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DRAFT EAST AFRICAN STANDARD

Air conditioning appliances for household and similar use — Minimum Energy Performance —Requirements

EAST AFRICAN COMMUNITY

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Foreword

Development of the East African Standards has been necessitated by the need for harmonizing requirements governing quality of products and services in the East African Community. It is envisaged that through harmonized standardization, trade barriers that are encountered when goods and services are exchanged within the Community will be removed.

The Community has established an East African Standards Committee (EASC) mandated to develop and issue East African Standards (EAS). The Committee is composed of representatives of the National Standards Bodies in Partner States, together with the representatives from the public and private sector organizations in the community.

East African Standards are developed through Technical Committees that are representative of key stakeholders including government, academia, consumer groups, private sector and other interested parties. Draft East African Standards are circulated to stakeholders through the National Standards Bodies in the Partner States. The comments received are discussed and incorporated before finalization of standards, in accordance with the Principles and procedures for development of East African Standards.

East African Standards are subject to review, to keep pace with technological advances. Users of the East African Standards are therefore expected to ensure that they always have the latest versions of the standards they are implementing.

The committee responsible for this document is Technical Committee EASC/TC 039, *Mechanical Engineering and Metallurgy,.*

Attention is drawn to the possibility that some of the elements of this document may be subject of patent rights. EAC shall not be held responsible for identifying any or all such patent rights.

Air conditioning appliances for household and similar use-Minimum energy performance-Requirements

1 Scope

This Draft East African Standard specifies the minimum energy performance and energy labelling requirements for 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 up to 16 kW placed on the market for any application.

This standard does not apply to:

- 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

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60335-2-40, Household and similar electrical appliances – Safety – Part 2-40: Particular requirements for electrical heat pumps, air-conditioners and dehumidifiers.

ISO 817, Refrigerants - Designation and safety classification.

ISO 5149, Refrigerating systems and heat pumps — Safety and environmental requirements.

ISO 5151, Non-ducted air conditioners and heat pumps – Testing and rating for performance

ISO 16358-1, 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, 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, Air-cooled air conditioners and air-to-air heat pumps — Testing and calculating methods for seasonal performance factors — Part 3: Annual performance factor.

ISO 18326, Non-ducted portable air-cooled air conditioners and air-to-air heat pumps having a single exhaust duct – Testing and rating for performance

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 16358 and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at http://www.iso.org/obp and http://www.electropedia.org

3.1
Annual Performance Factor (APF)
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.

3.2
Coefficient of Performance (COP)
ratio of the heating capacity in Watts to the effective power input in Watts at given rating conditions.

3.3
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.

3.4
competent authority
authority in the respective EAC member state charged with the responsibility to enforce requirements on air conditioners.

3.5
Cooling Seasonal Energy Consumption (CSEC)
total amount of energy consumed by the equipment when it is operated for cooling during the cooling season.

3.6
Cooling Seasonal Performance Factor (CSPF)
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.

3.7
Cooling Seasonal Total Load (CSTL)
total annual amount of heat that is removed from the indoor air when the equipment is operated for cooling in active mode.

3.8
non-ducted portable air-cooled air conditioner having a single exhaust duct
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.

3.9
Energy Efficiency Ratio (EER)
ratio of the total cooling capacity to the effective power input to the device at given rating conditions.

3.10
Seasonal Energy Efficiency Ratio (SEER)
ratio of the total annual cooling energy delivered by a system to the total annual electrical energy consumed by that system

3.11
fixed capacity unit
type of equipment that does not have the possibility to change its capacity.

3.12
Global Warming Potential (GWP)
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.

3.13
Heating Seasonal Total Load (HSTL)
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.

3.14
Heating Seasonal Energy Consumption (HSEC)
total annual amount of energy consumed by the equipment, including make-up heat, when it is operated for heating in active mode.

3.15
Heating Seasonal Performance Factor (HSPF)
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.

3.16
indoor unit
cabinet of a split system that is located indoors and provides the evaporation and air movement mechanism located on a floor, wall or ceiling.

3.17
multi-stage capacity unit
equipment where the capacity is varied by three or four steps.

3.18
outdoor unit
cabinet of a split system that is located outdoors and provides capacity to condense refrigerant.

3.19
Ozone Depletion Potential (ODP)
amount of degradation to the stratospheric ozone layer an emitted refrigerant causes relative to trichlorofluoromethane (CFC-11)

3.20
refrigerant
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.

3.23
split unit (single)
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.

3.24
self-contained unit
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).

3.25
two (2)-stage capacity unit
equipment where the capacity is varied by two steps

3.26
variable capacity unit
equipment where the capacity is varied by five or more steps to represent continuously variable capacity.

3.27

Bin

a statistical class (sometimes, a class interval) for outdoor air temperature with the class limits expressed in a temperature unit

3.28

bin number

bin number is the number of temperature bins (number of hours associated with groups of temperatures.

3.29

total cooling capacity

amount of sensible and latent heat that the equipment can remove from the conditioned space in a defined interval of time

Note 1 to entry: Total cooling capacity is expressed in units of watts

3.30

Heating capacity

Amount of heat that the equipment can add to the conditioned space (but not including supplementary heat) in a defined interval of time.

Note 1 to entry: Heating capacity is expressed in units of watts

3.31

Full load operation

Operation with the equipment and controls configured for the maximum continuous duty refrigeration capacity specified by the manufacturer and allowed by the unit controls.

Note 1 to entry: unless otherwise regulated by the automatic controls of the equipment, all indoor units and compressors operate during full load operations

4 Requirements

For ductless split systems, all parties (companies or individuals) shall identify pairs of indoor and outdoor units that jointly comprise the rated product. Sale or installation of cabinet units not identified as a matched pair shall not be allowed, as defined by the competent authority.

4.1 Test methods and energy performance calculation

4.1.1The tests shall be non-destructive.

4.1.2 Compliance with the energy performance requirements shall be tested according to ISO 16358 which refer to ISO 5151. 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.

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 (T1 moderate climate) Standard cooling capacity	27 °C / 19 °C (ISO 5151 T1)	35 °C / 24 °C (ISO 5151 T1)
ISO 16358-1 (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 Standard heating capacity		7 °C / 6 °C (ISO 5151 H1)
ISO 16358-2 Low temperature heating capacity	20 °C / 15 °C (maximum)	2 °C / 1 °C (ISO 5151 H2)
ISO 16358-2 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. Determining the CSPF and the APF requires testing products according to ISO 16358 and calculating the efficiency performance by using outdoor temperature bin data specified in ISO 16358. Reference test standards may be found in Table 3.

Table 3 — Reference standards for test methods and energy performance calculations

Temperature and humidity conditions and default values for cooling efficiency test at T1 for moderate climate *	ISO 16358-1, Table 1
Test methods for cooling efficiency	ISO 16358-1, Chapter 5
Cooling efficiency calculations	ISO 16358-1, 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)
Temperature and humidity conditions and default values for heating efficiency test	ISO 16358-2, Table 1
Temperature and humidity conditions and default values for cooling efficiency test at T3 for hot climate	ISO 16358-1, Table F.1
Test methods for heating efficiency	ISO 16358-2, Chapter 4
Heating efficiency calculations	ISO 16358-2, 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, 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

<table>
<tr><th colspan="2">Operating condition</th><th>Fixed</th><th>Two-stage</th><th>Multi-stage</th><th>Variable</th></tr>
<tr><td>Full capacity and power input</td><td rowspan="3">Standard Temperature
Outdoor
DB 35°C / WB 24°C
Indoor
DB 27°C / WB 19°C</td><td>Required</td><td>Required</td><td>Required</td><td>Required</td></tr>
<tr><td>Half capacity and power input</td><td>-[a]</td><td>-</td><td>Default[c]</td><td>Required</td></tr>
<tr><td>Minimum capacity and power input</td><td>-</td><td>Default[c]</td><td>-</td><td>-</td></tr>
<tr><td>Full capacity and power input</td><td rowspan="3">Low Temperature
Outdoor
DB 29°C / WB 19°C
Indoor
DB 27°C / WB 19°C</td><td>Default[b]</td><td>Default[b]</td><td>Default[b]</td><td>Default[b]</td></tr>
<tr><td>Half capacity and power input</td><td>-</td><td>-</td><td>Required</td><td>Default[b]</td></tr>
<tr><td>Minimum capacity and power input</td><td>-</td><td>Required</td><td>-</td><td>-</td></tr>
<tr><td colspan="6">[a] '-' represents Not applicable or Not considered.
[b] Performance at the lower temperature shall be calculated by using predetermined equations as below:
$\boldsymbol{Full\ Capacity(29°C) = Full Capacity(35°C) \times 1.077;}$
$\boldsymbol{Full\ Power\ input(29°C) = Full\ Power\ input(35°C) \times 0.914}$
$\boldsymbol{Half\ Capacity(29°C) = Half\ Capacity(35°C) \times 1.077;}$
$\boldsymbol{Half\ Power\ input(29°C) = Half\ Power\ input(35°C) \times 0.914}$
[c] Performance at the standard temperature shall be calculated by using predetermined equations as below:
$\boldsymbol{Half\ Capacity(35°C) = Half\ Capacity(29°C) \div 1.077;}$
$\boldsymbol{Half\ Power\ input(35°C) = Half\ Power\ input(29°C) \div 0.914}$
$\boldsymbol{Min\ Capacity(35°C) = Min\ Capacity(29°C) \div 1.077;}$
$\boldsymbol{Min\ Power\ input(35°C) = Min\ Power\ input(29°C) \div 0.914}$</td></tr>
</table>

Table 5 — Test requirements for HSPF

Operating condition		Fixed	Two-stage	Multi-stage	Variable
Full capacity $\varnothing_{ful}(7)$ 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 $\varnothing_{haf}(7)$ and power input $P_{haf}(7)$		-[a]	-	Required	Required
Minimum capacity $\varnothing_{min}(7)$ and power input $P_{min}(7)$		-	Required	-	-
Extended capacity $\varnothing_{ext,f}(2)$ 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 $\varnothing_{ext}(2)$ and power input $P_{ext}(2)$		-	-	Default[c]	Default[c]
Full capacity $\varnothing_{ful,f}(2)$ and power input $P_{ful,f}(2)$		Required	Required	Default[b,d] or Required	Default[b,d] or Required
Half capacity $\varnothing_{haf,f}(2)$ and power input $P_{haf,f}(2)$		-	-	Default[e]	Default[e]
Minimum capacity $\varnothing_{min,f}(2)$ and power input $P_{min,f}(2)$		-	Default[f]	-	-
Extended capacity $\varnothing_{ext}(-7)$ and power input $P_{ext}(-7)$		-	-	Default[g]	Default[g]
Full capacity $\varnothing_{ful}(-7)$ and power input $P_{ful}(-7)$		Default[h]	Default[h]	Default[h]	Default[h]
Half capacity $\varnothing_{haf}(-7)$ and power input $P_{haf}(-7)$		-	-	Default[i]	Default[i]
Minimum capacity $\varnothing_{min}(-7)$ 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] $\varnothing_{ext}(2) = \varnothing_{ext,f}(2) \times 1.12$; $P_{ext}(2) = P_{ext,f}(2) \times 1.06$

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

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

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

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

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

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

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

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

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

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

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

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

4.2 Standard cooling capacity and heating capacity tests

The standard cooling capacity tests, if applicable, shall be conducted in accordance with ISO 5151 and ISO 16358-1.

a) The cooling full capacity test shall be conducted at full load operating conditions.

b) 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.

The standard heating capacity tests, if applicable, shall be conducted in accordance with ISO 5151 and ISO 16358-2.

a) The heating full capacity test shall be conducted at full load operating conditions.

b) 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.

4.3 Low temperature cooling capacity and heating capacity tests

The low temperature cooling capacity tests, if applicable, shall be conducted in accordance with ISO 5151 and ISO 16358-1.

For multi-stage units, if 50% heating capacity is not achievable, then the test shall be conducted at the next step above 50%.

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.

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

The cooling capacity and its corresponding effective power input shall be measured in accordance with ISO 5151 and ISO 16358-1.

The heating capacity and its corresponding effective power input shall be measured in accordance with ISO 5151 and ISO 16358-2.

4.5 Maximum Cooling Performance and Heating Performance Tests

The maximum cooling performance test shall be conducted in accordance with the test method and performance requirements as specified in ISO 5151.

The maximum heating performance test shall be conducted for heat pumps in accordance with the test methodology and performance requirements as specified in ISO 5151.

4.6 Energy efficiency

4.6.1 Cooling Seasonal Performance Factor (CSPF)

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

$$F_{CSP} = \frac{L_{CST}}{C_{CSE}} \quad \ldots (1)$$

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 16358-1in 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)	$t_0 = 20$	$t_{100} = 35$

- t_0 is the outdoor temperature at 0% load,
- t_{100} is the outdoor temperature at 100 % load
- $\emptyset_{ful}(t_{100})$ 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

4.6.2 Heating Seasonal Performance Factor (HSPF)

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

$$F_{HSP} = \frac{L_{HST}}{C_{HSE}} \quad \ldots (2)$$

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 in Wh by using the defined heating load and the outdoor temperature distribution specified in Table **6**8 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)	$t_0 = 17$	$T_{100} = 0$

- 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 t100 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

4.6.3 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)	

CC: cooling capacity.

Table 11-Energy rating classification for Air Conditioners

Category	E	D	C	B	A
CC≤ 4.5 kW	4.50 ≤ CSPF < 5.40	5.40 ≤ CSPF < 6.30	6.30 ≤ CSPF < 7.20	7.20 ≤ CSPF < 8.10	8.10 ≤ CSPF
4.5 kW < CC ≤ 9.5 kW	4.20 ≤ CSPF < 5.1	5.1 ≤ CSPF < 6.0	6.0 ≤ CSPF < 6.8	6.8 ≤ CSPF < 7.60	7.60 ≤ CSPF
9.5 kW < CC ≤ 16.0 kW	3.80 ≤ CSPF < 4.6	4.6 ≤ CSPF < 5.5	5.5 ≤ CSPF < 6.3	6.3 ≤ CSPF < 7.10	7.10 ≤ CSPF
Outdoor Temperature Bin Hours		(Table 3 in ISO 16358-1)			

4.6.4 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 11, 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 11.

Table 11 — 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 12 — Labelling requirements for heat pumps

Category	E	D	C	B	A
CC≤ 4.5 kW	3.70 ≤ APF < 4.6	4.6 ≤ APF < 5.4	5.4 ≤ APF < 6.3	6.3 ≤ APF < 7.1	7.10 ≤ APF
4.5 kW < CC ≤ 9.5 kW	3.30 ≤PF < 4.10	4.1 ≤ APF < 4.9	4.90 ≤ APF < 5.6	5.6 ≤ APF < 6.4	6.40 ≤ APF

4.6.5 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 13, represented by the EER metric. 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.

Table 13 — Minimum Requirements for EER of Portable Air Conditioners

Type	EER
All	3.10

4.6.6 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 14, represented by the EER and COP metrics.

Table 14 — Minimum requirements for EER and COP of portable heat pumps

Type	EER	COP
All	3.10	3.10

4.7 Functional performance

All units shall be tested at a test AC voltage and rated frequency, as described in ISO 5151.

All units shall operate appropriately with the rated voltage with surge protection +/- 15%. Depending on national grid circumstances which cause an unstable voltage in weak grid areas, +20%/-15% may be considered.

4.8 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 15.

Table 15 — 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 or IEC 60335-2-40.

5 Labelling/marking

The marking affixed on the product shall be legible and indelible with the following

:

a) model number;

b) serial number

c) supply voltage

d) type of unit;

e) country of origin;

f) rated performance grade;

g) annual energy consumption in kWh at ambient temperature in °C or °F;

h) reference ambient temperature[s] used in performance rating;

i) refrigerant and foam-blowing designation in accordance with ISO 817 including ODP and GWP.

k) Rated cooling (and heating, if applicable) capacity in Kw or BTU/h;

l) Rated power consumption in kW;

m) Rated energy performance rating (A, B, C, D or E);

n) Rated energy efficiency in [CSPF, APF, EER, or COP] and, yearly electricity consumption in kWh

6: sampling requirements

2 complete units of each size and model shall be sampled per consignment.

8: Label placement

Each air conditioner shall have an energy guide label visibly attached to the front of the unit. Label requirements are as specified in Annex B


ENERGY LABEL
REFRIGERATOR
XXXXXXXXXXXXXX
Most Efficient
4
Least Efficient
175
kWh/annum
MORE STARS, MORE SAVINGS
Serial Number: xxxxxxx
Brand: xxxxxxx
Model: xxxxxxx

Annex A
informative)

Supplemental information

A.1 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	$\emptyset_{ful}(t_j)$	$P_{ful}(t_j)$	$L_C(t_j)$	$X(t_j)$	$F_{PL}(t_j)$	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.

A.2 Example of CSPF Calculation for Variable Capacity System

Power 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℃, $\boldsymbol{\emptyset_{ful}(35)}$	Measured	3,548 W
Full power input at 35℃, $\boldsymbol{P_{ful}(35)}$	Measured	996 W
Half capacity at 35℃, $\boldsymbol{\emptyset_{haf}(35)}$	Measured	1,774 W
Half power input at 35℃, $\boldsymbol{P_{haf}(35)}$	Measured	395 W
Full capacity at 29℃, $\boldsymbol{\emptyset_{ful}(29)}$	1.077 × $\boldsymbol{\emptyset_{ful}(35)}$	3,821, W
Full power input at 29℃, $\boldsymbol{P_{ful}(29)}$	0.914 × $\boldsymbol{P_{ful}(35)}$	910 W
Half capacity at 29℃, $\boldsymbol{\emptyset_{haf}(29)}$	1.077 × $\boldsymbol{\emptyset_{haf}(35)}$	1,911 W
Half power input at 29℃, $\boldsymbol{P_{haf}(29)}$	0.914 × $\boldsymbol{P_{haf}(35)}$	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_{CS} (t_j)
1	21	100	4185	2093	796	316	316	237	0.113	1.887	0.778	23,653	4,58
2	22	139	4140	2070	810	321	321	473	0.229	1.771	0.807	65,756	12,6
3	23	165	4094	2047	825	327	327	710	0.347	1.653	0.837	117,084	22,3
4	24	196	4049	2024	839	333	333	946	0.467	1.533	0.867	185,442	35,1
5	25	210	4003	2002	853	338	338	1183	0.591	1.409	0.898	248,360	46,7
6	26	215	3958	1979	868	344	344	1419	0.717	1.283	0.929	305,128	57,0
7	27	210	3912	1956	882	350	350	1656	0.846	1.154	0.962	347,704	64,6
8	28	181	3867	1933	896	355	355	1892	0.979	1.021	0.995	342,500	63,2
9	29	150	3821	1911	910	361	410	2129	1.114	0.886	1.000	319,320	61,5
10	30	120	3776	1888	925	367	481	2365	1.253	0.747	1.000	283,840	57,7
11	31	75	3730	1865	939	372	560	2602	1.395	0.605	1.000	195,140	41,9

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.

A.3 Example of HSPF Calculation for Fixed Capacity System

Power 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℃, $\boldsymbol{\varnothing_{ful}(7)}$	Measured	4,320 W
Full power input at 7℃, $\boldsymbol{P_{ful}(7)}$	Measured	960 W
Full heating capacity, frosting, at 2℃, $\boldsymbol{\varnothing_{ful,f}(2)}$	Measured	3765 W
Full power input, frosting, at 2℃, $\boldsymbol{P_{ful,f}(2)}$	Measured	898 W
Full heating capacity at -7℃, $\boldsymbol{\varnothing_{ful}(-7)}$	0.64 × $\boldsymbol{\varnothing_{ful}(7)}$	2,765 W
Full power input at -7℃, $\boldsymbol{P_{ful}(-7)}$	0.82 × $\boldsymbol{P_{ful}(7)}$	787 W
Degradation Coefficient, CD	Default	0.25

Results

Bin no. j	**Outdoor temperature (t$_j$)**	**Bin hours**	**$\varnothing_{ful}(t_j)$ or $\varnothing_{ful,f}(t_j)$**	**$P_{ful}(t_j)$ 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.

A.4 A.4 Example of HSPF Calculation for Variable Capacity System

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℃, $Ø_{ful}(7)$	Measured	4,320 W
Full power input at 7℃, $P_{ful}(7)$	Measured	960 W
Full heating capacity at 7℃, $Ø_{haf}(7)$	Measured	2,130 W
Full power input at 7℃, $P_{haf}(7)$	Measured	276 W
Extended heating capacity, frosting, at 2℃, $Ø_{ext,f}(2)$	Measured	5765 W
Extended power input, frosting, at 2℃, $P_{ext,f}(2)$	Measured	1,530 W
Full heating capacity, frosting, at 2℃, $Ø_{ful,f}(2)$	$Ø_{ful}(7) \div 1.12$	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℃, $Ø_{haf,f}(2)$	$Ø_{ful}(7) \div 1.12$	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℃, $Ø_{ext,f}(-7)$	$Ø_{ext}(2) \times 0.734$	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℃, $Ø_{ful}(-7)$	$Ø_{ful}(7) \times 0.64$	2,765 W
Full power input at -7℃, $P_{ful}(-7)$	$P_{ful}(7) \times 0.82$	787 W
Half heating capacity at -7℃, $Ø_{haf}(-7)$	$Ø_{haf}(7) \times 0.64$	1,363 W
Half power input at -7℃, $P_{haf}(-7)$	$P_{haf}(7) \times 0.82$	226 W
Extended heating capacity at 2℃, $Ø_{ext}(2)$	$Ø_{ext,f}(2) \times 1.12$	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℃, $Ø_{ful}(2)$	$Ø_{ful}(-7) + \frac{Ø_{ful}(7) - Ø_{ful}(-7)}{7-(-7)} \times (2-(-7))$	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℃, $Ø_{haf}(2)$	$Ø_{haf}(-7) + \frac{Ø_{haf}(7) - Ø_{haf}(-7)}{7-(-7)} \times (2-(-7))$	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

Outdoor emperatur e (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
1	4	5423	1494	3162	827	1559	238	3751	1.000	1.000	996	0	15,003
	15	5537	1506	3229	834	1592	240	3542	1.000	1.000	923	0	53,136
	33	5651	1518	3295	841	1625	242	3334	1.000	1.000	852	0	110,023

[illegible]	2	68	5765	1530	3361	847	1657	244	3126	1.000	1.000	720	0	
[illegible]	3	119	5879	1542	3427	854	1690	246	2917	1.000	1.000	605	0	
[illegible]	4	169	5993	1554	3494	861	1723	247	2709	1.000	1.000	511	0	
[illegible]	5	200	6107	1566	3560	868	1755	249	2501	1.000	1.000	432	0	
[illegible]	6	234	7220	0	4209	948	2075	272	2292	1.000	1.000	316	0	
[illegible]	7	250	7411	0	4320	960	2130	276	2084	0.978	0.995	276	0	
10	8	260	7602	0	4431	972	2185	280	1875	0.858	0.965	280	0	
11	9	265	7793	0	4542	985	2240	283	1667	0.744	0.936	283	0	
12	10	260	7983	0	4653	997	2294	287	1459	0.636	0.909	287	0	
13	11	245	8174	0	4764	1009	2349	290	1250	0.532	0.883	290	0	
14	12	215	8365	0	4875	1022	2404	294	1042	0.433	0.858	294	0	
15	13	192	8556	0	4987	1034	2459	297	834	0.339	0.835	297	0	
16	14	151	8747	0	5098	1046	2513	301	625	0.249	0.812	301	0	
17	15	110	8938	0	5209	1059	2568	304	417	0.162	0.791	304	0	
18	16	76	9128	0	5320	1071	2623	308	208	0.079	0.770	308	0	
HST kWh	4,908													
HSE C kWh	779													
HSP F	**6.30**													

A.5 Information on Voltage and frequency supplies in EAC member countries.

S.no	EAC Member Country	Single-Phase Voltage (Volts)	Three-Phase Voltage (Volts)	Frequency (Hertz)
1	Democratic Republic of the Congo	220 V	380 V	50 Hz
2	Republic of Burundi	220 V	380 V	50 Hz
3	Republic of Kenya	240 V	415 V	50 Hz
4	Republic of Rwanda	230 V	400 V	50 Hz
5	Republic of South Sudan	230 V	400 V	50 Hz
6	Republic of Uganda	240 V	415 V	50 Hz
7	United Republic of Tanzania	230 V	415 V	50 Hz

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

Bibliography

Handbook for the Montreal Protocol on Substances that Deplete the Ozone Layer, Twelfth Edition, annexes A, B, C, and F.