INTERNATIONAL STANDARD

ISO 16358-1

First edition
2013-04-15

AMENDMENT 1
2019-04

Air-cooled air conditioners and air-to-air heat pumps — Testing and calculating methods for seasonal performance factors —

Part 1: Cooling seasonal performance factor

AMENDMENT 1

Climatiseurs à condenseur à air et pompes à chaleur air/air — Essais et méthodes de calcul des coefficients de performance saisonniers —

Partie 1: Coefficient de performance saisonnier de refroidissement (COPSR)

AMENDEMENT 1

Reference number
ISO 16358-1:2013/Amd.1:2019(E)

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Published in Switzerland

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This document was prepared by Technical Committee ISO/TC 86, *Refrigeration and air-conditioning*, Subcommittee SC 6, *Testing and rating of air-conditioners and heat pumps*.

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Air-cooled air conditioners and air-to-air heat pumps — Testing and calculating methods for seasonal performance factors —

Part 1:
Cooling seasonal performance factor

AMENDMENT 1

Page 1, 1.2

Add " and T3" after the words "the rating conditions are those specified under T1".

Page 3, 3.13

Add " or T3" after the words "cooling capacity at T1".

Page 3, 3.14

Add " or T3" after the words "electric power input at T1".

Page 3, 3.15

Add " or T3" after the words "capacity which is 50 % of cooling full capacity at T1".

Page 3, 3.16

Add " or T3" after the words "electric power input when operated at 50 % of cooling full capacity at T1".

Page 3, 3.17

Add " or T3" after the words "capacity at T1".

Page 3, 3.18

Add " or T3" electric power input at T1".

Page 3, after 3.22

Add 3.23 and 3.24

3.23
T1 climate
standardized range of climate conditions for a moderate climate

3.24
T3 climate
standardized range of climate conditions for a hot climate

Page, 3, Clause 4 Symbols

Add the following row after C_{CSE} row

C_D degradation coefficient

Add the following row after $P_{ful}(t_j)$ row

*P*ful(46) cooling full power input at T3 temperature condition W

Add the following row after $P_{haf}(t_j)$ row

*P*haf(46) cooling half power input at T3 temperature condition W

Add the following row after $P_{min}(t_j)$ row

P_{min}(46) cooling minimum power input at T1 temperature condition W

Add the following row after ϕful(tj) row

ϕful(46) cooling full capacity at T3 temperature condition W

Add the following row after ϕhaf(tj) row

ϕhaf(46) cooling half capacity at T3 temperature condition W

Add the following row after ϕmin(tj) row

ϕmin(46) cooling minimum capacity at T3 temperature condition W

Page 5, 5.2 Test conditions

Add

“for units rated for T1 climate and Table F.1 in Annex F for units rated for T3 climate”

after

“for calculation shall be as specified in Table 1”

Page 6, 5.3.2 Low temperature cooling capacity tests

Add

“for T1 climate or Table F.1 for T3 climate”

after

“default values as given in Table 1”

*Page 7, 5.3.*3 Low humidity cooling test and cyclic cooling test

Add

"for T1 climate or Table F.1 for T3 climate"

after

"default values as given in Table 1"

Page 7, Clause 6 Calculations

Add the following sentences and Table after the first sentence:

For units rated for T1 climate, calculations shall be made according to Clause 6 and for units rated for T3 climate, calculations shall be made according to F.2.

NOTE A calculation tool (spreadsheet) is available to perform all the calculations of Clause 6, given the individual test input. It is available at https://standards.iso.org/iso/16358/-1/ed-1/en/amd/1. The issuer is permitted to use the calculation tool in its original format without any modifications for the purpose specified in this document.

Table 2 shows the formulae used for T1 climate and T3 climate in order to read this document more easily.

Table 2 — Formulae used to calculate CSPF and FCSP for T1 climate and T3 climate

		T1 climate	T3 climate
	CSPF, FCSP	(1) and Annex B	(1) and Annex B
	Cooling load $L_c(t_j)$	(2) with t_0 = 20 °C and t_{100} = 35 °C	(2) with t_0 = 20 °C and t_{100} = 46 °C
Fixed	$\phi_{ful}(t_j)$	(3)	(F.1), (F.2)
	$P_{ful}(t_j)$	(4)	(F.3), (F.4)
	(CSTL), L_{CST}	(5)	(5)
	(CSEC), C_{CSE}	(6), (7), (8)	(6), (7), (8)
Two-stage	$\phi_{ful}(t_j)$	(3)	(F.1), (F.2)
	$\phi_{min}(t_j)$	(9)	(F.5), (F.6)
	$P_{ful}(t_j)$	(4)	(F.3), (F.4)
	$P_{min}(t_j)$	(10)	(F.7), (F.8)
	(CSTL), L_{CST}	(5)	(5)
	(CSEC), C_{CSE}	(11), (7), (12), (13), (4)	(11), (7), (12), (13), (4)
Multi-stage	$\phi_{ful}(t_j)$	(3)	(F.1), (F.2)
	$\Phi_{haf}(t_j)$	(14)	(F.9), (F.10)
	$\phi_{min}(t_j)$	(9)	(F.5), (F.6)
	$P_{ful}(t_j)$	(4)	(F.3), (F.4)
	$P_{haf}(t_j)$	(15)	(F.11), (F.12)
	$P_{min}(t_j)$	(10)	(F.7), (F.8)
	(CSTL), L_{CST}	(5)	(5)
	(CSEC), C_{CSE} when minimum capacity available	(16), (7), (17), (18), (19), (20), (4) (Annex E)	(16), (7), (17), (18), (19), (20), (4) (Annex E)
	(CSEC), C_{CSE} when minimum capacity not available	(21), (7), (19), (20), (4) (Annex E)	(21), (7), (19), (20), (4) (Annex E)

Table 2 *(continued)*

		T1 climate	T3 climate
Variable	$\phi_{ful}(t_j)$	(3)	(F.1), (F.2)
	$\Phi_{haf}(t_j)$	(14)	(F.9), (F.10)
	$\phi_{min}(t_j)$	(9)	(F.5), (F.6)
	$P_{ful}(t_j)$	(4)	(F.3), (F.4)
	$P_{haf}(t_j)$	(15)	(F.11), (F.12)
	$P_{min}(t_j)$	(10)	(F.7), (F.8)
	(CSTL), L_{CST}	(5)	(5)
	(CSEC), C_{CSE} when minimum capacity available	(16), (7), (22), (23), (24), (25), (26),(27),(4) (Annex E)	(16), (7), (22), (23), (24), (25), (26),(27),(4) (F.13), (F.14), (F.15), (F.16), (F.17), (F.18)
	(CSEC), C_{CSE} when minimum capacity is not available	(21), (7), (24), (25), (26),(27),(4) (Annex E)	(21), (7), (24), (25), (26),(27),(4) (F.15), (F.16), (F.17), (F.18)

Page 7, 6.2

Replace "Table 2 — Defined cooling load"

with

"Table 3 — Defined cooling load"

Page 7, 6.3

Replace

"Table 3 — Reference outdoor temperature bin distribution for T1 climate"

with "Table 4 — Reference outdoor temperature bin distribution for T1 climate"

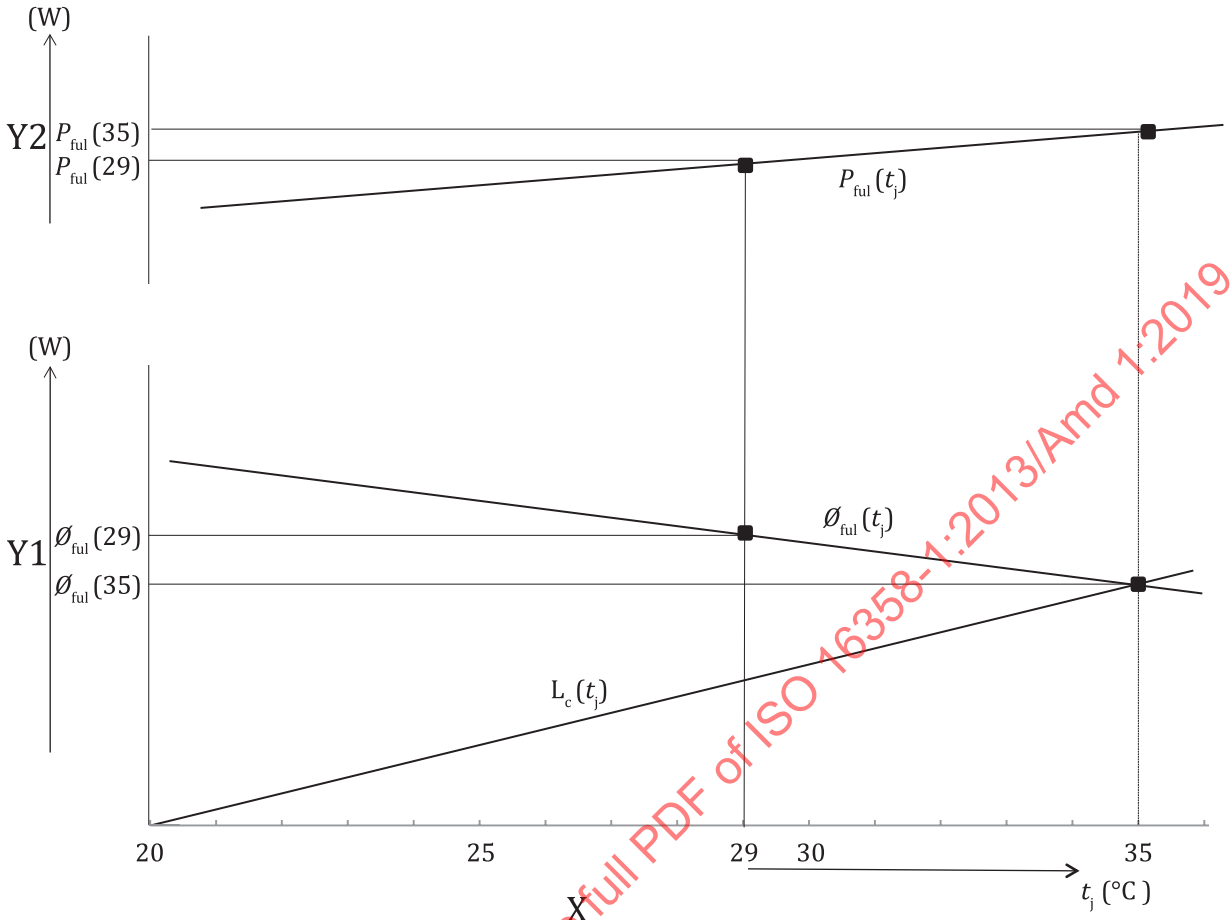
Page 13, Clause 7 Test report

Add the following sentence at the end of the last sentence of the Clause.

> "It shall be specified whether the CSPF is for T1 climate, T3 climate or a location specific temperature bin distribution."

Annex A

Replace Figure A.1 — Cooling capacity, power input and cooling load for fixed capacity units, by the following figure:

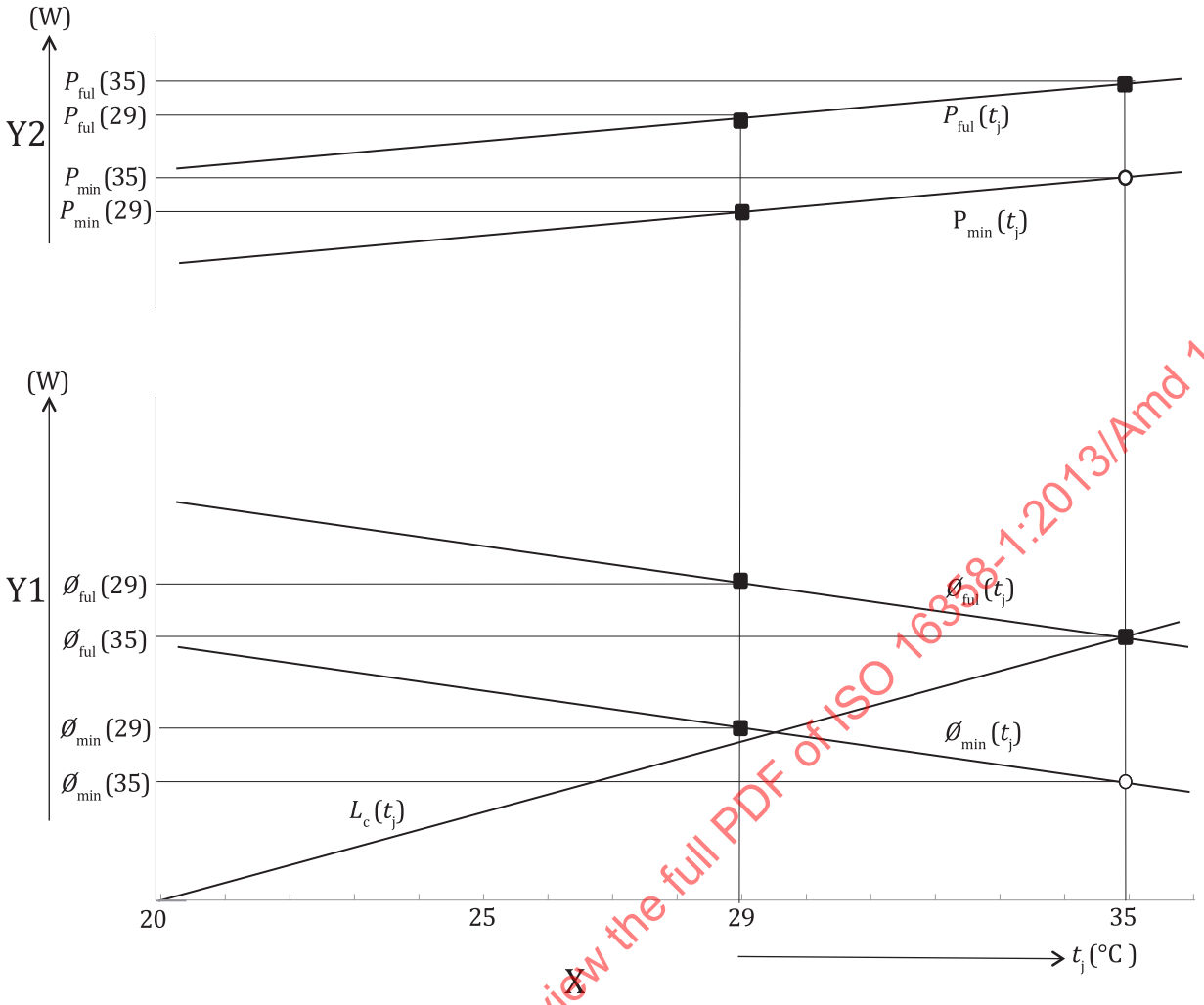


Key

X outdoor temperature
Y1 capacity or load
Y2 power input

Figure A.1 — Cooling capacity, power input and cooling load for fixed capacity units

Replace Figure A.2 — Cooling capacity, power input and cooling load for two-stage capacity units, by the following figure:

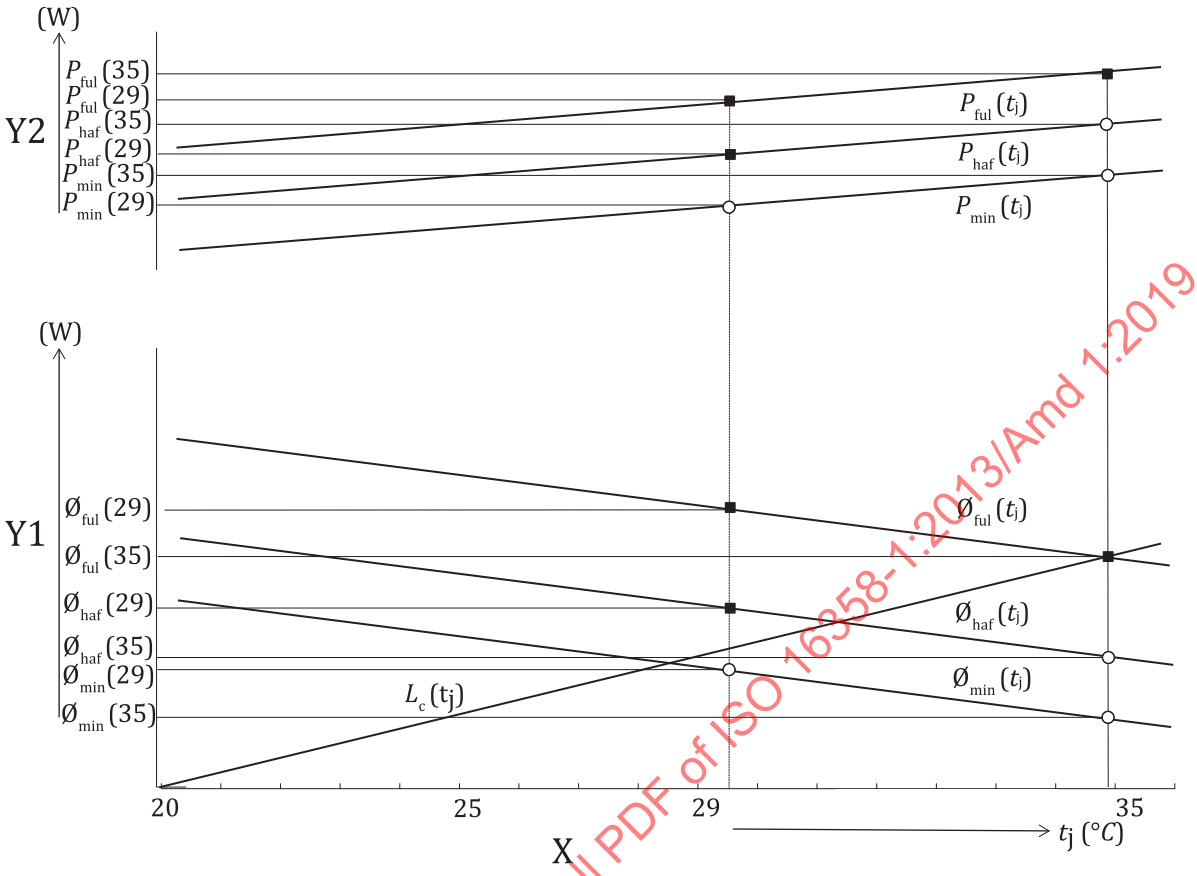


Key

X outdoor temperature
Y1 capacity or load
Y2 power input

Figure A.2 — Cooling capacity, power input and cooling load for two-stage capacity units

Replace Figure A.3 — Cooling capacity, power input and cooling load for multi-stage capacity units, by the following figure:

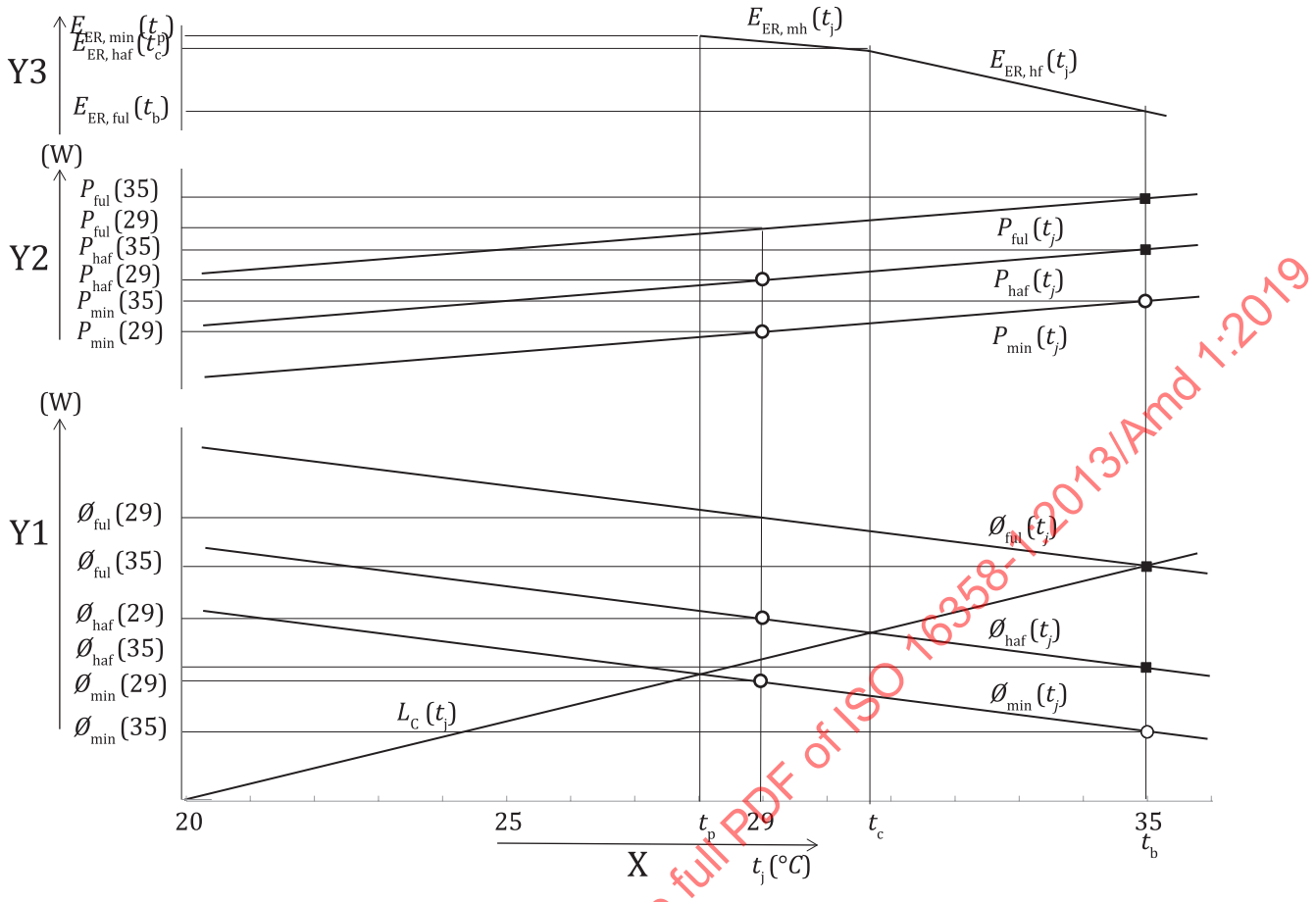


Key

X outdoor temperature
Y1 capacity or load
Y2 power input

Figure A.3 — Cooling capacity, power input and cooling load for multi-stage capacity units

Replace Figure A.4 — Cooling capacity, power input and cooling load and EER for variable capacity units, by the following figure:



Key

X outdoor temperature
Y1 capacity or load
Y2 power input

Figure A.4 — Cooling capacity, power input and cooling load and EER for variable capacity units

Annex B

Page 19, B.2

Replace Table B.1 with the following table

Temperature condition	5 °C	10 °C	15 °C	20 °C
Weighting factor, T1 climate	0,05	0,13	0,27	0,55
Weighting factor, T3 climate	0,00	0,18	0,27	0,55

In the definition for H_{ia} add “for T1 climate or Table B.3 for T3 climate” after “as given in Table B.2”.

Page 19, B.3, second sentence

Add “and for T3 climate according to Annex F.”

after

"according to the main body of this document".

Add "for T1 climate"

after

"Calculation of L_{CST} and C_{CSE} is"

Page 20, B.3

Add "for T1 climate or Table B.3 for T3 climate"

after

"cooling seasonal performance factor are shown in Table B.2".

Add Table B.3 after Table B.2

Table B.3 — Default hours for T3 climate by mode for the calculation of reference total cooling seasonal performance factor

Unit	Active mode h	Inactive mode, H_{ia} h	Disconnected mode h
Cooling only unit and reversible unit	6 493	2 267	0

Annex C

Page 21, C.1

Replace the sentence "Testing condition for cyclic test is shown in Table C.1"

by

"Testing conditions for cyclic cooling tests are shown in Table C.1 for T1 climate and Table C.2 for T3 climate."

Add new Table C.2.

Table C.2 — Temperature and humidity conditions for T3 climate cyclic cooling test

Test	Indoor temperature °C		Outdoor temperature °C	
	Dry-bulb	Wet-bulb	Dry-bulb	Wet-bulb
A test: Steady, dry coil	27	13,9 or less	35	—
B test: Cyclic, dry coil	27	13,9 or less	35	—
The entering air to the unit shall have a low enough moisture content so that no condensate forms on the indoor coil. (It is recommended that an indoor wet-bulb temperature of 13,9 °C or less be used.) NOTE Maintain the airflow nozzles static pressure difference or velocity pressure during the ON period at the same pressure difference or velocity pressure as measured during the A test.				

Add this sentence

"For T1climate and T3 climate, duration of ON and OFF interval of cyclic operation test is shown in Table C.3"

after the new table C.2

Replace “Table C.2 — Duration of ON and OFF interval of cyclic operation test”

with

“Table C.3 — Duration of ON and OFF interval of cyclic operation test”

Page 22, C.2.2.1

Replace

“Table C.2”

with

“Table C.3”

in the sentence “Duration of ON and OFF interval shall be in accordance with Table C.2.”

Page 22, C.2.2.4, second paragraph

Replace

> “Test tolerance of the dry-bulb temperature shall be ±2,5 °CC on the indoor side and ±5 °C on the outdoor side as specified in ISO 5151, ISO 13253 and ISO 15042.”

with

> “Variation of individual readings of the dry-bulb temperature shall be ±2,5 K on the indoor side and ±5 K on the outdoor side and variation of arithmetical mean values of the dry-bulb temperature shall be ±1,5 K on both the indoor and outdoor side as specified in ISO 5151, ISO 13253 and ISO 15042.”

Page 23, C.2.2.4, fifth paragraph

Add “for T1 climate and Table C.2 for T3 climate” after “A test and B test of Table C.1”.

Annex E, Page 25

Replace Annex E label “(informative)” to “(normative)”.

Add the following sentence after the title

“For units rated for T1 climate the following calculations apply. See Annex F for units rated for T3 climate.”

Replace Formula (E.2) with “$\varnothing_{\text{ful}}\left(t_{\text{j}}\right)=\varnothing_{\text{ful}}\left(35\right)+\frac{\varnothing_{\text{ful}}\left(29\right)-\varnothing_{\text{ful}}\left(35\right)}{\left(35-29\right)}\times\left(35-t_{\text{j}}\right)$

Add the following new Annex F.

Annex F
(informative)

Test conditions and calculations of the cooling seasonal performance factor (CSPF) and total cooling seasonal performance factor (TCSPF) for hot climates

Refer to Annex B for calculation of TCSPF.

F.1 Test conditions

For hot climates, temperature conditions and humidity conditions as well as default values shall be calculated as specified in Table F.1.

Table F.1 — Temperature and humidity conditions and default values for cooling at T3 hot climate condition according to ISO 5151, ISO 13253, ISO 15042

Test	Characteristics	Fixed	Two-stage	Multi-stage	Variable	Default value
Standard cooling capacity test Indoor DB 29 °C WB 19 °C Outdoor DB 46 °C WB 24 °C	Full capacity ϕ_{ful} (46) (W)	■	■	■	■	—
	Full power input P_{ful} (46) (W)					
	Half capacity ϕ_{haf} (46) (W)	-	-	○	○	0,859 x ϕ_{haf} (35)
	Half power input P_{haf} (46) (W)					1,25 x P_{haf} (35)
	Minimum capacity ϕ_{min} (46) (W)	-	○	○	○	0,859 x ϕ_{min} (35)
	Minimum power input P_{min} (46) (W)					1,25 x P_{min} (35)
Medium cooling capacity test Indoor DB 27 °C WB 19 °C Outdoor DB 35 °C WB 24 °C	Full capacity ϕ_{ful} (35) (W)	■	■	■	■	-
	Full power input P_{ful} (35) (W)					
	Half capacity ϕ_{haf} (35) (W)	-	-	■	■	-
	Half power input P_{haf} (35) (W)					
	Minimum capacity ϕ_{min} (35) (W)	-	■	○	○	-
	Minimum power input P_{min} (35) (W)					
Medium cooling capacity test Indoor DB 27 °C WB 19 °C Outdoor DB 29 °C WB 24 °C	Full capacity ϕ_{ful} (29) (W)	○	○	○	-	1,077 x ϕ_{ful} (35)
	Full power input P_{ful} (29) (W)					0,914 x P_{ful} (35)
	Half capacity ϕ_{haf} (29) (W)	-	-	○	○	1,077 x ϕ_{haf} (35)
	Half power input P_{haf} (29) (W)					0,914 x P_{haf} (35)
	Minimum capacity ϕ_{min} (29) (W)	-	○	○	○	1,077 x ϕ_{min} (35)
	Minimum power input P_{min} (29)					0,914 x P_{min} (29)

■ required test

○ optional test

NOTE 1 If the medium capacity test is measured, min (35) test is conducted first. Min (46) or min(29) test may be measured or may be calculated by using default values.

NOTE 2 Voltage(s) and frequenc(i)e(s) are as given in the three referenced standards.

NOTE 3 In lieu of conducting a cyclic test at 35°C, the C_D from the 29°C cyclic test multiplied by 1,08 may be used.

Table F.1 *(continued)*

Test	Characteristics		Fixed	Two-stage	Multi-stage	Variable	Default value
Low humidity and cyclic cooling Indoor DB 27 °C WB 16 °C or lower Outdoor DB 35 °C WB -	Degradation coefficient C_D	Full capacity	○	-	-	-	0,27
		Half capacity	-	-	○	-	0,27
		Minimum capacity	-	○	○	-	0,27

■ required test

○ optional test

NOTE 1 If the medium capacity test is measured, min (35) test is conducted first. Min (46) or min(29) test may be measured or may be calculated by using default values.

NOTE 2 Voltage(s) and frequenc(i)e(s) are as given in the three referenced standards.

NOTE 3 In lieu of conducting a cyclic test at 35°C, the C_D from the 29°C cyclic test multiplied by 1,08 may be used.

F.2 Calculations

The calculations shall be performed as per Clause 6, unless specified differently in this clause.

F.2.2 Defined cooling load

The defined cooling load L_c (t_j) at outdoor temperature t_j shall be determined by Formula (2).

In Formula (2), t_0 =20 and t_{100} =46.

In case of setting other cooling load, refer to the setting method as described in Annex D.

F.2.3 Outdoor temperature bin distribution for cooling

Cooling seasonal performance factor (CSPF) for **T3 climate** shall be calculated at the reference climate condition in Table F.2.

The calculation of cooling seasonal performance factor may also be done for other climate conditions using different bin distribution under hot climate conditions.

Table F.2 — Reference outdoor temperature bin distribution for T3 climate

Bin number j	Outdoor temperature t_j °C	Fractional bin hours (informative)	Bin hours n_j	Reference bin hours (n_j)h
1	21	0,047	n_1	307
2	22	0,048	n_2	311
3	23	0,049	n_3	317
4	24	0,050	n_4	325
5	25	0,051	n_5	334
6	26	0,053	n_6	342
7	27	0,054	n_7	349
8	28	0,054	n_8	354
9	29	0,055	n_9	356
10	30	0,055	n_{10}	355

Table F.2 *(continued)*

Bin number j	Outdoor temperature t_j °C	Fractional bin hours (informative)	Bin hours n_j	Reference bin hours (n_j)h
11	31	0,054	n_{11}	351
12	32	0,053	n_{12}	344
13	33	0,051	n_{13}	332
14	34	0,049	n_{14}	317
15	35	0,046	n_{15}	299
16	36	0,043	n_{16}	277
17	37	0,039	n_{17}	252
18	38	0,035	n_{18}	225
19	39	0,030	n_{19}	195
20	40	0,025	n_{20}	165
21	41	0,021	n_{21}	133
22	42	0,016	n_{22}	103
23	43	0,011	n_{23}	73
24	44	0,007	n_{24}	47
25	45	0,004	n_{25}	24
26	46	0,001	n_{26}	6
			Total	6 493

NOTE The fractional bin hours are rounded to the closest one-thousandth.

The calculation of cooling performance factor may also be done for other climate conditions, e.g. instead of the reference climate a climate of a specific city.

In case the outdoor temperature is higher than 46 °C, the 100 % cooling load can be set based on that temperature without changing the test conditions in Table F.1. In case of setting other temperature bin distribution, refer to the setting method as described in Annex D.

F.2.4 Cooling seasonal characteristics of fixed speed capacity units

Operational performance at each test, which is used for calculation of seasonal performance factor, shall be in accordance with Table F.1.

F.2.4.1 Capacity characteristics against outdoor temperature

The capacity $\phi_{ful}(t_j)$ (W) of the equipment when it is operated for cooling at outdoor temperature t_j linearly changes depending on outdoor temperatures as shown in Figure F.1, and it is determined by Formula (F.1) and (F.2) from three characteristics, one at 46 °C, one at 35 °C and the other at 29 °C.

Lower temperature range $t_j \leq 35$ °C

$$\phi_{ful}(t_j) = \phi_{ful}(35) + \frac{\phi_{ful}(29) - \phi_{ful}(35)}{35 - 29} \times (35 - t_j) \quad \text{(F.1)}$$

Higher temperature range $t_j > 35$ °C

$$\phi_{ful}(t_j) = \phi_{ful}(46) + \frac{\phi_{ful}(35) - \phi_{ful}(46)}{46 - 35} \times (46 - t_j) \quad \text{(F.2)}$$

F.2.4.2 Power input characteristics against outdoor temperature

The power input $P_{ful}(t_j)$ (W) of the equipment when it is operated for cooling at outdoor temperature t_j linearly changes depending on outdoor temperatures as shown in Figure F.1, and it is determined by Formula (F.3) and (F.4) from three characteristics, one at 46 °C, one at 35 °C and the other at 29 °C.

Lower temperature range $t_j \leq 35$ °C

$$P_{ful}(t_j) = P_{ful}(35) + \frac{P_{ful}(29) - P_{ful}(35)}{35 - 29} \times (35 - t_j) \quad \text{(F.3)}$$

Higher temperature range $t_j > 35°C$

$$P_{ful}(t_j) = P_{ful}(46) + \frac{P_{ful}(35) - P_{ful}(46)}{46 - 35} \times (46 - t_j) \quad \text{(F.4)}$$

F.2.4.3 Calculation of cooling seasonal total load (*CSTL*)

Cooling seasonal total load (CSTL), L_{CST}, shall be determined using Formula (5).

$L_C(t_j)$ shall be calculated by Formula (2), modified as described in Clause F.2.2.

$\phi_{ful}(t_j)$ shall be calculated by Formula (F.1) and (F.2).

F.2.5 Cooling seasonal characteristics of two-stage capacity units

Operational performance at each test, which is used for calculation of seasonal performance factor, shall be in accordance with Table F.1.

F.2.5.1 Capacity characteristics against outdoor temperature

The capacity $\phi_{ful}(t_j)$ (W) of the equipment when it is operated for cooling full capacity at outdoor temperature t_j are shown in Figure F.2 and calculated by Formula (F.1) and (F.2).

The capacity $\phi_{min}(t_j)$ (W) of the equipment when it is operated for cooling minimum capacity at outdoor temperature t_j shall be calculated by Formula (F.5) and (F.6) from three characteristics, one at 46 °C, one at 35 °C and the other at 29 °C.

Lower temperature range $t_j \leq 35$ °C

$$\phi_{\min}(t_j) = \phi_{\min}(35) + \frac{\phi_{\min}(29) - \phi_{\min}(35)}{35 - 29} \times (35 - t_j) \quad \text{(F.5)}$$

Higher temperature range $t_j > 35$ °C

$$\phi_{\min}(t_j) = \phi_{\min}(46) + \frac{\phi_{\min}(35) - \phi_{\min}(46)}{46 - 35} \times (46 - t_j) \quad \text{(F.6)}$$

F.2.5.2 Power input characteristics against outdoor temperature

The power input $P_{ful}(t_j)$ (W) of the equipment when it is operated for cooling full capacity at outdoor temperature t_j are shown in Figure F.2 and calculated by Formula (F.3) and (F.4).

The power input $P_{min}(t_j)$ (W) of the equipment when it is operated for cooling minimum capacity at outdoor temperature t_j shall be calculated by Formula (F.7) and (F.8) from three characteristics, one at 46 °C, one at 35 °C and the other at 29 °C.

Lower temperature range $t_j \leq 35$ °C

$$P_{\min}(t_j) = P_{\min}(35) + \frac{P_{\min}(29) - P_{\min}(35)}{35-29} \times (35 - t_j) \quad \text{(F.7)}$$

Higher temperature range $t_j > 35$ °C

$$P_{\min}(t_j) = P_{\min}(46) + \frac{P_{\min}(35) - P_{\min}(46)}{46-35} \times (46 - t_j) \quad \text{(F.8)}$$

F.2.6 Cooling seasonal characteristic of multistage capacity units

Operational performance at each test, which is used for calculation of seasonal performance factor, shall be in accordance with Table F.1.

F.2.6.1 Capacity characteristics against outdoor temperature

The capacity $\phi_{ful}(t_j)$ and $\phi_{min}(t_j)$ (W) of the equipment when it is operated for cooling full capacity at outdoor temperature t_j are shown in Figure F.3 and calculated by Formulas (F.1) and (F.2 and (F.5) and (F.6).

Formulas (F.9) and (F.10) show cooling half capacity characteristics at outdoor temperature t_j from three characteristics, one at 46 °C, one at 35 °C and the other at 29 °C.

Lower temperature range $t_j \leq 35$ °C

$$\phi_{haf}(t_j) = \phi_{haf}(35) + \frac{\phi_{haf}(29) - \phi_{haf}(35)}{35-29} \times (35 - t_j) \quad \text{(F.9)}$$

Higher temperature range $t_j > 35$ °C

$$\phi_{haf}(t_j) = \phi_{haf}(46) + \frac{\phi_{haf}(35) - \phi_{haf}(46)}{46-35} \times (46 - t_j) \quad \text{(F.10)}$$

F.2.6.2 Power input characteristics against outdoor temperature

The power input $P_{ful}(t_j)$ and $P_{min}(t_j)$ (W) of the equipment when it is operated for cooling full capacity at outdoor temperature t_j are shown in Figure F.3 and calculated by Formulas (F.3) and (F.4) and (F.7) and (F.8).

Formulas (F.11) and (F.12) show cooling half power input characteristics at outdoor temperature t_j.

Lower temperature range $t_j \leq 35$ °C

$$P_{haf}(t_j) = P_{haf}(35) + \frac{P_{haf}(29) - P_{haf}(35)}{35-29} \times (35 - t_j) \quad \text{(F.11)}$$

Higher temperature range $t_j > 35$ °C

$$P_{haf}(t_j) = P_{haf}(46) + \frac{P_{haf}(35) - P_{haf}(46)}{46-35} \times (46 - t_j) \quad \text{(F.12)}$$

F.2.7 Cooling seasonal characteristics of variable capacity units

Operational performance at each test, which is used for calculation of seasonal performance factor, shall be in accordance with Table F.1.

F.2.7.1 Capacity characteristics against outdoor temperature

The capacity $\phi_{ful}(t_j)$, $\phi_{haf}(t_j)$ and $\phi_{min}(t_j)$ (W) of the equipment when it is operated for cooling full capacity at outdoor temperature t_j are shown in Figure F.4 and calculated by Formulae (F.1) and (F.2), (F.9) and (F.10) and (F.5) and (F.6).

F.2.7.2 Power input characteristics against outdoor temperature

The power input $P_{ful}(t_j)$, $P_{haf}(t_j)$ and $P_{min}(t_j)$ (W) of the equipment when it is operated for cooling full capacity at outdoor temperature t_j are shown in Figure F.4 and calculated by Formulae(F.3) and (F.4), (F.11) and (F.12) and (F.7) and (F.8).

F.2.7.3 Calculation of cooling seasonal energy consumption (CSEC)

The cooling seasonal energy consumption shall be calculated as described in 6.7.4.

Relation of cooling capacity, power input and EER characteristics to cooling load at outdoor temperature t_j is shown in Figure F.4.

In Formula (22), t_p shall be calculated from Formulae (F.13) and (F.14):

Lower temperature range $t_j \leq 35$ °C

$$t_p = \frac{(35-29)\varnothing_{ful}(t_{100})t_0 + (35-29)\varnothing_{\min}(35)(t_{100}-t_0) + 35\left(\varnothing_{\min}(29)-\varnothing_{\min}(35)\right)(t_{100}-t_0)}{(35-29)\varnothing_{ful}(t_{100}) + \left(\varnothing_{\min}(29)-\varnothing_{\min}(35)\right)(t_{100}-t_0)} \quad \text{(F.13)}$$

Higher temperature range $t_j > 35$ °C

$$t_p = \frac{(46-35)\varnothing_{ful}(t_{100})t_0 + (46-35)\varnothing_{\min}(46)(t_{100}-t_0) + 46\left(\varnothing_{\min}(35)-\varnothing_{\min}(46)\right)(t_{100}-t_0)}{(46-35)\varnothing_{ful}(t_{100}) + \left(\varnothing_{\min}(35)-\varnothing_{\min}(46)\right)(t_{100}-t_0)} \quad \text{(F.14)}$$

In formulae (22), (24) and (26), t_c shall be calculated from (F.15) and (F.16):

Lower temperature range $t_j \leq 35$ °C

$$t_c = \frac{(35-29)\varnothing_{ful}(t_{100})t_0 + (35-29)\varnothing_{haf}(35)(t_{100}-t_0) + 35\left(\varnothing_{haf}(29)-\varnothing_{haf}(35)\right)(t_{100}-t_0)}{(35-29)\varnothing_{ful}(t_{100}) + \left(\varnothing_{haf}(29)-\varnothing_{haf}(35)\right)(t_{100}-t_0)} \quad \text{(F.15)}$$

Higher temperature range $t_j > 35$ °C