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ADDENDA

**ANSI/ASHRAE Addendum o to**
**ANSI/ASHRAE Standard 15-2024**

# Safety Standard for Refrigeration Systems

Approved by ASHRAE and the American National Standards Institute on September 30, 2025.

This addendum was approved by a Standing Standard Project Committee (SSPC) for which the Standards Committee has established a documented program for regular publication of addenda or revisions, including procedures for timely, documented, consensus action on requests for change to any part of the standard. Instructions for how to submit a change can be found on the ASHRAE® website (www.ashrae.org/continuous-maintenance).

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## FOREWORD

*Addendum o revises Informative Appendix C to fix an editorial error in an equation and revises the example calculation to use accurate thermodynamic properties of R-410A as calculated using REFPROP v10.0. It also revises Table C–1 to remove refrigerants whose use is banned under the Montreal Protocol and adds refrigerants approved by the U.S. Environmental Protection Agency under the SNAP program in Final Rules 21, 23, 25, and 26.*

***Informative Note:*** In this addendum, changes to the current standard are indicated in the text by underlining (for additions) and ~~strikethrough~~ (for deletions) unless the instructions specifically mention some other means of indicating the changes.

## Addendum o to Standard 15-2024

***Modify Section 9 as shown. The remainder of Section 9 is unchanged.***

[ . . . ]

**9.7.6*** The rated discharge capacity of a *pressure relief device* expressed in lb of air/min (kg of air/s) shall be determined in accordance with ASME Boiler and Pressure Vessel Code[15], Section XIII. When the relieving capacity of a *pressure relief device* is expressed in standard cubic feet per minute (scfm) of air, the density of air *shall* be set to 0.0764 lb/ft$^3$. All pipe and fittings between the pressure relief valve and the parts of the refrigeration system it protects shall have at least the area of the pressure relief valve inlet area.

[ . . . ]

**9.7.9.3.1** The design back pressure due to flow in the discharge *piping* at the outlet of *pressure relief devices* and *fusible plugs*, discharging to atmosphere, *shall* be limited by the allowable equivalent length of *piping* determined using Equation 9-7a or 9-7b:

[ . . . ]

where

[ . . . ]

$C_r$ = rated capacity as stamped on the pressure relief device in lb/min (kg/s), or in standard cubic feet per minute multiplied by 0.0764 lb/ft$^3$ (the density of air in accordance with Section 9.7.6), or as calculated in Section 9.7.7 for a rupture member or fusible plug, or as adjusted for reduced capacity due to piping as specified by the manufacturer of the device, or as adjusted for reduced capacity due to piping as estimated by an approved method.

[ . . . ]

***Modify Informative Appendix A as shown. The remainder of Informative Appendix A is unchanged.***

[ . . . ]

### Section 9.7.6

The specified value for the density of dry air of 0.0764 lb/ft$^3$ is prescribed by the National Board of Boiler and Pressure Vessel Inspectors in their publication NB-18[68] to convert the calculated relieving capacity of *pressure relief devices* from pounds per minute to standard cubic feet per minute (scfm) of air. The National Board serves as the certification body for the pressure relief device requirements documented in the ASME Boiler and Pressure Vessel Code's Section XIII.

[ . . . ]

***Modify Informative Appendix B as shown. The remainder of Informative Appendix B is unchanged.***

[ . . . ]

67. ~~NIST. 2013. NIST REFPROP, Standard Reference Database 23, Version 9.1. National Institute of Standards and Technology, Gaithersburg, MD.~~ Lemmon, E.W., I.H. Bell, M.L. Huber, and M.O. McLin-

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den. 2018. NIST Standard Reference Database 23: Reference Fluid Thermodynamic and Transport Properties-REFPROP, Version 10.0. National Institute of Standards and Technology, Standard Reference Data Program, Gaithersburg, MD.

68. NBBI. 2024. *Pressure Relief Device Certification* (NB-18). Columbus, OH: National Board of Boiler and Pressure Vessel Inspectors (www.nationalboard.org).

***Modify Informative Appendix C as shown. The remainder of Informative Appendix C is unchanged.***

## INFORMATIVE APPENDIX C
## METHOD FOR CALCULATING DISCHARGE CAPACITY OF POSITIVE DISPLACEMENT COMPRESSOR PRESSURE RELIEF DEVICE

[ . . . ]

~~$$W_v = \frac{Q \times \mathrm{PL} \times \eta_v}{v_g} \quad \text{(C-1)}$$~~

$$W_r = \frac{Q \times \mathrm{PL} \times \eta_v}{v_g} \quad \text{(C-1)}$$

where

$W_r$ = mass flow of *refrigerant*, lb/min (kg/s)

[ . . . ]

### Example

Determine the flow capacity of a *pressure relief device* for an R-410A *compressor* with a swept volume ($Q$) of ~~341~~ 342 $ft^3$/min (~~0.1609~~ 0.1614 $m^3$/s). The *compressor* is equipped with capacity control that is actuated at 90% of the *pressure relief device set pressure* and has a minimum regulated flow of 10%.

$Q$ = ~~341~~ 342 $ft^3$/min

$Q$ = ~~0.16095~~ 0.1614 $m^3$/s

$\eta_v$ = 0.90, assumed volumetric efficiency of compressor

PL = 0.1, minimum regulated flow factor

$\upsilon_g$ @ (R-410A, T = 50°F) = ~~1.1979~~ 0.38214 $ft^3$/lb (I-P)

$\upsilon_g$ @ (R–410A, T = 10°C) = ~~0.0748~~ 0.023856 $m^3$/kg (SI)

~~$$W_r = \frac{341\ \frac{\mathrm{ft}^3}{\mathrm{min}} \times 0.1 \times 0.9}{1.1979 \frac{\mathrm{ft}^3}{\mathrm{lb}}} = 25.62\ \frac{\mathrm{lb}}{\mathrm{min}} \quad \text{(I-P [see C-1])}$$~~

~~$$W_r = \frac{0.1609\ \frac{\mathrm{m}^3}{\mathrm{s}} \times 0.1 \times 0.9}{0.0748\ \frac{\mathrm{m}^3}{\mathrm{kg}}} = 0.1936\ \frac{\mathrm{kg}}{\mathrm{s}} \quad \text{(SI [see C-1])}$$~~

~~$$W_a = W_r \times r_w = 25.62 \times 0.62 = 15.88\ \frac{\mathrm{lb}}{\mathrm{min}} \text{ of air} \quad \text{(I-P [see C-2])}$$~~

~~$$W_a = W_r \times r_w = 0.1936 \times 0.62 = 0.12\ \frac{\mathrm{kg}}{\mathrm{s}} \text{ of air} \quad \text{SI [see C-2])}$$~~

$$W_r = \frac{342\ \frac{\mathrm{ft}^3}{\mathrm{min}} \times 0.1 \times 0.9}{0.38214 \frac{\mathrm{ft}^3}{\mathrm{lb}}} = 80.546\ \frac{\mathrm{lb}}{\mathrm{min}} \quad \text{(I-P [see C-1])}$$

$$W_r = \frac{0.1614\ \frac{\mathrm{m}^3}{\mathrm{s}} \times 0.1 \times 0.9}{0.023856\ \frac{\mathrm{m}^3}{\mathrm{kg}}} = 0.60890\ \frac{\mathrm{kg}}{\mathrm{s}} \quad \text{(SI [see C-1])}$$

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$$W_a = 80.546\frac{\text{lb}}{\text{min}} \times 0.6208 = 50.003\ \frac{\text{lb}}{\text{min}}\ \text{of air} \qquad \text{(I-P [see C-2])}$$

$$W_a = 0.60890\frac{\text{kg}}{\text{s}} \times 0.6208 = 0.37801\ \frac{\text{kg}}{\text{s}}\ \text{of air} \qquad \text{SI [see C-2])}$$

Converting to standard ~~ft³/min~~ volumetric flow rate of air, $\dot{Q}_{a,std}$, where ~~$V_a$ = specific volume of air = 13.1 ft³/lb (0.818 m³/kg) for dry air at 60 °F (15.6 °C)~~ $\rho_{da,std}$ = 0.0764 $lb_m/ft^3$ (1.224 $kg/m^3$) for dry air at 60.0°F (15.6°C) at a barometric pressure of 14.70 psia (101.3 kPa):

~~scfm = 13.1 (15.88) = 208.02 ft³/min (I-P)~~
~~scfm = 0.818 (0.12) = 0.098 m³/s (SI)~~

$$\dot{Q}_{a,std} = W_a \times \frac{1}{\rho_{da,std}} = 50.003\frac{\text{lb}}{\text{min}} \times \frac{1}{0.0764}\frac{\text{ft}^3}{\text{lb}_{\text{mda}}} = 654\frac{\text{ft}^3}{\text{min}} \qquad \text{(I-P)}$$

$$\dot{Q}_{a,std} = W_a \times \frac{1}{\rho_{da,std}} = 0.37801\frac{\text{kg}}{\text{s}} \times \frac{1}{1.224}\frac{\text{m}^3}{\text{kg}_{\text{da}}} = 0.309\frac{\text{m}^3}{\text{s}} \qquad \text{(SI)}$$

**Table C-1 Constants for Calculating Discharge Capacity**

| Refrigerant | $k$[a] | Relative Molar Mass | $C_r$ | $r_w$ |
|---|---|---|---|---|
| ~~R–11~~ | ~~1.137~~ | ~~137.4~~ | ~~330.7~~ | ~~0.49~~ |
| ~~R–12~~ | ~~1.205~~ | ~~120.9~~ | ~~337.7~~ | ~~0.51~~ |
| ~~R–13~~ | ~~2.050~~ | ~~104.5~~ | ~~403.4~~ | ~~0.46~~ |
| R–22 | 1.319<u>1</u> | 86.5 | 348.8 | 0.5<u>9850</u> |
| ~~R–23~~ | ~~2.742~~ | ~~70.0~~ | ~~439.3~~ | ~~0.52~~ |
| <u>R–32</u> | <u>1.5337</u> | <u>52.0</u> | <u>367.3</u> | <u>0.7164</u> |
| ~~R–113~~ | ~~1.081~~ | ~~187.4~~ | ~~324.7~~ | ~~0.43~~ |
| ~~R–114~~ | ~~1.094~~ | ~~170.9~~ | ~~326.1~~ | ~~0.45~~ |
| R–123 | 1.103<u>5</u> | ~~153.0~~<u>152.9</u> | 327.1 | 0.4<u>7691</u> |
| R–134a | 1.196<u>1</u> | 102.0 | 336.8 | 0.5<u>6578</u> |
| <u>R–152a</u> | <u>1.2331</u> | <u>66.1</u> | <u>340.5</u> | <u>0.6854</u> |
| R–236fa | 1.10<u>218</u> | 152.0 | 326.9 | 0.47<u>08</u> |
| R–245fa | 1.098<u>78</u> | 134.0 | 326.5 | 0.50<u>21</u> |
| R–290 | 1.236<u>7</u> | ~~44.0~~<u>44.1</u> | 340.9 | 0.84<u>383</u> |
| <u>R–600a</u> | <u>1.1346</u> | <u>58.1</u> | <u>330.5</u> | <u>0.7533</u> |
| <u>R–718</u> | <u>1.3278</u> | <u>18.0</u> | <u>349.6</u> | <u>1.2795</u> |
| <u>R–744</u> | <u>2.690</u> | <u>44.0</u> | <u>437.0</u> | <u>0.6546</u> |
| <u>R–1234yf</u> | <u>1.1685</u> | <u>114.0</u> | <u>334.0</u> | <u>0.5321</u> |
| <u>R–1234ze(E)</u> | <u>1.1437</u> | <u>114.0</u> | <u>331.4</u> | <u>0.5362</u> |
| R–404A | 1.276<u>5</u> | 97.6 | 344.7 | 0.5<u>572</u> |
| R–407C | 1.269<u>3</u> | 86.2 | 344.1 | 0.59<u>40</u> |
| R–410A | 1.431<u>0</u> | 72.6 | 358.8 | 0.62<u>08</u> |
| ~~R–500~~ | ~~1.236~~ | ~~99.3~~ | ~~340.8~~ | ~~0.56~~ |
| ~~R–502~~ | ~~1.262~~ | ~~111.6~~ | ~~343.4~~ | ~~0.52~~ |
| ~~R–507A~~ | ~~1.282~~ | ~~98.9~~ | ~~345.2~~ | ~~0.55~~ |
| ~~R–600~~ | ~~1.122~~ | ~~58.1~~ | ~~329.2~~ | ~~0.76~~ |
| ~~R–718~~ | ~~1.328~~ | ~~18.0~~ | ~~349.6~~ | ~~1.28~~ |

a. Source: NIST ~~REFPROP,~~ Standard Reference Database <u>23, REFPROP</u> v~~9.1~~<u>10.0, ~~2013~~2018</u>.[67]

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**Table C-1 Constants for Calculating Discharge Capacity**

| Refrigerant | $k$[a] | Relative Molar Mass | $C_r$ | $r_w$ |
|---|---|---|---|---|
| ~~R–744~~ | ~~2.690~~ | ~~44.0~~ | ~~437.0~~ | ~~0.65~~ |
| R–448A | 1.2760 | 86.3 | 344.7 | 0.5926 |
| R–449A | 1.2755 | 87.2 | 344.7 | 0.5896 |
| R–450A | 1.1659 | 108.7 | 333.7 | 0.5453 |
| R–452B | 1.4324 | 63.5 | 358.9 | 0.6635 |
| R–454A | 1.2903 | 80.5 | 346.1 | 0.6112 |
| R–454B | 1.4299 | 62.6 | 358.7 | 0.6687 |
| R–454C | 1.2365 | 90.8 | 340.9 | 0.5842 |
| R–455A | 1.2435 | 87.5 | 341.6 | 0.5939 |
| R–457A | 1.2326 | 87.6 | 340.5 | 0.6055 |
| R–513A | 1.1859 | 108.4 | 335.8 | 0.5428 |
| R–515B | 1.1410 | 117.5 | 331.1 | 0.5286 |
| R–516A | 1.1849 | 102.6 | 335.7 | 0.5580 |

a. Source: NIST ~~REFPROP,~~ Standard Reference Database 23, REFPROP v~~9.1~~10.0, ~~2013~~2018.[67]

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Through its *Handbook*, appropriate chapters will contain up-to-date Standards and design considerations as the material is systematically revised.

ASHRAE will take the lead with respect to dissemination of environmental information of its primary interest and will seek out and disseminate information from other responsible organizations that is pertinent, as guides to updating Standards and Guidelines.

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ASHRAE's primary concern for environmental impact will be at the site where equipment within ASHRAE's scope operates. However, energy source selection and the possible environmental impact due to the energy source and energy transportation will be considered where possible. Recommendations concerning energy source selection should be made by its members.

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9/25