ADDENDA

ANSI/ASHRAE Addendum b to
ANSI/ASHRAE Standard 30-2019

Method of Testing Liquid Chillers

Approved by ASHRAE and the American National Standards Institute on April 30, 2021.

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 (https://www.ashrae.org/continuous-maintenance).

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FOREWORD

Addendum b to ASHRAE Standard 30-2019 includes the following changes:

a. *Changes "water" to "liquid" where applicable.*
b. *Clarifies requirements for* Δp_{adj}.
c. *Replaces reference to ASME and ISA standards with exclusive reference to the ASHRAE Standard 41 series of standards.*
d. *Removes ft* H_2O *from the standard.*
e. *Adds a new Informative Appendix B with link and description to a supplemental Microsoft® Excel® spreadsheet.*

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 b to Standard 30-2019

Modify Section 3 as shown. The remainder of Section 3 is unchanged.

3. DEFINITIONS, ABBREVIATIONS, AND ACRONYMS

[. . .]

capacity: a measurable physical quantity, the rate that heat (energy) is added to or removed from the liquid side of a refrigerating system. Capacity is defined as the mass flow rate of the liquid multiplied by the difference in enthalpy of liquid entering and leaving the heat exchanger. For the purposes of this standard, the enthalpy change is approximated as the sensible heat transfer using specific heat and temperature difference and, in some calculations, also the energy associated with liquid-side pressure losses.

[. . .]

gross heating capacity: the capacity of the ~~water~~liquid-cooled condenser as measured by the total heat transferred from the refrigerant to the liquid in the condenser. This value includes both the sensible heat transfer and the friction heat losses from pressure drop effects of the liquid flow through the condenser. This value is used to calculate the energy balance of a test.

[. . .]

energy balance: a dimensionless ratio metric used to check for gross errors in measurement instrumentation and test results for units with a ~~water~~liquid-cooled condenser (with or without ~~water~~liquid-cooled heat reclaim condenser) and defined as the difference between energy inputs and energy outputs to the liquid-chilling package, normalized to a percentage by dividing by the mean of the total input energy and the total output energy. For this standard, the energy inputs are generally limited to the gross refrigerating capacity and the input power, although other auxiliary power inputs are included when analysis demonstrates significance to the energy balance.

Modify Section 5.4.4 as shown. The remainder of Section 5 is unchanged. (Note: This section incorporates changes made by previously published Addendum a to Standard 30-2019.)

5.4.4 Liquid Pressure Drop Correction. Measured liquid pressure-drop values shall be adjusted to subtract additional static pressure drop due to piping external to the chiller connection points if any such external piping is installed for the test. The additional static pressure drop shall be the sum of all losses between the unit connections and the location of static pressure taps. Record the original measured value, the calculated adjustment value, and the final calculated result for liquid pressure drop. The density values ρ_{in} and ρ_{out} shall be determined at the time-averaged mean of the entering and leaving temperatures, respectively, corresponding to the operating test co~~nditions of the test plan and not to nonoperating or standby con~~ditions.

$$\Delta p_{adj} = \rho g\left[\sum_i (h_f)_i + \sum_j (h_m)_j\right]$$

$$\cancel{\Delta p_{adj} = \rho_{in} g\left[\sum_i (h_f)_i + \sum_j (h_m)_j\right]_{in} + \rho_{out} g\left[\sum_i (h_f)_i + \sum_j (h_m)_j\right]_{out}}$$

5.4.4.1 The correction adjustment shall not exceed 10% of the measured liquid pressure drop Δp_{test}.

~~**5.4.4.2**~~ If Δp_{adj} is less than or equal to 10% of Δp_{test}, ~~T~~the corrected pressure drop $\Delta p_{corrected}$ shall be calculated as follows:

$$\Delta p_{corrected} = \Delta p_{test} - \Delta p_{adj}$$

If Δp_{adj} is greater than 10% of Δp_{test}, either (a) piping external to the chiller connection points shall be reconfigured to allow Δp_{adj} to be less than or equal to 10% of Δp_{test} and the test repeated, or (b) $\Delta p_{corrected}$ shall be calculated as follows and, in accordance with Section 9 the test report, shall state that Δp_{adj} exceeded 10% of Δp_{test}:

$$\Delta p_{corrected} = \Delta p_{test} - 10\%\Delta p_{test}$$

4.4.4.~~3~~2 The general form [. . .]

4.4.4.~~4~~3 The head loss [. . .]

Loss coefficients shall be from Section 5.4.4.~~5~~4, Section 5.4.4.~~6~~5, Crane Technical Publication 410 [1], or ASHRAE research report RP-1034 [2].

Modify Section 6 as shown. The remainder of Section 6 is unchanged.

6. TEST REQUIREMENTS

Table 6-1 Requirements for Test Instrumentation

Measurement	Measurement System Accuracy[b,c,d,e]	Measurement Resolution[f, g]	Selected, Installed, Operated, Maintained in Accordance with
Liquid temperature	±0.11 Δ°C (±0.2 Δ°F)	0.005°C (0.01°F)	ANSI/ASHRAE Standard 41.1 [4]
Air temperature	±0.11 Δ°C (±0.20 Δ°F)	0.05°C (0.1°F)	ANSI/ASHRAE Standard 41.1 [4]
Liquid mass flow rate [a]	±1.0% RDG	4 significant figures	ANSI/ASHRAE Standard 41.8 [5] ~~or ASME Power Test Code PTC 19.5 [6] (flow measurement)~~
			~~ASME MFC-16 [7] (electromagnetic type)~~
			~~ASME MFC-3M [8] (orifice and venturi type)~~
			~~ASME MFC-6M [9] (vortex type)~~
			~~ASME MFC-11 [10] (Coriolis type)~~
			~~ISA Standard RP31.1 [11] (turbine type)~~
Differential pressure	±1.0% RDG	3 significant figures	~~ASME Power Test Code PTC 19.2 [12]~~ ANSI/ASHRAE Standard 41.3[XX]
Electrical power		4 significant figures	ANSI/ASHRAE Standard 41.11 [13] IEEE C57.13 [14]
≤600 V	±1.0% FS, ±2.0% RDG	(V, A, kW, Hz)	
>600 V	±1.5% FS, ±2.5% RDG		
Atmospheric pressure	±1.0 kPa (±0.15 psia)	0.1 kPa (0.01 psia)	~~ASME Power Test Code PTC 19.2 [12]~~ ANSI/ASHRAE Standard 41.3[XX]
Steam condensate mass flow rate	±1.0% RDG	4 significant figures	
Steam pressure	±1.0% RDG	3 significant figures	
Fuel volumetric flow rate	±1.0% RDG	4 significant figures	
Fuel energy content	—	3 significant figures	Gas quality shall be acquired by contacting the local authority and requesting a gas quality report for calorific value on the day of the test.

a. Accuracy requirement also applies to volumetric type meters.
b. Measurement system accuracy shall apply over the range of use during testing, as indicated by the turndown ratio determined during calibration—i.e., from full scale down to a value of full scale divided by the turndown ratio. For many types of instruments and/or systems, this may require exceeding the accuracy requirement at full scale.
c. %RDG = percent of reading; %FS = percent of full scale for the usable range of the measurement instrument or measurement system.
d. If dual requirements are shown in the table, FS and RDG, then both requirements shall be met.
e. Current transformers (CTs) and potential transformers (PTs) shall have a metering accuracy class of 0.3 or better, rated in accordance with IEEE C57.13.
f. Measurement resolution shown is the minimum requirement (most coarse resolution allowable). Better (finer) resolution is acceptable for instrument or panel displays or computer screen displays. Resolution includes all parts of the measurement system, such as analog-to-digital conversion.
g. Significant figures (also known as significant digits) are determined in accordance with Section 5.7.

Table 6-6 Definition of Operating Condition Tolerances and Stability Criteria

Measurement or Calculation Result		Applicable Operating Modes	Values Calculated from Data Samples: Mean	Values Calculated from Data Samples: Std. Dev.	Operating Condition Tolerance Limits	Stability Criteria
Net capacity (cooling or heating)		Cooling, heating, heat recovery	$\bar{Q}$	—	Unit with continuous unloading: Part-load test capacity shall be within 2% of the target part-load capacity [a]. $\frac{\lvert\bar{Q}-Q_{target}\rvert}{Q_{100\%}} \le 2.000\%$	No requirement
					Units with discrete capacity steps: Part-load test points shall be taken as close as practical to the specified part-load rating points as stated in the test plan.	
Evaporator	Entering ~~water~~liquid temperature	Cooling	$\bar{T}$	s_T	No requirement	$s_T \le 0.10$ Δ°C [0.18 Δ°F]
	Leaving ~~water~~liquid temperature				$\lvert\bar{T}-T_{target}\rvert \le 0.28$ Δ°C [0.50 Δ°F]	
Condenser	Entering ~~water~~liquid temperature					
	Leaving ~~water~~liquid temperature				No requirement	

a. The ±2.0% tolerance shall be calculated as 2.0% of the full load rated capacity (kW). For example, a nominal 50.0% part-load point shall be tested between 48.0% and 52.0% of the full-load capacity to be used directly for IPLV.SI and NPLV.SI calculations. Outside this tolerance, interpolation shall be used.
b. The heat portion shall apply when the unit is in the heating mode, except for the first ten minutes after terminating a defrost cycle. The defrost portion shall include the defrost cycle plus the first ten minutes after terminating the defrost cycle.
c. When computing average air temperatures for heating mode tests, omit data samples collected during the defrost portion of the cycle.
d. For electrically driven machines, voltage and frequency shall be maintained at the nameplate rating values within tolerance limits and stability criteria on voltage and frequency when measured at the locations specified in Section 6.3.1.7. For dual nameplate voltage ratings, tests shall be performed at the lower of the two voltages.
e. For steam turbine and gas turbine drive machines the pressure shall be maintained at the nameplate rating values within the tolerance limits.
f. For speed-controlled compressors, the speed shall be maintained at the nameplate rating value within the tolerance limits.

Table 6-6 Definition of Operating Condition Tolerances and Stability Criteria *(Continued)*

Measurement or Calculation Result		Applicable Operating Modes	Values Calculated from Data Samples: Mean	Values Calculated from Data Samples: Std. Dev.	Operating Condition Tolerance Limits	Stability Criteria
Evaporator	Entering ~~water~~liquid temperature [b]	Heating, heat recovery	$\bar{T}$	s_T	Heating portion: No requirement Defrost portion: $\lvert\bar{T} - T_{target}\rvert \le 1.11\ \Delta°C\ [2.00\ \Delta°F]$	Heating portion: $s_T \le 0.10\ \Delta°C\ [0.18\ \Delta°F]$ Defrost portion: $s_T \le 0.28\ \Delta°C\ [0.50\ \Delta°F]$
	Leaving ~~water~~liquid temperature [b]				Heating portion: $\lvert\bar{T} - T_{target}\rvert \le 0.28\ \Delta°C\ [0.50\ \Delta°F]$ Defrost portion: No requirement	Heating portion: $s_T \le 0.10\ \Delta°C\ [0.18\ \Delta°F]$ Defrost portion: No requirement
Condenser	Leaving ~~water~~liquid temperature				$\lvert\bar{T} - T_{target}\rvert \le 0.28\ \Delta°C\ [0.50\ \Delta°F]$	$s_T \le 0.10\ \Delta°C\ [0.18\ \Delta°F]$
	Entering ~~water~~liquid temperature				No requirement	
Evaporator or condenser	Entering air mean dry-bulb temperature [c]	Cooling, heating (nonfrosting)	$\bar{T}$	s_T	$\lvert\bar{T} - T_{target}\rvert \le 0.56\ \Delta°C\ [1.00\ \Delta°F]$	$s_T \le 0.42\ \Delta°C\ [0.75\ \Delta°F]$
		Heating (frosting) [c]			Heating portion: $\lvert\bar{T} - T_{target}\rvert \le 1.1\ \Delta°C\ [2.00\ \Delta°F]$	Heating portion: $s_T \le 5.6\ \Delta°C\ [1.00\ \Delta°F]$
					Defrost portion: No requirement for $\bar{T}$	Defrost portion: $s_T \le 1.39\ \Delta°C\ [2.50\ \Delta°F]$
	Entering air mean wet-bulb temperature [c]	Cooling, heating (nonfrosting)			$\lvert\bar{T} - T_{target}\rvert \le 0.56\ \Delta°C\ [1.00\ \Delta°F]$	$s_T \le 0.28\ \Delta°C\ [0.50\ \Delta°F]$
		Heating (frosting) [c]			Heating portion: $\lvert\bar{T} - T_{target}\rvert \le 0.83\ \Delta°C\ [1.50\ \Delta°F]$	
					Defrost portion: No requirement for $\bar{T}$	

a. The ±2.0% tolerance shall be calculated as 2.0% of the full load rated capacity (kW). For example, a nominal 50.0% part-load point shall be tested between 48.0% and 52.0% of the full-load capacity to be used directly for IPLV.SI and NPLV.SI calculations. Outside this tolerance, interpolation shall be used.
b. The heat portion shall apply when the unit is in the heating mode, except for the first ten minutes after terminating a defrost cycle. The defrost portion shall include the defrost cycle plus the first ten minutes after terminating the defrost cycle.
c. When computing average air temperatures for heating mode tests, omit data samples collected during the defrost portion of the cycle.
d. For electrically driven machines, voltage and frequency shall be maintained at the nameplate rating values within tolerance limits and stability criteria on voltage and frequency when measured at the locations specified in Section 6.3.1.7. For dual nameplate voltage ratings, tests shall be performed at the lower of the two voltages.
e. For steam turbine and gas turbine drive machines the pressure shall be maintained at the nameplate rating values within the tolerance limits.
f. For speed-controlled compressors, the speed shall be maintained at the nameplate rating value within the tolerance limits.

Table 6-6 Definition of Operating Condition Tolerances and Stability Criteria *(Continued)*

Measurement or Calculation Result	Applicable Operating Modes	Values Calculated from Data Samples		Operating Condition Tolerance Limits	Stability Criteria
		Mean	Std. Dev.		
~~Water~~Liquid flow (volumetric, entering)	Cooling, heating, heat recovery	$\overline{V_w}$	s_{V_w}	$\frac{\lvert\bar{V} - V_{w,\,target}\rvert}{V_{w,\,target}} \le 5.000\%$	$\frac{s_{V_w}}{\bar{V}_w} \le 0.750\%$
Voltage [d] (If multiphase, this is the average of all phases.)		$\bar{V}$	s_V	$\frac{\lvert\bar{V} - V_{target}\rvert}{V_{target}} \le 10.00\%$	$\frac{s_V}{\bar{V}} \le 0.500\%$
Frequency [d]		$\bar{\omega}$	s_ω	$\frac{\lvert\bar{\omega} - \omega_{target}\rvert}{\omega_{target}} \le 1.000\%$	$\frac{s_\omega}{\bar{\omega}} \le 0.500\%$
Condenserless refrigerant saturated discharge temperature	Cooling	$\bar{T}$	s_T	$\lvert\bar{T} - T_{target}\rvert \le 0.28\ \Delta°C\ [0.50\ \Delta°F]$	$s_T \le 0.14\ \Delta°C\ [0.25\ \Delta°F]$
Condenserless liquid temperature				$\lvert\bar{T} - T_{target}\rvert \le 0.56\ \Delta°C\ [1.00\ \Delta°F]$	$s_T \le 0.28\ \Delta°C\ [0.50\ \Delta°F]$
Steam turbine pressure/vacuum [e]	Cooling, heating, heat recovery	$\bar{p}$	s_p	$\lvert\bar{p} - p_{rating}\rvert \le 3.45\ \text{kPa}\ [0.500\ \text{psid}]$	$s_p \le 1.72\ \text{kPa}\ [0.250\ \text{psid}]$
Gas turbine inlet gas pressure [e]					
Governor control compressor speed [f]		$\bar{n}$	s_n	$\frac{\lvert\bar{n} - n_{target}\rvert}{n_{target}} \le 0.500\%$	$\frac{s_n}{n} \le 0.250\%$

a. The ±2.0% tolerance shall be calculated as 2.0% of the full load rated capacity (kW). For example, a nominal 50.0% part-load point shall be tested between 48.0% and 52.0% of the full-load capacity to be used directly for IPLV.SI and NPLV.SI calculations. Outside this tolerance, interpolation shall be used.

b. The heat portion shall apply when the unit is in the heating mode, except for the first ten minutes after terminating a defrost cycle. The defrost portion shall include the defrost cycle plus the first ten minutes after terminating the defrost cycle.

c. When computing average air temperatures for heating mode tests, omit data samples collected during the defrost portion of the cycle.

d. For electrically driven machines, voltage and frequency shall be maintained at the nameplate rating values within tolerance limits and stability criteria on voltage and frequency when measured at the locations specified in Section 6.3.1.7. For dual nameplate voltage ratings, tests shall be performed at the lower of the two voltages.

e. For steam turbine and gas turbine drive machines the pressure shall be maintained at the nameplate rating values within the tolerance limits.

f. For speed-controlled compressors, the speed shall be maintained at the nameplate rating value within the tolerance limits.

Modify Section 8 as shown. The remainder of Section 8 is unchanged.

8. TEST PROCEDURES

[. . .]

8.4 Liquid Pressure Drop Measurement Procedure

8.4.1 Purpose. The purpose of this section is to prescribe a measurement method for liquid pressure drop and, where required, a correction method to compensate for friction losses associated with external piping measurement sections when installed per Section 6.3.1.6. The measurement method only applies to pipe of circular cross section.

8.4.2 Background. As a certified test point for the liquid to refrigerant heat exchangers, the liquid-side pressure drop needs to be determined by test with acceptable measurement uncertainty. In some cases, the measured Liquid Pressure Drop per this standard will be determined by using static pressure taps in piping external to the unit. When using external piping, adjustment factors are allowed to compensate the reported pressure drop measurement. Numerous studies conclude that the determination of a calculated correction term for these external components may contain significant sources of error, and therefore, the use of external correction factors will be restricted to limit the magnitude of these potential errors. For units with small connection sizes, it is feasible that straight pipe sections be directly connected to the units with adequate length to obtain static pressure measurements with acceptable systematic errors due to instrument installation location. This is the preferred connection methodology. Units with larger size connections may have spatial limits in the connection arrangement such that elbows or pipe diameter changes may be necessary to accommodate the available space at the test facility, or to provide mechanical support for piping weight loads. While this may increase the measurement uncertainty, it is a practical compromise considering capital costs of test facilities.

8.4.3 Correction Method. The average measured liquid pressure drop values Δp_{test} during test shall be adjusted to subtract additional static pressure drop Δp_{adj} due to external piping. The additional static pressure drop shall be the sum of all losses between the unit connections and the location of static pressure taps. Record the original measured value Δp_{test}, the calculated adjustment value Δp_{adj}, and the final calculated corrected test result for liquid pressure drop $\Delta p_{corrected}$.

8.4.3.1 The adjustment shall not exceed 10% of the measured liquid pressure drop.

8.4.3.2 Refer to Section 5.4.4 for the equations to be used.

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

9. REPORTING OF RESULTS

Table 9-1 Data to be Reported [a]

Type	Report Item
General	Name and address of the chiller test facility
	Report identification number
Chiller Operation	Operating mode (cooling, heating, simultaneous heating and cooling, or heat recovery)
	All inputs necessary to ensure that the equipment under test runs in the operating mode tested [b]
Capacity	Net capacity
	Gross capacity values as used for energy balance
	Heat reclaim capacity [c]
Input power	Total input power
	List of components that utilize auxiliary power
Energy efficiency[d]	One or more of the *energy efficiency* metrics per Section 5.4.3
Liquid pressure drop[e]	Liquid corrected pressure drop $\Delta p_{corrected}$ at ~~water temperatures~~operating conditions per the test plan, measured per Section 8.4 and corrected per Section 5.4.4
	If $\Delta p_{adj} > 10\% \Delta p_{test}$, then report the value of Δp_{adj} and include the statement "Δp_{adj} exceeded 10% of Δp_{test}"
Test validation	Energy Balance when required per Sections 5.5.1 and 5.5.1.4
	Voltage Balance per Section 5.5.2
Correction values	Δp_{adj} per Section 5.4.4 (even if exceeding 10% of Δp_{test})
	Any other correction values required by the test plan
Test plan	Attach a copy of the test plan in accordance with Section 6.4 or provide target operating condition values such as capacity, temperature, and flow.
Test data	All data recorded in accordance with Section 7
Uncertainty analysis	Results of the uncertainty analysis in accordance with Section 6.7.3.

a. Test Results shall be rounded to the number of significant figures identified in Section 5.7, using the definitions in Section 3, and rounding rules and formats in Section 5.7.
b. Example: In the case that a unit operates in "Heating" mode only when the ambient temperature is below 12.8°C (55.0°F) the report shall state the temperature and how the ambient temperature signal is provided to the equipment under test.
c. Required for liquid-cooled heat reclaim condenser only.
d. Pump energy associated with pressure drop through the chiller heat exchangers is not included in the total input power. This is done because any adjustment to the chiller performance would confuse the overall system analysis for capacity and efficiency. It is therefore important for any system analysis to account for the cooling loads associated with the system pump energy and to include the pump power into the overall equations for system efficiency.
e. Liquid pressure drop shall be reported in units of pressure differential, not in head or liquid column height. **Note:** Due to industry typical practice, Liquid Pressure Drop is often reported in head (ft H2O) and corrected to a reference temperature (e.g. 60 °F); however, test data is acquired in pressure, psid, for use in calculations and test result reporting.

Modify Section 10 as shown. The remainder of Section 10 is unchanged.

Table 10-1 Nomenclature

Group	Symbol	Description	SI Unit Name	SI Unit Symbol	IP Unit Name	IP Unit Symbol
[. . .]						
Pressure Drop						
	d	pipe inside diameter dimension	millimetre	mm	inch	in
	ε	absolute roughness	metre	m	foot	ft
	f	Darcy friction factor				
	g	standard gravitational term	metre per second squared	m/s^2	foot per second squared	ft/s^2
	h_f	frictional head loss in pipe (pressure drop, pressure differential)	metre	m	foot	ft
	h_m	minor head loss in fittings (pressure drop, pressure differential)	metre	m	foot	ft
	K	resistance coefficient				
	p	pressure	kilopascal	kPa	pound-force per square inch	psia
	Δp	pressure differential	kilopascal	kPa	pound-force per square inch	psid ~~or ft of water (at 60°F)~~
	r	radius of the centerline of the elbow	millimetre	mm	inch	in.
	Re	Reynolds number				
	v	velocity, average across at the inlet cross section	metre per second	m/s	foot per second	ft/s

Modify Section 11 as shown.

11. NORMATIVE REFERENCES

1. Crane Technical Paper Number 410, 2009 edition.
2. ASHRAE. 1999. *Develop Design Data on Pressure Loss of Large Pipe Fittings*. Final Report RP-1034. Atlanta: ASHRAE
3. NIST. 2008. NIST Special Publication 811, *Guide for the Use of the International System of Units (SI)*. NIST Standard Reference. Gaithersburg, MD: National Institute of Standards and Technology.
4. ASHRAE. 2013. ANSI/ASHRAE Standard 41.1, *Standard Method for Temperature Measurement*. Atlanta: ASHRAE
5. ASHRAE. 2016. ANSI/ASHRAE Standard 41.8, *Standard Methods for Liquid Flow Measurement*. Atlanta: ASHRAE.

~~6. ASME. 2004 (R2013). ASME Standard PTC 19.5, *Flow Measurement*. New York: American Society of Mechanical Engineers.~~

~~7. ASME. 2014. ASME Standard MFC-16, *Measurement of Liquid Flow in Closed Conduits With Electromagnetic Flowmeters*. New York: American Society of Mechanical Engineers.~~

~~8. ASME. 2004. ASME Standard MFC-3M, *Measurement of Fluid Flow in Pipes Using Orifice, Nozzle, and Venturi*. New York: American Society of Mechanical Engineers.~~

~~9. ASME. 2005. ASME Standard MFC-6M-1998 (R2005), *Measurement of Fluid Flow in Pipes Using Vortex Flowmeters*. New York: American Society of Mechanical Engineers.~~

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~~11. ISA. 1977. ISA Standard RP31.1, *Recommended Practice Specification, Installation, and Calibration of Turbine Flowmeters*. Research Triangle Park, NC: Instrument Society of America.~~

~~12. ASME. 2010 (R2015). ASME Standard PTC 19.2, *Pressure Measurement, Instruments and Apparatus Supplement*. New York: American Society of Mechanical Engineers.~~

13. ASHRAE. 2014. ANSI/ASHRAE Standard 41.11, *Standard Methods for Power Measurement*. Atlanta: ASHRAE.

14. IEEE. 2016. IEEE C57.13, *IEEE Standard Requirements for Instrument Transformers*. New York: Institute of Electrical and Electronic Engineers.

1~~0~~5. ASME. 2013. Standard PTC 19.1, *Test Uncertainty*. New York: American Society of Mechanical Engineers.

XX. ASHRAE. 2014. ANSI/ASHRAE Standard 41.3, *Standard Methods for Pressure Measurement*. Atlanta: ASHRAE.

Add new Informative Appendix B as shown. Reletter existing Normative Appendix B and as Normative Appendix C.

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INFORMATIVE APPENDIX B
SYSTEM CALIBRATION WORKSHEET

This appendix provides guidance on the calculations required to determine the range over which the required accuracy can be achieved for a calibrated system as prescribe in Section 6.

An example spreadsheet workbook shows one possible approach to implement the Section 6 calculations and allows multiple systems to be evaluated for all instruments and measurement systems required by the standard.

The workbook can be downloaded from ASHRAE at https://www.ashrae.org/XXXX.

POLICY STATEMENT DEFINING ASHRAE'S CONCERN FOR THE ENVIRONMENTAL IMPACT OF ITS ACTIVITIES

ASHRAE is concerned with the impact of its members' activities on both the indoor and outdoor environment. ASHRAE's members will strive to minimize any possible deleterious effect on the indoor and outdoor environment of the systems and components in their responsibility while maximizing the beneficial effects these systems provide, consistent with accepted Standards and the practical state of the art.

ASHRAE's short-range goal is to ensure that the systems and components within its scope do not impact the indoor and outdoor environment to a greater extent than specified by the Standards and Guidelines as established by itself and other responsible bodies.

As an ongoing goal, ASHRAE will, through its Standards Committee and extensive Technical Committee structure, continue to generate up-to-date Standards and Guidelines where appropriate and adopt, recommend, and promote those new and revised Standards developed by other responsible organizations.

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.

The effects of the design and selection of equipment and systems will be considered within the scope of the system's intended use and expected misuse. The disposal of hazardous materials, if any, will also be considered.

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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About ASHRAE

Founded in 1894, ASHRAE is a global professional society committed to serve humanity by advancing the arts and sciences of heating, ventilation, air conditioning, refrigeration, and their allied fields.

As an industry leader in research, standards writing, publishing, certification, and continuing education, ASHRAE and its members are dedicated to promoting a healthy and sustainable built environment for all, through strategic partnerships with organizations in the HVAC&R community and across related industries.

To stay current with this and other ASHRAE Standards and Guidelines, visit www.ashrae.org/standards, and connect on LinkedIn, Facebook, Twitter, and YouTube.

Visit the ASHRAE Bookstore

ASHRAE offers its Standards and Guidelines in print, as immediately downloadable PDFs, and via ASHRAE Digital Collections, which provides online access with automatic updates as well as historical versions of publications. Selected Standards and Guidelines are also offered in redline versions that indicate the changes made between the active Standard or Guideline and its previous version. For more information, visit the Standards and Guidelines section of the ASHRAE Bookstore at www.ashrae.org/bookstore.

IMPORTANT NOTICES ABOUT THIS STANDARD

To ensure that you have all of the approved addenda, errata, and interpretations for this Standard, visit www.ashrae.org/standards to download them free of charge.

Addenda, errata, and interpretations for ASHRAE Standards and Guidelines are no longer distributed with copies of the Standards and Guidelines. ASHRAE provides these addenda, errata, and interpretations only in electronic form to promote more sustainable use of resources.

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