SADC HT 110: 2023

Minimum Energy Performance Standards for Air Conditioners

December, 2023

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1. Scope of Covered products

1.1 Scope

This harmonized standard applies to all new electrical non-ducted single-split, self-contained air-cooled air conditioners, air-to-air reversible heat pumps, and portable air conditioners, with a rated cooling output of at or below 16 kilo-Watts (kW)[1] placed on the market for any application.

1.2 Exemptions

Air conditioners with a rated cooling output exceeding 16 kW, water-cooled air conditioners, water-source heat pumps, multi-split air conditioners, multi-split air-to-air heat pumps, variable refrigerant flow systems, and ducted equipment as well as non-electric energy sources are exempt from this standard.

2. Normative Reference

The following referenced documents are indispensable for the application of this document[2]:

- ISO 16358-1:2013, Air-cooled air conditioners and air-to-air heat pumps - Testing and calculating methods for seasonal performance factors – Part 1: Cooling seasonal performance factor
- ISO 16358-2:2013, Air-cooled air conditioners and air-to-air heat pumps — Testing and calculating methods for seasonal performance factors — Part 2: Heating seasonal performance factor.
- ISO 16358-3:2013, Air-cooled air conditioners and air-to-air heat pumps — Testing and calculating methods for seasonal performance factors — Part 3: Annual performance factor.
- ISO 5151:2017, Non-ducted air conditioners and heat pumps – Testing and rating for performance
- ISO 18326:2018, Non-ducted portable air-cooled air conditioners and air-to-air heat pumps having a single exhaust duct – Testing and rating for performance
- IEC 60335-2-40:2018, Household and similar electrical appliances – Safety – Part 2-40: Particular requirements for electrical heat pumps, air-conditioners and dehumidifiers.
- ISO 817:2014, Refrigerants - Designation and safety classification.
- ANSI/ASHRAE 15-2019, Safety Standard for Refrigeration Systems and
- ANSI/ASHRAE 34-2019, Designation and Safety Classification of Refrigerants
- ISO 5149:2017, Refrigerating systems and heat pumps — Safety and environmental requirements.
- Handbook for the Montreal Protocol on Substances that Deplete the Ozone Layer, Twelfth Edition, annexes A, B, C, and F.

[1] If a conversion to BTU/hr is needed, the following conversion factor can be used: 1kW= 3412 BTU/hr.
[2] In case the standards are outdated, kindly refer to the SADCSTAN TC16 before following the updated source of a standard.

3. Terms & Definitions

Below are the definitions of the relevant terms in this document. Unless otherwise specified, these definitions are harmonized with definitions in ISO 16358-1,2,3:2013, ISO 5151:2017, and ISO 18326:2018

Annual Performance Factor (APF)
The ratio of the total annual amount of heat that the equipment can remove from and add to the indoor air during the cooling and heating seasons in active mode, respectively, to the total amount of energy consumed by the equipment.

Coefficient of Performance (COP)
The ratio of the heating capacity in Watts to the effective power input in Watts at given rating conditions.

Conformity Assessment Report (CAR) or Certificate of Conformity
Documentation prepared by the manufacturer or importer of the product which contains the compliance declaration or certificate of conformity, the evidence and the test reports to demonstrate that the product is fully compliant with all applicable regulatory requirements.

Competent Authority
The authority in the respective SADC member state charged with the responsibility to enforce requirements on air conditioners.

Cooling Seasonal Energy Consumption (CSEC)
The total amount of energy consumed by the equipment when it is operated for cooling during the cooling season.

Cooling Seasonal Performance Factor (CSPF)
The ratio of the total annual amount of heat that the equipment can remove from the indoor air when operated for cooling in active mode to the total annual amount of energy consumed by the equipment during the same period.

Cooling Seasonal Total Load (CSTL)
The total annual amount of heat that is removed from the indoor air when the equipment is operated for cooling in active mode.

Non-Ducted Portable Air-Cooled Air Conditioner having a single exhaust duct
An encased assembly, designed primarily to provide free delivery of conditioned air to an enclosed space, room or zone which takes its source of air for cooling the condenser from the conditioned space, and discharges this air through a duct to the outdoor space.

Non-Ducted Portable Air-Cooled Air Conditioner having a single exhaust duct

An encased assembly designed primarily to provide free delivery of conditioned air to an enclosed space, room or zone and includes a prime source of refrigeration for heating and which takes its source of air for the evaporator from the conditioned space, and discharges this air through a duct to the outdoor space.

Energy Efficiency Ratio (EER)[3]

The ratio of the total cooling capacity to the effective power input to the device at given rating conditions.

Fixed Capacity Unit

The type of equipment that does not have the possibility to change its capacity.

Global Warming Potential (GWP)

A measure of how much heat a greenhouse gas traps in the atmosphere up to a specific time horizon, relative to an equal mass of carbon dioxide in the atmosphere. GWPs in this document refer to those measured in the IPCC's Fifth Assessment Report over a 100-year time horizon.

Heating Seasonal Total Load (HSTL)

The total annual amount of heat, including make-up heat, which is added to the indoor air when the equipment is operated for heating in active mode.

Heating Seasonal Energy Consumption (HSEC)

The total annual amount of energy consumed by the equipment, including make-up heat, when it is operated for heating in active mode.

Heating Seasonal Performance Factor (HSPF)

The ratio of the total annual amount of heat that the equipment, including make-up heat, can add to the indoor air when operated for heating in active mode to the total annual amount of energy consumed by the equipment during the same period, calculated by HSTL over HSEC.

Indoor Unit

The cabinet of a split system that is located indoors and provides the evaporation and air movement mechanism located on a floor, wall or ceiling.

Multi-stage capacity unit

Equipment where the capacity is varied by three or four steps.

Outdoor Unit

The cabinet of a split system that is located outdoors and provides capacity to condense refrigerant.

[3] An alternate definition of EER is sometimes used as a ratio of the cooling capacity delivered by a system in BTU/h to the power consumed by the system in watts (W) at any given set of rating conditions. 1 BTU/h is equivalent to 0.293 W. However, here we use the definition of EER listed above in the units of W/W.

Ozone Depletion Potential (ODP)
The amount of degradation to the stratospheric ozone layer an emitted refrigerant causes relative to trichlorofluoromethane (CFC-11). ODPs in this document refer to "Handbook for the Montreal Protocol on Substances that Deplete the Ozone Layer, Twelfth Edition, annexes A, B, C and F".

Refrigerant
A substance or mixture, usually a fluid, used for heat transfer in a heat pump and refrigeration cycle, which absorbs hear at a low temperature and a low pressure of the fluid and rejects it at a higher temperature and a higher pressure of the fluid involving changes of the phase of the fluid.

Split Unit (single)
A type of air conditioner or heat pump that is comprised of an indoor unit and outdoor unit, with the indoor unit mounted on floor or wall or ceiling. It consists of compressor, heat exchangers, fan motors and air handling system installed in two separate cabinets.

Self-Contained Unit
A type of air conditioner or heat pump that consists of an encased assembly designed as a self-contained unit primarily for mounting in a window or through the wall or as a console ducted to the outdoors. It consists of compressor, heat exchangers and air handling system installed in one cabinet and is designed primarily to provide free delivery of conditioned air to an enclosed space, room or zone (conditioned space).

Two (2)-stage capacity unit

Equipment where the capacity is varied by two steps.

Ton of Refrigeration (RT)
Used as a measure of cooling or heating capacity, one RT is the rate of heat transfer that results in the melting of 1 short ton of ice at 0°C in 24 hours.

Variable Capacity Unit
Equipment where the capacity is varied by five or more steps to represent continuously variable capacity.

4. Requirements

Air conditioners and heat pumps falling within the scope of Clause 1 may meet the energy efficiency requirements of Clause 3. The importation of used products shall be prohibited by the competent authority.

For ductless split systems, manufacturers shall identify pairs of indoor and outdoor units that jointly comprise the rated product and shall independently represent each of those pairs in any applicable registration system prior to introduction into commerce. Sale or installation of cabinet units not identified as a matched pair may not be allowed, as defined by the competent authority.

4.1 Test Methods and Energy Efficiency Performance Calculation

Compliance with the energy performance requirements shall be tested according to ISO 16358-1,-2,-3:2013, which refer to ISO 5151:2017. Rating conditions for cooling capacity and heating capacity may be found in

Table 1 and Table 2. Ductless portable products or portable products with a single exhaust duct shall be tested according to ISO 18326:2018[4].

Table 1. Cooling Capacity Rating Conditions

	Temperature of air entering indoor side. dry-bulb / wet-bulb	Temperature of air entering outdoor side. dry-bulb / wet-bulb[a]
ISO 16358-1:2013 (T1 moderate climate) Standard cooling capacity	27 °C / 19 °C (ISO 5151 T1)	35 °C / 24 °C (ISO 5151 T1)
ISO 16358-1:2013 (T1 moderate climate) Low temperature cooling capacity	27 °C / 19 °C	29 °C / 19 °C

[a] The wet-bulb temperature condition shall only be required when testing air-cooled condensers which evaporate the condensate.

Table 2. Heating Capacity Rating Conditions

	Temperature of air entering indoor side. dry-bulb / wet-bulb	Temperature of air entering outdoor side. dry-bulb / wet-bulb
ISO 16358-2:2013 Standard heating capacity	20 °C / 15 °C (maximum)	7 °C / 6 °C (ISO 5151 H1)
ISO 16358-2:2013 Low temperature heating capacity		2 °C / 1 °C (ISO 5151 H2)
ISO 16358-2:2013 Extra-low temperature heating capacity		-7 °C / -8 °C (ISO 5151 H3)

Products shall be represented according to the calculation of a seasonal performance factor as prescribed in ISO 16358-1,-2,-3:2013. Determining the CSPF and the APF requires testing products according to ISO 16358-1,-2,-3:2013 and calculating the efficiency performance by using outdoor temperature bin data specified in ISO 16358-1,-2,-3:2013. Reference test standards may be found in Table 3.

Table 3. Reference Standards for Test Methods and Energy Efficiency Calculations

Temperature and humidity conditions and default values for cooling efficiency test at T1 for moderate climate *	ISO 16358-1:2013 Table 1
Test methods for cooling efficiency	ISO 16358-1:2013 Chapter 5
Cooling efficiency calculations	ISO 16358-1:2013 Chapter 6 Clause 6.4 (fixed capacity units) Clause 6.5 (two-stage capacity units) Clause 6.6 (multi-stage capacity units) Clause 6.7 (variable capacity units)

[4] The term ISO 18326:2018 in this document includes ISO 18326:2018/Amd 1:2021.

Temperature and humidity conditions and default values for heating efficiency test	ISO 16358-2:2013 Table 1
Temperature and humidity conditions and default values for cooling efficiency test at T3 for hot climate	ISO 16358-1:2013/Amd 1:2019 Table F.1
Test methods for heating efficiency	ISO 16358-2:2013 Chapter 4
Heating efficiency calculations	ISO 16358-2:2013 Chapter 5 Clause 5.3 (fixed capacity units) Clause 5.4 (two-stage capacity units) Clause 5.5 (multi-stage capacity units) Clause 5.6 (variable capacity units)
APF calculation	ISO 16358-3:2013 Chapter 5

Temperature and humidity conditions as well as default values for CSPF calculation shall be as specified in Table 4. Degradation coefficient (CD) = 0.25 shall be used for all CSPF calculations.

Table 4. Test Requirements for CSPF

Operating condition		**Fixed**	**Two-stage**	**Multi-stage**	**Variable**
Full capacity and power input	Standard Temperature Outdoor DB 35°C / WB 24°C Indoor DB 27°C / WB 19°C	Required	Required	Required	Required
Half capacity and power input		-[a]	-	Default[c]	Required
Minimum capacity and power input		-	Default[c]	-	-
Full capacity and power input	Low Temperature Outdoor DB 29°C / WB 19°C Indoor DB 27°C / WB 19°C	Default[b]	Default[b]	Default[b]	Default[b]
Half capacity and power input		-	-	Required	Default[b]
Minimum capacity and power input		-	Required	-	-

[a] '-' represents Not applicable or Not considered.

[b] Performance at the lower temperature shall be calculated by using predetermined equations as below:

$Full\ Capacity(29°C) = \mathrm{Full}Capacity(35°C) \times 1.077$; $Full\ Power\ input(29°C) = \mathrm{Full}\ Power\ input(35°C) \times 0.914$

$Half\ \ Capacity(29°C) = \mathrm{Half}\ Capacity(35°C) \times 1.077$; $Half\ \ Power\ input(29°C) = \mathrm{Half}\ Power\ input(35°C) \times 0.914$

[c] Performance at the standard temperature shall be calculated by using predetermined equations as below:

$Half\ \ Capacity(35°C) = \mathrm{Half}\ Capacity(29°C) \div 1.077$; $Half\ \ Power\ input(35°C) = \mathrm{Half}\ Power\ input(29°C) \div 0.914$

$Min\ Capacity(35°C) = \mathrm{Min}\ Capacity(29°C) \div 1.077$; $Min\ Power\ input(35°C) = \mathrm{Min}\ Power\ input(29°C) \div 0.914$

Temperature and humidity conditions as well as default values for HSPF calculation shall be as specified in Table 4. Degradation coefficient (CD) = 0.25 shall be used for all HSPF calculations.

Table 5. Test Requirements for HSPF

Operating condition		Fixed	Two-stage	Multi-stage	Variable
Full capacity $\emptyset_{ful}(7)$ and power input $P_{ful}(7)$	Standard Temperature Outdoor DB 7°C / WB 6°C Indoor DB 20°C / WB 15°C Max	Required	Required	Required	Required
Half capacity $\emptyset_{haf}(7)$ and power input $P_{haf}(7)$		-[a]	-	Required	Required
Minimum capacity $\emptyset_{min}(7)$ and power input $P_{min}(7)$		-	Required	-	-
Extended capacity $\emptyset_{ext,f}(2)$ and power input $P_{ext,f}(2)$	Low Temperature Outdoor DB 2°C / WB 1°C Indoor DB 20°C / WB 15°C Max	-	-	Required[b]	Required[b]
Calculated extended capacity $\emptyset_{ext}(2)$ and power input $P_{ext}(2)$		-	-	Default[c]	Default[c]
Full capacity $\emptyset_{ful,f}(2)$ and power input $P_{ful,f}(2)$		Required	Required	Default[b,d] or Required	Default[b,d] or Required
Half capacity $\emptyset_{haf,f}(2)$ and power input $P_{haf,f}(2)$		-	-	Default[e]	Default[e]
Minimum capacity $\emptyset_{min,f}(2)$ and power input $P_{min,f}(2)$		-	Default[f]	-	-
Extended capacity $\emptyset_{ext}(-7)$ and power input $P_{ext}(-7)$		-	-	Default[g]	Default[g]
Full capacity $\emptyset_{ful}(-7)$ and power input $P_{ful}(-7)$		Default[h]	Default[h]	Default[h]	Default[h]
Half capacity $\emptyset_{haf}(-7)$ and power input $P_{haf}(-7)$		-	-	Default[i]	Default[i]
Minimum capacity $\emptyset_{min}(-7)$ and power input $P_{min,f}(2)$		-	-	-	-

[a] '-' represents Not applicable or Not considered.

[b] When the equipment has an extended mode, low temperature extended capacity measurement is mandatory, and low temperature full capacity measurement is optional. When the equipment has not an extended mode, low temperature full capacity measurement is mandatory.

[c] $\emptyset_{ext}(2) = \emptyset_{ext,f}(2) \times 1.12$; $P_{ext}(2) = P_{ext,f}(2) \times 1.06$

[d] $\emptyset_{ful,f}(2) = \emptyset_{ful}(2) \div 1.12$; $P_{ful,f}(2) = P_{ful}(2) \div 1.06$, where

$$\emptyset_{ful}(2) = \emptyset_{ful}(-7) + \frac{\emptyset_{ful}(7) - \emptyset_{ful}(-7)}{7-(-7)} \times (2-(-7))$$

$$P_{ful}(2) = P_{ful}(-7) + \frac{P_{ful}(7) - P_{ful}(-7)}{7-(-7)} \times (2-(-7))$$

[e] $\emptyset_{haf,f}(2) = \emptyset_{haf}(2) \div 1.12$; $P_{haf,f}(2) = P_{haf}(2) \div 1.06$, where

$$\emptyset_{haf}(2) = \emptyset_{haf}(-7) + \frac{\emptyset_{haf}(7) - \emptyset_{haf}(-7)}{7-(-7)} \times (2-(-7))$$

$$P_{haf}(2) = P_{haf}(-7) + \frac{P_{haf}(7) - P_{haf}(-7)}{7-(-7)} \times (2-(-7))$$

[f] $\emptyset_{min,f}(2) = \emptyset_{min}(2) \div 1.12$; $P_{min,f}(2) = P_{min}(2) \div 1.06$, where

$$\emptyset_{min}(2) = \emptyset_{min}(-7) + \frac{\emptyset_{min}(7) - \emptyset_{min}(-7)}{7-(-7)} \times (2-(-7))$$

$$P_{min}(2) = P_{min}(-7) + \frac{P_{min}(7) - P_{min}(-7)}{7-(-7)} \times (2-(-7))$$

[g] $\emptyset_{ext}(-7) = \emptyset_{ext}(2) \times 0.734$; $P_{ext}(-7) = P_{ext}(2) \times 0.877$

[h] $\emptyset_{ful}(-7) = \emptyset_{ful}(7) \times 0.64$; $P_{ful}(-7) = P_{ful}(7) \times 0.82$

[h] $\emptyset_{haf}(-7) = \emptyset_{haf}(7) \times 0.64$; $P_{haf}(-7) = P_{haf}(7) \times 0.82$

4.1.1 Standard Cooling Capacity and Heating Capacity Tests

a. The standard cooling capacity tests, if applicable, shall be conducted in accordance with ISO 5151:2017 and ISO 16358-1:2013.
b. The cooling full capacity test shall be conducted at full load operating conditions.
c. The cooling half capacity test, if required, shall be conducted at 50 % of full load operation. The test tolerance shall be ± 5 % of the tested full load capacity for variable capacity units.
d. The heating full capacity test shall be conducted at full load operating conditions.
e. The heating half capacity test, if required, shall be conducted at 50 % of full load operation. The test tolerance shall be ± 5 % of the tested full load capacity for variable capacity units.

4.1.2 Low Temperature Cooling Capacity and Heating Capacity Tests

a. The low temperature cooling capacity tests, if applicable, shall be conducted in accordance with ISO 5151:2017 and ISO 16358-1:2013.
b. For multi-stage units, if 50% heating capacity is not achievable, then the test shall be conducted at the next step above 50%.
c. For two-stage units, the heating minimum capacity test shall be conducted at the lowest capacity control setting which allows steady-state operation of the unit at the given test conditions.

4.1.3 Measurement of Cooling Capacity, Heating Capacity, and Power Consumption

a. The cooling capacity and its corresponding effective power input shall be measured in accordance with ISO 5151:2017 and ISO 16358-1:2013.
b. The heating capacity and its corresponding effective power input shall be measured in accordance with ISO 5151:2017 and ISO 16358-2:2013.

4.1.4 Maximum Cooling Performance and Heating Performance Tests

a. The maximum cooling performance test shall be conducted in accordance with the test method and performance requirements as specified in clause 5.2 of ISO 5151:2017.
b. The maximum heating performance test shall be conducted for heat pumps in accordance with the test methodology and performance requirements as specified in clause 6.2 of ISO 5151:2017.

4.2 Energy Efficiency

4.2.1 Cooling Seasonal Performance Factor (CSPF)

The CSPF, F_{CSP}, shall be calculated as follows:

$$F_{CSP} = \frac{L_{CST}}{C_{CSE}} \quad \text{...Eq. 1}$$

Where L_{CST} is the cooling seasonal total load (CSTL) and C_{CSE} is the cooling seasonal energy consumption (CSEC) to be calculated in accordance with ISO 16358-1:2013 in Wh by using the defined cooling load and the outdoor temperature distribution specified in Table 6 and Table 7. **Error! Reference source not found.**

Table 6. Defined Cooling Load

Parameter	Load 0%	Load 100%
Cooling Load (W)	0	$\emptyset_{ful}(t_{100})$
Outdoor Temperature (°C)	$t_0 = 20$	$t_{100} = 35$

where t_0 is the outdoor temperature at 0% load, t_{100} is the outdoor temperature at 100% load, and $\emptyset_{ful}(t_{100})$ is the cooling capacity at t_{100} at full load operation condition.

Table 7. Outdoor Temperature Bin Distribution for Cooling

Bin number j	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Total
Outdoor temperature t_j °C	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	-
Bin hours	100	139	165	196	210	215	210	181	150	120	75	35	11	6	4	1817

4.2.2 Heating Seasonal Performance Factor (HSPF)

The HSPF, F_{HSP}, shall be calculated as follows:

$$F_{HSP} = \frac{L_{HST}}{C_{HSE}} \quad \text{...Eq. 2}$$

Where L_{HST} is the heating seasonal total load (HSTL) and C_{HSE} is the heating seasonal energy consumption (HSEC) to be calculated in accordance with ISO 16358-2:2013 in Wh by using the defined heating load and the outdoor temperature distribution specified in Table 68 and Table 9.

Table 8. Defined Heating Load

Parameter	Load 0%	Load 100%
Heating Load (W)	0	$0.82 \times \emptyset_{ful}(7)$
Outdoor Temperature (°C)	$t_0 = 17$	$T_{100} = 0$

where t_0 is the outdoor temperature at 0% load, t_{100} is the outdoor temperature at 100% load, and $\emptyset_{ful}(t_{100})$ is the heating capacity at t_{100} at full load operation condition.

Table 9. Outdoor Temperature Bin Distribution for Heating

Bin number j	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	Total
Outdoor temperature t_j °C	-1	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	-
Bin hours	4	15	33	68	119	169	200	234	250	260	265	260	245	215	192	151	110	76	2866

4.2.3 Ductless Split and Self-Contained Air Conditioners

Cooling performance for all ductless split and self-contained air conditioners, except for portable air conditioners, within the scope of this standard shall meet or exceed the energy performance levels in Table 10, represented by the CSPF metric.

For a product to meet the higher performance grades and use the recognition on the product label, it shall meet or exceed the levels in Table 10.

Table 10. Minimum CSPF Requirements for Air Conditioners

Category	CSPF (CONSIDERATION 2024)	CSPF (CONSIDERATION 2027 and beyond)
CC≤ 4.5 kW	4.50	6.10
4.5 kW < CC ≤ 9.5 kW	4.20	5.10
9.5 kW < CC ≤ 16.0 kW	3.80	4.50
Outdoor Temperature Bin Hours	Table 7 (Table 3 in ISO 16358-1:2013)	

CC: cooling capacity.

Table 11. Labeling Requirements for Air Conditioners

Category	Low	Intermediate 1	Intermediate 2	High
CC≤ 4.5 kW	4.50 ≤ CSPF < 6.10	6.10 ≤ CSPF < 7.10	7.10 ≤ CSPF < 8.00	8.00 ≤ CSPF
4.5 kW < CC ≤ 9.5 kW	4.20 ≤ CSPF < 5.10	5.10 ≤ CSPF < 6.40	6.40 ≤ CSPF < 7.60	7.60 ≤ CSPF
9.5 kW < CC ≤ 16.0 kW	3.80 ≤ CSPF < 4.50	4.50 ≤ CSPF < 5.80	5.80 ≤ CSPF < 7.10	7.10 ≤ CSPF
Outdoor Temperature Bin Hours	Table 7 (Table 3 in ISO 16358-1:2013)			

4.2.4 Ductless Split and Self-Contained Heat Pumps

Cooling and heating performance for all ductless split and self-contained heat pumps, except for portable heat pumps, within the scope of this standard shall meet or exceed the energy performance levels in Table 12, represented by the APF metric.

For a product to meet the higher performance grades and use the recognition on the product label, it shall meet or exceed the levels in Table 12.

Table 12. Minimum APF Requirements for Heat Pumps

Category	APF (CONSIDERATION 2024)	APF (CONSIDERATION 2027 and beyond)
CC≤ 4.5 kW	3.70	5.00
4.5 kW < CC ≤ 9.5 kW	3.30	4.00
9.5 kW < CC ≤ 16.0 kW	3.00	3.60
Outdoor Temperature Bin Hours	Table 7 (Table 3 in ISO 16358-1) Table 9 (Table 3 in ISO 16358-2)	

CC: cooling capacity.

Table 13. Labeling Requirements for Heat Pumps

Category	Low	Intermediate 1	Intermediate 2	High
CC≤ 4.5 kW	3.70 ≤ APF < 5.00	5.00 ≤ APF < 6.10	6.10 ≤ APF < 7.10	7.10 ≤ APF
4.5 kW < CC ≤ 9.5 kW	3.30 ≤ APF < 4.00	4.00 ≤ APF < 5.20	5.20 ≤ APF < 6.40	6.40 ≤ APF
9.5 kW < CC ≤ 16.0 kW	3.00 ≤ APF < 3.60	3.60 ≤ APF < 4.70	4.70 ≤ APF < 5.80	5.80 ≤ APF
Outdoor Temperature Bin Hours	Table 7 (Table 3 in ISO 16358-1:2013) Table 9 (Table 3 in ISO 16358-2:2013)			

4.2.5 Portable Air Conditioners

Cooling performance for all portable air conditioners within the scope of this standard shall meet or exceed the energy efficiency level in Table 14, represented by the EER metric.[5]

Table 14. Minimum Requirements for EER of Portable Air Conditioners

Type	EER
All	3.10

4.2.6 Portable Heat Pumps

Cooling performance for all portable heat pumps within the scope of this standard shall meet or exceed the energy efficiency level in Table 15, represented by the EER and COP metrics.

Table 15. Minimum Requirements for EER and COP of Portable Heat Pumps

Type	EER	COP
All	3.10	3.10

4.3 Functional Performance

a. All units shall be tested at a test AC voltage and rated frequency, as described in ISO 5151:2017.
b. All units shall operate appropriately with the rated voltage with surge protection +/- 15%.[6]

4.4 Refrigerant

Refrigerants used in air conditioners shall comply with requirements for ozone depletion potential (ODP) and global warming potential (GWP) over a 100-year time horizon according to Table 16.

Table 16. Requirements for Refrigerant Characteristics (numbers shown are upper limits)

	GWP	ODP
Self-Contained & Portable Systems	150	0
Ductless Split System	750	0

All units shall comply with standard ISO 5149:2014 or IEC 60335-2-40:2018, a subsequent revision, or a nationally-modified edition of ISO 5149: or IEC 60335-2-40:2018.

[5] Portable air conditioners covered by this standard are placed entirely inside the space to be conditioned, hence the performance evaluation for these products does not use outdoor temperature bin hours used for evaluating performance of other product types.
[6] Depending on national grid circumstances which cause an unstable voltage in weak grid areas, +20%/-15% may be considered.

4.5 Product Information

The original equipment manufacturer shall provide a label to the importer, product retailer, or installer before the product enters the market.

The label shall indicate:

a. Model name / number;
b. Type of unit
c. Country where the product was manufactured;
d. Rated cooling (and heating, if applicable) capacity in kW;
e. Rated maximum power consumption in kW;
f. Rated performance grade;
g. Rated energy efficiency in [CSPF, APF, EER, or COP], and yearly electricity consumption in kWh;
h. Refrigerant designation in accordance with ISO 817:2014 or ASHRAE 34:2020, including ODP and GWP.[7]

All representations of energy performance shall indicate that the performance rating is an indicative value and not representative of actual annual energy consumption in all situations. [CSPF, APF, EER or COP] shall be declared to three significant digits.

The label shall be affixed on the product in a location that is readily visible for the consumer.

Products that meet the higher performance grade requirements per Clause 4 of this standard are eligible for [TBD by country].

5. Declaration of Conformity

Compliance with the requirements of Clause 4 and any additional optional claims shall be demonstrated in the Conformity Assessment Report (CAR), which:

1) demonstrates that the product model fulfils the requirements of this standard;
2) provides any other information required to be present in the technical documentation file; and
3) specifies the reference setting and conditions in which the product complies with this standard.

The CAR shall include a test report on one sample of the model:

a. The air conditioner shall be tested at a voltage and frequency of mains electricity in the country where the unit will be sold with tolerances as specified in ISO 5151:2017.

[7] In addition, also the sound in decibels can be added as an optional requirement if a country wishes to do so. However, it should be kept in mind that sound level testing might be expensive, which is why it is not part of the above list.

b. The measured cooling capacity from cooling full capacity test at the standard cooling condition shall not be less than 95% of the rated cooling capacity of the air conditioner or the heat pump.
c. The measured power consumption from cooling full capacity test at the standard cooling condition shall not be greater than 105% of the rated power consumption of the air conditioner or the heat pump.
d. The calculated CSPF shall not be less than 95% of the rated CSPF of the air conditioner or the heat pump.
e. The measured heating capacity from heating full capacity test at the standard heating condition shall not be less than 95% of the rated heating capacity of the heat pump.
f. The measured power consumption from heating full capacity test at the standard heating condition shall not be greater than 105% of the rated power consumption of the heat pump.
g. The calculated APF shall not be less than 95% of the rated APF of the heat pump.

6. Revision

This harmonized standard shall undergo a systematic review once every five years after approval in accordance with the SADC harmonization procedures.

Annex 1: Supplemental Information

Supplemental information to the accompanying standard above

1. An Example of CSPF Calculation for Fixed Capacity System

Inputs

Parameter		Input
Full cooling capacity at 35℃	Rated	3,600 W
Full power input at 35℃	Rated	1,000 W
Full cooling capacity at 35℃, $\emptyset_{ful}(35)$	Measured	3,548 W
Full power input at 35℃, $P_{ful}(35)$	Measured	996 W
Full cooling capacity at 29℃, $\emptyset_{ful}(29)$	$1.077 \times \emptyset_{ful}(35)$	3,821 W
Full power input at 29℃, $P_{ful}(29)$	$0.914 \times P_{ful}(35)$	910 W
Degradation Coefficient, CD	Default	0.25

Results

Bin no. j	Outdoor temperature (t_j)	Bin hours	$Ø_{ful}(t_j)$	$P_{ful}(t_j)$	$L_C(t_j)$	$X(t_j)$	$F_{PL}(t_j)$	$L_{CST}(t_j)$	$C_{CSE}(t_j)$
1	21	100	4185	796	237	0.057	0.764	23,653	5,888
2	22	139	4140	810	473	0.114	0.779	65,756	16,533
3	23	165	4094	825	710	0.173	0.793	117,084	29,727
4	24	196	4049	839	946	0.234	0.808	185,442	47,532
5	25	210	4003	853	1183	0.295	0.824	248,360	64,251
6	26	215	3958	868	1419	0.359	0.840	305,128	79,654
7	27	210	3912	882	1656	0.423	0.856	347,704	91,574
8	28	181	3867	896	1892	0.489	0.872	342,500	90,985
9	29	150	3821	910	2129	0.557	0.889	319,320	85,545
10	30	120	3776	925	2365	0.626	0.907	283,840	76,669
11	31	75	3730	939	2602	0.698	0.924	195,140	53,136
12	32	35	3685	953	2838	0.770	0.943	99,344	27,265
13	33	11	3639	967	3075	0.845	0.961	33,824	9,355
14	34	6	3594	982	3311	0.922	0.980	19,869	5,537
15	35	4	3548	996	3548	1.000	1.000	14,192	3,984
CSTL (kWh)	2,601								
CSEC (kWh)	688								
CSPF	**3.78**								

Refer to ISO 16358-1 for the abbreviations and detailed calculation methods.

2. An Example of CSPF Calculation for Variable Capacity System

Inputs

Parameter		Input
Full capacity at 35℃	Rated	3,600 W
Full power input at 35℃	Rated	1,000 W
Half capacity at 35℃	Rated	1,800 W
Half power input at 35℃	Rated	400 W
Full capacity at 35℃, $\emptyset_{ful}(35)$	Measured	3,548 W
Full power input at 35℃, $P_{ful}(35)$	Measured	996 W
Half capacity at 35℃, $\emptyset_{haf}(35)$	Measured	1,774 W
Half power input at 35℃, $P_{haf}(35)$	Measured	395 W
Full capacity at 29℃, $\emptyset_{ful}(29)$	$1.077 \times \emptyset_{ful}(35)$	3,821, W
Full power input at 29℃, $P_{ful}(29)$	$0.914 \times P_{ful}(35)$	910 W
Half capacity at 29℃, $\emptyset_{haf}(29)$	$1.077 \times \emptyset_{haf}(35)$	1,911 W
Half power input at 29℃, $P_{haf}(29)$	$0.914 \times P_{haf}(35)$	361 W
Degradation Coefficient, CD	Default	0.25

Results

Bin no. j	Outdoor temperature (t_j)	Bin hours	$Ø_{ful}$ (t_j)	$Ø_{haf}$ (t_j)	P_{ful} (t_j)	P_{haf} (t_j)	P (t_j)	L_C (t_j)	X(t_j)	X(t_j)	F_{PL}(t_j)	L_{CST} (t_j)	C_{CSE} (t_j)
1	21	100	4185	2093	796	316	316	237	0.113	1.887	0.778	23,653	4,585
2	22	139	4140	2070	810	321	321	473	0.229	1.771	0.807	65,756	12,649
3	23	165	4094	2047	825	327	327	710	0.347	1.653	0.837	117,084	22,357
4	24	196	4049	2024	839	333	333	946	0.467	1.533	0.867	185,442	35,160
5	25	210	4003	2002	853	338	338	1183	0.591	1.409	0.898	248,360	46,770
6	26	215	3958	1979	868	344	344	1419	0.717	1.283	0.929	305,128	57,085
7	27	210	3912	1956	882	350	350	1656	0.846	1.154	0.962	347,704	64,642
8	28	181	3867	1933	896	355	355	1892	0.979	1.021	0.995	342,500	63,291
9	29	150	3821	1911	910	361	410	2129	1.114	0.886	1.000	319,320	61,543
10	30	120	3776	1888	925	367	481	2365	1.253	0.747	1.000	283,840	57,721
11	31	75	3730	1865	939	372	560	2602	1.395	0.605	1.000	195,140	41,998
12	32	35	3685	1842	953	378	649	2838	1.541	0.459	1.000	99,344	22,705
13	33	11	3639	1820	967	384	749	3075	1.690	0.310	1.000	33,824	8,241
14	34	6	3594	1797	982	389	864	3311	1.843	0.157	1.000	19,869	5,183
15	35	4	3548	1774	996	395	996	3548	2.000	0.000	1.000	14,192	3,984
CSTL (kWh)	2,601												
CSEC (kWh)	508												
CSPF	**5.12**												

Refer to ISO 16358-1 for the abbreviations and detailed calculation methods.

3. An Example of HSPF Calculation for Fixed Capacity System

Inputs

Parameter		Input
Full heating capacity at 7℃	Rated	4,300 W
Full power input at 7℃	Rated	1,000 W
Full heating capacity at 7℃, $\emptyset_{ful}(7)$	Measured	4,320 W
Full power input at 7℃, $P_{ful}(7)$	Measured	960 W
Full heating capacity, frosting, at 2℃, $\emptyset_{ful,f}(2)$	Measured	3765 W
Full power input, frosting, at 2℃, $P_{ful,f}(2)$	Measured	898 W
Full heating capacity at -7℃, $\emptyset_{ful}(-7)$	$0.64 \times \emptyset_{ful}(7)$	2,765 W
Full power input at -7℃, $P_{ful}(-7)$	$0.82 \times P_{ful}(7)$	787 W
Degradation Coefficient, CD	Default	0.25

Results

Bin no. j	Outdoor temperature (t_j)	Bin hours	$\emptyset_{ful}(t_j)$ or $\emptyset_{ful,f}(t_j)$	$P_{ful}(t_j)$ or $P_{ful,f}(t_j)$	$L_h(t_j)$	$X(t_j)$	$F_{PL}(t_j)$	$P_{RH}(t_j)$	$L_{HST}(t_j)$	$C_{HSE}(t_j)$
1	-1	4	3432	861	3751	1.000	1.000	861	1277	15,003
2	0	15	3543	873	3542	1.000	1.000	873	0.000	53,136
3	1	33	3654	886	3334	0.912	0.978	886	0.000	110,023
4	2	68	3765	898	3126	0.830	0.958	898	0.000	212,544
5	3	119	3876	910	2917	0.753	0.938	910	0.000	347,155
6	4	169	3987	923	2709	0.679	0.920	923	0.000	457,803
7	5	200	4098	935	2501	0.610	0.903	935	0.000	500,104
8	6	234	4209	948	2292	0.545	0.886	948	0.000	536,361
9	7	250	4320	960	2084	0.482	0.871	960	0.000	520,941
10	8	260	4431	972	1875	0.423	0.856	972	0.000	487,601
11	9	265	4542	985	1667	0.367	0.842	985	0.000	441,758
12	10	260	4653	997	1459	0.313	0.828	997	0.000	379,245
13	11	245	4764	1009	1250	0.262	0.816	1009	0.000	306,313
14	12	215	4875	1022	1042	0.214	0.803	1022	0.000	224,005
15	13	192	4987	1034	834	0.167	0.792	1034	0.000	160,033
16	14	151	5098	1046	625	0.123	0.781	1046	0.000	94,395
17	15	110	5209	1059	417	0.080	0.770	1059	0.000	45,843
18	16	76	5320	1071	208	0.039	0.760	1071	0.000	15,837
HSTL (kWh)	4,908									
HSEC (kWh)	1,254									
HSPF	**3.91**									

Refer to ISO 16358-2 for the abbreviations and detailed calculation methods.

4. An Example of HSPF Calculation for Variable Capacity System

Inputs

Parameter		Input
Full heating capacity at 7℃	Rated	4,300 W
Full power input at 7℃	Rated	1,000 W
Full heating capacity at 7℃, $\emptyset_{ful}(7)$	Measured	4,320 W
Full power input at 7℃, $P_{ful}(7)$	Measured	960 W
Full heating capacity at 7℃, $\emptyset_{haf}(7)$	Measured	2,130 W
Full power input at 7℃, $P_{haf}(7)$	Measured	276 W
Extended heating capacity, frosting, at 2℃, $\emptyset_{ext,f}(2)$	Measured	5765 W
Extended power input, frosting, at 2℃, $P_{ext,f}(2)$	Measured	1,530 W
Full heating capacity, frosting, at 2℃, $\emptyset_{ful,f}(2)$	$\emptyset_{ful}(7) \div 1.12$	3,361 W
Full power input, frosting, at 2℃, $P_{ful,f}(2)$	$P_{ful}(7) \div 1.06$	847 W
Half heating capacity, frosting, at 2℃, $\emptyset_{haf,f}(2)$	$\emptyset_{ful}(7) \div 1.12$	1,657 W
Half power input, frosting, at 2℃, $P_{haf,f}(2)$	$P_{ful}(7) \div 1.06$	244 W
Extended heating capacity, frosting, at -7℃, $\emptyset_{ext,f}(-7)$	$\emptyset_{ext}(2) \times 0.734$	4,793 W
Extended power input, frosting, at -7℃, $P_{ext,f}(-7)$	$P_{ext}(2) \div 0.877$	1,422 W
Full heating capacity at -7℃, $\emptyset_{ful}(-7)$	$\emptyset_{ful}(7) \times 0.64$	2,765 W
Full power input at -7℃, $P_{ful}(-7)$	$P_{ful}(7) \times 0.82$	787 W
Half heating capacity at -7℃, $\emptyset_{haf}(-7)$	$\emptyset_{haf}(7) \times 0.64$	1,363 W
Half power input at -7℃, $P_{haf}(-7)$	$P_{haf}(7) \times 0.82$	226 W
Extended heating capacity at 2℃, $\emptyset_{ext}(2)$	$\emptyset_{ext,f}(2) \times 1.12$	6,457 W
Extended power input at 2℃, $P_{ext}(2)$	$P_{ext,f}(2) \times 1.06$	1,622 W
Full heating capacity at 2℃, $\emptyset_{ful}(2)$	$\emptyset_{ful}(-7) + \frac{\emptyset_{ful}(7) - \emptyset_{ful}(-7)}{7-(-7)} \times (2-(-7))$	3,765 W
Full power input at 2℃, $P_{ful}(2)$	$P_{ful}(-7) + \frac{P_{ful}(7) - P_{ful}(-7)}{7-(-7)} \times (2-(-7))$	898 W
Half heating capacity at 2℃, $\emptyset_{haf}(2)$	$\emptyset_{haf}(-7) + \frac{\emptyset_{haf}(7) - \emptyset_{haf}(-7)}{7-(-7)} \times (2-(-7))$	1,856 W
Half power input at 2℃, $P_{fhaf}(2)$	$P_{haf}(-7) + \frac{P_{haf}(7) - P_{haf}(-7)}{7-(-7)} \times (2-(-7))$	258 W
Degradation Coefficient, CD	Default	0.25

Results

Bin no. j	Outdoor temperature (t_j)	Bin hours	$Ø_{ext}$(tj) or $Ø_{ext,f}(t_j)$	P_{ext}(tj) or $P_{ext,f}(t_j)$	$Ø_{ful}(t_j)$ or $Ø_{ful,f}(t_j)$	$P_{ful}(t_j)$ or $P_{ful,f}(t_j)$	$Ø_{haf}(t_j)$ or $Ø_{haf,f}(t_j)$	$P_{haf}(t_j)$ or $P_{haf,f}(t_j)$	$L_h(t_j)$	$X(t_j)$	$F_{PL}(t_j)$	$P_{RH}(t_j)$	L_{HST} (t_j)	C_{HSE} (t_j)
1	-1	4	5423	1494	3162	827	1559	238	3751	1.000	1.000	996	0	15,003
2	0	15	5537	1506	3229	834	1592	240	3542	1.000	1.000	923	0	53,136
3	1	33	5651	1518	3295	841	1625	242	3334	1.000	1.000	852	0	110,023
4	2	68	5765	1530	3361	847	1657	244	3126	1.000	1.000	720	0	212,544
5	3	119	5879	1542	3427	854	1690	246	2917	1.000	1.000	605	0	347,155
6	4	169	5993	1554	3494	861	1723	247	2709	1.000	1.000	511	0	457,803
7	5	200	6107	1566	3560	868	1755	249	2501	1.000	1.000	432	0	500,104
8	6	234	7220	0	4209	948	2075	272	2292	1.000	1.000	316	0	536,361
9	7	250	7411	0	4320	960	2130	276	2084	0.978	0.995	276	0	520,941
10	8	260	7602	0	4431	972	2185	280	1875	0.858	0.965	280	0	487,601
11	9	265	7793	0	4542	985	2240	283	1667	0.744	0.936	283	0	441,758
12	10	260	7983	0	4653	997	2294	287	1459	0.636	0.909	287	0	379,245
13	11	245	8174	0	4764	1009	2349	290	1250	0.532	0.883	290	0	306,313
14	12	215	8365	0	4875	1022	2404	294	1042	0.433	0.858	294	0	224,005
15	13	192	8556	0	4987	1034	2459	297	834	0.339	0.835	297	0	160,033
16	14	151	8747	0	5098	1046	2513	301	625	0.249	0.812	301	0	94,395
17	15	110	8938	0	5209	1059	2568	304	417	0.162	0.791	304	0	45,843
18	16	76	9128	0	5320	1071	2623	308	208	0.079	0.770	308	0	15,837
HSTL (kWh)	4,908													
HSEC (kWh)	779													
HSPF	**6.30**													

Refer to ISO 16358-2 for the abbreviations and detailed calculation methods.

5. A Comparison of ISO CSPF and RSEER

Seasonal energy efficiency ratio (SEER) metrics have been designed to estimate air conditioner (AC) performance, based on part- and full-load operations at multiple temperature conditions depending on climate. Local climatic conditions affect the amount of time an AC operates at part or full load, so climate-specific weighting is used in calculating SEER to provide a more representative measure of performance than the traditional energy-efficiency ratio (EER), typically defined as rated cooling capacity (CC) over rated power input.

The difference in seasonal efficiency metrics is primarily due to the outside temperature profiles that are used to aggregate steady-state and cyclic ratings into a seasonal efficiency value, as well as the ways of evaluating performance at part-load operation in the metric. Specific parameters to account for AC performance at part-load and/or lower-temperature operation in the efficiency metric vary by country.[8] [9] [10]

Rwanda is the country that established its standards and labels in parallel with the Model Regulation Guidelines (Guidelines) development. The Rwanda SEER (RSEER) is a recognition of the country's effort on this and is consistent with ISO CSPF the Guidelines is based on, except for using the Rwanda-specific temperature bin hours. Hence, it would be necessary to have the relationship between RSEER and ISO CSPF, although the difference is minor.

Fixed-speed (non-inverter) ACs

For fixed-speed (non-inverter) ACs, the Guidelines are based on one set of test data at full-capacity operation at 35°C, the same as the EER test, and another set of data points at 29°C calculated by predetermined equations. In this case, linear relationships among these metrics are determined as follows:

$$\text{RSEER} = 1.085 \times \text{EER}$$

$$\text{EER} = 0.922 \times \text{RSEER}$$

$$\text{ISO CSPF} = 1.062 \times \text{EER}$$

$$\text{EER} = 0.942 \times \text{ISO CSPF}$$

Variable-speed (inverter) ACs

For variable-speed (inverter) ACs, the Guidelines are based on two sets of test data at full- and half-capacity operation at 35°C and another set of data points at 29°C calculated by predetermined equations, without considering minimum-capacity operation. RSEER is approx. 3-6% greater than ISO CSPF, depending on the half-load performance. Linear regression relationships are as follows:

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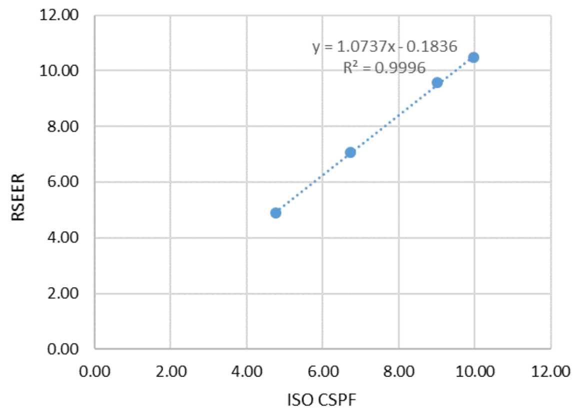
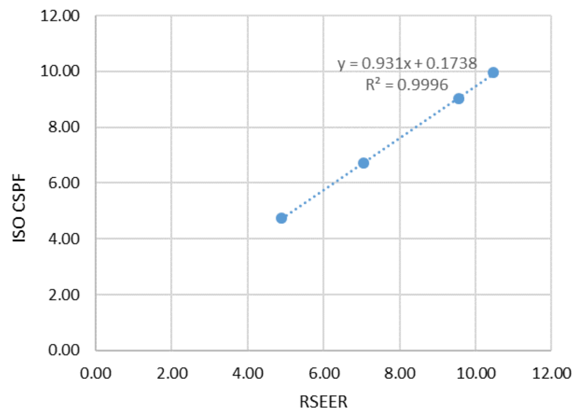
[8] Park et al. 2020. *Lost in translation: Overcoming divergent seasonal performance metrics to strengthen air conditioner energy-efficiency policies*. Energy for Sustainable Development (55) 56-68. https://doi.org/10.1016/j.esd.2020.01.003

[9] Park et al. 2021. *Harmonizing Energy-Efficiency Standards for Room Air Conditioners in Southeast Asia*. Lawrence Berkeley National Laboratory, Berkeley: CA. https://eta-publications.lbl.gov/sites/default/files/asean_ac_ee_harmonization_final_may_2021.pdf.

[10] Park et al. 2019. *Adopting a Seasonal Efficiency Metric for Room Air Conditioners: A Case Study in Brazil*. https://kigali.org.br/wp-content/uploads/2019/09/Case-Study-in-Brazil_03.pdf





RSEER= 1.074 × ISO CSPF - 0.184

ISO CSPF= 0.931 × RSEER + 0.174

6. AC Market Transition

Penetration of variable-speed units in developing and emerging economies is generally still low. Most products in developing economies are fixed-speed units that use HCFC refrigerants and have low upfront costs but are relatively inefficient. However, in Brazil, India, and South Africa, the share of variable-speed units in new sales has grown to 30–60 per cent of the markets as of 2018. The share of variable-speed units sold in China increased from 10–18 per cent in 2010 to 58–65 per cent in 2018. China has recently revised its MEPS and labels in 2020. The standard includes five grades covering both fixed- and variable-speed ACs in seasonal efficiency metrics, with Grade 5 being the threshold for fixed-speed units and Grade 3 being the threshold for variable-speed units. The minimum efficiency requirements in 2024 and 2027 for EAC and SADC member states are aligned with the Rwanda MEPS and China 2020 MEPS for variable-speed units. Anecdotal reports from China also show the market has moved significantly with fixed-speed units comprising only ~5% of the market in 2021. It is expected that the cost of inverter units will fall significantly with this increase in the market adoption in China. In a similar approach along with this trend, it would be beneficial for the countries to have the MEPS rolled out in a phased manner, improving the policy process and infrastructure.

7. Climate Groups and Countries

Countries by Climate Group

1. Secondary climate group is based on the data of ASHRAE weather data viewer 6.0.
2. * represents the climate of the largest population city or region where data available.
3. ◊ represents the climate estimated from other sources than the ASHRAE weather data.
4. The representative climate group may be subject to change with additional information.

Country	Climate Group	
	Primary	Secondary
Angola	1	1A◊
Botswana	1*, 2	1B, 2B*
Burundi	1	1A◊
Comoros	1	0A
Democratic Republic of the Congo	1	1A
Eswatini	1	3A◊
Kenya	1	0A, 0B, 1B, 2A*, 2B, 3A, 3C
Lesotho	1	3B◊
Madagascar	1	0A, 1A, 3A*
Malawi	1	3A◊
Mauritius	1	0A, 1A*, 2A
Mozambique	1	1A
Namibia	1	2B
Rwanda	1	2A◊
Seychelles	1	0A
South Africa	1*, 2, 3	1B, 2A, 2B, 3A, 3B, 3C*, 6A
South Sudan	2	0B
Uganda	1	2A◊
United Republic of Tanzania	1	0A, 1A*, 2B
Zambia	1	3A◊
Zimbabwe	1	2B, 3A*

8. Market Surveillance

The competent authority shall develop a program to check compliance with this standard and surveil the market for noncompliance. The program should include details on sample size, lab accreditation requirements (ISO/IEC 17025 certified), and a challenge process that manufacturers can utilize if the initial testing of their product is found to be out of compliance.

The competent authority will be responsible for enforcement activities that include potential assessment of penalties for non-compliant products in the country. The competent authority shall establish written policies that clearly spell out its authority, procedures, and penalties. All testing done for compliance and market surveillance testing purposes shall be done using the measurement and calculation methods set out in this standard.

9. Information on Voltage and frequency supplies in SADC member countries.

S.no	SADC Member Country	Single-Phase Voltage (Volts)	Three-Phase Voltage (Volts)	Frequency (Hertz)
1	Angola	220 V	380 V	50 Hz
2	Botswana	230 V	400 V	50 Hz
3	Comoros	220 V	380 V	50 Hz
4	Democratic Republic of Congo	220 V	380 V	50 Hz
5	Eswatini	230 V	400 V	50 Hz
6	Lesotho	220 V	380 V	50 Hz
7	Madagascar	220 V	380 V	50 Hz
8	Malawi	230 V	400 V	50 Hz
9	Mauritius	230 V	400 V	50 Hz
10	Mozambique	220 V	380 V	50 Hz
11	Namibia	220 V	380 V	50 Hz
12	Seychelles	240 V	240 V	50 Hz
13	South Africa	230 V	400 V	50 Hz
14	United Republic of Tanzania	230 V	415 V	50 Hz
15	Zambia	230 V	400 V	50 Hz
16	Zimbabwe	240 V	415 V	50 Hz

The voltages for capacity and performance tests shall be carried out in accordance with Table 2 of ISO 5151:2017.