ADDENDA

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

Method of Testing Liquid Chillers

Approved by ASHRAE and the American National Standards Institute on May 29, 2020.

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).

The latest edition of an ASHRAE Standard may be purchased on the ASHRAE website (www.ashrae.org) or from ASHRAE Customer Service, 1791 Tullie Circle, NE, Atlanta, GA 30329-2305. E-mail: orders@ashrae.org. Fax: 678-539-2129. Telephone: 404-636-8400 (worldwide), or toll free 1-800-527-4723 (for orders in US and Canada). For reprint permission, go to www.ashrae.org/permissions.

 ISSN 1041-2336

Approved American National Standard
ANSI
www.ansi.org

SPECIAL NOTE

This American National Standard (ANS) is a national voluntary consensus Standard developed under the auspices of ASHRAE. *Consensus* is defined by the American National Standards Institute (ANSI), of which ASHRAE is a member and which has approved this Standard as an ANS, as "substantial agreement reached by directly and materially affected interest categories. This signifies the concurrence of more than a simple majority, but not necessarily unanimity. Consensus requires that all views and objections be considered, and that an effort be made toward their resolution." Compliance with this Standard is voluntary until and unless a legal jurisdiction makes compliance mandatory through legislation.

ASHRAE obtains consensus through participation of its national and international members, associated societies, and public review.

ASHRAE Standards are prepared by a Project Committee appointed specifically for the purpose of writing the Standard. The Project Committee Chair and Vice-Chair must be members of ASHRAE; while other committee members may or may not be ASHRAE members, all must be technically qualified in the subject area of the Standard. Every effort is made to balance the concerned interests on all Project Committees.

The Senior Manager of Standards of ASHRAE should be contacted for

a. interpretation of the contents of this Standard,
b. participation in the next review of the Standard,
c. offering constructive criticism for improving the Standard, or
d. permission to reprint portions of the Standard.

DISCLAIMER

ASHRAE uses its best efforts to promulgate Standards and Guidelines for the benefit of the public in light of available information and accepted industry practices. However, ASHRAE does not guarantee, certify, or assure the safety or performance of any products, components, or systems tested, installed, or operated in accordance with ASHRAE's Standards or Guidelines or that any tests conducted under its Standards or Guidelines will be nonhazardous or free from risk.

ASHRAE INDUSTRIAL ADVERTISING POLICY ON STANDARDS

ASHRAE Standards and Guidelines are established to assist industry and the public by offering a uniform method of testing for rating purposes, by suggesting safe practices in designing and installing equipment, by providing proper definitions of this equipment, and by providing other information that may serve to guide the industry. The creation of ASHRAE Standards and Guidelines is determined by the need for them, and conformance to them is completely voluntary.

In referring to this Standard or Guideline and in marking of equipment and in advertising, no claim shall be made, either stated or implied, that the product has been approved by ASHRAE.

(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

ASHRAE Standard 30 prescribes methods for obtaining performance data relating to liquid-chilling or liquid-heating equipment using any type of compressor. The intent of this standard is to provide uniform test methods to measure the performance of this equipment by addressing the test and instrumentation requirements, test procedures, data to be recorded, and calculations to generate and confirm valid test results.

Addendum a includes the following major revisions:

- *Updated capacity and condenser definitions to align with the rest of the standard.*
- *Added enthalpy measurement and capacity calculations.*
- *Updated thermal input power calculations.*
- *Clarified existing pressure drop correction calculation.*
- *Added requirement to test based on operating mode set points defined prior to testing.*
- *Simplified existing test data collection and test report requirements.*

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 a 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-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.
>
> ***gross ~~cooling~~refrigerating capacity:*** the *capacity* of the *evaporator* as measured by the total heat transferred from the liquid to the refrigerant in the *evaporator*. This value includes both the sensible heat transfer and the friction heat losses from pressure drop effects of the *liquid* flow through the *evaporator*. This value is used to calculate the *energy balance* of a test.
>
> ***net heating capacity:*** the *capacity* of the *condenser* available for useful heating of the thermal load, external to the liquid chilling system, calculated using only the sensible heat transfer.
>
> ***net ~~cooling~~ refrigerating capacity:*** the *capacity* of the *evaporator* available for useful cooling of the thermal load, external to the liquid chilling system, calculated using only the sensible heat transfer.

condenser: a *refrigerating system* component which condenses refrigerant from vapor state to liquid state by the removal of heat. De-superheating and sub-cooling of the refrigerant may occur as well.

air-cooled condenser: a *condenser*, including condenser fans, that condenses refrigerant vapor by rejecting heat to air mechanically circulated over a dry heat transfer surface, causing ~~a temperature~~ an enthalpy rise in the air.

evaporatively-cooled condenser: a *condenser* which condenses refrigerant vapor by rejecting heat to a water and air mixture mechanically circulated over ~~its~~a wetted heat transfer surface, causing evaporation of the water and an increase in the enthalpy of the air.

liquid-cooled condenser: a *condenser* that condenses refrigerant vapor by rejecting heat to *liquid* mechanically circulated over its heat transfer surface, causing ~~a temperature~~an enthalpy rise in the *liquid*.

liquid-cooled heat reclaim condenser: a *liquid-cooled condenser*, that may be either a separate parallel *condenser* in a *refrigerating system* using two or more *condensers*, or a portion of a *liquid-cooled condenser* with two or more *liquid* circuits, with the purpose of *heat recovery*.

Modify Section 5 as shown. The remainder of Section 5 is unchanged.

5. CALCULATIONS AND CONVERSIONS

[. . .]

5.4 Performance Refer to Normative Appendix B for schematics of each system type and the physical location of measurement instruments.

5.4.1 Capacity. One of the following three methods shall be used depending on the available measurements and with consideration of the acceptable test uncertainty required by the ~~parties~~test plan. Enthalpy capacity method shall be used for setups with significant distance and pressure drop between the temperature and pressure measurements on the inlet and/or outlet external piping. The additional temperature increase due to frictional pressure losses shall be determined by measuring pressure at a location within ± 2 pipe diameters of each temperature measurement point in the external piping. The pressure measurements adjacent to the temperature measurements shall be used when determining the physical properties of enthalpy. The sign convention, positive or negative, is to show all capacity values as positive whether energy is input into the chiller system or energy is removed from the chiller system. Adjust the sign for temperature difference or enthalpy difference accordingly by subtracting the lesser of inlet and outlet from the greater value. For pressure difference, however, the sign is significant with respect to the direction of energy flow.

5.4.2 Power

5.4.2.1 Thermal *input power* for a gaseous fuel for given fluid volume flow rate and higher heating value assuming complete combustion~~:~~

Delete the following equations from the standard.

$$Q_{input} = m \times \mathrm{HHV}$$

$$U_{Q_{input}} = \sqrt{(\theta_m U_m)^2 + (\theta_{HHV} U_{HHV})^2}$$

$$\theta_m = \mathrm{HHV}$$

$$\theta_{HHV} = m$$

Replace the deleted equations above with the following new equations as shown.

$$Q_{input} = V \times \mathrm{HHV}_v \times (T_s \times p)/(T_{abs} \times p_s)$$

$$U_{Q_{input}} = \sqrt{(\theta_V U_V)^2 + (\theta_{HHV_v})^2 + (\theta_p U_p)^2 + (\theta_T + U_T)^2}$$

$$\theta_V = \mathrm{HHV}_v \times (T_s \times p)/(T_{abs} \times p_s)$$

$$\theta_{HHV_v} = V \times (T_s \times p)/(T_{abs} \times p_s)$$

$$\theta_p = V \times \mathrm{HHV}_v \times T_s/(T_{abs} \times p_s)$$

$$\theta_{T_{abs}} = -V \times \mathrm{HHV}_v \times (T_s \times p) \times (p_s \times T_{abs}^2)$$

Add new Section 5.4.2.2, and renumber subsequent sections.

5.4.2.2 Thermal input power for a liquid fuel for a given mass flow rate and higher heating value assuming complete combustion.

$$Q_{input} = m \times \mathrm{HHV}_m$$

$$U_{Q_{input}} = \sqrt{(\theta_m U_m)^2 + (\theta_{HHV_m} U_{HHV_m})^2}$$

$$\theta_m = \mathrm{HHV}_m$$

$$\theta_{HHV_m} = m$$

5.4.2.~~2~~3 For use in [. . .]

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. 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 result for liquid pressure drop $\Delta p_{corrected}$.

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

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

5.4.4.2 The corrected pressure drop shall be calculated as follows:

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

5.4.4.~~2~~3 The general form [. . .]

5.4.4.~~3~~4 The head loss [. . .]

Loss coefficients shall be from Section 5.4.4.~~4~~5, Section 5.4.4.~~5~~6, [. . .]

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

6. TEST REQUIREMENTS

[. . .]

6.4 Plan. A test plan shall document all requirements for conducting the test. This includes a list of the required full-load and part-load test points and associated operating conditions, including adjusted liquid temperature targets based on the rated fouling factor allowance. In addition to the requirements specifically listed in this standard the test plan shall include all other input signals or controls positions necessary to place the chiller in the operating mode for each test to be performed.

Modify Section 7 as shown. The remainder of Section 7 is unchanged.

7. DATA TO BE RECORDED

7.1 General. For each test point, at a specific load and set of operating conditions report the test time period and number of data point measurements. Include the sample mean and sample standard deviation for each measurement value (temperature, flow, pressure drop, power, etc.) as calculated per Section 5.2.

~~7.1~~7.2 Primary Data. [. . .]

~~7.2~~7.3 Auxiliary Data. [. . .]

~~7.3~~7.4 Auxiliary Data. Table 7-2 summarizes the auxiliary data that shall be recorded for the test.

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

9. REPORTING OF RESULTS

9.1 General. Table 9-1 summarizes the results to be reported for each test type.

~~**9.1.1** Refrigerant designation shall be in accordance with ANSI/ASHRAE Standard 34.~~

Table 7-1 Data to be Recorded During the Test

Type		Data Item
All types	General	Date and t~~T~~ime ~~of day~~ for each data point sample
		Atmospheric pressure
	Evaporator	T_{in}
		T_{out}
		m_w or V_w
		Δp_{test}
Evaporatively cooled condenser	Condenser	Spatial average dry-bulb temperature of entering air
		Spatial average wet-bulb temperature of entering air
		Make-up water flow rate
		Make-up water temperature

Table 7-2 Auxiliary Data to Be Recorded

Type	Data Item
All	Date, place, and time of test.
	Names of test supervisor and witnessing personnel.
	Ambient temperature at test site.
	Nameplate data, including make, model, size, serial number, voltage, frequency, and refrigerant designation number (in accordance with ASHRAE Standard 34)~~, sufficient to completely identify the liquid chiller. Unit voltage and frequency shall be recorded~~.
	Prime mover nameplate data (motor, engine, or turbine).
Nonelectric Drive	Fuel specification (if applicable) and calorific value.

~~**9.1.2** Report shall identify net refrigerating capacity or net heating capacity (equations in Section 5.4.1) (W [Btu/h or ton$_R$]).~~

~~**9.1.3** Total input power to chiller (W, kW, or MW) shall be identified.~~

~~**9.1.3.1** Excluding power input to integrated liquid pumps when present (refer to Section 6.3.1.7.2).~~

~~**9.1.4** Report shall identify energy efficiency, expressed as energy efficiency ratio (EER), coefficient of performance (COP), or power input per capacity, with qualifier to indicate operating mode (cooling, heating, simultaneous heating and cooling, or heat recovery), Btu/W·h or W/W or kW/kW or kW/ton$_R$.~~

~~***Informative Note:*** It is important to note that pump energy associated with pressure drop through the chiller heat exchangers is not included in the chiller input power. This is 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.~~

~~**9.1.5** Chilled-liquid entering and leaving temperatures (°C [°F]) or leaving liquid temperature and temperature difference (Δ°C [Δ°F]).~~

~~**9.1.5.1** Chillers with an integral pump: evaporator heat exchanger liquid pressure drop as rated water temperatures, kPa (ft of water [at 60°F] or psid).~~

~~**9.1.5.2** Chillers without an integral pump: chilled-liquid pressure drop at rated water temperature (customer inlet to customer outlet), kPa (ft of water [at 60°F] or psid).~~

~~***Informative Note:*** Due to typical industry practice, liquid pressure drop is often reported in head (kPa [ft of water]); however, test data are acquired in pressure (psid) for use in calculations.~~

~~**Table 9-1 Results to be Reported**~~

~~Item~~	~~Units of Measure~~	
	~~SI~~	~~IP~~
~~Net capacity (heating and/or cooling as applicable; corrected if applicable)~~	~~kW or W~~	~~ton_R or Btu/h~~
~~Gross capacity (heating and cooling only for liquid-cooled condenser type)~~	~~kW or W~~	~~ton_R or Btu/h~~
~~Input power (W_{input} and W_{refrig}, as applicable)~~	~~kW or W~~	~~kW or W~~
~~Efficiency (corrected if applicable)~~	~~COP~~	~~kW/ton_R, EER, or COP~~
~~$\Delta p_{corrected}$~~	~~kPa~~	~~ft of water (at 60°F)~~
~~Energy balance~~	~~%~~	~~%~~
~~Voltage balance~~	~~%~~	~~%~~

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 at water temperatures per the test plan, measured per Section 8.4 and corrected per Section 5.4.4
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
	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.

~~**9.1.6** Chilled-liquid flow rate (L/s or m^3/h [gpm]) at entering heat exchanger conditions.~~

~~**9.1.7** Nominal voltage (V or kV) and frequency (Hz) for which ratings are valid. For units with a dual nameplate voltage rating, testing shall be performed at the lower of the two voltages.~~

~~**9.1.8** Components that use auxiliary power shall be listed.~~

~~**9.1.9** Part-load weighted efficiency metric IPLV.IP or NPLV.IP, expressed as energy efficiency ratio, coefficient of performance, or power input per capacity (Btu/W·h or W/W or kW/kW or kW/ton$_R$) for cooling operating mode only.~~

~~**9.1.10 Test Results.** 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. A written test report shall be generated that contains the data included in Section 7 for each test point at a specific load and set of operating conditions.~~

~~**9.2 Data.** For each test point, at a specific load and set of operating conditions, report the test time period and number of data-point measurements. Include the sample mean and sample standard deviation for each measurement value (temperature, flow, pressure drop, power, etc.).~~

~~**9.3 Calculations.** Report the correction adjustment values Δp_{adj} and ΔT_{adj}, correction factors CF$_Q$ and CF$_\eta$ when applicable, and associated input data used for the correction calculations. Report the density, specific heat capacity, and mass flow values used for capacity calculations. Report all values of Q used in energy balance calculations.~~

~~**9.4 Results.** Report the test results following calculations and procedures identified in Sections 5 and 8. Table 9-1 provides a generic summary.~~

~~**9.4.1** Test Results Reporting Requirements. Tests shall report calculated results in accordance with methods and procedures described in this method of test, Sections 5 and 8. The final test report shall include the following:~~

- ~~a. Name and address of the chiller test facility~~
- ~~b. Report identification number and disclaimer~~
- ~~c. Description of test chiller, including model and serial numbers~~
- ~~d. Date and time of tests~~
- ~~e. Instrumentation and calibration list from test facility~~
- ~~f. Chilled-water capacity~~
- ~~g. Total input power~~
- ~~h. Efficiency~~
- ~~i. Chilled-water pressure drop~~
- ~~j. Water-cooled condenser~~
    - ~~1. Total heat rejection~~
    - ~~2. Condenser water pressure drop~~
    - ~~3. Energy balance~~
- ~~k. Air-cooled condenser~~
    - ~~1. Total input power~~
    - ~~2. Condenser entering air temperature~~
- ~~l. Evaporatively cooled condenser~~
    - ~~1. Total input power~~
    - ~~2. Condenser entering air temperature dry bulb~~
    - ~~3. Condenser entering air temperature wet bulb~~
    - ~~4. Make-up water flow rate~~
    - ~~5. Make-up water temperature~~
- ~~m. Water-cooled condenser with heat reclaim~~
    - ~~1. Heat rejection of condenser~~
    - ~~2. Heat reclaim rejection~~

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

10. NOMENCLATURE

Some symbols use a subscript suffix; multiple subscripts are separated by a comma. Equations in this standard use the following units of measure for dimensional consistency. See Section 5.6 for converting to or from other units of measure.

Table 10-1 Nomenclature

			SI		IP	
Group	**Symbol**	**Description**	**Unit Name**	**Unit Symbol**	**Unit Name**	**Unit Symbol**
General						
	HHV	higher heating value (mass or volume basis) at a specified reference temperature (T_s) and pressure (P_s)	kilojoule per cubic metre or kilojoule per kilogram	kJ/m^3 or kJ/kg	British thermal unit (IT) per cubic foot or British thermal unit (IT) per pound	Btu/ft^3 or Btu/lb
Capacity						
	T_{abs}	absolute temperature	Kelvin	K	degree Rankin	°R

Table 10-2 Subscripts

Subscripts	**Description**
abs	absolute
fuel	fuel for combustion as a thermal input power source
m	mass or mass basis
s	specified reference condition for use with HHV_v or HHV_m values
v	volume basis
V	volume

Modify Normative Appendix B, including replacing Figures B-1, B-2, B-3, and B-4, as shown.

NORMATIVE APPENDIX B
MEASUREMENT POINTS

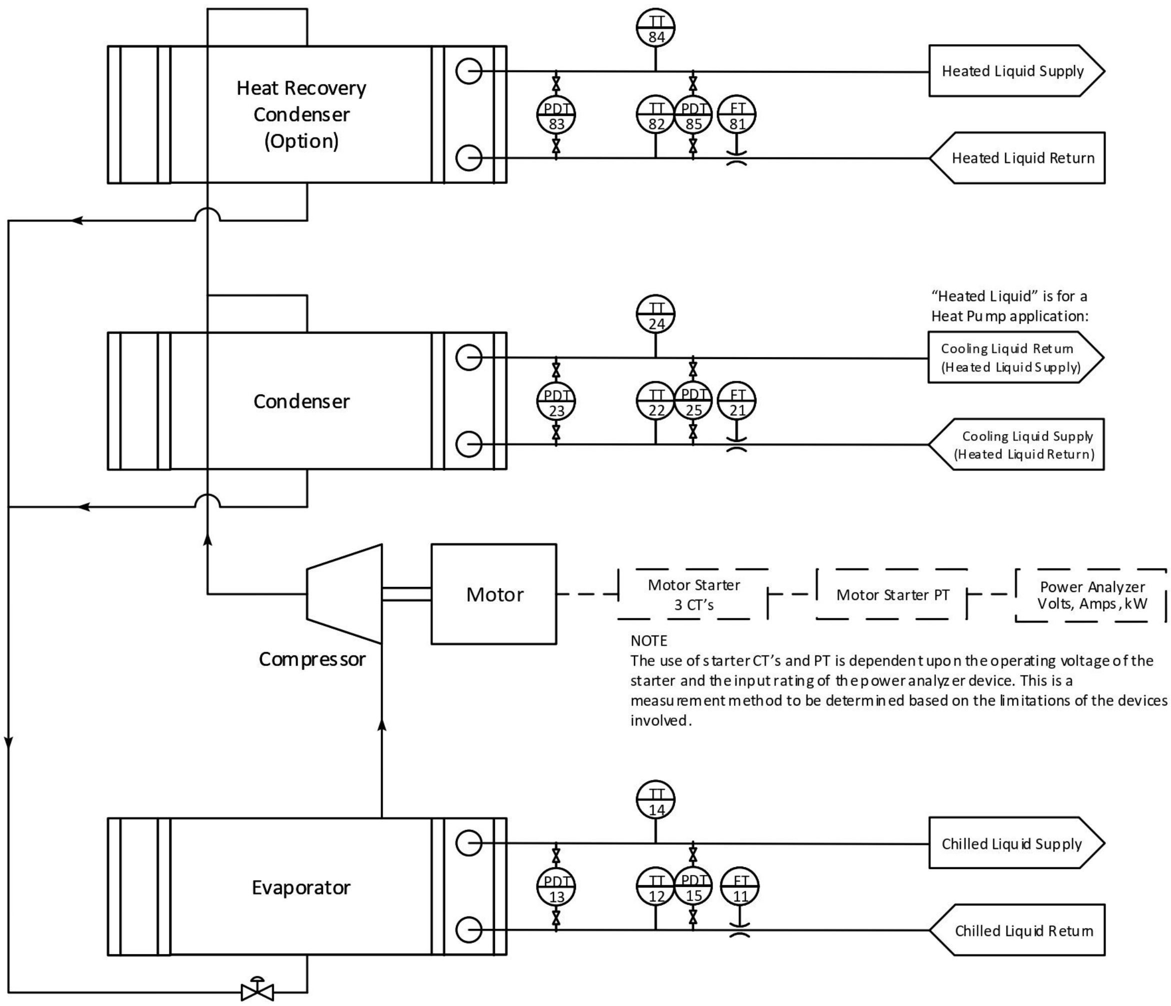

Figure B-1 Electrically driven liquid-cooled chiller (with or without heat recovery) or heat pump.

ID	Description of Measurement
FT-11	Evaporator liquid flow
TT-12	Evaporator inlet temperature
PDT-13	Evaporator pressure difference
TT-14	Evaporator outlet temperature
PDT-15 [1]	Evaporator pressure difference at temperature measurement location
FT-21	Condenser liquid flow
TT-22	Condenser inlet temperature
PDT-23	Condenser pressure difference
TT-24	Condenser outlet temperature
PDT-25 [1]	Condenser pressure difference at temperature measurement location
FT-81	Heat recovery condenser (when included) liquid flow
TT-82	Heat recovery condenser (when included) inlet temperature
PDT-83	Heat recovery condenser (when included) difference
TT-84	Heat recovery condenser (when included) outlet temperature
Not identified	Power consumption for the chiller, including any auxiliary systems contained in the test boundary, includes voltage balance measurement
Notes: 1. Optional pressure measurement used for enthalpy capacity calculation method.	

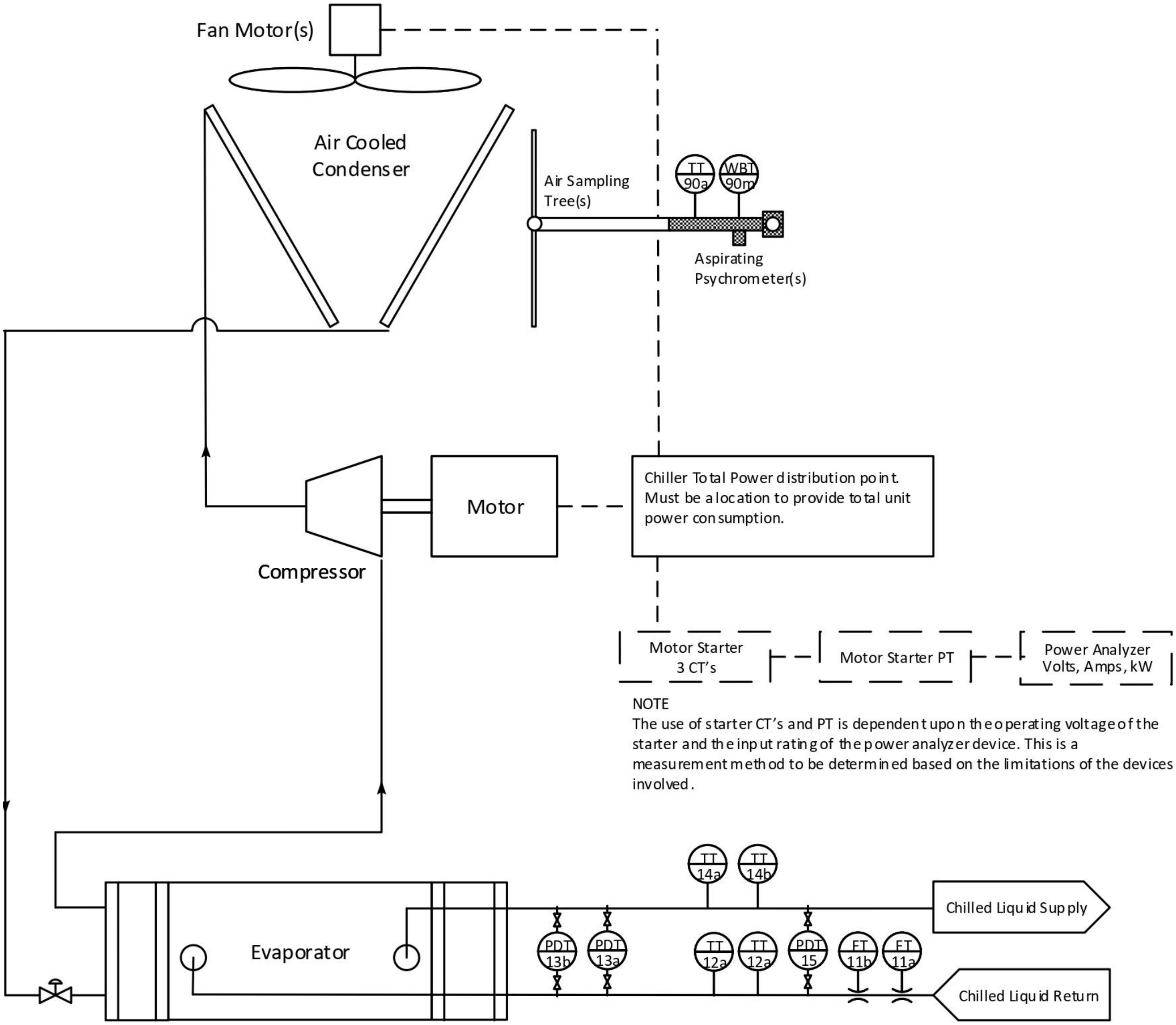

Figure B-2 Electrically driven air-cooled chiller.

ID	Description of Measurement
FT-11a, b	Evaporator liquid flow (redundant measurements)
TT-12a, b	Evaporator inlet temperature (redundant measurements)
PDT-13a, b	Evaporator pressure difference (redundant measurements)
PDT-15 [1]	Evaporator pressure difference at temperature measurement location
TT-14a, b	Evaporator outlet temperature (redundant measurements)
TT-90a to n	Ambient air temperature (one or more aspirating psychrometers)
WBT-90m	Entering wet-bulb temperature for evaporatively cooled or air-cooled in heating mode
Not identified	Power consumption for the chiller, including any auxiliary systems contained in the test boundary; includes voltage balance measurement.

Notes:
1. Optional pressure measurement used for enthalpy capacity calculation method.

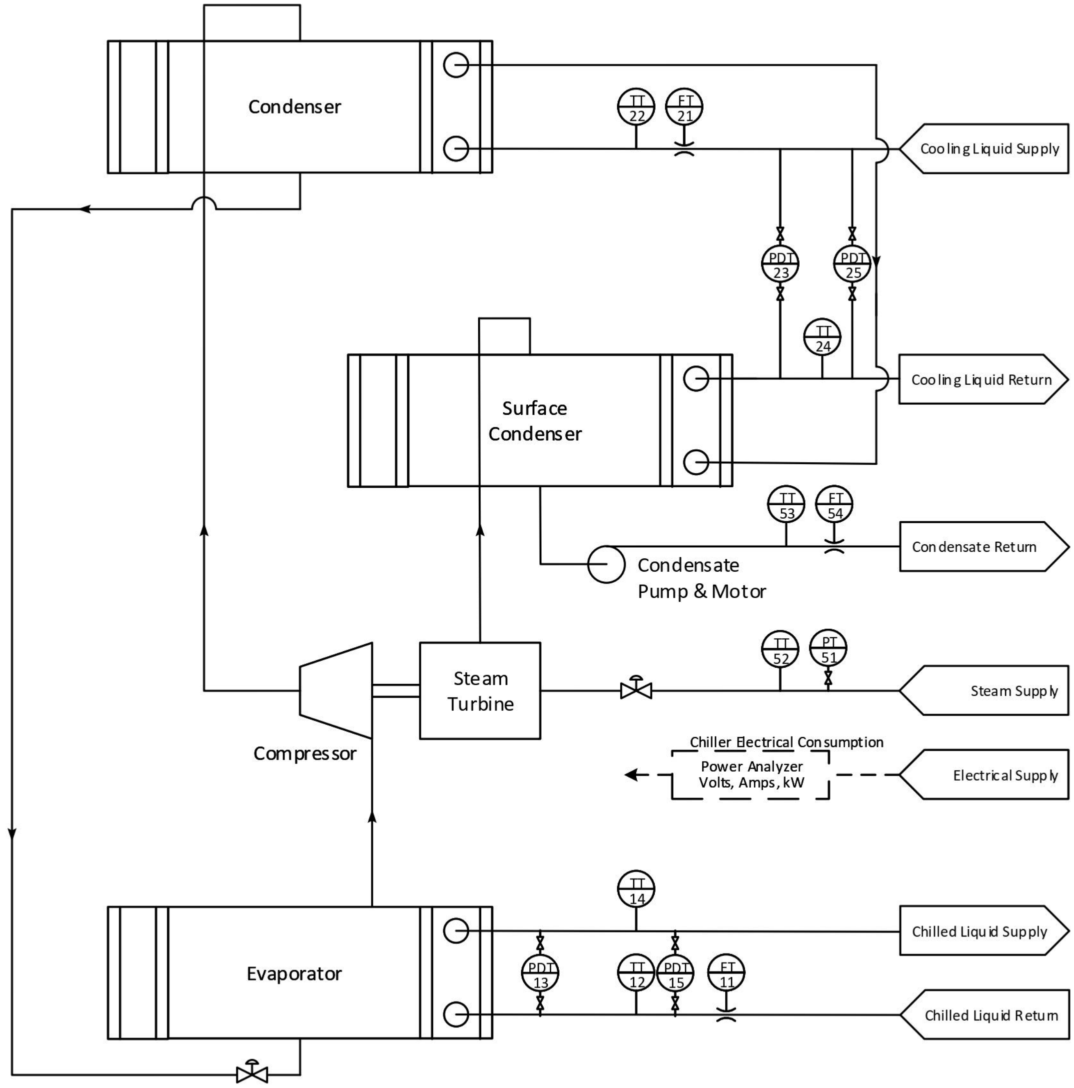

Figure B-3 Steam-turbine-driven liquid-cooled chiller.

ID	Description of Measurement
FT-11	Evaporator liquid flow
TT-12	Evaporator inlet temperature
PDT-13	Evaporator pressure difference
TT-14	Evaporator outlet temperature
PDT-15[1]	Evaporator pressure difference at temperature measurement location
FT-21	Condenser liquid flow
TT-22	Condenser inlet temperature
PDT-23	Condenser pressure difference
TT-24	Condenser outlet temperature
PDT-25[1]	Condenser pressure difference at temperature measurement location
PT-51	Steam supply pressure
TT-52	Steam supply inlet temperature
TT-53	Steam condensate temperature
FT-54	Steam condensate flow
Not identified	Power consumption for the chiller, including any auxiliary systems contained in the test boundary; includes voltage balance measurement
Notes: a. Optional pressure measurement used for enthalpy capacity calculation method.	

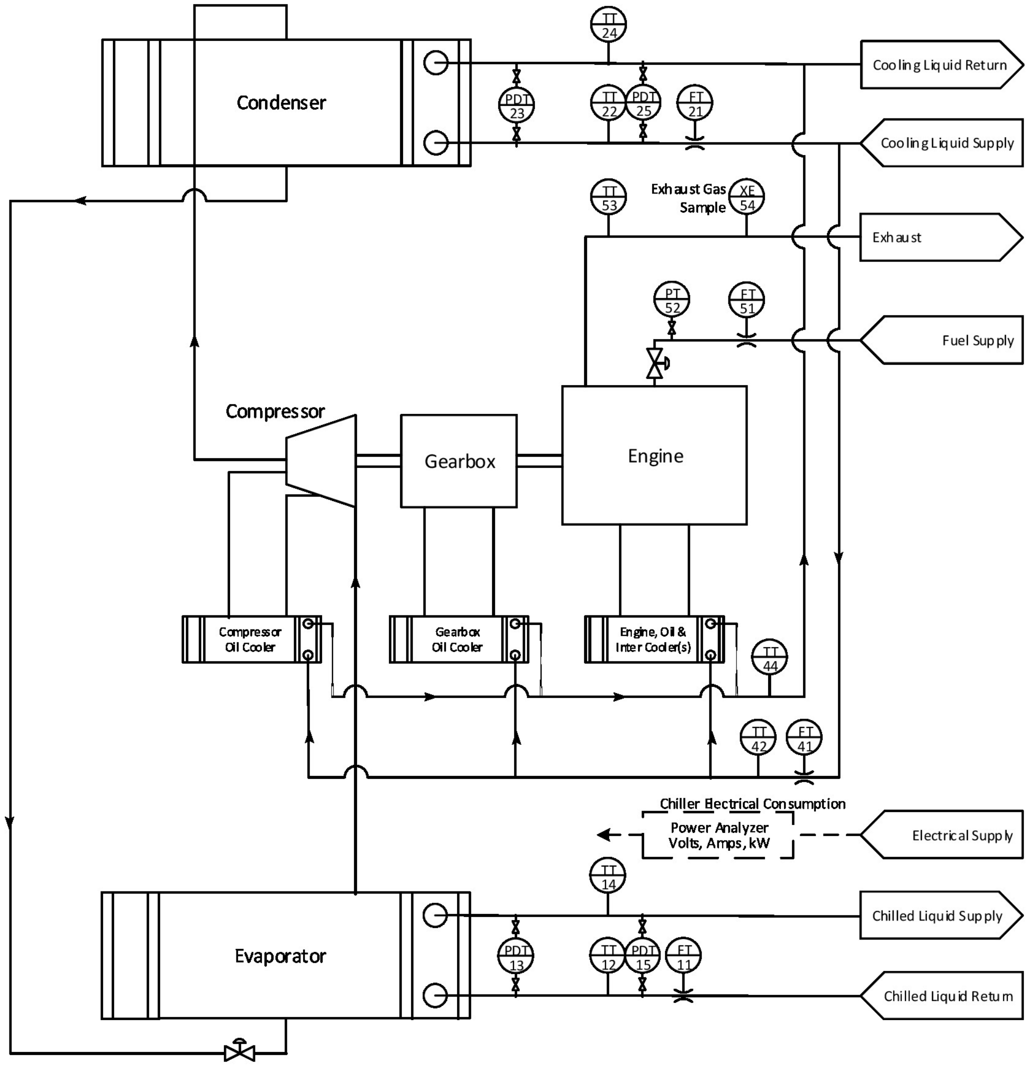

Figure B-4 Engine-driven liquid-cooled chiller.

ID	Description of Measurement
FT-11	Evaporator liquid flow
TT-12	Evaporator inlet temperature
PDT-13	Evaporator pressure difference
TT-14	Evaporator outlet temperature
PDT-15[1]	Evaporator pressure difference at temperature measurement location
FT-21	Condenser liquid flow
TT-22	Condenser inlet temperature
PDT-23	Condenser pressure difference
TT-24	Condenser outlet temperature
PDT-25[1]	Condenser pressure difference at temperature measurement location
FT-41	Cooling system liquid flow
TT-22	Cooling system liquid inlet temperature
TT-23	Cooling system liquid outlet temperature
PT-51	Fuel supply flow
TT-52	Fuel supply inlet pressure
TT-53	Exhaust temperature
Not identified	Power consumption for the chiller, including any auxiliary systems contained in the test boundary; includes voltage balance measurement
Notes: a. Optional pressure measurement used for enthalpy capacity calculation method.	

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.

ASHRAE · 1791 Tullie Circle NE · Atlanta, GA 30329 · www.ashrae.org

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.

5/20