ductwork, refrigerant detectors shall be located within the listed equipment. For refrigerating systems that are directly connected to the occupied space without ductwork, the refrigerant detector shall be located in the equipment, or shall be located in the occupied space at a height of not more than 12 inches (30 cm) above the floor and within a horizontal distance of not more 3.3 feet (1.0 m) with a direct line of sight of the unit.

3. The refrigerant detector as installed, including any sampling tubes, shall cause the functions required by Section 1104.6.1.2 within a time not to exceed 10 seconds, after exposure to a refrigerant concentration exceeding 25 percent of the LFL.

4. The refrigerant detector shall provide a means for automatic operational self-test as provided in the product listing. Use of a refrigerant test gas is not required. If a failure is detected, a trouble alarm shall be activated and the actions required by Section 1104.6.1.2 shall be initiated.

5. The refrigerant detector shall be tested during installation to verify the alarm set point and response time as required by Section 1104.6.1.5 items 1 and 3. After installation, the refrigerant detector shall be tested to verify the alarm set point and response time annually or at an interval not exceeding the manufacturer's installation instructions, whichever is less.

**SUBSTANTIATION:**

We support ASHRAE’s efforts to align the UMC with the 2019 edition of ASHRAE 15.
Item #: 092
UMC 2021 Section: 1105.1, Table 1701.1, Table 1701.2

SUBMITTER: David C. Bixby
Air Conditioning Contractors of America

RECOMMENDATION:
Revise text

1105.0 General Requirements.
1105.1 Human Comfort. Cooling systems used for human comfort shall be in accordance with the return-air and outside-air provisions for furnaces in Section 904.7 and Section 904.8. Cooling equipment used for human comfort in dwelling units shall be selected in accordance with ACCA Manual S to satisfy the calculated loads determined in accordance with the reference standards in Chapter 17 ACCA Manual J or other approved methods. Refrigerants used for human comfort shall be in accordance with Section 1104.6.

### TABLE 1701.1
**REFERENCED STANDARDS**

<table>
<thead>
<tr>
<th>STANDARD NUMBER</th>
<th>STANDARD TITLE</th>
<th>APPLICATION</th>
<th>REFERENCED SECTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>ANSI/ACCA Manual J-2016</td>
<td>Residential Load Calculations</td>
<td>Ducts</td>
<td>1105.1</td>
</tr>
<tr>
<td>ANSI/ACCA Manual S-2014</td>
<td>Residential Equipment Selection</td>
<td>Equipment</td>
<td>1105.1</td>
</tr>
</tbody>
</table>

(portion of table not shown remains unchanged)

**Note:** ACCA Manual J and ACCA Manual S meet the requirements for mandatory reference standards in accordance with Section 3-3.7.1 of IAPMO's Regulations Governing Committee Projects.

### TABLE 1701.2
**STANDARDS, PUBLICATIONS, PRACTICES, AND GUIDES**

<table>
<thead>
<tr>
<th>DOCUMENT NUMBER</th>
<th>DOCUMENT TITLE</th>
<th>APPLICATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACCA Manual J-2016</td>
<td>Residential Load Calculations</td>
<td>Ducts</td>
</tr>
</tbody>
</table>

(portion of table not shown remains unchanged)

**SUBSTANTIATION:**
The 2018 UMC mandates the use of ACCA Manual D (Residential Duct Systems) in Section 601.2 for duct sizing. However, mandating the use of only Manual D without using Manual J and Manual S will result in an incomplete design and installation as it will not account for calculating heating/cooling loads (Manual J) which is critical for duct sizing. In addition, Manual S needs to be used as it covers the design, sizing and selection of heating/cooling equipment based on use of Manuals D and J. Moreover, by not having the UMC mandate the use of Manuals S and J, the safety and performance of the HVAC system could be adversely affected and potentially impact the health and safety of the occupants. One concern is related to the potential for undersizing or oversizing HVAC equipment if these Manuals are not required. Such a condition could create excessive humidity levels in a home which in turn allows for the formation of mold with its potential associated health effects.
Like ACCA Manual D, ACCA Manuals J and S also include a Normative code-enforceable section and are both ANSI standards that meet the requirements for mandatory reference standards in accordance with Section 3-3.7.1 of IAPMO’s Regulations Governing Projects.

The addition of ACCA Manual J to Table 1701.1 is needed to support its proposed reference as a new requirement under 1105.1. Manual J includes a Normative code-enforceable section and is an ANSI standard that meets the requirements for mandatory reference standards in accordance with Section 3-3.7.1 of IAPMO’s Regulations Governing Projects.

The addition of ACCA Manual S to Table 1701.1 is needed to (1) support its current reference in Appendix E 607.2(3), and (2) support its proposed reference as a new requirement under 1105.1. Manual S includes a Normative code-enforceable section and is an ANSI standard that meets the requirements for mandatory reference standards in accordance with Section 3-3.7.1 of IAPMO’s Regulations Governing Projects.

COMMITTEE ACTION: ACCEPT AS AMENDED BY THE TC

Amend proposal as follows:

1105.0 General Requirements.
1105.1 Human Comfort. Cooling systems used for human comfort shall be in accordance with the return-air and outside-air provisions for furnaces in Section 904.7 and Section 904.8. Cooling equipment used for human comfort in residential buildings shall be selected in accordance with ACCA Manual S to satisfy the calculated loads determined in accordance with ACCA Manual J or other approved methods. Refrigerants used for human comfort shall be in accordance with Section 1104.6.

### TABLE 1701.1 REFERENCED STANDARDS

<table>
<thead>
<tr>
<th>STANDARD NUMBER</th>
<th>STANDARD TITLE</th>
<th>APPLICATION</th>
<th>REFERENCED SECTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>ANSI/ACCA Manual J-2016</td>
<td>Residential Load Calculations</td>
<td>Ducts</td>
<td>1105.1</td>
</tr>
<tr>
<td>ANSI/ACCA Manual S-2014</td>
<td>Residential Equipment Selection</td>
<td>Equipment</td>
<td>1105.1</td>
</tr>
</tbody>
</table>

(portion of table not shown remains unchanged)

COMMITTEE STATEMENT:
The modification further clarifies the intent of code in regards to the section applying to “residential buildings” as the standards referenced only apply to residential occupancies.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 25 NOT RETURNED: 1 HOWARD

Appended Comments

PUBLIC COMMENT 1

Code Year: 2021 UMC  Section #: 1105.1, Table 1701.1, Table 1701.2  Item #: 092

SUBMITTER: David C. Bixby
Air Conditioning Contractors of America

RECOMMENDATION:
Add new text

Request to accept the code change proposal as modified by this public comment.

1105.1 Human Comfort. Cooling systems used for human comfort shall be in accordance with the return-air and outside-air provisions for furnaces in Section 601.4 and Section 904.7. Cooling equipment used for human comfort in residential buildings shall be selected in accordance with ACCA Manual S to satisfy the calculated loads determined in accordance with ACCA Manual J or other approved methods. Refrigerants used for human comfort shall be in accordance with Section 1104.6.
Cooling equipment used for human comfort in commercial buildings shall be selected in accordance with ACCA Manual CS to satisfy the calculated loads determined in accordance with ACCA Manual N or other approved methods.

**TABLE 1701.1**

<table>
<thead>
<tr>
<th>STANDARD NUMBER</th>
<th>STANDARD TITLE</th>
<th>APPLICATION</th>
<th>REFERENCED SECTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACCA Manual CS-1993</td>
<td>Commercial Systems Overview</td>
<td>Equipment</td>
<td>1105.1</td>
</tr>
<tr>
<td>ACCA Manual N-2012</td>
<td>Commercial Load Calculations</td>
<td>Ducts</td>
<td>1105.1</td>
</tr>
</tbody>
</table>

(portion of table not shown remain unchanged)

**Note:** ACCA Manual CS and ACCA Manual N meet the requirements for a mandatory referenced standard in accordance with Section 3-3.7.1 of IAPMO's Regulations Governing Committee Projects.

**TABLE 1701.2**

<table>
<thead>
<tr>
<th>DOCUMENT NUMBER</th>
<th>DOCUMENT TITLE</th>
<th>APPLICATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACCA Manual N-2012</td>
<td>Commercial Load Calculations</td>
<td>Ducts</td>
</tr>
</tbody>
</table>

(portion of table not shown remain unchanged)

**SUBSTANTIATION:**

This change addresses Commercial applications for cooling equipment in Section 1105.1 (Human Comfort). ACCA Manual CS is the Commercial application counterpart to ACCA Manual S, and ACCA Manual N is the Commercial application counterpart to ACCA Manual J.
Item #: 093

UMC 2021  Section: 1105.4

SUBMITTER: Christopher Jensen
UL LLC

RECOMMENDATION:
Delete text without substitution

1105.0 General Requirements.

1105.4 Illumination and Service Receptacles. In addition to the requirements of Section 301.4, permanent lighting fixtures shall be installed for equipment required by this code to be accessible or readily accessible. Such fixtures shall provide illumination to perform the required tasks for which access is provided. Control of the illumination source shall be provided at the access entrance.

Exception:
(1) Lighting fixtures shall be permitted to be omitted where the fixed lighting of the building will provide the required illumination.
(2) Equipment located on the roof or on the exterior walls of a building.

(renumber remaining sections)

SUBSTANTIATION:
The requirements for a lighting outlet to illuminate appliances installed in attics, underfloor spaces, utility rooms and basement are adequately covered in NFPA 70 Sections 210.70(A)(3) and 210.70(C). The requirements found in NFPA 70 cover all equipment that requires serving not just refrigeration equipment. There are conflicts with some of the terms used in this section and the corresponding requirements found in NFPA 70. The term “Lighting Fixture” has been replaced in the 2002 edition of NFPA 70 to the term “Luminaire” which is used internationally for lighting products. By removing specific electrical requirements from this code and leaving them in NFPA 70 it guarantees that there will be no conflicts between the codes.

COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
The current language should remain in the code in order to give direction to the installer and to the AHJ.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS:  AFFIRMATIVE: 25  NOT RETURNED: 1  HOWARD

Appended Comments

PUBLIC COMMENT 1

Code Year: 2021 UMC  Section #: 1105.4  Item #: 093
SUBMITTER: Phil Pettit
Control Air
Rep: Self

RECOMMENDATION:
Revise text

Request to replace the code change proposal by this public comment.

1105.4 Illumination and Service Receptacles. In addition to the requirements of Section 301.4, permanent lighting fixtures luminaires shall be installed for equipment required by this code to be accessible or readily accessible. Such fixtures shall provide illumination to perform the required tasks for which access is provided. Control of the illumination source shall be provided at the access entrance.

Exception:
(1) Lighting fixtures Luminaires shall be permitted to be omitted where the fixed lighting of the building will provide the required illumination.
(2) Equipment located on the roof or on the exterior walls of a building.

SUBSTANTIATION:
In harmony with the action taken on UMC Item # 067, replace the term "Lighting Fixture" with the term "Luminaire." The term "Luminaire" is the proper term used in the industry, not "Lighting Fixture."
Item #: 094

UMC 2021  Section: 1107.1.4

SUBMITTER: Connor Barbaree
ASHRAE

RECOMMENDATION:
Delete text without substitution

1107.0 Machinery Room, Special Requirements.
1107.1 General. (remaining text unchanged)

1107.1.4 Machinery Rooms. The refrigeration machinery room shall have a door that opens directly to the outdoors or through a vestibule equipped with self-closing, tightfitting doors.

(renumber remaining sections)

SUBSTANTIATION:
Section 1107.1.4 is being deleted to be consistent with industry standards. Furthermore, ASHRAE 15 also published Addenda F where the same provision was removed.

COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
The proposed deletion is being rejected because the text is needed for enforcement of the code.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 24  NEGATIVE: 1  NOT RETURNED: 1  HOWARD

EXPLANATION OF NEGATIVE:
P. TRAFTON: ASHRAE standards has elected this requirement and it's the prior standard for refrigeration rooms.

Appended Comments

PUBLIC COMMENT 1

Code Year: 2021 UMC  Section #: 1107.1.4  Item #: 094

SUBMITTER: Connor Barbaree
ASHRAE  Comment #: 1

RECOMMENDATION:
Delete text without substitution

Request to accept the code change proposal as submitted by this public comment.

SUBSTANTIATION:
ASHRAE SSPC 15 requests that this proposal be approved as originally submitted. The original change is requested by this public comment to Item # 094. Section 1107.1.4 is being deleted to be consistent with industry standards. Furthermore, ASHRAE 15 also published Addenda F where the same provision was removed.
REVISE TEXT

1109.0 Refrigeration Piping, Containers, and Valves.

1109.1 Materials. Materials used in the construction and installation of refrigeration systems shall be compatible with the conveying refrigerant used. Materials shall not be used that will deteriorate due to the chemical action of the refrigerant, lubricant, or combination of both where exposed to air or moisture to a degree that poses a safety hazard. [ASHRAE 15:9.1.1] Refrigerant piping shall be metallic.

1109.1.1 Copper and Copper Alloy Pipe. Copper and copper alloy refrigeration piping, valves, fittings, and related parts used in the construction and installation of refrigeration systems shall be approved for the intended use. Refrigeration piping shall comply with ASME B31.5.

1109.1.2 Copper Linesets. Copper linesets shall comply with ASTM B280 or ASTM B1003.

1109.1.3 Iron and Steel. Iron and steel refrigeration piping, valves, fittings, and related parts shall be approved for the intended use. Pipe exceeding 2 inches (50 mm) iron pipe size shall be electric-resistance welded or seamless pipe. Refrigeration piping shall comply with ASME B31.5.

1109.1.4 Prohibited Contact. Aluminum, zinc, magnesium, or their alloys shall not be used in contact with methyl chloride. Magnesium alloys shall not be used where in contact with halogenated refrigerants. [ASHRAE 15:9.1.2]

1109.2 Joints. Iron or steel pipe joints shall be of approved threaded, flanged, or welded types. Exposed threads shall be tinned or coated with an approved corrosion inhibitor. Copper or copper alloy pipe joints of iron pipe size shall be of approved threaded, flanged, press connect or brazed types. Copper tubing joints and connections shall be connected by approved flared, lapped, swaged, or brazed joints, soldered joints, or mechanical joints that comply with UL 207 either individually or as part of an assembly or a system by an approved nationally recognized laboratory. Piping and tubing shall be installed so as to prevent vibration and strains at joints and connections.

1109.3 Penetration of Piping. Refrigerant piping shall not penetrate floors, ceilings, or roofs.

Exceptions:

1. Penetrations connecting the basement and the first floor.
2. Penetrations connecting the top floor and a machinery penthouse or roof installation.
3. Penetrations connecting adjacent floors served by the refrigeration system.
4. Penetrations of a direct system where the refrigerant concentration does not exceed that listed in Table 1102.3 for the smallest occupied space through which the refrigerant piping passes.
5. In other than industrial occupancies and where the refrigerant concentration exceeds that listed in Table 1102.3 for the smallest occupied space, penetrations that connect separate pieces of equipment that are in accordance with one of the following:
   a. Located on an exterior wall of a building where vents to the outdoors are used as an air shaft, closed court, or similar place.
   b. Located on an exterior wall of a building where vents to the outdoors or to the space served by the system not used as an air shaft, closed court, or similar place. [ASHRAE 15:8.10.3]

1109.4 Location of Refrigeration Piping. Refrigerant piping crossing an open space that affords passageway in a building shall be not less than 7.25 feet (2210 mm) above the floor unless the piping is located against the ceiling of such space and is permitted by the Authority Having Jurisdiction. [ASHRAE 15:8.10.1]

1109.4.1 Protection from Mechanical Damage. Passages shall not be obstructed by refrigerant piping. Refrigerant piping shall not be located in an elevator, dumbwaiter, or other shaft containing a moving object, or in a shaft that has openings to living quarters, or to means of egress. Refrigerant piping shall not be installed in an enclosed public stairway, stair landing, or means of egress. [ASHRAE 15:8.10.2]

1109.5 Underground Piping. Refrigerant piping placed underground shall be protected against corrosion.
1109.5.1 Piping in Concrete Floors. Refrigerant piping installed in concrete floors shall be encased in a pipe duct. Refrigerant piping shall be isolated and supported to prevent damaging vibration, stress, or corrosion. [ASHRAE 15:8.10.4]

1109.6 Support. In addition to the requirements of Section 1105.2, piping and tubing shall be securely fastened to a permanent support within 6 feet (1829 mm) following the first bend in such tubing from the compressor and within 2 feet (610 mm) of each subsequent bend or angle. Piping and tubing shall be supported at points not more than 15 feet (4572 mm) apart.

1109.7 Pipe Enclosure. Refrigerant piping and tubing shall be installed so that it is not subject to damage from an external source. Soft-annealed copper tubing shall not exceed 1 3/8 inches (35 mm) nominal size. Mechanical joints, other than approved press-connect joints, shall not be made on tubing exceeding 3/4 of an inch (20 mm) nominal size. Soft-annealed copper tubing conveying refrigerant shall be enclosed in iron or steel piping and fittings, or in conduit, molding, or raceway that will protect the tubing against mechanical injury from an exterior source.

Exceptions:
(1) Tubing entirely within or tubing within 5 feet (1524 mm) of a refrigerant compressor where so located that it is not subject to external injury.
(2) Copper tubing serving a dwelling unit, where such tubing contains Group A1 refrigerant and is placed in locations not subject to damage from an external source.

1109.8 Visual Inspection. Refrigerant piping and joints erected on the premises shall be exposed to view for visual inspection prior to being covered or enclosed.

Exception: Copper tubing enclosed in iron or steel piping conduit, molding, or raceway, provided there are no fittings or joints concealed therein.

1109.9 Condensation. Piping and fittings that convey brine, refrigerant, or coolants that during normal operation are capable of reaching a surface temperature below the dew point of the surrounding air and that are located in spaces or areas where condensation will cause a hazard to the building occupants or damage to the structure, electrical or other equipment shall be protected to prevent such damage.

1109.10 Identification. Piping shall be in accordance with the reference standard for identification. The type of refrigerant, function and pressure shall be indicated.

1110.0 Valves.

1110.1 More than 6.6 Pounds of Refrigerant. Systems containing more than 6.6 pounds (2.99 kg) of refrigerant shall have stop valves installed at the following locations:
(1) The suction inlet of a compressor, compressor unit, or condensing unit.
(2) The discharge of a compressor, compressor unit, or condensing unit.
(3) The outlet of a liquid receiver.

Exceptions:
(1) Systems that have a refrigerant pumpout function capable of storing the refrigerant charge, or are equipped with the provisions for pumpout of the refrigerant.
(2) Self-contained systems. [ASHRAE 15:9.12.4]

1110.2 More than 110 Pounds of Refrigerant. Systems containing more than 110 pounds (49.9 kg) of refrigerant shall have stop valves installed at the following locations:
(1) The suction inlet of a compressor, compressor unit, or condensing unit.
(2) The discharge outlet of a compressor, compressor unit, or condensing unit.
(3) The inlet of a liquid receiver, except for self-contained systems or where the receiver is an integral part of the condenser or condensing unit.
(4) The outlet of a liquid receiver.
(5) The inlets and outlets of condensers where more than one condenser is used in parallel in the systems.

Exception: Systems that have a refrigerant pumpout function capable of storing the refrigerant charge, or are equipped with the provisions for pumpout of the refrigerant or self-contained systems. [ASHRAE 15:9.12.5]

1110.3 Support. Stop valves installed in copper refrigerant lines of 3/4 of an inch (20 mm) or less outside diameter shall be supported independently of the tubing or piping.

1110.4 Access. Stop valves required by Section 1110.0 shall be readily accessible from the refrigeration machinery room floor or a level platform.

1110.5 Identification. Stop valves shall be identified by tagging in accordance with the reference standard for identification. A valve chart shall be mounted under glass at an approved location near the principal entrance to a refrigeration machinery room.

1109.0 Piping Material.

1109.1 Piping. Refrigerant piping material shall conform to the requirements in this section.

1109.2 Used Materials. Reused pipe, fittings, valves or other materials shall be clean and free of foreign materials and shall be approved by the code official for reuse.

1109.3 Material Rating. Materials, joints and connections shall be rated for the operating temperature and pressure of the refrigerant system. Materials shall be suitable for the type of refrigerant and type of lubricant in the refrigerant system. Magnesium alloys shall not be used in contact with any halogenated refrigerants. Aluminum, zinc, magnesium, or their alloys shall not be used in contact with R-40 (methyl chloride).
**1109.4 Piping Materials Standards.** Refrigerant pipe shall conform to one or more of the standards listed in Table 1109.4. The exterior of the pipe shall be protected from corrosion and degradation.

| TABLE 1109.4  
REFRIGERANT PIPE |
<table>
<thead>
<tr>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>PIPING MATERIAL</strong></td>
</tr>
<tr>
<td>Aluminum Tube</td>
</tr>
<tr>
<td>Brass (Copper Alloy) Pipe</td>
</tr>
<tr>
<td>Copper Pipe</td>
</tr>
<tr>
<td>Copper Tube</td>
</tr>
<tr>
<td>Copper Linesets</td>
</tr>
<tr>
<td>Steel Pipe</td>
</tr>
<tr>
<td>Steel Tube</td>
</tr>
</tbody>
</table>

Note 1. Soft annealed copper tubing larger than 1 in. (25 mm) O.D. shall not be used for field assembled refrigerant piping, unless it is protected from mechanical damage.

Note 2. ASTM A53, Type F steel pipe shall not be used for refrigerant lines having an operating temperature less than -20°F (-29°C).

**1109.4.1 Steel Pipe Group A2, A3, B2, and B3.** The minimum weight of steel pipe for Group A2, A3, B2, and B3 refrigerants shall be Schedule 80 for sizes 1-1/2 inch (40 mm) or less in diameter.

**1109.5 Pipe Fittings.** Refrigerant pipe fittings shall be approved for installation with the piping materials to be installed and shall conform to one or more of the standards listed in Table 1109.5 or shall be listed and labeled in accordance with UL 207.

| TABLE 1109.5  
REFRIGERANT PIPE FITTINGS |
<table>
<thead>
<tr>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>FITTING MATERIAL</strong></td>
</tr>
<tr>
<td>Aluminum</td>
</tr>
<tr>
<td>Brass (Copper Alloy)</td>
</tr>
<tr>
<td>Steel</td>
</tr>
</tbody>
</table>

**1109.5.1 Copper Brazed Field Swaged.** The minimum and maximum cup depth of field fabricated copper brazed swaged fitting connections shall comply with Table 1109.5.1.
### TABLE 1109.5.1 COPPER BRAZED SWAGED CUP DEPTHS

<table>
<thead>
<tr>
<th>FITTING SIZE (Inch)</th>
<th>MINIMUM (Inch)</th>
<th>MAXIMUM (Inch)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/8</td>
<td>0.15</td>
<td>0.23</td>
</tr>
<tr>
<td>3/16</td>
<td>0.16</td>
<td>0.24</td>
</tr>
<tr>
<td>1/4</td>
<td>0.17</td>
<td>0.26</td>
</tr>
<tr>
<td>3/8</td>
<td>0.20</td>
<td>0.30</td>
</tr>
<tr>
<td>1/2</td>
<td>0.22</td>
<td>0.33</td>
</tr>
<tr>
<td>5/8</td>
<td>0.24</td>
<td>0.36</td>
</tr>
<tr>
<td>3/4</td>
<td>0.25</td>
<td>0.38</td>
</tr>
<tr>
<td>1</td>
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<td>0.42</td>
</tr>
<tr>
<td>1 1/4</td>
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<td>0.47</td>
</tr>
<tr>
<td>1 1/2</td>
<td>0.34</td>
<td>0.51</td>
</tr>
<tr>
<td>2</td>
<td>0.40</td>
<td>0.60</td>
</tr>
<tr>
<td>2 1/2</td>
<td>0.47</td>
<td>0.71</td>
</tr>
<tr>
<td>3</td>
<td>0.53</td>
<td>0.80</td>
</tr>
<tr>
<td>3 1/2</td>
<td>0.59</td>
<td>0.89</td>
</tr>
<tr>
<td>4</td>
<td>0.64</td>
<td>0.96</td>
</tr>
</tbody>
</table>

1109.6 Valves. Valves shall be of materials that are compatible with the type of piping material, refrigerants, and oils in the system. Valves shall be listed and labeled and rated for the temperatures and pressures of the refrigerant systems in which the valves are installed.

1109.7 Flexible Connectors, Expansion and Vibration Compensators. Flexible connectors and expansion and vibration control devices shall be listed and labeled for use in refrigerant systems.

1110.0 Joints and Connections.
1110.1 Approval. Joints and connections shall be of an approved type. Joints and connections shall be tight for the pressure of the refrigerant system when tested in accordance with Section 1116.
1110.1.1 Joints Between Different Piping Materials. Joints between different piping materials shall be made with approved adapter fittings. Joints between dissimilar metallic piping materials shall be made with a dielectric fitting or a dielectric union conforming to dielectric tests of ASSE 1079. Adapter fittings with threaded ends between different materials shall be joined with proper thread lubricant in accordance with Section 1110.3.4.
1110.2 Preparation of Pipe Ends. Pipe shall be cut square, reamed and chamfered, and shall be free of burrs and obstructions. Pipe ends shall have full-bore openings and shall not be undercut.
1110.3 Joint Preparation and Installation. Where required by Section 1110.4 through Section 1110.9, the preparation and installation of brazed, flared, mechanical, press-connect, soldered, threaded and welded joints shall comply with Section 1110.3.1 through Section 1110.3.5.
1110.3.1 Brazed Joints. Joint surfaces shall be cleaned. An approved flux shall be applied where required by the braze filler metal manufacturer. The piping being brazed shall be purged of air to remove the oxygen and filled with one of the following inert gases: oxygen-free nitrogen, helium, or argon. The piping system shall be pre-purged with an inert gas for a minimum time.
corresponding to five volume changes through the piping system prior to brazing. The pre-purge rate shall be at a minimum velocity of 100 feet per minute (0.5 m/s). The inert gas shall be directly connected to the tube system being brazed to prevent the entrainment of ambient air. After the pre-purge, the inert gas supply shall be maintained through the piping during the brazing operation at a minimum pressure of 1.0 psi (6.9 kPa) and a maximum pressure of 3.0 psi (20 kPa). The joint shall be brazed with a filler metal conforming to AWS A5.8.

1110.3.2 Mechanical Joints. Mechanical joints shall be installed in accordance with the manufacturer’s instructions.

1110.3.2.1 Flared Joints. Flared fittings shall be installed in accordance with the manufacturer’s instructions. The flared fitting shall be used with the tube material specified by the fitting manufacturer. The flared tube end shall be made by a tool designed for that operation.

1110.3.2.2 Press-Connect Joints. Press-connect joints shall be installed in accordance with the manufacturer’s instructions.

1110.3.3 Soldered Joints. Joint surfaces shall be cleaned. A flux conforming to ASTM B813 shall be applied. The joint shall be soldered with a solder conforming to ASTM B 32. Solder joints shall be limited to refrigerant systems using Group A1 refrigerant and having a pressure of less than or equal to 200 psi.

1110.3.4 Threaded Joints. Threads shall conform to ASME B1.20.1, ASME B1.20.3, ASME B1.13M, or ASME B1.1. Thread lubricant, pipe-joint compound, or tape shall be applied on the external threads only and shall be approved for application on the piping material.

1110.3.5 Welded Joints. Joint surfaces shall be cleaned by an approved procedure. Joints shall be welded with an approved filler metal.

1110.4 Aluminum Tube. Joints between aluminum tubing or fittings shall be brazed, mechanical, press-connect, or welded joints conforming to Section 1110.3.

1110.5 Brass (Copper Alloy) Pipe. Joints between brass pipe or fittings shall be brazed, mechanical, press-connect, threaded, or welded joints conforming to Section 1110.3.

1110.6 Copper Pipe. Joints between copper or copper-alloy pipe or fittings shall be brazed, mechanical, press-connect, soldered, threaded, or welded joints conforming to Section 1110.3.

1110.7 Copper Tube. Joints between copper or copper-alloy tubing or fittings shall be brazed, flared, mechanical, press-connect, or soldered joints.

1110.8 Steel Pipe. Joints between steel pipe or fittings shall be mechanical joints, threaded, press-connect, or welded joints conforming to Section 1110.3.

1110.9 Steel Tube. Joints between steel tubing or fittings shall be flared, mechanical, press-connect, or welded joints conforming to Section 1110.3.

1111.0 Refrigerant Pipe Installation.

1111.1 General. Refrigerant piping installations shall comply with the requirements of this section. The design of refrigerant piping shall be in accordance with ASME B31.5.

1111.2 Piping Location. Refrigerant piping shall comply with the installation location requirements of Section 1111.2.1 through Section 1111.2.6. Refrigerant piping for group A2L and B2L shall also comply with the requirements of Section 1111.3. Refrigerant piping for group A2, A3, B2 and B3 shall also comply with the requirements of Section 1111.4.

1111.2.1 Minimum Height. Exposed refrigerant piping installed in open spaces that afford passage shall be not less than 7 feet 3 inches (2210 mm) above the finished floor.

1111.2.2 Refrigerant Pipe Enclosure. Refrigerant piping shall be protected by locating it within either the building elements or protective enclosure.

1111.2.2.1 Enclosure Not Required. Piping protection within the building elements or protective enclosure shall not be required in any of the following locations:

(1) Where installed without ready access or located more than 7 feet 3 inches (2210 mm) above the finished floor.
(2) Where located within 6 feet 0 inches (1830 mm) of the refrigerant unit or appliance.
(3) Where located in a machinery room complying with Section 1105.

1111.2.3 Prohibited Locations. Refrigerant piping shall not be installed in any of the following locations:

(1) Exposed within a fire-resistance-rated exit access corridor.
(2) Interior exit stairway.
(3) Interior exit ramp.
(4) Exit passageway.
(5) Elevator, dumbwaiter or other shaft containing a moving object.

1111.2.4 Piping in Concrete Floors. Refrigerant piping installed in concrete floors shall be encased in pipe, conduit, or ducts. The piping shall be protected to prevent damage from vibration, stress and corrosion.

1111.2.5 Refrigerant Pipe Shafts. Refrigerant piping that penetrates two or more floor/ceiling assemblies shall be enclosed in a fire-resistance-rated shaft enclosure. The fire-resistance-rated shaft enclosure shall comply with Building Code. Other building utilities or piping systems shall be allowed in the refrigerant piping shaft.

1111.2.5.1 Shaft Not Required. A Shaft enclosure shall not be required for the refrigerant piping for any of the following systems:

(1) For systems using R-718 refrigerant.
(2) Piping in a direct system using Group A1 refrigerant where the refrigerant quantity does not exceed Table 1103.1 for the smallest
occupied space through which the piping passes.

1111.2.6 Exposed Piping Surface Temperature. Exposed piping with ready access having temperatures greater than 120°F (49°C) or less than 5°F (-15°C) shall be protected from contact or have thermal insulation which limits the exposed insulation surface temperature to a range of 5°F (-15°C) to 120°F (49°C).

1111.2.7 Pipe Identification. Refrigerant pipe located in areas other than the room or space where the refrigerating equipment is located shall be identified. The pipe identification shall be located at intervals not exceeding 20 feet on the refrigerant piping or pipe insulation. The minimum height of lettering of the identification label shall be ½ inch. The identification shall indicate the refrigerant designation and safety group classification of refrigerant used in the piping system. For Group A2, A3, B2, and B3 refrigerant the identification shall also include the following statement: "DANGER – Risk of Fire or Explosion. Flammable Refrigerant." For any Group B refrigerant, the identification shall also include the following statement: "DANGER - Toxic Refrigerant."

1111.3 Installation Requirements for A2L and B2L Refrigerants. Piping systems using Group A2L or B2L refrigerant shall comply with the requirements of Section 1111.3.1 through Section 1111.3.2.

1111.3.1 Pipe protection. In addition to the requirements in Section 305.5, aluminum, copper, or steel tube for Group A2L and B2L refrigerants located in concealed locations where tubing is installed in studs, joists, rafters or similar member spaces and located less than 1-1/2 inches (38 mm) from the nearest edge of the member, shall be continuously protected by shield plates. Protective steel shield plates having a minimum thickness of 0.0575 inch (1.463 mm) (No. 16 gage) shall cover the area of the tube, and shall extend a minimum of 2 inches (51 mm) beyond the outside edge of the tube.

1111.3.2 Shaft Ventilation. Refrigerant pipe shafts with systems using Group A2L or B2L refrigerants shall be naturally or mechanically ventilated. The shaft ventilation exhaust outlet shall comply with Section 501.3.1. Naturally ventilated shafts shall have a minimum of a 4 inch (100 mm) diameter pipe, duct, or conduit that connects at the lowest point of the shaft and connects to the outdoors. The pipe, duct, or conduit shall be level or pitched to the outdoors. Mechanically ventilated shafts shall have a minimum air velocity, in accordance with Table 1111.3.2. The mechanical ventilation shall either be continuously operated or activated by a refrigerant detector. Systems utilizing a refrigerant detector shall activate the mechanical ventilation at a maximum refrigerant concentration of 25 percent of the lower flammable limit of the refrigerant. The detector, or a sampling tube that draws air to the detector, shall be located in an area where refrigerant from a leak will concentrate. The shaft shall not be required to be ventilated for double wall refrigerant pipe where the interstitial space of the double wall pipe is vented to the outdoors.

<table>
<thead>
<tr>
<th>CROSS SECTIONAL AREA OF SHAFT (Sq. In)</th>
<th>MINIMUM VENTILATION VELOCITY (feet per minute)</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>100</td>
</tr>
<tr>
<td>&gt; 20 to ≤ 250</td>
<td>200</td>
</tr>
<tr>
<td>&gt; 250 to ≤ 1250</td>
<td>300</td>
</tr>
<tr>
<td>&gt; 1250</td>
<td>400</td>
</tr>
</tbody>
</table>

1111.4 Installation Requirements for A2, A3, B2, and B3 Refrigerants. Piping systems using Group A2, A3, B2, or B3 refrigerant shall comply with the requirements of Section 1111.4.1 through 1111.4.2.

1111.4.1 Piping Material. Piping material for Group A2, A3, B2, or B3 refrigerant located inside the building, except for machinery rooms, shall be copper pipe, brass pipe, or steel pipe. Pipe joints located in areas other than the machinery room shall be welded. Self-contained listed and labeled equipment or appliances shall have piping material based on the listing requirements.

1111.4.2 Shaft ventilation. Refrigerant pipe shafts with systems using Group A2, A3, B2, or B3 refrigerants shall be continuously mechanically ventilated. The shaft ventilation exhaust outlet shall comply with Section 501.3.1. Mechanically ventilated shafts shall have a minimum air velocity of specified in Table 1111.3.2. The shaft shall not be required to be ventilated for double wall refrigerant pipe where the interstitial space of the double wall pipe is vented to the outdoors.

1111.5 Refrigerant Pipe Penetrations. The annular space between the outside of a refrigerant pipe and the inside of a pipe sleeve or opening in a building envelope wall, floor, or ceiling assembly penetrated by a refrigerant pipe shall be sealed in an approved manner with caulking material, foam sealant or closed with a gasketing system. The caulking material, foam sealant or gasketing system shall be designed for the conditions at the penetration location and shall be compatible with the pipe, sleeve and building materials in contact with the sealing materials. Refrigerant pipes penetrating fire-resistance-rated assemblies or membranes of fire-resistance-rated assemblies shall be sealed or closed in accordance with the Building Code.

1111.6 Stress and Strain. Refrigerant piping shall be installed so as to prevent strains and stresses that exceed the structural strength of the pipe. Where necessary, provisions shall be made to protect piping from damage resulting from vibration, expansion,
1111.7 Condensation Control. Refrigerating piping and fittings that, during normal operation, will reach a surface temperature below the dew point of the surrounding air, and are located in spaces or areas where condensation has the potential to cause a safety hazard to the building occupants, structure, electrical equipment or any other equipment or appliances, shall be insulated or protected in an approved manner to prevent damage from condensation.

1111.8 Stop valves. Stop valves shall be installed in specified locations when required in accordance with Section 1111.8.1 and Section 1111.8.2. Stop valves shall be supported in accordance with Section 1111.8.3 and identified in accordance with Section 1111.8.4.

Exceptions:
(1) Systems that have a refrigerant pump out function capable of storing the entire refrigerant charge in a receiver or heat exchanger.
(2) Systems that are equipped with provisions for pump out of the refrigerant using either portable or permanently installed refrigerant recovery equipment.
(3) Self-contained listed and labeled systems.

1111.8.1 Refrigerating Systems Containing More Than 6.6 Pounds (3.0 kg) of Refrigerant. Stop valves shall be installed in the following locations on refrigerating systems containing more than 6.6 pounds (3.0 kg) of refrigerant:
(1) The suction inlet of each compressor, compressor unit or condensing unit.
(2) The discharge outlet of each compressor, compressor unit or condensing unit.
(3) The outlet of each liquid receiver.

1111.8.2 Refrigerating Systems Containing More Than 100 Pounds (45 kg) of Refrigerant. In addition to stop valves required by Section 1111.8.1, systems containing more than 100 pounds (45 kg) of refrigerant shall have stop valves installed in the following locations:
(1) Each inlet of each liquid receiver.
(2) Each inlet and each outlet of each condenser, when more than one condenser is used in parallel.

Exceptions:
(1) Stop valves shall not be required on the inlet of a receiver in a condensing unit, nor on the inlet of a receiver which is an integral part of the condenser.
(2) Systems utilizing nonpositive displacement compressors.

1111.8.3 Stop Valve Support. Stop valves shall be supported to prevent undo stress or strain on the refrigerant piping system. The piping system shall not be utilized to support stop valves on copper tubing or aluminum tubing 1 inch (25 mm) OD or larger in diameter.

1111.8.4 Identification. Stop valves shall be identified where their intended purpose is not obvious. When valves are identified by a numbering or lettering system, legend(s) or key(s) for the valve identification shall be located in the room containing the indoor refrigeration equipment. The minimum height of lettering of the identification label shall be ½ inch (12.7 mm).
Refrigeration systems containing Group R-22, not exceeding 5 tons of refrigeration capacity (18 kW), and field-piped using approved, factory-charged line sets shall be permitted to be proved tight by observing retention of pressure on a set of charging gauges and soaping connections while the system is operating.

### TABLE 1116.2
FIELD LEAK TEST PRESSURES (psig)*

<table>
<thead>
<tr>
<th>REFRIGERANT NUMBER</th>
<th>HIGHTSIDE WATER COOLED</th>
<th>HIGHTSIDE AIR COOLED</th>
<th>LOWSIDE</th>
</tr>
</thead>
<tbody>
<tr>
<td>11</td>
<td>15</td>
<td>15</td>
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<tr>
<td>12</td>
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<td>220</td>
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<tr>
<td>22</td>
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<td>360</td>
<td>220</td>
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<tr>
<td>113</td>
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<td>15</td>
<td>15</td>
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<td>114</td>
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<td>80</td>
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<td>115</td>
<td>275</td>
<td>340</td>
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<tr>
<td>134a</td>
<td>150</td>
<td>250</td>
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<tr>
<td>152a</td>
<td>130</td>
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<tr>
<td>500</td>
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<td>265</td>
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</tr>
<tr>
<td>502</td>
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<td>285</td>
<td>250</td>
</tr>
<tr>
<td>744</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

For SI units: 1 pound-force per square inch gauge = 6.8947 kPa
*Special design required; test pressures typically exceed 1000 psig (6895 kPa).

#### 1116.0 Refrigerant Piping System Test.
**1116.1 General.** Refrigerant piping systems erected in the field shall be pressure tested for strength and leak tested for tightness, after installation and before being placed in operation, in accordance with the requirements of this section. Tests shall include both the high and low-pressure sides of each system.

**1116.1.1 Testing Not Required.** Listed and labeled equipment, including compressors, condensers, vessels, evaporators, gas bulk storage tanks, safety devices, pressure gauges and control mechanisms, shall not be required to be tested.

**1116.2 Exposure of Refrigerant Piping System.** Refrigerant pipe and joints installed in the field shall be exposed for visual inspection and testing prior to being covered or enclosed.

**1116.3 Test Gases.** The medium used for pressure testing the refrigerant system shall be one of the following inert gases: oxygen-free nitrogen, helium, or argon. For R-744 refrigerant systems carbon dioxide shall be allowed as the test medium. For R-718 refrigerant systems water shall be allowed as the test medium. Oxygen, air, combustible gases and mixtures containing such gases shall not be used as test medium. Systems erected on the premises with tubing not exceeding 5/8 inch (15.8 mm) OD shall be allowed to use the refrigerant identified on the nameplate label or marking as the test medium.

**1116.4 Test Apparatus.** The means used to pressurize the refrigerant piping system shall have either a pressure-limiting device or a pressure-reducing device and a test pressure measuring device on the outlet side. The test pressure measuring device shall have an accuracy of ±3 percent or less of the test pressure, and shall have a resolution of 5 percent or less of the test pressure.

**1116.5 Piping System Pressure Test and Leak Test.** The refrigerant piping system shall be tested, however, separate tests for low-side and high-side sections of the piping system shall be allowed. The refrigerant piping system shall be tested in accordance with both of the following methods:

1. Pressurized for a minimum of 60 minutes to not less than the lower of the design pressures or the setting of the pressure relief device(s). The design pressures for testing shall be the pressure listed on the label nameplate of the condensing unit, compressor, compressor unit, pressure vessel, or other system component with a nameplate. No additional test gas shall be added to the system after the start of the pressure test. The system shall show no loss of pressure on the test pressure measuring device during the pressure test. When using refrigerant as a test medium in accordance with Section 1116.3, the test pressure shall be not less than the saturation dew point pressure at 77°F (25°C).
A vacuum of 500 microns shall be achieved. After achieving a vacuum, the system shall be isolated from the vacuum pump. The system pressure shall not rise above 1500 microns for a minimum period of 10 minutes.

1116.5.1 Joints and Refrigerant-Containing Parts in Air Ducts. Joints and all refrigerant-containing parts of a refrigerating system located in an air duct of an air-conditioning system carrying conditioned air to and from human-occupied space shall be tested at a pressure of 150 percent of the higher of the design pressure or pressure relief device setting.

1116.5.2 Limited Charge Systems. Limited-charge systems with a pressure relief device, erected on the premises, shall be tested at a pressure not less than one and one-half times the pressure setting of the relief device. Listed and labeled limited charge systems shall be tested at the equipment or appliance design pressure.

1116.6 Booster Compressor. Where a compressor protected by a pressure relief device is used as a booster to obtain an intermediate pressure and discharges into the suction side of another compressor, the booster compressor shall be considered a part of the low side.

1116.7 Centrifugal/Nonpositive Displacement Compressors. When testing systems using centrifugal or other nonpositive displacement compressors, the entire system shall be considered the low-side pressure for test purposes.

1116.8 Contractor or Engineer Declaration. The installing contractor or registered design professional of record shall issue a certificate of test to the code official for all systems containing 55 pounds (25 kg) or more of refrigerant. The certificate shall give the test date, name of the refrigerant, test medium, and the field test pressure applied to the high-side and the low-side of the system. The certification of test shall be signed by the installing contractor or registered design professional and shall be made part of the public record.

<table>
<thead>
<tr>
<th>STANDARD NUMBER</th>
<th>STANDARD TITLE</th>
<th>APPLICATION</th>
<th>REFERENCED SECTIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASME B1.1-2003 (R2008)</td>
<td>Unified Inch Screw Threads</td>
<td>Fittings</td>
<td>1110.3.4</td>
</tr>
<tr>
<td>ASME B1.13M-2005 (R2015)</td>
<td>Metric Screw Threads: M Profile</td>
<td>Fittings</td>
<td>1110.3.4</td>
</tr>
<tr>
<td>ASTM A105/A105M-2014</td>
<td>Carbon Steel Forgings for Piping Applications</td>
<td>Fittings</td>
<td>Table 1109.5</td>
</tr>
<tr>
<td>ASTM A181/A181M-2014</td>
<td>Carbon Steel Forgings, for General-Purpose Piping</td>
<td>Piping</td>
<td>Table 1109.5</td>
</tr>
<tr>
<td>ASTM A193/A193M-2017</td>
<td>Alloy Steel and Stainless Steel Bolting for High Temperature or High Pressure Service and Other Special Purpose Applications</td>
<td>Bolting</td>
<td>Table 1109.5</td>
</tr>
<tr>
<td>ASTM A234/A234M-2018</td>
<td>Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service</td>
<td>Fittings</td>
<td>Table 1109.5</td>
</tr>
<tr>
<td>ASTM A334/A334M-2004a (R2016)</td>
<td>Seamless and Welded Carbon and Alloy-Steel Tubes for Low-Temperature Service</td>
<td>Tubing</td>
<td>Table 1109.4</td>
</tr>
<tr>
<td>ASTM A707/A707M-2014</td>
<td>Forged Carbon and Alloy Steel Flanges for Low-Temperature Service</td>
<td>Fittings</td>
<td>Table 1109.5</td>
</tr>
<tr>
<td>ASTM B68/ASTM B68M-2011</td>
<td>Seamless Copper Tube, Bright Annealed</td>
<td>Tubing</td>
<td>Table 1109.4</td>
</tr>
<tr>
<td>ASTM B210M-2012</td>
<td>Aluminum and Aluminum-Alloy Drawn Seamless Tubes (Metric)</td>
<td>Tubing</td>
<td>Table 1109.4</td>
</tr>
<tr>
<td>ASTM B361-2016</td>
<td>Factory-Made Wrought Aluminum and Aluminum-Alloy Welding Fittings</td>
<td>Fittings</td>
<td>Table 1109.5</td>
</tr>
<tr>
<td>ASTM B491/B491M-2015</td>
<td>Aluminum and Aluminum-Alloy Extruded Round Tubes for General-Purpose Applications</td>
<td>Tubing</td>
<td>Table 1109.4</td>
</tr>
<tr>
<td>ASTM B819-2018</td>
<td>Seamless Copper Tube for Medical Gas Systems</td>
<td>Tubing</td>
<td>Table 1109.4</td>
</tr>
</tbody>
</table>

(portion of table not shown remains unchanged)

ASTM B491/B491M, ASTM B813, ASTM B819, ASTM B1003, AWS A5.8, and UL 207 meet the requirements for mandatory reference standards in accordance with Section 3-3.7.1 of IAPMO's Regulations Governing Committee Projects.

SUBSTANTIATION:
I organized a group of 8 experts in the field of refrigerant piping to help develop this code change. I refer to them as the Refrigerant Piping Committee. However, I am submitting this change as the proponent. In addition to the Committee I created, I circulated a draft to other experts in the field of refrigeration. I received a number of comments through that review. Those comments have been incorporated in the final text that I am submitting.

It is the intent of the Refrigerant Piping Committee to submit a similar change to ASHRAE 15. A change has already been submitted to the IMC. The goal is to update all refrigerant piping requirements addressing every type of refrigerant system other than ammonia.

This proposed change reorganizes and updates the requirements for refrigerant piping. Many of the requirements remain the same as in the current code. The change follows the Manual of Style for listing piping material, joints and connections, and installation requirements.

Section 1109 is the piping material section. Section 1109.1 is the general section indicating that compliance to the section for material requirements. It should be understood that ammonia piping requirements are regulated by IIAR 2. The code currently requires compliance with IIAR 2 for ammonia systems. Hence, these requirements do not cover ammonia refrigerant piping systems.

There is currently no section regarding used materials, yet other chapters include requirements for used materials. This section is similar to the used material requirements in other chapters.

Section 1109.3 is a general requirement for the piping material to be rated for the temperatures, pressures, and type of refrigerant. The aluminum, zinc, and magnesium alloys exception for R-40 (methyl chloride) is the same as the current Section 1109.1.3. The same is true for magnesium alloys which cannot be used with any halogenated refrigerants since the material will react and fail.

Section 1109.4 includes a table for listing all of the acceptable piping material. The appropriate standards for the piping material are listed in the table. While the word brass was previously convert to copper alloy throughout the code, ASTM B43 is still identified as a brass pipe standard. Therefore, brass was used with copper alloy included in parenthesis.

The current code has a restriction on the use of mechanical joints with annealed copper tubing. This is a hold over requirement that is out of date. ASME B31.5 has a different limitation. Note 1 to the table includes the requirements listed in ASME B31.5.

Note 2 of the table currently appears in in the code. The requirement remains the same.

Section 1109.5 includes a table of the fitting standards used in refrigerant piping systems. Some of the standards are new to this chapter since the previous requirements were weak with regard to referencing the appropriate fitting standards. There is also a general reference to UL 207. There are refrigerant fittings that do not meet fitting standard, however, they are listed to UL 207. This is an appropriate standard for specialty type of refrigerant fittings.

Copper tubing is a common material used in refrigerant piping systems. A common joint is a swaged fitting which is made in the field. Since the swaging of copper expands the wall of the pipe, thus weakening the outer tube of the joint where not supported by the joint filler material and inner tube, the depth of the swage must be included. This depth is similar to the brazed fitting cup depths in the ASME B16.50 standard. The maximum depth allows a 50% increase in cup depth. A greater depth will result in too weak a pipe wall.

Section 1109.6 adds requirements for valves. The current code has valve installation requirements but is missing valve material requirements.

Section 1109.7 adds material requirements for flexible connectors and expansion and vibration compensators. These components are required to be listed and labeled for refrigerant systems.

Section 1110 is organized with general requirements in the beginning, followed by joining methods, and completed with piping material allowances of various joining methods. Many of the requirements are new since the current code requirements are not up to date.
Section 1110.1 is the general section on joints requiring them to be approved and meet the tightness requirements to pass the system test.

Section 1110.1.1 lists requirements for joints between different materials. A reference to the testing requirements in ASSE 1079 is made in the section for joints between dissimilar metals. The standard has appropriate testing requirements for dielectric tests that can be used on refrigeration piping systems even though the standard appears to address water piping systems.

Section 1110.2 is similar to the preparation of pipe ends found in other chapters. The same requirements would apply to refrigerant piping.

Section 1110.3 lists all of the acceptable joining methods. For brazing, there are requirements for using an inert gas inside the piping. This prevents oxidation on the interior of the piping. If there is excessive oxidation, it could result in obstruction of small piping or components in the system, as well as other system chemistry degradation, increasing the probability of future repair work. Reducing the frequency of opening refrigerating systems for repair reduces the exposure to numerous hazards and risks. For many of the joints, a reference to UL 207 is included. This standard covers the various refrigerant joining methods. The press-connect refrigerant fittings are listed to this standard, as are many mechanical joints.

Section 1110.3.4 includes all of the various threads that are used in refrigerant piping systems. This expands the listing of ASME standards for threaded joints.

Section 1110.4 through Section 1110.9 list each material and the acceptable joining methods for the particular material.

The piping installation requirements are listed in a separate section from the material and joints and connections. The piping requirements have been expanded to address the necessary safety measures to assure a proper piping installation.

With a greater use of VRV and VRF systems, there is significantly more refrigerant piping installed inside a building. Additionally, with split systems and multi-split systems in multistory residential buildings, there is also a significant amount of piping installed.

There will be an expanded use of Group A2L refrigerants that are low global warming potential refrigerants. These refrigerants were previously listed as a subgroup of A2 refrigerants. As a separate group, the requirements need to be provided to address the installation of piping with Group A2L refrigerants.

The new section on piping is divided into four main subject matters. The first part of the section addresses piping requirements for all types of refrigerants being used. The second part is for Group A2L and B2L refrigerants. The third part is for piping requirements for Group A2, A3, B2, and B3 refrigerants. The last part has additional general requirements for piping installations.

Section 1111.1 includes a reference to ASME B31.5. This standard is currently referenced in Section 1109.1. There is no change regarding the application of ASME B31.5.

Section 1111.2 identifies which sections are applicable to which refrigerant groups.

Section 1111.2.1 is a rewording of the requirements currently found in Section 1109.4.

Section 1111.2.2 is a new section requiring refrigerant piping to be concealed within the building elements. While this is implied in the current code, it is not stated. Section 1111.2.2.1, allowing refrigerant piping to be exposed, is similar to the current allowance specified in Section 1109.4 and Section 1109.4.1. The other allowance would be refrigerant piping located in a machinery room. Exposed piping is anticipated in a machinery room where access is restricted to authorized personnel.

Section 1111.2.3 is similar to current Section 1109.2. One of the changes is the allowance for refrigerant piping to be located in the ceiling of a corridor, hence, not exposed. This appears to be implied, however, when the ceiling space is considered a part of the corridor, it appears to be prohibited. Refrigerant piping, especially for multi-split systems is often installed in the ceiling of a corridor. If the RCL requirements are met, there is no hazard posed to the corridor.

Section 1111.2.4 is a duplication of the requirements currently found in Section 1109.5.1.

Section 1111.2.5 is a new section regulating the requirements for shaft containing refrigerant piping. A fire-resistance-rated shaft will be required when the refrigerant piping connects three or more stories. Other utilities can also be located within the same shaft. There are three exceptions proposed to the shaft requirements in Section 1111.2.5.1, one is when water is use, that is R718 refrigerant. The second is for the use of Group A1 refrigerants provided the smallest space in which the pipe pass meets the RCL requirements for the refrigerant. The last exception is for when the piping is installed on the outside of
the building where any leak would vent to atmosphere.

Section 1111.2.6 is also a new requirement. This section is intended to protect an individual from directly contacting a hot or cold refrigerant pipe. The temperatures are based on avoiding burning the skin or causing frostbite or frost damage to the skin. One of the methods of protection would adding insulation around the pipe. This is the most common method of protection for exposed piping.

Section 1111.2.7 lists the requirements for identifying the piping material. Since Group B refrigerant is toxic, there are special requirements to label the pipe as containing toxic refrigerant. For flammable refrigerants, Group A2 and A3, the piping must indicate that the refrigerant is flammable and there is a risk of fire or explosion.

Section 1111.3 is a new section regulating the installation of piping using Group A2L or B2L refrigerants. These refrigerants are lower flammable, lower burning velocity refrigerants. While the refrigerant will burn, it doesn’t ignite or burn very easily. Since it is flammable additional protection requirements are proposed.

Section 1111.3.1 will require continuous protection when the piping is located within 1-1/2 inches of the nearest edge of a member. Currently the code requires a level of protection in Section 316 for certain locations, such as the top plate and bottom plate. This section will require the protection where ever the piping is installed. The protection is intended to prevent the tubing from be punctured by a nail or screw.

Section 1111.3.2 requires ventilation of the shaft in which the refrigerant piping is located. A minimal movement of air will exhaust the leaking refrigerant out of the shaft. The velocity rates identified in Table 1111.3.2 are taken from a peer reviewed paper published by ASME and ensure that density differences between air and refrigerant will not defeat the purpose to exhaust the released refrigerant out of the shaft, whether in horizontal or vertical shaft orientation.

The ventilation would only be required when there is a leak of refrigerant. A leak detector is required in the shaft to identify when a leak occurs. Another option would be to naturally ventilate the shaft or continuously ventilate the shaft. Since most refrigerants are heavier than air, they tend to move downward. If naturally ventilated, the refrigerant moves to outside the building. An exception to the ventilation requirements would be the use of double wall pipe. While this is not commonly installed, the possibility exists that there will be greater use of double wall pipe.

Section 1111.4 has the special requirement for the more flammable and more toxic refrigerants. Section 1111.4.1 requires the systems to be installed using only pipe, not tubing. The added strength of the pipe will reduce any potential leak from a puncture. The exception to this requirement would be self-contained listed equipment. Some refrigerators and similar appliances are using Group A3 refrigerants. However, these appliances are tested and listed.

Section 1111.4.2 requires any shaft with these refrigerants to be continuously ventilated. The same velocity requirements apply to this group of refrigerants as Group A2L and B2L. There is also an exception for double wall pipe.

Section 1111.5 is a new section regulating pipe penetrations. Any time a pipe penetrated a wall, floor, or ceiling, it must be sealed to prevent the passage of any refrigerant that may be leaking. There is a direct reference to the building code for penetrations of fire-resistance-rated assemblies.

Section 1111.6 is a new requirement for pipe protection. These requirements are similar to other piping systems in the Mechanical Code and the Plumbing Code. The requirements are also applicable to refrigerant piping.

Section 1111.7 through Section 1111.8.4 are rewording and relocation of current Section 1109.9, Section 1109.10, and Section 1110.0.

The Refrigerant Piping Committee spent a considerable amount of time rewriting and discussing the testing requirements. The basis for Section 1116 is the current Section 1116. The key elements of Section 1116 are captured in the new section. The significant differences relate to the test medium, the test equipment, and the pressure and vacuum test.

The test gas is specified as being either oxygen-free nitrogen, helium, or argon. These are the three inert gases used for testing refrigerant piping systems. Carbon dioxide refrigerant systems are permitted to be tested with carbon dioxide. Water refrigerant piping systems are permitted to be tested with water.

For smaller systems, refrigerant contractors have used the refrigerant for testing. This would be permitted for systems having 5/8 inch or smaller tubing.

The accuracy of the test gage is not currently specified. Most test gages used by refrigerant contractors have an accuracy within 2-1/2 percent. The allowance for up to 3 percent takes into consideration other gages that may be used.
For the testing of the system, the Committee believes it is important to run two tests; one is a pressure test, the other is a vacuum test. When testing with internal pressures, a one-way leak in the reverse direction may not be discovered. However, when a vacuum is placed on the system, the leak will be identified. The standard test for refrigerant systems is one hour for pressure and 10 minutes for a vacuum. These tests have been added to the section.

COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
The proposed change contains overly stringent language. Furthermore, Table 1109.5.1 is overly restrictive and is not user-friendly.

TOTAL ELIGIBLE TO VOTE: 26
VOTING RESULTS: AFFIRMATIVE: 25 NOT RETURNED: 1 HOWARD

Appended Comments

PUBLIC COMMENT 1

Code Year: 2021 UMC Section #: 1109.0 - 1116.8, Table 1701.1 Item #: 096

SUBMITTER: Julius Ballanco
JB Engineering and Code Consulting, P.C.
Rep: Daikin US

RECOMMENDATION:
Revise text

Request to replace the code change proposal by this public comment.

1109.0 Refrigeration Piping, Containers, and Valves.
1109.1 Materials. Materials used in the construction and installation of refrigerating systems shall be compatible with the conveying refrigerant used. Materials shall not be used that will deteriorate due to the chemical action of the refrigerant, lubricant, or combination of both where exposed to air or moisture to a degree that poses a safety hazard. [ASHRAE 15:9.1.1] Refrigerant piping shall be metallic.

1109.1.1 Copper and Copper Alloy Pipe. Copper and copper alloy refrigeration piping, valves, fittings, and related parts used in the construction and installation of refrigeration systems shall be approved for the intended use. Refrigeration piping shall comply with ASME B31.5.

1109.1.2 Copper Linesets. Copper linesets shall comply with ASTM B280 or ASTM B1003.

1109.1.3 Iron and Steel. Iron and steel refrigeration piping, valves, fittings, and related parts shall be approved for the intended use. Pipe exceeding 2 inches (50 mm) iron pipe size shall be electric-resistance welded or seamless pipe. Refrigeration piping shall comply with ASME B31.5.

1109.1.4 Prohibited Contact. Aluminum, zinc, magnesium, or their alloys shall not be used in contact with methyl chloride. Magnesium alloys shall not be used where in contact with halogenated refrigerants. [ASHRAE 15:9.1.2]

1109.2 Joints. Iron or steel pipe joints shall be of approved threaded, flanged, or welded types. Exposed threads shall be tinned or coated with an approved corrosion inhibitor. Copper or copper alloy pipe joints of iron pipe size shall be of approved threaded, flanged, press-connect or brazed types. Copper tubing joints and connections shall be connected by approved flared, lapped, swaged, or brazed joints, soldered joints, or mechanical joints that comply with UL 207 either individually or as part of an assembly or a system by an approved nationally recognized laboratory. Piping and tubing shall be installed so as to prevent vibration and strains at joints and connections.

1109.3 Penetration of Piping. Refrigerant piping shall not penetrate floors, ceilings, or roofs. Exceptions:
(1) Penetrations connecting the basement and the first floor.
(2) Penetrations connecting the top floor and a machinery penthouse or roof installation.
(3) Penetrations connecting adjacent floors served by the refrigerating system.
(4) Penetrations of a direct system where the refrigerant concentration does not exceed that listed in Table 1102.3 for the smallest occupied space through which the refrigerant piping passes.
(5) In other than industrial occupancies and where the refrigerant concentration exceeds that listed in Table 1102.3 for the smallest occupied space, penetrations that connect separate pieces of equipment that are in accordance with one of the following:
(a) Enclosed by an approved gastight, fire-resistive duct or shaft with openings to those floors served by the refrigerating system.
1109.4 Location of Refrigeration Piping. Refrigerant piping crossing an open space that affords passageway in a building shall not be less than 7.25 feet (2210 mm) above the floor unless the piping is located against the ceiling of such space and is permitted by the Authority Having Jurisdiction. [ASHRAE 15:8.10.1]

1109.4.1 Protection from Mechanical Damage. Passages shall not be obstructed by refrigerant piping. Refrigerant piping shall not be located in an elevator, dumbwaiter, or other shaft containing a moving object, or in a shaft that has openings to living quarters, or to means of egress. Refrigerant piping shall not be installed in an enclosed public stairway, stair landing, or means-of-egress. [ASHRAE 15:8.10.2]

1109.5 Underground Piping. Refrigerant piping placed underground shall be protected against corrosion. 

1109.5.1 Piping in Concrete Floors. Refrigerant piping installed in concrete floors shall be encaised in a pipe duct. Refrigerant piping shall be isolated and supported to prevent damaging vibration, stress, or corrosion. [ASHRAE 15:8.10.4]

1109.6 Support. In addition to the requirements of Section 1105.2, piping and tubing shall be securely fastened to a permanent support within 6 feet (1829 mm) following the first bend in such tubing from the compressor and within 2 feet (610 mm) of each subsequent bend or angle. Piping and tubing shall be supported at points not more than 15 feet (4572 mm) apart.

1109.7 Pipe Enclosure. Refrigerant piping and tubing shall be installed so that it is not subject to damage from an external source. Soft annealed copper tubing shall not exceed 3/4 of an inch (20 mm) nominal size. Mechanical joints, other than approved press-connect joints, shall not be made on tubing exceeding 3/4 of an inch (20 mm) nominal size. Soft annealed copper tubing conveying refrigerant shall be encased in iron or steel piping and fittings, or in conduit, molding, or raceway that will protect the tubing against mechanical injury from an exterior source.

Exceptions:
(1) Tubing entirely within or tubing within 5 feet (1524 mm) of a refrigerant compressor where so located that it is not subject to external injury.
(2) Copper tubing serving a dwelling unit, where such tubing contains Group A1 refrigerant and is placed in locations not subject to damage from an external source.

1109.8 Visual Inspection. Refrigerant piping and joints erected on the premises shall be exposed to view for visual inspection prior to being covered or enclosed.

Exception: Copper tubing enclosed in iron or steel piping conduit, molding, or raceway, provided there are no fittings or joints concealed therein.

1109.9 Condensation. Piping and fittings that convey brine, refrigerant, or coolants that during normal operation are capable of reaching a surface temperature below the dew point of the surrounding air and that are located in spaces or areas where condensation will cause a hazard to the building occupants or damage to the structure, electrical or other equipment shall be protected to prevent such damage.

1109.10 Identification. Piping shall be in accordance with the reference standard for identification. The type of refrigerant, function and pressure shall be indicated.

1110 Valves.

1110.1 More than 6.6 Pounds of Refrigerant. Systems containing more than 6.6 pounds (2.99 kg) of refrigerant shall have stop valves installed at the following locations:
(1) The suction inlet of a compressor, compressor unit, or condensing unit.
(2) The discharge of a compressor, compressor unit, or condensing unit.
(3) The outlet of a liquid receiver.

Exceptions:
(1) Systems that have a refrigerant pumpout function capable of storing the refrigerant charge, or are equipped with the provisions for pumpout of the refrigerant.
(2) Self-contained systems. [ASHRAE 15:9.12.4]

1110.2 More than 110 Pounds of Refrigerant. Systems containing more than 110 pounds (49.9 kg) of refrigerant shall have stop valves installed at the following locations:
(1) The suction inlet of a compressor, compressor unit, or condensing unit.
(2) The discharge outlet of a compressor, compressor unit, or condensing unit.
(3) The inlet of a liquid receiver, except for self-contained systems or where the receiver is an integral part of the condenser or condensing unit.
(4) The outlet of a liquid receiver.
(5) The inlets and outlets of condensers where more than one condenser is used in parallel in the systems.

Exception: Systems that have a refrigerant pumpout function capable of storing the refrigerant charge, or are equipped with the provisions for pumpout of the refrigerant or self-contained systems. [ASHRAE 15:9.12.5]

1110.3 Support. Stop valves installed in copper refrigerant lines of 3/4 of an inch (20 mm) or less outside diameter shall be supported independently of the tubing or piping.

1110.4 Access. Stop valves required by Section 1110.0 shall be readily accessible from the refrigeration machinery room floor or a level platform.

1110.5 Identification. Stop valves shall be identified by tagging in accordance with the reference standard for identification. A valve chart shall be mounted under glass at an approved location near the principal entrance to a refrigeration machinery room.
1109.0 Piping Material.
1109.1 Piping. Refrigerant piping material shall conform to the requirements in this section.
1109.2 Used Materials. Reused pipe, fittings, valves or other materials on existing refrigerant systems being renovated or modified shall comply with the requirements of this section.
1109.3 Material Rating. Materials, joints and connections shall be rated for the operating temperature and pressure of the refrigerant system. Materials shall be suitable for the type of refrigerant and type of lubricant in the refrigerant system. Magnesium alloys shall not be used in contact with any halogenated refrigerants. Aluminum, zinc, magnesium, or their alloys shall not be used in contact with R-40 (methyl chloride).
1109.4 Piping Materials Standards. Refrigerant pipe shall conform to one or more of the standards listed in Table 1109.4. The exterior of the pipe shall be protected from corrosion and degradation.

### TABLE 1109.4
**REFRIGERANT PIPE**

<table>
<thead>
<tr>
<th>Piping Material</th>
<th>Standard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aluminum Tube</td>
<td>ASTM B210, ASTM B491</td>
</tr>
<tr>
<td>Brass (Copper Alloy)</td>
<td>Pipe</td>
</tr>
<tr>
<td>Copper</td>
<td>Pipe</td>
</tr>
<tr>
<td>Copper Tube</td>
<td>ASTM B68, ASTM B75, ASTM B88, ASTM B280, ASTM B819</td>
</tr>
<tr>
<td>Copper Linesets</td>
<td>ASTM B1003, ASTM B280</td>
</tr>
<tr>
<td>Steel Pipe</td>
<td>ASTM A53, ASTM A106</td>
</tr>
<tr>
<td>Steel Tube</td>
<td>ASTM A254, ASTM A334</td>
</tr>
</tbody>
</table>

1109.4.1 Annealed Copper Tube limitation. Soft annealed copper tubing larger than $1\frac{3}{8}$ in. (35 mm) O.D. shall not be used for field assembled refrigerant piping, unless it is protected from mechanical damage.

1109.4.2 Type F Steel Pipe Limitation. ASTM A53. Type F steel pipe shall only be permitted for discharge lines that discharge to atmosphere.

1109.5 Pipe Fittings. Refrigerant pipe fittings shall be approved for installation with the piping materials to be installed and shall conform to one or more of the standards listed in Table 1109.5 or shall be listed and labeled in accordance with UL 207.

### TABLE 1109.5
**REFRIGERANT PIPE FITTINGS**

<table>
<thead>
<tr>
<th>Fitting Material</th>
<th>Standard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aluminum</td>
<td>ASTM B361</td>
</tr>
<tr>
<td>Brass (Copper Alloy)</td>
<td>ASME B16.15, ASME B16.24</td>
</tr>
<tr>
<td>Steel</td>
<td>ASTM A105, ASTM A181, ASTM A193, ASTM A234, ASTM A420, ASTM A707</td>
</tr>
</tbody>
</table>

1109.5.1 Copper Brazed Field Swaged. The minimum and maximum cup depth of field fabricated copper brazed swaged fitting connections shall comply with Table 1109.5.1.
## COPPER BRAZED SWAGED CUP DEPTHS

<table>
<thead>
<tr>
<th>FITTING SIZE (Inch)</th>
<th>MINIMUM (Inch)</th>
<th>MAXIMUM (Inch)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/8</td>
<td>0.15</td>
<td>0.23</td>
</tr>
<tr>
<td>3/16</td>
<td>0.16</td>
<td>0.24</td>
</tr>
<tr>
<td>1/4</td>
<td>0.17</td>
<td>0.26</td>
</tr>
<tr>
<td>3/8</td>
<td>0.20</td>
<td>0.30</td>
</tr>
<tr>
<td>1/2</td>
<td>0.22</td>
<td>0.33</td>
</tr>
<tr>
<td>5/8</td>
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<td>0.36</td>
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<td>0.28</td>
<td>0.42</td>
</tr>
<tr>
<td>1 1/4</td>
<td>0.31</td>
<td>0.47</td>
</tr>
<tr>
<td>1 1/2</td>
<td>0.34</td>
<td>0.51</td>
</tr>
<tr>
<td>2</td>
<td>0.40</td>
<td>0.60</td>
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<tr>
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<tr>
<td>3</td>
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<tr>
<td>3 1/2</td>
<td>0.59</td>
<td>0.89</td>
</tr>
<tr>
<td>4</td>
<td>0.64</td>
<td>0.96</td>
</tr>
</tbody>
</table>

### 1109.6 Valves, Flexible Connectors, Expansion and Vibration Compensators

Valves, flexible connectors and expansion, vibration control devices or other similar components shall be listed and labeled to UL 207 for the refrigerant systems, and pressures for which the components are installed.

### 1110.0 Joints and Connections

#### 1110.1 Approval

Joints and connections shall be of an approved type. Joints and connections shall be tight for the pressure of the refrigerant system when tested in accordance with Section 1116.

#### 1110.1.1 Joints Between Different Piping Materials

Joints between different piping materials shall be made with approved adapter fittings. Joints between dissimilar metallic piping materials shall be designed to prevent galvanic action which includes but is not limited to the use of a dielectric fitting or a dielectric union conforming to dielectric tests of ASSE 1079. Adapter fittings with threaded ends between different materials shall be joined with proper thread lubricant in accordance with Section 1110.3.4.

#### 1110.2 Allowable Joints

The allowable joints for a specific piping material shall be in accordance with Table 1110.2.

### TABLE 1110.2

#### ALLOWABLE JOINTS

<table>
<thead>
<tr>
<th>Material</th>
<th>Brazed (see Section 1110.3.1)</th>
<th>Mechanical (See Section 1110.3.2)</th>
<th>Flared (See Section 1110.3.2.1)</th>
<th>Press-connect (See Section 1110.3.2.2)</th>
<th>Soldered (See Section 1110.3.3)</th>
<th>Threaded (See Section 1110.3.4)</th>
<th>Welded (See Section 1110.3.5)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aluminum Tube</td>
<td>X</td>
<td>X</td>
<td>-</td>
<td>X</td>
<td>-</td>
<td>-</td>
<td>X</td>
</tr>
</tbody>
</table>
### Preparation of Pipe Ends
Pipe shall be cut square, reamed and chamfered, and shall be free of burrs and obstructions. Pipe ends shall not be undercut to reduce pipe wall below the minimum thickness as required for the application.

### Joint Preparation and Installation
Where required by Section 1110.4 through Section 1110.9, the preparation and installation of brazed, flared, mechanical, press-connect, soldered, threaded and welded joints shall comply with Section 1110.3.1 through Section 1110.3.5.

#### Brazed Joints
Joint surfaces shall be cleaned. An approved flux shall be applied where required by the braze filler metal manufacturer. The piping being brazed shall be purged of air to remove the oxygen and filled with one of the following inert gases: oxygen-free nitrogen, helium, or argon. The piping system shall be pre-purged with an inert gas for a minimum time corresponding to five volume changes through the piping system prior to brazing. The pre-purge rate shall be at a minimum velocity of 100 feet per minute (0.5 m/s). The inert gas shall be directly connected to the tube system being brazed to prevent the entrainment of ambient air. After the pre-purge, the inert gas supply shall be maintained through the piping during the brazing operation at a minimum pressure of 1.0 psi (6.9 kPa) and a maximum pressure of 3.0 psi (20 kPa). The joint shall be brazed with a filler metal conforming to AWS A5.8.

#### Mechanical Joints
Mechanical joints shall be installed in accordance with the manufacturer’s instructions.

##### Flared Joints
Flared fittings shall be installed in accordance with the manufacturer’s instructions. The flared fitting shall be used with the tube material specified by the fitting manufacturer. The flared tube end shall be made by a tool designed for that operation.

##### Press-Connect Joints
Press-connect joints shall be installed in accordance with the manufacturer’s instructions.

##### Soldered Joints
Joint surfaces shall be cleaned. A flux conforming to ASTM B813 shall be applied. The joint shall be soldered with a solder conforming to ASTM B 32. Solder joints shall be limited to refrigerant systems using Group A1 refrigerant and having a pressure of less than or equal to 200 psi.

##### Threaded Joints
Threads shall conform to ASME B1.20.1, ASME B1.20.3, ASME B1.13M, or ASME B1.1. Thread lubricant, pipe-joint compound, or tape shall be applied on the external threads only and shall be approved for application on the piping material.

#### Welded Joints
Joint surfaces shall be cleaned by an approved procedure. Joints shall be welded with an approved filler metal.

### Refrigerant Pipe Installation

#### General
Refrigerant piping installations shall comply with the requirements of this section.

#### Piping Location
Refrigerant piping shall comply with the installation location requirements of Section 1111.2.1 through Section 1111.2.6. Refrigerant piping for group A2L and B2L shall also comply with the requirements of Section 1111.3. Refrigerant piping for group A2, A3, B2 and B3 shall also comply with the requirements of Section 1111.4.

#### Minimum Height
Exposed refrigerant piping installed in open spaces that afford passage shall be not less than 7 feet 3 inches (2210 mm) above the finished floor.

### Pipe Protection
Refrigerant piping shall be protected by one of the following:

1. Piping inside the building shall be protected by locating the pipe within either the building elements or protective enclosure. In concealed locations where aluminum tube, copper tube, or steel tube is installed through holes or notches in studs, joists, rafters or similar members less than 1-1/2 inches (38 mm) from the nearest edge of the member, the tube shall be protected by steel shield plates having a minimum thickness of 0.0575 inch (1.463 mm) (No. 16 gage). Protective steel shield plates shall cover the area of the tube where the member is notched or bored, and shall extend not less than 2 inches (51 mm) above sole plates and below top plates.
2. Where located more than 7 feet 3 inches (2.2 m) above the finished floor.
3. Pipe inside the building shall be permitted to be exposed within 6 feet 0 inches (1830 mm) of the refrigerant unit or appliance.
4. Where located in a machinery room complying with Section 1105.
5. Where isolated in an attic or crawl space without ready access. Aluminum tube, copper tube, or steel tube shall be protected in accordance with Item 1 when located within 1-1/2 inches (38 mm) from the nearest edge of the member.
Pipe located outside the building shall be protected from damage from the weather and foot traffic.

1111.2.3 Prohibited Locations. Refrigerant piping shall not be installed in any of the following locations:

(1) Exposed within a fire-resistance-rated exit access corridor.
(2) Interior exit stairway.
(3) Exposed within an interior exit ramp.
(4) Exit passageway.
(5) Elevator, dumbwaiter or other shaft containing a moving object.

1111.2.4 Piping in Concrete Floors. Refrigerant piping installed in concrete floors shall be encased in pipe, conduit, or ducts. The piping shall be protected to prevent damage from vibration, stress and corrosion.

1111.2.5 Refrigerant Pipe Shafts. Refrigerant piping that penetrates two or more floor/ceiling assemblies shall be enclosed in a fire-resistance-rated shaft enclosure. The fire-resistance-rated shaft enclosure shall comply with Building Code. Other building utilities or piping systems shall be allowed in the refrigerant piping shaft.

1111.2.5.1 Shaft Not Required. A Shaft enclosure shall not be required for the refrigerant piping for any of the following systems:

(1) For systems using R-718 refrigerant.
(2) Piping in a direct system using Group A1 refrigerant where the refrigerant quantity does not exceed Table 1103.1 for the smallest occupied space through which the piping passes.
(3) Piping located on the exterior of the building where vented to the outdoors.

1111.2.6 Exposed Piping Surface Temperature. Exposed piping with ready access having temperatures greater than 120°F (49°C) or less than 5°F (-15°C) shall be protected from contact or have thermal insulation which limits the exposed insulation surface temperature to a range of 5°F (-15°C) to 120°F (49°C).

1111.2.7 Pipe Identification. Refrigerant pipe located in areas other than the room or space where the refrigerating equipment is located shall be identified. The pipe identification shall be located at intervals not exceeding 20 feet on the refrigerant piping or pipe insulation. The minimum height of lettering of the identification label shall be ½ inch. The identification shall indicate the refrigerant designation and safety group classification of refrigerant used in the piping system. For Group A2, A3, B2, and B3 refrigerant the identification shall also include the following statement: "DANGER – Risk of Fire or Explosion. Flammable Refrigerant." For any Group B refrigerant, the identification shall also include the following statement: "DANGER - Toxic Refrigerant."

1111.3 Installation Requirements for A2L and B2L Refrigerants. Piping systems using Group A2L or B2L refrigerant shall comply with the requirements of Section 1111.3.1 through Section 1111.3.2.

1111.3.1 Pipe Protection. In addition to the requirements in Section 305.5, aluminum, copper, or steel tube for Group A2L and B2L refrigerants located in concealed locations where tubing is installed in studs, joists, rafters or similar member spaces and located less than 1-1/2 inches (38 mm) from the nearest edge of the member, shall be continuously protected by shield plates. Protective steel shield plates having a minimum thickness of 0.0575 inch (1.463 mm) (No. 16 gage) shall cover the area of the tube, and shall extend a minimum of 2 inches (51 mm) beyond the outside edge of the tube.

1111.3.2 Shaft Ventilation. Refrigerant pipe shafts with systems using Group A2L or B2L refrigerants shall be naturally or mechanically ventilated. The shaft ventilation exhaust outlet shall comply with Section 501.3.1. Naturally ventilated shafts shall have a minimum of a 4 inch (100 mm) diameter pipe, duct, or conduit that connects at the lowest point of the shaft and connects to the outdoors. The pipe, duct, or conduit shall be level or pitched to the outdoors. Mechanically ventilated shafts shall have a minimum air velocity in accordance with Table 1111.3.2. The mechanical ventilation shall either be continuously operated or activated by a refrigerant detector. Systems utilizing a refrigerant detector shall activate the mechanical ventilation at a maximum refrigerant concentration of 25 percent of the lower flammable limit of the refrigerant. The detector, or a sampling tube that draws air to the detector, shall be located in an area where refrigerant from a leak will concentrate. The shaft shall not be required to be ventilated for double wall refrigerant pipe where the interstitial space of the double wall pipe is vented to the outdoors.

<table>
<thead>
<tr>
<th>CROSS SECTIONAL AREA OF SHAFT (Sq. In)</th>
<th>MINIMUM VENTILATION VELOCITY (feet per minute)</th>
</tr>
</thead>
<tbody>
<tr>
<td>= 20</td>
<td>100</td>
</tr>
<tr>
<td>≥ 20 to 250</td>
<td>200</td>
</tr>
<tr>
<td>≥ 250 to 1250</td>
<td>300</td>
</tr>
<tr>
<td>≥ 1250</td>
<td>400</td>
</tr>
</tbody>
</table>
1111.4 Installation Requirements for A2, A3, B2, and B3 Refrigerants. Piping systems using Group A2, A3, B2, or B3 refrigerant shall comply with the requirements of Section 1111.4.1 through 1111.4.2.

1111.4.1 Piping Material. Piping material for Group A2, A3, B2, or B3 refrigerant located inside the building, except for machinery rooms, shall be copper pipe, brass pipe, or steel pipe. Pipe joints located in areas other than the machinery room shall be welded. Self-contained listed and labeled equipment or appliances shall have piping material based on the listing requirements.

1111.4.2 Shaft Ventilation. Refrigerant pipe shafts with systems using Group A2, A3, B2, or B3 refrigerants shall be continuously mechanically ventilated. The shaft ventilation exhaust outlet shall comply with Section 501.3.1. Mechanically ventilated shafts shall have a minimum air velocity of specified in Table 1111.3.2. The shaft shall not be required to be ventilated for double wall refrigerant pipe where the interstitial space of the double wall pipe is vented to the outdoors.

1111.5 Refrigerant Pipe Penetrations. The annular space between the outside of a refrigerant pipe and the inside of a pipe sleeve or opening in a building envelope wall, floor, or ceiling assembly penetrated by a refrigerant pipe shall be sealed in an approved manner with caulking material, foam sealant or closed with a gasketing system. The caulking material, foam sealant or gasketing system shall be designed for the conditions at the penetration location and shall be compatible with the pipe, sleeve and building materials in contact with the sealing materials. Refrigerant pipes penetrating fire-resistance-rated assemblies or membranes of fire-resistance-rated assemblies shall be sealed or closed in accordance with the Building Code.

1111.6 Stress and Strain. Refrigerant piping shall be installed so as to prevent strains and stresses that exceed the structural strength of the pipe. Where necessary, provisions shall be made to protect piping from damage resulting from vibration, expansion, contraction, and structural settlement.

1111.7 Condensation Control. Refrigerating piping and fittings that, during normal operation, will reach a surface temperature below the dew point of the surrounding air, and are located in spaces or areas where condensation has the potential to cause a safety hazard to the building occupants, structure, electrical equipment or any other equipment or appliances, shall be insulated or protected in an approved manner to prevent damage from condensation.

1111.8 Stop Valves. Stop valves shall be installed in specified locations when required in accordance with Section 1111.8.1 and Section 1111.8.2. Stop valves shall be supported in accordance with Section 1111.8.3 and identified in accordance with Section 1111.8.4.

Exceptions:
(1) Systems that have a refrigerant pump out function capable of storing the entire refrigerant charge in a receiver or heat exchanger.
(2) Systems that are equipped with provisions for pump out of the refrigerant using either portable or permanently installed refrigerant recovery equipment.
(3) Self-contained listed and labeled systems.

1111.8.1 Refrigerating Systems Containing More Than 6.6 Pounds (3.0 kg) of Refrigerant. Stop valves shall be installed in the following locations on refrigerating systems containing more than 6.6 pounds (3.0 kg) of refrigerant:
(1) The suction inlet of each compressor, compressor unit or condensing unit.
(2) The discharge outlet of each compressor, compressor unit or condensing unit.
(3) The outlet of each liquid receiver.

1111.8.2 Refrigerating Systems Containing More Than 100 Pounds (45 kg) of Refrigerant. In addition to stop valves required by Section 1111.8.1, systems containing more than 100 pounds (45 kg) of refrigerant shall have stop valves installed in the following locations:
(1) Each inlet of each liquid receiver.
(2) Each inlet and each outlet of each condenser, when more than one condenser is used in parallel.

Exceptions:
(1) Stop valves shall not be required on the inlet of a receiver in a condensing unit, nor on the inlet of a receiver which is an integral part of the condenser.
(2) Systems utilizing nonpositive displacement compressors.

1111.8.3 Stop Valve Support. Stop valves shall be supported to prevent undo stress or strain on the refrigerant piping system. The piping system shall not be utilized to support stop valves on copper tubing or aluminum tubing 1 inch (25 mm) OD or larger in diameter.

1111.8.4 Identification. Stop valves shall be identified where their intended purpose is not obvious. When valves are identified by a numbering or lettering system, legend(s) or key(s) for the valve identification shall be located in the room containing the indoor refrigeration equipment. The minimum height of lettering of the identification label shall be ½ inch (12.7 mm).

(renumber remaining sections)

1116.0 Testing of Refrigeration Equipment.

1116.1 Factory Tests. Refrigerant-containing parts of unit systems shall be tested and proved tight by the manufacturer at not less than the design pressure for which they are rated. Pressure vessels shall be tested in accordance with Section 1117.0. [ASHRAE 15:9.1.1]

1116.1.1 Testing Procedure. Tests shall be performed with dry nitrogen or another nonflammable, nonreactive, dried gas. Oxygen, air, or mixtures containing them shall not be used. The means used to build up the test pressure shall have a pressure-limiting device or a pressure-reducing device and a gage on the outlet side. The pressure relief device shall be set above the test pressure but low enough to prevent permanent deformation of the system's components.

Exceptions:

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Mixtures of dry nitrogen, inert gases, nonflammable refrigerants permitted for factory tests.

Mixtures of dry nitrogen, inert gases, or a combination of them with flammable refrigerants in concentrations not exceeding the lesser of a refrigerant weight fraction (mass fraction) of 5 percent or 25 percent of the LFL shall be permitted for factory tests.

Compressed air without added refrigerant shall be permitted for factory tests provided the system is subsequently evacuated to less than 0.039 inch of mercury (0.132 kPa) before charging with refrigerant. The required evacuation level is atmospheric pressure for systems using R-718 (water) or R-744 (carbon dioxide) as the refrigerant. [ASHRAE 15:9.14.1.1]

1116.1.2 Applied Pressure. The test pressure applied to the highside of each factory-assembled refrigerating system shall be not less than the design pressure of the highside. The test pressure applied to the lowside of a factory assembled refrigerating system shall be not less than the design pressure of the lowside.

1116.1.3 Design Pressure of 15 psig or Less. Units with a design pressure of 15 psig (103 kPa) or less shall be tested at a pressure not less than 1.33 times the design pressure, and shall be proved leak-tight at not less than the lowside design pressure. [ASHRAE 15:9.14.3]

1116.2 Field Tests. Refrigerant containing parts of a system that is field-erected shall be tested and proved tight after complete installation and before the operation. The high and low sides of each system shall be tested and proved tight at not less than the lower of the pressure in Table 1116.2 or the setting of the pressure-relief device.

Exceptions:
(1) Compressors, condensers, evaporators, coded pressure vessels, safety devices, pressure gauges, control mechanisms, and systems that are factory tested.
(2) Refrigeration systems containing Group R-22, not exceeding 5 tons of refrigeration capacity (18 kW), and field-piped using approved, factory-charged line sets shall be permitted to be proved tight by observing retention of pressure on a set of charging gauges and soaping connections while the system is operating.

### TABLE 1116.2
FIELD LEAK TEST PRESSURES (psig)*

<table>
<thead>
<tr>
<th>REFRIGERANT NUMBER</th>
<th>HIGHSIDE WATER COOLED</th>
<th>HIGH SIDE AIR COOLED</th>
<th>LOWSIDE</th>
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</thead>
<tbody>
<tr>
<td>11</td>
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<td>134a</td>
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<td>220</td>
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<tr>
<td>500</td>
<td>165</td>
<td>265</td>
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</tr>
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<td>502</td>
<td>250</td>
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<td>250</td>
</tr>
<tr>
<td>744</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

For SI units: 1 pound-force per square inch gauge = 6.8947 kPa
* Special design required; test pressures typically exceed 1000 psig (6895 kPa).

1116.0 Refrigerant Piping System Test.

1116.1 General. Refrigerant piping systems erected in the field shall be pressure tested for strength and leak tested for tightness, after installation and before being placed in operation, in accordance with the requirements of this section. Tests shall include both the high and low-pressure sides of each system.

1116.1.1 Testing Not Required. Listed and labeled equipment, including compressors, condensers, vessels, evaporators, gas bulk storage tanks, safety devices, pressure gauges and control mechanisms, shall not be required to be tested.

1116.2 Exposure of Refrigerant Piping System. Refrigerant pipe and joints installed in the field shall be exposed for visual inspection and testing prior to being covered or enclosed.

1116.3 Test Gases. The medium used for pressure testing the refrigerant system shall be one of the following inert gases: oxygen.
free nitrogen, helium, or argon. For R-744 refrigerant systems carbon dioxide shall be allowed as the test medium. For R-718 refrigerant systems water shall be allowed as the test medium. Oxygen, air, combustible gases and mixtures containing such gases shall not be used as test medium.

**1116.4 Test Apparatus.** The means used to pressurize the refrigerant piping system shall have either a pressure-limiting device or a pressure-reducing device and a test pressure measuring device on the outlet side. The test pressure measuring device shall have an accuracy of ±3 percent or less of the test pressure, and shall have a resolution of 5 percent or less of the test pressure.

**1116.5 Piping System Pressure Test and Leak Test.** The refrigerant piping system shall be tested, however, separate tests for low-side and high-side sections of the piping system shall be allowed. The refrigerant piping system shall be tested in accordance with both of the following methods:

1. Pressurized for a minimum of 60 minutes to not less than the lower of the design pressures or the setting of the pressure relief device(s). The design pressures for testing shall be the pressure listed on the label nameplate of the condensing unit, compressor, compressor unit, pressure vessel, or other system component with a nameplate. No additional test gas shall be added to the system after the start of the pressure test. The system shall show no loss of pressure on the test pressure measuring device during the pressure test. When using refrigerant as a test medium in accordance with Section 1116.3, the test pressure shall be not less than the saturation dew point pressure at 77°F (25°C).

2. A vacuum of 500 microns shall be achieved. After achieving a vacuum, the system shall be isolated from the vacuum pump. The system pressure shall not rise above 1500 microns for a minimum period of 10 minutes.

**1116.5.1 Joints and Refrigerant-Containing Parts in Air Ducts.** Joints and all refrigerant-containing parts of a refrigerating system located in an air duct of an air-conditioning system carrying conditioned air to and from human-occupied space shall be tested at a pressure of 150 percent of the higher of the design pressure or pressure relief device setting.

**1116.5.2 Limited Charge Systems.** Limited-charge systems with a pressure relief device, erected on the premises, shall be tested at a pressure not less than one and one-half times the pressure setting of the relief device. Listed and labeled limited charge systems shall be tested at the equipment or appliance design pressure.

**1116.6 Booster Compressor.** Where a compressor protected by a pressure relief device is used as a booster to obtain an intermediate pressure and discharges into the suction side of another compressor, the booster compressor shall be considered a part of the low side.

**1116.7 Centrifugal/Nonpositive Displacement Compressors.** When testing systems using centrifugal or other nonpositive displacement compressors, the entire system shall be considered the low-side pressure for test purposes.

**1116.8 Contractor or Engineer Declaration.** The installing contractor or registered design professional of record shall issue a certificate of test to the code official for all systems containing 55 pounds (25 kg) or more of refrigerant. The certificate shall give the test date, name of the refrigerant, test medium, and the field test pressure applied to the high-side and the low-side of the system. The certification of test shall be signed by the installing contractor or registered design professional and shall be made part of the public record.

### TABLE 1701.1 REFERENCED STANDARDS

<table>
<thead>
<tr>
<th>STANDARD NUMBER</th>
<th>STANDARD TITLE</th>
<th>APPLICATION</th>
<th>REFERENCED SECTIONS</th>
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<td>ASME B1.1-2003</td>
<td>Unified Inch Screw Threads</td>
<td>Fittings</td>
<td>1110.3.4</td>
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<td>Metric Screw Threads: M Profile</td>
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<td>ASME B16.15-2013</td>
<td>Cast Copper Alloy Threaded Fittings: Classes 125 and 250</td>
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<td>Table 1109.5, Table 1210.1</td>
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<td>ASME B16.18-2012</td>
<td>Cast Copper Alloy Solder Joint Pressure Fittings</td>
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<td>Table 1109.5, Table 1210.1</td>
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<td>ASME B16.22-2013</td>
<td>Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings</td>
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<td>Table 1109.5, Table 1210.1</td>
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<td>ASME B16.24-2016</td>
<td>Cast Copper Alloy Pipe Flanges, Flanged Fittings, and Valves Classes 150, 300, 600, 900, 1500, and 2500</td>
<td>Fittings</td>
<td>Table 1109.5, Table 1210.1, 1308.5.9.2</td>
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<td>ASME B16.26-2013</td>
<td>Cast Copper Alloy Fittings for Flared Copper Tubes</td>
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<td>ASME B16.50-2018</td>
<td>Wrought Copper and Copper Alloy Brazed-Joint Pressure Fittings</td>
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<td>ASME B1.20.1-2013</td>
<td>Pipe Threads, General Purpose (Inch)</td>
<td>Joints</td>
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<td>1110.1.1, 1211.14.1</td>
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<td>ASTM A53/A53M-2012 2018</td>
<td>Pipe, Steel, Black and Hot-Dipped,</td>
<td>Piping</td>
<td>1109.4.2, 1308.5.2.1(2), Table</td>
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<td>Specifications</td>
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<td>ASTM A105/A105M-2014</td>
<td>Carbon Steel Forgings for Piping Applications</td>
<td>Fittings</td>
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<td>ASTM A106/A106M-2018</td>
<td>Seamless Carbon Steel Pipe for High-Temperature Service</td>
<td>Piping</td>
<td>1308.5.2.1(3), Table 1109.4, Table 1210.1</td>
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<td>ASTM A181/A181M-2014</td>
<td>Carbon Steel Forgings, for General-Purpose Piping</td>
<td>Piping</td>
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<td>ASTM A193/A193M-2017</td>
<td>Alloy-Steel and Stainless Steel Bolting for High Temperature or High Pressure Service and Other Special Purpose Applications</td>
<td>Bolting</td>
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<td>ASTM A234/A234M-2018</td>
<td>Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service</td>
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<td>Copper-Brazed Steel Tubing</td>
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<td>ASTM A334/A334M-2004a (R2016)</td>
<td>Seamless and Welded Carbon and Alloy-Steel Tubes for Low-Temperature Service</td>
<td>Tubing</td>
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<td>ASTM A420/A420M-2016</td>
<td>Piping Fittings of Wrought Carbon Steel and Alloy Steel for Low-Temperature Service</td>
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<td>ASTM A707/A707M-2014</td>
<td>Forged Carbon and Alloy Steel Flanges for Low-Temperature Service</td>
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<td>ASTM B32-2008 (R2014)</td>
<td>Solder Metal</td>
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<td>ASTM B42-2015a</td>
<td>Seamless Copper Pipe, Standard Sizes</td>
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<td>ASTM B43-2015</td>
<td>Seamless Red Brass Pipe, Standard Sizes</td>
<td>Piping</td>
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<td>ASTM B68/ASTM B68M-2011</td>
<td>Seamless Copper Tube, Bright Annealed</td>
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<td>ASTM B75/B75M-2011</td>
<td>Seamless Copper Tube</td>
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<td>ASTM B88-2016</td>
<td>Seamless Copper Water Tube</td>
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<td>ASTM B210/B210M-2012 2019</td>
<td>Aluminum and Aluminum-Alloy Drawn Seamless Tubes</td>
<td>Piping</td>
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<td>ASTM B280-2016</td>
<td>Seamless Copper Tube for Air Conditioning and Refrigeration Field Service</td>
<td>Piping</td>
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<td>ASTM B302-2017</td>
<td>Threadless Copper Pipe, Standard Sizes</td>
<td>Piping</td>
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<td>ASTM B361-2016</td>
<td>Factory-Made Wrought Aluminum and Aluminum-Alloy Welding Fittings</td>
<td>Fittings</td>
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<td>ASTM B491/B491M-2015</td>
<td>Aluminum and Aluminum-Alloy Extruded Round Tubes for General-Purpose Applications</td>
<td>Tubing</td>
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<td>ASTM B813-2016</td>
<td>Liquid and Paste Fluxes for Soldering of Copper and Copper Alloy Tube</td>
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<td>1110.3.1, 1211.4(1)</td>
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<td>UL 207-2009</td>
<td>Refrigerant-Containing Components and Accessories, Nonelectrical (with revisions through June 27, 2014)</td>
<td>Refrigeration Components</td>
<td>1109.2, 1109.5, 1109.6</td>
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</table>


SUBSTANTIATION:
As indicated in the original submittal, this change is intended to coordinate the UMC requirements with ASHRAE 15 regarding refrigerant piping requirements. The changes are being reviewed simultaneously. The modification proposed are the current changes proposed by the ASHRAE SSPC 15 Refrigerant Piping Working Group. This working group was created by the Chair of SSPC 15 at the June ASHRAE Convention.

The reason for rejection was that the proposed change contains overly restrictive language. The only specific given was that Table 1109.5.1 is overly restrictive and not user friendly. Table 1109.5.1 is provided by Copper Development Association. As such, it is a standard requirement for copper tube swaged brazed joints that are field made. This table is very important to avoid field failures of brazed joints. There is nothing overly restrictive with the requirements. Furthermore, the table is rather easy to use since it lists pipe size, minimum cup depth of the joint and maximum cup depth of the joint. It could not be made any easier to follow than what appears in the table.

As for other overly restrictive requirements, nothing else is identified. Refrigerant piping must be restrictive to assure the long term performance of the piping system. The industry does not want unrestrictive requirements that could result in the leakage of refrigerant into the atmosphere.

The modification proposed by the ASHRAE working group and shown in the modifications to this item are intended to address issues found in the original proposal. The first modification is to the used material section. It is important that any existing piping that is reused when equipment or appliances are changed must comply with the current code requirements for piping material. This will prevent failure of the piping systems when new equipment is installed.

The change to the piping material table removes the notes and converts them to separate code sections. Furthermore, the limitation on Type F steel pipe is limited to discharge line similar to the requirements in ASHRAE 15.

The restriction on Group A2, A3, B2, and B3 refrigerants for steel pipe is removed. This was found to be an antiquated requirement that should not be continued. Schedule 40 pipe will perform adequately for the temperatures and pressures of these piping systems.

The Valves section was combined with the Flexible connectors and expansion, vibration control devices section to create a single section addressing the requirements. Added to the list is “or other similar components” to cover items that may not be individually listed.

For adapter fittings, the allowance of listed fittings was added. While this was always the intent, it was not clear in the original proposed text. The galvanic protection requirement was further clarified to allow options for preventing galvanic corrosion.

The allowable joints for refrigerant piping was reduced to a table format. This will make it easier to understand without having to read a lot of text. All the allowable joints are listed in the table.

The reference for design of piping systems to ASME B31.5 has been deleted. The standard is already referenced as an option in ASHRAE 15 and should not be added to this section.

The final change is to the piping protection requirements. It was determined that a single section listing all of the options for protecting the piping is a better for clarifying the requirements. In addition, text was added regarding exposed piping in a stair enclosure. Without this text, it would not be possible to condition that air in a stair enclosure. However, the refrigerant piping to the units in the stair enclosure in not exposed.

The Technical Committee is encouraged to accept these important changes on refrigerant piping.
Item #: 099
UMC 2021 Section: 1127.0, 1127.1, Table 1701.1

SUBMITTER: Billy Smith
ASPE

RECOMMENDATION:
Add new text

1127.0 Operation and Maintenance.
1127.1 General. Cooling towers shall be operated and maintained in accordance with ASHRAE 188.

<table>
<thead>
<tr>
<th>STANDARD NUMBER</th>
<th>STANDARD TITLE</th>
<th>APPLICATION</th>
<th>REFERENCED SECTIONS</th>
</tr>
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<tbody>
<tr>
<td>ASHRAE 188-2015</td>
<td>Legionellosis: Risk Management for Building Water Systems</td>
<td>Miscellaneous</td>
<td>1127.1</td>
</tr>
</tbody>
</table>

(portion of table not shown remains unchanged)

Note: ASHRAE 188 meets the requirements for mandatory reference standards in accordance with Section 3-3.7.1 of IAPMO’s Regulations Governing Committee Projects.

SUBSTANTIATION:
Cooling towers have been identified as an opportunistic environment for Legionella bacteria growth and release to the environment where people risk exposure to the organisms and the resulting health effects. ASHRAE standard 188 provides specific Legionella risk mitigation elements for cooling towers and the related mechanical components. The standard provides for an initial evaluation of the system and ongoing measures to reduce human exposure/risk to the bacteria.

COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
The proposed language is a maintenance requirement and is not within the scope of the UMC.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 24 ABSTAIN: 1 NOT RETURNED: 1 HOWARD

EXPLANATION OF ABSTAIN:
EGG: Cooling towers can spread Legionella and pose a risk to health and human safety and should have some identification in the UMC

Appended Comments
PUBLIC COMMENT 1

Code Year: 2021 UMC  Section #: 1127.0, 1127.1, Table 1701.1  Item #: 099
SUBMITTER: Connor Barbaree  Comment #: 1
ASHRAE

RECOMMENDATION:
Add new text

Request to replace the code change proposal by this public comment.

1127.0 Operation and Maintenance.

1127.1 General. Cooling towers shall be operated and maintained in accordance with ASHRAE 188.

<table>
<thead>
<tr>
<th>TABLE 1701.1</th>
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<tr>
<td>REFERENCED STANDARDS</td>
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</table>

(portion of table not shown remains unchanged)

Note: ASHRAE 188 meets the requirements for mandatory reference standards in accordance with Section 3-3.7.1 of IAPMO’s Regulations Governing Committee Projects.

SUBSTANTIATION:
Cooling towers have been identified as an opportunistic environment for Legionella bacteria growth and release to the environment where people risk exposure to the organisms and the resulting health effects. ASHRAE Standard 188 provides specific Legionella risk mitigation elements for cooling towers and the related mechanical components. The standard provides for an initial evaluation of the system and ongoing measures to reduce human exposure/risk to the bacteria.
1209.0 Expansion Tanks.

1209.1 General. An expansion tank shall be installed in each closed hydronic system to control system pressure due to thermal expansion and contraction. Expansion tanks shall be of the closed or open type. Expansion tanks shall be rated for the pressure of the system.

1209.2 Installation. Expansion tanks shall be accessible for maintenance and shall be installed in accordance with the manufacturer’s installation instructions. Each tank shall be equipped with a shutoff device that will remain open during operation of the heating hydronic system. Valve handles shall be locked open or removed to prevent from being inadvertently shut off. Provisions shall be made for draining the tank without emptying the system. Expansion tanks shall be securely fastened to the structure. Supports shall be capable of carrying twice the weight of the tank filled with water without placing a strain on connecting piping. Hot-water-heating systems incorporating hot water tanks or fluid relief columns shall be installed to prevent freezing under normal operating conditions.

SUBSTANTIATION:
The revision to Section 1209.1 and Section 1209.2 will provide clarity in regard to expansion tanks. Furthermore, the modification will correlate with the action taken by the USEHC Technical Committee.

COMMITTEE ACTION: ACCEPT AS SUBMITTED

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 25 NOT RETURNED: 1 HOWARD

Appended Comments

PUBLIC COMMENT 1

Code Year: 2021 UMC Section #: 1209.2 Item #: 103
SUBMITTER: Lance MacNevin, P.Eng. Plastic Pipe Institute Comment #: 1

RECOMMENDATION:
Revise text

Request to accept the code change proposal as modified by this public comment.

1209.0 Expansion Tanks.

1209.2 Installation. Expansion tanks shall be accessible for maintenance and shall be installed in accordance with the
manufacturer’s installation instructions. Each expansion tank shall be equipped with a shutoff device that will remain open during operation of the hydronic system. Valve handles shall be locked open or removed to prevent from being inadvertently shut off. Provisions shall be made for draining the tank without emptying the system. Expansion tanks shall be securely fastened to the structure. Supports shall be capable of carrying twice the weight of the tank filled with water without placing a strain on connecting piping. Hot-water-heating systems incorporating hot water tanks or fluid relief columns shall be installed to prevent freezing under normal operating conditions.

SUBSTANTIATION:
The proposed modification will clarify that the tank being referenced is for expansion tanks. Section 1209.2 applies to expansion tanks, not all types of tanks. Furthermore, this will correlate with the USHGC Section 407.2.
Item #: 105
UMC 2021 Section: Table 1210.1

SUBMITTER: Lance MacNevin, P.Eng.
Plastics Pipe Institute

RECOMMENDATION: Revise text

**TABLE 1210.1**
MATERIALS FOR HYDRONIC SYSTEM PIPING, TUBING, AND FITTINGS

<table>
<thead>
<tr>
<th>MATERIAL</th>
<th>STANDARDS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>STANDARDS</strong></td>
</tr>
<tr>
<td></td>
<td><strong>PIPING/TUBING</strong></td>
</tr>
<tr>
<td>Cross-Linked Polyethylene (PEX)</td>
<td>ASTM F876, CSA B137.5, NSF 358-3</td>
</tr>
</tbody>
</table>

(portion of table not shown remains unchanged)

**Note:** ASTM F1055 meets the requirements for mandatory reference standards in accordance with Section 3-3.7.1 of IAPMO's Regulations Governing Committee Projects.

**SUBSTANTIATION:**
ASTM F1055 electrofusion fittings are compatible with PEX tubing described in ASTM F876 and CSA B137.5 and should be added into the FITTING column for PEX tubing.

The addition of F876 PEX tubing into ASTM F1055 was approved by the ASTM F17 Technical Committee in 2013, to attest to the compatibility of connections made between F876 PEX tubing and F1055 fittings. Connections between F876 PEX tubing and F1055 fittings must meet the same requirements as those between HDPE tubing and F1055 fittings.

Although F1055 fittings produced of HDPE material should not be used for hydronic applications operating at temperatures above 140°F, there are many hydronic applications, including low-temperature radiant heating and chilled water systems, for which F1055 fittings are very suitable for use with PEX tubing.

F1055 fittings are already listed in Table 1210.1 for use with HDPE and PE-RT pipe and tubing, and also in Table E505.6.

**COMMITTEE ACTION:** ACCEPT AS SUBMITTED

**TOTAL ELIGIBLE TO VOTE:** 26

**VOTING RESULTS:** AFFIRMATIVE: 25 NOT RETURNED: 1 HOWARD
PUBLIC COMMENT 1

Code Year: 2021 UMC  Section #: Table 1210.1, Table 1701.1  Item #: 105

SUBMITTER: Steve Mawn  ASTM

Comment #: 1

RECOMMENDATION:
Revise text

Request to accept the code change proposal as modified by this public comment.

TABLE 1210.1
MATERIALS FOR HYDRONIC SYSTEM PIPING, TUBING, AND FITTINGS

<table>
<thead>
<tr>
<th>MATERIAL</th>
<th>STANDARDS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cross-Linked Polyethylene (PEX)</td>
<td>ASTM F876, ASTM F3253, CSA B137.5, NSF 358-3</td>
</tr>
<tr>
<td>Cross-Linked Polyethylene/ Aluminum/Cross-Linked Polyethylene (PEX-AL-PEX)</td>
<td>ASTM F1281, ASTM F2262, CSA B137.10</td>
</tr>
</tbody>
</table>

(portions of table not shown remain unchanged)

TABLE 1701.1
REFERENCED STANDARDS

<table>
<thead>
<tr>
<th>STANDARD NUMBER</th>
<th>STANDARD TITLE</th>
<th>APPLICATION</th>
<th>REFERENCED SECTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASTM F1961-2009</td>
<td>Metal Mechanical Cold Flare Compression Fittings with Disc Spring for Crosslinked Polyethylene (PEX) Tubing (WITHDRAWN)</td>
<td>Fittings</td>
<td>Table 1210.1</td>
</tr>
<tr>
<td>ASTM F2262-2009</td>
<td>Crosslinked Polyethylene/Aluminum/ Crosslinked Polyethylene Tubing OD Controlled SDR9 (WITHDRAWN)</td>
<td>Piping, Plastic</td>
<td>Table 1210.1</td>
</tr>
</tbody>
</table>

(portions of table not shown remain unchanged)

SUBSTANTIATION:
The proposed modification removes reference to ASTM F1961 and ASTM F2262 as the promulgator has withdrawn the standards.
Item #: 109
UMC 2021 Section: 1211.2, 1211.3

SUBMITTER: Lance MacNevin, P.Eng.
Plastic Pipe Institute

RECOMMENDATION:
Revise text

1211.0 Joints and Connections.

1211.2 Chlorinated Polyvinyl Chloride (CPVC) Pipe. Joints between chlorinated polyvinyl chloride (CPVC) pipe or fittings shall be installed in accordance with one of the following methods:
(1) Mechanical joints shall include, but not be limited to, flanged, grooved, and push fit fittings. Removable and non-removable push fit fittings with an elastomeric o-ring that employ quick assembly push fit connectors shall be in accordance with ASSE 1061.
(2) – (3) (remaining text unchanged)

1211.3 CPVC/AL/CPVC Plastic Pipe and Joints. Joints between chlorinated polyvinyl chloride/aluminum/ chlorinated polyvinyl chloride (CPVC/AL/CPVC) pipe or fittings shall be installed in accordance with one of the following methods:
(1) Mechanical joints shall include, but not be limited to, flanged and grooved fittings.
(2) (remaining text unchanged)

SUBSTANTIATION:
The proposed modification will clarify that other mechanical joints may be included. Furthermore, the modification will correlate with the action taken by the USEHC Committee.

COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
The proposed language is unenforceable and may lead to misinterpretation of the sections.

TOTAL ELIGIBLE TO VOTE: 26
VOTING RESULTS: AFFIRMATIVE: 24 NEGATIVE: 1 NOT RETURNED: 1 HOWARD
EXPLANATION OF NEGATIVE:
HYDE: I believe that the USHGC and the UMC shall be consistent where applicable for those AHJs that adopt both codes.

Appended Comments

PUBLIC COMMENT 1
Code Year: 2021 UMC Section #: 1211.3
SUBMITTER: Lance MacNevin, P.Eng.
Plastic Pipe Institute
RECOMMENDATION:
Revise text

Request to replace the code change proposal by this public comment.

1211.0 Joints and Connections.

1211.3 CPVC/AL/CPVC Plastic Pipe and Joints. Joints between chlorinated polyvinyl chloride/aluminum/chlorinated polyvinyl chloride (CPVC/AL/CPVC) pipe or fittings shall be installed in accordance with one of the following methods:
(1) Mechanical joints shall include, but not be limited to, flanged, and grooved, and push-fit fittings.
(2) (remaining text unchanged)

SUBSTANTIATION:
The proposed modification will clarify that push-fit fitting type mechanical joints may also be included. Push-fit fittings are already allowed in the code and need to be added to the list along with flanged and grooved. Adding the new inclusive language will give the AHJ the opportunity to allow other approved joining methods. Furthermore, the modification will correlate with the USHGC.

PUBLIC COMMENT 2

Code Year: 2021 UMC  Section #: 1211.0 - 1211.13  Item #: 109

SUBMITTER: David Dias  
Sheet Metal Workers Local 104  
Comment #: 2

RECOMMENDATION:
Revise text

Request to accept the code change proposal as modified by this public comment.

1211.0 Joints and Connections.

1211.1 General. Joints and connections shall be of an approved type. Joints shall be gas and watertight and designed for the pressure of the hydronic system. Changes in direction shall be made by the use of fittings or with pipe bends. Pipe bends shall have a radius of not less than six times the outside diameter of the tubing or shall be in accordance with the manufacturer’s installation instructions. Joints between pipe and fittings shall be installed in accordance with the manufacturer’s installation instructions.

1211.2 Chlorinated Polyvinyl Chloride (CPVC) Pipe. Joints between chlorinated polyvinyl chloride (CPVC) pipe or fittings shall be installed in accordance with one of the following methods:
(1) - (3) (remaining text unchanged)

1211.4 Copper or Copper Alloy Pipe and Tubing. Joints between copper or copper alloy pipe, or tubing, or fittings shall be installed in accordance with one of the following methods:
(1) Brazed joints between copper or copper alloy pipe, or tubing, or fittings shall be made with brazing alloys having a liquid temperature above 1000°F (538°C). The joint surfaces to be brazed shall be cleaned bright by either manual or mechanical means. Tubing shall be cut square and reamed to full inside diameter. Brazing flux shall be applied to the joint surfaces where required by manufacturer’s recommendation. Brazing filler metal in accordance with AWS A5.8 shall be applied at the point where the pipe or tubing enters the socket of the fitting.
(2) - (5) (remaining text unchanged)
(6) Soldered joints between copper or copper alloy pipe, or tubing, or fittings shall be made in accordance with ASTM B828. Pipe or tubing shall be cut square and reamed to the full inside diameter including the removal of burrs on the outside of the pipe or tubing. Surfaces to be joined shall be cleaned bright by manual or mechanical means. Flux shall be applied to pipe or tubing and fittings and shall be in accordance with ASTM B813, and shall become noncorrosive and nontoxic after soldering. Insert pipe or tubing into the base of the fitting and remove excess flux. Pipe or tubing and fitting shall be supported to ensure a uniform capillary space around the joint. Joint surfaces shall not be disturbed until cool, and any remaining flux residue shall be cleaned.
(7) Threaded joints for copper or copper alloy pipe shall be made with pipe threads in accordance with ASME B1.20.1. Thread sealant tape or compound shall be applied only on male threads, and such material shall be of approved types, insoluble in water, and nontoxic.

1211.5 Cross-Linked Polyethylene (PEX) Pipe. Joints between cross-linked polyethylene (PEX) pipe or fittings shall be installed with fittings for PEX tubing that comply with the applicable standards referenced in Table 1210.1. PEX tubing labeled in accordance with ASTM F876 shall be marked with the applicable standard designation for the fittings specified for use with the tubing. Mechanical joints shall be installed in accordance with the manufacturer’s installation instructions.

1211.6 Cross-Linked Polyethylene/Aluminum/Cross-Linked Polyethylene (PEX-AL-PEX) Pipe. Joints between cross-linked
polyethylene/aluminum/cross-linked polyethylene (PEX-AL-PE) pipe or and fittings shall be installed in accordance with one of the following methods:

1. Mechanical joints between PEX-AL-PE pipe or and fittings shall include mechanical and compression type fittings and insert fittings with a crimping ring. Insert fittings utilizing a crimping ring shall be in accordance with ASTM F1974 or ASTM F2434. Crimp joints for crimp insert fittings shall be joined to PEX-AL-PE pipe by the compression of a crimp ring around the outer circumference of the pipe, forcing the pipe material into annular spaces formed by ribs on the fitting.

2. Compression joints shall include compression insert fittings and shall be joined to PEX-AL-PE pipe through the compression of a split ring or compression nut around the outer circumference of the pipe, forcing the pipe material into the annular space formed by the ribs on the fitting.

1211.7 Ductile Iron Pipe. Joints between ductile iron pipe or and fittings shall be installed in accordance with one of the following methods:

1. Mechanical joints for ductile iron pipe or and fittings shall consist of a bell that is cast integrally with the pipe or fitting and provided with an exterior flange having bolt holes and a socket with annular recesses for the sealing gasket and the plain end of the pipe or fitting. The elastomeric gasket shall comply with AWWA C111. Lubricant recommended for the application by the pipe manufacturer shall be applied to the socket with annular recesses for the sealing gasket and the plain end of the pipe or fitting. The plain end shall compress the elastomeric gasket to form a positive seal and shall be designed so that the elastomeric gasket shall be locked in place against displacement. The elastomeric gasket shall comply with AWWA C111. Lubricant recommended for the application by the pipe manufacturer shall be applied to the socket with annular recesses for the sealing gasket and the plain end of the pipe.

2. Push-on joints for ductile iron pipe or and fittings shall consist of a single elastomeric gasket that shall be assembled by positioning the elastomeric gasket in an annular recess in the pipe or fitting socket and forcing the plain end of the pipe or fitting into the socket. The plain end of the pipe shall compress the elastomeric gasket to form a positive seal and shall be designed so that the elastomeric gasket shall be locked in place against displacement. The elastomeric gasket shall comply with AWWA C111. Lubricant recommended for the application by the pipe manufacturer shall be applied to the socket with annular recesses for the sealing gasket and the plain end of the pipe.

1211.8 Polyethylene (PE) Plastic Pipe/Tubing. Joints between polyethylene (PE) plastic pipe, or tubing, or and fittings shall be installed in accordance with one of the following methods:

1. Butt-fusion joints shall be installed in accordance with ASTM F2620 and shall be made by heating the squared ends of two pipes, pipe and fitting, or two fittings by holding ends against a heated element. The heated element shall be removed where the proper melt is obtained, and joined ends shall be placed together with applied force.

2. Electro-fusion joints shall be heated internally by a conductor at the interface of the joint. Align and restrain fitting to pipe to prevent movement and apply electric current to the fitting. Turn off the current when the proper time has elapsed to heat the joint. The joint shall fuse together and remain undisturbed until cool.

3. Socket-fusion joints shall be installed in accordance with ASTM F2620 and shall be made by simultaneously heating the outside surface of a pipe end and the inside of a fitting socket. Where the proper melt is obtained, the pipe and fitting shall be joined by inserting one into the other with applied force. The joint shall fuse together and remain undisturbed until cool.

4. Mechanical joints between PE plastic pipe, or tubing, or and fittings shall include insert and mechanical compression fittings that provide a pressure seal resistance to pullout. Joints for insert fittings shall be made by cutting the pipe square, using a cutter designed for plastic piping, and removal of sharp edges. Two stainless steel clamps shall be placed over the end of the pipe. Fittings shall be checked for proper size based on the diameter of the pipe. The end of pipe shall be placed over the barbed insert fitting, making contact with the fitting shoulder. Clamps shall be positioned equal to 180 degrees (3.14 rad) apart and shall be tightened to provide a leak tight joint. Compression type couplings and fittings shall be permitted for use in joining PE piping or tubing. Stiffeners that extend beyond the clamp or nut shall be prohibited. Bends shall be not less than 30 pipe diameters, or the coil radius where bending with the coil. Bends shall not be permitted closer than 10 pipe diameters of a fitting or valve. Mechanical joints shall be designed for their intended use.

1211.9 Polyethylene/Aluminum/Polyethylene (PE-AL-PE). Joints between polyethylene/aluminum/ polyethylene (PE-AL-PE) pipe or and fittings shall be installed in accordance with one of the following methods:

1. Mechanical joints for PE-AL-PE plastic pipe, or tubing, or and fittings shall be either of the metal insert fittings with a split ring and compression nut or metal insert fittings with copper crimp rings. Metal insert fittings shall comply with ASTM F1974. Crimp insert fittings shall be joined to the pipe by placing the copper crimp ring around the outer circumference of the pipe, forcing the pipe material into the space formed by the ribs on the fitting until the pipe contacts the shoulder of the fitting. The crimp ring shall then be positioned on the pipe so the edge of the crimp ring is 1/8 of an inch (3.2 mm) to 1/4 of an inch (6.4 mm) from the end of the pipe. The jaws of the crimping tool shall be centered over the crimp ring and tool perpendicular to the barb. The jaws shall be closed around the crimp ring and shall not be crimped more than once.

2. Compression joints for PE-AL-PE plastic pipe, or tubing, or and fittings shall be joined through the compression of a split ring, by a compression nut around the circumference of the pipe. The compression nut and split ring shall be placed around the pipe. The ribbed end of the fitting shall be inserted onto the pipe until the pipe contacts the shoulder of the fitting. Position and compress the split ring by tightening the compression nut onto the insert fitting.

1211.10 Polyethylene of Raised Temperature (PE-RT). Joints between polyethylene of raised temperature (PE-RT) tubing or and fittings shall be installed with fittings for PE-RT tubing that comply with the applicable standards referenced in Table 1210.1. Metal insert fittings, metal compression fittings, and plastic fittings shall be manufactured to and marked in accordance with the standards for fittings in Table 1210.1.

1211.11 Polypropylene (PP) Pipe. Joints between polypropylene pipe or and fittings shall be installed in accordance with one of the following methods:

1. - (2) (remaining text unchanged)

1211.12 Polyvinyl Chloride (PVC) Pipe. Joints between polyvinyl chloride pipe or and fittings shall be installed in accordance with one of the following methods:

1. Mechanical joints shall be designed to provide a permanent seal and shall be of the mechanical or push-on joint. The mechanical
joint shall include a pipe spigot that has a wall thickness to withstand without deformation or collapse; the compressive force exerted where the fitting is tightened. The push-on joint shall have a minimum wall thickness of the bell at any point between the ring and the pipe barrel. The elastomeric gasket shall comply with ASTM D3139, and be of such size and shape as to provide a compressive force against the spigot and socket after assembly to provide a positive seal.

(2) Solvent cement joints for PVC pipe or fittings shall be clean from dirt and moisture. Pipe shall be cut square and pipe shall be deburred. Where surfaces to be joined are cleaned and free of dirt, moisture, oil, and other foreign material, apply primer purple in color in accordance with ASTM F656. Primer shall be applied until the surface of the pipe and fitting is softened. Solvent cements in accordance with ASTM D2564 shall be applied to all joint surfaces. Joints shall be made while both the inside socket surface and outside surface of pipe are wet with solvent cement. Hold joint in place and undisturbed for 1 minute after assembly.

(3) Threads shall comply with ASME B1.20.1. A minimum of Schedule 80 shall be permitted to be threaded; however, the pressure rating shall be reduced by 50 percent. The use of molded fittings shall not result in a 50 percent reduction in the pressure rating of the pipe provided that the molded fittings shall be fabricated so that the wall thickness of the material is maintained at the threads. Thread sealant compound that is compatible with the pipe and fitting, insoluble in water, and nontoxic shall be applied to male threads. Caution shall be used during assembly to prevent over tightening of the PVC components once the thread sealant has been applied. Female PVC threaded fittings shall be used with plastic male threads only.

1211.13 Steel Pipe and Tubing. Joints between steel pipe, or tubing, or fittings shall be installed in accordance with one of the following methods:

(1) - (4) (remaining text unchanged)

SUBSTANTIATION:
The proposed modification changes the term "or" to "and" since joints include pipe, tubing, and fittings. Using the term "and" clarifies the intent of the code. UMC Item # 151 (D 113.3) and Item # 152 (E 503.4.7.1.2) also made changes from the term "or" to "and." Furthermore, this will also correlate with the action taken by the USHGC Technical Committee.
SUBMITTER: Lee H Stevens
LH Stevens Constructors LLC

RECOMMENDATION:
Revise text

1214.0 Pressure and Flow Controls.

1214.4 Automatic Makeup Fluid. Where an automatic makeup fluid supply fill device is used to maintain the water content of the heat-source unit, or any closed loop in the system, the makeup supply shall be located at the expansion tank connection or other approved location.

Where an automatic makeup water supply fill device for a closed loop system is supplied by a potable water supply, the fill system shall automatically shut off flow when the supplied makeup water volume exceeds the greater of 5 gallons (19 L) or five percent of the total system fluid volume. A manual reset shall be required.

Where an automatic makeup fluid fill device for a closed loop system is supplied by an isolated tank, the fluid capacity of the tank shall not exceed the greater of 5 gallons (19 L) or 5 percent of the total system fluid volume.

A pressure-reducing valve shall be installed on a makeup water feed line. The pressure of the feed line shall be set in accordance with the design of the system, and connections to potable water shall be in accordance with Section 1202.0 to prevent contamination due to backflow.

SUBSTANTIATION:
Homeowners insurance property losses for water damage (2011-2015) are the second most frequent loss category, and second costliest per claim. Water damage from a leaking hydronic system can include mold damage, structural damage, and may render a building temporarily uninhabitable and or subject to freezing up with additional damage.

An automatic feed valve will maintain water pressure in a hydronic system, but will also continually supply a breached system at a potentially high rate of flow. Particularly if a breach occurs while a structure is unattended, the potential exists for the consequent water damage to far exceed the actual damage to the hydronic system.

As building codes and industry practices have evolved in recent decades, largely pushed by the mandates of energy codes, hydronic systems have become more susceptible to damage and leakage.

1. Setback thermostats, along with houses being left unattended, increase the risk of freeze-thaw damage.
2. Cast iron boilers have largely been replaced by high-efficiency units with low-mass stainless steel heat exchangers, which are much more subject to corrosion damage due to water quality issues.
3. High efficiency in-floor radiant heating systems inherently have a greater vulnerability to physical damage, such as fastener penetration, than traditional baseboard systems.

A code requirement to limit water release through an automatic feed valve would be a significant step towards addressing consequential damage. This proposal also specifically addresses the trade practice of use of a system feeder, in lieu of an automatic feed valve, for the purpose of limiting water release. A release volume limit as a percentage of total system volume has the intent to address and allow for the usual losses of larger volume systems.

COMMITTEE ACTION: ACCEPT AS AMENDED BY THE TC
Amend proposal as follows:

1214.0 Pressure and Flow Controls.
1214.4 Automatic Makeup Fluid. Where an automatic makeup fluid supply fill device is used to maintain the water-fluid content of the heat-source unit, or any closed loop in the system, the makeup supply shall be located at the expansion tank connection or other approved location.

Where an automatic makeup water supply fill device for a closed loop system is supplied by a potable water supply, the fill system shall automatically shut off flow when the supplied makeup water volume exceeds the greater of 5 gallons (19 L) or five percent of the total system fluid volume. A manual reset shall be required.

Where an automatic makeup fluid fill device for a closed loop system is supplied by an isolated tank, the fluid capacity of the tank shall not exceed the greater of 5 gallons (19 L) or 5 percent of the total system fluid volume.

A pressure-reducing valve shall be installed on a makeup water feed line. The pressure of the feed line shall be set in accordance with the design of the system, and connections to potable water shall be in accordance with Section 1202.0 to prevent contamination due to backflow.

COMMITTEE STATEMENT:
The proposed modification adds changes accepted in Item #115. Furthermore, Item #117 is being accepted in favor of Item #116 as this change applies to water in large and small systems.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 24  NEGATIVE: 1  NOT RETURNED: 1  HOWARD

EXPLANATION OF NEGATIVE:
MACNEVIN: I am concerned that the technology that could be used to satisfy the new language is not readily available in the hydronic market.

Appended Comments

PUBLIC COMMENT 1

Code Year: 2021 UMC  Section #: 1214.4
SUBMITTER: Lance MacNevin
Plastics Pipe Institute

RECOMMENDATION:
Revise text

Request to reject the code change proposal by this public comment.

SUBSTANTIATION:
As currently accepted as amended in the UMC ROP Preprint, Item #117 will force all hydronic systems, from small residential radiant heating systems to large commercial systems in hotels, hospitals, etc. to utilize a series of electronic flow sensors to detect small leaks, to measure the accumulated flow of those leaks over time, and then to automatically shut-off the supply of make-up fluid to the hydronic system when a leak is detected or perceived. There are several concerns about this proposal:

1. In large hydronic systems with a significant volume of fluid (100s to 1000s of gallons), it is not unreasonable that 5 percent of the system volume is entrained air that will be released in the early days and weeks of operation of the system. According to a Taco publication, “Cold water contains dissolved gases such as oxygen, nitrogen, carbon dioxide, and the other gases that constitute air. These gas molecules are dissolved in with the water (H2O) molecules, and thus cannot be seen. A given volume of cold water at a temperature of 50°F and pressure of 50 psi can be up to 10 percent dissolved gas molecules (90 percent H2O, 10 percent gases). As water is heated its ability to retain these gas molecules decreases. The gas molecules coalesce into tiny bubbles along the surface that is heating the water. This is usually the inside surface of the boiler’s heat exchanger. The tiny bubbles eventually merge into visible bubbles and rise upward within the boiler. This mixture of bubbles and liquid water is not desirable for the reasons cited earlier. Hence, it makes sense to “grab” the air bubbles where they are available and eject them from the system as soon as possible.” See https://www.taco-hvac.com/uploads/FileLibrary/AirElimination.pdf.

Existing air elimination devices required by the UMC perform this function – while the air is eliminated, make-up water or fluid replaces the expelled air. If the theoretical item described in Item #117 was installed, then adequate make-up water of more than 5 percent of system volume would not be allowed into the system, and the hydronic system would fail. Failure includes shutting off (bad) or exploding (very bad).
2. The inclusion of a leak measurement and auto shut-off device or system can create significant safety issues in all affected buildings. This is because with most commercial and residential boilers shutting off the flow of make-up water in the case of a detected leak, or any other reason that tricks the shut-off device into thinking there is a leak, can cause the boiler to malfunction in ways that could result in boiler failure and potential explosion. This is because low water levels in boilers can “boil over” and flash to steam with a tremendous and instantaneous increase in volume, causing pressurized components such as boilers to fail. This can cause grave risk to life and limb of building occupants.

3. The UMC does not require low-water fuel cut-off devices for boilers; see Section 1214.3. However, if a boiler has an (optional) appropriate low-water fuel cut-off control which prevents low-water levels (that could be caused by a small leak) from causing boiler failure, then the boiler would automatically shut-off after a leak of 5 gallons or 5 percent of the system volume is detected. This would deactivate the heating system for the building, possibly allowing freeze-up and damage throughout the building, lack of domestic water, frozen fire protection sprinklers, and even more serious damage in the cause of a health care facility, for instance. Having No Heat on a cold winter day is far more serious than a small water leak.

4. Finally, as far as I’m aware, there are no commercially available leak measurement and auto shut-off devices that would satisfy the new requirements proposed in Item #117 for all types of hydronic systems.

This means that new electro-mechanical devices which can measure the accumulated flow of make-up water (due to air elimination and small leaks over time) must be invented, standardized, codified, certified, and put into production in time for 2021 code implementation, at a cost that would likely add $1000s of dollars to every hydronic system using make-up water. More likely, such devices will not be available for many years, so that hydronic systems will simply not be able to meet the Code. In essence, then the code would severely restrict the use of hydronic systems.

For these reasons, it’s my opinion that item #117 should be stricken from the code. If this is not an option, then I plan to discuss these concerns during Hearing on Public Comments in May 2019, in Denver.
Although a system that automatically shuts off the flow of make-up water when its volume exceeds 5 gallons or 5 percent of the system volume is theoretically a good idea, it is not known if reliable devices exist that can accomplish this requirement, or if such devices meet any consensus standard, or if such devices are certified for this purpose. For these reasons, an Exception is important until further research into such automatic shut-off devices is provided to the TC.

PUBLIC COMMENT 3

Code Year: 2021 UMC  Section #: 1214.4  Item #: 117
SUBMITTER: Lance MacNevin
Plastics Pipe Institute
Comment #: 3

RECOMMENDATION:
Revise text

Request to accept the code change proposal as modified by this public comment.

1214.4 Automatic Makeup Fluid. Where an automatic makeup fluid supply fill device is used to maintain the fluid content of the heat-source unit, or any closed loop in the system, the makeup supply shall be located at the expansion tank connection or other approved location.

Where an automatic makeup water supply fill device for a closed loop system is supplied by a potable water supply, the fill system shall automatically shut off flow when the supplied makeup water volume exceeds the greater of 5 gallons (19 L) or five percent of the total system fluid volume. A manual reset shall be required.

Where an automatic makeup fluid fill device for a closed loop system is supplied by an isolated tank, the fluid capacity of the tank shall not exceed the greater of 5 gallons (19 L) or 5 percent of the total system fluid volume. A pressure-reducing valve shall be installed on a makeup feed line. The pressure of the feed line shall be set in accordance with the design of the system, and connections to potable water shall be in accordance with Section 1202.0 to prevent contamination due to backflow.

1214.4.2 Tank Capacity. Where an automatic makeup fluid fill device for a closed loop system is supplied by an isolated tank, the fluid capacity of the tank shall not exceed the greater of 5 gallons (19 L) or 5 percent of the total system fluid volume.

SUBSTANTIATION:
The new requirements from Item # 117 should be added in their own sub-sections, such as Section 1214.4.2, as they are distinct from the existing text.

A separate proposal was submitted for the proposed new text of Sub-Section 1214.4.1.

PUBLIC COMMENT 4

Code Year: 2021 UMC  Section #: 1214.4  Item #: 117
SUBMITTER: Jeff Matson
Viega LLC
Comment #: 4

RECOMMENDATION:
Revise text

Request to accept the code change proposal as modified by this public comment.

1214.0 Pressure and Flow Controls.

1214.4 Automatic Makeup Fluid. Where an automatic makeup fluid supply fill device is used to maintain the fluid content of the heat-source unit, or any closed loop in the system, the makeup supply shall be located at the expansion tank connection or other approved location.

Where an automatic makeup water supply fill device for a closed loop system is supplied by a potable water supply, the fill system shall automatically shut off flow when the supplied makeup water volume exceeds the greater of 5 gallons (19 L) or five percent of the total system volume. A manual reset shall be required.
Where an automatic makeup fluid fill device for a closed loop system is supplied by an isolated tank, the fluid capacity of the tank shall not exceed the greater of 5 gallons (19 L) or 5 percent of the total system fluid volume.

A pressure-reducing valve shall be installed on a makeup feed line. The pressure of the feed line shall be set in accordance with the design of the system, and connections to potable water shall be in accordance with Section 1202.0 to prevent contamination due to backflow.

**Exception:** Where a manual shutoff valve is provided for makeup water supply line(s) and remains closed while unattended, an automatic shutoff shall not be required.

**SUBSTANTIATION:**
Products which fulfill the intent of the proposed text (to automatically limit system fill due to leaks) are not currently readily available in the US, thus the proposal may unduly complicate or limit hydronic installations. This is a good goal for the industry to work toward, and adding an exception for fill lines with closed valves allows currently available fill valves to be installed until such time as automatic limiting fill valves are more readily available.
Proposal

Item #: 119

UMC 2021  Section: 1214.6, 1214.7

SUBMITTER:  Lance MacNevin, P.Eng.
Plastic Pipe Institute

RECOMMENDATION:
Revise text

1214.0 Pressure and Flow Controls.

1214.6 Air-Removal Device. Provision shall be made for the removal of air in the heat distribution piping system from fluid in hydronic systems. Air-removal devices shall be located in the areas of the hydronic piping system where air is likely to accumulate. Air-removal devices shall be installed to facilitate their removal for examination, repair, or replacement.

Exception: Drainback type solar thermal systems shall not require an air-removal device.

1214.7 Air-Separation Device. To assist with the removal of entrained air, an air-separation device shall be installed in hydronic systems. The device shall be located in accordance with the manufacturer’s installation instructions or at the point of no mechanically-induced pressure change within the distribution hydronic system.

SUBSTANTIATION:
The proposed modification clarifies that the air-separation device are required for hydronic systems. Furthermore, this will correlate with the action taken by the USEHC Technical Committee.

COMMITTEE ACTION: ACCEPT AS SUBMITTED

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 25  NOT RETURNED: 1  HOWARD

Appended Comments

PUBLIC COMMENT 1

Code Year: 2021 UMC  Section #: 1214.6  
SUBMITTER: David Dias  
Sheet Metal Workers Local 104

RECOMMENDATION:
Delete text

Request to accept the code change proposal as modified by this public comment.

1214.6 Air-Removal Device. Provisions shall be made for the removal of air from fluid in hydronic systems. Air-removal devices shall be located in the areas of the hydronic piping system where air is likely to accumulate. Air-removal devices shall be installed to facilitate their removal for examination, repair, or replacement.

Exception: Drainback type solar thermal systems shall not require an air-removal device.
SUBSTANTIATION:
Section 1214.6 is being further modified to clarify that Chapter 12 does not apply to solar thermal systems, therefore the exception referencing solar thermal systems is unnecessary and creates confusion. Solar provisions are already covered in Chapter 15 of the UMC and in the USHGC.
Item #: 127

UMC 2021  Section: 1220.2

SUBMITTER: Lance MacNevin, P.Eng.
Plastic Pipe Institute

RECOMMENDATION:
Revise text

1220.0 Auxiliary Systems.

1220.2 Snow and Ice Melt Controls. An automatic th{}ermos{}tat{}ically operating control device that controls the supply hydronic solution fluid temperature to the snow and ice melt area shall be installed in the system. A means shall be provided to prevent low return hydronic fluid temperature in accordance with Section 1201.5. Snow and ice melt systems shall be protected from freezing with a mixture of propylene glycol or ethylene glycol, and water, or other approved fluid. Automotive antifreeze shall not be used.

SUBSTANTIATION:
The term “solution” has been changed to “fluid” for consistency with other sections. The reference to ethylene glycol is being removed as the use of ethylene glycol is highly regulated by local jurisdictions for health and safety reasons. Lastly, the modification to Section 1220.2 will correlate with the action taken by the USEHC Technical Committee. The title is being revise to “snow melt” to be consistent with technology used throughout the code.

COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
The proposed change is not necessary and the current language is needed for enforcement of the code by the AHJ.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS:  AFFIRMATIVE: 24  NEGATIVE: 1  NOT RETURNED: 1  HOWARD

EXPLANATION OF NEGATIVE:
MACNEVIN: The proposed language would improve the code by protecting boilers against low return temperatures, allowing electronic mixing valves, and eliminating toxic ethylene glycol.

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Appended Comments

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PUBLIC COMMENT 1

Code Year: 2021 UMC  Section #: 1220.4  Item #: 127

SUBMITTER: Lance MacNevin, P.Eng.
Plastic Pipe Institute

RECOMMENDATION:
Revise text

Request to accept the code change proposal as submitted by this public comment.
SUBSTANTIATION:
The term “solution” has been changed to “fluid” for consistency with other sections. The reference to ethylene glycol is being removed as the use of ethylene glycol is highly regulated by local jurisdictions for health and safety reasons. Lastly, the modification to Section 1220.4 will correlate with the action taken by the USHGC Technical Committee.
Item #: 133
UMC 2021  Section: 1221.2

SUBMITTER: Lance MacNevin
Plastics Pipe Institute

RECOMMENDATION:
Revise text

1221.0 Piping Installation.

1221.2 Embedded Piping Materials and Joints. Piping embedded in concrete shall be steel pipe, Type L copper tubing or plastic pipe or tubing rated at not less than 80 psi at 180°F (551 kPa at 82°C). Joints of pipe or tubing that are embedded in a portion of the building, such as concrete or plaster shall be installed in accordance with the requirements of Section 1221.2.1 through Section 1221.2.3.

SUBSTANTIATION:
A pressure rating of 100 psi at 180°F is not necessary for hydronic applications, particularly when the tubing is embedded in concrete. Hydronic heating systems are typically designed with operating pressures of 12 psi to 20 psi; hydronic expansion tanks are typically factory set to 12 psi. Further, safety relief valves on hot-water boilers are typically set at 30 psi or 50 psi.

Using any pipe or tubing embedded in concrete to convey 180°F fluid is likely to chemically and structurally damage the concrete, since most concrete mixes are rated for exposure to embedded pipes not higher than 140°F. So the pressure and temperature required in 1221.2 are extraordinary.

PE-RT tubing listed in Table 1210.1 for HYDRONIC applications is in compliance with ASTM Standard F2623, “Standard Specification for Polyethylene of Raised Temperature (PE-RT) SDR 9 Tubing” which requires a pressure rating of 80 psi at 180°F (551 kPa at 82°C). This proposed change would update section 1221.2 to match the requirements of the products which are permitted to be installed in this manner.

COMMITTEE ACTION: ACCEPT AS SUBMITTED

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS:  AFFIRMATIVE: 25  NOT RETURNED: 1  HOWARD

Appended Comments

PUBLIC COMMENT 1

Code Year: 2021 UMC  Section #: 1205.2  
Item #: 133

SUBMITTER: Pennie L Feehan
Pennie L Feehan Consulting
Rep: Copper Development Association

Comment #: 1

RECOMMENDATION:
Add new text

Request to accept the code change proposal as modified by this public comment.
1205.2 Pressure Testing. System piping and components shall be tested with a pressure of not less than one and one-half times the operating pressure but not less than 100 psi (689 kPa). Piping shall be tested with water or air except that plastic pipe shall not be tested with air. Test pressures shall be held for a period of not less than 30 minutes with no perceptible drop in pressure. These tests shall be made in the presence of the Authority Having Jurisdiction.

Exceptions:

(1) For PEX, PP-R, PP-RCT, PEX-AL-PEX, PE-RT, and PE-AL-PE piping systems, testing with air shall be permitted where authorized by the manufacturer’s instructions for the PEX, PP-R, PP-RCT, PEX-AL-PEX, PE-RT, and PE-ALPE pipe and fittings products, and air testing is not prohibited by applicable codes, laws, or regulations outside this code.

(2) Copper tubing shall be permitted to be tested at not less than 80 psi (552 kPa).

SUBSTANTIATION:

Based on the action taken on Item #133, Section 1205.2 now conflicts with Section 1221.2 as they state conflicting pressure ratings; Section 1205.2 states 100 psi and Section 1221.2 states 80 psi. Section 1221.2 is applicable to copper. I am adding an exception note to Section 1205.2 for copper. Therefore, copper will be allowed to be tested at not less than 80 psi in accordance with Section 1205.2 and PE-RT will be required to be pressure tested at no less than 100 psi in accordance with Section 1221.2. This will remove any confusion or contradictions regarding pressure testing requirements between Section 1205.2 and Section 1221.2.
Item #: 134

UMC 2021  Section: 1221.2.3

SUBMITTER: Lance MacNevin, P.Eng.
Plastic Pipe Institute

RECOMMENDATION:
Revise text
Request to replace the code change proposal by this public comment.

1221.0 Piping Installation.

1221.2 Embedded Piping Materials and Joints. (remaining text unchanged)

1221.2.3 Plastics. Plastic pipe and tubing shall be installed in continuous lengths or shall be joined by heat fusion methods, solvent cement joints, or other approved fittings in accordance with Table 1210.1 and the manufacturer's installation instructions.

SUBSTANTIATION:
Heat fusion is applicable only to certain materials such as PP, PE-RT, or PE. For common hydronic materials such as CPVC, PEX and PE-RT, the ability to use embedded fittings when necessary is important, as fittings might be required to repair pipe that was damaged during construction. Many fittings for plastic tubing have been approved for use in other codes for years, and have been successfully installed in embedded applications for decades. Manufacturers of CPVC, PEX and PE-RT tubing and fittings systems want the ability to recommend use of their fittings in limited embedded applications when necessary. Examples of such fittings are those covered by existing ASTM standards D2846, F877, F1807, F1960, F2080, F2159, F2434, and F2735. In fact, each of these fitting systems are already included in Table 408.1. When manufacturers approve the use of such fittings for embedded applications, this code should not prohibit that use. The added reference to Table 408.1 ensures that only approved fittings for each type of pipe or tubing are eligible for this type of installation. Please see PPI Position Paper on Installation of PEX Fittings Within and Under Concrete Slabs at this link: http://www.plasticpipe.org/pdf/position-paper-pex-fitting-locations.pdf and PPI Position Paper on Installation of CPVC Fittings Within and Under Concrete Slabs at this link: https://plasticpipe.org/pdf/position-paper-cpvc-fitting-locations.pdf

Furthermore, the revision to Section 1221.2.3 will correlate with the action taken by the USEHC Technical Committee.

COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
The proposed change is being rejected as the language would allow joints under slabs. The TC does not agree that joints can be under slab except for heat fusion methods.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 24  NEGATIVE: 1  NOT RETURNED: 1  HOWARD

EXPLANATION OF NEGATIVE:
MACNEVIN: The submitted language is technically appropriate and should be added to this section.

Appended Comments
PUBLIC COMMENT 1

Code Year: 2021 UMC  Section #: 1221.2.3  Item #: 134
SUBMITTER: David Nickelson  REHAU Construction LLC  Comment #: 1

RECOMMENDATION:
Revise text

Request to replace the code change proposal by this public comment.

1221.0 Piping Installation.

1221.2 Embedded Piping Materials and Joints. (remaining text unchanged)

1221.2.3 Plastics. Plastic pipe and tubing shall be installed in continuous lengths or shall be joined by heat fusion methods or other approved fittings in accordance with Table 1210.1 and the manufacturer's installation instructions.

SUBSTANTIATION:
Heat fusion (three types) is applicable only to plastic piping materials PP, PE-RT, and PE. For the common hydronic radiant tubing materials PEX and PE-RT, the ability to use embedded fittings when necessary is important when fittings are required to repair pipe that was damaged during construction. Several types of fittings for PEX and PE-RT plastic tubing have been successfully installed in embedded applications for decades. Examples of such fittings are those covered by existing ASTM standards F877, F1807, F1960, F2080, F2159, F2434, and F2735; each of these fitting systems are already included in Table 1210.1. None of those fitting standards restrict the use of the fitting to non-embedded applications. The reference to Table 1210.1 within the proposal ensures that only approved fittings for each type of pipe or tubing are eligible for this type of installation.

Manufacturers of PEX and PE-RT tubing and fittings systems recommend the use of their fittings in limited embedded applications when necessary. When manufacturers approve the use of such fittings for embedded applications, this code should not prohibit that use.

Please see “PPI Position Paper on Installation of PEX Fittings Within and Under Concrete Slabs” at this link: https://plasticpipe.org/pdf/postion-paper-pex-fitting-locations.pdf

Furthermore, this proposed revision to Section 1221.2.3 will correlate with the action taken by the USHGC Technical Committee.
Item #: 142

UMC 2021 Section: 1312.6

SUBMITTER: Paul Cabot
American Gas Association

RECOMMENDATION:
Revise text

Request to replace the code change proposal by this public comment.

1312.0 Appliance Connections to Building Piping.

1312.6 Appliance Shutoff Valves and Connections. Each appliance connected to a piping system shall have an accessible, approved manual shutoff valve with a nondisplaceable valve member, or a listed gas convenience outlet. Appliance shutoff valves and convenience outlets shall serve a single appliance only. The shutoff valve shall be located within 6 feet (1829 mm) of the appliance it serves. Where a connector is used, the valve shall be installed upstream of the connector. A union or flanged connection shall be provided downstream from the valve to permit removal of appliance controls. Shutoff valves serving decorative appliances shall be permitted to be installed in fireplaces if listed for such use. [NFPA 54:9.6.5, 9.6.5.1(A)(B)]

Exceptions:
(1) Shutoff valves shall be permitted to be accessibly located inside or under an appliance where such appliance is removed without removal of the shutoff valve.
(2) Shutoff valves shall be permitted to be accessibly located inside wall heaters and wall furnaces listed for recessed installation where necessary maintenance is performed without removal of the shutoff valve.
(3) Where installed at a manifold, the appliance shutoff valve shall be located within 50 feet (15 240 mm) of the appliance served and shall be readily accessible and permanently identified. The piping from the manifold to within 6 feet (1829 mm) of the appliance shall be designed, sized, installed, and tested in accordance with Chapter 12. [NFPA 54:9.6.5.3]

SUBSTANTIATION:
The UPC does not contain the option that allows shutoff valves to be located at a manifold up to 50 ft away from the appliance it serves. The proposed text is taken from the 2018 National Fuel Gas Code. This option is a long standing option in the NFGC and does not prohibit the installation of a shutoff valve near the appliance if the installer wishes to do so for convenience of testing or service.

COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
The proposed text is being rejected as it allows a valve to be installed near a fireplace. Furthermore, it would conflict with Section 1312.6 in regards to the piping within 6 feet of the appliance.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 25 NOT RETURNED: 1 HOWARD

Appended Comments

PUBLIC COMMENT 1

Code Year: 2021 UMC Section #: 1312.6
SUBMITTER: Paul Cabot  
American Gas Association

RECOMMENDATION:
Revise text

Request to replace the code change proposal by this public comment.

1312.6 Appliance Shutoff Valves and Connections. Each appliance connected to a piping system shall have an accessible, approved manual shutoff valve with a nondisplaceable valve member or a listed gas convenience outlet. Appliance shutoff valves and convenience outlets shall serve a single appliance only. The shutoff valve shall be located within 6 feet (1829 mm) of the appliance it serves. Where a connector is used, the valve shall be installed upstream of the connector. A union or flanged connection shall be provided downstream from the valve to permit removal of appliance controls.

Exceptions:
1. Shutoff valves serving decorative appliances in a fire-place shall not be located within the fireplace firebox except where the valve is listed for such use.
2. Shutoff valves shall be permitted to be accessibly located inside wall heaters and wall furnaces listed for recessed installation where necessary maintenance is performed without removal of the shutoff valve.
3. Where installed at a manifold, the appliance shutoff valve shall be located within 50 feet (15240 mm) of the appliance served and shall be readily accessible and permanently identified. The piping from the manifold to within 6 feet (1829 mm) of the appliance shall be designed, sized, installed, and tested in accordance with this chapter. [NFPA 54:9.6.5.3]

SUBSTANTIATION:
Reconsider the decision to reject this proposal. The committee reason does not state what health and safety concern would result from adoption of the exception. The National Fuel Gas Code, NFPA 54/Z223.1, has long allowed this installation and no evidence of a safety concern has been brought to the committee. The UMC does not contain the option that allows shutoff valves to be located at a manifold up to 50 ft away from the appliance it serves. The proposed text is taken from the 2018 National Fuel Gas Code. This option is a long-standing option in the NFGC and does not prohibit the installation of a shutoff valve near the appliance if the installer wishes to do so for convenience of testing or service.
Item #: 143
UMC 2021 Section: 1313.3

SUBMITTER: Paul Cabot
American Gas Association

RECOMMENDATION:
Revise text

1313.0 Pressure Testing and Inspection.

1313.3 Test Pressure. The necessary apparatus for conducting pressure tests shall be furnished by the permit holder. Test gauges used in conducting pressure tests shall be in accordance with Section 318.0. This inspection shall include an air, CO₂, or nitrogen pressure test in the presence of the Authority Having Jurisdiction, at which time the gas piping shall stand a pressure of in accordance with Section 1313.3.1 or Section 1313.3.2.

1313.3.1 Pressure Limits. The test pressure to be used shall be no less than 1½ times the proposed maximum working pressure, but not less than 3 psi (21 kPa), irrespective of design pressure. Where the test pressure exceeds 125 psi (862 kPa), the test pressure shall not exceed a value that produces a hoop stress in the piping greater than 50 percent of the specified minimum yield strength of the pipe. [NFPA 54: 8.1.4.2]

1313.3.2 Elevated Pressure Test. Where the Authority Having Jurisdiction requires an elevated pressure test, the pressure shall be not less than 10 psi (69 kPa) gauge pressure. Test pressures shall be held for a length of time satisfactory to the Authority Having Jurisdiction but in no case less than 15 minutes with no perceptible drop in pressure. For welded piping, and for piping carrying gas at pressures in excess of 14 inches water column pressure (3.5 kPa), the test pressure shall be not less than 60 psi (414 kPa) and shall be continued for a length of time satisfactory to the Authority Having Jurisdiction, but in no case for less than 30 minutes. For CSST carrying gas pressures in excess of 14 inches water column (3.5 kPa) pressure, the test pressure shall be not less than 30 psi (207 kPa) for 30 minutes. These tests shall be made using air, CO₂, or nitrogen pressure and shall be made in the presence of the Authority Having Jurisdiction. Necessary apparatus for conducting tests shall be furnished by the permit holder. Test gauges used in conducting tests shall be in accordance with Section 318.0.

SUBSTANTIATION:
The proposal would permit the use of the pressure test criteria contain in the 2018 National Fuel Gas Code while continuing to allow the current UPC pressure test criteria when it is determined by the AHJ that an elevated pressure test is need for a particular piping installation. The NFGC test criteria has been successfully used for over 40 years and is widely used in the U.S.

COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
The proposed text is being rejected as this would reduce the test pressure requirements and will cause confusion in regards to enforcement of pressure testing and inspection.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 25 NOT RETURNED: 1 HOWARD

Appended Comments

PUBLIC COMMENT 1
RECOMMENDATION:
Revise text

Request to accept the code change proposal as submitted by this public comment.

SUBSTANTIATION:
Reconsider the rejection of this proposal. The committee reason states that the optional pressure test would cause enforcement confusion. The UMC and UPC has a long history of requiring some installation practices only with the permission of the AHJ.

The minimum 3 psi test pressure has long been allowed by the National Fuel Gas Code, NFPA 54/Z223.1 and has proven to provide a safe pressure to test gas piping. The proposal would permit the use of the pressure test criteria contain in the 2018 National Fuel Gas Code while continuing to allow the current UPC pressure test criteria when it is determined by the AHJ that an elevated pressure test is need for a particular piping installation. The NFGC test criteria has been successfully used for over 40 years and is widely used in the U.S.
1302.0 Coverage of Piping System.

1302.3 Applications. This code shall not apply to the following items (reference standards for some of which appear in Chapter 17):

1. Portable LP-Gas appliances and equipment of all types that are not connected to a fixed fuel piping system.
2. Installation of appliances such as brooders, dehydrators, dryers, and irrigation equipment used for agricultural purposes.
3. Raw material (feedstock) applications except for piping to special atmosphere generators.
4. Oxygen-fuel gas cutting and welding systems.
5. Industrial gas applications using such gases as acetylene and acetylenic compounds, hydrogen, ammonia, carbon monoxide, oxygen, and nitrogen.
6. Petroleum refineries, pipeline compressor or pumping stations, loading terminals, compounding plants, refinery tank farms, and natural gas processing plants.
7. Large integrated chemical plants or portions of such plants where flammable or combustible liquids or gases are produced by chemical reactions or used in chemical reactions.
8. LP-Gas installations at utility gas plants.
10. Fuel gas piping in electric utility power plants.
11. Proprietary items of equipment, apparatus, or instruments such as gas-generating sets, compressors, and calorimeters.
12. LP-Gas equipment for vaporization, gas mixing, and gas manufacturing.
13. LP-Gas piping for buildings under construction or renovations that is not to become part of the permanent building piping system—that is, temporary fixed piping for building heat.
15. Installation of LP-Gas and compressed natural gas (CNG) systems on vehicles.
16. Gas piping, meters, gas-pressure regulators, and other appurtenances used by the serving gas supplier in distribution of gas, other than undiluted LP-Gas.
17. Building design and construction, except as specified herein.
18. Fuel gas systems on recreational vehicles manufactured in accordance with NFPA 1192.
20. Construction of appliances. [NFPA 54:1.1.1.2]

1308.0 Gas Piping System Design, Materials, and Components.

1308.1.1 Addition to Existing System. When additional appliances are being connected to a gas piping system, the existing piping shall be checked to determine whether it has adequate capacity. If the capacity of the system is determined to be inadequate for the additional appliances, the existing system shall be enlarged as required, or separate gas piping of adequate capacity shall be provided. [NFPA 54:5.1.2—5.1.2.2]

1308.4 Sizing of Gas Piping Systems. Gas piping systems shall be of such size and so installed as to provide a supply of gas sufficient to meet the maximum demand and supply gas to each appliance inlet at not less than the minimum supply pressure required by the appliance. [NFPA 54:5.4.1]
1308.4.2 Sizing Methods. Gas piping shall be sized in accordance with one of the following:
(1) Pipe sizing tables or sizing equations in this chapter.
(2) Other approved engineering methods acceptable to the Authority Having Jurisdiction.
(3) Sizing tables included in a listed piping system manufacturer’s installation instructions. [NFPA 54:5.4.3]

1308.5.2.1 Steel, Stainless Steel, and Wrought Iron. Steel, stainless steel, and wrought-iron pipe shall be at least not less than standard weight (Schedule 40) and shall comply with the dimensional standards of ASME B36.10M and one of the following standards:
(1) ASME B36.10M ASTM A53
(2) ASTM A53M ASTM A106
(3) ASTM A106M ASTM A312 [NFPA 54:5.6.2.2]

1308.5.3 Metallic Tubing. Seamless copper, aluminum alloy, or steel tubing shall not be used with gases corrosive to such the tubing material. [NFPA 54:5.6.3.1]

1308.5.3.1 Stainless Steel. Stainless steel tubing shall comply with one of the following:
(1) ASTM A268
(2) ASTM A269 [NFPA 54:5.6.3.3]

1308.5.4 Plastic Pipe, Tubing, and Fittings. Polyethylene plastic pipe, tubing, and fittings used to supply fuel gas shall conform to ASTM D2513. Pipe to be used shall be marked “gas” and “ASTM D2513.” [NFPA 54:5.6.4.1.1] Polyamide pipe, tubing, and fittings shall be identified in and conform to ASTM F2945. Pipe to be used shall be marked “gas” and “ASTM F2945.” [NFPA 54:5.6.4.1.2] Polyvinyl chloride (PVC) and chlorinated polyvinyl chloride (CPVC) plastic pipe, tubing, and fittings shall not be used to supply fuel gas. [NFPA 54:5.6.4.1.3]

1308.5.6 Protective Coating. Where in contact with material or atmosphere exerting a corrosive action, metallic piping and fittings coated with a corrosion-resistant material shall be used. External or internal coatings or linings used on piping or components shall not be considered as adding strength. [NFPA 54:5.6.6]

1308.5.8.2 Tubing Joints. Tubing Schedule 40 and heavier pipe joints shall either be made threaded, flanged, brazed, welded, or assembled with approved gas tubing press-connect fittings, listed to ANSI CSA LC 4/CSA 6.32.
(1) Pipe lighter than Schedule 40 shall be brazed with a material having connected using press-connect fittings, flanges, brazing, or welding.
(2) Where nonferrous pipe is brazed, the brazing materials shall have a melting point in excess of 1000°F (538°C), or made by press-connect fittings in accordance with CSA LC-4.
(3) Brazing alloys shall not contain more than 0.05 percent phosphorus. [NFPA 54:5.6.8.27.1]

1308.5.8.3 Copper Tubing Joints. Copper tubing joints shall be assembled with approved gas tubing fittings, shall be brazed with a material having a melting point in excess of 1000°F (538°C), or shall be assembled with press-connect fittings listed to ANSI LC 4/CSA 6.32, Press-Connect Metallic Fittings for Use in Fuel Gas Distribution Systems. Brazing alloys shall not contain more than 0.05 percent phosphorus. [NFPA 54:5.6.7.2]

1308.5.8.4 Stainless Steel Tubing Joints. Stainless steel joints shall be welded, assembled with approved tubing fittings, brazed with a material having a melting point in excess of 1000°F (538°C), or assembled with press-connect fittings listed to ANSI LC 4/CSA 6.32, Press-Connect Metallic Fittings for Use in Fuel Gas Distribution Systems. Brazing alloys and fluxes shall be recommended by the manufacturer for use on stainless steel alloys. [NFPA 54:5.6.7.3]

1308.7 Gas Pressure Regulators. A line pressure regulator or gas appliance pressure regulator, as applicable, shall be installed where the gas supply pressure is higher than that at which the branch supply line or appliance is designed to operate or vary beyond design pressure limits exceeds the maximum allowable inlet pressure of the appliance served. [NFPA 54:5.8.1]

1308.7.1 Listing. Line pressure regulators shall be listed in accordance with CSA Z21.80 where the outlet pressure is set to 2 psi or less. [NFPA 54:5.8.2]

1308.7.6 Discharge of Vents. The discharge of vents shall be in accordance with the following:
1) The discharge stacks, vents, or outlet parts of all pressure-relieving and pressure-limiting devices shall be located so that gas is safely discharged to the outdoors. 2) Discharge stacks or vents shall be designed to prevent the entry of water, insects, or other...
foreign material that could cause blockage. The discharge stack or vent line shall be at least the same size as the outlet of the pressure-relieving device. [NFPA 54:5.9.8.1, 5.9.8.2]

1308.10 Overpressure Protection Devices. Overpressure protection devices shall be one of the following:
(1) Pressure relief valve.
(2) Monitor regulator.
(3) Series regulator installed upstream from the line regulator and set to continuously limit the pressure on the inlet of the line regulator to the maximum values specified by Section 1308.9 or less.
(4) Automatic shutoff device installed in series with the line pressure regulator and set to shut off when the pressure on the downstream piping system reaches the maximum values specified by Section 1308.9 or less. This device shall be designed so that it will remain closed until manually reset. [NFPA 54:5.9.3.1]

1308.10.1 Separate Devices. The devices in Section 1308.10 shall be installed either as an integral part of the service or line pressure regulator or as separate units. Where separate overpressure protection devices are installed, they shall comply with Section 1308.10.2 through Section 1308.10.7. [NFPA 54:5.9.3.2]

1308.10.2 Construction and Installation. All overpressure protection devices shall meet the following requirements:
(1) Be constructed of materials so that the operation of the device is not impaired by corrosion of external parts by the atmosphere or of internal parts by the gas.
(2) Be designed and installed so they can be operated to determine whether the valve is free. The devices shall also be designed and installed so they can be tested to determine the pressure at which they operate and be examined for leakage when in the closed position. [NFPA 54:5.9.4]

1308.10.3 External Control Piping. External control piping shall be designed and installed so that damage to the control piping of one device does not render both the regulator and the overpressure protective device inoperative. [NFPA 54:5.9.5]

1308.10.4 Setting. Each pressure limiting or pressure relieving device shall be set so that the gas pressure supplied to the connected appliance(s) does not exceed the limits specified in Section 1308.9 and Section 1308.9.1. [NFPA 54:5.9.6]

1308.10.5 Unauthorized Operation. Where unauthorized operation of any shutoff valve could render a pressure relieving valve or pressure limiting device inoperative, one of the following shall be accomplished:
(1) The valve shall be locked in the open position. Instruct authorized personnel in the importance of leaving the shutoff valve open and of being present while the shutoff valve is closed so that it can be locked in the open position before leaving the premises.
(2) Duplicate relief valves shall be installed, each having adequate capacity to protect the system, and arrange the isolating valves or three-way valve so that only one relief valve can be rendered inoperative at a time. [NFPA 54:5.9.7]

1308.7.6 1308.10.6 Discharge of Vents. (remaining text unchanged)

1308.10.7 Size of Fittings, Pipe, and Openings. The fittings, pipe, and openings located between the system to be protected and the pressure relieving device shall be sized to prevent hammering of the valve and to prevent impairment of relief capacity. [NFPA 54:5.9.9]

(renumber remaining sections)

1310.0 Gas Piping Installation.
1310.1 Piping Underground. Underground gas piping shall be installed with approved sufficient clearance from any other underground structure to avoid contact therewith, to allow maintenance, and to protect against damage from proximity to other structures. In addition, underground plastic piping shall be installed with approved sufficient clearance or shall be insulated from any source of heat so as to prevent the heat from impairing the serviceability of the pipe. [NFPA 54:7.1.1.1]

1310.2 CSST Piping Systems. CSST piping systems shall be installed in accordance with this code and the manufacturer's installation instructions. [NFPA 54:7.1.8]

1310.3 Installation of Piping. (remaining text unchanged)
1310.3.1 Protective Coating. Where piping is in contact with a material or an atmosphere corrosive to the piping system, the piping and fittings shall be coated with a corrosion-resistant material. Any such coating used on piping or components shall not be considered as adding strength to the system. [NFPA 54:7.2.2]

(renumber remaining sections)

1310.4 Hangers, Supports, and Anchors. Piping shall be supported with metal pipe hooks, metal pipe straps, metal bands, metal brackets, metal hangers, or building structural components, approved suitable for the size of piping, of adequate strength and quality, and located at intervals so as to prevent or damp out excessive vibration. Piping shall be anchored to prevent undue strains on connected appliances and equipment and shall not be supported by other piping. Pipe hangers and supports shall conform to the requirements of MSS SP-58. [NFPA 54:7.2.56.1]

1310.5 Maximum Design Operating Pressure. The maximum design operating pressure for any piping systems located inside buildings shall not exceed 5 psi (34 kPa) unless one or more of the following conditions are met:
The piping system is joints are welded or brazed. The piping joints are flanged and all pipe-to-flange connections are made by welding or brazing. The piping is located in a ventilated chase or otherwise enclosed for protection against accidental gas accumulation. The piping is located inside buildings or separate areas of buildings used exclusively for one of the following:
(a) Industrial processing or heating
(b) Research
(c) Warehousing
(d) Boiler or mechanical rooms
(45) The piping is a temporary installation for buildings under construction.
(46) The piping serves appliances or equipment used for agricultural purposes.
(47) The piping system is an LP-Gas piping system with an operating pressure greater than 20 psi (138 kPa) and complies with NFPA 58. [NFPA 54:5.5.44]

1310.10 Branch Pipe Connection. When a branch outlet is placed on a main supply line before it is known what size pipe will be connected to it, the outlet shall be of the same size as the line that supplies it. [NFPA 54:7.8]

1310.12 Prohibited Devices. No device shall not be placed inside within the interior of gas piping or fittings that reduces where such devices reduce the cross-sectional area or otherwise obstructs the free flow of gas, except where proper allowance in the piping system design has been made for such a device and where approved by the Authority Having Jurisdiction. [NFPA 54:7.109]

1311.0 Electrical Bonding and Grounding.

1311.2 Bonding of CSST Gas Piping. CSST gas piping systems, and gas piping systems containing one or more segments of CSST, shall be electrically continuous and bonded to the electrical service grounding electrode system or, where provided, lightning protection grounding electrode system. [NFPA 54:7.132.2]

1311.2.3 Bonding Jumper Length. The length of the jumper between the connection to the gas piping system and the grounding electrode system shall not exceed 75 feet (22 860 mm). Any additional grounding electrodes installed to meet this requirement shall be bonded to the electrical service grounding electrode system or, where provided, lightning protection grounding electrode system. [NFPA 54:7.132.2.3]

1311.3 Arc-Resistant Jacketed CSST. CSST listed with an arc-resistant jacket or coating system in accordance with ANSI LC 1/ CSA 6.26 shall be electrically continuous and bonded to an effective ground fault current path. Where any CSST component of a piping system does not have an arc-resistant jacket or coating system, the bonding requirements of 1311.2 shall apply. Arc-resistant jacketed CSST shall be considered to be bonded when it is connected to appliances that are connected to the appliance grounding conductor of the circuit supplying that appliance. [NFPA 54:7.12.3]

1312.0 Appliance Connections to Building Piping.
1312.1 Connecting Appliances and Equipment. Appliances and equipment shall be connected to the building piping in compliance with Section 1312.6 through Section 1312.8 by one of the following:
(1) - (4) (remaining text unchanged)
(5) CSST where installed in accordance with the manufacturer’s installation instructions. CSST shall connect only to appliances that are fixed in place.
(6) Listed nonmetallic gas hose connectors in accordance with Section 1312.3.
(7) Unlisted gas hose connectors for use in laboratories and educational facilities in accordance with Section 1212.4. [NFPA 54:9.6.1]

1312.9 Sediment Trap. Where a sediment trap is not incorporated as a part of the appliance, a sediment trap shall be installed downstream of the appliance shutoff valve as close to the inlet of the appliance as practical, but before the flex connector, where used at the time of appliance installation. The sediment trap shall be either a tee fitting with a capped nipple in the bottom outlet, as illustrated in Figure 1312.9, or another device recognized as an effective sediment trap. Illuminating appliances, gas ranges, clothes dryers, decorative appliances for installation in vented fireplaces, gas fireplaces, and outdoor grills cooking appliances shall not be required to be so equipped. [NFPA 54:9.6.8]

1313.0 Pressure Testing and Inspections.

1313.1.6 Test Medium. The test medium shall be air, nitrogen, carbon dioxide, or an inert gas. Oxygen shall never be used as a test medium. [NFPA 54:8.1.2]

1315.0 Required Gas Piping Size.

1315.2 Tables for Sizing Gas Piping Systems. Table 1315.2(1) through Table 1315.2(36) shall be used to size gas piping in
Section 1315.1.2 Sizing of Gas Piping Systems. Sizing of piping systems shall be in accordance with Section 1315.2.1 for natural gas piping system and Section 1315.2.2 for propane piping systems.

1315.2.1 Natural Gas Piping Systems. Table 1315.2(1) through Table 1315.2(23) shall be used in conjunction with one of the methods described in Section 1315.1.1 through Section 1315.1.3 for piping materials other than non-corrugated stainless steel tubing. Section 1315.3 shall be used in conjunction with one of the methods described in Section 1315.1.1 through Section 1315.1.3 for non-corrugated stainless steel tubing. [NFPA 54:6.2.1, 6.2.2]

1315.2.2 Propane Piping Systems. Table 1315.2(24) through Table 1315.2(36) shall be used in conjunction with one of the methods described in Section 1315.1.1 through Section 1315.1.3 for piping materials other than non-corrugated stainless steel tubing. Section 1315.3 shall be used in conjunction with one of the methods described in Section 1315.1.1 through Section 1315.1.3 for non-corrugated stainless steel tubing. [NFPA 54:6.3.1, 6.3.2]

1315.3 Sizing Equations. The inside diameter of smooth wall pipe or tubing shall be determined by Equation 1315.3(1), Equation 1315.3(2), Table 1315.3, and using the equivalent pipe length determined by the methods in Section 1315.1.1 through Section 1315.1.3. [NFPA 54:6.4]

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### INTENDED USE: INITIAL SUPPLY PRESSURE OF 8.0 INCH WATER COLUMN OR GREATER

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INTENDED USE: INITIAL SUPPLY PRESSURE OF 11.0 INCH WATER COLUMN OR GREATER

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TABLE 1701.1
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</table>

(portion of table not shown remains unchanged)

Note: ASME B36.10M, ASTM A53/A53M, ASTM A106/A106M, ASTM A312/A312M, ASTM A268, ASTM A269, ASTM F2945, CSA LC 1, CSA LC 4a, and NFPA 54/Z223.1 meet the requirements for mandatory reference standards in accordance with Section 3-3.7.1 of IAPMO's Regulations Governing Committee Projects.

### TABLE 1701.2
### STANDARDS, PUBLICATIONS, PRACTICES, AND GUIDES

<table>
<thead>
<tr>
<th>DOCUMENT NUMBER</th>
<th>DOCUMENT TITLE</th>
<th>APPLICATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASTM A312/A312M-2016a</td>
<td>Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes</td>
<td>Piping, Ferrous</td>
</tr>
</tbody>
</table>

SUBSTANTIATION:
In accordance with IAPMO's Regulations Governing Committee Projects (Extract Guidelines), Section Chapter 13 is being revised to the latest edition of NFPA 54-2018.

COMMITTEE ACTION: ACCEPT AS AMENDED BY THE TC

Amend proposal as follows:

1302.0 Coverage of Piping System.

1302.3 Applications. This code shall not apply to the following items:
(1) Portable LP-Gas appliances and equipment of all types that are not connected to a fixed fuel piping system.
(2) Installation of appliances such as brooders, dehydrators, dryers, and irrigation equipment used for agricultural purposes.
(3) Raw material (feedstock) applications except for piping to special atmosphere generators.
(4) Oxygen- fuel gas cutting and welding systems.
(5) Industrial gas applications using such gases as acetylene and acetylenic compounds, hydrogen, ammonia, carbon monoxide, oxygen, and nitrogen.
(6) Petroleum refineries, pipeline compressor or pumping stations, loading terminals, compounding plants, refinery tank farms, and natural gas processing plants.
(7) Large integrated chemical plants or portions of such plants where flammable or combustible liquids or gases are produced by chemical reactions or used in chemical reactions.
(8) LP-Gas installations at utility gas plants.
(9) Liquefied natural gas (LNG) installations.
(10) Fuel gas piping in electric utility power plants.
Proprietary items of equipment, apparatus, or instruments such as gas-generating sets, compressors, and calorimeters.

LP-Gas equipment for vaporization, gas mixing, and gas manufacturing.

LP-Gas piping for buildings under construction or renovations that is not to become part of the permanent building piping system—that is, temporary fixed piping for building heat.

Installation of LP-Gas systems for railroad switch heating.

Installation of LP-Gas and compressed natural gas (CNG) systems on vehicles.

Gas piping, meters, gas-pressure regulators, and other appurtenances used by the serving gas supplier in distribution of gas, other than undiluted LP-Gas.

Building design and construction, except as specified herein.

Fuel gas systems on recreational vehicles manufactured in accordance with NFPA 1192.

Fuel gas systems using hydrogen as a fuel.

Construction of appliances. [NFPA 54:1.1.1.2]

1308.0 Gas Piping System Design, Materials, and Components.

1308.1.1 Addition to Existing System. When additional appliances are being connected to a gas piping system, the existing piping shall be checked to determine whether it has adequate capacity. If the capacity of the system is determined to be inadequate for the additional appliances, the existing system shall be enlarged as required, or separate gas piping of adequate capacity shall be provided. [NFPA 54:5.1.2]

1308.4 Sizing of Gas Piping Systems. Gas piping systems shall be of such size and so installed as to provide a supply of gas sufficient to meet the maximum demand and supply gas to each appliance inlet at not less than the minimum supply pressure required by the appliance. [NFPA 54:5.4.1]

1308.4.2 Sizing Methods. Gas piping shall be sized in accordance with one of the following:

(1) Pipe sizing tables or sizing equations in this chapter.
(2) Other approved engineering methods.
(3) Sizing tables included in a listed piping system manufacturer’s installation instructions. [NFPA 54:5.4.3]

1308.5.2.1 Steel, Stainless Steel, and Wrought Iron. Steel, stainless steel, and wrought-iron pipe shall be at least Schedule 40 and shall comply with the dimensional standards of ASME B36.10M and one of the following:

(1) ASTM A53
(2) ASTM A106
(3) ASTM A312 [NFPA 54:5.6.2.2]

1308.5.3 Metallic Tubing. Tubing shall not be used with gases corrosive to the tubing material. [NFPA 54:5.6.3.1]

1308.5.3.1 Stainless Steel. Stainless steel tubing shall comply with one of the following:

(1) ASTM A268
(2) ASTM A269 [NFPA 54:5.6.3.3]

Plastic Pipe, Tubing, and Fittings. Polyethylene plastic pipe, tubing, and fittings used to supply fuel gas shall conform to ASTM D2513. Pipe to be used shall be marked “gas” and “ASTM D2513.” [NFPA 54:5.6.4.1.1] Polyamide pipe, tubing, and fittings shall be identified in and conform to ASTM F2945. Pipe to be used shall be marked “gas” and “ASTM F2945.” [NFPA 54:5.6.4.1.2] Polyvinyl chloride (PVC) and chlorinated polyvinyl chloride (CPVC) plastic pipe, tubing, and fittings shall not be used to supply fuel gas. [NFPA 54:5.6.4.1.3]

Pipe Joints. Schedule 40 and heavier pipe joints shall be threaded, flanged, brazed, welded, or assembled with press-connect fittings listed to ANSI CSA LC 4/CSA 6.32.

(1) Pipe lighter than Schedule 40 shall be connected using press-connect fittings, flanges, brazing, or welding.
(2) Brazing alloys shall not contain more than 0.05 percent phosphorus. [NFPA 54:5.6.7.1]

1308.5.8.3 Copper Tubing Joints. Copper tubing joints shall be assembled with approved gas tubing fittings, shall be brazed with a material having a melting point in excess of 1000°F (538°C), or shall be assembled with press-connect fittings listed to ANSI LC 4/CSA 6.32, Press-Connect Metallic Fittings for Use in Fuel Gas Distribution Systems. Brazing alloys shall not contain more than 0.05 percent phosphorus. [NFPA 54:5.6.7.2]

1308.5.8.4 Stainless Steel Tubing Joints. Stainless steel joints shall be welded, assembled with approved tubing fittings, brazed with a material having a melting point in excess of 1000°F (538°C), or assembled with press-connect fittings listed to ANSI LC 4/CSA 6.32, Press-Connect Metallic Fittings for Use in Fuel Gas Distribution Systems. Brazing alloys and fluxes shall be recommended by the manufacturer for use on stainless steel alloys. [NFPA 54:5.6.7.3]
1308.5.8.3 Flared Joints. Flared joints shall be used in systems constructed from nonferrous pipe and tubing where experience or tests have demonstrated that the joint is suitable for the conditions and where provisions are made in the design to prevent separation of the joints. [NFPA 54:5.6.7.4]

1308.7 Gas Pressure Regulators. A line pressure regulator shall be installed where the gas supply pressure exceeds the maximum allowable inlet pressure of the appliance served. [NFPA 54:5.8.1]

1308.7.1 Listing. Line pressure regulators shall be listed in accordance with CSA Z21.80 where the outlet pressure is set to 2 psi or less. [NFPA 54:5.8.2]

1308.7.6 Discharge of Vents. The discharge stacks, vents, or outlet parts of all pressure-relieving and pressure-limiting devices shall be located so that gas is safely discharged to the outdoors. Discharge stacks or vents shall be designed to prevent the entry of water, insects, or other foreign material that could cause blockage. The discharge stack or vent line shall be at least the same size as the outlet of the pressure-relieving device. [NFPA 54:5.9.8.1, 5.9.8.2]

1308.10 Overpressure Protection Devices. Overpressure protection devices shall be one of the following:
(1) Pressure relief valve.
(2) Monitor regulator.
(3) Series regulator installed upstream from the line regulator and set to continuously limit the pressure on the inlet of the line regulator to the maximum values specified by Section 1308.9 or less.
(4) Automatic shutoff device installed with the line pressure regulator and set to shut off when the pressure on the downstream piping system reaches the maximum values specified by Section 1308.9 or less. This device shall be designed so that it will remain closed until manually reset. [NFPA 54:5.9.3.1]

1308.10.1 Separate Devices. The devices in Section 1308.10 shall be installed either as an integral part of the service or line pressure regulator or as separate units. Where separate overpressure protection devices are installed, they shall comply with Section 1308.10.2 through Section 1308.10.7. [NFPA 54:5.9.3.2]

1308.10.2 Construction and Installation. All overpressure protection devices shall meet the following requirements:
(1) Be constructed of materials so that the operation of the device is not impaired by corrosion of external parts by the atmosphere or of internal parts by the gas.
(2) Be designed and installed so that they can be operated to determine whether the valve is free. The devices shall also be designed and installed so that they can be tested to determine the pressure at which they operate and be examined for leakage when in the closed position. [NFPA 54:5.9.4]

1308.10.3 External Control Piping. External control piping shall be designed and installed so that damage to the control piping of one device does not render both the regulator and the overpressure protective device inoperative. [NFPA 54:5.9.5]

1308.10.4 Setting. Each pressure limiting or pressure relieving device shall be set so that the gas pressure supplied to the connected appliance(s) does not exceed the limits specified in Section 1308.9 and Section 1308.9.1. [NFPA 54:5.9.6]

1308.10.5 Unauthorized Operation. Where unauthorized operation of any shutoff valve could render a pressure relieving valve or pressure limiting device inoperative, one of the following shall be accomplished:
(1) The valve shall be locked in the open position. Instruct authorized personnel in the importance of leaving the shutoff valve open and of being present while the shutoff valve is closed so that it can be locked in the open position before leaving the premises.
(2) Duplicate relief valves shall be installed, each having adequate capacity to protect the system, and arrange the isolating valves or three-way valve so that only one relief valve can be rendered inoperative at a time. [NFPA 54:5.9.7]

1308.10.6 Discharge of Vents. (remaining text unchanged)

1308.10.7 Size of Fittings, Pipe, and Openings. The fittings, pipe, and openings located between the system to be protected and the pressure relieving device shall be sized to prevent hammering of the valve and to prevent impairment of relief capacity. [NFPA 54:5.9.9]

1310.0 Gas Piping Installation.
1310.1 Piping Underground. Underground gas piping shall be installed with sufficient clearance from any other underground structure to avoid contact therewith, to allow maintenance, and to protect against damage from proximity to other structures. In addition, underground plastic piping shall be installed with sufficient clearance or shall be insulated from any source of heat so as to prevent the heat from impairing the serviceability of the pipe. [NFPA 54:7.1.1]

1310.2 CSST Piping Systems. CSST piping systems shall be installed in accordance with this code and the manufacturer's installation instructions. [NFPA 54:7.1.8]

1310.3 Installation of Piping. (remaining text unchanged)
1310.3.1 Protective Coating. Where piping is in contact with a material or an atmosphere corrosive to the piping system, the piping and fittings shall be coated with a corrosion-resistant material. Any such coating used on piping or components shall not be considered as adding strength to the system. [NFPA 54:7.2.2]

1310.2.4 Hangers, Supports, and Anchors. Piping shall be supported with metal pipe hooks, metal pipe straps, metal bands, metal brackets, metal hangers, or building structural components, suitable for the size of piping, of adequate strength and quality, and located at intervals so as to prevent or damp out excessive vibration. Piping shall be anchored to prevent undue strains on connected appliances and equipment and shall not be supported by other piping. Pipe hangers and supports shall conform to the requirements of MSS SP-58. [NFPA 54:7.2.6.1]

1310.5 Maximum Design Operating Pressure. The maximum operating pressure for any piping systems located inside buildings shall not exceed 5 psi (34 kPa) unless one or more of the following conditions are met:
1. The piping joints are welded or brazed.
2. The piping joints are flanged and all pipe-to-flange connections are made by welding or brazing.
3. The piping is located in a ventilated chase or otherwise enclosed for protection against accidental gas accumulation.
4. The piping is located inside buildings or separate areas of buildings used exclusively for one of the following:
   a. Industrial processing or heating
   b. Research
   c. Warehousing
   d. Boiler or mechanical rooms
5. The piping is a temporary installation for buildings under construction.
6. The piping serves appliances or equipment used for agricultural purposes.
7. The piping system is an LP-Gas piping system with an operating pressure greater than 20 psi (138 kPa) and complies with NFPA 58. [NFPA 54:5.5.4]

1310.12 Prohibited Devices. Devices shall not be placed within the interior of gas piping or fittings where such devices reduce the cross-sectional area or otherwise obstruct the free flow of gas, except where allowance in the piping system design has been made for such devices. [NFPA 54:7.9]

1311.0 Electrical Bonding and Grounding.

1311.2 Bonding of CSST Gas Piping. CSST gas piping systems, and gas piping systems containing one or more segments of CSST, shall be electrically continuous and bonded to the electrical service grounding electrode system or, where provided, lightning protection grounding electrode system. [NFPA 54:7.12.2]

1311.2.3 Bonding Jumper Length. The length of the jumper between the connection to the gas piping system and the grounding electrode system shall not exceed 75 feet (22 860 mm). Any additional grounding electrodes installed to meet this requirement shall be bonded to the electrical service grounding electrode system or, where provided, lightning protection grounding electrode system. [NFPA 54:7.12.2.3]

1311.3 Arc-Resistant Jacketed CSST. CSST listed with an arc-resistant jacket or coating system in accordance with ANSI LC 1/ CSA 6.26 shall be electrically continuous and bonded to an effective ground fault current path. Where any CSST component of a piping system does not have an arc-resistant jacket or coating system, the bonding requirements of 1311.2 shall apply. Arc-resistant jacketed CSST shall be considered to be bonded when it is connected to appliances that are connected to the appliance grounding conductor of the circuit supplying that appliance. [NFPA 54:7.12.3]

1312.0 Appliance Connections to Building Piping.

1312.1 Connecting Appliances and Equipment. Appliances and equipment shall be connected to the building piping in compliance with Section 1312.6 through Section 1312.8 by one of the following:
1. CSST where installed in accordance with the manufacturer’s installation instructions. CSST shall connect only to appliances that are fixed in place.
2. Listed nonmetallic gas hose connectors in accordance with Section 1312.3.
3. Unlisted gas hose connectors for use in laboratories and educational facilities in accordance with Section 1212.4. [NFPA 54:9.6.1]

1312.9 Sediment Trap. Where a sediment trap is not incorporated as a part of the appliance, a sediment trap shall be installed
downstream of the appliance shutoff valve as close to the inlet of the appliance as practical at the time of appliance installation. The sediment trap shall be either a tee fitting with a capped nipple in the bottom outlet, as illustrated in Figure 1312.9, or another device recognized as an effective sediment trap. Illuminating appliances, gas ranges, clothes dryers, decorative appliances for installation in vented fireplaces, gas fireplaces, and outdoor cooking appliances shall not be required to be so equipped. [NFPA 54:9.6.8]

1313.0 Pressure Testing and Inspections.

1313.1.6 Test Medium. The test medium shall be air, nitrogen, carbon dioxide, or an inert gas. Oxygen shall not be used as a test medium. [NFPA 54:8.1.2]

1315.0 Required Gas Piping Size.

1315.2 Sizing of Gas Piping Systems. Sizing of piping systems shall be in accordance with Section 1315.2.1 for natural gas piping system and Section 1315.2.2 for propane piping systems.

1315.2.1 Natural Gas Piping Systems. Table 1315.2(1) through Table 1315.2(23) shall be used in conjunction with one of the methods described in Section 1315.1.1 through Section 1315.1.3 for piping materials other than non-corrugated stainless steel tubing. Section 1315.3 shall be used in conjunction with one of the methods described in Section 1315.1.1 through Section 1315.1.3 for non-corrugated stainless steel tubing. [NFPA 54:6.2.1, 6.2.2]

1315.2.2 Propane Piping Systems. Table 1315.2(24) through Table 1315.2(36) shall be used in conjunction with one of the methods described in Section 1315.1.1 through Section 1315.1.3 for piping materials other than non-corrugated stainless steel tubing. Section 1315.3 shall be used in conjunction with one of the methods described in Section 1315.1.1 through Section 1315.1.3 for non-corrugated stainless steel tubing. [NFPA 54:6.3.1, 6.3.2]

1315.3 Sizing Equations. The inside diameter of smooth wall pipe or tubing shall be determined by Equation 1315.3(1), Equation 1315.3(2), Table 1315.3, and using the equivalent pipe length determined by the methods in Section 1315.1.1 through Section 1315.1.3. [NFPA 54:6.4]

<table>
<thead>
<tr>
<th>TABLE 1315.2(15)</th>
<th>CORRUGATED STAINLESS STEEL TUBING (CSST) [NFPA 54:TABLE 6.2.1(p)]</th>
<th>1, 2</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>GAS: NATURAL</td>
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</tr>
<tr>
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<td>INLET PRESSURE: LESS THAN 2 psi</td>
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<td>PRESSURE DROP: 3.0 in. w.c.</td>
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<tr>
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<td>SPECIFIC GRAVITY: 0.60</td>
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<td>INTENDED USE: INITIAL SUPPLY PRESSURE OF 8.0 INCH WATER COLUMN OR GREATER</td>
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<tr>
<td>FLOW DESIGNATION:</td>
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<td>LENGTH (feet)</td>
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### TABLE 1315.2(16)
CORRUGATED STAINLESS STEEL TUBING (CSST) [NFPA 54:TABLE 6.2.1(a)]

<table>
<thead>
<tr>
<th>TUBE SIZE (EHD)</th>
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<td>PRESSURE DROP:</td>
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<td>SPECIFIC GRAVITY:</td>
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**INTENDED USE: INITIAL SUPPLY PRESSURE OF 11.0 INCH WATER COLUMN OR GREATER**

<table>
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<tr>
<th>FLOW DESIGNATION:</th>
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<tr>
<td></td>
<td>13</td>
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<td>LENGTH (feet)</td>
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(portion of table not shown remains unchanged)

### TABLE 1701.1
REFERENCED STANDARDS

<table>
<thead>
<tr>
<th>STANDARD NUMBER</th>
<th>STANDARD TITLE</th>
<th>APPLICATION</th>
<th>REFERENCED SECTION</th>
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<tbody>
<tr>
<td>ASME B36.10M</td>
<td>Welded and Seamless Wrought Steel Pipe</td>
<td>Fuel Gas Piping</td>
<td>1308.5.2.1</td>
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2015

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<th>Standard Number</th>
<th>Standard Title</th>
<th>Type</th>
<th>Section(s)</th>
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<tr>
<td>ASTM A53/A53M-2012</td>
<td>Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless</td>
<td>Piping</td>
<td>1308.5.2.1(1), Table 1210.1, 1308.5.2.1</td>
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<tr>
<td>ASTM A106/A106M-2015</td>
<td>Seamless Carbon Steel Pipe for High-Temperature Service</td>
<td>Piping</td>
<td>1308.5.2.1(2), Table 1210.1</td>
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<tr>
<td>ASTM A312/A312M-2016a</td>
<td>Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes</td>
<td>Piping, Ferrous</td>
<td>1308.5.2.1</td>
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<tr>
<td>ASTM A268/A268M-2010 (R2016)</td>
<td>Seamless and Welded Ferritic and Martensitic Stainless Steel Tubing for General Service</td>
<td>Tubing</td>
<td>1308.5.3.1</td>
</tr>
<tr>
<td>ASTM A269/A269M-2015a</td>
<td>Seamless and Welded Austenitic Stainless Steel Tubing for General Service</td>
<td>Tubing</td>
<td>1308.5.3.1</td>
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<tr>
<td>ASTM F2945-2015</td>
<td>Polyamide 11 Gas Pressure Pipe, Tubing, and Fittings</td>
<td>Tubing, Fittings</td>
<td>1308.5.4</td>
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<tr>
<td>CSA LC 1-2016</td>
<td>Fuel Gas Piping Systems Using Corrugated Stainless Steel Tubing (same as CSA 6.26)</td>
<td>Fuel Gas</td>
<td>1308.5.3.4, 1311.3</td>
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<td>CSA LC 4a-2013</td>
<td>Press-Connect Metallic Fittings For Use in Fuel Gas Distribution Systems (same as CSA 6.32a)</td>
<td>Fuel Gas</td>
<td>1308.5.8.1, 1308.5.8.2, 1308.5.8.3</td>
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<td>NFPA 54/Z223.1-2015</td>
<td>National Fuel Gas Code</td>
<td>Fuel Gas</td>
<td>516.2.1</td>
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</table>

(portion of table not shown remains unchanged)

**COMMITTEE STATEMENT:**
The modification adds back schedule 40 in favor of schedule 10 for steel pipe.

**TOTAL ELIGIBLE TO VOTE:** 26

**VOTING RESULTS:** AFFIRMATIVE: 24 NEGATIVE: 1 NOT RETURNED: 1 HOWARD

**EXPLANATION OF NEGATIVE:**

**WHITE:** This item should be approved as submitted. Schedule 10 steel pipe has burst strength that exceeds other approved materials, offers reduction in material handling weights, and provides a viable option for installations.

The TCC has the responsibility to resolve conflicts and achieve correlation among the recommendations of the Technical Committee. The TCC has the authority to choose between alternative text recommended by the Technical Committee, but only as necessary for correlation, consistency, and the correction of errors and omissions in accordance with Section 3-4 of the Regulations Governing Committee Projects.

Actions taken on UMC Item # 145, Section 1308.5.8.2 (Pipe Joints), Section 1308.5.8.3 (Copper Tubing Joints), Section 1308.5.8.4 (Stainless Steel Tubing Joints), and Section 1311.3 (Arc-Resistant Jacketed CSST) resulted in conflicting language between UPC Item # 157, Section 1211.3 (Arc-Resistant Jacketed CSST). In order to correlate the language, the Technical Correlating Committee proposed the following modifications to the UMC:

**1308.5.8.2 Pipe Joints.** Schedule 40 and heavier pipe joints shall be threaded, flanged, brazed, welded, or assembled with press-connect fittings listed to ANSI CSA LC 4, CSA 6.32.

1. Where nonferrous pipe is brazed, the brazing materials shall have a melting point in excess of 1000°F (538°C).
2. Brazing alloys shall not contain more than 0.05 percent phosphorus.

**1308.5.8.3 Copper Tubing Joints.** Copper tubing joints shall be assembled with approved gas tubing fittings, shall be brazed with a material having a melting point in excess of 1000°F (538°C), or shall be assembled with press-connect fittings listed to ANSI CSA LC 4, CSA 6.32, Press-Connect Metallic Fittings for Use in Fuel Gas Distribution Systems. Brazing alloys shall not contain more than 0.05 percent phosphorus. [NFPA 54:5.6.7.2]

**1308.5.8.4 Stainless Steel Tubing Joints.** Stainless steel joints shall be welded, assembled with approved tubing fittings,
brazed with a material having a melting point in excess of 1000°F (538°C), or assembled with press-connect fittings listed to ANSI CSA LC 4/CSA 6.32, Press-Connect Metallic Fittings for Use in Fuel Gas Distribution Systems. Brazing alloys and fluxes shall be recommended by the manufacturer for use on stainless steel alloys. [NFPA 54:5.6.7.3]

1311.3 Arc-Resistant Jacketed CSST. CSST listed with an arc-resistant jacket or coating system in accordance with ANSI CSA LC 1/CSA 6.26 shall be electrically continuous and bonded to an effective ground fault current path. Where any CSST component of a piping system does not have an arc-resistant jacket or coating system, the bonding requirements of 1311.2 shall apply. Arc-resistant jacketed CSST shall be considered to be bonded when it is connected to appliances that are connected to the appliance grounding conductor of the circuit supplying that appliance. [NFPA 54:7.12.3]

TCC ACTION: ACCEPT AS SUBMITTED

TCC STATEMENT:
The language in UMC Item # 145, Section 1308.5.8.2 (Pipe Joints), Section 1308.5.8.3 (Copper Tubing Joints), Section 1308.5.8.4 (Stainless Steel Tubing Joints), and Section 1311.3 (Arc-Resistant Jacketed CSST) are being revised to correlate with the language approved by the UPC TC Item # 157, Section 1211.3 (Arc-Resistant Jacketed CSST) with regards to the term "ANSI" not being part of the standard title as referenced throughout the UPC and UMC. Additionally, the references to "ANSI LC 1/CSA 6.26" and "ANSI LC 4/CSA 6.32" are being revised to correlate with the other references to similar standards in the UPC, UMC, and Table 1701.1. These CSA standards are referenced in Table 1701.1 and throughout the codes as "CSA LC 1" and "CSA LC 4."

The action moves forward as approved by the TCC and supersedes the recommendation from the UMC TC for actions taken for Section 1308.5.8.2 (Pipe Joints), Section 1308.5.8.3 (Copper Tubing Joints), Section 1308.5.8.4 (Stainless Steel Tubing Joints), and Section 1311.3 (Arc-Resistant Jacketed CSST) with regard to the standard title reference within the codes.

Append Comment

PUBLIC COMMENT 1

Code Year: 2021 UMC  Section #: Chapter 13  Item #: 145
SUBMITTER: IAPMO Staff - Update Extracts NFPA 54 Extract Update  Comment #: 1

RECOMMENDATION:
Revise text

Request to accept the code change proposal as modified by this public comment.

1308.4.1 Maximum Gas Demand. The volumetric flow rate of gas to be provided shall be the sum of the maximum inputs of the appliances served. The volumetric flow rate of gas to be provided shall be adjusted for altitude where the installation is above 2 000 feet (610 m). [NFPA 54:5.4.2.1 – 5.4.2.2] Where the input rating is not indicated, the gas supplier, appliance manufacturer, or a qualified agency shall be contacted or the rating from Table 1308.4.1 shall be used for estimating the volumetric flow rate of gas to be supplied.
The total connected hourly load shall be used as the basis for piping sizing, assuming all appliances are operating at full capacity simultaneously.
Exception: Sizing shall be permitted to be based upon established load diversity factors. [NFPA 54:5.4.2.3]

1308.5.2.2 Copper and Copper Alloy Pipe. Copper and copper alloy pipe shall not be used where the gas contains more than an average of 0.3 grains of hydrogen sulfide per 100 standard cubic feet (scf) of gas (0.7 mg/100 L). [NFPA 54:5.6.2.2] Threaded copper, copper alloy, or aluminum alloy pipe shall not be used with gases corrosive to such material. [NFPA 54:5.6.2.4]

1308.5.3.3 Copper and Copper Alloy Tubing. Copper and copper alloy tubing shall not be used where the gas contains more than an average of 0.3 grains of hydrogen sulfide per 100 scf of gas (0.7 mg/100 L). Copper tubing shall comply with standard Type K or L of ASTM B88 or ASTM B280. [NFPA 54:5.6.3.4]

1308.5.3.4 Aluminum Alloy Tubing. Aluminum alloy tubing shall comply with ASTM B210 or ASTM B241. Aluminum alloy tubing shall be coated to protect against external corrosion where it is in contact with masonry, plaster, or insulation, or is subject to repeated wettings by such liquids as water, detergent, or sewage. Aluminum alloy tubing shall not be used in exterior locations or
1308.5.4.1 Regulator Vent Piping. Plastic pipe and fittings used to connect regulator vents to remote vent terminations shall be PVC in accordance with conforming to UL 651. PVC vent piping shall not be installed indoors. [NFPA 54:5.6.4.2]

1308.5.4.2.2 Service Head Adapters and Field-Assembled Anodeless Risers. Service head adapters and field assembled anodeless risers incorporating service head adapters shall be recommended by the manufacturer for the gas used and shall be design-certified to be in accordance with meet the requirements of Category I of ASTM D2513 and 49 CFR 192.281(e). The manufacturer shall provide the user qualified installation instructions as prescribed by 49 CFR 192.283(b). [NFPA 54:5.6.4.3(2)]

1308.5.7.4 Flared Joints. Flared joints shall be used only in systems constructed from nonferrous pipe and tubing where experience or tests have demonstrated that the joint is suitable for the conditions and where provisions are made in the design to prevent separation of the joints. [NFPA 54:5.6.7.4]

1308.5.8 Plastic Piping, Joints, and Fittings. Plastic pipe, tubing, and fittings shall be installed joined in accordance with the manufacturer’s installation instructions. Section 1308.5.8.1 through Section 1308.5.8.4 shall be observed when making such joints. [NFPA 54:5.6.8]

1308.5.8.2 Heat-Fusion Joint. Heat-fusion joints shall be made in accordance with qualified procedures that have been established and proven by test to produce gastight joints at least as strong as the pipe or tubing being joined. Joints shall be made with the joining method recommended by the pipe manufacturer. Heat-fusion fittings shall be marked “ASTM D2513.” [NFPA 54:5.6.8(2)]

1308.5.8.3 Compression-Type Mechanical Joints. Where compression-type mechanical joints are used, the gasket material in the fitting shall be compatible with the plastic piping and with the gas distributed by the system. An internal tubular rigid stiffener shall be used in conjunction with the fitting. The stiffener shall be flush with the end of the pipe or tubing and shall extend not less than at least to the outside end of the compression fitting when installed. The stiffener shall be free of rough or sharp edges and shall not be a forced fit in the plastic. Split tubular stiffeners shall not be used. [NFPA 54:5.6.8(3)]

1308.5.10.5 Separated Flanges. When a flanged joint is separated, the gasket shall be replaced. [NFPA 54:5.6.10.4]

1308.7.4 Venting of Line Pressure Regulators. Line pressure regulators shall comply with all of the following:
(1) An independent vent to the exterior of the building, sized in accordance with the regulator manufacturer’s instructions, shall be provided where the location of a regulator is such that a ruptured diaphragm will cause a hazard.
(a) Where more than one regulator is at a location, each regulator shall have a separate vent to the outdoors or, if approved by the Authority Having Jurisdiction, the vent lines shall be permitted to be manifolded in accordance with accepted engineering practices to minimize back pressure in the event of diaphragm failure.
(b) Materials for vent piping shall be in accordance with Section 1308.5 through Section 1308.5.10.5. Exception: A regulator and vent limiting means combination listed as complying with CSA Z21.80 shall be permitted to be used without a vent to the outdoors.
(2) The vent shall be designed to prevent the entry of water, insects, or other foreign materials that could cause blockage.
(3) The regulator vent shall terminate at least 3 feet (914 mm) from a source of ignition.
(4) At locations where regulators might be submerged during floods, a special antiflood-type breather vent fitting shall be installed, or the vent line shall be extended above the height of the expected flood waters.
(5) A regulator shall not be vented to the appliance flue or exhaust system. [NFPA 54:5.8.5.1]

1308.10.6 Discharge of Vents. The discharge stacks, vents, or outlet parts of all pressure-relieving and pressure-limiting devices shall be located so that gas is safely discharged to the outdoors. Discharge stacks or vents shall be designed to prevent the entry of water, insects, or other foreign material that could cause blockage. The discharge stack or vent line shall be at least the same size as the outlet of the pressure relieving device. [NFPA 54:5.9.8.1, 5.9.8.2]

1308.11 Backpressure Protection. Protective devices shall be installed as close to the equipment as practical where the design of the equipment connected is such that air, oxygen, or standby gases are capable of being forced into the gas supply system. Gas and air combustion mixers incorporating double diaphragm “zero” or “atmosphere” governors or regulators shall require no further protection unless connected directly to compressed air or oxygen at pressures of 5 psi (34 kPa) or more. [NFPA 54:5.10.1.1, 5.10.1.2]

1308.11.1 Protective Devices. Protective devices shall include, but not be limited to the following:
(1) Check valves.
(2) Three-way valves (of the type that completely closes one side before starting to open the other side).
(3) Reverse flow indicators controlling positive shutoff valves.
(4) Normally closed air-actuated positive shutoff pressure regulators. [NFPA 54:5.10.2]

1308.12 Low-Pressure Protection. A protective device shall be installed between the meter and the appliance or equipment where it is capable of producing a vacuum or a dangerous reduction in gas pressure at the meter. Such protective devices include, but are not limited to, mechanical, diaphragm-operated, or
electrically operated low-pressure shutoff valves. [NFPA 54:5.11]

1310.8.1 Metallic Pipe. Metallic pipe bends shall comply with the following:
(1) Bends shall be made only with bending tools and procedures intended for that purpose.
(2) All bends shall be smooth and free from buckling, cracks, or other evidence of mechanical damage.
(3) The longitudinal weld of the pipe shall be near the neutral axis of the bend.
(4) Pipe shall not be bent through an arc of more than 90 degrees.
(5) The inside radius of a bend shall be not less than six times the outside diameter of the pipe. [NFPA 54:7.5.1]

1315.0 Required Gas Piping Size.
1315.1 Pipe Sizing Methods. Where the pipe size is to be determined using any of the methods in Section 1315.1.1 through Section 1315.1.3, the diameter of each pipe segment shall be obtained from the pipe sizing tables in Section 1315.2 or from the sizing equations in Section 1315.3. [NFPA 54:6.1]

1315.1.1 Longest Length Method. The pipe size of each section of gas piping shall be determined using the longest length of piping from the point of delivery to the most remote outlet and the load of the section. [NFPA 54:6.1.1]

1315.1.2 Branch Length Method. Pipe shall be sized as follows:
(1) The pipe size of each section of the longest pipe run from the point of delivery to the most remote outlet shall be determined using the longest run of piping and the load of the section.
(2) The pipe size of each section of branch piping not previously sized shall be determined using the length of piping from the point of delivery to the most remote outlet in each branch and the load of the section. [NFPA 54:6.1.2]

1315.3 Sizing Equations. The inside diameter of smooth wall pipe or tubing shall be determined by Equation 1315.3(1), Equation 1315.3(2), and Table 1315.3, and using the equivalent pipe length determined by the methods in Section 1315.1.1 through Section 1315.1.3. [NFPA 54:6.4]

### TABLE 1701.1
**REFERENCED STANDARDS**

<table>
<thead>
<tr>
<th>STANDARD NUMBER</th>
<th>STANDARD TITLE</th>
<th>APPLICATION</th>
<th>REFERENCED SECTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>49 CFR 192.281</td>
<td>Plastic Pipe</td>
<td>Piping, Plastic</td>
<td>1308.5.4.2.2</td>
</tr>
<tr>
<td>49 CFR 192.283</td>
<td>Plastic Pipe: Qualifying Joining Procedures</td>
<td>Piping, Plastic</td>
<td>1308.5.4.2.2</td>
</tr>
</tbody>
</table>

(portion of table not shown remain unchanged)

**Note:** 49 CFR 192.281(e) and 49 CFR 192.183(b) do not meet the requirements for mandatory reference standards in accordance with Section 3-3.7.1 of IAPMO’s Regulations Governing Committee Projects.

**SUBSTANTIATION:**
In accordance with IAPMO’s Regulations Governing Committee Projects (Extract Guidelines), the above sections are being revised to the latest edition of NFPA 54-2018.

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**PUBLIC COMMENT 2**

**Code Year:** 2021 UMC  **Section #:** 1308.5.2.1, 1308.5.7.1  **Item #:** 145  
**SUBMITTER:** Paul Cabot  
American Gas Association  
**Comment #:** 2  
**RECOMMENDATION:**
Revise text  
Request to accept the code change proposal as modified by this public comment.

1308.5.2.1 Steel, Stainless Steel, and Wrought-Iron Pipe. Steel, stainless steel, and wrought-iron pipe shall be at least Schedule 401 and shall comply with the dimensional standards of ASME B36.10M and one of the following:
1308.5.7.1 Pipe Joints. Schedule 40 and heavier pipe joints shall be threaded, flanged, brazed, welded, or assembled with press-connect fittings listed to CSA LC 4.

- Pipe lighter than Schedule 40 shall be connected using press-connect fittings, flanges, brazing, or welding.
- Where nonferrous pipe is brazed, the brazing materials shall have a melting point in excess of 1000°F (538°C).
- Brazing alloys shall not contain more than 0.05 percent phosphorus. [NFPA 54:5.6.7.1]

SUBSTANTIATION:
The committee statement for changing the above extracted NFPA 54 material does not provide a valid reason as required by IAPMO's procedures. The committee statement provides only what was done, not why it was done. Without a valid reason I cannot address the committee's concerns regarding their action. AGA still maintains that any TC's action to technical revise an extract violates the IAPMO extract policy.
Item #: 149
UMC 2021  Section: Appendix B: B 101.1 - B 107.1

SUBMITTER: IAPMO Staff - Update Extracts
NFPA 54 Extract Update

RECOMMENDATION:
Revise text

B 101.0 Adjusting the Burner Input.
B 101.1 Adjusting Input. The input rate of the burner shall be adjusted to the proper value in accordance with the appliance manufacturer’s instructions. Firing at a rate in excess of the nameplate rating shall be prohibited. The input rate shall be adjusted by either changing the size of a fixed orifice, changing the adjustment of an adjustable orifice, or readjusting the appliance’s gas pressure regulator outlet pressure (where a regulator is provided in the appliance). [NFPA 54:11.1.1, 11.1.1.1]

B 104.0 Automatic Ignition.
B 104.1 General. Appliances supplied with means for automatic ignition shall be checked for operation within the parameters provided by the manufacturer. Any adjustments made shall be in accordance with the manufacturer’s installation instructions. [NFPA 54:11.4]

B 105.0 Protective Devices.
B 105.1 General. Where required by the manufacturer’s installation instructions, all protective devices furnished with the appliance such as a limit control, fan control to blower, temperature-and pressure -relief valve, low-water cutoff device, or manual operating features, shall be checked for operation within the parameters provided by the manufacturer. Adjustments made shall be in accordance with the manufacturer’s installation instructions. [NFPA 54:11.5]

B 107.0 Operating Instructions.
B 107.1 General. Operating instructions shall be furnished and shall be left in a prominent position near the appliance for the use of the consumer. [NFPA 54:11.7]

SUBSTANTIATION:
In accordance with IAPMO's Regulations Governing Committee Projects (Extract Guidelines), Section Appendix B is being revised to the latest edition of NFPA 54-2018.

COMMITTEE ACTION: ACCEPT AS SUBMITTED

TOTAL ELIGIBLE TO VOTE: 26
VOTING RESULTS: AFFIRMATIVE: 25  NOT RETURNED: 1  HOWARD

Appended Comments

PUBLIC COMMENT 1
Code Year: 2021 UMC  Section #: Appendix B  Item #: 149
SUBMITTER: IAPMO Staff - Update Extracts
NFPA 54 Extract Update  Comment #: 1

RECOMMENDATION:
Request to accept the code change proposal as modified by this public comment.

B 101.0 Adjusting the Burner Input.
B 101.1 Adjusting Input. The input rate of the burner shall be adjusted to the proper value in accordance with the appliance manufacturer’s instructions. Firing at a rate in excess of the nameplate rating shall be prohibited. The input rate can be adjusted by either changing the size of a fixed orifice, changing the adjustment of an adjustable orifice, or readjusting the appliance’s gas pressure regulator outlet pressure (where a regulator is provided in the appliance). [NFPA 54:11.1.1, 11.1.1.1]

B 101.1.2 High Altitude. Gas input ratings of appliances shall be used for elevations up to 2000 feet (610 m). The input ratings of appliances operating at elevations above 2000 feet (610 m), shall be reduced in accordance with one of the following methods:
(1) At the rate of 4 percent for each 1000 feet (305 m) above sea level before selecting appropriately sized appliances.
(2) As permitted by the Authority Having Jurisdiction.
(3) In accordance with the manufacturer’s installation instructions. [NFPA 54:11.1.2]

B 102.0 Primary Air Adjustment.
B 102.1 General. The primary air for injection (Bunsen)-type burners shall be adjusted for proper flame characteristics in accordance with the appliance manufacturer’s instructions. After setting the primary air, the adjustment means shall be secured in position. [NFPA 54:11.2]

B 103.1 Safety Shutoff Devices.
B 103.1 General. Where a safety shutoff device is provided, it shall be checked for proper operation and adjustment in accordance with the appliance manufacturer’s instructions. Where the device does not function properly to turn off the gas supply in the event of pilot outage or other improper operation, it shall be properly serviced or replaced with a new device. [NFPA 54:11.3]

SUBSTANTIATION:
In accordance with IAPMO’s Regulations Governing Committee Projects (Extract Guidelines), the above sections are being revised to the latest edition of NFPA 54-2018.
Item #: 150

UMC 2021  Section: D 105.0, D 105.1

SUBMITTER: Mohamed Dano
Control Air Conditioning Corporation

RECOMMENDATION:
Delete text without substitution

**D-105.0 Cathodic Protection Requirements.**

**D-105.1 General.** Cathodic protection shall be installed for corrosion control of buried or submerged metallic gas piping in accordance with the following requirements:

1. Where amphoteric metals are included in a buried or submerged pipeline containing a metal of different anodic potential the following protection shall be provided:
   a. The buried or submerged pipeline shall be cathodically protected at a negative (cathodic) voltage of 0.85 volt, measured between the structure surface and a saturated copper-copper sulfate half cell contacting the electrolyte.
   b. The amphoteric metals shall be electrically isolated from the remainder of the pipeline with insulating flanges, or equivalent, and cathodically protected.
2. The amount of cathodic protection shall be such that the protective coating and the pipe are not damaged.

SUBSTANTIATION:
Section D 105.0 and Section D 105.1 are being deleted as they conflict with the other cathodic protection sections that are already addressed within Appendix D. For example, Section D 110.2 and Section D 110.2.1 already provide cathodic protection provisions applicable to manufactured homes.

COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
The proposed deletion of text is being rejected as existing language covers different piping systems and the text is needed for enforcement of the code in regards to cathodic protection requirements.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 25  NOT RETURNED: 1  HOWARD

Appended Comments

PUBLIC COMMENT 1

Code Year: 2021 UMC  Section #: D 105.0, D 105.1

SUBMITTER: Mohamed Dano
Control Air Conditioning Corporation
Rep: Self

RECOMMENDATION:
Delete text without substitution

Request to accept the code change proposal as submitted by this public comment.
SUBSTANTIATION:
Section D 105.0 and Section D 105.1 of Appendix D are being deleted as they conflict with the other cathodic protection sections that are already addressed within Appendix D. For example, Section D 110.2 and Section D 110.2.1 already provide cathodic protection provisions applicable to manufactured homes.
Item #: 151
UMC 2021 Section: Appendix D: D 101.1 - D 115.3

SUBMITTER: IAPMO Staff - Update Extracts
NFPA 501A Extract Update

RECOMMENDATION:
Revise text

D 101.0 Fuel Gas Piping Systems.  
D 101.1 General. All fuel gas piping systems serving manufactured homes, accessory buildings, or structures and communities shall be designed and constructed in accordance with any applicable provisions of NFPA 54 and NFPA 58. NFPA 31 shall apply to oil fuel-burning systems and shall comply with the criteria of the Authority Having Jurisdiction. [NFPA 501A:4.1.1.1 – 4.1.1.2]

D 101.2 Gas Supply Connections. Gas supply connections at sites, where provided from an underground gas supply piping system, shall be located and arranged to permit attachment to a manufactured home (M/H) occupying the site. For the installation of liquefied petroleum gas (LP-Gas) storage systems, the applicable provisions of NFPA 58 shall be followed. [NFPA 501A:4.1.2.1 – 4.1.2.2]

D 101.3 Location of Gas Supply Connection. The gas supply to the M/H manufactured home shall be located within 4 feet (1219 mm) of the M/H manufactured home stand. Exception: The requirement of Section D 101.3 shall not apply to gas supply connections for manufactured homes located on all-weather wood, concrete, or concrete block foundation systems or on foundations constructed in accordance with the local building code or, in the absence of a local code, with a recognized model building code. [NFPA 501A:4.1.3]

D 102.0 Single and Multiple Manufactured Home Site Fuel Supply Systems.  
D 102.1.1 Open-Ended Gastight Conduit. Underground gas piping shall not be installed beneath that portion of a M/H manufactured home site reserved for the location of a manufactured home or M/H manufactured home accessory building or structure unless installed in the open-ended gastight conduit of Section D 102.1.2. [NFPA 501A:4.2.1.1]

D 102.1.2 Requirements. The open-ended gastight conduit shall comply with the following:
(1) The conduit shall be not less than Schedule 40 pipe that is approved for underground installation beneath buildings.
(2) The interior diameter of the conduit shall be not less than 1/2 of an inch (15 mm) larger than the outside diameter of the gas piping.
(3) The conduit shall extend to a point not less than 4 inches (102 mm) beyond the outside wall of the M/H manufactured home or accessory building or structure, and the outer ends shall not be sealed.
(4) Where the conduit terminates within a M/H manufactured home or accessory building or structure, it shall be accessible; and the space between the conduit and the gas piping shall be sealed to prevent leakage of gas into the building. [NFPA 501A:4.2.1.2 – 4.2.1.2.4]

D 103.0 Manufactured Home Site Gas Shutoff Valve.  
D 103.1 General. Each M/H manufactured home site shall have a listed gas shutoff valve installed upstream of the M/H manufactured home site gas outlet. The gas shutoff valve shall be located on the outlet riser at a height of not less than 6 inches (152 mm) above grade. A gas shutoff valve shall not be located under any manufactured home. The outlet shall be equipped with a cap or plug to prevent discharge of gas whenever the M/H manufactured home site outlet is not connected to a M/H manufactured home. [NFPA 501A:4.2.2.1 – 4.2.2.4]

Exception: Gas shutoff valves shall conform to Section D 103.1, except for manufactured homes located on foundations constructed in accordance with the local building code or, in the absence of a local code, with a recognized model building code. [NFPA 501A:4.2.2.2]

D 104.0 Gas Meters.
D 104.1 Support of Meters. Where installed, gas meters shall be supported by a post or bracket placed on a firm footing or other means providing equivalent support and shall not depend on the gas outlet riser for support. [NFPA 501A:4.2.3.1]

D 104.2 Location of Meters. Each gas meter shall be installed in an accessible location and shall be provided with unions or other fittings so that the meter can be removed easily and placed in an upright position. Meters shall not be installed in unventilated or inaccessible locations or closer than 3 feet (914 mm) to sources of ignition. [NFPA 501A:4.2.3.2 – 4.2.3.2.2]

D 104.3 Meter Shutoff Valve or Cock. All gas meter installations shall be provided with shutoff valves or cocks located adjacent to and on the inlet side of the meters. In the case of a single meter installation utilizing an LP-Gas container, the container service valve shall be permitted to be used in lieu of the shutoff valve or cock. All gas meter installations shall be provided with test tees located adjacent to and on the outlet side of the meters. [NFPA 501A:4.2.4.1 – 4.2.4.3]

D 106.0 Manufactured Home Community LPG Supply Systems.

D 106.1 General. Where 10 or more customers are served by one LP-Gas supply system, the installation of the gas supply system shall be in accordance with 49 CFR 192. Other types of liquefied petroleum gas supply systems and the storage and handling of LP-Gas shall be in accordance with NFPA 58. (see Section D113.0 – 111.1) [NFPA 501A:4.3.2 – 4.3.2.2]

D 107.0 Required Gas Supply.

D 107.1 General. The minimum hourly volume of gas required at each Manufactured home site outlet or a any section of the Manufactured home community gas piping system shall be calculated as shown in Table D 107.1. [NFPA 501A:4.3.4.1]

In extreme climate areas, additional capacities other than those shown in Table D 107.1 shall be considered.

### TABLE D 107.1

DEMAND FACTORS FOR USE IN CALCULATING GAS PIPING SYSTEMS IN **MANUFACTURED HOME COMMUNITIES**

<table>
<thead>
<tr>
<th>NUMBER OF MANUFACTURED HOME SITES</th>
<th>BRITISH THERMAL UNITS PER HOUR PER MANUFACTURED HOME SITE</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>125 000</td>
</tr>
<tr>
<td>2</td>
<td>117 000</td>
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<td>3</td>
<td>104 000</td>
</tr>
<tr>
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<td>58 000</td>
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<tr>
<td>41–60</td>
<td>55 000</td>
</tr>
<tr>
<td>Over 60</td>
<td>50 000</td>
</tr>
</tbody>
</table>

For SI units: 1000 British thermal units per hour = 0.293 kW

*In extreme climate areas, additional capacities shall be considered.*

D 108.0 Gas Pipe Sizing and Pressure.

D 108.2 Pressure. Where all connected appliances are operated at their rated capacity, the gas supply pressure shall be not less
D 109.0 Gas Piping Materials.

D 109.2 Protection Coatings for Metal Gas Piping. All buried or submerged metallic gas piping shall be protected from corrosion by approved coatings or wrapping materials. All gas pipe protective coatings shall be approved types, shall be machine applied, and shall comply with conformance to recognized standards. Field wrapping shall provide equivalent protection and is restricted to those short sections and fittings that are necessarily stripped for threading or welding. Risers shall be coated or wrapped to a point not less than at least 6 inches (152 mm) above ground. [NFPA 501A:4.3.6.2 – 4.3.6.2.4]

D 110.0 Gas Piping Installations.
D 110.1 Minimum Burial Below Ground Level and Clearances. All gas piping installed below ground level shall have an absolute earth cover of not less than 18 inches (457 mm) and shall be installed with not less than at least 12 inches (305 mm) of clearance in any direction from any other underground utility systems. [NFPA 501A:4.3.7.1]

D 110.2 Metallic Gas Piping. All metallic gas piping systems shall be installed in accordance with approved plans and specifications, including provisions for cathodic protection. Each cathodic protection system shall be designed and installed to conform to in accordance with the provisions of 49 CFR 192. [NFPA 501A:4.3.7.2.1, 4.3.7.2.2]

D 110.2.1 Cathodic Protection. Where the cathodic protection system is designed to protect only the gas piping system, the gas piping system shall be electrically isolated from all other underground metallic systems or installations. Where only the gas piping system is cathodically protected against corrosion, a dielectric fitting shall be used in the manufactured home gas connection to the gas piping system, the gas piping system, and the gas appliance connectors shall be tested with soapy water or bubble solution while connected to the manufactured home gas supply. [NFPA 501A:4.3.7.3.1 – 4.3.7.3.3]

D 110.2.2 Underground Metallic Systems. Where a cathodic protection system is designed to provide all underground metallic systems and installations with protection against corrosion, all such systems and installations shall be electrically bonded together and protected as a whole. [NFPA 501A:4.3.7.2.5]

D 110.3 Plastic Gas Piping. Plastic gas piping shall be used only underground and shall be installed with an electrically conductive wire for locating the pipe. The wire used to locate the plastic pipe shall be copper, not less smaller in size than No. 18 AWG, with insulation approved for direct burial. Every portion of a plastic gas piping system consisting of metallic shall be cathodically protected against corrosion. [NFPA 501A:4.3.7.3.1 – 4.3.7.3.3]

D 110.4 Gas Piping System Shutoff Valve. An accessible and identifiable shutoff valve controlling the flow of gas to the entire manufactured home gas piping system shall be installed in a location approved acceptable by the Authority Having Jurisdiction and near the point of connection to the service piping or to the supply connection of an LP-Gas container. [NFPA 501A:4.3.7.4]

D 113.0 Fuel Supply Systems Installation.

D 113.2 Use of Approved Pipe and Fittings of Extension. Where it is necessary to extend the manufactured home inlet to permit connection of the 6 foot (1829 mm) listed connector to the site gas outlet, the extension shall be of approved materials of the same size as the manufactured home inlet and shall be adequately supported at not no more than 4 foot (1219 mm) intervals to the manufactured home. [NFPA 501A:4.4.2]

D 113.3 Mechanical Protection. All gas outlet risers, regulators, meters, valves, or and other exposed equipment shall be protected against accidental damage. [NFPA 501A:4.4.3]

D 113.4 Special Rules on Atmospherically Controlled Regulators. Atmospherically controlled regulators shall be installed in such a manner that moisture cannot enter the regulator vent and accumulate above the diaphragm. Where the regulator vent is obstructed due to snow and icing conditions, shields, hoods, or other approved suitable devices shall be provided to guard against closing of the vent opening. [NFPA 501A:4.4.4.1 – 4.4.4.2]

D 113.5 Fuel Gas Piping Test. The manufactured home fuel gas piping system shall be tested only with air before it is connected to the gas supply. The manufactured home manufactured home gas piping system shall be subjected to a pressure test with all appliance shutoff valves in their closed positions. [NFPA 501A:4.4.5.3]

D 113.5.1 Procedures. The fuel gas piping test shall consist of air pressure of at not less than 10 inches water column or more than 14 inches water column (2.5 kPa to 3.5 kPa). The fuel gas piping system shall be isolated from the pressure test source and shall maintain this pressure for not less than 10 minutes without perceptible leakage. Upon satisfactory completion of the fuel gas piping test, the appliance valves shall be opened and the gas appliance connectors shall be tested with soapy water or bubble solution while under the pressure remaining in the piping system. Solutions used for testing for leakage shall not contain corrosive chemicals. Pressure shall be measured with either a manometer, slope gauge, or gauge that is calibrated in either water inch (mm) or psi (kPa), with increments of either 1/10 of an inch (2.5 mm) or 1/10 psi (0.7 kPa) gauge, as applicable. Upon satisfactory completion of the fuel gas piping test, the manufactured home manufactured home manufactured home gas supply connector shall be installed and the connections shall be tested with soapy water or bubble solution. [NFPA 501A:4.4.5.1.1 – 4.4.5.1.6]

D 113.5.2 Warning. The following warning shall be supplied to the installer:

WARNING: Do not overpressurize the fuel gas piping system. Damage to valves, regulators, and appliances is capable of can occurring due to pressurization beyond the maximums specified. [NFPA 501A:4.4.5.2]

D 113.5.3 Vents. Gas appliance vents shall be visually inspected to ensure that they have not been dislodged in transit and are connected securely to the appliance. [NFPA 501A:4.4.5.3]
D 113.6 Oil Tanks. Oil tank capacities shall comply with the following:

1. No more than one 660 gallon (2498 L) tank or two tanks with an aggregate capacity of 660 gallons (2498 L) or less shall be connected to one oil-burning appliance.

2. Two supply tanks, where used, shall be cross-connected and provided with a single fill and single vent, in accordance with NFPA 31, and shall be on a common slab and rigidly secured, one to the other.

3. Tanks having a capacity of 660 gallons (2498 L) or less shall be securely supported by rigid, noncombustible supports to prevent settling, sliding, or lifting. [NFPA 501A:4.4.6]

D 113.6.1 Installation. Oil supply tanks shall be installed in accordance with the applicable provisions of NFPA 31. [NFPA 501A:4.4.6.1]

D 113.6.2 Capacity. A tank with a capacity not larger than 60 gallons (227 L) shall be permitted to be a DOT-5 shipping container (drum), and so marked, or a tank constructed in accordance with UL 80. Tanks other than DOT-5 shipping containers having a capacity of not more than 660 gallons (2498 L) shall be constructed in accordance with UL 80. Pressure tanks shall be constructed in accordance with Section VIII, Pressure Vessels, of the ASME Boiler and Pressure Vessel Code. [NFPA 501A:4.4.6.2.1-4.4.6.2.2]

D 113.6.3 Location. Tanks, as described in Section D 113.6 and Section D 113.6.2, that are adjacent to buildings shall be located not less than 10 feet (3048 mm) from a property line that is permitted to be built upon. [NFPA 501A:4.4.6.3]

D 113.6.4 Vent. Tanks with a capacity not larger than 660 gallons (2498 L) shall be equipped with an open vent not smaller than 1 1/2 inch (40 mm) iron pipe size; tanks with a 500 gallon (1892 L) or less capacity shall have a vent of 1 1/4 inch (32 mm) iron pipe size. [NFPA 501A:4.4.6.4]

D 114.0 Manufactured Home Accessory Building Fuel Supply Systems.

D 114.1 General. Fuel gas supply systems installed in a manufactured home accessory building or structure shall be in accordance with the applicable provisions of NFPA 54 and NFPA 58. Fuel oil supply systems shall comply with the applicable provisions of NFPA 31. [NFPA 501A:4.5.1 – 4.5.2]

D 115.0 Community Building Fuel Supply Systems in Manufactured Home Communities.

D 115.1 Fuel Gas Piping and Equipment Installations. Fuel gas piping and equipment installed within a permanent building in a manufactured home community shall be in accordance with nationally recognized appliance and fuel gas piping codes and standards adopted by the Authority Having Jurisdiction. Where the state or other political subdivision does not assume jurisdiction, such fuel gas piping and equipment installations shall be designed and installed in accordance with the applicable provisions of NFPA 54 or NFPA 58. [NFPA 501A:4.6.1.1-4.6.1.2]

D 115.2 Oil Supply Systems in Manufactured Home Communities. Oil-burning equipment and installations within a manufactured home community shall be designed and constructed in accordance with the applicable codes and standards adopted by the Authority Having Jurisdiction. Where the state or other political subdivision does not assume jurisdiction, such installations shall be designed and constructed in accordance with the applicable provisions of NFPA 31. [NFPA 501A:4.6.2.1-4.6.2.2]

D 115.3 Oil-Burning Equipment and Installation. Oil-burning equipment and installations within a building constructed in a manufactured home community in accordance with the local building code or a nationally recognized building code shall be in accordance with nationally recognized codes and standards adopted by the Authority Having Jurisdiction. Where the state or other political subdivision does not assume jurisdiction, such oil-burning equipment and installations shall be designed and installed in accordance with the applicable provisions of NFPA 31. [NFPA 501A:4.6.3.1 – 4.6.3.2]

SUBSTANTIATION:
In accordance with IAPMO’s Regulations Governing Committee Projects (Extract Guidelines), Section Appendix D is being revised to the latest edition of NFPA 501A-2017.

COMMITTEE ACTION: ACCEPT AS SUBMITTED

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 25  NOT RETURNED: 1  HOWARD

Appended Comments

PUBLIC COMMENT 1

Code Year: 2021 UMC  Section #: D 101.1  Item #: 151

SUBMITTER: Keith Blazer
Self

Comment #: 1
RECOMMENDATION:
Revise text

Request to accept the code change proposal as modified by this public comment.

D 101.1 General. All fuel gas piping systems serving manufactured homes, accessory buildings, or structures and communities shall be designed and constructed in accordance with any applicable provisions of NFPA 54 Chapter 13 and NFPA 58. NFPA 31 shall apply fuel-burning systems and shall conform to the criteria of the Authority Having Jurisdiction. [NFPA 501A:4.1.1.1 – 4.1.1.2]

SUBSTANTIATION:
There is no need to send the end user to NFPA 54 as Chapter 13 already addresses provisions from NFPA 54 for fuel gas piping systems serving manufactured homes, accessory buildings, or structures and communities.
Item #: 152

UMC 2021 Section: E 201.7, E 503.3.1 - E 503.8.2

SUBMITTER: Connor Barbaree  
ASHRAE

RECOMMENDATION:  
Revise text

E 201.7 Integrated Part-Load Value (IPLV). A single-number figure of merit based on part-load EER, COP, or kW/ton expressing part-load efficiency for air-conditioning and heat pump equipment on the basis of weighted operation at various load capacities for the equipment. [ASHRAE 90.1.3.2]

E 503.3.1 Criteria. The HVAC system shall comply with the following criteria:
(1) - (10) (remaining text unchanged)

(11) Systems serving hotel/motel guest rooms shall comply with Section E 503.4.6.3.5.
(12) Except for piping within manufacturer’s units, HVAC piping shall be insulated in accordance with Table E 503.7.3(1) and Table E 503.7.3(2). Insulation exposed to weather shall be suitable for outdoor service, (e.g., protected by aluminum, sheet metal, painted canvas, or plastic cover). Cellular foam insulation shall be protected as above or painted with a coating that is water retardant and provides shielding from solar radiation.
(13) Ductwork and plenums shall be insulated in accordance with Table E 503.7.2 and shall be sealed in accordance with Section E 503.4.7.2.
(14) Construction documents shall require a ducted system to be air balanced in accordance with industry-accepted procedures.
(15) Outdoor air intake and exhaust systems shall comply with Section E 503.4.6.4 through Section E 503.4.6.5.
(16) Where separate heating and cooling equipment serves the same temperature zone, thermostats shall be interlocked to prevent simultaneous heating and cooling.
(17) Systems with a design supply air capacity more than 10 000 ft³/min (4.7195 m³/s) shall have optimum start controls.
(18) The system shall comply with the demand control ventilation requirements of Section E 503.4.6.9 and the ventilation design requirements of Section E 503.5.6.6.
(19) The system shall comply with the door switch requirements of Section E 503.5.14. [ASHRAE 90.1.6.3.2]

E 503.4 Mandatory Provisions. Equipment shown in Table E 503.7.1(1) through Table E 503.7.1(16) shall have a minimum performance at the specified rating conditions where tested in accordance with the specified test procedure. Where multiple rating conditions or performance requirements are provided, the equipment shall satisfy the stated requirements unless otherwise exempted by footnotes in the table. Equipment covered under the Federal Energy Policy Act of 1992 (EPACT) shall have no minimum efficiency requirements for operation at minimum capacity or other than standard rating conditions. Equipment used to provide service water-heating functions as part of a combination system shall satisfy the stated requirements for the appropriate space heating or cooling category.

Tables are as follows:
(1) Table E 503.7.1(1), “Electrically Operated Unitary Air Conditioners and Condensing Units-Minimum Efficiency Requirements”
(2) Table E 503.7.1(2), “Electrically Operated Unitary and Applied Heat Pumps-Minimum Efficiency Requirements”
(3) Table E 503.7.1(3), “Water-Chilling Packages-Efficiency Requirements” (See Section E 503.4.1 for water-cooled centrifugal water-chilling packages that are designed to operate at nonstandard conditions.)
(4) Table E 503.7.1(4), “Electrically Operated Packaged Terminal Air Conditioners, Packaged Terminal Heat Pumps, Single- Package Vertical Air Conditioners, Single-Package Vertical Heat Pumps, Room Air Conditioners, and Room Air Conditioner
Heat Pumps-Minimum Efficiency Requirements

(5) Table E 503.7.1 (5), “Warm-Air Furnaces and Combination Warm-Air Furnaces/Air-Conditioning Units, Warm-Air Duct Furnaces, and Unit Heaters-Minimum Efficiency Requirements” Heating, Ventilating, and Air Conditioning

(6) Table E 503.7.1 (6), “Gas- and Oil-Fired Boilers-Minimum Efficiency Requirements”

(7) Table E 503.7.1 (7), “Performance Requirements for Heat-Rejection Equipment”

(8) Table E 503.7.1 (8), “Heat Transfer Equipment”

(9) Table E 503.7.1 (9), “Electrically Operated Variable-Refrigerant-Flow Air Conditioners-Minimum Efficiency Requirements”

(10) Table E 503.7.1 (10), “Electrically Operated Variable-Refrigerant-Flow and Applied Heat Pumps-Minimum Efficiency Requirements”

(11) Table E 503.7.1 (11), “Air Conditioners and Condensing Units Serving Computer Rooms”

(12) Table E 503.7.1 (12), “Commercial Refrigerators and Freezers-Minimum Efficiency Requirements”

(13) Table E 503.7.1 (13), “Commercial Refrigeration-Minimum Efficiency Requirements”

(14) Table E 503.7.1 (14), “Vapor-Compression-Based Indoor Pool Dehumidifiers-Minimum Efficiency Requirements”


All furnaces with input ratings of 225 000 Btu/h (66 kW) or more, including electric furnaces, that are not located within the conditioned space shall have jacket losses not exceeding 0.75 percent of the input rating. Air conditioners primarily serving computer rooms and covered by ASHRAE 127 shall comply with the requirements in Table E 503.7.1(11). All other air conditioners shall meet the requirements in Table E 503.7.1(1). [ASHRAE 90.1:6.4.1.1]

E 503.4.1 Water-Cooled Centrifugal Chilling Packages. Equipment not designed for operation in accordance with AHRI 550/590 test conditions of 44.00°F (6.67°C) leaving and 54.00°F (12.22°C) entering chilled-fluid temperatures, and 2.4 gallons per minute per ton (gpm/ton) (0.00015 L/s/kg) evaporator fluid flow and with 85.00°F (29.44°C) entering and 94.30°F (34.61°C) leaving condenser-fluid temperatures, with 3.0 gpm/ton (0.00018 L/s/kg) condenser-fluid flow shall have maximum full-load kW/ton (FL) and part-load rating requirements adjusted in accordance with Equation E 503.4.1(1) through Equation E 503.4.1(3):

\[
FL_{adj} = FL/K_{adj} \quad [\text{Equation E 503.4.1(1)}]
\]

\[
PLV_{adj} = IPLV/IP/K_{adj} \quad [\text{Equation E 503.4.1(2)}]
\]

\[
K_{adj} = A \times B \quad [\text{Equation E 503.4.1(3)}]
\]

Where:

\[
FL \quad = \quad \text{full-load kW/ton value from Table E 503.7.1(3)}
\]

\[
FL_{adj} \quad = \quad \text{maximum full-load kW/ton rating, adjusted for nonstandard conditions}
\]

\[
IPLV/IP \quad = \quad \text{IPLV/IP value from Table E 503.7.1(3)}
\]

\[
PLV_{adj} \quad = \quad \text{maximum NPLV rating, adjusted for nonstandard conditions}
\]

\[
A \quad = \quad 0.00000014592 \times (LIFT)^4 - 0.0000346496 \times (LIFT)^3 + 0.00314196 \times (LIFT)^2 - 0.147199 \times (LIFT) + 3.930273
\]

\[
B \quad = \quad 0.0015 \times LvgEvap + 0.934
\]

\[
LIFT \quad = \quad LvgCond - LvgEvap
\]

\[
LvgCond \quad = \quad \text{Full-load condenser leaving fluid temperature (°F)}
\]

\[
LvgEvap \quad = \quad \text{Full-load evaporator leaving temperature (°F)}
\]

The \(FL_{adj}\) and \(PLV_{adj}\) values shall only be applicable for centrifugal chillers in accordance with meeting all of the following full-load design ranges:

1. Minimum Evaporator Leaving Temperature: 36.00°F (2.22°C) \(< LvgEvap < 60.00°F (15.56°C)
2. Maximum Condenser Leaving Temperature: 115°F (46°C) < LvgCond < 115.00°F (46.11°C)
3. \(LIFT\) is not less than 20.00°F (-6.67°C) \(< \text{and not more than} \ 80.00°F (26.67°C)

Manufacturers shall calculate the \(FL_{adj}\) and \(PLV_{adj}\) before determining whether to label the chiller in accordance with Section E 503.4.4. Chillers that are in accordance with ASHRAE 90.1 shall be labeled on chillers in accordance with the scope of ASHRAE 90.1.

Centrifugal chillers designed to operate outside of these ranges shall not be covered under this appendix.

Example: Path A, 600 ton (600 000 kg) centrifugal chiller Table E 503.7.1(3) efficiencies.

\[
F \quad = \quad 0.5600 \text{ kW/ton}
\]

\[
IPLV \quad = \quad 0.5000 \text{ kW/ton}
\]

\[
LvgCond \quad = \quad 91.16°F
\]

\[
LvgEvap \quad = \quad 42.00°F
\]

\[
LIFT \quad = \quad 91.16°F - 42.00°F = 49.16°F
\]

\[
K_{adj} = A \times B
\]
\[ A = 0.00000014592 \times (49.16)^4 - 0.0000346496 \times (49.16)^3 + 0.00314196 \times (49.16)^2 - 0.147199 \times (49.16) + 3.9302 \]

\[ 3.93073 = 0.0228 \]

\[ B = 0.0015 \times 42 + 0.934 = 0.9970 \]

\[ K_{adj} = \frac{A \times B}{4.560/(1.0228 \times 0.9970) = 0.549 \}

\[ 0.560/(1.0228 \times 0.9970) = 0.5489 \text{ kW/ton} \]

\[ \frac{PLV}{adj} = \frac{0.500/(1.0228 \times 0.9970) = 0.490 \text{ kW/ton}} {0.5000/1.02024 = 0.4901 \text{ kW/ton}} \text{ [ASHRAE 90.1:6.4.1.2.1]} \]

For SI units: 1 metric ton = 1000 kg, 1000 British thermal units per hour = 0.293 kW, 1 gallon per minute = 0.06 L/s, °C = (°F-32)/1.8

**E 503.4.1.1 Positive Displacement (air- and water-cooled) Chilling Packages.** Equipment with an evaporator leaving fluid temperature **more higher** than 32.00°F (0.00°C) and water-cooled positive displacement chilling packages with a condenser leaving fluid temperature **less than below** 115.00°F (46.11°C) shall be in accordance show compliance with Table E 503.7.1(3) where when tested or certified with water at standard rating conditions, in accordance with the referenced test procedure. [ASHRAE 90.1:6.4.1.2.2]

**E 503.4.4.1 Packaged Terminal Air Conditioners.** Nonstandard-size packaged terminal air conditioners and heat pumps with existing sleeves having an external wall opening of less than 16 inches (406 mm) high or less than 42 inches (1067 mm) wide and having a cross-sectional area less than 670 square inches (0.432 m²) shall be factory labeled in accordance with the as following follows:

*Manufactured for nonstandard-size applications only: *Not to be installed in new construction projects.* [ASHRAE 90.1:6.4.1.5.2]

**E 503.4.6 Zone Thermostatic Controls.** The supply of heating and cooling energy to each zone shall be individually controlled by thermostatic controls responding to temperature within the zone. For the purposes of Section E 503.4.6, a dwelling unit shall be permitted to be considered a single zone.

**Exceptions:** Independent perimeter systems that are designed to offset only building envelope loads shall be permitted to serve one or more zones also served by an interior system, provided that:

1. (1) the perimeter system includes not less than one thermostatic control zone for each building exposure having walls facing only one orientation for 50 contiguous feet (15 240 mm) or more and
2. (2) the perimeter system heating and cooling supply is controlled by thermostatic controls located within the zones served by the system.

Exterior walls and semiexterior walls are considered to have different orientations where the exposures they face differ by more than 45 degrees (0.79 rad). [ASHRAE 90.1:6.4.3.1.1]

**E 503.4.6.3.5 Automatic Control of HVAC in Hotel/Motel Guest Rooms.** Hotels and motels with more than 50 guest rooms shall be provided with automatic controls for the HVAC equipment serving each guest room capable of and configured according to the requirements in Section E 503.4.6.3.1. [ASHRAE 90.1:6.4.3.3.5]

**E 503.4.6.3.5.1 Guest Room HVAC Set-Point Control.** Within 30 minutes of all occupants leaving the guest room, HVAC set points shall be automatically raised by not less than 4°F (2°C) from the occupant set point in the cooling mode and automatically lowered by at least 4°F (2°C) from the occupant set point in the heating mode. When the guest room is unrented and unoccupied, HVAC set points shall be automatically reset to 80°F (27°C) or higher in the cooling mode and to 60°F (16°C) or lower in the heating mode. Unrented and unoccupied guest rooms shall be determined by either of the following:

1. (1) The guest room has been continuously unoccupied for up to 16 hours.
2. (2) A networked guest room control system indicates the guest room is unrented and unoccupied for no more than 30 minutes.

**Exceptions:**

1. (1) A networked guest room control system shall be permitted to return the thermostat set points to their default occupied set points 60 minutes prior to the time the room is scheduled to be occupied.
2. (2) Cooling for humidity control shall be permitted during unoccupied periods.

**E 503.4.6.5 Enclosed Parking Garage Ventilation.** Enclosed parking garage ventilation systems shall automatically detect contaminant levels and stage fans or modulate fan airflow rates to 50 percent or less of design capacity, provided acceptable contaminant levels are maintained.

**Exceptions:**

1. (1) Garages not more less than 30 000 square feet (2787.09 m²) with ventilation systems that do not utilize mechanical cooling or mechanical heating.
2. (2) Garages that have a garage area to ventilation system motor nameplate hp horsepower ratio that exceeds 1500 square feet per horsepower (ft²/hp) (186.8 m²/kW) and do not utilize mechanical cooling or mechanical heating.
3. (3) Where not permitted by the Authority Having Jurisdiction. [ASHRAE 90.1:6.4.3.4.5]
E 503.4.6.7 Humidification and Dehumidification. Humidity control shall prevent the use of fossil fuel or electricity to produce relative humidity (RH) more than above 30 percent in the warmest zone served by the humidification system and to reduce the RH relative humidity valve to less than below 60 percent in the coldest zone served by the dehumidification system. Where a zone is served by a system or systems with both humidification and dehumidification capability, means (such as limit switches, mechanical stops, or, for DDC systems, software programming) shall be provided capable of preventing and configured to prevent simultaneous operation of humidification and dehumidification equipment.

Exceptions:
(1) Zones served by desiccant systems, used with direct evaporative cooling in series.
(2) Systems serving zones where specific humidity levels are required, such as museums and hospitals, and approved by the Authority Having Jurisdiction or required by accreditation standards and humidity controls are capable of and configured to maintain a dead band of not less than at least 10 percent RH relative humidity where no active humidification or dehumidification takes place.
(3) Systems serving zones where humidity levels are required to be maintained with precision of not more than ± 5 percent RH relative humidity to comply with applicable codes or accreditation standards or as approved by the Authority Having Jurisdiction. [ASHRAE 90.1:6.4.3.6]

E 503.4.7.1.2 Piping Insulation. Piping shall be thermally insulated in accordance with Table E 503.7.3(1) and Table E 503.7.3(2).

Exceptions:
(1) Factory-installed piping within HVAC equipment tested and rated in accordance with Section E 503.4 through Section E 503.4.4.1.
(2) Piping that conveys fluids having a design operating temperature range between 60°F (16°C) and 105°F (41°C), inclusive.
(3) Piping that conveys fluids that have not been heated or cooled through the use of fossil fuels or electricity (such as roof and condensate drains, domestic cold water supply, or and natural gas piping).
(4) Where heat gain or heat loss will not increase energy usage (such as liquid refrigerant piping).
(5) For In piping 1 inch (25.4 mm) or less, insulation shall not be required for strainers, control valves, and balancing valves. [ASHRAE 90.1:6.4.4.1.3]

E 503.4.7.1.3 Sensible Heating Panel. Thermally ineffective panel surfaces of sensible heating panels, including U-bends and headers, shall be insulated with not less than a minimum of R-3.5. Adjacent building envelope insulation shall be applied to counts toward this insulation value requirement. [ASHRAE 90.1:6.4.4.1.4]

E 503.4.7.1.4 Radiant Floor Heating. The bottom surfaces of floor structures incorporating radiant heating shall be insulated not less than with a minimum of R-3.5. Adjacent building envelope insulation shall be applied to counts toward this insulated value requirement.

Exception: Heated slab-on-grade floors incorporating radiant heating shall be in accordance with ASHRAE 90.1. [ASHRAE 90.1:6.4.4.1.5]

E 503.5.1.3 Dampers. Return air, exhaust or relief, and outdoor air dampers shall comply with Section E 503.4.6.4.2. [ASHRAE 90.1:6.5.1.1.4]

E 503.5.1.4 Relief of Excess Outdoor Air. Systems shall provide a means to relieve excess outdoor air during air economizer operation to prevent overpressurizing the building. The relief air outlet shall be located so as to avoid recirculation into the building. [ASHRAE 90.1:6.5.1.1.5]

E 503.5.5 Simultaneous Heating and Cooling Limitation, Zone Controls. Zone thermostatic controls shall prevent the following:
(1) Reheating.
(2) Recooling.
(3) Mixing or simultaneously supplying air that has been previously mechanically heated and air that has been previously cooled, either by mechanical cooling or by economizer systems.
(4) Other simultaneous operation of heating and cooling systems to the same zone.

Exceptions:
(1) Zones for which the volume of air that is reheated, recooled, or mixed is less than the larger of the following:
   (a) Twenty percent of the zone design peak supply for systems with DDC and 30 percent for other systems.
   (b) The outdoor airflow rate required to be in accordance with the ventilation requirements of Chapter 4 or ASHRAE 62.1 for the zone.
   (c) Any higher rate that can be demonstrated, to the satisfaction of the Authority Having Jurisdiction, to reduce overall system annual energy use by offsetting reheat or recool energy losses through a reduction in outdoor air intake for the system.
   (d) The airflow rate required to be in accordance with applicable codes or accreditation standards, such as pressure relationships or minimum air change rates.
(2) Zones with DDC that comply with the following:
   (a) The airflow rate in dead band between heating and cooling does not exceed the larger of the following:
      (1) Twenty percent of the zone design peak supply rate.

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(2) The outdoor airflow rate required to be in accordance with the ventilation requirements of Chapter 4 or ASHRAE 62.1 for the zone.

(3) A higher rate that is capable of demonstrating to the satisfaction of the Authority Having Jurisdiction, to reduce overall system annual energy usage by offsetting reheat or recool energy losses through a reduction in outdoor air intake.

(4) The airflow rate required in accordance with applicable codes or accreditation standards, such as pressure relationships or minimum air change rates.

(b) The airflow rate that is reheated, recooled, or mixed shall be less than 50 percent of the zone design peak supply rate.

(c) The first stage of heating consists of modulating the zone supply air temperature set point up to a maximum setpoint while the airflow is maintained at the dead band flow rate.

(d) The second stage of heating consists of modulating the airflow rate from the dead band flow rate up to the heating maximum flow rate.

(3) Laboratory exhaust systems in accordance with Section E 503.5.11.3.

(4) Zones where not less than at least 75 percent of the energy for reheating or for providing warm air in mixing systems is provided from a site-recovered energy (including condenser heat) or site-solar energy source. [ASHRAE 90.1:6.5.2.1]

E 503.5.5.2.3 Hydronic (Water Loop) Heat Pump Systems. Hydronic heat pumps connected to a common heat pump water loop with central devices for heat rejection (e.g., cooling tower) and heat addition (e.g., boiler) shall have the following:

(1) Controls that are capable of and configured to provide a heat pump water supply temperature dead band of not less than at least 20°F (11°C) between initiation of heat rejection and heat addition by the central devices (e.g., tower and boiler).

(2) For climate zone 3 through zone 8, where a closed-circuit cooling tower (fluid cooler) is used, either an automatic valve shall be installed to bypass all but a minimal flow of water around the tower (for freeze protection) or low-leakage positive closure dampers shall be provided. Where an open-circuit cooling tower is used directly in the heat pump loop, an automatic valve shall be installed to bypass all heat pump water flow around the tower. Where an open-circuit cooling tower is used in conjunction with a separate heat exchanger to isolate the tower from the heat pump loop, then heat loss shall be controlled by shutting down the circulation pump on the cooling tower loop.

Exception: Where a system loop temperature optimization controller is used to determine the most efficient operating temperature based on real-time conditions of demand and capacity, dead bands of less than 20°F (11°C) shall be permitted. [ASHRAE 90.1:6.5.2.2.3]

E 503.5.6.1 Motor Nameplate Horsepower. For each fan, the selected fan motor shall be not larger than the first available motor size more greater than the brake horsepower (bhp) (kW). The fan brake horsepower bhp shall be indicated on the design documents to allow for compliance verification by the Authority Having Jurisdiction.

Exceptions:

(1) For fans less than 6 bhp (4.5 kW), where the first available motor larger than the bhp (kW) has a nameplate rating within 50 percent of the bhp (kW), the next larger nameplate motor size shall be permitted to be selected.

(2) For fans 6 bhp (4.5 kW) and larger, where the first available motor larger than the bhp (kW) has a nameplate rating within 30 percent of the bhp (kW), the next larger nameplate motor size shall be permitted to be selected.

(3) Systems that are in accordance with Section E 503.5.6.1, Option 1.

(4) Fans with motor nameplate horsepower of less than 1 hp (0.7 kW). [ASHRAE 90.1:6.5.3.1.2]

E 503.5.6.2 Supply Fan Airflow Control. Each cooling system listed in Table E 503.5.6.2 shall be designed to vary the indoor supply fan airflow as a function of load and shall be in accordance comply with the following requirements:

(1) DX and chilled-water cooling units that control the capacity of the mechanical cooling directly based on space temperature shall have a minimum of two stages of fan control. Low or minimum speed shall not exceed 66 percent of full speed. At low or minimum speed, the fan system shall draw not less than 40 percent of the fan power at full fan speed. Low or minimum speed shall be used during periods of low cooling load and ventilation-only operation.

(2) Other units, including DX cooling units and chilled-water units that control the space temperature by modulating the airflow to the space, shall have modulating fan control. Minimum speed shall not exceed 50 percent of full speed. At minimum speed, the fan system shall draw not less than 30 percent of the power at full fan speed. Low or minimum speed shall be used during periods of low cooling load and ventilation-only operation.

(3) Units that include an air-side economizer to comply meet with the requirements of Section E 503.5 through Section E 503.5.4.1 shall have not less than a minimum of two speeds of fan control during economizer operation.

Exceptions:

(1) Modulating fan control shall not be required for chilled-water and evaporative cooling units with less than 1 hp (0.7 kW) fan motors where the units are not used to provide ventilation air or where the indoor fan cycles with the load.

(2) Where the volume of outdoor air required to comply meet with the ventilation requirements of Chapter 4 or ASHRAE 62.1 at low speed exceeds the air that would be delivered at the speed defined in Section E 503.5.6.2(1), or Section E 503.5.6.2(2), then the minimum speed shall be selected to provide the required ventilation air. [ASHRAE 90.1:6.5.3.2.1]
E 503.5.6.3 Multiple-Zone VAV System Ventilation Optimization Control. Multiple-zone VAV systems with DDC of individual zone boxes reporting to a central control panel shall include a means to automatically reduce outdoor air intake flow below design rates in response to changes in system ventilation efficiency in accordance with ASHRAE 62.1 Section 404.0.

Exceptions:
(1) VAV systems with zonal transfer fans that recirculate air from other zones without directly mixing it with outdoor air, dual-duct dual-fan VAV systems, and VAV systems with fan-powered terminal units.
(2) Systems where total design exhaust airflow is more than 70 percent of total design outdoor air intake flow requirements. [ASHRAE 90.1:6.5.3.3]

E 503.5.6.4 Supply Air Temperature Reset Controls. Multiple zone HVAC systems shall include controls that automatically reset the supply air temperature in response to representative building loads, or to outdoor air temperature. The controls shall reset the supply air temperature to not less than at least 25 percent of the difference between the design supply air temperature and the design room air temperature. Controls that adjust the reset based on zone humidity shall be permitted. Zones that are expected to experience relatively constant loads, such as electronic equipment rooms, shall be designed for the fully reset supply temperature.

Exceptions:
(1) Climate zones 0A, 1A, 2A, and 3A.
(2) Systems that prevent reheating, recooling, or mixing of heated and cooled supply air.
(3) Systems where not less than 75 percent of the energy for reheating, (on an annual basis, or site-solar energy sources. [ASHRAE 90.1:6.5.3.5]

E 503.5.7.3 Chilled- and Hot-Water Temperature Reset Controls. Chilled- and hot-water systems with a design capacity exceeding 300 000 Btu/h (88 kW) supplying chilled or heated water (or both) to comfort conditioning systems shall include controls that automatically reset supply water temperatures by representative building loads (including return water temperature) or by outdoor air temperature. Where DDC is used to control valves, the set point shall be reset based on valve positions until one valve is nearly wide open or set point limits of the system equipment or application have been reached.

Exceptions:
(1) Where chilled-water supply is already cold, such as chilled water supplied from a district cooling or thermal energy storage system, such that blending would be required to achieve the reset chilled-water supply temperature.
(2) Where a specific temperature is required for a process.
(3) Water temperature reset is not required where valve position is used to comply with Section E 503.5.7. [ASHRAE 90.1:6.5.4.4]

E 503.5.7.5 Pipe Sizing. Chilled-water and condenser-water piping shall be designed such that the design flow rate in a pipe each piping segment does shall not exceed the values listed in Table E 503.5.7.5 for the appropriate total annual hours of operation. Pipe size selections for systems that operate under variable flow conditions, such as modulating two-way control valves at coils), and that contain variable-speed pump motors shall be permitted to be made from the “Variable Flow/Variable Speed” columns. All others shall be made from the “Other” columns.

Exceptions:
(1) Design flow rates exceeding the values in Table E 503.5.7.5 shall be permitted in specific sections of pipe where the pipe piping if the piping in question is not in the critical circuit at design conditions and is not predicted to be in the critical circuit during more than 30 percent or more of operating hours.
(2) Piping systems that have not more than the equivalent or lower total pressure drop than the same system constructed with standard weight steel pipe with piping and fittings sized in accordance with Table E 503.5.7.5. [ASHRAE 90.1:6.5.4.6]

E 503.5.8 Heat Rejection Equipment. Section E 503.5.8 through Section E 503.5.9 apply applies to heat-rejection equipment used in comfort cooling systems, such as air-cooled condensers, dry coolers, open-circuit cooling towers, closed-circuit cooling towers, and evaporative condensers.

Exception: Heat-rejection devices whose energy usage use is included in the equipment efficiency ratings listed in Table E 503.7.1(1) through Table E 503.7.1(4). [ASHRAE 90.1:6.5.5.1]

E 503.5.8.1 Fan Speed Control. The fan system on a heat-rejection device powered by an individual motor or an array of motors with a connected power, including the motor service factor, totaling 5 hp (3.7 kW) or more shall have controls and/or devices (such as variable-speed control) that shall result in fan motor demand of no more than 30 percent of design wattage at 50 percent of the design airflow and that shall automatically change modulate the fan speed to control the leaving fluid temperature or condensing temperature or pressure of the heat-rejection device.

Exceptions:
(1) Condenser fans serving multiple refrigerant circuits or fluid cooling circuits.
(2) Condenser fans serving flooded condensers. [ASHRAE 90.1:6.5.5.2.1]

E 503.5.10.1.2 Capacity. The required heat recovery system shall have the capacity to provide the smaller of:
(1) Sixty percent of the peak heat-rejection load at design conditions or
Preheat of the peak service hot-water draw to 85°F (29°C).

**Exceptions:**
1. Facilities that employ condenser heat recovery for space heating with a heat recovery design exceeding 30 percent of the peak water-cooled condenser load at design conditions.
2. Facilities that provide 60 percent of their service water heating from site-solar energy, or site-recovered energy, or from other sources. [ASHRAE 90.1:6.5.6.2.2]

**E 503.5.11.1.1 503.5.11.1 Conditioned Supply Air Transfer Air.** Conditioned supply air delivered to a space with a kitchen hood mechanical exhaust shall not exceed the greater of the following:
1. The supply flow required to be in accordance with the space heating or cooling load;
2. The ventilation rate required by the Authority Having Jurisdiction, the Facility Environmental Health and Safety department, or ASHRAE 62.1; or
3. The hood mechanical exhaust flow minus the available transfer air from adjacent conditioned spaces, or return air plenums on the same floor, not in different smoke or fire compartments, and that at their closest point are within 15 feet (4572 mm) of each other. Available transfer air is that portion of outdoor ventilation air that:
   a. is not required to satisfy other exhaust needs, such as restrooms, and
   b. is not required to maintain pressurization of adjacent other spaces, and
   c. is transferable according to applicable codes and standards and to the class of air recirculation limitations in ASHRAE 62.1.

**Exceptions:**
1. Biosafety level classified laboratories 3 or higher.
2. Vivarium spaces.
3. Spaces that are required by applicable codes and standards to be maintained at positive pressure relative to adjacent spaces. For spaces taking this exception, any transferable air that is not directly transferred shall be made available to the associated air-handling unit and shall be used whenever economizer or other options do not save more energy.
4. Spaces where the demand for transfer air may exceed the available transfer airflow rate and where the spaces have a required negative pressure relationship. For spaces taking this exception, any transferable air that is not directly transferred shall be made available to the associated air-handling unit and shall be used whenever economizer or other options do not save more energy. [ASHRAE 90.1:6.5.7.1.2 6.5.7.1]

**E 503.5.11.4 503.11.2 Kitchen Exhaust Systems.** (remaining text unchanged)
**E 503.5.11.2 503.11.2.1 Exhaust Flow Rate.** (remaining text unchanged)
**E 503.5.11.2.1 503.11.2.2 Kitchen or Dining Facility.** (remaining text unchanged)
**E 503.5.11.2.2 503.11.2.3 Performance Testing.** An approved field test method shall be used to evaluate design airflow rates and demonstrate proper capture and containment performance of installed commercial kitchen exhaust systems. Where demand ventilation systems are utilized to be in accordance with Section E 503.5.11.2.1, additional performance testing shall be provided required to demonstrate proper capture and containment at minimum airflow. [ASHRAE 90.1:6.5.7.2.4]

**E 503.5.12.1 Heating Enclosed Spaces.** Radiant heating systems that are used as primary or supplemental heating for enclosed spaces shall be in conformance with the governing provisions of the standard. Space heating shall be in accordance with this appendix, including, but not limited to, the following:
1. Radiant hydronic ceiling or floor panels (used for heating or cooling).
2. Combination or hybrid systems incorporating radiant heating (or cooling) panels.
3. Radiant heating (or cooling) panels used in conjunction with other systems such as VAV or thermal storage systems. [ASHRAE 90.1:6.5.8.2]

**E 503.5.13 Hot Gas Bypass Limitation.** Cooling systems shall not use hot gas bypass or other evaporator pressure control systems unless the system is designed with multiple steps of unloading or continuous capacity modulation. The capacity of the hot gas bypass shall be limited as indicated in Table E 503.5.13 for VAV units and single-zone VAV units. Hot-gas bypass shall not be used on constant-volume units. [ASHRAE 90.1:6.5.9]

**E 503.6.3.1 Required Information.** Construction documents shall require that an operating manual and maintenance manual be provided to the building owner. The manuals shall include, at a minimum, the following:
1. Submittal data stating equipment rating and selected options for each piece of equipment requiring maintenance.
2. Operation manuals and maintenance manuals for each piece of equipment requiring maintenance. Required routine maintenance actions shall be clearly identified.
3. Names and addresses of not less than one qualified service agency.
4. A complete narrative of how each system is intended to operate.
   The Authority Having Jurisdiction shall only check to ensure that the construction documents required are provided require this information to be transmitted to the owner, and shall should not expect copies of any of the materials. [ASHRAE 90.1:8.7.2]
<table>
<thead>
<tr>
<th>CLIMATE ZONE</th>
<th>PUE*</th>
</tr>
</thead>
<tbody>
<tr>
<td>0A</td>
<td>1.64</td>
</tr>
<tr>
<td>0B</td>
<td>1.62</td>
</tr>
<tr>
<td>1A</td>
<td>1.61</td>
</tr>
<tr>
<td>1B</td>
<td>1.53</td>
</tr>
<tr>
<td>2A</td>
<td>1.49</td>
</tr>
<tr>
<td>2B</td>
<td>1.45</td>
</tr>
<tr>
<td>3A</td>
<td>1.41</td>
</tr>
<tr>
<td>3B</td>
<td>1.42</td>
</tr>
<tr>
<td>3C</td>
<td>1.39</td>
</tr>
<tr>
<td>4A</td>
<td>1.36</td>
</tr>
<tr>
<td>4B</td>
<td>1.38</td>
</tr>
<tr>
<td>4C</td>
<td>1.38</td>
</tr>
<tr>
<td>5A</td>
<td>1.36</td>
</tr>
<tr>
<td>5B</td>
<td>1.33</td>
</tr>
<tr>
<td>5C</td>
<td>1.36</td>
</tr>
<tr>
<td>6A</td>
<td>1.34</td>
</tr>
<tr>
<td>6B</td>
<td>1.33</td>
</tr>
<tr>
<td>7</td>
<td>1.32</td>
</tr>
<tr>
<td>8</td>
<td>1.30</td>
</tr>
</tbody>
</table>

* PUE₀ and PUE₁ shall not include energy for battery charging.

**E 503.8.2 Computer Room (PUE₀).** The computer room PUE₀ shall be not more is less than or equal to the values listed in Table E 503.8.1. The PUE₀ shall be the highest value determined at outdoor cooling design temperatures, and shall be limited to systems utilizing only using electricity for an energy source. The PUE₀ shall be calculated for the following two conditions:
(1) One hundred percent design IT equipment energy; and
(2) Fifty percent design IT equipment energy. [ASHRAE 90.1:6.6.1.2]

### TABLE E 503.7.1(6)
**GAS- AND OIL-FIRED BOILERS - MINIMUM EFFICIENCY REQUIREMENTS**

[ASHRAE 90.1: TABLE 6.8.1-6]  

<table>
<thead>
<tr>
<th>EQUIPMENT TYPE</th>
<th>SUBCATEGORY OR RATING CONDITION</th>
<th>SIZE CATEGORY (INPUT)</th>
<th>MINIMUM EFFICIENCY</th>
<th>EFFICIENCY AS OF 3/2/2020</th>
<th>TEST PROCEDURE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boilers, steam</td>
<td>Gas fired</td>
<td>&lt;300 000 Btu/h</td>
<td>80% AFUE</td>
<td>80% AFUE</td>
<td>10 CFR Part 430</td>
</tr>
<tr>
<td></td>
<td>Gas fired— all, except natural draft</td>
<td>≥300 000 Btu/h and ≤2 500 000 Btu/h</td>
<td>79% Et</td>
<td>79% Et</td>
<td>10 CFR Part 430</td>
</tr>
<tr>
<td></td>
<td></td>
<td>&gt;2 500 000 Btu/h</td>
<td>79% Et</td>
<td>79% Et</td>
<td>10 CFR Part 431</td>
</tr>
<tr>
<td></td>
<td>Gas fired— natural draft</td>
<td>≥300 000 Btu/h and ≤2 500 000 Btu/h</td>
<td>77% Et</td>
<td>79% Et</td>
<td>10 CFR Part 431</td>
</tr>
<tr>
<td></td>
<td></td>
<td>&gt;2 500 000 Btu/h</td>
<td>77% Et</td>
<td>79% Et</td>
<td>10 CFR Part 431</td>
</tr>
<tr>
<td></td>
<td>Oil fired</td>
<td>&lt;300 000 Btu/h</td>
<td>82% AFUE</td>
<td>82% AFUE</td>
<td>10 CFR Part 430</td>
</tr>
<tr>
<td></td>
<td></td>
<td>≥300 000 Btu/h and ≤2 500 000 Btu/h</td>
<td>81% Et</td>
<td>81% Et</td>
<td>10 CFR Part 431</td>
</tr>
<tr>
<td></td>
<td></td>
<td>&gt;2 500 000 Btu/h</td>
<td>81% Et</td>
<td>81% Et</td>
<td>10 CFR Part 431</td>
</tr>
</tbody>
</table>

(portions of table not shown remain unchanged)

### TABLE E 503.7.1(10)
**ELECTRICALLY OPERATED VARIABLE-REFRIGERANT-FLOW AND APPLIED HEAT PUMPS - MINIMUM EFFICIENCY REQUIREMENTS**  
[ASHRAE 90.1: TABLE 6.8.1-10]  

<table>
<thead>
<tr>
<th>EQUIPMENT TYPE</th>
<th>SIZE CATEGORY</th>
<th>HEATING SECTION TYPE</th>
<th>SUBCATEGORY OR RATING CONDITION</th>
<th>MINIMUM EFFICIENCY</th>
<th>TEST PROCEDURE</th>
</tr>
</thead>
<tbody>
<tr>
<td>VRF Air cooled (heating mode)</td>
<td>&lt;65 000 Btu/h (cooling capacity)</td>
<td>—</td>
<td>VRF Multi-split system</td>
<td>7.7 HSPF</td>
<td>AHRI 1230</td>
</tr>
<tr>
<td></td>
<td>≥65 000 Btu/h and &lt;135 000 Btu/h</td>
<td>—</td>
<td>VRF Multi-split system 47°F db/43°F wb outdoor air</td>
<td>3.3 COP_h</td>
<td></td>
</tr>
<tr>
<td>Fluid Operating Temperature Range (°F) and Usage</td>
<td>Insulation Conductivity</td>
<td>&gt;Nominal Pipe Size or Tube Size (inches)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-----------------------------------------------</td>
<td>-------------------------</td>
<td>----------------------------------------</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Conductivity Btu•in/(h•ft²•°F)</td>
<td>Mean Rating Temperature °F</td>
<td>&lt;1</td>
<td>1 to 1 1/2</td>
<td>1 1/2 to 4</td>
</tr>
<tr>
<td>&gt;350</td>
<td>0.32 - 0.34</td>
<td>250</td>
<td>4.5</td>
<td>5.0</td>
<td>5.0</td>
</tr>
<tr>
<td>251 - 350</td>
<td>0.29 - 0.32</td>
<td>200</td>
<td>3.0</td>
<td>4.0</td>
<td>4.5</td>
</tr>
<tr>
<td>201 - 250</td>
<td>0.27 - 0.30</td>
<td>150</td>
<td>2.5</td>
<td>2.5</td>
<td>2.5</td>
</tr>
<tr>
<td>141 - 200</td>
<td>0.25 - 0.29</td>
<td>125</td>
<td>1.5</td>
<td>1.5</td>
<td>2.0</td>
</tr>
<tr>
<td>105 - 140</td>
<td>0.22 - 0.28</td>
<td>100</td>
<td>1.0</td>
<td>1.0</td>
<td>1.5</td>
</tr>
</tbody>
</table>

For SI units: °C=(°F-32)/1.8, 1 inch = 25 mm, 1 British thermal unit inch per hour square foot degree Fahrenheit = [0.1 W/(m•K)]

Notes:
1 For insulation outside the stated conductivity range, the minimum thickness (T) shall be determined as follows:
   \[ T = \frac{r}{r} (1 + \frac{t}{r}) K - k - 1 \]

   Where:
   - T = minimum insulation thickness (inches).
   - r = actual outside radius of pipe (inches).
   - t = insulation thickness listed in this table for applicable fluid temperature and pipe size.
   - K = conductivity of alternate material at mean rating temperature indicated for the applicable fluid temperature [Btu•in/(h•ft²•°F)] [W/(m•K)].
   - k = the upper value of the conductivity range listed in this table for the applicable fluid temperature.

2 These thicknesses shall be based on energy efficiency considerations only. Additional insulation shall be permitted to is sometimes required relative to safety issues/surface temperature.

3 Piping For piping smaller than 1 1/2 inches (40 mm) or less and located in partitions within conditioned spaces, reduction of insulation thickness these thicknesses by 1 inch (25.4 mm) shall be permitted (before thickness adjustment required in footnote 1), but not a thickness less than to thicknesses below 1 inch (25.4 mm).

4 For direct-buried heating and hot water system piping, reduction of insulation thickness these thicknesses by 1 1/2 inch (40 mm) shall be permitted (before thickness adjustment required in footnote 1), but not a thickness less than to thicknesses below 1 inch (25.4 mm).

5 Table E 503.7.3(1) is based on steel pipe. Non-metallic pipes, less than schedule 80 thickness or less shall use the table values. For other non-metallic pipes having a thermal resistance more than that of steel pipe, reduced insulation thicknesses shall be permitted where documentation is provided showing that the pipe with the proposed insulation has less no more heat transfer per foot (mm) than a steel pipe of the same size with the insulation thickness shown in Table E 503.7.3(1).
<table>
<thead>
<tr>
<th>FLUID OPERATING TEMPERATURE RANGE (°F) AND USAGE</th>
<th>INSULATION CONDUCTIVITY</th>
<th>NOMINAL PIPE SIZE OR TUBE SIZE (inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>conductance Btu\cdot\text{inch}/(\text{h}\cdot\text{ft}^2\cdot\text{°F})</td>
<td>&lt;1</td>
</tr>
<tr>
<td>40°F - to 60°F</td>
<td>0.21 - to 0.27</td>
<td>75</td>
</tr>
<tr>
<td>&lt;40°F</td>
<td>0.20 - to 0.26</td>
<td>50</td>
</tr>
</tbody>
</table>

For SI units: °C = (°F-32)/1.8, 1 inch = 25 mm, 1 British thermal unit inch per hour square foot degree Fahrenheit = [0.1 W/(m•K)]

**Notes:**

1. For insulation outside the stated conductivity range, the minimum thickness ($T$) shall be determined as follows:

   $$T = r(1 + t/r)K/k - 1$$

   Where:
   - $T$ = minimum insulation thickness (inches).
   - $r$ = actual outside radius of pipe (inches).
   - $t$ = insulation thickness listed in this table for applicable fluid temperature and pipe size.
   - $K$ = conductivity of alternate material at mean rating temperature indicated for the applicable fluid temperature [Btu\cdot\text{inch}/(\text{h}\cdot\text{ft}^2\cdot\text{°F})] [W/(m•K)].
   - $k$ = the upper value of the conductivity range listed in this table for the applicable fluid temperature.

2. These thicknesses shall be based on energy efficiency considerations only. Issues such as water, vapor permeability, or surface condensation require vapor retarders or additional insulation.

3. Insulation shall not be required for direct-buried cooling system piping. Insulation is not required.

4. Table E 503.7.3(2) is based on steel pipe. Non-metallic pipes less than schedule 80 thickness or less shall use the table values. For other non-metallic pipes having thermal resistance more than that of steel pipe, reduced insulation thicknesses shall be permitted where documentation is provided showing that the pipe with the proposed insulation has no more heat transfer per foot (mm) than a steel pipe of the same size with the insulation thickness shown in Table E 503.7.3(2).

Note: ASHRAE 127 meets the requirements for mandatory reference standards in accordance with Section 3-3.7.1 of IAPMO's Regulations Governing Committee Projects.
E 503.5.3.3 Dehumidification. Where humidity controls are provided, such controls shall prevent reheating, mixing of hot and cold airstreams, or other means of simultaneous heating and cooling of the same airstream.

Exceptions:
(1) The system is capable of and configured to reduce supply air volume to 50 percent or less of the design airflow rate or the minimum outdoor air ventilation rate in accordance with Chapter 4 or ASHRAE 62.1 or other applicable federal, state, or local code or recognized standard, whichever is larger before simultaneous heating and cooling takes place.

E 503.5.6.6 Ventilation Design. The required minimum outdoor air rate is the larger of the minimum outdoor air rate or the minimum exhaust air rate required by Chapter 4, ASHRAE 62.1, ASHRAE 170, or applicable codes or accreditation standards. Outdoor air ventilation systems shall comply with one of the following:
(1) - (3) (remaining text unchanged) [ASHRAE 90.1:6.5.3.7]

E 503.5.10 Exhaust Air Energy Recovery. Each fan system shall have an energy recovery system where the design supply fan airflow rate exceeds the value listed in Table E 503.5.10(1) and Table E 503.5.10(2), based on the climate zone and percentage of outdoor air at design airflow conditions. Table E 503.5.10(1) shall be used for all ventilation systems that operate less than 8000 hours per year and Table E 503.5.10(2) shall be used for all ventilation systems that operate 8000 or more hours per year.

Energy recovery systems required by this section shall result in an enthalpy recovery ratio of not less than 50 percent. A fifty percent enthalpy recovery ratio shall mean a change in the enthalpy of the outdoor air supply equal to 50 percent of the difference between the outdoor air and entering exhaust air enthalpies at design conditions. Provision shall be provided to bypass or control the energy recovery system to permit air economizer operation in accordance with Section E 503.5.1.

Exceptions:
(1) - (5) (remaining text unchanged)
(6) Where the sum of the airflow rates exhausted and relieved within 20 feet (6096 mm) of each other is less than 75 percent of the design outdoor airflow rate, excluding exhaust air that is;
(a) used for another energy recovery system,
(b) not allowed by ASHRAE 170 for use in energy recovery systems with leakage potential, or
(c) of Class 4 as defined in Chapter 2 or ASHRAE 62.1.

E 503.5.11.1 Transfer Air. Conditioned supply air delivered to a space with a mechanical exhaust shall not exceed the greater of the following:
(1) The supply flow required to be in accordance with the space heating or cooling load;
(2) The ventilation rate required by the Authority Having Jurisdiction, the Facility Environmental Health and Safety department, Chapter 4 or ASHRAE 62.1; or
(3) The mechanical exhaust flow minus the available transfer air from conditioned spaces, or return air plenums on the same floor, not in different smoke or fire compartments, and that at their closest point are within 15 feet (4572 mm) of each other. Available transfer air is that portion of outdoor ventilation air that:
(a) is not required to satisfy other exhaust needs,
(b) is not required to maintain pressurization of other spaces, and
(c) is transferable according to applicable codes and standards and to the class of air recirculation limitations in Chapter 4 ASHRAE 62.1.

Exceptions:
(1) - (4) (remaining text unchanged) [ASHRAE 90.1:6.5.7.1]

E 606.1 Minimum Indoor Air Quality. The building shall comply with this code Chapter 4 and ASHRAE 62.1 for ventilation air supply.

SUBSTANTIATION:
There is no need to only send the end user to ASHRAE 62.1 as the UMC also has provisions for ventilation in Chapter 4, therefore, adding Chapter 4 will assist the end user and provide greater ease of use. For example, Section E 503.4.6.9 Exception (5), E 503.5.5 Exception (1)(b), E 503.5.5 Exception (2)(a)(2), and E 503.5.6.2 Exception (2) make reference to "Chapter 4 or ASHRAE 62.1" when required. Chapter 4 is a direct extract of ASHRAE 62.1. Therefore, referencing Chapter 4 is necessary for ease of use of the code.
Item #: 153
UMC 2021  Section: E 403.1, Table 1701.2

SUBMITTER: Billy Smith
ASPE

RECOMMENDATION:
Revise text

E 403.0 HVAC Water Use.
E 403.1 Operation and Maintenance. Cooling towers shall be operated and maintained in accordance with ASHRAE 188.

(renumber remaining sections)

TABLE 1701.2
STANDARDS, PUBLICATIONS, PRACTICES, AND GUIDES

<table>
<thead>
<tr>
<th>DOCUMENT NUMBER</th>
<th>DOCUMENT TITLE</th>
<th>APPLICATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASHRAE 188-2015</td>
<td>Legionellosis: Risk Management for Building Water Systems</td>
<td>Miscellaneous</td>
</tr>
</tbody>
</table>

(portion of table not shown remains unchanged)

SUBSTANTIATION:
Cooling towers have been identified as an opportunistic environment for Legionella bacteria growth and release to the environment where people risk exposure to the organisms and the resulting health effects. ASHRAE standard 188 provides specific Legionella risk mitigation elements for cooling towers and the related mechanical components. The standard provides for an initial evaluation of the system and ongoing measures to reduce human exposure/risk to the bacteria.

COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
The proposed language is a maintenance requirement and is not within the scope of the UMC.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS:  AFFIRMATIVE: 24  ABSTAIN: 1  NOT RETURNED: 1  HOWARD

EXPLANATION OF AFFIRMATIVE:
MANN: ASHRAE 188 is not an appropriate standard for the UMC. This would add undue costs to small facilities. This should be incorporated into a facilities maintenance procedures.

EXPLANATION OF ABSTAIN:
EGG: Cooling towers are a risk to health and human safety because they can spread Legionella. I believe this should be addressed in the UMC in the appropriate place (yet to be identified).
PUBLIC COMMENT 1

Code Year: 2021 UMC   Section #: E 403.1, Table 1701.2   Item #: 153

SUBMITTER: Connor Barbaree
ASHRAE   Comment #: 1

RECOMMENDATION:
Add new text

Request to replace the code change proposal by this public comment.

E 403.0 HVAC Water Use,
E 403.1 Operation and Maintenance. Cooling towers shall be operated and maintained in accordance with ASHRAE 188.

(renumber remaining sections)

<table>
<thead>
<tr>
<th>DOCUMENT NUMBER</th>
<th>DOCUMENT TITLE</th>
<th>APPLICATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASHRAE 188-2018</td>
<td>Legionellosis: Risk Management for Building Water Systems</td>
<td>Miscellaneous</td>
</tr>
</tbody>
</table>

(portion of table not shown remains unchanged)

SUBSTANTIATION:
Cooling towers have been identified as an opportunistic environment for Legionella bacteria growth and release to the environment where people risk exposure to the organisms and the resulting health effects. ASHRAE standard 188 provides specific Legionella risk mitigation elements for cooling towers and the related mechanical components. The standard provides for an initial evaluation of the system and ongoing measures to reduce human exposure/risk to the bacteria.
Item #: 155
UMC 2021 Section: E 505.5, E 505.6, Table 1701.2

SUBMITTER: Jeremy Brown
NSF International

RECOMMENDATION:
Revise text

TABLE E 505.5
PLASTIC GROUND SOURCE LOOP PIPING

<table>
<thead>
<tr>
<th>MATERIAL</th>
<th>STANDARD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Polyethylene Raised Temperature (PE-RT)</td>
<td>ASTM F2623; ASTM F2769, NSF 358-4</td>
</tr>
</tbody>
</table>

(portion of table not shown remains unchanged)

TABLE E 505.6
GROUND SOURCE LOOP PIPE FITTINGS

<table>
<thead>
<tr>
<th>MATERIAL</th>
<th>STANDARD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Polyethylene Raised Temperature (PE-RT)</td>
<td>ASTM D3261; ASTM F1807; ASTM F2159; ASTM F2769; CSA B137.1, NSF 358-4</td>
</tr>
</tbody>
</table>

(portion of table not shown remains unchanged)

TABLE 1701.2
STANDARD, PUBLICATIONS, PRACTICES, AND GUIDES

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<tr>
<th>DOCUMENT NUMBER</th>
<th>DOCUMENT TITLE</th>
<th>APPLICATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>NSF 358-4 (Draft)</td>
<td>Polyethylene of Raised Temperature (PE-RT) Pipe and Fittings for Water-Based Ground-Source (Geothermal) Heat Pump Systems</td>
<td>Piping, Plastic</td>
</tr>
</tbody>
</table>

(portion of table not shown remains unchanged)

Note: NSF 358-4 is a working draft and is not completed at the time of this monograph.

SUBSTANTIATION:
NSF 358-4 Polyethylene of Raised Temperature (PE-RT) Pipe and Fittings for Water-Based Ground-Source (Geothermal) Heat Pump Systems. This standard is the 4th in a series of standard for geothermal pipe and fittings. NSF 358-1 (PE), 358-2 (PP), 358-3(PEX) are already referenced in the UMC. This last version is adding the requirements for PE-RT. This standard addresses requirements for performance, long term strength, U-bend assembled joint testing, chemical resistance, thermocycling, constant tensile load joint testing, joint pressure testing, marking, suitability for burial and quality assurance.

A balloted draft version of this document will be submitted with this proposal and the final published version will be available.
in advance of the Technical Committee Meeting. Anyone wanting a copy of NSF 358-4 for the purposes of considering this proposal may request a free copy from brown@nsf.org

COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
The proposed text is being rejected as NSF 358-4 was a working draft and was not completed at the time of the monograph.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 24 NEGATIVE: 1 NOT RETURNED: 1 HOWARD

EXPLANATION OF AFFIRMATIVE:

MANN: This Standard may be published now but this committee has never accepted a Standard that is a working draft at the time of the UMC Committee Meeting. This can be submitted next year and debated at that time.

EXPLANATION OF NEGATIVE:

MACNEVIN: NSF 358-4 has since been published and made available to the TC. NSF 358-4 is appropriate for this product in these tables.

Appended Comments

PUBLIC COMMENT 1

Code Year: 2021 UMC  Section #: Table E 505.5, Table E 505.6, Table 1701.2  Item #: 155

SUBMITTER: Michael Cudahy PPFA  Comment #: 1

RECOMMENDATION:
Revise text

Request to replace the code change proposal by this public comment.

### TABLE E 505.5
**PLASTIC GROUND SOURCE LOOP PIPING**

<table>
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<tr>
<th>MATERIAL</th>
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### TABLE E 505.6
**GROUND SOURCE LOOP PIPE FITTINGS**

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### TABLE 1701.2
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<td>Piping, Plastic</td>
</tr>
</tbody>
</table>

(portion of table not shown remains unchanged)

**Note:** NSF 358-4 meets the requirements for a mandatory referenced standard in accordance with Section 3-3.7.1 of IAPMO’s Regulations Governing Committee Projects.

**SUBSTANTIATION:**
PPFA recommends approval as submitted of Item # 155 when the standard is complete. NSF 358-4-2018 has since been published.
Proposals

Item #: 158

UMC 2021  Section: E 605.1.3 - E 605.1.8

SUBMITTER: Connor Barbaree
ASHRAE

RECOMMENDATION:
Revise text

E 605.0 Indoor Air Quality for Low-Rise Residential.

E 605.1.3 Dwelling-Unit Ventilation. A Mechanical exhaust system, supply system, or combination thereof shall be installed to operate for each dwelling unit to provide continuous dwelling-unit ventilation with outdoor air at a rate not less than the rate specified in Section E 605.1.3.1. [ASHRAE 62.2:4.1]

E 605.1.3.1 Total Ventilation Rate. The total required ventilation rate ($Q_{tot}$) shall be as specified in Table E 605.1.3.1 or, alternatively, calculated in accordance with Equation E 605.1.3.1.

(Equation E 605.1.3.1)

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

Where:

- $Q_{tot}$ = total required ventilation rate, cfm cubic feet per minute ($\text{ft}^3/\text{min}$)
- $A_{floor}$ = dwelling unit floor area, square foot ($\text{ft}^2$)
- $N_{br}$ = number of bedrooms; (not to be less than one)

For SI units: 1 cubic foot per minute = 0.00047 m$^3$/s, 1 square foot = 0.0929 m$^2$

Exceptions: Dwelling-unit mechanical ventilation systems shall are not be required where if the Authority Having Jurisdiction determines that window operation is a locally permissible method of providing ventilation and provided that a least one or more of the following conditions is met:

1. The building has no mechanical cooling and is located in zone 1 or 2 of the climate zone map.
2. The building is thermally conditioned for human occupancy for less than 876 hours per year. [ASHRAE 62.2:4.1.1]

E 605.1.3.4 Different Occupant Density. Table E 605.1.3.1 and Equation E 605.1.3.1 assume two persons in a studio or one-bedroom dwelling unit and an additional person for each additional bedroom. Where higher occupant densities are known, the rate shall be increased by 7.5 ft$^3$/min (0.003 m$^3$/s) for each additional person. Where When approved by the Authority Having Jurisdiction, lower occupant densities may be permitted to be used. [ASHRAE 62.2:4.1.3]

E 605.1.4 System Type. The dwelling-unit mechanical ventilation system shall consist of one or more supply or exhaust fans and associated ducts and controls. Local exhaust fans shall be permitted to be part of a mechanical exhaust system. Where local exhaust fans are used to provide dwelling-unit ventilation, the local exhaust airflow may be credited towards the whole dwelling-unit ventilation airflow requirement. Outdoor air ducts connected to the return side of an air handler shall be permitted as supply ventilation where manufacturer’s requirements for return air temperature are met. See ASHRAE 62.2 for guidance on selection of methods. [ASHRAE 62.2:4.2]

E 605.1.5 Airflow Measurement. The airflow required by this section shall be is the quantity of outdoor ventilation air supplied and/or indoor air, which is exhausted by the mechanical ventilation system as installed and shall be measured according to the ventilation equipment manufacturer’s instructions, or by using a flow hood, flow grid, or other airflow measuring device at the mechanical ventilation fan’s inlet terminals/grilles, outlet terminals/grilles, or in the connected ventilation ducts. Ventilation airflow of systems with multiple operating modes shall be tested in all modes designed to be in accordance with meet this section. [ASHRAE 62.2:4.3]

E 605.1.7.1 Short-Term Average Ventilation. To comply with this section, a variable ventilation system shall be installed to provide an average dwelling-unit ventilation rate over any three-hour period that is greater than or equal to $Q_{fan}$ as determined in accordance with.

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**E 605.1.7.2 Scheduled Ventilation.** This section may only be allowed to be used when one or more fixed patterns of designed ventilation are known at the time compliance to Section E 605.0 is being determined. Such patterns include those both clock-driven and driven by typical meteorological data. Compliance with this section can be demonstrated with either Section E 605.1.3.3 or Section E 605.1.7.2.2. [ASHRAE 62.2:4.5.2]

**E 605.1.7.2.1 Annual Average Schedule.** An annual schedule of ventilation complies with this section when the annual average relative exposure during occupied periods is not more than unity as calculated in accordance with ASHRAE 62.2. [ASHRAE 62.2:4.5.2.1]

**E 605.1.7.2.2 Block Scheduling.** The schedule of ventilation complies with this section when it is broken into blocks of time and each block individually has an average relative exposure during occupied periods that is not more than unity as calculated in ASHRAE 62.2. [ASHRAE 62.2:4.5.2.2]

**E 605.1.7.3 Real-Time Control.** A real-time ventilation controller complies with this section when it is designed to adjust the ventilation system based on real-time input to the ventilation calculations so that the average relative exposure during occupied periods is not more than unity as calculated in ASHRAE 62.2. The averaging period shall be at least one day but not more than one year and shall be based on simple, recursive or running average, but not extrapolation. [ASHRAE 62.2:4.5.3]

**E 605.1.8 Equivalent Ventilation.** A dwelling-unit ventilation system shall be designed and operated in such a way as to provide the same or lower annual exposure as would be provided in accordance with Section E 605.1.3. The calculations shall be based on a single zone with a constant contaminant emission rate. The manufacturer, specifier, or designer of the equivalent ventilation system shall certify that the system meets this intent and provide supporting documentation. [ASHRAE 62.2:4.6]

**SUBSTANTIATION:**
In accordance with IAPMO’s Regulations Governing Committee Projects (Extract Guidelines), Appendix E has been revised to correlate with the latest ASHRAE 62.2-2016.

**COMMITTEE ACTION:** REJECT

**COMMITTEE STATEMENT:**
The proposed change removes mandatory enforceable language.

**TOTAL ELIGIBLE TO VOTE:** 26

**VOTING RESULTS:** AFFIRMATIVE: 25  NOT RETURNED: 1  HOWARD

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**PUBLIC COMMENT 1**

**Code Year:** 2021 UMC  **Section #:** E 605.0 - E 605.1.8  **Item #:** 158

**SUBMITTER:** Connor Barbaree  **ASHRAE**  **Comment #:** 1

**RECOMMENDATION:**
Revise text

Request to **replace** the code change proposal by this public comment.

**E 605.0 Indoor Air Quality for Low-Rise Residential.**

**E 605.1.3 Dwelling-Unit Ventilation.** A Mechanical exhaust system, supply system, or combination thereof shall be installed to operate for each dwelling unit to provide continuous dwelling-unit ventilation with outdoor air at a rate not less than the rate specified in Section E 605.1.3.1. [ASHRAE 62.2:4.1]

**E 605.1.3.1 Total Ventilation Rate.** The total required ventilation rate \( Q_{tot} \) shall be as specified in Table E 605.1.3.1 or, alternatively, calculated in accordance with Equation E 605.1.3.1.

\[
Q_{tot} = 0.03A_{floor} + 7.5(N_{br} + 1)
\]

Where:
- \( Q_{tot} \) = total required ventilation rate, cubic feet per minute (\( ft^3/min \))
- \( A_{floor} \) = dwelling unit floor area, square foot (\( ft^2 \))
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For SI units: 1 cubic foot per minute = 0.00047 m$^3$/s, 1 square foot = 0.0929 m$^2$

**Exceptions:** Dwelling-unit mechanical ventilation systems shall not be required where the Authority Having Jurisdiction determines that window operation is a locally permissible method of providing ventilation and provided one or more of the following conditions is met:

1. The building has no mechanical cooling and is located in zone 1 or 2 of the climate zone map.
2. The building is thermally conditioned for human occupancy for less than 876 hours per year.[ASHRAE 62.2:4.1.1]

**E 605.1.4 System Type.** The dwelling-unit mechanical ventilation system shall consist of one or more supply or exhaust fans and associated ducts and controls. Local exhaust fans shall be permitted to be part of a mechanical exhaust system. Where local exhaust fans are used to provide dwelling-unit ventilation, the local exhaust airflow shall be permitted to be credited towards the whole dwelling-unit ventilation airflow requirement. Outdoor air ducts connected to the return side of an air handler shall be permitted as supply ventilation where manufacturer’s requirements for return air temperature are met. See ASHRAE 62.2 for guidance on selection of methods. [ASHRAE 62.2:4.2]

**E 605.1.5 Airflow Measurement.** The airflow required by this section shall be the quantity of outdoor ventilation air supplied, supplied and/or indoor air, or both exhausted by the mechanical ventilation system as installed and shall be measured according to the ventilation equipment manufacturer’s instructions, or by using a flow hood, flow grid, or other airflow measuring device at the mechanical ventilation fan’s inlet terminals/grilles, outlet terminals/grilles, or in the connected ventilation ducts. Ventilation airflow of systems with multiple operating modes shall be tested in all modes designed to meet this section. [ASHRAE 62.2:4.3]

**E 605.1.7.1 Short-Term Average Ventilation.** To comply with this section, a variable ventilation system shall be installed to provide an average dwelling-unit ventilation rate over any three-hour period that is greater than or equal to $Q_{fan}$ as determined in accordance with Section E 605.1.3.3. [ASHRAE 62.2:4.]

**E 605.1.7.2 Scheduled Ventilation.** This section shall only be allowed to be used where one or more fixed patterns of designed ventilation are known at the time compliance to Section E 605.0 is being determined. Such patterns include those both clock-driven and driven by typical meteorological data. Compliance with this section shall be in accordance demonstrated with either Section E 605.1.7.2.1 or Section E 605.1.7.2.2. [ASHRAE 62.2:4.5.2]

**SUBSTANTIATION:**
In accordance with IAPMO’s Regulations Governing Committee Projects (Extract Guidelines), Appendix E has been revised to correlate with the latest ASHRAE 62.2-2016. Furthermore, the proposed modification includes enforceable language as required by the TC and in accordance with the IAPMO Manual of Style.
CHAPTER 2
DEFINITIONS

209.0 – G –
Geothermal Energy System. A system that uses thermal energy for space heating and cooling, and water heating.
Geothermal Energy System, Closed-Loop. A continuous, sealed, underground, or submerged heat exchanger through which a heat-transfer fluid passes to and returns from a heat pump.
Geothermal Energy System, Open-Loop. A liquid-source heat pump system that uses ground water or surface water to extract or reject heat.
Ground-Heat Exchanger. An underground closed-loop heat exchanger through which a heat-transfer medium passes to and from a heat pump or other rated mechanical equipment. It includes the buried pipe and connecting main(s) up to and terminating with the building.
Ground-Source Heat Pump. A term that is applied to a variety of systems that use the ground, groundwater, or surface water as a heat source and sink. The general terms include ground-coupled (GCHP), groundwater (GWHP), and surface-water (SWHP) heat pumps. Many parallel terms exist [e.g., geothermal heat pumps (GHP), geo-exchange, and ground-source (GS) systems] and are used to meet a variety of marketing or institutional needs.
Groundwater Source. A geothermal energy system that uses the groundwater as a heat source or sink.

210.0 – H –
Hydronic System. Relating to, or being a system of, heating or cooling that involves the transfer of heat by a circulating fluid (such as water or vapor).

Part I Closed-Loop Systems
F 101.0 General.
F 101.1 Applicability. Part I of this appendix shall apply to geothermal energy systems such as, but not limited to, building systems coupled with a ground-heat exchanger, submerged heat exchanger or groundwater (well) using water-based fluid as a heat transfer medium. The regulations of this appendix shall govern the construction, location and installation of geothermal energy systems.
Indoor piping, fittings, and accessories that are part of the groundwater system shall be in accordance with Section F 103.7 and Chapter 12.
F 101.1.1 Prior to Construction. Documents for permits shall be submitted prior to the construction of a building system, ground heat exchanger, submerged heat exchanger, or water well. Permits shall be issued by the Authority Having Jurisdiction.
F 101.1.2 Equipment, Accessories, Components, and Materials. The mechanical equipment, accessories, components, and materials used shall be of the type and rating approved for the specific use.
F 101.2 Construction Documents. The construction documents for the building system portion of the geothermal energy system shall be submitted to the Authority Having Jurisdiction.
F 101.3 Site Survey. A site survey shall be conducted prior to designing the geothermal system. The requirements for construction documents shall be defined by the Authority Having Jurisdiction. Where no guidance is provided, the following information shall be provided:
(1) Ground heat exchanger dimensions.
(2) Grout or sealing specifications, as applicable.
E 508.11 F 101.4 Decommissioning and Abandonment. Prior to the abandonment or decommissioning of a ground-heat exchanger, submerged heat exchanger or ground water (well) the owner shall obtain the necessary permits from the Authority Having Jurisdiction.

E 508.12 F 101.5 Used Materials. The installation of used pipe, fittings, valves, and other materials shall not be permitted.

E 508.13 F 101.6 Contact with Building Material. A ground source heat pump ground-loop piping system shall not be in direct contact with building materials that cause the piping or fitting material to degrade or corrode, or that interferes with the operation of the system.

E 508.14 F 101.7 Strains and Stresses. Piping shall be installed so as to avoid structural stresses or strains within building components.

E 508.15 F 101.8 Flood Hazard. Piping located in a flood hazard area shall be capable of resisting hydrostatic and hydrodynamic loads and stresses, including the effects of buoyancy, during the occurrence of flooding to the design flood elevation.

E 508.16 F 101.9 Pipe Support. Pipe shall be supported in accordance with Section 313.1.

E 508.17 F 101.10 Velocities. Ground source heat pump ground-loop systems shall be designed so that the flow velocities do not exceed the maximum flow velocity recommended by the pipe and fittings manufacturer. Flow velocities shall be controlled to reduce the possibility of water hammer.

E 508.18 F 101.11 Chemical Compatibility. Antifreeze and other materials used in the system shall be chemically compatible with the pipe, tubing, fittings, and mechanical systems.

E 508.19 F 101.12 Transfer Fluid. The transfer fluid shall be compatible with the makeup water supplied to the system.

SUBSTANTIATION:

The definition for “Ground-Source Heat Pump” was added to be consistent with definitions provided in the ASHRAE HVAC Applications Handbook (Chapter 34) for geothermal energy, current edition. Definitions for “Geothermal Energy Systems” and “Ground-Source Heat Pump” were also added to reflect the new proposed language. The definition for “ground-heat exchanger” will allow for ground-coupling with other types of mechanical equipment such as chillers and cooling towers. Furthermore, it provides clarity as to the extent or boundary of the “ground heat exchanger.”

The definition of “Hydronic System” has been added to encompass existing language within the UMC and to enhance and differentiate between the existing definition of “Hydronics”.

Construction documents are required to be of a quality and detail such that the Authority Having Jurisdiction can determine that the work conforms to the code and other applicable laws and regulations. To properly design a geothermal system, it is important to know the seasonal variation in the soil temperature, as well as the soil’s inherent capability to store and transmit heat, namely its heat capacity and thermal conductivity. These soil thermal properties depend on soil porosity and moisture content. Therefore, any preliminary assessment of a potential geothermal heat pump system will require knowing the soil texture and average groundwater level at the site. Another important geologic feature is the depth of bedrock, which determines the feasibility of certain ground loop configurations. The construction phase is dominated by observation of installation and verification of prefuctional checks and tests. The acceptance phase starts with functional tests and verification of all test results.

Proper decommissioning or abandonment eliminates the physical hazard of the well, eliminates a pathway for migration of contamination, and prevents hydrologic changes in the aquifer system, such as changes in hydraulic head and mixing of water between aquifers. The actual method will depend on both the reason for abandonment and the condition and construction details of the borehole or well. Many states have different requirements; therefore, it is imperative to check with the local jurisdiction.

The sources of information and recommendations for this chapter are included as follows:
Construction of a geothermal heat pump loop well includes, in continuous order, drilling of the vertical borehole into the earth, placement of the loop tube to the bottom of the vertical borehole with the grout tremie, and grouting of the vertical borehole from the bottom of the vertical borehole to the earth’s surface. When these three steps are completed, the vertical borehole may now be considered a loop well.

Permitting of the ground-coupled portion of the geothermal energy system varies from state to state. Some states issue permits, in others, local counties or water agencies issue permits.

Therefore, inclusion of any references to a well of any type is in violation of pre-existing well standards and do not appear in this section. Statements regarding the ground heat exchange side of the system are deferred to the Authority Having Jurisdiction and shall not be addressed in the UMC. Furthermore, this will correlate with the action taken by the USEHC Technical Committee.

COMMITTEE ACTION: ACCEPT AS AMENDED BY THE TC

Amend proposal as follows:

CHAPTER 2
DEFINITIONS

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Geothermal Energy System. A system that uses thermal energy for space heating and cooling, and water heating.
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APPENDIX F
GEOTHERMAL ENERGY SYSTEMS

Part I Closed-Loop Systems

F 101.0 General.
F 101.1 Applicability. Part I of this appendix shall apply to geothermal energy systems such as, but not limited to, building systems coupled with a ground-heat exchanger, submerged heat exchanger or groundwater (well) using water-based fluid as a heat transfer medium. The regulations of this appendix shall govern the construction, location and installation of geothermal energy systems. Indoor piping, fittings, and accessories that are part of the groundwater system shall be in accordance with Section F 103.7 and Chapter 12.
F 101.1.1 Prior to Construction. Documents for permits shall be submitted prior to the construction of a building system, ground heat exchanger, submerged heat exchanger, or water well. Permits shall be issued by the Authority Having Jurisdiction.
F 101.1.2 Equipment, Accessories, Components, and Materials. The mechanical equipment, accessories, components, and materials used shall be of the type and rating approved for the specific use.

F 101.2 Definitions.
Geothermal Energy System. A system that uses thermal energy for space heating and cooling, and water heating.
Geothermal Energy System, Closed-Loop. A continuous, sealed, underground, or submerged heat exchanger through which a heat-transfer fluid passes to and returns from a heat pump.
Geothermal Energy System, Open-Loop. A liquid-source heat pump system that uses ground water or surface water to extract or reject heat.
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Groundwater Source. A geothermal energy system that uses the groundwater as a heat source or sink.

(renumber remaining sections)
F 101.2 Construction Documents. The construction documents for the building system portion of the geothermal energy system shall be submitted to the Authority Having Jurisdiction.

F 101.3 Site Survey. A site survey shall be conducted prior to designing the geothermal system. The requirements for construction documents shall be defined by the Authority Having Jurisdiction. Where no guidance is provided, the following information shall be provided:

(1) Ground heat exchanger dimensions.
(2) Grout or sealing specifications, as applicable.
(3) Dimensions from building to water well, ground heat exchanger, or submerged heat exchanger.
(4) Operating temperatures and pressures.

F 101.4 Decommissioning and Abandonment. Prior to the abandonment or decommissioning of a ground-exchanger, submerged heat exchanger or ground water (well) the owner shall obtain the necessary permits from the Authority Having Jurisdiction.

F 101.5 Used Materials. The installation of used pipe, fittings, valves, and other materials shall not be permitted.

F 101.6 Contact with Building Material. A ground source heat pump ground-loop piping system shall not be in direct contact with building materials that cause the piping or fitting material to degrade or corrode, or that interfere with the operation of the system.

F 101.7 Strains and Stresses. Piping shall be installed so as to prevent detrimental strains and stresses in the pipe. Provisions shall be made to protect piping from damage resulting from expansion, contraction, and structural settlement. Piping shall be installed so as to avoid structural stresses or strains within building components.

F 101.8 Flood Hazard. Piping located in a flood hazard area shall be capable of resisting hydrostatic and hydrodynamic loads and stresses, including the effects of buoyancy, during the occurrence of flooding to the design flood elevation.

F 101.9 Pipe Support. Pipe shall be supported in accordance with Section 313.1.

F 101.10 Velocities. Ground source heat pump ground-loop systems shall be designed so that the flow velocities do not exceed the maximum flow velocity recommended by the pipe and fittings manufacturer. Flow velocities shall be controlled to reduce the possibility of water hammer.

F 101.11 Chemical Compatibility. Antifreeze and other materials used in the system shall be chemically compatible with the pipe, tubing, fittings, and mechanical systems.

F 101.12 Transfer Fluid. The transfer fluid shall be compatible with the makeup water supplied to the system.

APPENDIX FG
SIZING OF VENTING SYSTEMS AND OUTDOOR COMBUSTION AND VENTILATION OPENING DESIGN

APPENDIX GH
EXAMPLE CALCULATION OF OUTDOOR AIR RATE

COMMITTEE STATEMENT:
The proposed modification clarifies that this is a new Appendix F and the remaining appendices will be renumbered/relettered accordingly. Furthermore, some of the definitions are being relocated from Chapter 2 to the new Appendix F.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 25 NOT RETURNED: 1 HOWARD

PUBLIC COMMENT 1

Code Year: 2021 UMC  Section #: 1207.3.1, 1207.4  Item #: 159

SUBMITTER: Lance MacNevin, P.Eng.
Plastic Pipe Institute  Comment #: 1

RECOMMENDATION:
Revise text

Request to accept the code change proposal as modified by this public comment.

1207.3.1 Temperature Limitations. Where a combined space- and water-heating application requires water for space heating at temperatures exceeding 140°F (60°C), a thermostatic mixing valve that is in accordance with ASSE 1017 shall be installed to temper the water supplied to the potable water distribution system to a temperature of 140°F (60°C) or less.

SUBSTANTIATION:
The title of the Solar Code has been updated to include the term “Geothermal,” therefore the title of the Solar Code needs to be updated when being referenced within the UMC to the correct title. The title is now “Uniform Solar, Hydronics and Geothermal Code” or “USHGC.”
**E 505.5 F 103.5** Piping and Tubing Materials Standards. For water-based systems, ground source heat pump ground-loop pipe and tubing shall comply with the standards listed in Table **E 505.5 F 103.5.** Piping and tubing used for DX systems shall be of copper in accordance with Section F 103.8.

**E 505.6 F 103.6** Fittings. For water-based systems, fittings for ground source heat pump systems shall be approved for installation with the piping materials to be installed, and shall comply with the standards listed in Table **E 505.6 F 103.6.** Fittings for use in DX systems shall comply with Section F 103.8.

<table>
<thead>
<tr>
<th>MATERIAL</th>
<th>STANDARD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chlorinated polyvinyl chloride (CPVC)</td>
<td>ASTM D2846; ASTM F441; ASTM F442</td>
</tr>
<tr>
<td>Cross-linked polyethylene (PEX)</td>
<td>ASTM F876; ASTM F877; CSA B137.5; NSF 358-3, CSA C448</td>
</tr>
<tr>
<td>Polyethylene/aluminum/polyethylene (PE-AL-PE) pressure pipe</td>
<td>ASTM F1282; CSA B137.9</td>
</tr>
<tr>
<td>High Density Polyethylene (HDPE)</td>
<td>ASTM D2737; ASTM D3035; ASTM F714; AWWA C901; CSA B137.1; CSA C448; NSF 358-1</td>
</tr>
<tr>
<td>Polypropylene (PP)</td>
<td>ASTM F2389; CSA B137.11; NSF 358-2</td>
</tr>
<tr>
<td>Polyvinyl chloride (PVC)</td>
<td>ASTM D1785; ASTM D2241</td>
</tr>
<tr>
<td>Polyethylene Raised Temperature (PE-RT)</td>
<td>ASTM F2623; ASTM F2769, CSA B137.18, NSF 358-4, CSA C448</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>MATERIAL</th>
<th>STANDARD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chlorinated polyvinyl chloride (CPVC)</td>
<td>ASTM D2846; ASTM F447; ASTM F438; ASTM F439; ASTM F1970; CSA B137.6</td>
</tr>
<tr>
<td>Cross-linked polyethylene (PEX)</td>
<td>ASTM F877; ASTM F1807; ASTM F1960; ASTM F2080; ASTM F2159; ASTM F2434; CSAB137.5; NSF 358-3, CSA C448</td>
</tr>
</tbody>
</table>
**F 103.7 Underground Piping and Submerged Materials.** Underground and submerged piping for a ground-heat exchanger shall be polyethylene (PE) pipe or tubing in accordance with Section F 103.7.1 and Section F 103.7.1.1, or cross-linked polyethylene (PEX) pipe or tubing in accordance with Section F 103.7.2 and Section F 103.7.2.1.

**F 103.7.1 Polyethylene (PE).** Polyethylene pipe or tubing shall be manufactured in accordance with the standards listed in Table F 103.5. Pipe or tubing shall have a maximum dimension ratio of 11 and shall have a minimum pressure rating of not less than 160 psi (1103 kPa) at 73°F (23°C).

Polyethylene pipe and tubing shall be manufactured from a PE compound that has a pipe material designation code of PE 3608, PE 3708, PE 3710, PE 4608, PE 4708, or PE 4710 as defined in the applicable standards referenced in Table F 103.5, with a cell classification in accordance with ASTM D3350 appropriate for the material designation code, and a color and ultraviolet stabilizer code of C or E. Code E compounds shall be stabilized against deterioration from unprotected exposure to ultraviolet rays for not less than 3 years in accordance with the test criteria specified in ASTM D2513.

**F 103.7.1.1 Joining Methods for Polyethylene Pipe or Tubing.** Joints between high density polyethylene (HDPE) plastic pipe or tubing and fittings shall be installed in accordance with the manufacturer’s installation instructions, the appropriate standards listed in accordance with Table F 103.6, and one of the following heat fusion methods:

1. Butt-fusion joints shall be made in accordance with ASTM F2620.
2. Socket-fusion joints shall be made in accordance with ASTM F2620.
3. Electrofusion joints shall be made in accordance with ASTM F1055.

**F 103.7.2 Cross-Linked Polyethylene (PEX).** Cross-linked polyethylene pipe shall be manufactured in accordance with the standards listed in Table F103.6. PEX shall have a minimum tubing material designation code of PEX 1206 and shall have a minimum pressure rating of not less than 160 psi (1103 kPa) at 73°F (23°C).

**F 103.7.2.1 Joining Methods for Cross-Linked Polyethylene Tubing.** Joints between cross-linked polyethylene (PEX) tubing and fittings shall be installed in accordance with the manufacturer’s installation instructions and the appropriate standards in accordance with Table F 103.6.

**F 103.8 DX Systems.** Copper pipe and tubing installed for DX systems shall be manufactured in accordance with ASTM B280 and copper fittings in accordance with ASME B16.22. Joints shall be purged with an inert gas and brazed with a brazing alloy having 15 percent silver content in accordance with AWS A5.8. Underground piping and tubing shall have a cathodic protection system installed.

**F 103.9 Indoor Piping.** Indoor piping, fittings, and accessories that are part of the groundwater system shall be in accordance with Chapter 12. Such materials shall be rated for the operating temperature and pressures of the system and shall be compatible with the type of transfer medium. For DX systems, joints shall be purged with an inert gas and brazed with a brazing alloy having 15 percent silver content in accordance with AWS A5.8.

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**TABLE 1701.2**

<table>
<thead>
<tr>
<th>DOCUMENT NUMBER</th>
<th>DOCUMENT TITLE</th>
<th>APPLICATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>NSF 358-4 (Draft)</td>
<td>Polyethylene of Raised Temperature (PE-RT) Pipe and Fittings for Water-Based Ground-Source (Geothermal) Heat Pump Systems</td>
<td>Ground-Source Heat Pumps</td>
</tr>
</tbody>
</table>

(portions of table not shown remain unchanged)

**Note: NSF 358-4 is a working draft and is not completed at the time of this monograph.**

**SUBSTANTIATION:**
Piping, fittings and joints must be compatible with the heat transfer fluid, antifreeze (or the refrigerant in the case of direct exchange systems) and corrosion resistant. Piping is divided into underground piping for geothermal applications and indoor piping. In accordance with ASHRAE, Chapter 34 Geothermal Systems, carbon steel piping has shown good service in several systems as long as the system design excluded oxygen. However, the introduction of 0.03 mg/kg oxygen under turbulent flow conditions causes a fourfold increase in uniform corrosion. Saturation with air often increases the corrosion rate by at least 15 times. Oxygen contamination at the 0.05 mg/kg level causes severe pitting and chronic oxygen contamination causes rapid failure. External surfaces of buried steel pipe must be protected from contact with groundwater. Groundwater is aerated and has caused pipe failures by external corrosion. External protection can be obtained by coatings, wraps provided the selected material resists the system operating temperature and thermal stress. Carbon steel piping is primarily used on the inside or clean loop side of the isolation heat exchanger. In both underground and aboveground installations, allowance for expansion joints or loops must be provided. For these reasons, carbon steel is not recommended for underground piping, but may be used as an acceptable indoor piping material.

Copper-tubed fan-coil units and heat exchangers have consistently poor performance because of traces of sulfide species found in geothermal fluids in the United States. Copper tubing rapidly becomes fouled with cuprous sulfide films more than .04 mm thick. Serious crevice corrosion occurs at cracks in the film, and uniform corrosion rates of 50 to 150 mils per year appear typical, based on failure analysis. Copper pipe shows corrosion behavior similar to copper heat exchange tubes under conditions of moderate turbulence. Copper is not recommended for use in systems where it is exposed to the geothermal fluid (underground or indoor piping). This section does not apply to DX systems as the refrigerant is an inert gas - it does not cause electrolysis, so it will not corrode from the inside.

Unlike copper and cupronickel, stainless steels are not affected by traces of hydrogen sulfide. Most heat exchangers are of the plate and frame type, most of which are fabricated with one of two standard alloys, Type 304 and Type 316 austenitic stainless steel. Some pump and valve trim also are fabricated from these or other stainless steels. These alloys are subject to pitting and crevice corrosion above a threshold chloride level, which depends on the chromium and molybdenum content of the alloy and on the temperature of the geothermal fluid. At elevated temperatures, the passivation film, which gives the stainless steel its corrosion resistance, is ruptured, and local pitting and crevice corrosion occur. Type 304 is resistant at that temperature until the chloride level reaches approximately 510 mg/kg. Because of its 2% to 3% molybdenum content, Type 316 is always more resistant to chlorides than is Type 304. Stainless steel is recommended for the interior piping portion.

Aluminum alloys are not acceptable in most cases because of catastrophic pitting.

CPVC and PVC materials are easily fabricated and are not adversely affected by oxygen intrusion. External protection against groundwater is not required. The mechanical properties of these materials at higher temperatures may vary greatly from those at ambient temperature, and the materials’ mechanical limits should not be exceeded.

The usual mode of failure is creep rupture: strength decays with time. Manufacturer’s directions for joining should be followed to avoid premature failure of joints. CPVC and PVC are not recommended for underground piping of the ground heat exchanger. However, CPVC and PVC have been used for the interior piping portions.

Cross-linked polyethylene (PEX) is a high-density polyethylene material in which the individual molecules are “cross-linked” during the production of the material. The effect of the crosslinking imparts physical qualities to the piping which allow it to meet the requirements of much higher temperature/pressure applications. Joining the piping is accomplished using specially designed, conversion fittings which are generally of brass construction. Piping with and without an oxygen diffusion barrier is available. The oxygen barrier prevents the diffusion of oxygen through the piping wall and into the water. This is necessary corrosion prevention for closed systems in which ferrous materials are included. PEX is used for underground and indoor piping.

Polyethylene (PE) is a flexible material available in a wide variety of sizes. This is the most common type of piping materials for underground portion of a ground source heat pump. Standard dimension ratio (SDR) is the ratio of the pipe outside diameter to the wall thickness and relates to the pressure rating of the pipe. SDR 17 is generally rated at 100 psi for all diameters, SDR 11 is rated at 160 psi, and SDR 9 is rated at 200 psi. The only recommended joining method is by thermal fusion. Polyethylene is recommended for underground and indoor piping.

**COMMITTEE ACTION:** ACCEPT AS AMENDED BY THE TC

Amend proposal as follows:

**F 103.5 Piping and Tubing Materials Standards.** For water-based systems, ground source heat pump ground-loop pipe and tubing shall comply with the standards listed in Table F 103.5. Piping and tubing used for DX systems shall be of copper in accordance with Section F 103.8.
### TABLE F 103.5
**PLASTIC GROUND SOURCE LOOP PIPING**

<table>
<thead>
<tr>
<th>MATERIAL</th>
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</thead>
<tbody>
<tr>
<td>Cross-linked polyethylene (PEX)</td>
<td>ASTM F876; CSA B137.5; NSF 358-3, CSA C448</td>
</tr>
<tr>
<td>High Density Polyethylene (HDPE)</td>
<td>ASTM D2737; ASTM D3035; ASTM F714; AWWAC901; CSA B137.1; CSA C448; NSF 358-1</td>
</tr>
<tr>
<td>Polypropylene (PP)</td>
<td>ASTM F2389; CSA B137.11; NSF 358-2</td>
</tr>
<tr>
<td>Polyethylene Raised Temperature (PE-RT)</td>
<td>ASTM F2623; ASTM F2769, CSA B137.18, NSF 358-4, CSA C448</td>
</tr>
</tbody>
</table>

### F 103.6 Fittings
For water-based systems, fittings for ground source heat pump systems shall be approved for installation with the piping materials to be installed, and shall comply with the standards listed in Table F 103.6. Fittings for use in DX systems shall comply with Section F 103.8.

### TABLE F 103.6
**GROUND SOURCE LOOP PIPE FITTINGS**

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<tr>
<th>MATERIAL</th>
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<tbody>
<tr>
<td>Cross-linked polyethylene (PEX)</td>
<td>ASTM F877; ASTM F1807; ASTM F1960; ASTM F2080; ASTM F2159; ASTM F2434; CSA B137.5; NSF 358-3, CSA C448, ASTM F 1055</td>
</tr>
<tr>
<td>High Density Polyethylene (HDPE)</td>
<td>ASTM D2683; ASTM D3261; ASTM F1055; CSA B137.1; CSA C448; NSF 358-1</td>
</tr>
<tr>
<td>Polypropylene (PP)</td>
<td>ASTM F2389; CSA B137.11, NSF 358-2</td>
</tr>
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<td>ASTM D3261; ASTM F1807; ASTM F2159; ASTM F2769, CSA B137.18, CSA C448, ASTM F1055, ASTM F2080, NSF 358-4</td>
</tr>
</tbody>
</table>

### F 103.7 Underground Piping and Submerged Materials
Underground and submerged piping for a ground-heat exchanger shall be polyethylene (PE) pipe or tubing in accordance with Section F 103.7.1 and Section F 103.7.1.1, or cross-linked polyethylene (PEX) pipe or tubing in accordance with Section F 103.7.2 and Section F 103.7.2.1.

#### F 103.7.1 Polyethylene (PE)
Polyethylene pipe or tubing shall be manufactured in accordance with the standards listed in Table F 103.5. Pipe or tubing shall have a maximum dimension ratio of 11 and shall have a minimum pressure rating of not less than 160 psi (1103 kPa) at 73°F (23°C).
Polyethylene pipe and tubing shall be manufactured from a PE compound that has a pipe material designation code of PE 3608, PE 3708, PE 3710, PE 4608, PE 4708, or PE 4710 as defined in the applicable standards referenced in Table F 103.5, with a cell classification in accordance with ASTM D3350 appropriate for the material designation code, and a color and ultraviolet stabilizer code of C or E. Code E compounds shall be stabilized against deterioration from unprotected exposure to ultraviolet rays for not less than 3 years in accordance with the test criteria specified in ASTM D2513.

#### F 103.7.1.1 Joining Methods for Polyethylene Pipe or Tubing
Joints between high density polyethylene (HDPE) plastic pipe or tubing and fittings shall be installed in accordance with the manufacturer’s installation instructions, the appropriate standards listed in accordance with Table F 103.6, and one of the following heat fusion methods:
1. Butt-fusion joints shall be made in accordance with ASTM F2620.
2. Socket-fusion joints shall be made in accordance with ASTM F2620.
3. Electrofusion joints shall be made in accordance with ASTM F1055.

#### F 103.7.2 Cross-Linked Polyethylene (PEX)
Cross-linked polyethylene pipe shall be manufactured in accordance with the standards listed in Table F103.6. PEX shall have a minimum tubing material designation code of PEX 1206 and shall have a minimum pressure rating of not less than 160 psi (1103 kPa) at 73°F (23°C).

#### F 103.7.2.1 Joining Methods for Cross-Linked Polyethylene Tubing
Joints between cross-linked polyethylene (PEX) tubing and fittings shall be installed in accordance with the manufacturer’s installation instructions and the appropriate standards in accordance with Table F 103.6.

### F 103.8 DX Systems
Copper pipe and tubing installed for DX systems shall be manufactured in accordance with ASTM B280.
and copper fittings in accordance with ASME B16.22. Joints shall be purged with an inert gas and brazed with a brazing alloy having 15 percent silver content in accordance with AWS A5.8. Underground piping and tubing shall have a cathodic protection system installed.

**F 103.9 Indoor Piping.** Indoor piping, fittings, and accessories that are part of the groundwater system shall be in accordance with Chapter 12. Such materials shall be rated for the operating temperature and pressures of the system and shall be compatible with the type of transfer medium. For DX systems, joints shall be purged with an inert gas and brazed with a brazing alloy having 15 percent silver content in accordance with AWS A5.8.

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**TABLE 1701.2**  
STANDARDS, PUBLICATIONS, PRACTICES, AND GUIDES

<table>
<thead>
<tr>
<th>DOCUMENT NUMBER</th>
<th>DOCUMENT TITLE</th>
<th>APPLICATION</th>
</tr>
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<tbody>
<tr>
<td>NSF 358-4 (Draft)</td>
<td>Polyethylene of Raised Temperature (PE-RT) Pipe and Fittings for Water-Based Ground-Source (Geothermal) Heat Pump Systems</td>
<td>Ground-Source Heat Pumps</td>
</tr>
</tbody>
</table>

(portion of table not shown remain unchanged)

**COMMITTEE STATEMENT:**
The proposed text is being modified to remove reference to NSF 358-4 as it was a working draft and was not completed at the time of the monograph.

**TOTAL ELIGIBLE TO VOTE:** 26  
**VOTING RESULTS:**  
**AFFIRMATIVE:** 25  
**NOT RETURNED:** 1  
HOWARD

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**Appended Comments**

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**PUBLIC COMMENT 1**

**Code Year:** 2021 UMC  
**Section #:** Table F 104.5, Table F 104.6, Table 1701.2  
**Item #:** 164  
**SUBMITTER:** Jeremy Brown  
NSF International  
**Comment #:** 1  
**RECOMMENDATION:**
Revise text

Request to accept the code change proposal **as modified** by this public comment.

**TABLE F 104.5**  
PLASTIC GROUND SOURCE LOOP PIPING

<table>
<thead>
<tr>
<th>MATERIAL</th>
<th>STANDARD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Polyethylene Raised Temperature (PE-RT)</td>
<td>ASTM F2623; ASTM F2769, CSA B137.18, CSA C448, <strong>NSF 358-4</strong></td>
</tr>
</tbody>
</table>

(portion of table not shown remain unchanged)

**TABLE F 104.6**  
GROUND SOURCE LOOP PIPE FITTINGS

<table>
<thead>
<tr>
<th>MATERIAL</th>
<th>STANDARD</th>
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</thead>
<tbody>
<tr>
<td>Polyethylene Raised Temperature (PE-RT)</td>
<td>ASTM D3261; ASTM F1055; ASTM F1807; ASTM F2080; ASTM F2159; ASTM F2769; CSA B137.18; CSA C448, <strong>NSF 358-4</strong></td>
</tr>
</tbody>
</table>

(portion of table not shown remain unchanged)
TABLE 1701.2  
STANDARDS, PUBLICATIONS, PRACTICES, AND GUIDES

<table>
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<th>DOCUMENT NUMBER</th>
<th>DOCUMENT TITLE</th>
<th>APPLICATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>NSF 358-4-2018</td>
<td>Polyethylene of Raised Temperature (PE-RT) Tubing and Fittings for Water-Based Ground-Source (Geothermal) Heat Pump Systems</td>
<td>Ground-Source Heat Pumps</td>
</tr>
</tbody>
</table>

(portion of table not shown remain unchanged)

SUBSTANTIATION:
NSF/ANSI 358-4 Polyethylene of Raised Temperature (PE-RT) Tubing and Fittings for Water-Based Ground-Source (Geothermal) Heat Pump Systems is now complete and published. This standard is the 4th in a series of standard for geothermal pipe and fittings. NSF 358-1 (PE), NSF 358-2 (PP), and NSF 358-3 (PEX) are already referenced in the UMC. This last version, NSF 358-4, is adding the requirements for PE-RT. This standard addresses requirements for performance, long term strength, U-bend assembled joint testing, chemical resistance, thermocycling, constant tensile load joint testing, joint pressure testing, marking, suitability for burial and quality assurance. This document is appropriate for adoption into the UMC.

A final version of this document is available for review by the Technical Committee. Anyone else wanting a copy of NSF 358-4 for the purposes of considering this proposal may request a free copy from brown@nsf.org.
Item #: 177

UMC 2021  Section: Appendix F: F 101.4 - F 103.0

SUBMITTER: IAPMO Staff - Update Extracts  
NFPA 54 Extract Update

RECOMMENDATION:
Revise text

F 101.0 General.
F 101.4 Example 2: Single Fan-Assisted Appliance. An installer has an 80 000 Btu/h (23.4 kW) input fan-assisted appliance that shall must be installed using 10 feet (3048 mm) of lateral connector attached to a 30 foot (9144 mm) high Type B vent. Two 90-degree (1.57 rad) elbows are needed for the installation. Is Can a single-wall metal vent connector permitted to be used for this application? (See Figure F 101.4)

Solution:
Table 803.1.2(2) refers to the use of single-wall metal vent connectors with Type B vent. In the first column find the row associated with a 30 foot (9144 mm) height and a 10 foot (3048 mm) lateral. Read across this row, looking at the FAN Min and FAN Max columns, to find that a 3 inch (76 mm) diameter single-wall metal vent connector is not recommended. Moving to the next larger size single-wall connector [4 inch (102 mm)] we find that a 4 inch (102 mm) diameter single-wall metal connector has a recommended minimum vent capacity of 91 000 Btu/hr (26.7 kW) and a recommended maximum vent capacity of 144 000 Btu/h (42 kW). The 80 000 Btu/h (23.4 kW) fan-assisted appliance is outside this range, so the conclusion is that a single-wall metal vent connector shall not cannot be used to vent the this appliance using a 10 foot (3048 mm) of lateral for the connector. However, if the 80 000 Btu/hr (23.4 kW) input appliance is could be moved within 5 feet (1524 mm) of the vertical vent, a 4 inch (102 mm) single-wall metal connector shall could be used to vent the appliance. Table 803.1.2(2) shows the acceptable range of vent capacities for a 4 inch (102 mm) vent with 5 feet (1524 mm) of lateral to be between 72 000 Btu/h (21.1 kW) and 157 000 Btu/h (46 kW).

Where If the appliance cannot be moved closer to the vertical vent, then a Type B vent shall could be used as the connector material. In this case, Table 803.1.2(1) shows that, for a 30 foot (9144 mm) high vent with 10 feet (3048 mm) of lateral, the acceptable range of vent capacities for a 4 inch (102 mm) diameter vent attached to a fan-assisted appliance is between 37 000 Btu/h (10.8 kW) and 150 000 Btu/h (44 kW).

F 101.5 Example 3: Interpolating Between Table Values. An installer has an 80 000 Btu/h (23.4 kW) input appliance with a 4 inch (102 mm) diameter draft hood outlet that needs to be vented into a 12 foot (3658 mm) high Type B vent. The vent connector has a 5 foot (1524 mm) lateral length and is also Type B. Can Is this appliance permitted to be vented using a 4 inch (102 mm) diameter vent?

Solution:
Table 803.1.2(1) is used in the case of an all Type B Vent system. However, since there is no entry in Table 803.1.2(1) does not have an entry for a height of 12 feet (3658 mm), and interpolation shall must be used. Read down the 4 inch (102 mm) diameter NAT Max column to the row associated with a 10 foot (3048 mm) height and 5 foot (1524 mm) lateral to find the capacity value of 77 000 Btu/h (22.6 kW). Read further down to the 15 foot (4572 mm) height, 5 foot (1524 mm) lateral row to find the capacity value of 87 000 Btu/h (25.5 kW). The difference between the 15 foot (4572 mm) height capacity value and the 10 foot (3048 mm) height capacity value is 10 000 Btu/h (3 kW). The capacity for a vent system with a 12 foot (3658 mm) height is equal to the capacity for a 10 foot (3048 mm) height plus two-fifths of the difference between the 10 foot (3048 mm) and 15 foot (4572 mm) height values, or 77 000 Btu/h (22.6 kW) + 2/5 x 10 000 Btu/h (3 kW) = 81 000 Btu/h (23.7 kW). Therefore, a 4 inch (102 mm) diameter vent shall can be used in the installation.

F 102.0 Examples Using Common Venting Tables.
F 102.1 Example 4: Common Venting Two Draft Hood-Equipped Appliances. A 35 000 Btu/h (10.3 kW) water heater is to be common vented with a 150 000 Btu/h (44 kW) furnace, using a common vent with a total height of 30 feet (9144 mm). The connector rise is 2 feet (610 mm) for the water heater with a horizontal length of 4 feet (1219 mm). The connector rise for the furnace is 3 feet (914 mm) with a horizontal length of 8 feet (2438 mm). Assume single-wall metal connectors will be used with Type B vent. What size connectors and combined vent should be used in this
**Table 803.2(2) shall should be used to size single-wall metal vent connectors attached to Type B vertical vents. In the vent connector capacity portion of Table 803.2(2), find the row associated with a 30 foot (9144 mm) vent height. For a 2 foot (610 mm) rise on the vent connector for the water heater, read the shaded columns for draft hood-equipped appliances to find that a 3 inch (76 mm) diameter vent connector shall can be used with the water heater. For a draft hood-equipped furnace with a 3 foot (914 mm) rise, read across the appropriate row to find that a 5 inch (127 mm) diameter vent connector shall can be used without adjustments.**

In the common vent capacity portion of Table 803.2(2), find the row associated with a 30 foot (9144 mm) vent height and read over to the NAT + NAT portion of the 6 inch (152 mm) diameter column to find a maximum combined capacity of 257 000 Btu/h (75 kW). Since the two appliances total only 185 000 Btu/h (54 kW), a 6 inch (152 mm) common vent shall can be used.

**F 102.2 Example 5(a): Common Venting a Draft Hood-Equipped Water Heater with a Fan-Assisted Furnace into a Type B Vent.**

In this case, a 35 000 Btu/h (10.3 kW) input draft hood-equipped water heater with a 4 inch (102 mm) diameter draft hood outlet, 2 feet (610 mm) of connector rise, and 4 feet (1219 mm) of horizontal length is to be common vented with a 100 000 Btu/h (29 kW) fan-assisted furnace with a 4 inch (102 mm) diameter flue collar, 3 feet (914 mm) of connector rise, and 6 feet (1829 mm) of horizontal length. The common vent consists of a 30 foot (9144 mm) height of Type B vent. What are the recommended vent diameters for each connector and the common vent? The installer would like to use a single-wall vent connector. (See Figure F 102.2)

**Solution:**

Water Heater Vent Connector Diameter. Since the water heater vent connector horizontal length of 4 feet (1219 mm) is less than the maximum value listed in Table 803.2(2), the venting table values shall can be used without adjustments. Using the Vent Connector Capacity portion of Table 803.2(2), read down the Total Vent Height (H) column to 30 feet (9144 mm) and read across the 2 feet (610 mm) Connector Rise (R) row to the first Btu/h rating in the NAT Max column that is equal to or exceeding greater than the water heater input rating. The table shows that a 3 inch (76 mm) vent connector has a maximum input rating of 37 000 Btu/h (10.8 kW). Although this rating is exceeding greater than the water heater input rating, a 3 inch (76 mm) vent connector is prohibited by Section 803.2.18. A 4 inch (102 mm) vent connector has a maximum input rating of 85 000 Btu/h (24.9 kW). The 100 000 Btu/h (29 kW) furnace in this example falls within this range, so a 4 inch (102 mm) connector shall be permitted. Since is adequate. Because the furnace has a fan-assisted combustion system, find the first FAN Max column with a Btu/h rating exceeding greater than the furnace input rating. The 4 inch (102 mm) vent connector has a maximum input rating of 119 000 Btu/h (34.9 kW) and a minimum input rating of 85 000 Btu/h (24.9 kW).

Furnace Vent Connector Diameter. Using the Vent Connector Capacity portion of Table 803.2(2), read down the Total Vent Height (H) column to 30 feet (9144 mm) and across the 3 feet (914 mm) Connector Rise (R) row. Since Because the furnace has a fan-assisted combustion system, find the first FAN Max column with a Btu/h rating exceeding greater than the furnace input rating. The 4 inch (102 mm) vent connector has a maximum input rating of 135 000 Btu/h (40 kW). The 4 inch (102 mm) common vent shall be used without adjustment. Where If the furnace had an input rating of 80 000 Btu/h (23.4 kW), then a Type B vent connector shall would be needed in order to meet the minimum capacity limit.

Common Vent Diameter. The total input to the common vent is 135 000 Btu/h (40 kW). Using the Common Vent Capacity portion of Table 803.2(2), read down the Total Vent Height (H) column to 30 feet (9144 mm) and across this row to find the smallest vent diameter in the FAN + NAT column that has a Btu/h rating equal to or exceeding greater than 135 000 Btu/h (40 kW). The 4 inch (102 mm) common vent has a capacity of 132 000 Btu/h (39 kW) and the 5 inch (127 mm) common vent has a capacity of 202 000 Btu/h (59 kW). Therefore, the 5 inch (127 mm) common vent shall should be used in this example.

Summary: In this example, the installer shall can use a 4 inch (102 mm) diameter, single-wall metal vent connector for the water heater and a 4 inch (102 mm) diameter, single-wall metal vent connector for the furnace. The common vent shall should be a 5 inch (127 mm) diameter Type B vent.

**F 102.3 Example 5(b): Common Venting into an Interior Masonry Chimney.** In this case, the water heater and fan-assisted furnace of Example 5(a) are to be common-vented into a clay-tile lined masonry chimney with a 30 foot (9144 mm) height. The chimney is not exposed to the outdoors below the roof line. The internal dimensions of the clay tile liner are nominally 8 inches (203 mm) by 12 inches (305 mm). Assuming the same vent connector heights, laterals, and materials found in Example 5(a), what are the recommended vent connector diameters, and is this an acceptable installation?

**Solution:**

Water Heater Vent Connector Diameter. Using Table 803.2(4), Vent Connector Capacity, read down the Total Vent Height (H) column to 30 feet (9144 mm), and read across the 2 feet (610 mm) Connector Rise(R) row to the first Btu/h rating in the NAT Max column that is equal to or exceeding greater than the water heater input rating. The table shows that a 3 inch (76 mm) vent connector has a maximum input of only 31 000 Btu/h (9 kW), while a 4 inch (102 mm) vent connector has a maximum input of 57 000 Btu/h (16.7 kW). A 4 inch (102 mm) vent connector shall must therefore be used.

Furnace Vent Connector Diameter. Using the Vent Connector Capacity portion of Table 803.2(2), read down the total Total Vent Height (H) column
to 30 feet (9144 mm) and across the 3 feet (914 mm) Connector Rise (R) row. Because the furnace has a fan-assisted combustion system, find the first FAN Max column with a Btu/h rating exceeding greater than the furnace input rating. The 4 inch (102 mm) vent connector has a maximum input rating of 127 000 Btu/h (37 kW) and an a minimum input rating of not less than 95 000 Btu/h (27.8 kW). The 100 000 Btu/h (29 kW) furnace in this example falls within this range, so a 4 inch (102 mm) connector shall be permitted is adequate.

Masonry Chimney. From Table F 102.3, the Equivalent Area for a Nominal Liner size of 8 inches (203 mm) by 12 inches (305 mm) is 63.6 of a square inches (0.041 m²). Using Table 803.2(4), Common Vent Capacity, read down the FAN + NAT column under the Minimum Internal Area of Chimney value of 63 to the row for 30 foot (9144 mm) height to find a capacity value of 739 000 Btu/h (217 kW). The combined input rating of the furnace and water heater, 135 000 Btu/h (40 kW), is less than the table value so this is an acceptable installation.

Section 803.2.17 requires the common vent area to not exceed be no greater than seven times the smallest listed appliance categorized vent area, flue collar area, or draft hood outlet area. Both appliances in this installation have 4 inch (102 mm) diameter outlets. From Table F 102.3, the equivalent area for an inside diameter of 4 inches (102 mm) is 12.2 of a square inches (0.008 m²). Seven times 12.2 equals 85.4, which is exceeding greater than 63.6, so this configuration is acceptable.

**F 103.0 Example of Combination Indoor and Outdoor Combustion Air Opening Design.** Determine the required combination of indoor and outdoor combustion air opening sizes for the following appliance installation example.

Example Installation: A fan-assisted furnace and a draft hood-equipped water heater with the following inputs are located in a 15 foot by 30 foot (4572 mm by 9144 mm) basement with an 8 foot (2438 mm) ceiling. No additional indoor spaces shall can be used to help meet the appliance combustion air needs.

Fan-Assisted Furnace Input: 100 000 Btu/h (29 kW)
Draft Hood-Equipped Water Heater Input: 40 000 Btu/h (11.7 kW)

Solution:

1. Determine the total available room volume.
   - Appliance room volume.
     15 feet by 30 feet (4572 mm by 9144 mm) with an 8 foot (2438 mm) ceiling = 3600 cubic feet (101.94 m³)

2. Determine the total required volume.
   - The Standard Method to determine combustion air shall be is used to calculate the required volume.
     The combined input for the appliances located in the basement is calculated as follows:
     100 000 Btu/h (29 kW) + 40 000 Btu/h (11.7 kW) = 140 000 Btu/h (41 kW)
     The Standard Method requires that the required volume be determined based on 50 cubic feet per 1000 Btu/h (4.83 m³/kW).
     Using Table F 103.0 the required volume for a 140 000 Btu/h (41 kW) water heater is 7000 cubic feet (198.22 m³).

Conclusion:

The indoor volume is insufficient to supply combustion air since the total of 3600 cubic feet (101.94 m³) does not meet the required volume of 7000 cubic feet (198.22 m³). Therefore, additional combustion air shall must be provided from the outdoors.

3. Determine the ratio of the available volume to the required volume:
   - 3600 cubic feet = 0.51
   - 7000 cubic feet

4. Determine the reduction factor to be used to reduce the full outdoor air opening size to the minimum required based on ratio of indoor spaces:
   - 1.00 – 0.51 (from Step 3) = 0.49

5. Determine the single outdoor combustion air opening size as if though all combustion air is to come from outdoors. In this example, the combustion air opening directly communicates with the outdoors:
   - \[ \frac{140 000 \text{ Btu/h}}{3000 \text{ Btu/in}^2} = 47 \text{ square inch (0.03 m}^2) \]

6. Determine the minimum outdoor combustion air opening area:
   - Outdoor opening area = 0.49 (from Step 4) x 47 square inches (0.03 m²) = 23 square inches (0.01 m²)

Section 701.7.3(3) requires the minimum dimension of the air opening shall be should not be less than 3 inches (76 mm).

**SUBSTANTIATION:**
In accordance with IAPMO's Regulations Governing Committee Projects (Extract Guidelines), Appendix F is being revised to the latest edition of NFPA 54-2018.

**COMMITTEE ACTION:** ACCEPT AS SUBMITTED

**TOTAL ELIGIBLE TO VOTE:** 26

**VOTING RESULTS:** AFFIRMATIVE: 25  NOT RETURNED: 1  HOWARD

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**PUBLIC COMMENT 1**

**Code Year:** 2021 UMC  **Section #:** Appendix G  **Item #:** 177

**SUBMITTER:** IAPMO Staff - Update Extracts  **Comment #:** 1

**NFPA 54 Extract Update**

**RECOMMENDATION:**
Revise text

Request to accept the code change proposal *as modified* by this public comment.

Table 803.1.2(1) is used *where when* sizing a Type B double-wall gas vent connected directly to the appliance.

**Note:** The appliance *is permitted to can* be either Category I draft hood-equipped or fan-assisted type.

**FIGURE G 101.2(1)**

**TYPE B DOUBLE-WALL VENT SYSTEM SERVING A SINGLE APPLIANCE WITH A TYPE B DOUBLE-WALL VENT**
Table 803.1.2(2) is used where when sizing a single-wall metal vent connector attached to a Type B double-wall gas vent. 

**Note:** The appliance is permitted to be either Category I draft hood-equipped or fan-assisted type.

**FIGURE G 101.2(2)**

**TYPE B DOUBLE-WALL VENT SYSTEM SERVING A SINGLE APPLIANCE WITH A SINGLE-WALL METAL VENT CONNECTOR**

Table 803.1.2(3) is used when sizing a Type B double-wall gas vent connected attached to a tile-lined masonry chimney.

**Notes:**
1. \( A \) is the equivalent cross-sectional area of the tile liner.
2. The appliance is permitted to be either Category I draft hood-equipped or fan-assisted type.

**FIGURE G 101.2(3)**

**VENT SYSTEM SERVING A SINGLE APPLIANCE WITH A MASONRY CHIMNEY AND A TYPE B DOUBLE-WALL VENT CONNECTOR**
Table 803.1.2(4) is used when sizing a single-wall vent connector attached to a tile-lined masonry chimney.

Notes:
1. $A$ is the equivalent cross-sectional area of the tile liner.
2. The appliance may be either Category I draft hood-equipped or fan-assisted type.

FIGURE G 101.2(4)
VENT SYSTEM SERVING A SINGLE APPLIANCE USING A MASONRY CHIMNEY AND A SINGLE-WALL METAL VENT CONNECTOR

Table 803.1.2(1) is used when sizing Type B double-wall gas vent connectors attached to a Type B double-wall common vent.

Note: Each appliance may be either Category I draft hood-equipped or fan-assisted type.

FIGURE G 101.2(6)
VENT SYSTEM SERVING TWO OR MORE APPLIANCES WITH TYPE B DOUBLE-WALL VENT AND TYPE B DOUBLE-WALL VENT CONNECTORS
Table 803.2(2) is used when sizing single-wall vent connectors attached to a Type B double-wall common vent.  
**Note:** Each appliance is permitted to be either Category I draft hood-equipped or fan-assisted type.

**FIGURE G 101.2(7)**  
VENT SYSTEM SERVING TWO OR MORE APPLIANCES WITH TYPE B DOUBLE-WALL VENT AND SINGLE-WALL METAL VENT CONNECTORS

Table 803.2(3) is used when sizing Type B double-wall vent connectors attached to a tile-lined masonry chimney.  
**Notes:**  
1. $A$ is the equivalent cross-sectional area of the tile liner.  
2. The appliance is permitted to be either Category I draft hood-equipped or fan-assisted type.

**FIGURE G 101.2(8)**  
MASONRY CHIMNEY SERVING TWO OR MORE APPLIANCES WITH TYPE B DOUBLE-WALL VENT CONNECTORS
Table 803.2(4) is used when sizing single-wall vent connectors attached to a tile-masonry chimney.

Notes:
1. \( A \) is the equivalent cross-sectional area of the tile liner.
2. The appliance can be either Category I draft hood-equipped or fan-assisted type.

**FIGURE G 101.2(9)**
MASSORY CHIMNEY SERVING TWO OR MORE APPLIANCES WITH SINGLE-WALL METAL VENT CONNECTORS

See Section 803.2.4

Asbestos cement Type B or single-wall metal pipe vent serving two or more draft hood-equipped appliances. [See Table 803.2950]

**FIGURE G 101.2(10)**
ASBESTOS CEMENT TYPE B OR SINGLE-WALL METAL VENT SYSTEMS SERVING TWO OR MORE DRAFT HOOD-EQUIPPED APPLIANCES
Example: Manifolded common vent connector $LM$ can be no greater than 18 times the common vent connector manifold inside diameter; that is, a 4 inch (102 mm) inside diameter common vent connector manifold shall not exceed 72 inches (1829 mm) in length. [See Section 803.2.3]

Note: This is an illustration of a typical manifolded vent connector. Different appliance, vent connector, or common vent types are possible. [See Section 803.2]

**FIGURE G 101.2(11)**

**USE OF MANIFOLDED COMMON VENT CONNECTORS**

**FIGURE G 101.2(13)**

**MULTISTORY GAS VENT DESIGN PROCEDURE FOR EACH SEGMENT OF SYSTEM**

G 101.3 Example 1: Single Draft Hood-Equipped Appliance. (remaining text unchanged)

Solution:
Table 803.1.2(2) shall be used to solve this problem because single-wall metal vent connectors are being used with a Type B vent, as follows:

1. Read down the first column in Table 803.1.2(2) until the row associated with a 10 foot (3048 mm) height and 5 foot (1524 mm) lateral is found. Read across this row until a vent capacity exceeding 120 000 Btu/h (35 kW) is located in the shaded columns labeled NAT Max for draft hood-equipped appliances. In this case, a 5 inch (127 mm) diameter vent has a capacity of 122 000 Btu/h (35.7 kW) and shall be permitted to be used for this application.

2. Where three 90 degree (1.57 rad) elbows are used in the vent system, the maximum vent capacity listed in the tables must be reduced by 10 percent. This implies that the 5 inch (127 mm) diameter vent has an adjusted capacity of only 110 000 Btu/h (32 kW). In this case, the vent system must be increased to 6 inches (152 mm) in diameter. See the following calculations:

\[
122 000 \text{ Btu/h (35.7 kW)} \times 0.90 = 110 000 \text{ Btu/h (32 kW)} \text{ for 5 inch (127 mm) vent}
\]

From Table 803.1.2(2), select 6 inches (152 mm) vent.

\[
186 000 \text{ Btu/h (54.5 kW)} \times 0.90 = 167 000 \text{ Btu/h (49 kW)}
\]

This figure is exceeding the required 120 000 Btu/h (35 kW). Therefore, use a 6 inch (152 mm) vent and connector where three elbows are used.

---

**FIGURE G 101.2(14)**

PRINCIPLES OF DESIGN OF MULTISTORY VENTS USING VENT CONNECTOR AND COMMON VENT DESIGN TABLES

[See Section 803.2.12 through Section 803.2.15]
For SI units: 1 foot = 304.8 mm, 1000 British thermal units per hour = 0.293 kW

FIGURE G 101.3
SINGLE DRAFT HOOD-EQUIPPED APPLIANCE – EXAMPLE 1

G 101.4 Example 2: Single Fan-Assisted Appliance. (remaining text unchanged)

Solution:

Table 803.1.2(2) refers to the use of single-wall metal vent connectors with Type B vent. In the first column find the row associated with a 30 foot (9144 mm) height and a 10 foot (3048 mm) lateral. Read across this row, looking at the FAN Min and FAN Max columns, to find that a 3 inch (76 mm) diameter single-wall metal vent connector is not recommended. Moving to the next larger size single-wall connector [4 inch (102 mm)] we find that a 4 inch (102 mm) diameter single-wall metal connector has a recommended minimum vent capacity of 91,000 Btu/hr (26.7 kW) and a recommended maximum vent capacity of 144,000 Btu/hr (42 kW). The 80,000 Btu/hr (23.4 kW) fan-assisted appliance is outside this range, so the conclusion is that a single-wall metal vent connector cannot be used to vent this appliance using 10 foot (3048 mm) of lateral for the connector. However, if the 80,000 Btu/hr (23.4 kW) input appliance could be moved to within 5 feet (1524 mm) of the vertical vent, a 4 inch (102 mm) single-wall metal connector could be used to vent the appliance. Table 803.1.2(2) shows the acceptable range of vent capacities for a 4 inch (102 mm) vent with 5 feet (1524 mm) of lateral to be between 72,000 Btu/hr (21.1 kW) and 157,000 Btu/hr (46 kW).

If the appliance cannot be moved closer to the vertical vent, then a Type B vent could be used as the connector material. In this case, Table 803.1.2(1) shows that, for a 30 foot (9144 mm) high vent with 10 feet (3048 mm) of lateral, the acceptable range of vent capacities for a 4 inch (102 mm) diameter vent attached to a fan-assisted appliance is between 37,000 Btu/hr (10.8 kW) and 150,000 Btu/hr (44 kW).

TABLE G 102.3
MASONRY CHIMNEY LINER DIMENSIONS WITH CIRCULAR EQUIVALENTS*

(portion of table not shown remains unchanged)

For SI units, 1 inch = 25.4 mm, 1 square inch = 0.000645 m²

*Where liner sizes differ dimensionally from those shown in this table, equivalent diameters shall be permitted to be determined from published tables for square and rectangular ducts of equivalent carrying capacity or by other engineering methods.

SUBSTANTIATION:
In accordance with IAPMO’s Regulations Governing Committee Projects (Extract Guidelines), the above sections are being revised to the latest edition of NFPA 54-2018.
Item #: 178
UMC 2021  Section:  Table 1701.1, Table 1701.2

SUBMITTER:  Ladan Bulookbashi
Air Conditioning, Heating and Refrigeration Institute (AHRI)

RECOMMENDATION:
Revise text

TABLE 1701.1
REFERENCED STANDARDS

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<thead>
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<th>STANDARD NUMBER</th>
<th>STANDARD TITLE</th>
<th>APPLICATION</th>
<th>REFERENCED SECTION</th>
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<td>AHRI 700-2016a 2017a</td>
<td>Specifications for Refrigerants</td>
<td>Refrigerants</td>
<td>1104.7, 1104.7.3</td>
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(portion of table not shown remains unchanged)

Note: AHRI 700 meets the requirements for mandatory reference standards in accordance with Section 3-3.7.1 of IAPMO's Regulations Governing Committee Projects.

TABLE 1701.2
STANDARDS, PUBLICATIONS, PRACTICES, AND GUIDES

<table>
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<tr>
<th>DOCUMENT NUMBER</th>
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SUBSTANTIATION:
The references to the AHRI Standards should be updated to reflect the most recent publication year of the standards.

COMMITTEE ACTION: ACCEPT AS SUBMITTED
TOTAL ELIGIBLE TO VOTE: 26
VOTING RESULTS:  AFFIRMATIVE: 25  NOT RETURNED: 1  HOWARD
Appended Comments

PUBLIC COMMENT 1

Code Year: 2021 UMC  Section #: Table 1701.1, Table 1701.2  Item #: 178
SUBMITTER: Joseph Brooks
AMCA
Comment #: 1

RECOMMENDATION:
Revise text

Request to accept the code change proposal as modified by this public comment.

TABLE 1701.1
REFERENCED STANDARDS

<table>
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<td>AMCA 550-2015</td>
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<td>Louvers</td>
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Note: AMCA 550 meets the requirements for mandatory reference standards in accordance with Section 3-3.7.1 of IAPMO’s Regulations Governing Committee Projects.

TABLE 1701.2
STANDARDS, PUBLICATIONS, PRACTICES, AND GUIDES

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<td>AMCA 500-D-2012-2018</td>
<td>Laboratory Methods of Testing Dampers for Rating</td>
<td>Dampers</td>
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SUBSTANTIATION:
The above revisions reflect the latest update to the Air Movement and Control Association (AMCA) standards that are referenced in Table 1701.1 and Table 1701.2.
Item #: 180
UMC 2021  Section: Table 1701.1, Table 1701.2

SUBMITTER: Connor Barbaree
ASHRAE

RECOMMENDATION:
Revise text

**TABLE 1701.1**
**REFERENCED STANDARDS**

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<td>ASHRAE Handbook-2013 2017</td>
<td>Fundamentals</td>
<td>Climatic Conditions</td>
<td>Figure 803.1.2(6)</td>
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(portion of table not shown remain unchanged)

**Note:** The ASHRAE Handbook does not meet the requirements for mandatory reference standards in accordance with Section 3-3.7.1 of IAPMO's Regulations Governing Committee Projects.

**TABLE 1701.2**
**STANDARDS, PUBLICATIONS, PRACTICES, AND GUIDES**

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<td>ASHRAE 55-2013 2017</td>
<td>Thermal Environmental Conditions for Human Occupancy</td>
<td>Miscellaneous</td>
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**SUBSTANTIATION:**
The above revisions reflect the latest updates to the ASHRAE standards that are referenced in Table 1701.1 and Table 1701.2.

**COMMITTEE ACTION:** ACCEPT AS SUBMITTED

**TOTAL ELIGIBLE TO VOTE:** 26

**VOTING RESULTS:** AFFIRMATIVE: 25  NOT RETURNED: 1  HOWARD

Appended Comments

PUBLIC COMMENT 1
TABLE 1701.2
STANDARDS, PUBLICATIONS, PRACTICES, AND GUIDES

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SUBSTANTIATION:
The above revisions reflect the latest update to the ASHRAE standards that are referenced in Table 1701.2.

PUBLIC COMMENT 2
Code Year: 2021 UMC  Section #: Table 1701.1, Table 1701.2  Item #: 180
SUBMITTER: David Bixby  Air Conditioning Contractors of America (ACCA)  Comment #: 2

RECOMMENDATION:
Revise text

Request to accept the code change proposal as modified by this public comment.

TABLE 1701.1
REFERENCED STANDARDS

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<td>Maintenance of Residential HVAC Systems</td>
<td>HVAC Systems</td>
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<tr>
<td>ASHRAE/ACCA 180-2012-2018</td>
<td>Inspection and Maintenance of Commercial Building HVAC Systems</td>
<td>Maintenance</td>
<td>102.3.1, 1013.3</td>
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(portion of table not shown remains unchanged)

Note: ACCA 4 QM and ASHRAE/ACCA 180 meet the requirements for a mandatory referenced standard in accordance with Section 3-3.7.1 of IAPMO’s Regulations Governing Committee Projects.
SUBSTANTIATION:
The above revisions reflect the latest updates to the ASHRAE and ACCA standards that are referenced in Table 1701.1 and Table 1701.2.
**Item #: 181**

UMC 2021  Section: Table 1701.1, Table 1701.2

**SUBMITTER:** Carlton Ramcharran, Angel Guzman
American Society of Mechanical Engineering (ASME)

**RECOMMENDATION:**
Revise text

### TABLE 1701.1
**REFERENCED STANDARDS**

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<td>ASME B16.3-2014</td>
<td>2016</td>
<td>Malleable Iron Threaded Fittings: Classes 150 and 300</td>
<td>Fittings</td>
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<td>ASME B16.5-2013</td>
<td>Pipe Flanges and Flanged Fittings: NPS 1/2 through NPS 24 Metric/Inch</td>
<td>Fittings</td>
<td>Table 1210.1, 1308.5.10.1</td>
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<td>Forged Fittings, Socket-Welding and Threaded</td>
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<td>Table 1210.1</td>
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<td>1308.5.11.3</td>
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<td>Cast Copper Alloy Solder Joint Drainage Fittings</td>
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<td>Cast Copper Alloy Pipe Flanges, and Flanged Fittings, and Valves: Classes 150, 300, 600, 900, 1500, and 2500</td>
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<td>Large Diameter Steel Flanges: NPS 26 Through NPS 60 Metric/Inch</td>
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<td>1308.5.10.1</td>
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<td>Rules for Construction of Power Boilers</td>
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<td>Boilers</td>
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<tr>
<td>ASME BPVC Section VIII, 1-2015</td>
<td>2017</td>
<td>Rules for Construction of Pressure Vessels - Division 1</td>
<td>Pressure Vessels</td>
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</table>
Note: The ASME Standards meet the requirements for mandatory reference standards in accordance with Section 3-3.7.1 of IAPMO’s Regulations Governing Committee Projects.

TABLE 1701.2
STANDARDS, PUBLICATIONS, PRACTICES, AND GUIDES

<table>
<thead>
<tr>
<th>DOCUMENT NUMBER</th>
<th>DOCUMENT TITLE</th>
<th>APPLICATION</th>
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<tbody>
<tr>
<td>ASME A13.1-2007 (R2013)</td>
<td>Scheme for the Identification of Piping Systems</td>
<td>Piping</td>
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<tr>
<td>ASME A112.18.6/CSA B125.6-2009 (R2014) 2017</td>
<td>Flexible Water Connectors</td>
<td>Piping</td>
</tr>
<tr>
<td>ASME B16.33-2012 (R2017)</td>
<td>Manually Operated Metallic Gas Valves for Use in Gas Piping Systems up to 175 psi (Sizes NPS 1/2 through NPS 2)</td>
<td>Valves</td>
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SUBSTANTIATION:
The above revisions reflect the latest updates to the American Society of Mechanical Engineering (ASME) standards that are referenced in Table 1701.1 and Table 1701.2.

COMMITTEE ACTION: ACCEPT AS SUBMITTED

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 25 NOT RETURNED: 1 HOWARD

Appendix Comments

PUBLIC COMMENT 1

Code Year: 2021 UMC  Section #: Table 1701.1, Table 1701.2  Item #: 181

SUBMITTER: Carlton Ramcharan/Angel Luis Guzman Rodriguez  ASME

RECOMMENDATION:
Revise text

Request to accept the code change proposal as modified by this public comment.

TABLE 1701.1
REFERENCED STANDARDS

<table>
<thead>
<tr>
<th>STANDARD NUMBER</th>
<th>STANDARD TITLE</th>
<th>APPLICATION</th>
<th>REFERENCED SECTION</th>
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<tr>
<td>ASME B16.9-2012-2018</td>
<td>Factory-Made Wrought Buttwelding Fittings</td>
<td>Fittings</td>
<td>Table 1210.1</td>
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<tr>
<td>ASME B16.15-2013-2018</td>
<td>Cast Copper Alloy Threaded Fittings: Classes 125 and 250</td>
<td>Fittings</td>
<td>Table 1210.1</td>
</tr>
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</table>
## TABLE 1701.2

### DOCUMENT NUMBER | DOCUMENT TITLE | APPLICATION
--- | --- | ---
ASME B1.20.3-1976 (R2013) (R2018) | Dryseal Pipe Threads (Inch) | Joints
ASME B16.50-2013-2018 | Wrought Copper and Copper Alloy Braze-Joint Pressure Fittings | Fittings

(portion of table not shown remains unchanged)

**SUBSTANTIATION:**

The above revisions reflect the latest updates to the American Society of Mechanical Engineering (ASME) standards that are referenced in Table 1701.1 and Table 1701.2.
**Item #: 183**

UMC 2021  Section: Table 1701.1, Table 1701.2

**SUBMITTER:** Steve Mawn  
American Society of Testing and Materials (ASTM)

**RECOMMENDATION:**
Revise text

---

**TABLE 1701.1**  
**REFERENCED STANDARDS**

<table>
<thead>
<tr>
<th>STANDARD NUMBER</th>
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<th>APPLICATION</th>
<th>REFERENCED SECTION</th>
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<tr>
<td>ASTM B135-2010/B135M-2017</td>
<td>Seamless Brass Tube</td>
<td>Piping</td>
<td>Table 1210.1</td>
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<td>ASTM B251-2010/B251M-2017</td>
<td>General Requirements for Wrought Seamless Copper and Copper-Alloy Tube</td>
<td>Piping</td>
<td>Table 1210.1</td>
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<td>ASTM B302-2012</td>
<td>Threadless Copper Pipe, Standard Sizes</td>
<td>Piping</td>
<td>Table 1210.1</td>
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<td>ASTM C411-2011</td>
<td>Hot-Surface Performance of High-Temperature Thermal Insulation</td>
<td>Duct Coverings and Linings</td>
<td>604.1.2</td>
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<td>ASTM D2466-2015</td>
<td>Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40</td>
<td>Fittings</td>
<td>Table 1210.1</td>
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<td>ASTM D2513-2014*2016a</td>
<td>Polyethylene (PE) Gas Pressure Pipe, Tubing, and Fittings</td>
<td>Piping</td>
<td>1308.5.4, 1308.5.4.2.2, 1308.5.9.2, 1310.1.7.1(1), Table 1210.1</td>
</tr>
<tr>
<td>ASTM D2846/D2846M-2014*2017b</td>
<td>Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Hot- and Cold-Water Distribution Systems</td>
<td>Piping</td>
<td>1211.2(2), 1211.3(2), Table 1210.1</td>
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<tr>
<td>ASTM E84-2016*2017a</td>
<td>Surface Burning Characteristics of Building Materials</td>
<td>Miscellaneous</td>
<td>508.3.4, 602.2, 604.1.2, 1201.2</td>
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<td>ASTM E814-2013a (R2017)</td>
<td>Fire Tests of Penetration Firestop Systems</td>
<td>Miscellaneous</td>
<td>507.4.4, 507.4.5</td>
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<td>ASTM F438-2015*2017</td>
<td>Socket-Type Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 40</td>
<td>Fittings</td>
<td>Table 1210.1</td>
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<td>ASTM F876-2015a*2017</td>
<td>Crosslinked Polyethylene (PEX) Tubing</td>
<td>Piping</td>
<td>1211.5, Table 1210.1</td>
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<td>ASTM F1281-2014*2017</td>
<td>Crosslinked Polyethylene/Aluminum/Crosslinked</td>
<td>Piping</td>
<td>Table 1210.1</td>
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<td>ASTM F1282-2017</td>
<td>Polyethylene/Aluminum/Polyethylene (PE-AL-PE) Composite Pressure Pipe</td>
<td>Piping, Table 1210.1</td>
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<tr>
<td>ASTM F1807-2015</td>
<td>Metal Insert Fittings Utilizing a Copper Crimp Ring for SDR9 Cross-linked Polyethylene (PEX) Tubing and SDR9 Polyethylene of Raised Temperature (PE-RT) Tubing</td>
<td>Fittings, Table 1210.1</td>
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<td>ASTM F2389-2015</td>
<td>Pressure-Rated Polypropylene (PP) Piping Systems</td>
<td>Piping, 1211.10(1), Table 1210.1</td>
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(portion of table not shown remain unchanged)

**Note:** The ASTM Standards meet the requirements for mandatory reference standards in accordance with Section 3-3.7.1 of IAPMO's Regulations Governing Committee Projects.

**TABLE 1701.2**

<table>
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<th>DOCUMENT NUMBER</th>
<th>DOCUMENT TITLE</th>
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<tbody>
<tr>
<td>ASTM A312/A312M-2016</td>
<td>Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes</td>
<td>Piping, Ferrous</td>
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<tr>
<td>ASTM A568/A568M-2015</td>
<td>Steel, Sheet, Carbon, Structural, and High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, General Requirements for</td>
<td>Piping</td>
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<tr>
<td>ASTM A653/A653M-2015</td>
<td>Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process</td>
<td>Piping, Ferrous</td>
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<td>ASTM A733-2015</td>
<td>Welded and Seamless Carbon Steel and Austenitic Stainless Steel Pipe Nipples</td>
<td>Piping, Ferrous</td>
</tr>
<tr>
<td>ASTM D396-2016</td>
<td>Fuel Oils</td>
<td>Boiler</td>
</tr>
<tr>
<td>ASTM D2517-2018</td>
<td>Reinforced Epoxy Resin Gas Pressure Pipe and Fittings</td>
<td>Piping, Plastic</td>
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</table>

(portion of table not shown remain unchanged)

**SUBSTANTIATION:**
The above revisions reflect the latest updates to the ASTM standards that are referenced in Table 1701.1 and Table 1701.2.

**COMMITTEE ACTION:** ACCEPT AS SUBMITTED

**TOTAL ELIGIBLE TO VOTE:** 26

**VOTING RESULTS:** **AFFIRMATIVE:** 25 **NOT RETURNED:** 1 HOWARD
PUBLIC COMMENT 1

**Code Year:** 2021 UMC  **Section #:** Table 1701.1, Table 1701.2  **SUBMITTER:** Steve Mawn  **RECOMMENDATION:**
Revise text

Request to accept the code change proposal as modified by this public comment.

**TABLE 1701.1**
**REFERENCED STANDARDS**

<table>
<thead>
<tr>
<th>STANDARD NUMBER</th>
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<th>APPLICATION</th>
<th>REFERENCED SECTION</th>
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<tr>
<td>ASTM A53/A53M-2012</td>
<td>Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless</td>
<td>Piping</td>
<td>1308.5.2.1(2), Table 1210.1</td>
</tr>
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<td>ASTM A106/A106M-2018</td>
<td>Seamless Carbon Steel Pipe for High-Temperature Service</td>
<td>Piping</td>
<td>1308.5.2.1(3), Table 1210.1</td>
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<tr>
<td>ASTM A312/A312M-2017</td>
<td>Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes</td>
<td>Piping Ferrous</td>
<td>1308.5.2.1(1), Table 1210.1</td>
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<td>ASTM B280-2016-2018</td>
<td>Seamless Copper Tube for Air Conditioning and Refrigeration Field Service</td>
<td>Piping</td>
<td>1109.1.2, 1308.5.3.3</td>
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<td>ASTM D1785-2015</td>
<td>Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120</td>
<td>Piping</td>
<td>Table 1210.1</td>
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<td>ASTM D2513-2016a</td>
<td>Polyethylene (PE) Gas Pressure Pipe, Tubing, and Fittings</td>
<td>Piping</td>
<td>1308.5.4, 1308.5.4.2.2, 1308.5.8.2, 1310.1.7.1(1), Table 1210.1</td>
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<td>ASTM D2564-2012 (R2018)</td>
<td>Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems</td>
<td>Joints</td>
<td>1211.12(2)</td>
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<tr>
<td>ASTM D2846/D2846M-2017</td>
<td>Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Hot- and Cold-Water Distribution Systems</td>
<td>Piping</td>
<td>1211.2(2), 1211.3(2), Table 1210.1</td>
</tr>
<tr>
<td>ASTM E84-2017a-2018b</td>
<td>Surface Burning Characteristics of Building Materials</td>
<td>Miscellaneous</td>
<td>508.3.4, 602.2, 605.1.1, 605.1.2, 1201.2</td>
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<td>ASTM E2231-2015-2018</td>
<td>Specimen Preparation and Mounting of Pipe and Duct Insulation Materials to Assess Surface Burning Characteristics</td>
<td>Insulation of Ducts</td>
<td>605.1.2</td>
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<tr>
<td>ASTM F877-2014a-2018a</td>
<td>Crosslinked Polyethylene (PEX) Hot- and Cold-Water Distribution Systems</td>
<td>Piping</td>
<td>Table 1210.1</td>
</tr>
<tr>
<td>ASTM F1548-2001 (R2012) (R2018)</td>
<td>Performance of Fittings for Use with Gasketed Mechanical Couplings Used in Piping Applications</td>
<td>Fittings</td>
<td>Table 1210.1</td>
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<tr>
<td>ASTM F1807-2017-2018a</td>
<td>Metal Insert Fittings Utilizing a Copper Crimp Ring for SDR9 Cross-linked Polyethylene (PEX) Tubing</td>
<td>Fittings</td>
<td>Table 1210.1</td>
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<td>Standard</td>
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<td>Type</td>
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<td>ASTM F1960-2015</td>
<td>Cold Expansion Fittings with PEX Reinforcing Rings for Use with Cross-linked Polyethylene (PEX) and Polyethylene of Raised Temperature (PE-RT) Tubing</td>
<td>Fittings</td>
<td>1210.1</td>
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<td>ASTM F1961-2009</td>
<td>Metal Mechanical Cold Flare Compression Fittings with Disc Spring for Crosslinked Polyethylene (PEX) Tubing (WITHDRAWN)</td>
<td>Fittings</td>
<td>1210.1</td>
</tr>
<tr>
<td>ASTM F1973-2013 (R2018)</td>
<td>Factory Assembled Anodeless Risers and Transition Fittings in Polyethylene (PE) and Polyamide 11 (PA11) and Polyamide 12 (PA12) Fuel Gas Distribution Systems</td>
<td>Fuel Gas</td>
<td>1310.1.7.1(2)</td>
</tr>
<tr>
<td>ASTM F2080-2016-2018</td>
<td>Cold-Expansion Fittings with Metal Compression-Sleeves for Crosslinked Polyethylene (PEX) Pipe and SDR9 Polyethylene of Raised Temperature (PE-RT) Pipe</td>
<td>Fittings</td>
<td>1210.1</td>
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<td>ASTM F2159-2014-2018a</td>
<td>Plastic Insert Fittings Utilizing a Copper Crimp Ring for SDR9 Cross-linked Polyethylene (PEX) Tubing and SDR9 Polyethylene of Raised Temperature (PE-RT) Tubing</td>
<td>Fittings</td>
<td>1210.1</td>
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<td>ASTM F2262-2009</td>
<td>Crosslinked Polyethylene/Aluminum/Crosslinked Polyethylene Tubing OD Controlled SDR9 (WITHDRAWN)</td>
<td>Piping, Plastic</td>
<td>1210.1</td>
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<td>ASTM F2434-2014-2018</td>
<td>Metal Insert Fittings Utilizing a Copper Crimp Ring for SDR9 Cross-linked Polyethylene (PEX) Tubing and SDR9 Cross-linked Polyethylene/Aluminum/Cross-linked Polyethylene (PEX-AL-PEX) Tubing</td>
<td>Fittings</td>
<td>1211.6(1), Table 1210.1</td>
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<td>ASTM F2735-2009 (R2014-2018)</td>
<td>Plastic Insert Fittings for SDR9 Cross-linked Polyethylene (PEX) and Polyethylene of Raised Temperature (PE-RT) Tubing</td>
<td>Fittings</td>
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<tr>
<td>ASTM F2769-2016-2018</td>
<td>Polyethylene of Raised Temperature (PE-RT) Plastic Hot and Cold-Water Tubing and Distribution Systems</td>
<td>Piping, Fittings</td>
<td>1210.1</td>
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<tr>
<td>ASTM F2945-2015-2018</td>
<td>Polyamide 11 Gas Pressure Pipe, Tubing, and Fittings</td>
<td>Tubing, Fittings</td>
<td>1308.5.4</td>
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<td>ASTM F3253-2012-2018</td>
<td>Crosslinked Polyethylene (PEX) Tubing with Oxygen Barrier for Hot- and Cold-Water Hydronic Distribution Systems</td>
<td>Piping</td>
<td>1210.1</td>
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### TABLE 1701.2
STANDARDS, PUBLICATIONS, PRACTICES, AND GUIDES

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<tr>
<th>DOCUMENT NUMBER</th>
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<th>APPLICATION</th>
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<tbody>
<tr>
<td>ASTM D93-2016a-2018</td>
<td>Flash Point by Pensky-Martens Closed Cup Tester</td>
<td>Certification</td>
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<tr>
<td>ASTM D396-2017a-2018a</td>
<td>Fuel Oils</td>
<td>Boiler</td>
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(portion of table not shown remains unchanged)

**SUBSTANTIATION:**
The above revisions reflect the latest updates to the ASTM standards that are referenced in Table 1701.1 and Table 1701.2.
Item #: 185
UMC 2021  Section: Table 1701.1

SUBMITTER: Paul Olson
American Water Works Association (AWWA)

RECOMMENDATION:
Revise text

TABLE 1701.1
REFERENCED STANDARDS

<table>
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<tr>
<th>STANDARD NUMBER</th>
<th>STANDARD TITLE</th>
<th>APPLICATION</th>
<th>REFERENCED SECTION</th>
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<tr>
<td>AWWA C901-20082017</td>
<td>Polyethylene (PE) Pressure Pipe and Tubing, 1/4 3/4 in. (13 19 mm) Through 3 in. (76 mm) for Water Service</td>
<td>Piping, Plastic</td>
<td>Table 1210.1</td>
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(portion of table not shown remain unchanged)

Note: AWWA C901 meets the requirements for mandatory reference standards in accordance with Section 3-3.7.1 of IAPMO’s Regulations Governing Committee Projects.

SUBSTANTIATION:
The above revisions reflect the latest updates to the American Water Works Association (AWWA) standards that are referenced in Table 1701.1.

COMMITTEE ACTION: ACCEPT AS SUBMITTED

TOTAL ELIGIBLE TO VOTE: 26
VOTING RESULTS: AFFIRMATIVE: 25 NOT RETURNED: 1 HOWARD

Appended Comments

PUBLIC COMMENT 1
Code Year: 2021 UMC   Section #: Table 1701.1
SUBMITTER: Paul Olson
American Water Works Association (AWWA)

RECOMMENDATION:
Revise text

Request to accept the code change proposal as modified by this public comment.
### TABLE 1701.1
REFERENCED STANDARDS

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<tr>
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<tr>
<td>AWWA C151-2009-2017</td>
<td>Ductile-Iron Pipe, Centrifugally Cast</td>
<td>Piping, Ferrous</td>
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(portion of table not shown remains unchanged)

**Note:** AWWA C111 and AWWA C151 meet the requirements for a mandatory referenced standard in accordance with Section 3-3.7.1 of IAPMO’s Regulations Governing Committee Projects.

**SUBSTANTIATION:**
The above revisions reflect the latest update to the AWWA standards that are referenced in Table 1701.1.
Item #: 186

UMC 2021 Section: Table 1701.1 and Table 1701.2

**SUBMITTER:** Nikki Kidd
Canadian Standards Association (CSA)

**RECOMMENDATION:**
Revise text

### TABLE 1701.1
**REFERENCED STANDARDS**

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<th>STANDARD TITLE</th>
<th>APPLICATION</th>
<th>REFERENCED SECTION</th>
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<tr>
<td>CSA B137.1-2013 2017</td>
<td>Polyethylene (PE) Pipe, Tubing, and Fittings for Cold-Water Pressure Services</td>
<td>Piping</td>
<td>Table 1210.1</td>
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<tr>
<td>CSA B137.2-2013 2017</td>
<td>Polyvinylchloride (PVC) Injection-Moulded Gasketed Fittings for Pressure Applications</td>
<td>Piping, Plastic</td>
<td>Table 1210.1</td>
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<td>CSA B137.3-2013 2017</td>
<td>Rigid Polyvinylchloride (PVC) Pipe and Fittings for Pressure Applications</td>
<td>Piping, Plastic</td>
<td>Table 1210.1</td>
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<td>CSA B137.5-2013 2017</td>
<td>Crosslinked Polyethylene (PEX) Tubing Systems for Pressure Applications</td>
<td>Piping</td>
<td>Table 1210.1</td>
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<td>CSA B137.6-2013 2017</td>
<td>Chlorinated Polyvinylchloride (CPVC) Pipe, Tubing, and Fittings for Hot- and Cold-Water Distribution Systems</td>
<td>Piping, Plastic</td>
<td>Table 1210.1</td>
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<td>CSA B137.9-2013 2017</td>
<td>Polyethylene/Aluminum/Polyethylene (PE-AL-PE) Composite Pressure-Pipe Systems</td>
<td>Piping</td>
<td>Table 1210.1</td>
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<td>CSA B137.10-2013 2017</td>
<td>Crosslinked Polyethylene/Aluminum/Crosslinked Polyethylene (PEX-AL-PEX) Composite Pressure-Pipe Systems</td>
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<td>Table 1210.1</td>
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<td>CSA B137.11-2013 2017</td>
<td>Polypropylene (PP-R) Pipe and Fittings for Pressure Applications</td>
<td>Piping</td>
<td>1211.10(1)</td>
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<tr>
<td>CSA B137.18-2013 2017</td>
<td>Polyethylene of Raised Temperature Resistance (PE-RT) Tubing Systems for Pressure Applications</td>
<td>Piping, Plastic</td>
<td>Table 1210.1</td>
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<td>CSA Z21.10.1-2014 2017</td>
<td>Gas Water Heaters-, Volume I, Storage Water Heaters with Input Ratings of 75,000 Btu Per Hour or Less (same as CSA 4.1)</td>
<td>Fuel Gas, Appliances</td>
<td>Table 1203.2</td>
</tr>
<tr>
<td>CSA Z21.10.3-2013 2017</td>
<td>Gas-Fired Water Heaters, Volume III, Storage Water Heaters with Input Ratings Above 75,000 Btu Per Hour, Circulating and Instantaneous (same as CSA 4.3)</td>
<td>Fuel Gas, Appliances</td>
<td>Table 1203.2</td>
</tr>
<tr>
<td>CSA Z21.93-2013</td>
<td>Excess Flow Valves for Natural and <strong>LP Propane</strong> Gas with</td>
<td>Fuel Gas</td>
<td>1309.1</td>
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<tr>
<td>Year</td>
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<td>2017</td>
<td>CSA Z83.4-2015 2017</td>
<td>Non-Recirculating Direct Gas-Fired Industrial Air Heaters Heating and Forced Ventilation Appliances for Commercial and Industrial Application (same as CSA 3.7)</td>
<td>Air Heaters, Non-Recirculating, Non-Recirculating Heaters</td>
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(portion of table not shown remain unchanged)

**Note:** The CSA Standards meet the requirements for mandatory reference standards in accordance with Section 3-3.7.1 of IAPMO's Regulations Governing Committee Projects.

### TABLE 1701.2

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<th>DOCUMENT NUMBER</th>
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<td>ASME A112.18.6/ CSA B125.6-2009 (R2014) 2017</td>
<td>Flexible Water Connectors</td>
<td>Piping</td>
</tr>
<tr>
<td>CSA/IGSHPA C448-2016</td>
<td>Design and Installation of Ground Source Heat Pump Systems for Commercial and Residential Buildings</td>
<td>Miscellaneous</td>
</tr>
<tr>
<td>CSA Z21.5.1-2014-2017</td>
<td>Gas Clothes Dryers, Volume I, Type 1 Clothes Dryers (same as CSA 7.1)</td>
<td>Fuel Gas, Appliances</td>
</tr>
<tr>
<td>CSA Z21.11.2-2013</td>
<td>Gas-Fired Room Heaters, Volume II, Unvented Room Heaters</td>
<td>Room Heaters, Unvented Heaters</td>
</tr>
<tr>
<td>CSA Z21.13-2014</td>
<td>Gas-Fired Low Pressure Steam and Hot Water Boilers (same as CSA 4.9)</td>
<td>Fuel Gas, Appliances</td>
</tr>
<tr>
<td>CSA Z21.15b-2013 (R2014)</td>
<td>Manually Operated Gas Valves for Appliances, Appliance Connector Valves and Hose End Valves (same as CSA 9.1b)</td>
<td>Fuel Gas</td>
</tr>
<tr>
<td>CSA Z21.17a-2008 (R2014)</td>
<td>Domestic Gas Conversion Burners (same as CSA 2.7a)</td>
<td>Conversion Burner Installation, Gas Burners</td>
</tr>
<tr>
<td>CSA Z21.18b-2012 (R2012)-(R2016)</td>
<td>Gas Appliance Pressure Regulators (same as CSA 6.3b)</td>
<td>Appliance Regulators, Gas Refrigerators, Pressure Regulators</td>
</tr>
<tr>
<td>CSA Z21.47-2012</td>
<td>Gas-Fired Central Furnaces (same as CSA 2.3)</td>
<td>Fuel Gas, Appliances</td>
</tr>
<tr>
<td>CSA Z21.50-2014</td>
<td>Vented Gas Fireplaces Decorative Gas Appliances (same as CSA 2.22)</td>
<td>Appliances, Decorative Appliances</td>
</tr>
<tr>
<td>CSA Z21.58-2014</td>
<td>Outdoor Cooking Gas Appliances (same as CSA 1.6)</td>
<td>Cooking Appliances</td>
</tr>
<tr>
<td>CSA Z21.60-2012</td>
<td>Decorative Gas Appliances for Installation in Solid-Fuel Burning Fireplaces (same as CSA 2.26)</td>
<td>Decorative Appliances, Decorative Fireplace Appliances</td>
</tr>
</tbody>
</table>
SUBSTANTIATION:
The above revisions reflect the latest updates to the Canadian Standards Association (CSA) standards that are referenced in Table 1701.1 and Table 1701.2.

COMMITTEE ACTION: ACCEPT AS SUBMITTED

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 25  NOT RETURNED: 1 HOWARD

Appendix Comments

PUBLIC COMMENT 1

Code Year: 2021 UMC  Section #: Table 1701.1

SUBMITTER: Nikki Kidd  Canadian Standards Association (CSA)

RECOMMENDATION:
Revise text

Request to accept the code change proposal as modified by this public comment.

TABLE 1701.1
REFERENCED STANDARDS

<table>
<thead>
<tr>
<th>STANDARD NUMBER</th>
<th>STANDARD TITLE</th>
<th>APPLICATION</th>
<th>REFERENCED SECTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>CSA LC 1-2016-2018</td>
<td>Fuel Gas Piping Systems Using Corrugated Stainless Steel Tubing (same as CSA 6.26)</td>
<td>Fuel Gas</td>
<td>1308.5.3.5, 1311.3</td>
</tr>
<tr>
<td>CSA LC 4a-2013 (R2017)</td>
<td>Press-Connect Metallic Fittings For Use in Fuel Gas Distribution Systems (same as CSA 6.32a)</td>
<td>Fuel Gas</td>
<td>1308.5.7.1, 1308.5.7.2, 1308.5.7.3, 1310.4.1(3)</td>
</tr>
</tbody>
</table>

Note: CSA LC 1, CSA LC 4a and CSA Z21.8 meet the requirements for a mandatory referenced standard in accordance with Section 3-3.7.1 of IAPMO’s Regulations Governing Committee Projects.
SUBSTANTIATION:
The above revisions reflect the latest updates to the CSA International standards that are referenced in Table 1701.1.
Item #: 188

UMC 2021  Section: Table 1701.1

SUBMITTER: Eric Smith
International Institute of Ammonia Refrigeration (IIAR)

RECOMMENDATION:
Revise text

<table>
<thead>
<tr>
<th>STANDARD NUMBER</th>
<th>STANDARD TITLE</th>
<th>APPLICATION</th>
<th>REFERENCED SECTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>IIAR 3-2012</td>
<td>Ammonia Refrigeration Valves</td>
<td>Ammonia Refrigeration Systems</td>
<td>1102.2</td>
</tr>
</tbody>
</table>

(portion of table not shown remain unchanged)

Note: IIAR 3 meets the requirements for mandatory reference standards in accordance with Section 3-3.7.1 of IAPMO’s Regulations Governing Committee Projects.

SUBSTANTIATION:
The above revisions reflect the latest updates to the IIAR standards that are referenced in Table 1701.1.

COMMITTEE ACTION: ACCEPT AS SUBMITTED

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 25  NOT RETURNED: 1  HOWARD

Appended Comments

PUBLIC COMMENT 1

Code Year: 2021 UMC  Section #: Table 1701.1  Item #: 188

SUBMITTER: Eric Smith
IIAR

RECOMMENDATION:
Revise text

Request to accept the code change proposal as modified by this public comment.
### TABLE 1701.1
REFERENCED STANDARDS

<table>
<thead>
<tr>
<th>STANDARD NUMBER</th>
<th>STANDARD TITLE</th>
<th>APPLICATION</th>
<th>REFERENCED SECTION</th>
</tr>
</thead>
</table>

(portion of table not shown remains unchanged)

**Note:** IIAR 2-2014 meets the requirements for mandatory reference standards in accordance with Section 3-3.7.1 of IAPMO’s Regulations Governing Committee Projects.

**Note:** IIAR 5-2019 is a working draft and is not completed at the time of this monograph.

**SUBSTANTIATION:**
The above revisions reflect the latest updates to the IIAR standards that are referenced in Table 1701.1.
Item #: 189

UMC 2021  Section: Table 1701.2

SUBMITTER: David Thompson
Manufacturers Standardization Society (MSS)

RECOMMENDATION: Revise text

<table>
<thead>
<tr>
<th>STANDARD NUMBER</th>
<th>STANDARD TITLE</th>
<th>APPLICATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>MSS SP-67-2011</td>
<td>Butterfly Valves</td>
<td>Valves</td>
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</tbody>
</table>

(portion of table not shown remains changed)

SUBSTANTIATION: The above revisions reflect the latest updates to the MSS standards that are referenced in Table 1701.2.

COMMITTEE ACTION: ACCEPT AS SUBMITTED

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 25  NOT RETURNED: 1  HOWARD

Appended Comments

PUBLIC COMMENT 1

Code Year: 2021 UMC  Section #: Table 1701.2  Item #: 189

SUBMITTER: David Thompson
Manufacturers Standardization Society (MSS)  Comment #: 1

RECOMMENDATION: Revise text

Request to accept the code change proposal as modified by this public comment.
Table 1701.1

<table>
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<tr>
<th>STANDARD NUMBER</th>
<th>STANDARD TITLE</th>
<th>APPLICATION</th>
<th>REFERENCED SECTION</th>
</tr>
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</table>

(gradually table not shown remains unchanged)

Note: MSS SP-58 meets the requirements for a mandatory referenced standard in accordance with Section 3-3.7.1 of IAPMO’s Regulations Governing Committee Projects.

Table 1701.2

<table>
<thead>
<tr>
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<tbody>
<tr>
<td>MSS SP-104-2012-2018</td>
<td>Wrought Copper, Solder-Joint Pressure Fittings</td>
<td>Fittings</td>
</tr>
<tr>
<td>MSS SP-109-2012-2018</td>
<td>Weld-Fabricated, Copper Solder-Joint Pressure Fittings</td>
<td>Fittings</td>
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</table>

(gradually table not shown remains unchanged)

Substantiation:
The above revisions reflect the latest updates to the MSS standards that are referenced in Table 1701.1 and Table 1701.2.
Item #: 190
UMC 2021  Section: Table 1701.1, Table 1701.2

SUBMITTER: Laura Moreno  
National Fire Protection Association (NFPA)

RECOMMENDATION:  
Revise text

### TABLE 1701.1  
REFERENCES STANDARDS

<table>
<thead>
<tr>
<th>STANDARD NUMBER</th>
<th>STANDARD TITLE</th>
<th>APPLICATION</th>
<th>REFERENCED SECTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>NFPA 10-2013</td>
<td>Portable Fire Extinguishers</td>
<td>Fire Extinguishing</td>
<td>513.11, 513.11.1, 513.12, 517.7.4</td>
</tr>
<tr>
<td>NFPA 12-2015</td>
<td>Carbon Dioxide Extinguishing Systems</td>
<td>Fire Extinguishing</td>
<td>513.2.3(1)</td>
</tr>
<tr>
<td>NFPA 30A-2015</td>
<td>Motor Fuel Dispensing Facilities and Repair Garages</td>
<td>Miscellaneous</td>
<td>303.11.1</td>
</tr>
<tr>
<td>NFPA 37-2015</td>
<td>Installation and Use of Stationary Combustion Engines and Gas Turbines</td>
<td></td>
<td>1602.1, 1602.3</td>
</tr>
<tr>
<td>NFPA 54/Z223.1-</td>
<td>National Fuel Gas Code</td>
<td>Fuel Gas</td>
<td>516.2.1</td>
</tr>
<tr>
<td>2015</td>
<td></td>
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</tr>
<tr>
<td>NFPA 68-2013</td>
<td>Explosion Protection by Deflagration Venting</td>
<td>Product Conveying Ducts</td>
<td>505.3.3</td>
</tr>
<tr>
<td>NFPA 90B-2015</td>
<td>Installation of Warm Air Heating and Air-Conditioning Systems</td>
<td>HVAC</td>
<td>904.7</td>
</tr>
<tr>
<td>NFPA 96-2014</td>
<td>Ventilation Control and Fire Protection of Commercial Cooking Operations</td>
<td>Commercial Cooking</td>
<td>922.4</td>
</tr>
<tr>
<td>NFPA 221-2015</td>
<td>High Challenge Fire Walls, Fire Walls, and Fire Barrier Walls</td>
<td>Building Fire Walls, Fire Barrier</td>
<td>506.3</td>
</tr>
<tr>
<td>NFPA 1192-2015</td>
<td>Recreational Vehicles</td>
<td>Fuel Gas Piping</td>
<td>1302.3</td>
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</table>

(portion of table not shown remain unchanged)
Note: The NFPA Standards meet the requirements for mandatory reference standards in accordance with Section 3-3.7.1 of IAPMO’s Regulations Governing Committee Projects.

### TABLE 1701.2
**STANDARDS, PUBLICATIONS, PRACTICES, AND GUIDES**

<table>
<thead>
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<th>DOCUMENT NUMBER</th>
<th>DOCUMENT TITLE</th>
<th>APPLICATION</th>
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<tbody>
<tr>
<td>NFPA 30-2015 2018</td>
<td>Flammable and Combustible Liquids Code</td>
<td>Combustible Liquids, Flammable Liquids</td>
</tr>
<tr>
<td>NFPA 274-2013 2018</td>
<td>Test Method to Evaluate Fire Performance Characteristics of Pipe Insulation</td>
<td>Pipe Insulation</td>
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(portion of table not shown remain unchanged)

**SUBSTANTIATION:**
The above revisions reflect the latest updates to the National Fire Protection Association (NFPA) standards that are referenced in Table 1701.1 and Table 1701.2.

**COMMITTEE ACTION:** ACCEPT AS SUBMITTED

**TOTAL ELIGIBLE TO VOTE:** 26

**VOTING RESULTS:** AFFIRMATIVE: 25  NOT RETURNED: 1 HOWARD

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**APPENDED COMMENTS**

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**PUBLIC COMMENT 1**

**Code Year:** 2021 UMC  **Section #:** Table 1701.1  **Item #:** 190  
**SUBMITTER:** Heath Dehn  
National Fire Protection Association (NFPA)  
**Comment #:** 1

**RECOMMENDATION:**
Revise text

Request to accept the code change proposal as modified by this public comment.

### TABLE 1701.1
**REFERENCED STANDARDS**

<table>
<thead>
<tr>
<th>STANDARD NUMBER</th>
<th>STANDARD TITLE</th>
<th>APPLICATION</th>
<th>REFERENCED SECTION</th>
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<tbody>
<tr>
<td>NFPA 13-2016-2019</td>
<td>Installation of Sprinkler Systems</td>
<td>Miscellaneous</td>
<td>513.2.3(2), 517.7.6</td>
</tr>
<tr>
<td>NFPA 69-2014-2019</td>
<td>Explosion Prevention Systems</td>
<td>Explosion Prevention</td>
<td>505.3.1</td>
</tr>
<tr>
<td>NFPA 80-2016-2019</td>
<td>Fire Doors and Other Opening Protectives</td>
<td>Fire Doors</td>
<td>510.7.7</td>
</tr>
<tr>
<td>NFPA 82-2014-2019</td>
<td>Incinerators and Waste and Linen Handling Systems and Equipment</td>
<td>Incinerator Chutes</td>
<td>802.2.8, Table 802.4, 925.1</td>
</tr>
<tr>
<td>NFPA 85-2015-2019</td>
<td>Boiler and Combustion Systems Hazards Code</td>
<td>Appliances</td>
<td>1002.1(3), 1011.1, Table 1003.2.1</td>
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<tr>
<td>-------------------</td>
<td>--------------------------------------------</td>
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</tr>
<tr>
<td>NFPA 86-2015-2019</td>
<td>Ovens and Furnaces</td>
<td>Product Conveying Ducts</td>
<td>505.3.2</td>
</tr>
<tr>
<td>NFPA 211-2016-2019</td>
<td>Chimneys, Fireplaces, Vents, and Solid Fuel-Burning Appliances</td>
<td>Fuel Gas Appliances</td>
<td>517.7, 517.7.1, 801.2, 801.3, 802.5.2, 802.5.3, 802.5.7.1, 802.5.7.3, 902.10</td>
</tr>
<tr>
<td>NFPA 262-2015-2019</td>
<td>Standard Method of Test for Flame Travel and Smoke of Wires and Cables for Use in Air-Handling Spaces</td>
<td>Certification</td>
<td>602.2.1</td>
</tr>
</tbody>
</table>

(portion of table not shown remains unchanged)

**Note:** NFPA 13, NFPA 52, NFPA 69, NFPA 80, NFPA 82, NFPA 86, NFPA 88A, NFPA 211, and NFPA 262 meet the requirements for mandatory reference standards in accordance with Section 3-3.7.1 of IAPMO’s Regulations Governing Committee Projects.

**SUBSTANTIATION:**
The above revisions reflect the latest updates to the NFPA standards that are referenced in Table 1701.1.
Item #: 191

UMC 2021  Section: Table 1701.1

SUBMITTER: Jeremy Brown
NSF International

RECOMMENDATION:
Revise text

<table>
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<th>STANDARD NUMBER</th>
<th>STANDARD TITLE</th>
<th>APPLICATION</th>
<th>REFERENCED SECTION</th>
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<tbody>
<tr>
<td>NSF 358-1-2014</td>
<td>Polyethylene Pipe and Fittings for Water-Based</td>
<td>Piping, Plastic</td>
<td>Table 1210.1</td>
</tr>
<tr>
<td>2017</td>
<td>Ground-Source “Geothermal” Heat Pump Systems</td>
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</tr>
</tbody>
</table>

(portion of table not shown remain unchanged)

Note: NSF 358-1 meets the requirements for mandatory reference standards in accordance with Section 3-3.7.1 of IAPMO’s Regulations Governing Committee Projects.

SUBSTANTIATION:
The above revisions reflect the latest updates to the NSF standards that are referenced in Table 1701.1.

COMMITTEE ACTION: ACCEPT AS SUBMITTED

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 25  NOT RETURNED: 1  HOWARD

Appended Comments

PUBLIC COMMENT 1

Code Year: 2021 UMC  Section #: Table 1701.1, Table 1701.2  Item #: 191

SUBMITTER: Jeremy Brown
NSF International (NSF)

RECOMMENDATION:
Revise text

Request to accept the code change proposal as modified by this public comment.
### TABLE 1701.1
**REFERENCED STANDARDS**

<table>
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<tr>
<th>STANDARD NUMBER</th>
<th>STANDARD TITLE</th>
<th>APPLICATION</th>
<th>REFERENCED SECTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>NSF 358-2-2017</td>
<td>Polypropylene Pipe and Fittings for Water-Based Ground-Source “Geothermal” Heat Pump Systems</td>
<td>Piping, Plastic</td>
<td>Table 1210.1</td>
</tr>
</tbody>
</table>

(portion of table not shown remains unchanged)

**Note:** NSF 358-2 meets the requirements for a mandatory referenced standard in accordance with Section 3-3.7.1 of IAPMO’s Regulations Governing Committee Projects.

### TABLE 1701.2
**STANDARDS, PUBLICATIONS, PRACTICES, AND GUIDES**

<table>
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<tr>
<th>DOCUMENT NUMBER</th>
<th>DOCUMENT TITLE</th>
<th>APPLICATION</th>
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<tbody>
<tr>
<td>NSF 60-20162017</td>
<td>Drinking Water Treatment Chemicals - Health Effects</td>
<td>Miscellaneous</td>
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</tbody>
</table>

(portion of table not shown remains unchanged)

**SUBSTANTIATION:**
The above revisions reflect the latest updates to the NSF International standards that are referenced in Table 1701.1 and Table 1701.2.
Proposals

Item #: 193
UMC 2021 Section: Table 1701.1 Table 1701.2

SUBMITTER: John Taecker/Maggie Carroll
Underwriters Laboratories, Inc.

RECOMMENDATION:
Revise text

<table>
<thead>
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<th>STANDARD NUMBER</th>
<th>STANDARD TITLE</th>
<th>APPLICATION</th>
<th>REFERENCED SECTION</th>
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<tbody>
<tr>
<td>UL 103-2010</td>
<td>Factory-Built Chimneys for Residential Type and Building Heating Appliances</td>
<td>Fuel Gas, Appliances</td>
<td>802.5.1.1, 802.5.1.2</td>
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<tr>
<td></td>
<td>(with revisions through July 27, 2012 March 15, 2017)</td>
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<tr>
<td>UL 181-2013</td>
<td>Factory-Made Air Ducts and Air Connectors (with revisions through April 18, 2017)</td>
<td>Air Connectors, Air Ducts</td>
<td>602.6, 603.4, 603.5, 603.8, 604.1.1</td>
</tr>
<tr>
<td>UL 181A-2013</td>
<td>Closure Systems for Use with Rigid Air Ducts (with revisions through March 22, 2017)</td>
<td>Air Ducts</td>
<td>603.10, Table 603.10</td>
</tr>
<tr>
<td>UL 181B-2013</td>
<td>Closure Systems for Use with Flexible Air Ducts and Air Connectors (with revisions through March 21, 2017)</td>
<td>Air Connectors, Air Ducts</td>
<td>603.10, Table 603.10</td>
</tr>
<tr>
<td>UL 197-2010</td>
<td>Commercial Electric Cooking Appliances (with revisions through September 17, 2014 January 26, 2018)</td>
<td>Appliances, Commercial Cooking, Electric Appliances</td>
<td>921.1</td>
</tr>
<tr>
<td>UL 295-2007</td>
<td>Commercial-Industrial Gas Burners (with revisions through January 26, 2017)</td>
<td>Gas Burners</td>
<td>910.2</td>
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<td>2017</td>
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<tr>
<td>UL 412-2011</td>
<td>Refrigeration Unit Coolers (with revisions through September 17, 2013 January 9, 2017)</td>
<td>Refrigeration</td>
<td>934.2</td>
</tr>
<tr>
<td>UL 499-2014</td>
<td>Electric Heating Appliances (with revisions through February 23, 2017)</td>
<td>Kilns</td>
<td>931.4</td>
</tr>
<tr>
<td>UL 555C-2014</td>
<td>Ceiling Dampers (with revisions through May 1, 2017)</td>
<td>Dampers</td>
<td>605.3</td>
</tr>
<tr>
<td>UL 641-2010</td>
<td>Type L Low-Temperature Venting Systems (with revisions through June 12, 2013 December 12, 2017)</td>
<td>Equipment</td>
<td>802.1</td>
</tr>
<tr>
<td>UL 705-2004 2017</td>
<td>Power Ventilators (with revisions through December 12, 2013)</td>
<td>Power Ventilators</td>
<td>504.4.2.3</td>
</tr>
<tr>
<td>UL 723-2008</td>
<td>Test for Surface Burning Characteristics of Building Materials (with revisions through August 12, 2013 December 21, 2017)</td>
<td>Miscellaneous</td>
<td>508.3.4, 602.2, 604.1.2, 1201.2</td>
</tr>
<tr>
<td>UL 778-2016</td>
<td>Motor Operated Water Pumps (with revisions through February 22, 2017 October 20, 2017)</td>
<td>Pumps</td>
<td>1208.1</td>
</tr>
<tr>
<td>UL 834-2004</td>
<td>Heating, Water Supply, and Power Boilers - Electric (with revisions through December 9, 2013 January 10, 2018)</td>
<td>Appliances</td>
<td>1002.3, Table 1203.2</td>
</tr>
<tr>
<td>UL 858-2014</td>
<td>Household Electric Ranges (with revisions through April 6, 2016 November 1, 2017)</td>
<td>Electric Ranges, Ranges</td>
<td>920.1</td>
</tr>
<tr>
<td>UL 921-2016</td>
<td>Commercial Dishwashers (with revisions through September 20, 2017)</td>
<td>Appliances</td>
<td>519.1</td>
</tr>
<tr>
<td>UL 923-2013</td>
<td>Microwave Cooking Appliances (with revisions through November 18, 2015 July 19, 2017)</td>
<td>Microwaves</td>
<td>920.3.2(3)</td>
</tr>
<tr>
<td>UL 1046-2010</td>
<td>Grease Filters for Exhaust Ducts (with revisions through January 13, 2012 April 17, 2017)</td>
<td>Filters-Grease</td>
<td>509.1, 509.1.1, 518.1(4)</td>
</tr>
<tr>
<td>UL 1820-2004</td>
<td>Fire Test of Pneumatic Tubing for Flame and Smoke Characteristics (with revisions through May 10, 2013 July 13, 2017)</td>
<td>Surface Burning Test, Pneumatic Tubing</td>
<td>602.2.3</td>
</tr>
<tr>
<td>UL 1887-2004</td>
<td>Fire Test of Plastic Sprinkler Pipe for Visible Flame and Smoke Characteristics (with revisions through May 3, 2013 July 13, 2017)</td>
<td>Surface Burning Test, Fire Sprinkler Pipe</td>
<td>602.2.2</td>
</tr>
<tr>
<td>UL 1978-2010</td>
<td>Grease Ducts (with revisions through September 19, 2013 April 28, 2017)</td>
<td>Ducts, Grease</td>
<td>507.3.1, 510.4.1, 510.5.2, 510.5.3</td>
</tr>
<tr>
<td>UL 1996-2009</td>
<td>Electric Duct Heaters (with revisions through June 13, 2014 July 15, 2016)</td>
<td>Duct Heaters</td>
<td>905.8</td>
</tr>
<tr>
<td>UL 2021-2015</td>
<td>Fixed and Location-Dedicated Electric Room Heaters (with revisions through December 14, 2016)</td>
<td>Product, Heating, Electric</td>
<td>916.1</td>
</tr>
<tr>
<td>UL 2158A-2013</td>
<td>Clothes Dryer Transition Duct (with revisions through December 14, 2016)</td>
<td>Clothes Dryer Exhaust</td>
<td>504.4</td>
</tr>
</tbody>
</table>
Note: The UL Standards meet the requirements for mandatory reference standards in accordance with Section 3-3.7.1 of IAPMO's Regulations Governing Committee Projects.

<table>
<thead>
<tr>
<th>DOCUMENT NUMBER</th>
<th>DOCUMENT TITLE</th>
<th>APPLICATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>UL 21-2014</td>
<td>LP-Gas Hose (with revisions through September 29, 2015, July 28, 2017)</td>
<td>Hose, LPG Hose</td>
</tr>
<tr>
<td>UL 125-2014</td>
<td>Flow Control Valves for Anhydrous Ammonia and LP-Gas (with revisions through February 18, 2015, January 12, 2018)</td>
<td>Fuel Gas</td>
</tr>
<tr>
<td>UL 132-2015</td>
<td>Safety Relief Valves for Anhydrous Ammonia and LP-Gas (with revisions through February 17, 2014, January 12, 2018)</td>
<td>Fuel Gas</td>
</tr>
<tr>
<td>UL 174-2004</td>
<td>Household Electric Storage Tank Water Heaters (with revisions through April 10, 2015, December 15, 2016)</td>
<td>Appliances</td>
</tr>
<tr>
<td>UL 180-2012</td>
<td>Liquid-Level Gauges for Oil Burner Fuels and Other Combustible Liquids (with revisions through May 12, 2017)</td>
<td>Gauges, Level Gauges</td>
</tr>
<tr>
<td>UL 252-20102017</td>
<td>Compressed Gas Regulators (with revisions through January 28, 2015)</td>
<td>Fuel Gas</td>
</tr>
<tr>
<td>UL 343-2008</td>
<td>Pumps for Oil-Burning Appliances (with revisions through June 12, 2013, December 14, 2017)</td>
<td>Fuel Gas, Appliances</td>
</tr>
<tr>
<td>UL 525-2008</td>
<td>Flame Arresters (with revisions through August 10, 2012, October 13, 2017)</td>
<td>Flame Arresters</td>
</tr>
<tr>
<td>UL 565-2013</td>
<td>Liquid-Level Gauges for Anhydrous Ammonia and LP-Gas (with revisions through December 13, 2017)</td>
<td>Fuel Gas</td>
</tr>
<tr>
<td>UL 569-2013</td>
<td>Pigtails and Flexible Hose Connectors for LP-Gas (with revisions through July 28, 2017)</td>
<td>Fuel Gas</td>
</tr>
<tr>
<td>UL 842-2015</td>
<td>Valves for Flammable Fluids (with revisions through October 27, 2017)</td>
<td>Valves</td>
</tr>
<tr>
<td>UL 1453-2016</td>
<td>Electric Booster and Commercial Storage Tank Water Heaters (with revisions through March 9, 2017)</td>
<td>Appliances</td>
</tr>
</tbody>
</table>

SUBSTANTIATION:
The above revisions reflect the latest updates to the Underwriters Laboratories, Inc. (UL) standards that are referenced in Table 1701.1 and Table 1701.2.

COMMITTEE ACTION: ACCEPT AS SUBMITTED

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 25 NOT RETURNED: 1 HOWARD

Appended Comments

PUBLIC COMMENT 1

Code Year: 2021 UMC Section #: Table 1701.1, Table 1701.2 Item #: 193
**RECOMMENDATION:**
Revise text

Request to accept the code change proposal **as modified** by this public comment.

**TABLE 1701.1**
**REFERENCED STANDARDS**

<table>
<thead>
<tr>
<th>STANDARD NUMBER</th>
<th>STANDARD TITLE</th>
<th>APPLICATION</th>
<th>REFERENCED SECTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>UL 412-2011</td>
<td>Refrigeration Unit Coolers (with revisions through <strong>January 9, 2017 - August 28, 2018</strong>)</td>
<td>Refrigeration</td>
<td>934.2</td>
</tr>
<tr>
<td>UL 471-2010</td>
<td>Commercial Refrigerators and Freezers (with revisions through <strong>December 8, 2016 - November 8, 2018</strong>)</td>
<td>Freezers, Refrigerators</td>
<td>934.1</td>
</tr>
<tr>
<td>UL 641-2010</td>
<td>Type L Low-Temperature Venting Systems (with revisions through <strong>December 12, 2017 - April 23, 2018</strong>)</td>
<td>Equipment</td>
<td>802.1</td>
</tr>
<tr>
<td>UL 705-2017</td>
<td>Power Ventilators <em>(with revisions through October 8, 2018)</em></td>
<td>Power Ventilators</td>
<td>504.4.2.3</td>
</tr>
<tr>
<td>UL 710-2012</td>
<td>Exhaust Hoods for Commercial Cooking Equipment *(with revisions through <strong>March 22, 2017 - June 25, 2018</strong>)</td>
<td>Exhaust Hoods, Hoods</td>
<td>507.3.1, 508.2, 508.2.1</td>
</tr>
<tr>
<td>UL 723-2008-2018</td>
<td>Test for Surface Burning Characteristics of Building Materials <em>(with revisions through December 21, 2017)</em></td>
<td>Miscellaneous</td>
<td>508.3.4, 602.2, 605.1.1, 605.1.2, 1201.2</td>
</tr>
<tr>
<td>UL 727-2006-2018</td>
<td>Oil-Fired Central Furnaces <em>(with revisions through <strong>October 9, 2013</strong>)</em></td>
<td>Fuel Gas, Appliances</td>
<td>904.11</td>
</tr>
<tr>
<td>UL 731-1995-2018</td>
<td>Oil-Fired Unit Heaters <em>(with revisions through November 22, 2016)</em></td>
<td>Heaters, Oil Fired</td>
<td>917.6</td>
</tr>
<tr>
<td>UL 834-2004</td>
<td>Heating, Water Supply, and Power Boilers – Electric *(with revisions through <strong>January 10, 2018 - September 24, 2018</strong>)</td>
<td>Appliances</td>
<td>1002.3, Table 1203.2</td>
</tr>
<tr>
<td>UL 858-2014</td>
<td>Household Electric Ranges *(with revisions through <strong>November 1, 2017 - June 4, 2018</strong>)</td>
<td>Electric Ranges, Ranges</td>
<td>920.1</td>
</tr>
<tr>
<td>UL 867-2011</td>
<td>Electrostatic Air Cleaners *(with revisions through <strong>September 16, 2016 - August 7, 2018</strong>)</td>
<td>Filters</td>
<td>936.1</td>
</tr>
<tr>
<td>UL 1240-2005</td>
<td>Electric Commercial Clothes-Drying Equipment *(with revisions through <strong>October 20, 2017 - March 16, 2018</strong>)</td>
<td>Clothes Dryers, Commercial</td>
<td>908.1</td>
</tr>
<tr>
<td>UL 1812-2013</td>
<td>Ducted Heat Recovery Ventilators *(with revisions through <strong>June 24, 2017 - July 19, 2018</strong>)</td>
<td>Heat Recovery Ventilators</td>
<td>504.5</td>
</tr>
<tr>
<td>UL 1815-2012</td>
<td>Nonducted Heat Recovery Ventilators *(with revisions through <strong>June 6, 2017 - July 19, 2018</strong>)</td>
<td>Heat Recovery Ventilators</td>
<td>504.5</td>
</tr>
<tr>
<td>UL 2043-2013</td>
<td>Fire Test for Heat and Visible Smoke Release For Discrete Products and Their Accessories Installed in Air-Handling Spaces <em>(with revisions through July 13, 2018)</em></td>
<td>Surface Burning Test, Discrete Products</td>
<td>602.2.4</td>
</tr>
<tr>
<td>UL 2158-2015-2018</td>
<td>Electric Clothes Dryers</td>
<td>Clothes Dryers, Electric</td>
<td>908.1</td>
</tr>
<tr>
<td>UL 2523-2009</td>
<td>Solid Fuel-Fired Hydronic Heating Appliances, Water Heaters, and Boilers <em>(with revisions through <strong>February 8, 2013 - March 16, 2018</strong>)</em></td>
<td>Appliances</td>
<td>1002.4, Table 1203.2</td>
</tr>
</tbody>
</table>
Note: UL 412, UL 471, UL 641, UL 705, UL 710, UL 723, UL 727, UL 731, UL 834, UL 858, UL 867, UL 1240, UL 1812, UL 1815, UL 2043, UL 2158, and UL 2523 meet the requirements for a mandatory referenced standard in accordance with Section 3-3.7.1 of IAPMO's Regulations Governing Committee Projects.

<table>
<thead>
<tr>
<th>DOCUMENT NUMBER</th>
<th>DOCUMENT TITLE</th>
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</tr>
</thead>
<tbody>
<tr>
<td>UL 51-2013</td>
<td>Power-Operated Pumps and Bypass Valves for Anhydrous Ammonia, LP-Gas, and Propylene (with revisions through May 18, 2015 October 5, 2018)</td>
<td>Ammonia Pumps, LPG Pumps, Pumps</td>
</tr>
<tr>
<td>UL 252-2017</td>
<td>Compressed Gas Regulators (with revisions through August 10, 2018)</td>
<td>Fuel Gas</td>
</tr>
<tr>
<td>UL 565-2013</td>
<td>Liquid-Level Gauges for Anhydrous Ammonia and LP-Gas (with revisions through December 13, 2017 February 23, 2018)</td>
<td>Fuel Gas</td>
</tr>
<tr>
<td>UL 732-19952018</td>
<td>Oil-Fired Storage Tank Water Heaters (with revisions through October 9, 2013 August 9, 2018)</td>
<td>Fuel Gas, Appliances</td>
</tr>
<tr>
<td>UL 1453-2016</td>
<td>Electric Booster and Commercial Storage Tank Water Heaters (with revisions through March 9, 2017 May 18, 2018)</td>
<td>Appliances</td>
</tr>
</tbody>
</table>

SUBSTANTIATION:
The above revisions reflect the latest updates to the UL standards that are referenced in Table 1701.1 and Table 1701.2.

PUBLIC COMMENT 2
Code Year: 2021 UMC  Section #: Table 1701.1  Item #: 193
SUBMITTER: Helen Walter-Terrinoni [Air Conditioning, Heating, and Refrigeration Institute (AHRI)]; Christopher Jensen (UL LLC); Mary E. Koban (Chemours Company); Rusty Tharp (Goodman Manufacturing); Julius Ballanco (JB Engineering and Code Consulting, P.C., Rep: Daikin US)
RECOMMENDATION:
Revise text
Request to accept the code change proposal as modified by this public comment.

<table>
<thead>
<tr>
<th>STANDARD NUMBER</th>
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<th>APPLICATION</th>
<th>REFERENCED SECTION</th>
</tr>
</thead>
</table>

Note: UL 60335-2-40-2019 is a working draft and is not completed at the time of this monograph.

SUBSTANTIATION:
Helen Walter-Terrinoni:
The 3rd edition of UL 60335-2-40 is in the process of being updated to include additional information on refrigerants. UL 60335-2-40 is currently out for ballot and it is anticipated to be complete by September 2019 with publication soon after that. The 3rd edition of UL 60335-2-40 standard will be complete before the publication of the 2021 Uniform Mechanical Code. It is very important to the HVAC industry that the 3rd edition of UL 60335-2-40 be incorporated into the UMC code so that it is aligned with the most up-to-date standards and provide the consistent information to code officials.

Christopher Jensen:
This public comment is being submitted to update UL 60335-2-40 in addition to the Standards that were updated in the original proposal Item # 193. This Standard has been updated to the 2019 Edition. At the time of submission of this public comment a draft of the updated Standard is out for Ballot by the UL Standards Technical Panel. The 2019 Edition will be published in the latter half of 2019 and before publication of the 2021 Uniform Mechanical Code. The 2019 Edition of this Standard is aligned with the most current updates with ASHRAE 15 which is imperative for compliance with Chapter 11 of the UMC. To stay current with the minimum safety requirements for equipment being manufactured, the UMC should reference the most current editions of the applicable product standards.

Mary E. Koban:
UL 60335-2-40 is currently being updated to include additional information on refrigerants. The new updated version of UL 60335-2-40 will be the 3rd edition. UL 60335-2-40 is currently out for ballot and is expected to be finalized by the September 2019 with publication shortly after that. Therefore, the up-dated UL 60335-2-40 standard will be finalized before the publication of the 2021 Uniform Mechanical Code. It is critical to the HVAC industry that the most recent version of UL 60335-2-40 be incorporated into the UMC code so that the standards are aligned and provide the same information to code officials.

Rusty Tharp:
There are many important changes in the 2019 (3rd edition) of UL 60335-2-40, which is expected to be complete relatively soon. We would like the UMC to be as up to date as possible, referring to the latest version of the product safety standard.

Julius Ballanco:
This standard has been further up dated to the 2019 edition, which is the third edition. As this comment is being submitted, the standard is out for ballot. The up-dated standard will be finalized before the publication of the 2021 Uniform Mechanical Code. In order for the code to be current, the latest edition of this standard needs to be referenced.