BSR/ASHRAE Addendum b to ANSI/ASHRAE Standard 41.10-2020

Public Review Draft

Proposed Addendum b to Standard 41.10-2020, Standard Methods for Refrigerant Mass Flow Rate Measurements Using Flowmeters

First Public Review (August 2021)
(Draft shows Proposed Changes to Current Standard)

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This addendum makes proposed changes to the current standard. These changes are indicated in the text by underlining (for additions) and strikethrough (for deletions).

Section 3, Definitions: Add the new definition below for clarification.

steady-state criteria: the criteria that establish negligible change of refrigerant mass flow rate with time.

Section 5.1, Test Plan: Revise as shown below to make it easier for Method of Test (MOT) and Method of Rating (MOR) standards to adopt this standard by reference.

5.1 Test Plan. A test plan shall specify the refrigerant flow rate measurement system accuracy and the test points to be performed. The test plan shall be one of the following documents:

a. A document provided by the person or the organization that authorized the tests and calculations to be performed.
c. A rating standard.
d. A regulation or code.
e. Any combination of items a. through d.

The test plan shall specify:

a. The refrigerant mass flow rate measurement system accuracy.
b. The values to be determined and recorded that are selected from this list: refrigerant mass flow rate measurement and refrigerant mass flow rate measurement uncertainty.
c. Any combination of test points and targeted set points to be performed together with operating tolerances.
5.2 Values to be Determined and Reported

The test values to be determined and reported shall be as shown in Table 5-1 if specified in the test plan in Section 5.1. Use the units of measure in Table 5-1 unless otherwise specified in the test plan in Section 5.1.

TABLE 5-1 Measurement Values and Units of Measure

<table>
<thead>
<tr>
<th>Quantity</th>
<th>Units of Measure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Refrigerant mass flow rate and uncertainty in the refrigerant mass flow rate measurement</td>
<td>kilogram per second (kg/s)</td>
</tr>
<tr>
<td></td>
<td>pound (avoirdupois) per hour (lbm/h)</td>
</tr>
<tr>
<td>Density and uncertainty in density measurement</td>
<td>kilograms per cubic meter (kg/m³)</td>
</tr>
<tr>
<td></td>
<td>pound (avoirdupois) per cubic foot (lbm/ft³)</td>
</tr>
</tbody>
</table>

5.4 Uncertainty

The uncertainty in each refrigerant flow measurement shall be estimated as described in Section 4.9 for each test point unless otherwise specified in the test plan. Alternatively, if specified in the test plan, the worst-case uncertainty for all test points shall be estimated and reported for each test point.

5.8 Steady-State Test Criteria for Refrigerant Mass Flow Rate Measurements for Compressors that do not Incorporate Pulse-Width Modulation

Refrigerant mass flow rate test data shall be recorded at steady-state conditions unless otherwise specified in the test plan in Section 5.1. If the test plan requires refrigerant mass flow rate test data points to be recorded at steady-state test conditions and provides the operating condition tolerance but does not specify the steady-state criteria, then determine that steady-state test conditions have been achieved using one of the following methods:

a. Apply the steady-state criteria in Section 5.8.1 if the test plan provides test points for refrigerant mass flow rate measurement.

b. Apply the steady-state criteria in Section 5.8.2 if the test plan provides targeted set points for refrigerant mass flow rate measurement.
5.8.1 Steady-State Test Criteria Under Laboratory Test Conditions. If the test plan requires refrigerant mass flow rate test data points to be recorded at steady-state test conditions and provides the operating condition tolerance but does not specify the steady-state criteria, then determine that steady-state test conditions have been achieved using one of the following methods:

   a. Apply the steady-state criteria in Section 5.8.3 if the test plan provides test points for refrigerant mass flow rate measurement.

   b. Apply the steady-state criteria in Section 5.8.4 if the test plan provides targeted set points for refrigerant mass flow rate measurement.

5.8.2 Steady-State Test Criteria Under Field Test Conditions. If the test plan requires refrigerant mass flow rate test data points to be recorded at steady-state test conditions and provides the operating condition tolerance but does not specify the steady-state criteria, the methods in Section 5.8.1 are optional.

Informative Note: The steady-state methods in Section 5.8.1 are likely to be impractical under field test conditions. Under these circumstances, the user may want to select another method to determine the conditions for field test data to be recorded.

Section 5.5, Revise subsection header numbers and Equation 5-16 as shown below.

5.8.1 5.8.3 Steady-State Refrigerant Mass Flow Rate Criteria for Test Points

5.8.2 5.8.4 Steady-State Refrigerant Mass Flow Rate Criteria for Targeted Set Points

\[ b \Delta t \leq 0.50 \dot{m}_L \text{ kg/s (lbm/h)} \]  \hspace{1cm} (5-16)

\[ |b \Delta t| \leq 0.50 \dot{m}_L \text{ kg/s (lbm/h)} \]  \hspace{1cm} (5-16)

Section 9.1, Uncertainty Estimate: Revise as shown below to make it easier for MOT/MOR standards to adopt this standard by reference.

9.1 Uncertainty Estimate. An estimate of the refrigerant mass flow rate measurement system uncertainty performed in accordance with ASME PTC 19.1\textsuperscript{11} shall accompany each refrigerant flow measurement if specified in the test plan in Section 5.1.

Informative Note: Informative Annexes B and C contain examples of uncertainty calculations.

Section 10.6, Test Results: Revise as shown below to make it easier for MOT/MOR standards to adopt this standard by reference.

10.6 Test Results if Specified in the Test Plan in Section 5.1.

   a. Refrigerant mass flow rate, kg/s (lbm/h).
b. Uncertainty in refrigerant mass flow rate unless otherwise required by the test plan in Section 5.1, kg/s (lbm/h).

c. Lubricant circulation rate through the flowmeter if required in Section 5.5, percent.