UN environment

SUPPLEMENT TO THE AIR CONDITIONERS POLICY GUIDE:
«ACCELERATING THE GLOBAL ADOPTION OF ENERGY-EFFICIENT AND CLIMATE-FRIENDLY AIR CONDITIONERS»

MODEL REGULATION GUIDELINES

SEPTEMBER 2019

ENERGY-EFFICIENT AND CLIMATE-FRIENDLY AIR CONDITIONERS

U4E United for Efficiency

KIGALI COOLING EFFICIENCY PROGRAM

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United Nations Environment Programme – Global Environment Facility | United for Efficiency (U4E)

Acknowledgements

The lead authors, Brian Holuj of UNEP's United for Efficiency Initiative, Won Young Park and Nihar Shah of Lawrence Berkeley National Laboratory, and Noah Horowitz and Alex Hillbrand of the Natural Resources Defense Council would like to thank the following for their valuable contributions as reviewers:

Rashid Ali Abdallah African Energy Commission
Atef Marzouk African Union Commission - Energy Division
Fatih Demiray Arçelik A.Ş.
Marcello Padilla Chile Ministry of Energy
Li Pengcheng China National Institute of Standardization
Marie Baton CLASP
Naomi Wagura CLASP
Hilde Dhont Daikin Europe
Philipp Munzinger GIZ
Miriam Frisch GIZ
Fred Ishugah East African Centre of Excellence for Renewable Energy and Efficiency
Michael Kiza East African Centre of Excellence for Renewable Energy and Efficiency
Charles Diarra ECOWAS Centre for Renewable Energy and Energy Efficiency
Viktor Sundberg Electrolux
S.P. Garnaik Energy Efficiency Services Limited
Han Wei Energy Foundation China
Antoine Durand Fraunhofer ISI
Nora Steurer Global Alliance for Buildings and Construction
Miquel Pitarch HEAT
Bassam Elassaad Independent Consultant
Anett Matbadal Independent Consultant
James Wolf Independent Consultant
Frank Gao International Copper Association
Hal Stillman International Copper Association
Kerry Song International Copper Association
Kevin Lane International Energy Agency
John Dulac International Energy Agency
Chiara Delmastro International Energy Agency
Sommai Phon-Amnuaisuk International Institute for Energy Conservation
Didier Coulomb International Institute of Refrigeration
Norio Takahashi Johnson Controls - Hitachi Air Conditioning
Gabrielle Dreyfus Kigali Cooling Efficiency Program
Dae Hoon Kim Korea Refrigeration & Air Conditioning Assessment Center
Hee Jeong Kang Korea Refrigeration & Air Conditioning Assessment Center
Jinho Yoo Korea Refrigeration & Air Conditioning Assessment Center
Jun Young Choi Korea Testing Laboratory
Bum Young Kim LG Electronics
Tony Hong LG Electronics
Juan Rosales Mabe
Takashi Okazaki Mitsubishi Electric US
Fabio García Organización Latinoamericana de Energía (OLADE)
Jaime Guillén Organización Latinoamericana de Energía (OLADE)
Asad Mahmood Pakistan National Energy Efficiency & Conservation Authority
Sara Ibrahim Regional Center for Renewable Energy and Energy Efficiency
Maged Mahmoud Regional Center for Renewable Energy and Energy Efficiency
Kudakwashe Ndhlukula SADC Centre for Renewable Energy and Energy Efficiency
Hong Seok Jun Samsung Electronics
Hyun Seok Jung Samsung Electronics
Li Jiong Sanhua Holding Group
Lin-Jie Huang Sanhua Holding Group
Ousmane Sy Senegalese Association of Engineers and Refrigeration Technicians
Stephen Cowperthwaite UK Department for Environment, Food and Rural Affairs
Helena Rey De Assis UNEP Sustainable Tourism
Madeleine Edl UNEP U4E
Marco Duran UNEP U4E
Patrick Blake UNEP U4E
Paul Kellett UNEP U4E
Souhir Hammami UNEP U4E
Eric Antwi-Agyei UNEP U4E ECOWAS Refrigerators and ACs Initiative
Morris Kayitare UNEP U4E Rwanda Cooling Initiative
Paul Waide Waide Strategic Efficiency
Marco Spuri Whirlpool
Ashok Sarkar World Bank Group
Omar Abdelaziz Zewail City of Science and Technology

Foreword

The Model Regulation Guidelines supplement the United for Efficiency (U4E) Air Conditioner Policy Guide, "Accelerating the Global Adoption of Energy-Efficient and Climate-Friendly Air Conditioners."[1] It is voluntary guidance for governments in developing and emerging economies that are considering a regulatory or legislative framework that requires new room air conditioners to be energy-efficient and to use refrigerants with a lower global warming potential (GWP) than typical legacy refrigerants, and to ban the importation of used products. It covers products commonly used in residential and light commercial applications. An accompanying Supporting Information Document includes the underlying rationale and methodologies.

Today, less than 10 per cent of people in developing and emerging economies own air conditioners. As economies and populations grow, it is expected that energy used for space cooling will triple by 2050, and that the stock in developing and emerging economies will rise from 900 million in 2019 to 1.5 billion in 2030.[2] Space cooling, appliances and other plug loads are the fastest-growing energy end uses in buildings.[3] Cooling is critical for occupant health, student and employee productivity, manufacturing processes, data centers, and research. The key is expanding cooling access while mitigating energy and environmental impacts.

Improving energy efficiency has a profound impact on the cost to own and operate these devices. Minimum Energy Performance Standards (MEPS) and energy labels, if well-designed and implemented, are some of the fastest and most effective approaches to improve efficiency. While dozens of countries have MEPS and energy labels, many are outdated or unenforced. Inadequate MEPS and labels leave countries vulnerable as dumping grounds for products that cannot be sold elsewhere. China's MEPS and labels that are expected to take effect in 2022 should have significant impacts on the cost and availability of energy-efficient air conditioners globally given the size of the domestic and export markets.

Typical air conditioners require electricity and a refrigerant gas to operate. When electricity comes from fossil fuel power plants – which is the case for nearly 75 per cent of the electricity in non-OECD countries – greenhouse gasses and air pollution are emitted. Many refrigerants have a global warming potential that is well over 1,000 times as potent as an equivalent molecule of carbon dioxide. Fortunately, technologies are widely available to improve energy efficiency and use refrigerants with lower global warming potential.

[1] Policy Guide is available at https://united4efficiency.org/wp-content/uploads/2017/06/U4E-ACGuide-201705-Final.pdf

[2] Policy Guide page 29

[3] Global Alliance for Buildings and Construction Global Status Report 2018 page 13, available at https://globalabc.org/uploads/media/default/0001/01/f64f6de67d55037cd9984cc29308f3609829797a.pdf

Under the Kigali Amendment to the Montreal Protocol, countries will phase-down hydrofluorcarbons (HFCs) by over 80 per cent over the next 30 years. The climate benefits are significantly enhanced by improving energy efficiency while phasing down HFCs. U4E co-organised capacity building "Twinning" workshops for senior energy and environment officials from nearly 130 countries in 2018 and again in 2019 on sustainable cooling solutions. Many attendees expressed concerns about setting disjointed policies that only address efficiency or refrigerants and requested guidance on MEPS and labels that address both topics.

U4E consulted dozens of experts from various sectors and regions to assess best practices and new developments. The aim has been to balance ambitious energy performance and refrigerant requirements while limiting adverse impacts on the upfront costs and availability of products. Further evaluations (e.g. market assessments, and consumer, utility and manufacturer impact analyses) are needed before pursuing such guidance. The contents were developed assuming interested countries would put them into effect in approximately 2023, but the timing and text should be adjusted to whenever and however is most appropriate. While commonly-used standards are referenced, countries may be familiar with others that work well for their context.

Each country has unique characteristics. This general guidance is intended as a starting point to inform regulatory considerations rather than a final template to adopt. Regulatory processes should be undertaken transparently and with sufficient time to address local circumstances (e.g. availability and prices of products, income levels, utility tariffs, etc.). It is typically led by an energy ministry with the support of a national standards body and conducted in consultation with many experts from the public and private sectors, and civil society.[4] The National Ozone Unit (often in the environment ministry) should be closely involved in this process.

Countries committed to market transformation and prepared to invest in the requisite market assessment, impact analyses, stakeholder consultations, monitoring, verification, enforcement, awareness raising, and beyond should strongly consider mandatory MEPS and labels. A comprehensive approach also includes mandatory, performance-based building energy codes. Neighboring countries should align where practicable to reduce the complexity and cost of compliance for manufacturers and alleviate some of the oversight and enforcement challenges for officials. Consistent approaches across countries helps yield economies of scale for products that save consumers money on electricity bills, reduce air pollution, mitigate greenhouse gas emissions, and enable greater electrical grid stability.[5] U4E hopes that this guidance is helpful with unlocking the many benefits of energy-efficient and climate-friendly cooling.

[4] See figure 2.9 on page 60 of the Report on the Issues Related to Energy Efficiency while Phasing Down HFCs for additional context, available at http://conf.montreal-protocol.org/meeting/mop/mop30/presession/Background-Documents/TEAP_DecisionXXIX-10_Task_Force_EE_September2018.pdf

[5] For an approximation of the electricity and greenhouse gas impacts of adopting the model regulation guidance, see the U4E Country Savings Assessments at https://united4efficiency.org/countries/country-assessments

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For more information, contact:

United Nations Environment Programme –
United for Efficiency initiative
Economy Division
Energy, Climate, and Technology Branch
1 Rue Miollis, Building VII
75015, Paris
FRANCE
Tel: +33 (0)1 44 37 14 50
Fax: +33 (0)1 44 37 14 74
E-mail: u4e@un.org
http://united4efficiency.org/

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Acronyms

APF	annual performance factor
ASEAN	Association of Southeast Asian Nations
ANSI	American National Standards Institute
ASHRAE	American Society of Heating, Refrigerating and Air-Conditioning Engineers
CAR	Conformity Assessment Report
CSEC	Cooling Seasonal Energy Consumption
CSPF	cooling seasonal performance factor
CSTL	Cooling Seasonal Total Load
COP	Coefficient of Performance
GWP	global warming potential
HSEC	Heating Seasonal Energy Consumption
HSPF	Heating Seasonal Performance Factor
HSTL	Heating Seasonal Total Load
IEC	International Electrotechnical Commission
ISO	International Organization for Standardization
RT	refrigeration ton
TDB	to be determined
ODP	Ozone Depletion Potential

Article 1. Scope of Covered products

1.1 Scope

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

1.2 Exemptions

Air conditioners and heat pumps 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, and ducted equipment are exempt from this regulation.

Article 2. Terms & Definitions

Definitions of the relevant terms in this document are listed, below. Unless otherwise specified, these definitions are harmonized with definitions in ISO 16358:2013 “Air-cooled air conditioners and air-to-air heat pumps — Testing and calculating methods for seasonal performance factors (Part 1, 2, and 3)”, 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”, and ANSI/ASHRAE Standard 169-2013 “Climatic Data for Building Design Standards” for climate zone definitions.

Annual Performance Factor (APF)
The ratio of the total 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 for both seasons.

Climate Group
Defined by thermal criteria using the heating and cooling degree-days and moisture criteria using monthly average temperature and precipitation.

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.

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.

Double-duct[6] Portable Air Conditioner
An encased assembly or assemblies designed primarily to provide delivery of conditioned air to an enclosed space, room or zone which takes its source of air for cooling the condenser from the outdoor space by a duct, and discharges this air through a second duct, and which is placed wholly inside the space to be conditioned.

Double-duct Portable Heat Pump
An encased assembly or assemblies, which is placed wholly inside the space to be conditioned, designed primarily to provide 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 outdoor space by a duct.

Ductless Air Conditioner
An encased assembly or assemblies designed primarily to provide delivery of conditioned air to an enclosed space, room or zone.

Ductless Heat Pump
An encased assembly or assemblies designed primarily to provide delivery of conditioned air to an enclosed space, room or zone and includes a prime source of refrigeration for heating.
Note: Reversible unit works in either direction to provide cooling or heating to the space.

Energy Efficiency Ratio (EER)[7]
The ratio of the total cooling capacity to the effective power input to the device at given rating conditions.

[6] Also known as "dual hose"
[7] An alternate definition of EER is 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.

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.

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

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 heat 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).

Single-duct Portable Air Conditioner
An encased assembly or assemblies designed primarily to provide 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.

Single-duct Portable Heat Pump
An encased assembly or assemblies designed primarily to provide 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.

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
A type of air conditioner or heat pump where the capacity is varied by two steps (2-stage), 3-4 steps (multi-stage), or five or more steps (true variable capacity).

Article 3. Requirements

Air conditioners and heat pumps falling within the scope of Article 1 shall meet the energy efficiency requirements of Article 3. The importation of used products is prohibited.

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 is not allowed.

All products falling within Article 1 shall comply with the stipulations for one (1) regional climate group in Table 1. Climates by country and outdoor temperature bin hours used for energy efficiency performance calculation are available in Annex 3 and Annex 4 of this document.

Table 1: Climate Groups[8]

Primary Climate Group[a]	Secondary Climate Group[b]			
	Thermal	Humid	Dry	Marine
Group 1	Extremely Hot	0A (Extremely Hot-Humid)		
	Very Hot	1A (Very Hot-Humid)		
	Hot	2A (Hot-Humid)	2B (Hot-Dry)	
	Warm	3A (Warm-Humid)	3B (Warm-Dry)	3C (Warm-Marine)
Group 2	Extremely Hot		0B (Extremely Hot-Dry)	
	Very Hot		1B (Very Hot-Dry)	
Group 3	Mixed	4A (Mixed-Humid)	4B (Mixed-Dry)	
	Cool	5A (Cool-Humid)	5B (Cool-Dry)	
	Cold	6A (Cold-Humid)	6B (Cold-Dry)	
	Very Cold	7		
	Subarctic/Arctic	8		

[a] For cooling energy efficiency calculation, primary climate group 1 and 3 refer to ISO 16358-1: 2013, and primary climate group 2 refers to ISO 16358-1: 2013/Amd 1:2019.

[b] According to ASHRAE climate zone definitions available at ANSI/ASHRAE Standard 169-2013.

3.1 Test Methods and Energy Efficiency Performance Calculation

Compliance with the energy performance requirements shall be tested according to ISO 16358:2013, "Air-cooled air conditioners and air-to-air heat pumps — Testing and calculating methods for seasonal performance factors" (ISO 16358)[9] which refers to ISO 5151, "Non-ducted air conditioners and heat pumps — Testing and rating for performance" (ISO 5151).[10] Rating conditions for cooling capacity and heating capacity may be found in Table 2 and Table 3. Ductless portable products or portable products with a single exhaust duct shall be tested according to 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".[11]

[8] See Annex 4 for a list of countries and associated climate zones.

[9] The term ISO 16358 in this document includes ISO 16358-1:2013/Amd 1:2019.

[10] ISO 5151 specifies how to measure the cooling capacity and efficiency of air conditioners using stipulated test conditions. While ISO 5151 and ISO 16358 are primary references, countries might consider others that fulfil the same objective and maintain the energy efficiency requirements.

[11] EN14511 and the U.S. standard, i.e., USA Federal Register 81 (105), can be alternative references of testing portable products.

Table 2: 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
ISO 16358-1:2013/Amd 1:2019 (T3 hot climate) Standard cooling capacity	29 °C / 19 °C (ISO 5151 T3)	46 °C / 24 °C (ISO 5151 T3)

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

Table 3: Heating Capacity Rating Conditions

	Temperature of air entering indoor side	Temperature of air entering outdoor side
	dry-bulb / wet-bulb	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. 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 Annex 4, or country-specific temperature bin hours developed by the country. Reference test standards may be found in Table 4.

Table 4: 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)
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

* This regulation allows use of the default value below by setting the low-temperature cooling capacity test for fixed-speed units as an optional test.

Cooling full capacity at outdoor temperature 29°C = 1.077 × Cooling full capacity at outdoor dry-bulb temperature 35°C

Cooling full power input at outdoor temperature 29°C = 0.914 × Cooling full power input at outdoor dry-bulb temperature 35°C.

3.2 Energy Efficiency

3.2.1 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 5 or Table 11, depending on the appropriate climate group, represented by the CSPF metric coupled with climate group-specific outdoor temperature bin hours. Minimum requirement CSPF values according to sub-climate zone-specific outdoor temperature bin hours are available at Annex 1.

For a product to meet the higher performance grades and thus be eligible for [TBD by country] and recognition on the product label, it shall meet or exceed the levels in Table 13, 14, or 15 in Annex 2, depending on the product category by cooling capacity.

Table 5: Reference Minimum Requirements for CSPF

Category	Group 1	Group 2	Group 3
CC≤ 4.5 kW	6.10	5.00	5.30
4.5 kW < CC ≤ 9.5 kW	5.10	4.30	4.60
9.5 kW < CC ≤ 16.0 kW	4.50	3.80	4.10
Reference Standards	ISO 16358-1:2013	ISO 16358-1: 2013/Amd 1:2019	ISO 16358-1:2013
Outdoor Temperature Bin Hours	ISO 16358-1:2013 Table 3	ISO 16358-1: 2013/Amd 1:2019 Table F.2	U4E Model Regulation Guidelines Annex 4

CC: cooling capacity. See Annex 4 for outdoor temperature bin hours of each climate group.

3.2.2 Ductless Split and Self-Contained Heat Pumps

Cooling and heating performance for all split and self-contained heat pumps, except for portable heat pumps, within the scope of this standard shall meet or exceed the energy efficiency levels in Tables 6 or Table 12, depending on the appropriate climate group, represented by the APF metric. Minimum requirement APF values according to sub-climate zone-specific outdoor temperature bin hours are available at Annex 1.

For a product to meet the high efficiency performance grade, it shall meet or exceed the levels in Table 14, 17, or 18 in Annex 2, depending on the product category by cooling capacity.

Table 6: Reference Minimum Requirements for APF

Category	Group 1	Group 2	Group 3
CC≤ 4.5 kW	5.00	4.00	3.10
4.5 kW < CC ≤ 9.0 kW	4.00	3.60	2.50
9.5 kW < CC ≤ 16.0 kW	3.60	3.40	2.30
Reference Standards	ISO 16358-1: 2013 ISO 16358-2: 2013 ISO 16358-3: 2013	ISO 16358-1: 2013 /Amd 1: 2019 ISO 16358-2: 2013 ISO 16358-3: 2013	ISO 16358-1: 2013 ISO 16358-2: 2013 ISO 16358-3: 2013
Outdoor Temperature Bin Hours	ISO 16358-1: 2013/Amd 1: 2019 Table 3 (CSPF) ISO 16358-2: 2013 Table 3 (HSPF)	ISO 16358-1: 2013/Amd 1: 2019 Table F.2 (CSPF) ISO 16358-2: 2013 Table 3 (HSPF)	U4E Model Regulation Guidelines Annex 4 (CSPF and HSPF)

CC: cooling capacity. See Annex 4 for outdoor temperature bin hours of each climate group.

Countries with climate group 4A to 8 (Group 3) can optionally have additional minimum requirements for coefficient of performance (COP) at the extremely low temperature heating capacity test, as per Table 7.

Table 7: Additional Minimum Requirements for COP of Heat Pumps at −15 °C

Extremely low temperature heating capacity	COP
Temperature of air entering indoor side DB/WB 20 °C / 15 °C Temperature of air entering outdoor side DB/WB −15 °C / -	2.00

3.2.3 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 8, represented by the EER metric.[12]

Table 8: Minimum Requirements for EER of Portable Air Conditioners

Type	EER
All	3.10

3.2.4 Portable Heat Pumps

Cooling and heating performance for all portable heat pumps within the scope of this standard shall meet or exceed the energy efficiency levels in Table 9, represented by the EER and COP metrics.

Table 9: Minimum Requirements for EER and COP of Portable Heat Pumps

Type	EER	COP
All	3.10	3.10

3.3 Functional Performance[13]

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

All units shall operate appropriately with the rated voltage with surge protection +/- 15%.

3.4 Refrigerant

Refrigerants used in air conditioners and heat pumps shall comply with requirements for ozone depletion potential (ODP) and global warming potential (GWP) over a 100-year time horizon according to Table 10.

[12] Portable air conditioners and heat pumps covered by this regulation 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.

[13] Countries may wish to vary the date by which these requirements come into effect based on the availability and cost of viable refrigerant gasses, which may not coincide with the availability and cost of meeting the energy-efficiency requirements.

Table 10: Requirements for Refrigerant Characteristics (numbers shown are upper limits)

	GWP	ODP
Self-Contained System	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.

3.5 Product Information

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

The label shall indicate:

1) Model name / serial number;
2) Type of unit [ductless split, self-contained, or portable];
3) Country where the product was manufactured;
4) Rated cooling (and heating, if applicable) capacity in kW;
5) Rated maximum power consumption in kW;
6) Rated performance grade;
7) Rated energy efficiency in [CSPF, APF, EER, or COP], and yearly electricity consumption in kWh;
8) Refrigerant designation in accordance with [ISO 817 or ASHRAE 34], including ODP and GWP.

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 and include the reference outdoor temperature bin hours distribution that is used.

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

Article 4. Entry into Force

This regulation shall enter into force no earlier than [date] and at least [x year(s)] after adoption.

Article 5. Declaration of Conformity

Compliance with the requirements of Article 3 and any additional optional claims shall be demonstrated in the CAR, which:

1) demonstrates that the product model fulfils the requirements of this Regulation;

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 regulation.

The CAR shall be submitted to [agency name] for review prior to making the product available for sale.[14] If the CAR for the designated model is approved, which is confirmed by written correspondence from [agency name] and listing of the product on any applicable [product registration system], the model may be sold in the market. If a CAR is rejected, a written explanation will be provided to the submitter. All aspects identified in the written explanation shall be addressed in a revised CAR. Until the CAR is approved, the product is ineligible for sale in the market. The CAR is valid for the designated model for 24 months. An updated CAR or a notice of withdrawal shall be submitted to [agency name] at least 90 days prior to the change in specifications of or cancelation of production of the currently certified product.

Article 6. Market Surveillance

The designated authority implementing this regulation 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.[15] The program shall also consider specifying the tolerance for differences in efficiency and cooling/heating capacity between a product's certified rating and the measurements resulting from verification testing of that product.[16]

[Agency name] will be responsible for enforcement activities that include potential assessment of penalties for non-compliant products in the country. [Agency name] 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 regulation.

[14] Responsibilities are often split across various agencies, so list whichever are appropriate for each step.
[15] For further guidance on how to develop and implement compliance certification, market surveillance and enforcement programs please refer to the U4E Policy Guide. Additional stipulations regarding such protocols are often included in MEPS and labelling legislation / policy documents. Given the variance in approaches based on national context, a specific example is not provided in this Model Regulation Guidance.
[16] For example, for a product to be in compliance under some existing regulations, the efficiency determined via verification testing must be no more than 10% lower than the certified efficiency level. In addition, the capacity determined via verification testing must be no more than 5% higher than the certified capacity rating. Those tolerance values can vary, and setting the specific values is part of each individual regulatory process.

Article 7. Revision

This regulation shall be strengthened by a simple administrative rulemaking based on updated market, technology, and economic assessments conducted on the cost and availability of new technologies once every five years after this regulation enters into force. The review process shall assess the necessity and appropriateness to revise energy efficiency requirements that are in place or set additional requirements for energy efficiency and other elements.

Annex 1. Minimum Performance Requirements

Table 11: Minimum Requirements for Air Conditioners in CSPF by Secondary Climate Group

Primary	Secondary	Rated Cooling Capacity ≤ 4.5 kW	4.5 kW < Rated Cooling Capacity ≤ 9.5 kW	9.5 kW < Rated Cooling Capacity ≤ 16.0 kW	Outdoor Temperature Bin Hours
Group 1	0A	5.70	4.90	4.30	Model Regulation Guidelines Annex 4
	1A	5.40	4.70	4.20	
	2A	5.60	4.80	4.30	
	3A	5.40	4.70	4.20	
	2B	4.90	4.30	4.00	
	3B	5.40	4.70	4.20	
	3C	6.00	5.10	4.50	
Group 2	0B	4.60	4.00	3.70	
	1B	4.70	4.10	3.70	
Group 3	4A	5.30	4.60	4.20	
	5A	5.60	4.80	4.30	
	6A	6.00	5.10	4.50	
	4B	5.00	4.40	4.00	
	5B	4.70	4.20	3.90	
	6B	5.90	5.00	4.40	
	7	5.80	5.00	4.40	
	8	5.70	4.90	4.30	

Table 12: Minimum Requirements for Reversible Heat Pumps in APF by Secondary Climate Group

Primary	Secondary	Rated Cooling Capacity ≤ 4.5 kW	4.5 kW < Rated Cooling Capacity ≤ 9.5 kW	9.5 kW < Rated Cooling Capacity ≤ 16.0 kW	Outdoor Temperature Bin Hours
Group 1	0A	-	-	-	Model Regulation Guidelines Annex 4
	1A	4.60	3.80	3.50	
	2A	4.80	3.90	3.50	
	3A	4.70	3.90	3.50	
	2B	4.40	3.70	3.40	
	3B	4.40	3.70	3.40	
	3C	5.20	4.10	3.60	
Group 2	0B	3.90	3.50	3.30	
	1B	4.00	3.60	3.40	
Group 3	4A	3.60	3.00	2.80	
	5A	3.30	2.70	2.30	
	6A	3.20	2.70	2.40	
	4B	3.60	3.00	2.80	
	5B	3.50	2.90	2.70	
	6B	3.10	2.50	2.40	
	7	3.10	2.50	2.30	
	8	3.10	2.50	2.30	

Annex 2. Performance Grade Requirements

Labels indicating achievement of a higher performance grade may be applied to units that meet or exceed the levels specified in Article 3 during testing for compliance with the Article 3 requirements. Table 13, 14, and 15 show possible thresholds of labeling requirements for air conditioners. The high efficiency levels in Table 13 through 18 represent approximately 30-60 percent of the efficiency improvement that is possible in energy-efficient technologies globally, but less than the efficiency levels of best available technologies which are not necessarily available in all markets.

A. Air Conditioners

Table 13: Labeling Requirements for Air Conditioners in Group 1 Countries

Climate Group (Temperature Bin Hours)	Grade	Rated Cooling Capacity ≤ 4.5 kW	4.5 kW < Rated Cooling Capacity ≤ 9.5 kW	9.5 kW < Rated Cooling Capacity ≤ 16.0 kW
Group 1 (ISO 16358-1: 2013)	High Efficiency	8.00 ≤ CSPF	7.60 ≤ CSPF	7.10 ≤ CSPF
	Intermediate	7.10 ≤ CSPF < 8.00	6.40 ≤ CSPF < 7.60	5.80 ≤ CSPF < 7.10
	Low Efficiency	6.10 ≤ CSPF < 7.10	5.10 ≤ CSPF < 6.40	4.50 ≤ CSPF < 5.80
0A (Model Regulation)	High Efficiency	7.40 ≤ CSPF	7.00 ≤ CSPF	6.60 ≤ CSPF
	Intermediate	6.60 ≤ CSPF < 7.40	6.00 ≤ CSPF < 7.00	5.50 ≤ CSPF < 6.60
	Low Efficiency	5.70 ≤ CSPF < 6.60	4.90 ≤ CSPF < 6.00	4.30 ≤ CSPF < 5.50
1A (Model Regulation)	High Efficiency	7.00 ≤ CSPF	6.60 ≤ CSPF	6.20 ≤ CSPF
	Intermediate	6.20 ≤ CSPF < 7.00	5.70 ≤ CSPF < 6.60	5.20 ≤ CSPF < 6.20
	Low Efficiency	5.40 ≤ CSPF < 6.20	4.70 ≤ CSPF < 5.70	4.20 ≤ CSPF < 5.20
2A (Model Regulation)	High Efficiency	7.30 ≤ CSPF	6.90 ≤ CSPF	6.50 ≤ CSPF
	Intermediate	6.50 ≤ CSPF < 7.30	5.90 ≤ CSPF < 6.90	5.40 ≤ CSPF < 6.50
	Low Efficiency	5.60 ≤ CSPF < 6.50	4.80 ≤ CSPF < 5.90	4.30 ≤ CSPF < 5.40
3A (Model Regulation)	High Efficiency	7.00 ≤ CSPF	6.60 ≤ CSPF	6.20 ≤ CSPF
	Intermediate	6.20 ≤ CSPF < 7.00	5.70 ≤ CSPF < 6.60	5.20 ≤ CSPF < 6.20
	Low Efficiency	5.40 ≤ CSPF < 6.20	4.70 ≤ CSPF < 4.70	4.20 ≤ CSPF < 5.20

2B (Model Regulation)	High Efficiency	6.20 ≤ CSPF	5.90 ≤ CSPF	5.60 ≤ CSPF
	Intermediate	5.60 ≤ CSPF < 6.20	5.10 ≤ CSPF < 5.90	4.80 ≤ CSPF < 5.60
	Low Efficiency	4.90 ≤ CSPF < 5.60	4.30 ≤ CSPF < 5.10	4.00 ≤ CSPF < 4.80
3B (Model Regulation)	High Efficiency	6.90 ≤ CSPF	6.50 ≤ CSPF	6.10 ≤ CSPF
	Intermediate	6.20 ≤ CSPF < 6.90	5.60 ≤ CSPF < 6.50	5.20 ≤ CSPF < 6.10
	Low Efficiency	5.40 ≤ CSPF < 6.20	4.70 ≤ CSPF < 5.60	4.20 ≤ CSPF < 5.20
3C (Model Regulation)	High Efficiency	7.90 ≤ CSPF	7.50 ≤ CSPF	7.00 ≤ CSPF
	Intermediate	7.00 ≤ CSPF < 7.90	6.30 ≤ CSPF < 7.50	5.80 ≤ CSPF < 7.00
	Low Efficiency	6.00 ≤ CSPF < 7.00	5.10 ≤ CSPF < 6.30	4.50 ≤ CSPF < 5.80

Table 14: Labeling Requirements for Air Conditioners in Group 2 Countries

Climate Group (Temperature Bin Hours)	Grade	Rated Cooling Capacity ≤ 4.5 kW	4.5 kW < Rated Cooling Capacity ≤ 9.5 kW	9.5 kW < Rated Cooling Capacity ≤ 16.0 kW
Group 2 (ISO 16358-1: 2013 /Amd 1:2019)	High Efficiency	6.50 ≤ CSPF	6.20 ≤ CSPF	5.80 ≤ CSPF
	Intermediate	5.80 ≤ CSPF < 6.50	5.30 ≤ CSPF < 6.20	4.80 ≤ CSPF < 5.80
	Low Efficiency	5.00 ≤ CSPF < 5.80	4.30 ≤ CSPF < 5.30	3.80 ≤ CSPF < 4.80
0B (Model Regulation)	High Efficiency	5.90 ≤ CSPF	5.60 ≤ CSPF	5.30 ≤ CSPF
	Intermediate	5.30 ≤ CSPF < 5.90	4.80 ≤ CSPF < 5.60	4.50 ≤ CSPF < 5.30
	Low Efficiency	4.60 ≤ CSPF < 5.30	4.00 ≤ CSPF < 4.80	3.70 ≤ CSPF < 5.30
1B (Model Regulation)	High Efficiency	6.00 ≤ CSPF	5.70 ≤ CSPF	5.40 ≤ CSPF
	Intermediate	5.40 ≤ CSPF < 6.00	4.90 ≤ CSPF < 5.70	4.60 ≤ CSPF < 5.40
	Low Efficiency	4.70 ≤ CSPF < 5.40	4.10 ≤ CSPF < 4.90	3.70 ≤ CSPF < 3.50

Table 15: Labeling Requirements for Air Conditioners in Group 3 Countries

Climate Group (Temperature Bin Hours)	Grade	Rated Cooling Capacity ≤ 4.5 kW	4.5 kW < Rated Cooling Capacity ≤ 9.5 kW	9.5 kW < Rated Cooling Capacity ≤ 16.0 kW
Group 3 (Model Regulation)	High Efficiency	6.70 ≤ CSPF	6.40 ≤ CSPF	6.00 ≤ CSPF
	Intermediate	6.00 ≤ CSPF < 6.70	5.50 ≤ CSPF < 6.40	5.10 ≤ CSPF < 6.00
	Low Efficiency	5.30 ≤ CSPF < 6.00	4.60 ≤ CSPF < 5.50	4.10 ≤ CSPF < 5.10
4A (Model Regulation)	High Efficiency	6.80 ≤ CSPF	6.40 ≤ CSPF	6.10 ≤ CSPF
	Intermediate	6.10 ≤ CSPF < 6.80	5.50 ≤ CSPF < 6.40	5.20 ≤ CSPF < 6.10
	Low Efficiency	5.30 ≤ CSPF < 6.10	4.60 ≤ CSPF < 5.50	4.20 ≤ CSPF < 5.20
5A (Model Regulation)	High Efficiency	7.20 ≤ CSPF	6.80 ≤ CSPF	6.40 ≤ CSPF
	Intermediate	6.40 ≤ CSPF < 7.20	5.80 ≤ CSPF < 6.80	5.40 ≤ CSPF < 6.40
	Low Efficiency	5.60 ≤ CSPF < 6.40	4.80 ≤ CSPF < 5.80	4.30 ≤ CSPF < 5.40
6A (Model Regulation)	High Efficiency	7.90 ≤ CSPF	7.40 ≤ CSPF	7.00 ≤ CSPF
	Intermediate	7.00 ≤ CSPF < 7.90	6.30 ≤ CSPF < 7.40	5.80 ≤ CSPF < 7.00
	Low Efficiency	6.00 ≤ CSPF < 7.00	5.10 ≤ CSPF < 6.30	4.50 ≤ CSPF < 5.80
4B (Model Regulation)	High Efficiency	6.40 ≤ CSPF	6.10 ≤ CSPF	5.70 ≤ CSPF
	Intermediate	5.70 ≤ CSPF < 6.40	5.30 ≤ CSPF < 6.10	4.90 ≤ CSPF < 5.70
	Low Efficiency	5.00 ≤ CSPF < 5.70	4.40 ≤ CSPF < 5.30	4.00 ≤ CSPF < 4.90
5B (Model Regulation)	High Efficiency	6.00 ≤ CSPF	5.70 ≤ CSPF	5.40 ≤ CSPF
	Intermediate	5.40 ≤ CSPF < 6.00	5.00 ≤ CSPF < 5.70	4.90 ≤ CSPF < 5.40
	Low Efficiency	4.70 ≤ CSPF < 5.40	4.20 ≤ CSPF < 5.00	4.00 ≤ CSPF < 4.90
6B (Model Regulation)	High Efficiency	7.70 ≤ CSPF	7.20 ≤ CSPF	6.80 ≤ CSPF
	Intermediate	6.80 ≤ CSPF < 7.70	6.10 ≤ CSPF < 7.20	5.60 ≤ CSPF < 6.80
	Low Efficiency	5.90 ≤ CSPF < 6.80	5.00 ≤ CSPF < 6.10	4.40 ≤ CSPF < 5.60
7 (Model Regulation)	High Efficiency	7.60 ≤ CSPF	7.20 ≤ CSPF	6.70 ≤ CSPF
	Intermediate	6.70 ≤ CSPF < 7.60	6.10 ≤ CSPF < 7.20	5.60 ≤ CSPF < 6.70
	Low Efficiency	5.80 ≤ CSPF < 6.70	5.00 ≤ CSPF < 6.10	4.40 ≤ CSPF < 5.60
8 (Model Regulation)	High Efficiency	7.40 ≤ CSPF	7.00 ≤ CSPF	6.60 ≤ CSPF
	Intermediate	6.60 ≤ CSPF < 7.40	6.00 ≤ CSPF < 7.00	5.50 ≤ CSPF < 6.60
	Low Efficiency	5.70 ≤ CSPF < 6.60	4.90 ≤ CSPF < 6.00	4.30 ≤ CSPF < 5.50

B. Heat Pumps

Table 16, 17, and 18 show possible thresholds of labeling requirements for reversible heat pumps.

Table 16: Labeling Requirements for Reversible Heat Pumps in Group 1 Countries

Climate Group (Temperature Bin Hours)	Grade	Rated Cooling Capacity ≤ 4.5 kW	4.5 kW < Rated Cooling Capacity ≤ 9.5 kW	9.5 kW < Rated Cooling Capacity ≤ 16.0 kW
Group 1 (ISO 16358-1 and ISO 16358-2)	High Efficiency	7.10 ≤ APF	6.40 ≤ APF	5.80 ≤ APF
	Intermediate	6.10 ≤ APF < 7.10	5.20 ≤ APF < 6.40	4.70 ≤ APF < 5.80
	Low Efficiency	5.00 ≤ APF < 6.10	4.00 ≤ APF < 5.20	3.60 ≤ APF < 4.70
1A (Model Regulation)	High Efficiency	7.20 ≤ APF	6.10 ≤ APF	5.40 ≤ APF
	Intermediate	5.90 ≤ APF < 7.20	5.00 ≤ APF < 6.10	4.50 ≤ APF < 5.40
	Low Efficiency	4.60 ≤ APF < 5.90	3.80 ≤ APF < 5.00	3.50 ≤ APF < 4.50
2A (Model Regulation)	High Efficiency	7.50 ≤ APF	6.40 ≤ APF	5.70 ≤ APF
	Intermediate	6.20 ≤ APF < 7.50	5.20 ≤ APF < 6.40	4.60 ≤ APF < 5.70
	Low Efficiency	4.80 ≤ APF < 6.20	3.90 ≤ APF < 5.20	3.50 ≤ APF < 4.60
3A (Model Regulation)	High Efficiency	6.50 ≤ APF	5.90 ≤ APF	5.50 ≤ APF
	Intermediate	5.60 ≤ APF < 6.50	4.90 ≤ APF < 5.90	4.50 ≤ APF < 5.50
	Low Efficiency	4.70 ≤ APF < 5.60	3.90 ≤ APF < 4.90	3.50 ≤ APF < 4.50
2B (Model Regulation)	High Efficiency	6.50 ≤ APF	5.70 ≤ APF	5.20 ≤ APF
	Intermediate	5.50 ≤ APF < 6.50	4.70 ≤ APF < 5.70	4.30 ≤ APF < 5.20
	Low Efficiency	4.40 ≤ APF < 5.50	3.70 ≤ APF < 4.70	3.40 ≤ APF < 4.30
3B (Model Regulation)	High Efficiency	6.20 ≤ APF	5.60 ≤ APF	5.20 ≤ APF
	Intermediate	5.30 ≤ APF < 6.20	4.70 ≤ APF < 5.60	4.30 ≤ APF < 5.20
	Low Efficiency	4.40 ≤ APF < 5.30	3.70 ≤ APF < 4.70	3.40 ≤ APF < 4.30
3C (Model Regulation)	High Efficiency	7.20 ≤ APF	6.60 ≤ APF	6.10 ≤ APF
	Intermediate	6.20 ≤ APF < 7.20	5.40 ≤ APF < 6.60	4.90 ≤ APF < 6.10
	Low Efficiency	5.20 ≤ APF < 6.20	4.10 ≤ APF < 5.40	3.60 ≤ APF < 4.90

Table 17: Labeling Requirements for Reversible Heat Pumps in Group 2 Countries

Climate Group (Temperature Bin Hours)	Grade	Rated Cooling Capacity ≤ 4.5 kW	4.5 kW < Rated Cooling Capacity ≤ 9.5 kW	9.5 kW < Rated Cooling Capacity ≤ 16.0 kW
Group 2 (ISO 16358-1:2013/Amd 1:2019 and ISO 16358-2)	High Efficiency	5.20 ≤ APF	4.80 ≤ APF	4.60 ≤ APF
	Intermediate	4.60 ≤ APF < 5.20	4.20 ≤ APF < 4.80	4.00 ≤ APF < 4.60
	Low Efficiency	4.00 ≤ APF < 4.60	3.60 ≤ APF < 4.20	3.40 ≤ APF < 4.00
0B (Model Regulation)	High Efficiency	5.40 ≤ APF	4.90 ≤ APF	4.60 ≤ APF
	Intermediate	4.70 ≤ APF < 5.40	4.20 ≤ APF < 4.90	4.00 ≤ APF < 4.60
	Low Efficiency	3.90 ≤ APF < 4.70	3.50 ≤ APF < 4.20	3.30 ≤ APF < 4.00
1B (Model Regulation)	High Efficiency	5.20 ≤ APF	4.80 ≤ APF	4.60 ≤ APF
	Intermediate	4.60 ≤ APF < 5.20	4.20 ≤ APF < 4.80	4.00 ≤ APF < 4.60
	Low Efficiency	4.00 ≤ APF < 4.60	3.60 ≤ APF < 4.20	3.40 ≤ APF < 4.00

Table 18: Labeling Requirements for Reversible Heat Pumps in Group 3 Countries

Climate Group (Temperature Bin Hours)	Grade	Rated Cooling Capacity ≤ 4.5 kW	4.5 kW < Rated Cooling Capacity ≤ 9.5 kW	9.5 kW < Rated Cooling Capacity ≤ 16.0 kW
Group 3 (Model Regulation and ISO 16358-2)	High Efficiency	4.60 ≤ APF	4.00 ≤ APF	3.70 ≤ APF
	Intermediate	3.90 ≤ APF < 4.60	3.30 ≤ APF < 4.00	3.00 ≤ APF < 3.70
	Low Efficiency	3.10 ≤ APF < 3.90	2.50 ≤ APF < 3.30	2.30 ≤ APF < 3.00
4A (Model Regulation)	High Efficiency	5.20 ≤ APF	4.70 ≤ APF	4.30 ≤ APF
	Intermediate	4.40 ≤ APF < 5.20	3.90 ≤ APF < 4.70	3.60 ≤ APF < 4.30
	Low Efficiency	3.60 ≤ APF < 4.40	3.00 ≤ APF < 3.90	2.80 ≤ APF < 3.60
5A (Model Regulation)	High Efficiency	4.90 ≤ APF	4.30 ≤ APF	3.90 ≤ APF
	Intermediate	4.10 ≤ APF < 4.90	3.50 ≤ APF < 4.30	3.10 ≤ APF < 3.90
	Low Efficiency	3.30 ≤ APF < 4.10	2.70 ≤ APF < 3.50	2.30 ≤ APF < 3.10
6A (Model Regulation)	High Efficiency	4.70 ≤ APF	4.10 ≤ APF	3.80 ≤ APF
	Intermediate	4.00 ≤ APF < 4.70	3.40 ≤ APF < 4.10	3.10 ≤ APF < 3.80
	Low Efficiency	3.20 ≤ APF < 4.00	2.70 ≤ APF < 3.40	2.40 ≤ APF < 3.10
4B (Model Regulation)	High Efficiency	5.30 ≤ APF	4.70 ≤ APF	4.30 ≤ APF
	Intermediate	4.50 ≤ APF < 5.30	3.90 ≤ APF < 4.70	3.60 ≤ APF < 4.30
	Low Efficiency	3.60 ≤ APF < 4.50	3.00 ≤ APF < 3.90	2.80 ≤ APF < 3.60
5B (Model Regulation)	High Efficiency	5.10 ≤ APF	4.50 ≤ APF	4.10 ≤ APF
	Intermediate	4.30 ≤ APF < 5.10	3.70 ≤ APF < 4.50	3.40 ≤ APF < 4.10
	Low Efficiency	3.50 ≤ APF < 4.30	2.90 ≤ APF < 3.70	2.70 ≤ APF < 3.40
6B (Model Regulation)	High Efficiency	4.70 ≤ APF	4.10 ≤ APF	3.70 ≤ APF
	Intermediate	3.90 ≤ APF < 4.70	3.30 ≤ APF < 4.10	3.10 ≤ APF < 3.70
	Low Efficiency	3.10 ≤ APF < 3.90	2.50 ≤ APF < 3.30	2.40 ≤ APF < 3.10
7 (Model Regulation)	High Efficiency	4.60 ≤ APF	4.00 ≤ APF	3.60 ≤ APF
	Intermediate	3.90 ≤ APF < 4.60	3.30 ≤ APF < 4.00	3.00 ≤ APF < 3.60
	Low Efficiency	3.10 ≤ APF < 3.90	2.50 ≤ APF < 3.30	2.30 ≤ APF < 3.00
8 (Model Regulation)	High Efficiency	4.60 ≤ APF	4.00 ≤ APF	3.70 ≤ APF
	Intermediate	3.90 ≤ APF < 4.60	3.30 ≤ APF < 4.00	3.00 ≤ APF < 3.70
	Low Efficiency	3.10 ≤ APF < 3.90	2.50 ≤ APF < 3.30	2.30 ≤ APF < 3.00

Annex 3. Climate Groups and Countries

Table 19: 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
Afghanistan	1, 2*	2B, 3A, 4A*
Albania	1	3A
Algeria	1*, 2, 3	0B, 1B, 2A, 2B, 3A*, 3B, 4A, 4B
Angola	1	1A◊
Antigua and Barbuda	1	0A
Argentina	1*, 3	2A, 2B, 3A*, 3B, 4B, 5B, 5C, 6A
Armenia	3	4A*, 4B, 6A
Azerbaijan	1, 3*	3A, 3B, 4A, 4B*
Bahamas	1	1A
Bahrain	2	0B
Bangladesh	1	0A, 1A
Barbados	1	0A
Belarus	3	5A, 6A*
Belize	1	0A
Benin	1	0A
Bhutan	1	3A◊
Bolivia	1*, 3	1A*, 3B, 5A
Bosnia and Herzegovina	1, 3*	3A, 4A*, 5A, 7
Botswana	1*, 2	1B, 2B*
Brazil	1	0A, 1A, 2A*, 3A
Brunei Darussalam	1	0A
Burkina Faso	1, 2	0A, 0B*
Burundi	1	1A◊
Cambodia	1	0A◊
Cameroon	1	0A*, 1A
Cape Verde	2	1B
Central African Republic	1	0A
Chad	1, 2*	0A, 0B*
Chile	1*, 3	3B, 3C*, 4A, 4C, 6A
China	1*, 3	0A, 1A, 2A*, 2B, 3A, 3B, 3C, 4A, 4B, 5A, 5B, 6A, 6B, 7, 8
Colombia	1	0A, 1A, 3A*
Comoros	1	0A
Costa Rica	1	2A
Côte d'Ivoire	1	0A, 1A, 2A
Cuba	1	0B, 1A*
Democratic People's Republic of Korea	3	4A, 5A*, 6A, 7
Democratic Republic of the Congo	1	1A
Djibouti	2	0B◊
Dominica	1	0A◊
Dominican Republic	1	0A*, 1A
Ecuador	1*, 2	1A, 1B, 3A*
Egypt	1*, 2	0B, 1B, 2B*, 3B
El Salvador	1	0A
Equatorial Guinea	1	0A◊
Eritrea	2	0B◊
Ethiopia	1	2A◊
Federated States of Micronesia	1	0A
Fiji	1	0A, 1A*
Gabon	1	0A
Gambia	1	0A
Georgia	3	3A, 4A*, 5A, 7
Ghana	1, 2	0A◊, 0B
Grenada	1	0A
Guatemala	1	0A, 1A, 2A*, 3C
Guinea	1	0A
Guinea-Bissau	1	1A◊
Guyana	1	0A
Haiti	1	0A◊
Honduras	1	0A, 1A, 2A*
India	1*, 2	0A*, 0B, 1A, 1B, 2A, 2B
Indonesia	1	0A*, 1A
Iran	1*, 2, 3	0B, 1A, 1B, 2B, 3A, 3B*, 4A, 4B, 5A, 5C
Iraq	1, 2*	1B*, 2B
Israel	1*, 2	1B, 2A*, 2B, 3A
Jamaica	1	0A
Jordan	1*, 2	1B, 2B, 3A, 3B*
Kazakhstan	3	4A, 4B, 5A*, 6A, 6B, 7
Kenya	1	0A, 0B, 1B, 2A*, 2B, 3A, 3C

Kiribati	1	0A
Kuwait	2	0B
Kyrgyz Republic	3	4A, 4B, 5A, 7, 8
Lao People's Democratic Republic	1	0A
Lebanon	1	2A*, 3A
Lesotho	1	3B◊
Liberia	1	1A◊
Libya	1	1B, 2B*
Macedonia, FYR	3	4A*, 4C
Madagascar	1	0A, 1A, 3A*
Malawi	1	3A◊
Malaysia	1	0A
Maldives	1	0A
Mali	1	0A
Marshall Islands	1	0A
Mauritania	1, 2	0A◊, 0B*, 2B
Mauritius	1	0A, 1A*, 2A
Mexico	1*, 2	0A, 1A, 1B, 2A, 2B, 3A*, 3B, 3C
Mongolia	3	6B, 7, 8*
Montenegro	3A	3A*, 4A, 5A
Morocco	1	2B, 3A*, 3B, 3C
Mozambique	1	1A
Myanmar	1	0A
Namibia	1	2B
Nepal	1	2A◊
Nicaragua	1	0A
Niger	1, 2	0A◊, 0B
Nigeria	1	0A◊
Oman	2	0B*, 1B, 2B, 3B
Pakistan	2	0A, 0B, 1A, 1B*, 2A, 2B, 3A, 4B
Panama	1	0A
Papua New Guinea	1	0A
Paraguay	1	1A, 2A*
Peru	1	0A, 1B, 2B*, 3B, 3C, 4A
Philippines	1	0A*, 1A, 2A
Qatar	2	0B
Republic of Congo	1	1A
Republic of Moldova	3	5A
Russia	1, 3*	3A, 4A, 4B, 5A, 5B, 6A*, 7, 8
Rwanda	1	2A◊
Saint Kitts and Nevis	1	0A◊
Saint Lucia	1	0A
Saint Vincent and the Grenadines	1	0A◊
Samoa	1	0A
Sao Tome and Principe	1	1A◊
Saudi Arabia	1, 2*	0B*, 1B, 2B, 3B
Senegal	1, 2*	0A, 0B, 1A, 1B*
Serbia	3	4A*, 5A, 6A, 7
Seychelles	1	0A
Sierra Leone	1	1A◊
Singapore	1	0A
Solomon Islands	1	0A
Somalia	1	0A◊
South Africa	1*, 2, 3	1B, 2A, 2B, 3A, 3B, 3C*, 6A
South Sudan	2	0B
Sri Lanka	1	0A
State of Palestine	1	3A
Sudan	1, 2	0A◊, 0B
Suriname	1	0A
Swaziland	1	3A◊
Syrian Arab Republic	1	3B◊
Tajikistan	1*, 3	3A*, 3B, 4B, 5B, 6A
Thailand	1	0A*, 1A
Timor-Leste	1	0A◊
Togo	1	0A
Tonga	1	1A
Trinidad and Tobago	1	0A
Tunisia	1	2A*, 2B, 3A, 3B
Turkey	1, 3*	2A, 3A, 4A*, 4B, 4C, 5A, 5C, 6A
Turkmenistan	1*, 3	2B, 3B*, 4B
Uganda	1	2A◊
Ukraine	3	4A, 5A*, 6A
United Arab Emirates	2	0B
United Republic of Tanzania	1	0A, 1A*, 2B
Uruguay	1	3A
Uzbekistan	1, 3*	3B, 4A, 4B*, 5B, 5C
Vanuatu	1	0A, 1A*
Venezuela	1, 2*	0A, 0B*, 1A, 1B, 2A
Vietnam	1	0A*, 1A, 2A
Yemen	1*, 2	0B, 3B*
Zambia	1	3A◊
Zimbabwe	1	2B, 3A*

Annex 4. Outdoor Temperature Bin Hours

Table 20: Temperature bin hours for calculating CSPF in Group 1 countries

Outdoor temperature	Reference	0A	1A	2A	3A	2B	3B	3C
°C	Bin hours	Bin hours	Bin hours	Bin hours	Bin hours	Bin hours	Bin hours	Bin hours
21	ISO 16358-1: 2013	5	33	49	32	30	34	34
22		23	86	92	62	64	60	60
23		76	167	128	83	102	84	73
24		205	250	161	99	138	98	75
25		383	327	191	103	169	108	74
26		537	360	210	101	201	109	60
27		646	388	219	93	216	109	50
28		671	395	212	85	221	105	41
29		630	371	188	79	217	97	32
30		596	332	149	72	203	88	27
31		501	285	118	63	200	75	18
32		361	227	86	52	191	61	12
33		206	153	58	41	180	50	6
34		86	90	37	29	147	36	3
35		32	55	22	18	113	27	2
36		11	35	13	11	80	16	1
37		3	22	8	7	53	10	0
38		1	16	4	4	34	6	0
39		0	12	3	2	21	3	0
40		0	10	1	1	13	1	0
41		0	7	1	1	8	1	0
42		0	5	1	0	4	0	0
43		0	3	0	0	3	0	0
44		0	1	0	0	1	0	0
45		0	0	0	0	0	0	0
46		0	0	0	0	0	0	0
47		0	0	0	0	0	0	0
48		0	0	0	0	0	0	0
49		0	0	0	0	0	0	0
50		0	0	0	0	0	0	0
Total	1817	4973	3630	1951	1038	2609	1178	568

Table 21: Temperature bin hours for calculating CSPF in Group 2 countries

Outdoor temperature	Reference	0B	1B
°C	Bin hours	Bin hours	Bin hours
21	ISO 16358-1: 2013/Amd.1: 2019	18	22
22		40	47
23		74	83
24		130	113
25		198	151
26		241	182
27		290	228
28		329	253
29		364	277
30		381	289
31		388	289
32		393	287
33		372	288
34		307	257
35		255	234
36		213	189
37		185	164
38		155	134
39		131	116
40		106	97
41		88	78
42		71	59
43		55	40
44		41	22
45		27	11
46		19	4
47		11	1
48		6	0
49		3	0
50		1	0
Total	6492	4892	3915

Table 22: Temperature bin hours for calculating CSPF in Group 3 countries

Outdoor temperature	Reference	4A	5A	6A	4B	5B	6B	7	8
℃	Bin hours	Bin hours	Bin hours	Bin hours	Bin hours	Bin hours	Bin hours	Bin hours	Bin hours
21	16	20	20	13	22	13	18	14	10
22	31	39	39	22	45	26	36	25	19
23	44	55	55	28	67	38	52	35	25
24	54	70	67	30	85	49	65	41	30
25	61	82	76	30	100	57	75	43	29
26	65	90	80	29	109	64	82	43	30
27	66	95	79	26	115	69	79	41	28
28	64	97	78	22	115	72	71	36	24
29	59	93	70	17	117	73	60	28	21
30	55	91	62	12	115	74	50	23	17
31	48	83	49	8	111	72	35	18	13
32	42	74	38	5	104	70	25	13	9
33	35	60	28	3	92	67	15	9	8
34	26	42	19	1	72	58	7	6	5
35	19	28	12	1	56	49	4	3	3
36	13	15	6	1	40	39	2	1	2
37	8	8	3	0	26	28	1	0	1
38	5	4	2	0	15	19	0	0	0
39	2	2	1	0	7	11	0	0	0
40	1	1	0	0	3	6	0	0	0
41	0	0	0	0	2	3	0	0	0
42	0	0	0	0	0	1	0	0	0
43	0	0	0	0	0	0	0	0	0
44	0	0	0	0	0	0	0	0	0
45	0	0	0	0	0	0	0	0	0
46	0	0	0	0	0	0	0	0	0
47	0	0	0	0	0	0	0	0	0
48	0	0	0	0	0	0	0	0	0
49	0	0	0	0	0	0	0	0	0
50	0	0	0	0	0	0	0	0	0
Total	714	1049	784	248	1418	958	677	379	274

Table 23: Temperature bin hours for calculating HSPF in Group 1 countries

Outdoor temperature	Reference	1A	2A	3A	2B	3B	3C
°C	Bin hours	Bin hours	Bin hours	Bin hours	Bin hours	Bin hours	Bin hours
-7	ISO 16358-2: 2013	0	0	0	0	1	0
-6		0	0	1	0	2	0
-5		0	0	2	0	4	0
-4		0	0	4	0	7	0
-3		0	0	8	1	12	1
-2		0	1	13	1	19	3
-1		0	2	20	2	28	5
0		0	2	16	3	24	8
1		0	5	41	7	46	15
2		0	8	54	13	63	23
3		0	12	72	20	78	34
4		0	18	97	32	98	49
5		1	25	126	45	117	68
6		1	34	154	58	137	89
7		3	49	187	72	159	117
8		5	55	201	82	165	131
9		7	64	208	90	162	143
10		10	67	216	90	168	159
11		13	71	211	94	155	163
12		15	72	196	91	150	179
13		17	70	164	82	138	191
14		17	65	135	70	119	184
15		15	53	95	49	96	139
16		10	33	49	28	53	76
Total	2866	114	706	2270	930	2001	1777

Table 24: Temperature bin hours for calculating HSPF in Group 2 countries

Outdoor temperature	Reference	0B	1B
°C	Bin hours	Bin hours	Bin hours
-7	ISO 16358-2: 2013	0	0
-6		0	0
-5		0	0
-4		0	0
-3		0	0
-2		0	1
-1		0	1
0		0	1
1		0	3
2		1	5
3		2	9
4		4	15
5		6	26
6		8	36
7		11	48
8		15	58
9		18	67
10		22	68
11		25	70
12		27	68
13		27	63
14		25	51
15		20	39
16		12	20
Total	2866	223	649

Table 25: Temperature bin hours for calculating HSPF in Group 3 countries

Outdoor temperature	Reference	4A	5A	6A	4B	5B	6B	7	8
°C	Bin hours	Bin hours	Bin hours	Bin hours	Bin hours	Bin hours	Bin hours	Bin hours	Bin hours
-7	108	47	109	137	50	86	158	144	134
-6	119	62	127	158	60	102	158	148	142
-5	135	84	143	185	81	122	157	160	148
-4	150	112	169	200	102	139	166	163	150
-3	169	144	192	232	129	173	174	162	148
-2	191	176	225	265	160	204	172	168	160
-1	212	204	249	308	186	246	171	169	163
0	162	177	194	247	184	173	94	113	120
1	252	253	287	424	217	318	183	175	164
2	239	249	259	371	227	317	167	162	162
3	224	252	236	301	226	315	160	157	147
4	218	255	228	264	232	305	154	157	151
5	261	309	266	299	281	376	188	189	187
6	239	286	241	258	267	329	177	172	187
7	218	262	215	232	241	299	163	164	172
8	197	237	197	213	209	259	147	154	165
9	176	209	174	192	185	225	138	143	149
10	158	187	158	178	161	196	122	129	135
11	136	158	135	156	137	158	108	120	121
12	116	133	116	142	114	127	91	103	102
13	94	107	94	115	94	97	75	88	82
14	73	83	74	87	70	69	60	70	71
15	49	56	51	58	49	45	41	49	44
16	24	28	26	28	25	21	22	24	21
Total	3920	4070	4165	5050	3687	4701	3246	3283	3225

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