



**BSR/ASHRAE Addendum e
to ANSI/ASHRAE Standard 15-2024**

Second Public Review Draft

Proposed Addendum e to Standard 15-2024, Safety Standard for Refrigeration Systems

**Second Public Review (May 2026)
(Draft shows Proposed
Changes to Current Standard)**

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ASHRAE, 180 Technology Parkway NW, Peachtree Corners, GA 30092

(This foreword is not part of this standard. It is merely informative and does not contain requirements necessary for conformance to the standard. It has not been processed according to the ANSI requirements for a standard and may contain material that has not been subject to public review or a consensus process. Unresolved objectors on informative material are not offered the right to appeal at ASHRAE or ANSI.)

FOREWORD

In response to a continuous maintenance proposal, changes are proposed to the determination of releasable charge that will harmonize requirements with Edition 4 (dated December 15, 2022) of UL 60335-2-40 and CSA C22.2 No. 60335-2-40. Equipment marked as 'ETRS' in accordance with UL/CSA 60335-2-40 meets certain construction and testing requirements that justify a lower assumed value for the worst-case refrigerant release rate when determining releasable charge. The current edition of Standard 15-2024 assumes that lower value for all equipment, which is not an appropriate assumption, and is not harmonized with other requirements of both Standard 15 and UL/CSA 60335-2-40 that assume a four minute release as the reasonable worst-case scenario. Example calculations have been added to the Informative Appendix A entry for Section 7.3.4.4.b.

Note: This addendum makes proposed changes to the current standard. These changes are indicated in the text by underlining (for additions) and ~~striking through~~ (for deletions) except where the reviewer instructions specifically describe some other means of showing the changes. Only these changes to the current standard shown are open for review and comment at this time. Additional material is provided for context only and is not open for comment except as it relates to the proposed changes.

Addendum e to Standard 15-2024

Modify Section 3 as follows. The remainder of Section 3 remains unchanged.

3. DEFINITIONS

3.2 Acronyms, Abbreviations, and Initialisms

[...]

ETRS enhanced tightness refrigeration system

[...]

Modify Section 7 as follows. The remainder of Section 7 remains unchanged.

7. RESTRICTIONS ON REFRIGERANT USE

[...]

7.3 Refrigerant Charge Limits. [...]

[...]

7.3.4* Releasable Refrigerant Charge (m_{rel}) Determination. [...]

[...]

{Note to reviewers. The committee proposes to switch the sequence of Sections 7.3.4.3 and 7.3.4.4. The content of the existing Section 7.3.4.4, to be renumbered as Section 7.3.4.3, does not change as part of this addendum and is not shown for brevity. The two references, one to each of these sections, found in Figure 7-2 would also change accordingly.}

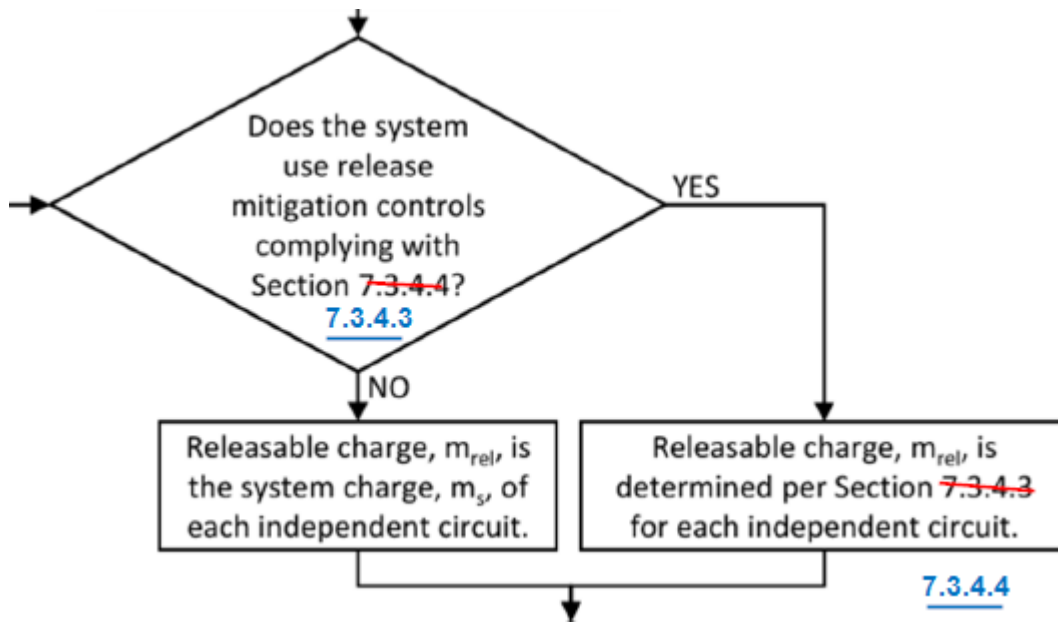


Figure 7-2 Refrigerant charge limit compliance path—Part 2.

7.3.4.1 Single Circuit. For single-circuit *refrigeration systems*, the *releasable refrigerant charge* (m_{rel}) shall be the *system refrigerant charge*, unless release mitigation controls are provided in accordance with Section 7.3.4.4 7.3.4.3.

7.3.4.2 Multiple Independent Circuits. For *refrigeration systems* with multiple *independent circuits*, the *releasable refrigerant charges* shall be the *refrigerant charges* in each *independent circuit*, unless release mitigation controls are provided in accordance with Section 7.3.4.4 7.3.4.3.

7.3.4.4 7.3.4.3 Release Mitigation Controls. [...]

7.3.4.3 7.3.4.4* Calculating Releasable Refrigerant Charge. For *releasable refrigerant charge*, release mitigation controls complying with Section 7.3.4.4 7.3.4.3 shall be provided to limit a release by automatically isolating leaking *pipng* or equipment. The *releasable refrigerant charge* (m_{rel}) shall be in accordance with one of the following:

a.* The quantity provided in the product instruction manual per UL 60335-2-40⁵ /CSA C22.2 No. 60335-2-40⁶ or UL 60335-2-89⁷/CSA C22.2 No. 60335-2-89⁸.

b.* ~~determined~~ Determined based on a release of the volume of *refrigerant* that will occur prior to operation of the release mitigation control plus the volume of *refrigerant* ~~contained downstream of a release mitigation control~~ isolated by activation of *safety shutoff valves*, in accordance with Equation 7-4a or 7-4b. The *refrigerant density*, ρ_{ref} , for the evaluated portion of the *refrigeration system* shall be determined for each operating mode, cooling or heating as applicable, using the maximum density of each section in accordance with all of the following:

1. For liquid *pipng*, the density of saturated liquid at 50 °F (10 °C).
2. For vapor *pipng*, the density of saturated vapor at 107.6 °F (42 °C).
3. For *pipng* containing mixture of vapor and liquid, the density of saturated liquid at 50 °F (10 °C).
4. For indoor *heat exchanger coils*, the density of saturated liquid at 50 °F (10°C).

$$m_{rel} = (t_{r1} \times 0.0062) + m_{r2} + m_{r3} \quad (7-4a[I-P])$$

$$m_{rel} = (t_{r1} \times 0.0028) + m_{r2} + m_{r3} \quad (7-4b[SI])$$

where

- t_{r1} = time before the leak is detected per Section 7.6.2.4
- 0.0062 = leakage rate in lb/s
- 0.0028 = leakage rate in kg/s
- m_{r2} = leakage between the detection of the leak and the closing of the *safety shutoff valve*, lb (kg)
- m_{r3} = leakage in the *pipng* downstream of the *safety shutoff valve* after the valve is closed, lb (kg)

$$m_{r2} = t_{close} \times 0.0062 \quad (7-5a[I-P])$$

$$m_{r2} = t_{close} \times 0.0028 \quad (7-5b[SI])$$

where

- t_{close} = time from when a leak is detected until the *safety shutoff valve* closes
- 0.0062 = leakage rate in lb/s
- 0.0028 = leakage rate in kg/s

$$m_{r3} = \sum V_{pipe} \times \rho_{ref} \quad (7-6)$$

where

- V_{pipe} = internal volume of each section of the *pipng* and *heat exchanger coil* downstream of the *safety shutoff valve*, ft³ (m³)
- ρ_{ref} = density of the *refrigerant* in each section of pipe downstream of the *safety shutoff valve*, lb/ft³ (kg/m³)

{Note to reviewers: renumber all subsequent equations in Section 7}

$$m_{rel} = m_{r1} + m_{r2} + m_{r3} \quad (7-4)$$

where

- m_{rel} = releasable refrigerant charge, lb (kg)
- m_{r1} = leakage during time before leak is detected, lb (kg)
- m_{r2} = leakage between the detection of the leak and the closing of the *safety shutoff valve*, lb (kg)
- m_{r3} = leakage in the *pipng* downstream of the *safety shutoff valve* after the valve is closed, lb (kg)

where

$$m_{r1} = t_{r1} \times K_m \quad (7-4a)$$

$$m_{r2} = t_{close} \times K_m \quad (7-4b)$$

$$m_{r3} = \sum (V_{pipe} \times \rho_{ref}) \quad (7-4c)$$

where

t_{rl} = a constant corresponding to the maximum time before the refrigerant detection system generates an output signal indicating that a leak has been detected, 120 s

t_{close} = a constant corresponding to the maximum time required to close the safety shutoff valve, starting from when the release mitigation controls receive an output signal from a refrigerant detection system indicating that a leak is detected, s

Informative Note: Maximum closing time can be obtained from the manufacturer.

K_m = a constant corresponding to leakage rate,

for refrigeration systems marked ETRS and where any indoor unit does not exceed 10 tons (35 kW) of rated cooling or heating capacity: 0.0062 lb/s (0.0028 kg/s)

for refrigeration systems not marked ETRS or where any indoor unit exceeds 10 tons (35 kW) of rated cooling or heating capacity: $\frac{m_s}{240}$ lb/s ($\frac{m_s}{240}$ kg/s)

V_{pipe} = internal volume of each section of the piping and heat exchanger coils isolated by activation of one or more safety shutoff valves, ft³ (m³)

Informative Note: Heat exchanger internal volume can be obtained from the manufacturer.

ρ_{ref} = density of the refrigerant corresponding to each section of the piping and heat exchanger coils isolated by activation of one or more safety shutoff valves, lb/ft³ (kg/m³)

[...]

Modify Section 9 as follows. The remainder of Section 9 remains unchanged.

9. DESIGN AND CONSTRUCTION OF REFRIGERATION EQUIPMENT AND SYSTEMS

[...]

9.11 Joints and Connections

9.11.1 Approvals. Joints and connections shall be either listed or an approved type. Joints and connections shall be tight for the pressure of the refrigeration system when tested in accordance with Section 9.13.

9.11.1.1 Joints between Different Piping Materials. Joints between different piping materials shall be made with either listed or 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 1079.21 Adapter fittings with threaded ends between different materials shall be lubricated in accordance with Section 9.11.4.4.

9.11.1.2 Installer Training for ETRS. Assembly of field-installed piping for refrigeration systems marked as ETRS shall be completed by installers trained by the refrigeration system manufacturer or its authorized agent. Documentation of installer training shall be supplied with the certification of test in accordance with Section 9.13.7.

[...]

9.13.7 Contractor or Engineer Declaration. The installing contractor or registered design professional of record shall issue a certificate of test, verifying strength test in accordance with Section 9.13.5 and leakage test in accordance with Section 9.13.6, to the AHJ for all refrigeration systems containing 55 lb (25 kg) or more of refrigerant. The certificate shall give the test date, photograph of the pressure gage at the test pressure, refrigerant designation, test medium, and the field test pressure applied to the high side and the low side of the refrigeration 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.

[...]

Modify Informative Appendix A as follows. The remainder of the appendix remains unchanged.

**INFORMATIVE APPENDIX A
 EXPLANATORY MATERIAL**

Sections of the standard with associated explanatory information in this appendix are marked with an asterisk “*” after the section number.

[...]

Section 7.3.4.4(a)

Determination of m_{rel} is based upon requirements in the product listing standards – namely UL 60335-2-40⁵/CSA C22.2 No. 60335-2-40⁶ or UL 60335-2-89⁷/CSA C22.2 No. 60335-2-89⁸.

For refrigeration systems listed to UL 60335-2-40⁵/CSA C22.2 No. 60335-2-40⁶, refrigeration systems marked as ETRS will use one of the following –

- A calculation method (Annex GG.12.7) with default values for mitigation response times.
- A test method (Annex GG.12.3.3DV) that determines releasable refrigerant charge.
- A combination of calculation and testing (Annex GG.12.4DV).

For refrigeration systems listed to UL 60335-2-40⁵/CSA C22.2 No. 60335-2-40⁶, and not marked as ETRS, Annex 101.DVQ will be used to test the worst-case releasable refrigerant charge.

For refrigeration systems listed to UL 60335-2-89⁷/CSA C22.2 No. 60335-2-89⁸, a calculation method (Annex 101.DVU.1.2) is used with default values for mitigation response times to determine releasable refrigerant charge.

Section 7.3.4.4(b)

Example calculations for determining releasable refrigerant charge (m_{rel}). Assume that a space served by a refrigeration system using R-32 has parameters shown below. The closing time (t_{close}) is obtained from the valve manufacturer’s technical specifications (see example below). Refrigerant density values are obtained from the ASHRAE Fundamentals Handbook, chapter title “Thermophysical Properties of Refrigerants”.

<u>system refrigerant charge</u>	<u>m_s</u>	<u>138.7 lb</u>	<u>62.9 kg</u>
<u>a constant corresponding to maximum time before detecting the leak</u>	<u>t_{r1}</u>	<u>120 s</u>	<u>120 s</u>
<u>an example of the maximum time from when a leak is detected until the safety shutoff valve closes</u>	<u>t_{close}</u>	<u>10 s</u>	<u>10 s</u>
<u>density of saturated liquid at 50 °F (10 °C)</u>	<u>$\rho_{R-32,liq}$</u>	<u>63.7 lb/ ft³</u>	<u>1020 kg/m³</u>
<u>density of saturated vapor at 107.6 °F (42 °C)</u>	<u>$\rho_{R-32,vap}$</u>	<u>4.85 lb/ ft³</u>	<u>77.7 kg/m³</u>
<u>internal volume of liquid piping, section 1</u>	<u>V_{pipe1}</u>	<u>3.32×10^{-2} ft³</u>	<u>9.41×10^{-4} m³</u>
<u>internal volume of vapor piping, section 2</u>	<u>V_{pipe2}</u>	<u>5.32×10^{-1} ft³</u>	<u>1.506×10^{-2} m³</u>
<u>internal volume of piping with liquid & vapor, section 3</u>	<u>V_{pipe3}</u>	<u>2.73×10^{-3} ft³</u>	<u>7.72×10^{-5} m³</u>

	Case 1 (not marked ETRS)		Case 2 (marked ETRS)	
	IP	SI	IP	SI
K_m	$= \frac{m_s}{240}$ $= \frac{138.7}{240}$ $= 0.578 \text{ lb/s}$	$= \frac{m_s}{62.9}$ $= \frac{240}{62.9}$ $= 0.262 \text{ kg/s}$	$= 0.0062 \text{ lb/s}$	$= 0.0028 \text{ kg/s}$
m_{r1}	Equation 7-4b $m_{r1} = t_{r1} \times K_m$			
	$= 120 \times 0.578$ $= 69.4 \text{ lb}$	$= 120 \times 0.262$ $= 31.5 \text{ kg}$	$= 120 \times 0.0062$ $= 0.744 \text{ lb}$	$= 120 \times 0.0028$ $= 0.336 \text{ kg}$
m_{r2}	Equation 7-4c $m_{r2} = t_{close} \times K_m$			
	$= 10 \times 0.578$ $= 5.78 \text{ lb}$	$= 10 \times 0.262$ $= 2.62 \text{ kg}$	$= 10 \times 0.0062$ $= 0.062 \text{ lb}$	$= 10 \times 0.0028$ $= 0.028 \text{ kg}$
m_{r3}	Equation 7-4d $m_{r3} = \sum (V_{pipe} \times \rho_{ref})$			
	$= 3.32 \times 10^{-2} \times 63.7$ $+ 5.32 \times 10^{-1} \times 4.85$ $+ 2.73 \times 10^{-3} \times 63.7$ $= 4.87 \text{ lb}$	$= 9.41 \times 10^{-4} \times 1020$ $+ 1.506 \times 10^{-2} \times 77.7$ $+ 7.72 \times 10^{-5} \times 1020$ $= 2.21 \text{ kg}$	$= 3.32 \times 10^{-2} \times 63.7$ $+ 5.32 \times 10^{-1} \times 4.85$ $+ 2.73 \times 10^{-3} \times 63.7$ $= 4.87 \text{ lb}$	$= 9.41 \times 10^{-4} \times 1020$ $+ 1.506 \times 10^{-2} \times 77.7$ $+ 7.72 \times 10^{-5} \times 1020$ $= 2.21 \text{ kg}$
m_{rel}	Equation 7-4a $m_{rel} = m_{r1} + m_{r2} + m_{r3}$			
	$= 69.4 + 5.78 + 4.87$ $= 80.0 \text{ lb}$	$= 31.5 + 2.62 + 2.21$ $= 36.3 \text{ kg}$	$= 0.744 + 0.062 + 4.87$ $= 5.67 \text{ lb}$	$= 0.336 + 0.028 + 2.21$ $= 2.57 \text{ kg}$