BSR/ASHRAE/IES Addendum bd
to ANSI/ASHRAE/IES Standard 90.1-2019

Public Review Draft

Proposed Addendum bd to Standard 90.1-2019, Energy Standard for Buildings Except Low-Rise Residential Buildings

First Public Review (November 2021)
(Draft Shows Proposed Changes to Current Standard)

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FOREWORD

Background
Many projects that follow Section 11 and Appendix G must model chillers in the baseline and/or proposed design. For Section 11, the chillers in the budget design must minimally comply with the full and part load efficiency requirements in Section 6 for the appropriate chiller type and capacity. For Appendix G, the baseline chillers must be modeled with part and full load efficiencies specified in Table G3.5.3. For both Appendix G and Section 11 chillers in the proposed designs must be modeled with part and full load efficiency of the specified equipment. In all cases, the part load efficiency is specified as IPLV. However, most simulation programs do not accept IPLV as an input, and require specifying performance curves that define variations in system performance depending on the operating conditions.

Since the performance curves for the budget/baseline chillers were not prescribed, modelers often rely on software default performance curves. These default curves differ between the simulation programs and do not reflect the intended IPLV. Similar problem exists when modeling the proposed chillers. While the performance curves can be generated based on detailed information for the specified chiller obtained from the manufacturer, these equipment-specific curves are often not available during the preliminary analysis before chiller make and model is known. Furthermore, creating the custom performance curves requires knowledge and time that modelers often do not have, thus the software default curves are often used even after chillers are specified. This proposed addendum addresses these issues by prescribing the performance curves for the baseline/budget chillers, and providing default performance curves that may be modeled for the chillers in the proposed design if the actual equipment curves are not available.

Addendum Description
The proposed addendum adds a new normative appendix (Appendix J) which contains two tables with sets of performance curves that aim to represent minimally compliant chiller performance for the *budget* and *baseline building design* when using Chapter 11 or Appendix G and for proposed building designs when specific equipment performance is not known. The sets of performance curves are provided for both modeling inputs in IP and SI units for both the IP and SI version of the standard. This is to accommodate inputs in software like EnergyPlus, which uses inputs in SI, and DOE-2 which uses inputs in IP. Both of these software could either target requirements from the IP or SI version of the standard (which are different). Reference to the sets of performance curves were added to the minimum efficiency tables, both for Chapter 11 (which refers to Section 6) and for Appendix G. Language was added in both Chapter 11 and Appendix G that requires users to use the curves if they are supported by the *simulation program*.

Development of default chiller performance curves
Generating chiller performance curves meeting both full and part load efficiency numbers require solving a largely underdetermined system of equations. The number of unknowns depend on the type of curves, which

mostly depend on the algorithm used by the software and used in models. It also means that an infinite number of solutions exists. One way to solve this issue is to turn it into an optimization type problem and use a simple genetic algorithm (GA) with a well-defined objective or cost function to determine potential solutions. A GA can have a short turn-around time, be scalable, versatile, find solutions to problems with large number of parameters to problems with multiple local optima and therefor was used for this task.

A GA that takes a "seed" set of curves, target full load, and part load efficiency as inputs was designed. The GA reproduces the process of natural selection on an initial population and subsequent generations. Individuals in the initial population are generated from the seed curves by randomly modifying the coefficient of each curve. An objective, fitness, or cost function is defined and is used to grade each individual on how close or how far they are from the target. Following the grading of each individual, some of the best performers are retained, others are discarded, and are used to create new individuals during the "crossover" process by combining the best performing sets of curves together. Finally, some individuals are randomly modified during the "mutation" process to avoid local optima. The process is repeated (i.e., new generations are created) until an individual matching the targets is identified. Generation after generation, the average fitness improves until the target is met.

While any sets of curves can be technically used as an input to generate a full and part load specific set of curves, it is important to first generate generic sets of performance curves, as the final curves depend strongly on the seed curves. As such, data was collected using in part existing publicly available chiller performance curves datasets and by collecting data of currently available equipment using manufacturer equipment selection software. Performance curves were created for that newly obtained data.
Among others, a "nearest neighbor" type method was developed to aggregate sets of curves and generate a generic set of curves for a specific target. This method selects the N sets of performance curves for chillers that best match the targeted chiller characteristics in terms of capacity, full load efficiency, part load efficiency, condenser type, compressor type, and compressor speed control. Each selected sets of curves are scored based on how close it is to the targeted chiller characteristics. A wide mesh of values for each input variable(s) to each curve is then created and corresponding output calculated. The outputs are then weighted averaged based on their previously determined score. A regression and normalization at rated conditions is then performed to obtain the aggregated curves.

Using the approach described above, the resulting curves generate IPLVs within 0.5% of the target under the AHRI Standard 550/590 and 551/591 rating conditions.

Cost effectiveness

This addendum impacts an optional performance path in the standard designed to provide increased flexibility and therefore was not subjected to cost effectiveness analysis.

[Note to Reviewers: This addendum makes proposed changes to the current standard. These changes are indicated in the text by underlining (for additions) and ~~strikethrough~~ (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 bd to 90.1-2019

Modify Table 6.8.1-3 as follows (IP Units)

Table 6.8.1-3 Liquid-Chilling Packages—Minimum *Efficiency* Requirements[a,b,e]

Equipment Type	Size Category	Units	Path A	Set of performance curves for use with Section 11	Path B[g]	Set of performance curves for use with Section 11	Test Procedure[c]
Air-cooled chillers	<150 tons	*EER* (Btu/Wh)	≥10.100 FL ≥13.700 *IPLV*.IP	A	≥9.700 FL ≥15.800 *IPLV*.IP	M	AHRI 550/590
	≥150 tons		≥10.100 FL ≥14.000 *IPLV*.IP	B	≥9.700 FL ≥16.100 *IPLV*.IP	N	
Air-cooled without condenser, electrically operated	All capacities	*EER* (Btu/Wh)	Air-cooled chillers without condensers must be rated with matching condensers and comply with air-cooled chiller *efficiency* requirements				AHRI 550/590
Liquid-cooled, electrically operated positive displacement	<75 tons	kW/ton	≤0.750 FL ≤0.600 *IPLV*.IP	C	≤0.780 FL ≤0.500 *IPLV*.IP	O	AHRI 550/590
	≥75 tons and <150 tons		≤0.720 FL ≤0.560 *IPLV*.IP	D	≤0.750 FL ≤0.490 *IPLV*.IP	P	
	≥150 tons and <300 tons		≤0.660 FL ≤0.540 *IPLV*.IP	E	≤0.680 FL ≤0.440 *IPLV*.IP	Q	
	≥300 tons and <600 tons		≤0.610 FL ≤0.520 *IPLV*.IP	F	≤0.625 FL ≤0.410 *IPLV*.IP	R	
	≥600 tons		≤0.560 FL ≤0.500 *IPLV*.IP	G	≤0.585 FL ≤0.380 *IPLV*.IP	S	
Liquid-cooled, electrically operated centrifugal	<150 tons	kW/ton	≤0.610 FL ≤0.550 *IPLV*.IP	H	≤0.695 FL ≤0.440 *IPLV*.IP	T	AHRI 550/590
	≥150 tons and <300 tons		≤0.610 FL ≤0.550 *IPLV*.IP	I	≤0.635 FL ≤0.400 *IPLV*.IP	U	
	≥300 tons and <400 tons		≤0.560 FL ≤0.520 *IPLV*.IP	J	≤0.595 FL ≤0.390 *IPLV*.IP	V	
	≥400 tons and <600 tons		≤0.560 FL ≤0.500 *IPLV*.IP	K	≤0.585 FL ≤0.380 *IPLV*.IP	W	
	≥600 tons		≤0.560 FL ≤0.500 *IPLV*.IP	L	≤0.585 FL ≤0.380 *IPLV*.IP	X	
Air-cooled absorption, single effect	All capacities	*COP* (W/W)	≥0.600 FL		NA[d]		AHRI 560
Liquid-cooled absorption, single effect	All capacities	*COP* (W/W)	≥0.700 FL		NA[d]		AHRI 560
Absorption double effect, indirect fired	All capacities	*COP* (W/W)	≥1.000 FL ≥1.050 *IPLV*.IP		NA[d]		AHRI 560
Absorption double effect, direct fired	All capacities	*COP* (W/W)	≥1.000 FL ≥1.000 *IPLV*.IP		NA[d]		AHRI 560

a. The requirements for centrifugal chillers shall be adjusted for nonstandard rating conditions according to Section 6.4.1.2.1 and are only applicable for the range of conditions listed there. The requirements for air-cooled, water-cooled positive displacement and absorption chillers are at standard rating conditions defined in the reference test procedure.

b. Both the full-load and *IPLV*.IP requirements must be met or exceeded to comply with this standard. When there is a Path B, compliance can be with either Path A or Path B for any application.

c. Section 12 contains a complete specification of the referenced test procedure, including the referenced year version of the test procedure.

d. NA means the requirements are not applicable for Path B, and only Path A can be used for compliance.

e. FL is the full-load performance requirements, and *IPLV*.IP is for the part-load performance requirements

f. Electrically operated chillers employing a freeze-protection liquid in accordance with Section 6.4.1.2.2 shall be tested or rated with water for the purpose of compliance with the requirements of this table.

g. See Normative Appendix J for the performance curves.

Modify Table 6.8.1-3 as follows (SI Units)

Table 6.8.1-3 Liquid-Chilling Packages—Minimum *Efficiency* Requirements[a,b,e]

Equipment Type	Size Category	Units	Path A	Set of performance curves for use with Section 11	Path B[g]	Set of performance curves for use with Section 11	Test Procedure[c]
Air-cooled chillers	<528 kW	*COP* (W/W)	≥2.985 FL ≥4.048 *IPLV*.SI	A	≥2.966 FL ≥4.669 *IPLV*.SI	M	AHRI 551/591
	≥528 kW		≥2.985 FL ≥4.137 *IPLV*.SI	B	≥2.866 FL ≥4.758 *IPLV*.SI	N	
Air-cooled without condenser, electrically operated	All capacities	*COP* (W/W)	Air-cooled chillers without condensers must be rated with matching condensers and comply with air-cooled chiller *efficiency* requirements				AHRI 551/591
Liquid-cooled, electrically operated positive displacement	<264 kW	*COP* (W/W)	≥4.694 FL ≥5.867 *IPLV*.SI	C	≥4.513 FL ≥7.041 *IPLV*.SI	O	AHRI 551/591
	≥264 kW and <528 kW		≥4.889 FL ≥6.286 *IPLV*.SI	D	≥4.694 FL ≥7.184 *IPLV*.SI	P	
	≥528 kW and <1055 kW		≥5.334 FL ≥6.519 *IPLV*.SI	E	≥5.177 FL ≥8.001 *IPLV*.SI	Q	
	≥1055 kW and <2110 kW		≥5.771 FL ≥6.770 *IPLV*.SI	F	≥5.633 FL ≥8.586 *IPLV*.SI	R	
	≥2100 kW		≥6.286 FL ≥7.041 *IPLV*.SI	G	≥6.018 FL ≥9.264 *IPLV*.SI	S	
Liquid-cooled, electrically operated centrifugal	<528 kW	*COP* (W/W)	≥5.771 FL ≥6.401 *IPLV*.SI	H	≥5.065 FL ≥8.001 *IPLV*.SI	T	AHRI 551/591
	≥528 kW and <1055 kW		≥5.771 FL ≥6.401 *IPLV*.SI	I	≥5.544 FL ≥8.801 *IPLV*.SI	U	
	≥1055 kW and <1407 kW		≥6.286 FL ≥6.770 *IPLV*.SI	J	≥5.917 FL ≥9.027 *IPLV*.SI	V	
	≥1407 kW and <2110 kW		≥6.286 FL ≥7.041 *IPLV*.SI	K	≥6.018 FL ≥9.264 *IPLV*.SI	W	
	≥2110 kW		≥6.286 FL ≥7.041 *IPLV*.SI	L	≥6.018 FL ≥9.264 *IPLV*.SI	X	
Air-cooled absorption, single effect	All capacities	*COP* (W/W)	≥0.600 FL		NA[d]		AHRI 560
Liquid-cooled absorption, single effect	All capacities	*COP* (W/W)	≥0.700 FL		NA[d]		AHRI 560
Absorption double effect, indirect fired	All capacities	*COP* (W/W)	≥1.000 FL ≥1.050 *IPLV.SI*		NA[d]		AHRI 560
Absorption double effect, direct fired	All capacities	*COP* (W/W)	≥1.000 FL ≥1.000 *IPLV.SI*		NA[d]		AHRI 560

a. The requirements for centrifugal chillers shall be adjusted for nonstandard rating conditions according to Section 6.4.1.2.1 and are only applicable for the range of conditions listed there. The requirements for air-cooled, water-cooled positive displacement and absorption chillers are at standard rating conditions defined in the reference test procedure.

b. Both the full-load and *IPLV*.IP requirements must be met or exceeded to comply with this standard. When there is a Path B, compliance can be with either Path A or Path B for any application.

c. Section 12 contains a complete specification of the referenced test procedure, including the referenced year version of the test procedure.

d. NA means the requirements are not applicable for Path B, and only Path A can be used for compliance.

e. FL is the full-load performance requirements, and *IPLV*.IP is for the part-load performance requirements

f. Electrically operated chillers employing a freeze-protection liquid in accordance with Section 6.4.1.2.2 shall be tested or rated with water for the purpose of compliance with the requirements of this table.

g. See Normative Appendix J for the performance curves.

Modify the standard as follows (IP and SI units)

11.5.2 HVAC Systems

The *HVAC system* type and related performance parameters for the *budget building design* shall be determined from Figure 11.5.2, the *system* descriptions in Table 11.5.2-1 and accompanying notes, and the following rules:

a. **Budget *Building Systems* Not Listed.** Components and parameters not listed in Figure 11.5.2 and Table 11.5.2-2 or otherwise specifically addressed in this subsection shall be identical to those in the *proposed design*.

Exception to 11.5.2(a)

Where there are specific requirements in Sections 6.4 and 6.5, the component *efficiency* in the *budget building design* shall be adjusted to the lowest *efficiency* level allowed by the requirement for that component type.

b. **Minimum *Equipment Efficiency*.** All HVAC and service water-heating equipment in the budget building design shall be modeled at the minimum efficiency levels, both part load and full load, in accordance with Sections 6.4 and 7.4 based on the budget system type determined following Section 11.5.2(j) and capacity determined following Section 11.5.2(i). Chillers shall use Path A efficiencies as shown in Table 6.8.1-3~~.~~, and modeled using the performance curves specified in Table 6.8.1-3 and included in Normative Appendix J. Simulation programs that do not use performance curves are permitted to use an alternative simulation method that results in the same performance as the curves described in Normative Appendix J.

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Table 11.5.1 Modeling Requirements for Calculating *Design Energy Cost* and *Energy Cost Budget Design*

10. *HVAC Systems*

The *HVAC system* type and all related performance parameters, such as *equipment* capacities and efficiencies, in the *proposed design* shall be determined as follows:

a. Where a complete *HVAC system* exists, the model shall reflect the actual *system* type using actual component capacities and efficiencies.
b. Where an *HVAC system* has been designed, the HVAC model shall be consistent with design documents. Mechanical *equipment* efficiencies shall be adjusted from actual *design conditions* to the standard rating conditions specified in Section 6.4.1 if required by the simulation model. Where *efficiency* ratings include supply fan *energy*, the *efficiency* rating shall be adjusted to remove the supply fan *energy* from the *efficiency* rating in the *budget building design.* The equations in Section 11.5.2 shall not be used in the *proposed design*. The *proposed design HVAC system* shall be modeled using *manufacturers'* full- and part-load data for the *HVAC system* without fan power.

Exception to a. and b: Where part load performance of chillers in the *proposed design* is not available, the performance curves in Normative Appendix J for the appropriate chiller type and capacity, as referenced in Table 6.8.1.3, shall be modeled for the specified chiller. Simulation programs that do not use performance curves are permitted to use an alternative simulation method that results in the same performance as the curves described in Normative Appendix J.

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G3.1.2 General Baseline HVAC System Requirements

HVAC systems in the *baseline building* design shall conform with the general provisions in this section.

G3.1.2.1 Equipment Efficiencies

All HVAC *equipment* in the *baseline building design* shall be modeled at the minimum *efficiency* levels, both part load and full load, in accordance with Tables G3.5.1 through G3.5.6. Where multiple *HVAC zones* or *residential spaces* are combined into a single *thermal block* in accordance with Table G3.1, the efficiencies (for baseline HVAC System Types 1, 2, 3, 4, 9, and 10) taken from Tables G3.5.1, G3.5.2, G3.5.4, and G3.5.5 shall be based on the equipment capacity of the *thermal block* divided by the number of *HVAC zones* or *residential spaces*. HVAC System Types 5 or 6 efficiencies taken from Table G3.5.1 shall be based on the cooling equipment capacity of a single floor when grouping identical floors in accordance with Section G3.1.1(a)(4). Fan *energy* shall be modeled separately according to Section G3.1.2.9.

$COP_{nfcooling}$ and $COP_{nfheating}$ are the packaged HVAC *equipment* cooling and heating *energy efficiency*, respectively, to be used in the *baseline building design*, which excludes supply fan power.

The sets of performance curves from Normative Appendix J specified in Table G3.5.3 should be used to represent part load performance of chillers in the *baseline building design.* Simulation programs that do not use performance curves are permitted to use an alternative simulation method that results in the same performance as the curves described in Normative Appendix J.

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Table G3.1 Modeling Requirements for Calculating Proposed and *Baseline Building Performance*

10. *HVAC Systems*

The *HVAC* system type and all related performance parameters, such as *equipment* capacities and efficiencies, in the *proposed design* shall be determined as follows:

a. Where a complete HVAC system exists, the model shall reflect the actual system type using actual component capacities and efficiencies.
b. Where an HVAC system has been designed, the HVAC model shall be consistent with design documents. Mechanical equipment efficiencies shall be adjusted from actual design conditions to the standard rating conditions specified in Section 6.4.1 if required by the simulation model. Where efficiency ratings include supply fan energy, the efficiency rating shall be adjusted to remove the supply fan energy from the efficiency rating in the budget building design. The equations in Section 11.5.2 shall not be used in the proposed design. The proposed design HVAC system shall be modeled using manufacturers' full- and part-load data for the HVAC system without fan power.

Exception to a. and b: Where part load performance of chillers in the proposed design is not available, the performance curves in Normative Appendix J, as referenced in Table 6.8.1.3, shall be modeled for the specified chiller. Simulation programs that do not use performance curves are permitted to use an alternative simulation method that results in the same performance as the curves described in Normative Appendix J.

Modify Table G3.5.3 as follows (IP units)

Table G3.5.3 *Performance Rating Method* Water Chilling Packages—Minimum *Efficiency* Requirements

***Equipment* Type**	**Size Category**	**Subcategory or Rating Condition**	**Minimum *Efficiency***	**Set of performance curves[a]**	**Test Procedure**
Water-cooled, electrically operated, positive displacement (rotary screw and scroll)	<150 tons	kW/ton	0.790 FL 0.676 *IPLV*.IP	Y	ARI 550/590
	≥150 tons and <300 tons		0.718 FL 0.629 *IPLV*.IP	Z	
	≥300 tons		0.639 FL 0.572 *IPLV*.IP	AA	
Water-cooled, electrically operated, centrifugal	<150 tons	kW/ton	0.703 FL 0.670 *IPLV*.IP	AB	ARI 550/590
	≥150 tons and <300 tons		0.634 FL 0.596 *IPLV*.IP	AC	
	≥300 tons		0.576 FL 0.549 *IPLV*.IP	AD	

a. See Normative Appendix J for curves.

Modify Table G3.5.3 as follows (SI units)

Table G3.5.3 *Performance Rating Method* Water Chilling Packages—Minimum *Efficiency* Requirements

***Equipment* Type**	**Size Category**	**Subcategory or Rating Condition**	**Minimum *Efficiency***	**Set of performance curves[a]**	**Test Procedure**
Water-cooled, electrically operated, positive displacement (rotary screw and scroll)	<528 kW	*COP*	4.45 *COP* 5.20 *IPLV*.SI	Y	ARI 550/590
	≥528 kW and <1055 kW		4.90 *COP* 5.60 *IPLV*.SI	Z	
	≥1055 kW		5.50 *COP* 6.15 *IPLV*.SI	AA	
Water-cooled, electrically operated, centrifugal	<528 kW	*COP*	5.00 *COP* 5.25 *IPLV*.SI	AB	ARI 550/590
	≥528 kW and <1055 kW		5.55 *COP* 5.90 *IPLV*.SI	AC	
	≥1055 kW		6.10 *COP* 6.40 *IPLV*.SI	AD	

a. See Normative Appendix J for curves.

Add the following new section, Appendix J, to the standard (SI and IP units):

This is a normative appendix and is part of this standard.

J Normative Appendix J

SETS OF PERFORMANCE CURVES

J1 GENERAL

J1.1 Description

This appendix provides sets of performance curves that shall be used to represent the part load performance of chillers in the *budget building design* when using Section 11 and in the *baseline building design* when using Normative Appendix G. They are also permitted to be used for the *proposed building design* when specific chiller performance is not known.

Each set includes three curves: an energy-input-ratio modifier as a function of temperatures (EIR-f-T) and as a function of a chiller's part load ratio (EIR-f-PLR), and a capacity modifier as a function of temperatures (CAP-f-T). These curves are intended the describe the part load performance of a chiller when its operating capacity and power (not including cycling degradation) are calculated by the *simulation program* as follows:

Operating Capacity = Rated Capacity × CAP-f-T

Operating Power = Operating Capacity × EIR-f-T × EIR-f-PLR / Rated COP

Table J-1 provides the reference values for the curves. Tables J-2 and J-4 are to be used when the *simulation program* uses IP units to evaluate the performance curves, and Tables J-3 and J-5 are to be used when the *simulation program* uses SI units to evaluate the performance curves.

Table J-1 Chiller performance curves references

Chiller Condenser Type	Output Variable[a]	Curve Type[b]	X[c]	Y[c]	Minimum/ Maximum Value for X (IP °F)	Minimum/Maximum Value for Y (IP °F)	Rated Values for X/Y (IP °F)	Minimum /Maximum Value for X (SI °C)	Minimum /Maximum Value for Y (SI °C)	Rated Values for X/Y (SI °C)
Air	EIR-f-T	T1	CHWT	OAT	39/60	50/104	44/95	4/16	10/40	7/35
Air	CAP-f-T	T1	CHWT	OAT	39/60	50/104	44/95	4/16	10/40	7/35
Air	EIR-f-PLR	T3	PLR		0/1		1	0/1	N/A	1
Water	EIR-f-T	T1	CHWT	ECT	39/60	50/104	44/85	4/16	10/40	7/30
Water	CAP-f-T	T1	CHWT	ECT	39/60	50/104	44/85	4/16	10/40	7/30
Water	EIR-f-PLR	T2	PLR		0/1		1	0/1	N/A	1

a. EIR-f-T is the energy input ratio modifier as a function of temperatures, CAP-f-T is the capacity modifier as a function of temperatures, and EIR-f-PLR is the energy input ratio modifier as a function of the chiller's part load ratio.

b. T1: $Output = Coeff1 + Coeff2 \times X + Coeff3 \times X^2 + Coeff4 \times Y + Coeff5 \times Y^2 + Coeff6 \times X \times Y$
T2: $Output = Coeff1 + Coeff2 \times X + Coeff3 \times X^2$
T3: $Output = Coeff1 + Coeff2 \times X + Coeff3 \times X^2 + Coeff4 \times X^3$

c. CHWT : chilled water temperature
OAT: outdoor air dry-bulb temperature
ECT: entering condenser temperature
PLR: part load ratio

Table J-2 Chiller Performance curves for Chapter 11 (Simulation Input Required in IP units)

Set	Description	Output Variable	Coeff 1	Coeff 2	Coeff 3	Coeff 4	Coeff 5	Coeff 6
A	Air-cooled <150 tons, 10.100 FL, 13.700 IPLV.IP Path A	EIR-f-T	2.322651E+00	-3.775211E-02	3.793007E-04	-2.035973E-02	2.001115E-04	-6.403191E-05
		CAP-f-T	-1.221849E+00	7.499814E-02	-6.399051E-04	1.091781E-02	-8.100835E-05	-3.478388E-05
		EIR-f-PLR	1.271245E-01	7.474001E-02	1.642999E+00	-8.439853E-01	N/A	N/A
B	Air-cooled ≥150 tons, 10.100 FL, 14.00 IPLV.IP Path A	EIR-f-T	2.008106E+00	-3.331764E-02	3.534994E-04	-1.711136E-02	1.910230E-04	-7.771526E-05
		CAP-f-T	-1.366885E+00	8.352108E-02	-7.104225E-04	1.076739E-02	-8.269150E-05	-5.008926E-05
		EIR-f-PLR	1.626651E-01	9.082154E-02	1.369886E+00	-6.246777E-01	N/A	N/A
C	Liquid-cooled positive displacement <75 tons 0.750 FL, 0.600 IPLV.IP Path A	EIR-f-T	1.715472E+00	-3.871818E-02	4.448659E-04	-4.938494E-03	1.550715E-04	-1.533579E-04
		CAP-f-T	-8.831767E-01	7.352698E-02	-6.584192E-04	3.164777E-03	-5.270015E-05	9.171137E-06
		EIR-f-PLR	2.341452E-01	1.898092E-01	5.756563E-01	N/A	N/A	N/A
D	Liquid-cooled positive displacement ≥75 and <150 tons 0.720 FL, 0.560 IPLV.IP Path A	EIR-f-T	2.060831E+00	-5.129643E-02	5.535544E-04	-7.649668E-03	1.795127E-04	-1.395741E-04
		CAP-f-T	-1.028779E+00	7.924781E-02	-7.113032E-04	3.688263E-03	-5.813264E-05	6.768388E-06
		EIR-f-PLR	2.138831E-01	2.656510E-01	5.226151E-01	N/A	N/A	N/A
E	Liquid-cooled positive displacement ≥150 and <300 tons 0.660 FL, 0.540 IPLV.IP Path A	EIR-f-T	1.555639E+00	-5.077078E-02	5.517066E-04	6.532104E-03	7.204757E-05	-1.244434E-04
		CAP-f-T	-4.567720E-01	5.085012E-02	-5.199447E-04	5.457352E-03	-7.795160E-05	8.695147E-05
		EIR-f-PLR	2.440184E-01	2.442857E-01	5.126299E-01	N/A	N/A	N/A
F	Liquid-cooled positive displacement ≥300 and <600 tons 0.610 FL, 0.520 IPLV.IP Path A	EIR-f-T	1.093508E+00	-4.011803E-02	4.313933E-04	1.424243E-02	6.881447E-06	-1.132790E-04
		CAP-f-T	-2.086287E-02	3.210187E-02	-3.591886E-04	5.769909E-03	-8.126990E-05	1.070637E-04
		EIR-f-PLR	2.518491E-01	2.404098E-01	5.070576E-01	N/A	N/A	N/A
G	Liquid-cooled positive displacement ≥600 tons 0.560 FL, 0.500 IPLV.IP Path A	EIR-f-T	8.856609E-01	-3.586175E-02	4.046449E-04	1.681896E-02	-4.877340E-06	-1.297752E-04
		CAP-f-T	-2.049442E-02	3.073887E-02	-3.543028E-04	6.340526E-03	-8.717089E-05	1.189026E-04
		EIR-f-PLR	2.849736E-01	2.388156E-01	4.762130E-01	N/A	N/A	N/A
H	Liquid-cooled centrifugal <150 tons 0.610 FL, 0.550 IPLV.IP Path A	EIR-f-T	6.143523E-01	-3.359578E-02	2.027663E-04	2.699494E-02	-1.567771E-04	8.276363E-05
		CAP-f-T	-1.788191E-01	5.549959E-02	-6.330298E-04	-5.531622E-03	-5.783983E-05	2.273545E-04
		EIR-f-PLR	3.000631E-01	4.191632E-02	6.582335E-01	N/A	N/A	N/A
I	Liquid-cooled centrifugal ≥150 tons <300 tons 0.610 FL, 0.550 IPLV.IP Path A	EIR-f-T	4.328339E-01	-2.976678E-02	1.599462E-04	2.954889E-02	-1.760088E-04	8.752244E-05
		CAP-f-T	5.314633E-02	5.110446E-02	-6.068952E-04	-8.773412E-03	-4.441031E-05	2.512446E-04
		EIR-f-PLR	2.990448E-01	3.428051E-02	6.662820E-01	N/A	N/A	N/A
J	Liquid-cooled centrifugal ≥300 tons	EIR-f-T	6.911406E-01	-2.484374E-02	1.746287E-04	1.888636E-02	-9.111422E-05	3.126793E-05
		CAP-f-T	7.657170E-02	5.096337E-02	-6.083239E-04	-7.836468E-03	-5.076154E-05	2.383564E-04

Set	Description	Output Variable	Coeff 1	Coeff 2	Coeff 3	Coeff 4	Coeff 5	Coeff 6
	<400 tons 0.560 FL, 0.520 IPLV.IP Path A	EIR-f-PLR	2.819901E-01	1.412214E-01	5.736863E-01	N/A	N/A	N/A
K	Liquid-cooled centrifugal ≥400 tons <600 tons 0.560 FL, 0.500 IPLV.IP Path A	EIR-f-T	7.866283E-01	-4.021414E-02	2.788085E-04	2.610611E-02	-1.509334E-04	8.411216E-05
		CAP-f-T	-4.637748E-01	6.408720E-02	-7.134349E-04	-3.563504E-03	-6.211647E-05	2.076694E-04
		EIR-f-PLR	2.637496E-01	1.412294E-01	5.951257E-01	N/A	N/A	N/A
L	Liquid-cooled centrifugal ≥600 tons 0.560 FL, 0.500 IPLV.IP Path A	EIR-f-T	7.049108E-01	-4.452300E-02	3.939002E-04	2.919322E-02	-1.426075E-04	1.083501E-05
		CAP-f-T	-8.858936E-01	8.181389E-02	-8.673368E-04	-2.739652E-03	-6.394675E-05	1.764606E-04
		EIR-f-PLR	2.902839E-01	8.150949E-02	6.281354E-01	N/A	N/A	N/A
M	Air-cooled <150 tons, 9.700 FL, 15.800 IPLV.IP Path B	EIR-f-T	1.774877E+00	-3.031106E-02	3.456711E-04	-1.345692E-02	1.786150E-04	-1.062063E-04
		CAP-f-T	-1.535707E+00	8.528156E-02	-7.014106E-04	1.338371E-02	-9.002472E-05	-7.603551E-05
		EIR-f-PLR	8.666142E-02	1.914037E-02	1.692007E+00	-7.990511E-01	N/A	N/A
N	Air-cooled ≥150 tons, 9.700 FL, 16.100 IPLV.IP Path B	EIR-f-T	1.977413E+00	-3.532163E-02	3.809837E-04	-1.550615E-02	1.894909E-04	-9.517979E-05
		CAP-f-T	-1.468600E+00	8.539789E-02	-7.128440E-04	1.193944E-02	-8.705894E-05	-6.159851E-05
		EIR-f-PLR	7.524241E-02	3.140241E-02	1.719616E+00	-8.302180E-01	N/A	N/A
O	Liquid-cooled positive displacement <75 tons 0.780 FL, 0.500 IPLV.IP Path B	EIR-f-T	2.441086E+00	-5.022680E-02	5.480290E-04	-1.886798E-02	2.576650E-04	-1.469804E-04
		CAP-f-T	-9.454208E-01	7.273589E-02	-6.503995E-04	6.139496E-03	-7.582246E-05	8.028577E-06
		EIR-f-PLR	1.571920E-01	8.838157E-02	7.551477E-01	N/A	N/A	N/A
P	Liquid-cooled positive displacement ≥75 and <150 tons 0.750 FL, 0.490 IPLV.IP Path B	EIR-f-T	2.244796E+00	-4.983078E-02	5.465921E-04	-1.405238E-02	2.269775E-04	-1.485760E-04
		CAP-f-T	-1.044337E+00	7.768462E-02	-6.940754E-04	5.339871E-03	-6.874760E-05	3.370301E-06
		EIR-f-PLR	2.022215E-01	-2.665837E-02	8.244708E-01	N/A	N/A	N/A
Q	Liquid-cooled positive displacement ≥150 and <300 tons 0.680 FL, 0.440 IPLV.IP Path B	EIR-f-T	1.459013E+00	-4.480183E-02	5.091600E-04	3.692180E-03	9.627271E-05	-1.290617E-04
		CAP-f-T	-6.119460E-01	5.710254E-02	-5.457051E-04	5.546777E-03	-6.650912E-05	4.408135E-05
		EIR-f-PLR	8.528650E-02	3.020189E-01	6.119897E-01	N/A	N/A	N/A
R	Liquid-cooled positive displacement ≥300 and <600 tons 0.625 FL, 0.410 IPLV.IP Path B	EIR-f-T	1.229736E+00	-4.083940E-02	4.625464E-04	8.368975E-03	6.309057E-05	-1.324358E-04
		CAP-f-T	-1.093763E-01	3.298631E-02	-3.604556E-04	7.674898E-03	-9.027195E-05	9.507631E-05
		EIR-f-PLR	8.299855E-02	3.120772E-01	6.051929E-01	N/A	N/A	N/A

Set	Description	Output Variable	Coeff 1	Coeff 2	Coeff 3	Coeff 4	Coeff 5	Coeff 6
S	Liquid-cooled positive displacement ≥600 tons 0.585 FL, 0.380 IPLV.IP Path B	EIR-f-T	9.439009E-01	-3.799764E-02	4.294098E-04	1.561281E-02	6.070656E-06	-1.267747E-04
		CAP-f-T	8.522708E-02	2.417509E-02	-2.993997E-04	7.547429E-03	-9.098655E-05	1.193807E-04
		EIR-f-PLR	9.654274E-02	2.895946E-01	6.138484E-01	N/A	N/A	N/A
T	Liquid-cooled centrifugal <150 tons 0.695 FL, 0.440 IPLV.IP Path B	EIR-f-T	6.709447E-01	-3.091660E-02	2.274835E-04	2.391438E-02	-1.282680E-04	3.825356E-05
		CAP-f-T	4.518734E-01	5.193651E-02	-5.814088E-04	-1.936194E-02	3.254846E-05	2.136313E-04
		EIR-f-PLR	4.155899E-02	2.301757E-01	7.291148E-01	N/A	N/A	N/A
U	Liquid-cooled centrifugal ≥150 tons <300 tons 0.635 FL, 0.400 IPLV.IP Path B	EIR-f-T	7.559675E-01	-3.738043E-02	3.184120E-04	2.458491E-02	-1.169158E-04	7.330850E-06
		CAP-f-T	-1.344226E-01	5.786030E-02	-6.432444E-04	-7.562743E-03	-3.050949E-05	1.863679E-04
		EIR-f-PLR	3.593929E-02	2.732155E-01	6.900992E-01	N/A	N/A	N/A
V	Liquid-cooled centrifugal ≥300 tons <400 tons 0.595 FL, 0.390 IPLV.IP Path B	EIR-f-T	1.183814E+00	-4.603112E-02	4.094415E-04	1.966896E-02	-7.972090E-05	-1.253771E-05
		CAP-f-T	-7.910226E-02	4.934383E-02	-5.767583E-04	-3.472418E-03	-6.150874E-05	2.042778E-04
		EIR-f-PLR	5.843788E-02	2.407848E-01	6.996940E-01	N/A	N/A	N/A
W	Liquid-cooled centrifugal ≥400 tons <600 tons 0.585 FL, 0.380 IPLV.IP Path B	EIR-f-T	9.596420E-01	-3.739003E-02	2.999855E-04	1.879602E-02	-8.718639E-05	3.665766E-05
		CAP-f-T	-3.699189E-01	5.480625E-02	-6.759736E-04	2.130623E-03	-1.229576E-04	2.604898E-04
		EIR-f-PLR	1.103822E-01	5.621453E-02	8.338188E-01	N/A	N/A	N/A
X	Liquid-cooled centrifugal ≥600 tons 0.585 FL, 0.380 IPLV.IP Path B	EIR-f-T	9.979209E-01	-4.635669E-02	3.918557E-04	2.310071E-02	-1.070748E-04	2.494717E-05
		CAP-f-T	-3.060212E-01	5.315977E-02	-6.378943E-04	-3.072051E-04	-8.478098E-05	2.247257E-04
		EIR-f-PLR	7.054777E-02	2.108096E-01	7.164217E-01	N/A	N/A	N/A

Table J-3 Chiller Performance curves for Chapter 11 (Simulation Input Required in SI units)

Set	Description	Output Variable	Coeff 1	Coeff 2	Coeff 3	Coeff 4	Coeff 5	Coeff 6
A	Air-cooled <150 tons, 10.100 FL, 13.700 IPLV.IP Path A	EIR-f-T	9.908216E-01	-2.794660E-02	1.228934E-03	-1.728291E-02	6.483612E-04	-2.074634E-04
		CAP-f-T	7.536275E-01	5.927603E-02	-2.073292E-03	8.316337E-03	-2.624670E-04	-1.126998E-04
		EIR-f-PLR	1.271245E-01	7.474001E-02	1.642999E+00	-8.439853E-01		
B	Air-cooled ≥150 tons, 10.100 FL, 14.00 IPLV.IP Path A	EIR-f-T	8.723881E-01	-2.372502E-02	1.145338E-03	-1.327100E-02	6.189144E-04	-2.517974E-04
		CAP-f-T	7.869058E-01	6.561212E-02	-2.301769E-03	6.970101E-03	-2.679205E-04	-1.622892E-04
		EIR-f-PLR	1.626651E-01	9.082154E-02	1.369886E+00	-6.246777E-01	N/A	N/A
C		EIR-f-T	7.757557E-01	-2.727760E-02	1.441365E-03	1.415286E-04	5.024315E-04	-4.968795E-04

Set	Description	Output Variable	Coeff 1	Coeff 2	Coeff 3	Coeff 4	Coeff 5	Coeff 6
	Liquid-cooled positive displacement <75 tons 0.750 FL, 0.600 IPLV.IP Path A	CAP-f-T	8.521648E-01	5.702694E-02	-2.133278E-03	1.537995E-04	-1.707485E-04	2.971448E-05
		EIR-f-PLR	2.341452E-01	1.898092E-01	5.756563E-01	N/A	N/A	N/A
D	Liquid-cooled positive displacement ≥75 and <150 tons 0.720 FL, 0.560 IPLV.IP Path A	EIR-f-T	7.822933E-01	-3.660357E-02	1.793516E-03	-1.129007E-03	5.816211E-04	-4.522200E-04
		CAP-f-T	8.442039E-01	6.109378E-02	-2.304622E-03	3.318524E-04	-1.883498E-04	2.192958E-05
		EIR-f-PLR	2.138831E-01	2.656510E-01	5.226151E-01	N/A	N/A	N/A
E	Liquid-cooled positive displacement ≥150 and <300 tons 0.660 FL, 0.540 IPLV.IP Path A	EIR-f-T	6.512959E-01	-3.499874E-02	1.787529E-03	1.288973E-02	2.334341E-04	-4.031966E-04
		CAP-f-T	8.218596E-01	3.664099E-02	-1.684621E-03	5.851614E-03	-2.525632E-04	2.817228E-04
		EIR-f-PLR	2.440184E-01	2.442857E-01	5.126299E-01	**N/A**	**N/A**	**N/A**
F	Liquid-cooled positive displacement ≥300 and <600 tons 0.610 FL, 0.520 IPLV.IP Path A	EIR-f-T	5.982846E-01	-2.904081E-02	1.397714E-03	1.990426E-02	2.229589E-05	-3.670239E-04
		CAP-f-T	8.496378E-01	2.257171E-02	-1.163771E-03	7.190412E-03	-2.633145E-04	3.468863E-04
		EIR-f-PLR	2.518491E-01	2.404098E-01	5.070576E-01			
G	Liquid-cooled positive displacement ≥600 tons 0.560 FL, 0.500 IPLV.IP Path A	EIR-f-T	5.527637E-01	-2.541112E-02	1.311049E-03	2.223721E-02	-1.580258E-05	-4.204716E-04
		CAP-f-T	8.357333E-01	2.136306E-02	-1.147941E-03	8.219648E-03	-2.824337E-04	3.852443E-04
		EIR-f-PLR	2.849736E-01	2.388156E-01	4.762130E-01	N/A	N/A	N/A
H	Liquid-cooled centrifugal <150 tons 0.610 FL, 0.550 IPLV.IP Path A	EIR-f-T	5.349681E-01	-3.234655E-02	6.569628E-04	3.529735E-02	-5.079580E-04	2.681542E-04
		CAP-f-T	9.455165E-01	4.006986E-02	-2.051016E-03	-3.524451E-03	-1.874011E-04	7.366284E-04
		EIR-f-PLR	3.000631E-01	4.191632E-02	6.582335E-01	N/A	N/A	N/A
I	Liquid-cooled centrifugal ≥150 tons <300 tons 0.610 FL, 0.550 IPLV.IP Path A	EIR-f-T	4.990362E-01	-3.011312E-02	5.182257E-04	3.795308E-02	-5.702685E-04	2.835727E-04
		CAP-f-T	9.980774E-01	3.654538E-02	-1.966341E-03	-6.436521E-03	-1.438894E-04	8.140324E-04
		EIR-f-PLR	2.990448E-01	3.428051E-02	6.662820E-01	N/A	N/A	N/A
J	Liquid-cooled centrifugal ≥300 tons <400 tons 0.560 FL, 0.520 IPLV.IP Path A	EIR-f-T	6.180413E-01	-2.280048E-02	5.657968E-04	2.530012E-02	-2.952101E-04	1.013081E-04
		CAP-f-T	1.025806E+00	3.538449E-02	-1.970969E-03	-6.224045E-03	-1.644674E-04	7.722746E-04
		EIR-f-PLR	2.819901E-01	1.412214E-01	5.736863E-01	N/A	N/A	N/A
K	Liquid-cooled centrifugal ≥400 tons <600 tons 0.560 FL, 0.500 IPLV.IP Path A	EIR-f-T	5.522463E-01	-3.542186E-02	9.033396E-04	3.444833E-02	-4.890243E-04	2.725234E-04
		CAP-f-T	8.914724E-01	4.513102E-02	-2.311529E-03	-1.608365E-03	-2.012574E-04	6.728490E-04
		EIR-f-PLR	2.637496E-01	1.412294E-01	5.951257E-01	N/A	N/A	N/A
L	Liquid-cooled centrifugal ≥600 tons 0.560 FL, 0.500 IPLV.IP Path A	EIR-f-T	4.827766E-01	-3.414001E-02	1.276237E-03	3.674351E-02	-4.620483E-04	3.510543E-05
		CAP-f-T	8.715432E-01	5.751193E-02	-2.810171E-03	-2.133909E-03	-2.071875E-04	5.717324E-04
		EIR-f-PLR	2.902839E-01	8.150949E-02	6.281354E-01	N/A	N/A	N/A
M	Air-cooled <150 tons, 9.700 FL,	EIR-f-T	8.024150E-01	-2.085608E-02	1.119974E-03	-9.763491E-03	5.787126E-04	-3.441085E-04
		CAP-f-T	7.332917E-01	6.832466E-02	-2.272570E-03	9.340191E-03	-2.916801E-04	-2.463550E-04

Set	Description	Output Variable	Coeff 1	Coeff 2	Coeff 3	Coeff 4	Coeff 5	Coeff 6
	15.800 IPLV.IP Path B	EIR-f-PLR	8.666142E-02	1.914037E-02	1.692007E+00	-7.990511E-01	N/A	N/A
N	Air-cooled ≥150 tons, 9.700 FL, 16.100 IPLV.IP Path B	EIR-f-T	8.376258E-01	-2.517197E-02	1.234387E-03	-1.156407E-02	6.139504E-04	-3.083825E-04
		CAP-f-T	7.640172E-01	6.804849E-02	-2.309615E-03	7.913721E-03	-2.820710E-04	-1.995792E-04
		EIR-f-PLR	7.524241E-02	3.140241E-02	1.719616E+00	-8.302180E-01	N/A	N/A
O	Liquid-cooled positive displacement <75 tons 0.780 FL, 0.500 IPLV.IP Path B	EIR-f-T	9.045752E-01	-3.574138E-02	1.775614E-03	-1.274543E-02	8.348345E-04	-4.762165E-04
		CAP-f-T	8.431616E-01	5.646103E-02	-2.107294E-03	2.778792E-03	-2.456648E-04	2.601259E-05
		EIR-f-PLR	1.571920E-01	8.838157E-02	7.551477E-01	N/A	N/A	N/A
P	Liquid-cooled positive displacement ≥75 and <150 tons 0.750 FL, 0.490 IPLV.IP Path B	EIR-f-T	8.405285E-01	-3.528597E-02	1.770958E-03	-7.704455E-03	7.354071E-04	-4.813863E-04
		CAP-f-T	8.347674E-01	6.006896E-02	-2.248804E-03	1.886173E-03	-2.227422E-04	1.091978E-05
		EIR-f-PLR	2.022215E-01	-2.665837E-02	8.244708E-01	N/A	N/A	N/A
Q	Liquid-cooled positive displacement ≥150 and <300 tons 0.680 FL, 0.440 IPLV.IP Path B	EIR-f-T	6.313079E-01	-2.942203E-02	1.649678E-03	1.030259E-02	3.119236E-04	-4.181599E-04
		CAP-f-T	8.110640E-01	4.245842E-02	-1.768085E-03	4.861435E-03	-2.154895E-04	1.428236E-04
		EIR-f-PLR	8.528650E-02	3.020189E-01	6.119897E-01	N/A	N/A	N/A
R	Liquid-cooled positive displacement ≥300 and <600 tons 0.625 FL, 0.410 IPLV.IP Path B	EIR-f-T	5.933202E-01	-2.785387E-02	1.498650E-03	1.470389E-02	2.044134E-04	-4.290919E-04
		CAP-f-T	8.275954E-01	2.332727E-02	-1.167876E-03	8.891883E-03	-2.924811E-04	3.080473E-04
		EIR-f-PLR	8.299855E-02	3.120772E-01	6.051929E-01	N/A	N/A	N/A
S	Liquid-cooled positive displacement ≥600 tons 0.585 FL, 0.380 IPLV.IP Path B	EIR-f-T	5.437012E-01	-2.622996E-02	1.391288E-03	2.150018E-02	1.966893E-05	-4.107499E-04
		CAP-f-T	8.228381E-01	1.590065E-02	-9.700552E-04	9.980052E-03	-2.947964E-04	3.867936E-04
		EIR-f-PLR	9.654274E-02	2.895946E-01	6.138484E-01	N/A	N/A	N/A
T	Liquid-cooled centrifugal <150 tons 0.695 FL, 0.440 IPLV.IP Path B	EIR-f-T	5.876418E-01	-2.724038E-02	7.370465E-04	3.047281E-02	-4.155884E-04	1.239415E-04
		CAP-f-T	1.150985E+00	3.881258E-02	-1.883765E-03	-1.879675E-02	1.054570E-04	6.921654E-04
		EIR-f-PLR	4.155899E-02	2.301757E-01	7.291148E-01	N/A	N/A	N/A
U	Liquid-cooled centrifugal ≥150 tons <300 tons 0.635 FL, 0.400 IPLV.IP Path B	EIR-f-T	5.603499E-01	-3.018144E-02	1.031655E-03	3.120640E-02	-3.788071E-04	2.375195E-05
		CAP-f-T	9.760160E-01	4.078158E-02	-2.084112E-03	-6.392843E-03	-9.885076E-05	6.038319E-04
		EIR-f-PLR	3.593929E-02	2.732155E-01	6.900992E-01	N/A	N/A	N/A
V	Liquid-cooled centrifugal	EIR-f-T	6.650205E-01	-3.641052E-02	1.326591E-03	2.549811E-02	-2.582957E-04	-4.062218E-05

Set	Description	Output Variable	Coeff 1	Coeff 2	Coeff 3	Coeff 4	Coeff 5	Coeff 6
	≥300 tons <400 tons 0.595 FL, 0.390 IPLV.IP Path B	CAP-f-T	9.443778E-01	3.414273E-02	-1.868697E-03	-1.569759E-03	-1.992883E-04	6.618600E-04
		EIR-f-PLR	5.843788E-02	2.407848E-01	6.996940E-01	N/A	N/A	N/A
W	Liquid-cooled centrifugal ≥400 tons <600 tons 0.585 FL, 0.380 IPLV.IP Path B	EIR-f-T	6.200772E-01	-3.063225E-02	9.719531E-04	2.590044E-02	-2.824839E-04	1.187708E-04
		CAP-f-T	9.006969E-01	3.578329E-02	-2.190155E-03	4.674613E-03	-3.983828E-04	8.439869E-04
		EIR-f-PLR	1.103822E-01	5.621453E-02	8.338188E-01	N/A	N/A	N/A
X	Liquid-cooled centrifugal ≥600 tons 0.585 FL, 0.380 IPLV.IP Path B	EIR-f-T	5.708909E-01	-3.686332E-02	1.269612E-03	3.068322E-02	-3.469222E-04	8.082883E-05
		CAP-f-T	8.753606E-01	3.514636E-02	-2.066778E-03	2.624465E-03	-2.746904E-04	7.281114E-04
		EIR-f-PLR	7.054777E-02	2.108096E-01	7.164217E-01	N/A	N/A	N/A

Table J-4 Chiller Performance curves for Appendix G (IP)

Set	Description	Output Variable	Coeff 1	Coeff 2	Coeff 3	Coeff 4	Coeff 5	Coeff 6
Y	Liquid-cooled positive displacement <150 tons 0.790 FL, 0.676 IPLV.IP	EIR-f-T	1.734609E+00	-3.743186E-02	4.134308E-04	-4.230009E-03	1.275367E-04	-1.202529E-04
		CAP-f-T	-8.806600E-01	7.301216E-02	-6.548120E-04	2.744228E-03	-4.462670E-05	6.651724E-06
		EIR-f-PLR	2.626791E-01	1.874186E-01	5.448017E-01	N/A	N/A	N/A
Z	Liquid-cooled positive displacement ≥150 and <300 tons 0.718 FL, 0.629 IPLV.IP	EIR-f-T	1.127918E+00	-3.200260E-02	3.557940E-04	9.605004E-03	2.557016E-05	-1.095341E-04
		CAP-f-T	-6.703285E-01	6.815124E-02	-6.122827E-04	-8.622246E-04	-1.730376E-05	1.477103E-05
		EIR-f-PLR	2.896737E-01	9.709947E-02	6.149597E-01	N/A	N/A	N/A
AA	Liquid-cooled positive displacement ≥300 tons 0.639 FL, 0.572 IPLV.IP	EIR-f-T	1.217568E+00	-4.006384E-02	4.230044E-04	1.249594E-02	5.772918E-06	-1.009141E-04
		CAP-f-T	-2.130970E-01	4.701328E-02	-4.570115E-04	6.776277E-04	-3.382633E-05	5.775217E-05
		EIR-f-PLR	3.000626E-01	1.380634E-01	5.613940E-01	N/A	N/A	N/A
AB	Liquid-cooled centrifugal <150 tons 0.703 FL, 0.670 IPLV.IP	EIR-f-T	5.907542E-01	-2.302265E-02	1.410007E-04	2.269056E-02	-1.192516E-04	2.198921E-05
		CAP-f-T	1.895721E-01	4.987883E-02	-5.211517E-04	-1.155689E-02	8.105882E-06	1.466178E-04
		EIR-f-PLR	3.230957E-01	5.687948E-02	6.178610E-01	N/A	N/A	N/A
AC	Liquid-cooled centrifugal ≥150 and <300 tons 0.634 FL, 0.596 IPLV.IP	EIR-f-T	3.806274E-01	-2.186988E-02	6.991295E-05	2.702159E-02	-1.656821E-04	9.266979E-05
		CAP-f-T	5.430326E-01	4.140117E-02	-4.703608E-04	-1.492690E-02	1.743967E-05	1.841162E-04
		EIR-f-PLR	3.208405E-01	3.157996E-02	6.470161E-01	N/A	N/A	N/A
AD	Liquid-cooled centrifugal ≥300 tons 0.576 FL, 0.549 IPLV.IP	EIR-f-T	4.942444E-01	-2.838050E-02	1.741913E-04	2.818544E-02	-1.594234E-04	4.636760E-05
		CAP-f-T	2.443101E-01	4.397410E-02	-4.988315E-04	-1.004921E-02	-7.984035E-06	1.867150E-04
		EIR-f-PLR	3.518518E-01	-1.869226E-02	6.670833E-01			

Table J-5 Chiller Performance curves for Appendix G (Simulation Input Required in SI units)

Set	Description	Output Variable	Coeff 1	Coeff 2	Coeff 3	Coeff 4	Coeff 5	Coeff 6
Y	Liquid-cooled positive displacement <150 tons 0.790 FL, 0.676 IPLV.IP	EIR-f-T	8.322405E-01	-2.667669E-02	1.339516E-03	1.516470E-04	4.132189E-04	-3.896192E-04
		CAP-f-T	8.341305E-01	5.637068E-02	-2.121591E-03	1.817547E-04	-1.445905E-04	2.155159E-05
		EIR-f-PLR	2.626791E-01	1.874186E-01	5.448017E-01	**N/A**	**N/A**	**N/A**
Z	Liquid-cooled positive displacement ≥150 and <300 tons 0.718 FL, 0.629 IPLV.IP	EIR-f-T	6.895489E-01	-2.292636E-02	1.152773E-03	1.392553E-02	8.284731E-05	-3.548904E-04
		CAP-f-T	8.533490E-01	5.298808E-02	-1.983796E-03	-2.694586E-03	-5.606418E-05	4.785815E-05
		EIR-f-PLR	2.896737E-01	9.709947E-02	6.149597E-01	N/A	N/A	N/A
AA	Liquid-cooled positive displacement ≥300 tons 0.639 FL, 0.572 IPLV.IP	EIR-f-T	6.711269E-01	-2.919746E-02	1.370534E-03	1.734508E-02	1.870425E-05	-3.269617E-04
		CAP-f-T	8.695325E-01	3.530271E-02	-1.480717E-03	6.494621E-04	-1.095973E-04	1.871170E-04
		EIR-f-PLR	3.000626E-01	1.380634E-01	5.613940E-01	N/A	N/A	N/A
AB	Liquid-cooled centrifugal <150 tons 0.703 FL, 0.670 IPLV.IP	EIR-f-T	6.249153E-01	-2.393092E-02	4.568422E-04	2.837181E-02	-3.863750E-04	7.124506E-05
		CAP-f-T	1.040652E+00	3.819041E-02	-1.688532E-03	-1.142341E-02	2.626306E-05	4.750417E-04
		EIR-f-PLR	3.230957E-01	5.687948E-02	6.178610E-01	N/A	N/A	N/A
AC	Liquid-cooled centrifugal ≥150 and <300 tons 0.634 FL, 0.596 IPLV.IP	EIR-f-T	5.423081E-01	-2.597404E-02	2.265179E-04	3.489005E-02	-5.368101E-04	3.002501E-04
		CAP-f-T	1.114953E+00	3.094165E-02	-1.523969E-03	-1.425428E-02	5.650452E-05	5.965366E-04
		EIR-f-PLR	3.208405E-01	3.157996E-02	6.470161E-01	N/A	N/A	N/A
AD	Liquid-cooled centrifugal ≥300 tons 0.576 FL, 0.549 IPLV.IP	EIR-f-T	5.506052E-01	-2.834728E-02	5.643798E-04	3.503898E-02	-5.165318E-04	1.502310E-04
		CAP-f-T	1.002123E+00	3.244277E-02	-1.616214E-03	-8.253561E-03	-2.586827E-05	6.049564E-04
		EIR-f-PLR	3.518518E-01	-1.869226E-02	6.670833E-01	N/A	N/A	N/A