



**BSR/ASHRAE Addendum p  
to ANSI/ASHRAE Standard 15-2019**

**First Public Review Draft**

# **Proposed Addendum p to Standard 15-2019, Safety Standard for Refrigeration Systems**

**First Public Review (January 2022)  
(Draft shows Proposed Changes to Current Standard)**

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**(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

*Efforts to address impending required refrigerant changes have been ongoing for many years. ASHRAE SSPC 34 first created the A2L subcategory in 2010, and ASHRAE SSPC 15 created a working group in 2010 to begin work on how to address that group of refrigerants in ANSI/ASHRAE Standard 15. SSPC 15 published its first addenda in 2018 (addendum d and addendum h to ANSI/ASHRAE Standard 15-2016). UL and CSA published the first major revision to their safety standard (UL 60335-2-40/CSA 22.2 No. 60335-2-40 3<sup>rd</sup> edition) in 2019. Many research projects have been completed, including joint research by AHRI, ASHRAE, DOE, and California Air Resources Board, which began research project activity in 2015. One research project recently completed is AHRTI-9015, Assessment of Refrigerant Leakage Mitigation Effectiveness for Air-Conditioning and Refrigeration Equipment (the final report is publicly available at [www.ahrinet.org/App\\_Content/ahri/files/RESEARCH/AHRTI9015\\_Final.pdf](http://www.ahrinet.org/App_Content/ahri/files/RESEARCH/AHRTI9015_Final.pdf)).*

*SSPC 15 created a working group (WG02) in 2019 to study the differences in requirements of ANSI/ASHRAE Standard 15, the draft BSR/ASHRAE Standard 15.2P, and the product safety standard, and tasked the group with harmonizing the requirements, to the extent possible. The working group was opened broadly to interested stakeholders, and included participants including code consultants, fire service, government agencies, users of the standard, academia, equipment manufacturers, component manufacturers, refrigerant manufacturers, and industry associations. The results of the AHRTI-9015 research, completed by UL at their facility in Northbrook, IL, were shared with the WG02 during meetings in May 2021 and at the SSPC 15 meetings in June 2021. This proposed addendum to Standard 15-2019 makes a modification to refrigerant charge quantity limits, which aligns Standard 15 with the outcome of the research project. This modification will also make the requirements in Standard 15 more consistent with the requirements of the product safety standard.*

**Note:** This addendum makes proposed changes to the current standard. These changes are indicated in the text by underlining (for additions) and ~~striketrough~~ (for deletions) except where the reviewer instructions specifically describe some other means of showing the changes. Only these changes to the current standard 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 p to Standard 15-2019**

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

## **7. RESTRICTIONS ON REFRIGERANT USE**

[ ... ]

**7.6 Group A2L Refrigerants for Human Comfort.** High-probability systems using Group A2L *refrigerants* for human comfort applications *shall* comply with this section.

### **~~7.6.1 Refrigerant Concentration Limits~~**

~~7.6.1.1 Occupied spaces shall comply with Section 7.2.~~

~~7.6.1.2 Unoccupied spaces with *refrigerant* containing equipment, including but not limited to *pipng* or tubing, shall comply with Section 7.2 except as permitted by Section 7.6.4.~~

**7.6.1 Refrigerant Quantity Limits.** The maximum *refrigerant* charge of any *independent circuit* of each refrigeration system shall be as specified in Sections 7.6.1.1 and 7.6.1.2.

**7.6.1.1 Refrigeration Systems with Air Circulation.** Where a high-probability system for human comfort using Group A2L *refrigerants* has either:

- a. air circulation initiated by a *refrigerant detector* in compliance with Section 7.6.5, or
- b. continuous air circulation,

the refrigerant charge quantity shall be limited per the following equation:

$$M = V \times LFL \times CF \times FOCC$$

where:

$M$   $\equiv$  refrigerant charge of the largest independent circuit of the system, lb (kg)

$V$   $\equiv$  volume of space established in accordance with Section 7.3, ft<sup>3</sup> (m<sup>3</sup>)

$LFL$   $\equiv$  lower flammability limit, lb/ft<sup>3</sup> (kg/m<sup>3</sup>)

$CF$   $\equiv$  concentration factor, value of 0.5

$FOCC$   $\equiv$  occupancy adjustment factor. For all occupancies other than institutional,  $FOCC$  has a value of 1. For institutional occupancies,  $FOCC$  has a value of 0.5.

**7.6.1.2 Other Refrigeration Systems.** For any refrigeration system not meeting the requirements of Section 7.6.1.1, the refrigerant charge of the largest independent circuit of the system shall not exceed the appropriate value in Table 7.6.1.2, “Refrigerant Charge Limit.” The floor area,  $FA$ , (in ft<sup>2</sup> [m<sup>2</sup>]) shall be the floor area of the volume of space established in accordance with Section 7.3. The height  $h$  shall be the lowest of any duct opening, supply or return, or the lowest point of the equipment opening delivering conditioned air. Linear interpretation shall be used for floor area, if necessary. Height below 5.9 ft (1.8 m) shall use the first height column. Heights greater than or equal to 9.0 ft (2.75 m) shall use the last height column. For heights in between the values listed, linear interpolation or the next lower value shall be used.

**Table 7.6.1.2 Refrigerant Charge Limit (I-P)**

| <b>Floor Area,<br/><i>FA</i> (ft<sup>2</sup>)</b> | <b>Height, <i>h</i> (ft)</b> |             |             |              |              |              |              |              |
|---|------------------------------|-------------|-------------|--------------|--------------|--------------|--------------|--------------|
|   | <b>≤ 2.0</b>                 | <b>3.3</b>  | <b>4.6</b>  | <b>5.9</b>   | <b>6.6</b>   | <b>7.2</b>   | <b>8.0</b>   | <b>≥ 9.0</b> |
| <u>100</u>  | <u>4.0</u>                   | <u>4.0</u>  | <u>5.3</u>  | <u>6.9</u>   | <u>7.6</u>   | <u>7.6</u>   | <u>7.6</u>   | <u>7.6</u>   |
| <u>125</u>  | <u>4.0</u>                   | <u>4.3</u>  | <u>6.0</u>  | <u>7.7</u>   | <u>8.5</u>   | <u>9.4</u>   | <u>9.5</u>   | <u>9.5</u>   |
| <u>150</u>  | <u>4.0</u>                   | <u>4.7</u>  | <u>6.5</u>  | <u>8.4</u>   | <u>9.3</u>   | <u>10.3</u>  | <u>11.4</u>  | <u>11.4</u>  |
| <u>175</u>  | <u>4.0</u>                   | <u>5.0</u>  | <u>7.1</u>  | <u>9.1</u>   | <u>10.1</u>  | <u>11.1</u>  | <u>12.4</u>  | <u>13.4</u>  |
| <u>200</u>  | <u>4.0</u>                   | <u>5.4</u>  | <u>7.6</u>  | <u>9.7</u>   | <u>10.8</u>  | <u>11.9</u>  | <u>13.2</u>  | <u>14.8</u>  |
| <u>225</u>  | <u>4.0</u>                   | <u>5.7</u>  | <u>8.0</u>  | <u>10.3</u>  | <u>11.4</u>  | <u>12.6</u>  | <u>14.0</u>  | <u>15.7</u>  |
| <u>250</u>  | <u>4.0</u>                   | <u>6.0</u>  | <u>8.4</u>  | <u>10.9</u>  | <u>12.1</u>  | <u>13.3</u>  | <u>14.8</u>  | <u>16.5</u>  |
| <u>300</u>  | <u>4.0</u>                   | <u>6.6</u>  | <u>9.3</u>  | <u>11.9</u>  | <u>13.2</u>  | <u>14.5</u>  | <u>16.2</u>  | <u>18.1</u>  |
| <u>350</u>  | <u>4.3</u>                   | <u>7.1</u>  | <u>10.0</u> | <u>12.8</u>  | <u>14.3</u>  | <u>15.7</u>  | <u>17.5</u>  | <u>19.6</u>  |
| <u>400</u>  | <u>4.6</u>                   | <u>7.6</u>  | <u>10.7</u> | <u>13.7</u>  | <u>15.3</u>  | <u>16.8</u>  | <u>18.7</u>  | <u>20.9</u>  |
| <u>450</u>  | <u>4.9</u>                   | <u>8.1</u>  | <u>11.3</u> | <u>14.6</u>  | <u>16.2</u>  | <u>17.8</u>  | <u>19.8</u>  | <u>22.2</u>  |
| <u>500</u>  | <u>5.1</u>                   | <u>8.5</u>  | <u>11.9</u> | <u>15.4</u>  | <u>17.1</u>  | <u>18.8</u>  | <u>20.9</u>  | <u>23.4</u>  |
| <u>600</u>  | <u>5.6</u>                   | <u>9.3</u>  | <u>13.1</u> | <u>16.8</u>  | <u>18.7</u>  | <u>20.6</u>  | <u>22.9</u>  | <u>25.6</u>  |
| <u>700</u>  | <u>6.1</u>                   | <u>10.1</u> | <u>14.1</u> | <u>18.2</u>  | <u>20.2</u>  | <u>22.2</u>  | <u>24.7</u>  | <u>27.7</u>  |
| <u>800</u>  | <u>6.5</u>                   | <u>10.8</u> | <u>15.1</u> | <u>19.4</u>  | <u>21.6</u>  | <u>23.7</u>  | <u>26.4</u>  | <u>29.6</u>  |
| <u>900</u>  | <u>6.9</u>                   | <u>11.4</u> | <u>16.0</u> | <u>20.6</u>  | <u>22.9</u>  | <u>25.2</u>  | <u>28.0</u>  | <u>31.4</u>  |
| <u>1000</u>                                       | <u>7.2</u>                   | <u>12.1</u> | <u>16.9</u> | <u>21.7</u>  | <u>24.1</u>  | <u>26.5</u>  | <u>29.6</u>  | <u>33.1</u>  |
| <u>1200</u>                                       | <u>7.9</u>                   | <u>13.2</u> | <u>18.5</u> | <u>23.8</u>  | <u>26.4</u>  | <u>29.1</u>  | <u>32.4</u>  | <u>36.3</u>  |
| <u>1400</u>                                       | <u>8.6</u>                   | <u>14.3</u> | <u>20.0</u> | <u>25.7</u>  | <u>28.6</u>  | <u>31.4</u>  | <u>35.0</u>  | <u>39.2</u>  |
| <u>1600</u>                                       | <u>9.2</u>                   | <u>15.3</u> | <u>21.4</u> | <u>27.5</u>  | <u>30.5</u>  | <u>33.6</u>  | <u>37.4</u>  | <u>41.9</u>  |
| <u>1800</u>                                       | <u>9.7</u>                   | <u>16.2</u> | <u>22.7</u> | <u>29.1</u>  | <u>32.4</u>  | <u>35.6</u>  | <u>39.7</u>  | <u>44.4</u>  |
| <u>2000</u>                                       | <u>10.2</u>                  | <u>17.1</u> | <u>23.9</u> | <u>30.7</u>  | <u>34.1</u>  | <u>37.5</u>  | <u>41.8</u>  | <u>46.8</u>  |
| <u>2250</u>                                       | <u>10.9</u>                  | <u>18.1</u> | <u>25.3</u> | <u>32.6</u>  | <u>36.2</u>  | <u>39.8</u>  | <u>44.3</u>  | <u>49.6</u>  |
| <u>2500</u>                                       | <u>11.4</u>                  | <u>19.1</u> | <u>26.7</u> | <u>34.3</u>  | <u>38.2</u>  | <u>42.0</u>  | <u>46.7</u>  | <u>52.3</u>  |
| <u>2750</u>                                       | <u>12.0</u>                  | <u>20.0</u> | <u>28.0</u> | <u>36.0</u>  | <u>40.0</u>  | <u>44.0</u>  | <u>49.0</u>  | <u>54.9</u>  |
| <u>3000</u>                                       | <u>12.5</u>                  | <u>20.9</u> | <u>29.3</u> | <u>37.6</u>  | <u>41.8</u>  | <u>46.0</u>  | <u>51.2</u>  | <u>57.3</u>  |
| <u>3500</u>                                       | <u>13.5</u>                  | <u>22.6</u> | <u>31.6</u> | <u>40.6</u>  | <u>45.1</u>  | <u>49.7</u>  | <u>55.3</u>  | <u>61.9</u>  |
| <u>4000</u>                                       | <u>14.5</u>                  | <u>24.1</u> | <u>33.8</u> | <u>43.4</u>  | <u>48.3</u>  | <u>53.1</u>  | <u>59.1</u>  | <u>66.2</u>  |
| <u>4500</u>                                       | <u>15.4</u>                  | <u>25.6</u> | <u>35.8</u> | <u>46.1</u>  | <u>51.2</u>  | <u>56.3</u>  | <u>62.7</u>  | <u>70.2</u>  |
| <u>5000</u>                                       | <u>16.2</u>                  | <u>27.0</u> | <u>37.8</u> | <u>48.6</u>  | <u>54.0</u>  | <u>59.4</u>  | <u>66.1</u>  | <u>74.0</u>  |
| <u>6000</u>                                       | <u>17.7</u>                  | <u>29.6</u> | <u>41.4</u> | <u>53.2</u>  | <u>59.1</u>  | <u>65.0</u>  | <u>72.4</u>  | <u>81.1</u>  |
| <u>7000</u>                                       | <u>19.2</u>                  | <u>31.9</u> | <u>44.7</u> | <u>57.5</u>  | <u>63.8</u>  | <u>70.2</u>  | <u>78.2</u>  | <u>87.6</u>  |
| <u>8000</u>                                       | <u>20.5</u>                  | <u>34.1</u> | <u>47.8</u> | <u>61.4</u>  | <u>68.3</u>  | <u>75.1</u>  | <u>83.6</u>  | <u>93.6</u>  |
| <u>9000</u>                                       | <u>21.7</u>                  | <u>36.2</u> | <u>50.7</u> | <u>65.2</u>  | <u>72.4</u>  | <u>79.6</u>  | <u>88.7</u>  | <u>99.3</u>  |
| <u>10000</u>                                      | <u>22.9</u>                  | <u>38.2</u> | <u>53.4</u> | <u>68.7</u>  | <u>76.3</u>  | <u>83.9</u>  | <u>93.5</u>  | <u>104.7</u> |
| <u>15000</u>                                      | <u>28.0</u>                  | <u>46.7</u> | <u>65.4</u> | <u>84.1</u>  | <u>93.5</u>  | <u>102.8</u> | <u>114.5</u> | <u>128.2</u> |
| <u>20000</u>                                      | <u>32.4</u>                  | <u>54.0</u> | <u>75.5</u> | <u>97.1</u>  | <u>107.9</u> | <u>118.7</u> | <u>132.2</u> | <u>148.0</u> |
| <u>25000</u>                                      | <u>36.2</u>                  | <u>60.3</u> | <u>84.5</u> | <u>108.6</u> | <u>120.7</u> | <u>132.7</u> | <u>147.8</u> | <u>165.5</u> |
| <u>28000</u>                                      | <u>38.3</u>                  | <u>63.8</u> | <u>89.4</u> | <u>114.9</u> | <u>127.7</u> | <u>140.5</u> | <u>156.4</u> | <u>175.1</u> |

**Table 7.6.1.2 Refrigerant Charge Limit (SI)**

| <b>Floor Area,<br/><i>FA</i> (m<sup>2</sup>)</b> | <b>Height, <i>h</i> (m)</b> |             |             |             |             |             |             |               |
|--|-----------------------------|-------------|-------------|-------------|-------------|-------------|-------------|---------------|
|  | <b>≤ 0.60</b>               | <b>1.00</b> | <b>1.40</b> | <b>1.80</b> | <b>2.00</b> | <b>2.20</b> | <b>2.45</b> | <b>≥ 2.74</b> |
| 5  | 1.8                         | 1.8         | 1.8         | 1.9         | 1.9         | 1.9         | 1.9         | 1.9           |
| 10   | 1.8                         | 1.8         | 2.5         | 3.2         | 3.6         | 3.7         | 3.7         | 3.7           |
| 15   | 1.8                         | 2.2         | 3.1         | 4.0         | 4.4         | 4.8         | 5.4         | 5.6           |
| 20   | 1.8                         | 2.5         | 3.6         | 4.6         | 5.1         | 5.6         | 6.2         | 7.0           |
| 25   | 1.8                         | 2.8         | 4.0         | 5.1         | 5.7         | 6.3         | 7.0         | 7.8           |
| 30   | 1.9                         | 3.1         | 4.4         | 5.6         | 6.2         | 6.9         | 7.6         | 8.5           |
| 35   | 2.0                         | 3.4         | 4.7         | 6.1         | 6.7         | 7.4         | 8.2         | 9.2           |
| 40   | 2.2                         | 3.6         | 5.0         | 6.5         | 7.2         | 7.9         | 8.8         | 9.9           |
| 45   | 2.3                         | 3.8         | 5.3         | 6.9         | 7.6         | 8.4         | 9.4         | 10.5          |
| 50   | 2.4                         | 4.0         | 5.6         | 7.2         | 8.0         | 8.9         | 9.9         | 11.0          |
| 60   | 2.6                         | 4.4         | 6.2         | 7.9         | 8.8         | 9.7         | 10.8        | 12.1          |
| 70   | 2.9                         | 4.8         | 6.7         | 8.6         | 9.5         | 10.5        | 11.7        | 13.1          |
| 80   | 3.1                         | 5.1         | 7.1         | 9.2         | 10.2        | 11.2        | 12.5        | 14.0          |
| 90   | 3.2                         | 5.4         | 7.6         | 9.7         | 10.8        | 11.9        | 13.2        | 14.8          |
| 100  | 3.4                         | 5.7         | 8.0         | 10.2        | 11.4        | 12.5        | 13.9        | 15.6          |
| 125  | 3.8                         | 6.4         | 8.9         | 11.5        | 12.7        | 14.0        | 15.6        | 17.4          |
| 150  | 4.2                         | 7.0         | 9.8         | 12.5        | 13.9        | 15.3        | 17.1        | 19.1          |
| 175  | 4.5                         | 7.5         | 10.5        | 13.5        | 15.1        | 16.6        | 18.4        | 20.6          |
| 200  | 4.8                         | 8.0         | 11.3        | 14.5        | 16.1        | 17.7        | 19.7        | 22.1          |
| 225  | 5.1                         | 8.5         | 11.9        | 15.4        | 17.1        | 18.8        | 20.9        | 23.4          |
| 250  | 5.4                         | 9.0         | 12.6        | 16.2        | 18.0        | 19.8        | 22.0        | 24.7          |
| 300  | 5.9                         | 9.9         | 13.8        | 17.7        | 19.7        | 21.7        | 24.1        | 27.0          |
| 350  | 6.4                         | 10.6        | 14.9        | 19.2        | 21.3        | 23.4        | 26.1        | 29.2          |
| 400  | 6.8                         | 11.4        | 15.9        | 20.5        | 22.8        | 25.0        | 27.9        | 31.2          |
| 450  | 7.2                         | 12.1        | 16.9        | 21.7        | 24.1        | 26.6        | 29.6        | 33.1          |
| 500  | 7.6                         | 12.7        | 17.8        | 22.9        | 25.4        | 28.0        | 31.2        | 34.9          |
| 600  | 8.4                         | 13.9        | 19.5        | 25.1        | 27.9        | 30.7        | 34.1        | 38.2          |
| 700  | 9.0                         | 15.1        | 21.1        | 27.1        | 30.1        | 33.1        | 36.9        | 41.3          |
| 800  | 9.7                         | 16.1        | 22.5        | 29.0        | 32.2        | 35.4        | 39.4        | 44.1          |
| 900  | 10.2                        | 17.1        | 23.9        | 30.7        | 34.1        | 37.6        | 41.8        | 46.8          |
| 1000   | 10.8                        | 18.0        | 25.2        | 32.4        | 36.0        | 39.6        | 44.1        | 49.4          |
| 1200   | 11.8                        | 19.7        | 27.6        | 35.5        | 39.4        | 43.4        | 48.3        | 54.1          |
| 1400   | 12.8                        | 21.3        | 29.8        | 38.3        | 42.6        | 46.8        | 52.2        | 58.4          |
| 1600   | 13.7                        | 22.8        | 31.9        | 41.0        | 45.5        | 50.1        | 55.8        | 62.4          |
| 1800   | 14.5                        | 24.1        | 33.8        | 43.5        | 48.3        | 53.1        | 59.1        | 66.2          |
| 2000   | 15.3                        | 25.4        | 35.6        | 45.8        | 50.9        | 56.0        | 62.3        | 69.8          |
| 2200   | 16.0                        | 26.7        | 37.4        | 48.0        | 53.4        | 58.7        | 65.4        | 73.2          |
| 2400   | 16.7                        | 27.9        | 39.0        | 50.2        | 55.7        | 61.3        | 68.3        | 76.5          |
| 2600   | 17.4                        | 29.0        | 40.6        | 52.2        | 58.0        | 63.8        | 71.1        | 79.6          |