

UMC TIA 007-18

UNIFORM MECHANICAL CODE TIA FORM - 2018

Reference Code Section: 1104.0, 1104.5, 1106.0, 1106.2.2, 1106.2.3, 1106.2.4, 1106.2.5, 1106.2.6, 1106.2.5.1, 1106.2.5.2, 1106.4, 1106.13, 1106.13.1, 1106.13.2, 1106.13.3, 1106.13.4, 1106.13.5, 1106.13.6, 1106.13.6.1, 1106.13.6.2, 1106.13.7, 1106.13.8, 1106.13.9, 1106.13.10, 1106.13.10.1, 1106.13.10.2, 1106.13.10.3, 1106.13.10.4, 1106.13.11, 1106.13.11.1, 1106.13.11.2, 1106.13.11.3, 1106.13.11.4, 1107.1.7.1, 1107.1.7.2, 1107.1.7.3, 1107.1.7.4, 1112.11.1

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Proposed language for TIA:

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.

1106.2.2 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~~ 1106.2.3, there shall be no openings that will permit passage of escaping refrigerant to other parts of the building. [ASHRAE 15: 8.11.2]

~~1106.6~~ 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:~~8.11.7~~ 8.11.3]

~~1106.11~~ 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~~ 8.11.4]

~~1106.2.2.1~~ 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 ~~1106.2.2.2~~ 1106.2.4 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.

~~1106.2.2.2~~ 1106.2.6 **Refrigerant Detectors.** Refrigerant detectors required in accordance with Section ~~1106.2.2.1~~ 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~~ 1106.2.5 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~~ 1106.2.5 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, then 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:

$$Q = 100\sqrt{G} \quad (\text{Equation 1106.2.5.1})$$

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**

~~$Q_{A2L} = [(P \cdot V \cdot A) / (LFL \cdot 0.50)]$ (Equation 1106.2.5.2)~~

~~Where:~~

~~P = Refrigerant density, pounds per cubic foot (kg/m³).~~

~~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 (m²), $A = 0.00136 \text{ ft}^2$ (0.000126 m²).~~

~~LFL = Lower Flammability Limit, or ETFL60 where no LFL exist, published value in accordance with ASHRAE 34.~~

~~Q_{A2L} = Minimum required air flow rate, conversion to other units of measures is permitted, cubic feet per second (m³/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 m³/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 detection limit of the refrigerant detector, whichever is lower, shall automatically de-energize the following equipment in the machinery room:

(1) Refrigerant compressors

(2) Refrigerant pumps

(3) Normally closed automatic refrigerant valves

(4) Other unclassified electrical sources of ignition with apparent power rating greater than 1 kVA, where the apparent power is the product of the circuit voltage and current rating. [ASHRAE 15:8.13.6.2]

1106.13.7 Mechanical Equipment Control. Remote control of the mechanical equipment in the refrigerating machinery room shall be provided immediately outside the machinery room door solely for the purpose of shutting down the equipment in an emergency. Ventilation fans shall be on a separate electrical circuit and have a control switch located immediately outside the machinery room door. [ASHRAE 15:8.13.7]

1106.13.8 Refrigerant Detectors. Each refrigerating machinery room in accordance with Section 1106.13 shall contain one or more refrigerant detectors in accordance with Section 1106.13.9, with sensing element located in areas where refrigerant from a leak will concentrate, with one or more set points that activate responses in accordance with Section 1106.13.10 for alarms and Section 1106.13.11 for mechanical ventilation. Multiport type devices shall be prohibited. [ASHRAE 15:8.13.8]

1106.13.9 Refrigerant Detectors Requirements. Refrigerant detectors required by Section 1106.13 shall meet all of the following conditions:

(1) A refrigerant detector shall be capable of detecting each of the specific refrigerant designations in the machinery room.

(2) The refrigerant detector shall activate responses within a time not to exceed a limit specified in Sections 1106.13.10 and 1106.13.11 after exposure to refrigerant concentration exceeding a limit value specified in Section 1106.13.10 and Section 1106.13.11.

(3) The refrigerant detector shall have a set point not greater than the applicable Occupational Exposure Limit (OEL) value as published in Table 1102.3. The applicable OEL value shall be the lowest OEL value for any refrigerant designation in the machinery room. For refrigerants that do not have a published OEL value in Table 1102.3, use a value determined in accordance with the OEL as defined by Standard Table 1102.3 where approved by the Authority Having Jurisdiction.

(4) The refrigerant detector shall have a set point not more than the applicable Refrigerant Concentration Limit (RCL) value as published in Table 1102.3. The applicable RCL value shall be the lowest RCL value for any refrigerant designation in the machinery room. For refrigerants that do not have a published RCL value in Table 1102.3, use a value determined in accordance with the RCL as defined by Table 1102.3 where approved by the Authority Having Jurisdiction.

(5) The refrigerant detector shall provide a means for automatic self-testing and shall be in accordance with Section 1106.13.10.4. The refrigerant detector shall be tested during installation and annually thereafter, or at an interval not exceeding the manufacturer's installation instructions, whichever is less. Testing shall verify compliance with the alarm set points and response times per Sections 1106.13.10 and Section 1106.13.11.

[ASHRAE 15:8.13.9]

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 nonsparking, 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 air.

(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]

TABLE 1106.13.10.2
SAFETY GROUPS: A2L, B2L OTHER THAN R-717 (AMMONIA)
[ASHRAE 15:Table 8.13.10.2]

<u>LIMIT VALUE</u>	<u>RESPONSE TIME (seconds)</u>	<u>ALARM TYPE</u>	<u>ALARM RESET TYPE</u>	<u>VENTILATION RATE</u>	<u>VENTILATION RESET TYPE</u>
<u>Set point ≤ OEL</u>	<u>≤ 300</u>	<u>Troubled Alarm</u>	<u>Automatic</u>	<u>Level 1</u>	<u>Automatic</u>
<u>Set point ≤ RCL</u>	<u>≤ 15</u>	<u>Emergency Alarm</u>	<u>Manual</u>	<u>Level 2</u>	<u>Manual</u>

TABLE 1106.13.11.2
LEVEL 1 VENTILATION RATE FOR CLASS 2L REFRIGERANTS
[ASHRAE 15: Table 8.13.11.2]

<u>STATUS</u>	<u>AIRFLOW</u>
<u>Operated when occupied and operated when activated in accordance with Section 1106.13.10.2 and Table 1106.13.10.2</u>	<u>The greater of the following:</u> <u>(1) 0.5 ft³/min per ft² (2.54 L/s per m²) of machinery room area, or</u> <u>(2) 20 ft³/min (9.44 L/s) per person</u>
<u>Operable when occupied</u>	<u>With or without mechanical cooling of the machinery room, the greater of:</u> <u>(1) The airflow rate required to not exceed a temperature rise of 18 °F (10 °C) above inlet air temperature or</u> <u>(2) The airflow rate required to not exceed a maximum air temperature of 122 °F (50 °C) in the machinery room.</u>

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~~ 1106.13.11.

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

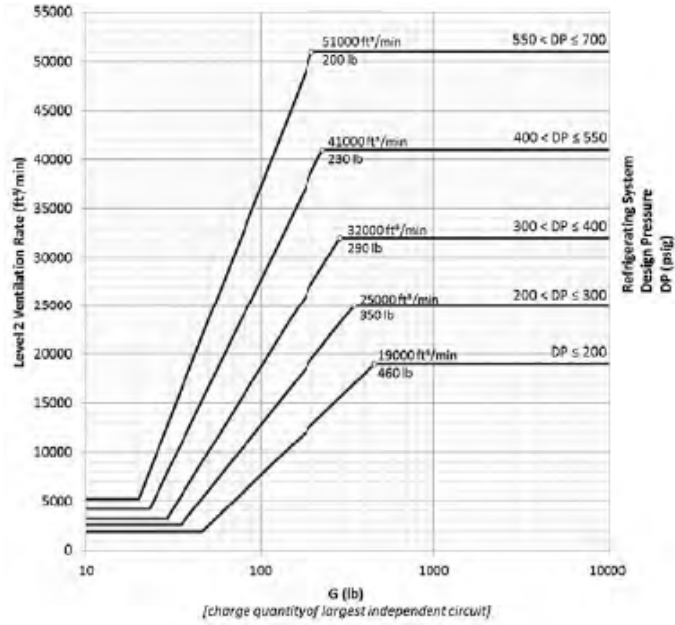
1107.1.7.3 Machinery Rooms. The machinery room shall comply with Section ~~1107.1.8~~ 1106.13.

1112.11 Discharge from Pressure-Relief Devices. Pressure-relief systems designed for vapor shall comply with Section 1112.11.1 through Section 1112.11.4.1.

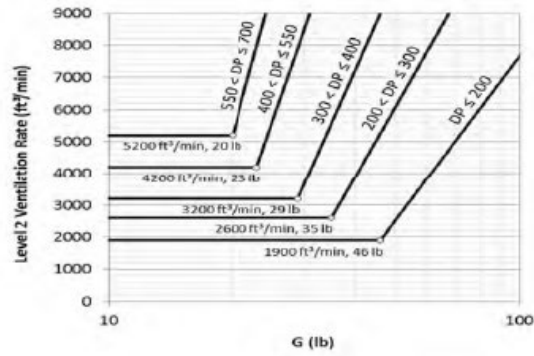
1112.11.1 Discharging Location Interior to Building. Pressure-relief devices, including fusible plugs, serving refrigeration systems shall be permitted to discharge to the interior of a building where in accordance with the following:

- (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, ~~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]



(a)



(b)

FIGURE 1106.13.11.4

LEVEL 2 VENTILATION RATE FOR CLASS 2L REFRIGERANTS
[ASHRAE 15: FIGURE 8.13.11.4-1]

Substantiation:

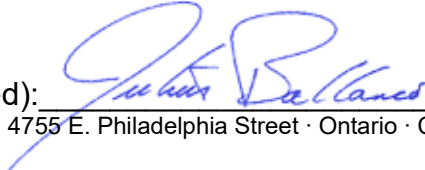
Technical Merit: The current requirement in the Uniform Mechanical Code are not consistent with ASHRAE 15-2019 and published errata. Furthermore, the requirements are incomplete and wrong. Unfortunately, the text currently found in the UMC was developed from an initial draft of proposed changes to ASHRAE 15. After multiple public reviews, the requirements in ASHRAE 15 changed significantly. Unfortunately, the initial ventilation table was declared inappropriate following further research by the initial research report author. This TIA will bring the Uniform Mechanical Code in line with ASHRAE 15 as currently published. It also follows the extraction policy used by IAPMO to reference the sections from ASHRAE 15.

It should be noted that this text was submitted as a Public Comment, however, the Mechanical Technical Committee placed the change on hold claiming that they did not receive a copy of ASHRAE 15. While the TC may not have read ASHRAE 15-2019 prior to the hearing in May 2019, the standard is available and has been submitted with this TIA request.

The following supporting document has been submitted with this TIA: ASHRAE 15, Addendum h. ASHRAE is submitting ASHRAE 15-2019 and ASHRAE 34-2019 to be posted on Kavi.

Emergency nature: Since the requirement in the current Uniform Mechanical Code are not based on ASHRAE 15, nor any previous edition of ASHRAE 15, they are incorrect. There was an attempt to guess what would be required in ASHRAE 15 and this guess was accepted as a revision to the 2018 edition of the UMC. This is dangerous since the consensus process should be completed by ASHRAE before there is any attempt to regulate new requirements regarding refrigerants. It is important to correct these requirements before an A2L or B2L system is installed in a machinery room.

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