EWA
هيئة الكهرباء والماء
Electricity & Water Authority

Energy Efficiency Guidelines for **Commercial Sector**

Energy Efficiency Guidelines for Commercial Sector

Version 1.0 – July 2022

For enquiries, comments, and suggestions, please contact:

Electricity & Water Conservation Directorate
Electricity & Water Authority, P. O. Box 2
Fax: 17212559 - Tel: 17991501 - Email: ECS@EWA.bh

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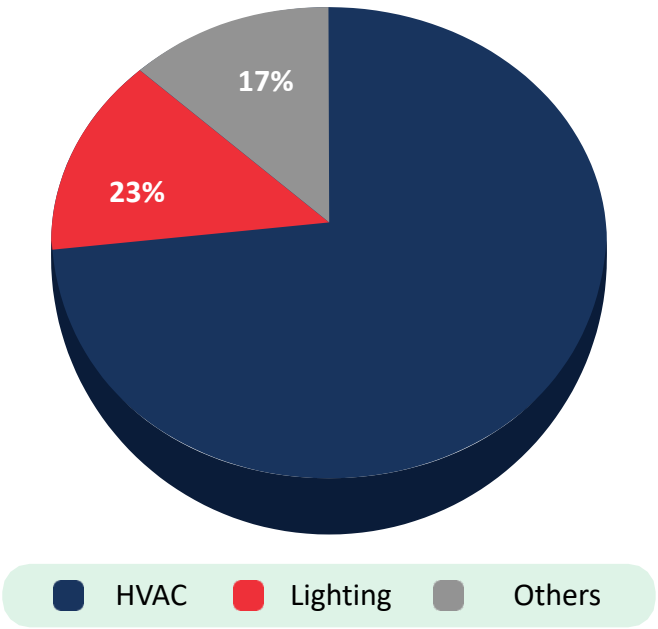
Kamal bin Ahmed Mohamed
President of Electricity & Water Authority

Preface

Electricity & Water Authority has been taking several initiatives for efficient utilization of energy in the Kingdom of Bahrain. These initiatives are to align with EWA's Energy Efficiency Action Plan (EWA-EEAP). This 5-year action plan forms a road map with a clear timeline and measures to improve energy efficiency. To achieve the target outlined in the plan, Electricity & Water Authority developed engineering recommendations for the efficient usage of electricity in the commercial sector. It is to be noted that there has been overwhelming response for the similar recommendations published in March 2021 for the government sector.

Electricity Consumption in Commercial Buildings



As shown from the above chart, most of the electrical loads (83%) in the commercial buildings are needed for cooling and lighting. Therefore, most of the guide- lines stipulated in this booklet were directed for cooling and lighting.

It is important to note that energy efficiency in buildings commences early from the design stage. The impact of buildings' dimensions, orientation and morphology on energy efficiency should never be underestimated. Also, while stressing the importance of the design stage, the construction and operation stages are very important too. Poor management of efficiently constructed buildings often leads to lots of waste and inefficiency and hence the unnecessary higher electricity bills.

Finally, we encourage commercial building owners, developers, architects & consultants to consider these guidelines as minimum requirements, not targets. With the visionary of excellence by our leadership, we should strive for the best, not the minimum. EWA intends to update these guidelines regularly, so feel free to review, apply and comment as well.

INTRODUCTION

1. Introduction

The commercial sector consumes more than 25% of the overall electricity supplied by EWA as per the statistics in 2021. Commercial buildings have high energy needs and can put great strain on the Kingdom's power grids during peak periods. Developing / maintaining / retrofitting more efficient buildings helps ensure a steady supply of affordable power and significantly lowers operating costs for business.

EWA endeavor to help in increasing efficiency and reducing cost of powering commercial buildings. Through research, best practices and industry standards, EWA is working with businesses to create a cleaner and more sustainable future to align with the vision 2060 of net zero energy consumption in all sectors. This booklet has been prepared in view of achieving this goal.

The booklet is divided into four main categories: air-conditioning, lighting installations, electrical appliances and building envelope. We have also included the necessary technical regulations as addendum.

Finally, we would like to clarify that the guidelines stipulated here are considered minimum requirements. Designers and operators are highly encouraged to adopt a proactive approach to exceed these minimum energy efficiency requirements and recommendations.

AIR CONDITIONING

2. Air Conditioning Installations

The following guidelines and recommendations apply to all commercial buildings provided with air conditioning (AC) installations for human comfort except any area or any part of the building which is constructed, used or intended to be used for industrial process purposes, hospital wards and similar conditions which are subject to special environmental conditions.

Design parameters and control criteria of AC installations and minimum COP / EER for AC Equipment are specified.

2.1 General approach

All units shall be designed and operated to restrict the controls for varying the cooling temperatures of air conditioners. Minimum temperature allowed is restricted to 24°C. Each AC system shall be provided with at least one automatic control device for regulation of temperature.

2.1.1 Zone Control

Each air-conditioned zone shall be controlled by individual thermostatic control corresponding to temperature within the zone. As a minimum each floor of a building shall be considered as a separate zone.

2.1.2 Off Hours Control

Each AC system should be equipped with automatic controls capable of accomplishing a reduction of energy use through temperature control (automatic temperature control through thermostat – such as programmable thermostat, building management system etc.) or equipment shutdown (e.g. timer etc.) during periods of non-use hours / days of the spaces served by the system.

System with cooling capacity not more than 36000 BTU/hr may be controlled by readily accessible manual off hour / period control. However, if it runs continuously, the unit should be provided with appropriate automatic controls or timers as indicated above capable of accomplishing reduction in energy consumption.

2.1.3 Building Automation System:

It is recommended to install building automation (BMS) or Automatic HVAC Control System for efficient monitoring, management & control of the building's mechanical and electrical equipment such as air conditioning, ventilation, lighting, power systems, fire systems and security system. The system helps in monitoring and optimizing the use of equipment and their efficient operations.

The Building Automation core functionality is to keep building climate within a specified range, light rooms based on an occupancy schedule, monitor performance and device failures in all systems and provide malfunction alarms. Automation systems reduce building energy and maintenance costs compared to a non-controlled building.

All buildings with a load requirement above 3000 kVA must be equipped with Building Management System (Communicating Thermostat's, DDC's & Central Monitoring & Control Station with Software etc.). Smaller building shall be equipped with Standalone HVAC Control System (Standalone Programmable Thermostat's, DDC's, etc.). A draft specification of BMS is given below for guidance only. Facilities or Building Manager should draw detailed specifications as per requirements and facilities available in the building.

2.1.3.1 Specifications of Building Automation

Complete Building Management System, or Standalone HVAC Control System, should be installed including all necessary hardware and all operating and applications software necessary to perform the control sequences of operations. All components of the system such as workstations, servers, application controllers, unitary controllers, etc. shall communicate using protocol as defined by ASHRAE Standard 135-2007, EIA standard 709.1 or any other acceptable industry standard protocol. At a minimum, provide controls for the following:

1. All kind of Air handling units, Fan Coil Units, VAV's, Packaged Units, etc.
2. All kind of Central Ventilation Fans (Supply, Exhaust, Jet Fan's, etc.)
3. Chilled water system including pumps, chillers and cooling towers.
4. All other air-conditioning units and thermostats.
5. Boilers including hot water pumps.
6. Computer room air handling units.
7. Monitoring points for packaged equipment such as emergency generators.
8. Lighting control system.
9. Fire safety, Safety & security installation & devices.
10. And any other system which has provision for BMS to control and monitor.

The control system shall consist of all necessary Network Controllers, Standalone Digital Control Units, workstations, software, sensors, transducers, relays, valves, dampers, damper operators, control panels, and other accessory equipment, along with a complete system of electrical interlocking wiring to fill the intent of the specification and provide for a complete and operable system. Provision should also be made for control of equipment such as dampers if not provided by the manufacturers.

The BMS contractor, or assigned consultant, shall review and study all HVAC drawings and the entire specification to familiarize themselves with the equipment and system operation and to verify the quantities and types of dampers, alarms, etc. to be provided.

All interlocking wiring, wiring and installation of control devices associated with the equipment listed below shall be provided. When the BMS system is fully installed and operational, the BMS contractor and building facility manger shall review and check out the System Acceptance and Testing of the system. During testing, the BMS contractor shall demonstrate the operation of the system and prove that it complies with the intent of the drawings and specifications.

Commissioning of the installation & system should be done in coordination with the HVAC Contractor, Balancing Contractor and building facility manger.

2.1.3.2 Guidelines for installation & commissioning of Building Management System (BMS) and Standalone HVAC Control System.

Building Management systems (BMS) should be installed & commissioned for buildings with connected electrical load above 3000 kVA to serve the objectives of optimization and conservation of energy.

Standalone HVAC Control System should be installed & commissioned for smaller buildings for optimizing the air-conditioning system for electricity savings. The Standalone HVAC Control System will not have any Computer, Software or associated items for centralized monitoring and controlling of buildings. However, it is equipped with field level controllers, thermostats & sensors to automate small-scale buildings to optimize mechanical & electrical equipment.

The complete process of installation, pre-commissioning and commissioning is to be in accordance with the British Code of Building Control and Management Systems (CIBSE - the Chartered Institution of Building Services Engineers).

2.1.3.3 BMS Installation

The installation process includes installation and pre-commissioning activities of the BMS.

Installation & pre-commissioning

1. Computer system
2. Software
3. Control panels
4. Electrical installations
5. Networks Sensors

BMS Final Commissioning

6. Automatic control of lighting systems
7. Automatic control of air conditioning systems
8. Operating computer system
9. Verification of communication systems
10. Check the operation of the occupancy sensors
11. Turning the power on and off
12. Operating and control of fire alarm systems.
13. Maintain records of all drawings, documents, installation & commissioning activities.

2.1.4 Selecting Air Filters for Ventilation

Install air filters with a minimum efficiency reporting value (MERV) of 8 or higher on all recirculating space conditioning systems and as per ASHRAE 62.2–2010. Design ductwork and specify the central blower to account for pressure drop across the filter. Air filter housings must be airtight to prevent bypass or leakage.

Non-ducted systems are exempt from the minimum MERV 8 requirements but must have an internal air filter in the air-handling unit.

Install air filters rated MERV 6 or higher for mechanically supplied outdoor air for systems with 10 feet (3 meters) of ductwork or more, per ASHRAE 62.2–2010, Section 6.7.

Projects may use equivalent filtration media class of F5 or higher for MERV 8 and G4 or higher for MERV 6, as defined by CEN standard EN779—2002.

2.1.5 Recommended Ventilation

(As Per Standard ASHRAE 62.1- 2019: Ventilation for Acceptable Air Quality)

Table: Recommended Ventilation

Area	Air Rate (L/s. m^2) / Person
Office space	8.5
Main Entry Lobby	5.5
Reception area	3.5
Telephone / Data Entry Room	3.0
Break Room	3.5
Occupiable storage roomfor dry material	17.5
Auditorium Seating Area	2.7
Cafeteria	4.7
Conference room	3.1
Computer (not printing)	10.0

2.2 Minimum AC Equipment Efficiency

All factory-designed and prefabricated electrically driven equipment shall have a minimum coefficient of performance (COP) / Energy Efficiency Ratio (EER) at the following specified rating conditions as given below.

T3 Temperature Conditions

Outside temperature	46 ^{0}C (114.8 ^{0}F) DB / 24 ^{0}C (75.2 ^{0}F) WB
Indoor temperature	29 ^{0}C (84.2 ^{0}F) DB / 19 ^{0}C (66.2 ^{0}F) WB

T1 Temperature Conditions

Outside temperature	35 ^{0}C (95.0 ^{0}F) DB / 24 ^{0}C (75.2 ^{0}F) WB
Indoor temperature	27 ^{0}C (80.6 ^{0}F) DB / 19 ^{0}C (66.2 ^{0}F) WB

Equipment should be designed to ensure uninterrupted operations up to 520C (125.60F) ambient temperature.

2.2.1 MEPS for Air cooled units (Up to 65000 BTU/hr.)

(For Single Package window, split ducted & non-ducted and heat pumps using air cooled condensers or using electric resistance with nominal capacities less than or equal to 65,000 Btu/h.)

Table 1: MEPS for air cooled units

Air-conditioner Appliance Type	EER Value {(Btu/h) / W}	
	T1	T3
Window Type	9.8	7.0
Split and all other types	11.8	8.5

2.2.2 MEPS for Air cooled units (Up to 65000 BTU/hr.)

Table 2: MEPS for electrically operated ACs (Unitary Air Conditioning Equipment)[1,2]

Air-conditioner / Appliance Type	Rated Cooling Capacity (Btu/h) [kW]	Testing Method	EER (T1) (Btu/W.h)
Air Conditioners,air cooled	> 65,000 [19.05 kW] and ≤ 135,000 [39.56 kW]	ANSI/AHRI 340/360 or ISO 5151 Or ISO 13253	11.2
	> 135,000 [39.56 kW] and ≤ 240,000 [70.32 kW]		11.0
	> 240,000 [70.32 kW] and ≤ 760,000 [222.68 kW]		10.0
	> 760,000 [222.68 kW]		9.7
Air Conditioners,water cooled	> 65,000 [19.05 kW] and ≤ 135,000 [39.56 kW]	ANSI/AHRI 340/360 or ISO 13256-1	12.1
	> 135,000 [39.56 kW] and ≤ 240,000 [70.32 kW]		12.5
	> 240,000 [70.32 kW] and ≤ 760,000 [222.68 kW]		12.4
	> 760,000 [222.68 kW]		12.2
Air Conditioners, evaporatively cooled	> 65,000 [19.05 kW] and ≤ 135,000 [39.56 kW]	ANSI/AHRI 340/360	12.1
	> 135,000 [39.56 kW] and ≤ 240,000 [70.32 kW]	ANSI/AHRI 340/360	12.0
	> 240,000 [70.32 kW] and ≤ 760,000 [222.68 kW]	ANSI/AHRI 340/360	11.9
	> 760,000 [222.68 kW]	ANSI/AHRI 340/360	11.7

1. *Values apply when the unit has no heating section or when the heating section is of electrical resistance type. For all other types, deduct 0.2 from the EER values.*

2. *For systems with heat recovery, deduct 0.2 from the EER values.*

2.2.3 MEPS for Condensing Units

Table 3: MEPS for condensing units

Air-conditioner / Appliance Type	Rated Cooling Capacity (Btu/h) [kW]	Testing Method	EER (T1) (Btu/W.h)
Condensing units,air cooled	≤ 135,000 [39.56 kW	ANSI/AHRI 210/240 ANSI/AHRI 340/360	11.0
	> 135,000 [39.56 kW]	ANSI/AHRI 365	10.5
Condensing units, water cooled	≤ 135,000 [39.56 kW]	ANSI/ANSI/AHRI 340/360	11.9
	> 135,000 [39.56 kW]	ANSI/AHRI 365	13.5
Condensing units, evaporatively cooled	≤ 135,000 [39.56 kW]	ANSI/AHRI 340/360	11.9
	> 135,000 [39.56 kW]	ANSI/AHRI 365	13.5

2.2.4 MEPS for Chillers

Table 4: MEPS for chillers

Air-conditioner / Appliance Type	Rated Cooling Capacity (Btu/h) [kW][1]	Testing Method	EER (T1)[2] (Btu/W.h)
Air-cooled chillers	≤ 1,800,000 [527.40 kW]	ANSI/AHRI 550/590	9.7
	> 1,800,000 [527.40 kW]		9.7
Water-cooled electrically operated,positive displacement	≤ 900,000 [263.70 kW]	ANSI/AHRI 550/590 or ISO 13256-2	15.4
	> 900,000 [263.70 kW] and ≤ 1,800,000 [[527.40 kW]		16.0
	> 1,800,000 [527.40 kW] and ≤ 3,600,000 [1,054.80 kW]		17.7
	> 3,600,000 [1054.80 kW] and ≤ 7,200,000 [21,109.60 kW]		19.2
	> 7,200,000 [2,109.60 kW] and ≤ 14,400,000 [4,219.20 kW]		19.2

Air-conditioner / Appliance Type	Rated Cooling Capacity (Btu/h) [kW][1]	Testing Method	EER (T1)[2] (Btu/W.h)
Water-cooled electrically operated, centrifugal (K_{adj} factor)	≤ 3,600,000 [1,054.80 kW]	ANSI/AHRI 550/590 or ISO 13256-2	17.3
	> 3,600,000 [1,054.80 kW] and ≤ 7,200,000 [2,109.60 kW]		20.5
	> 7,200,000 [2,109.60 kW] and ≤ 14,400,000 [4,219.20 kW]		20.5
	> 14,400,000 [4,219.20 kW]		20.5

1 *Expression of cooling capacity using TR units is accepted using conventional conversion of 1 TR = 12,000 Btu/h.*

2 *Use of the Kadj factor expressed in ASHRAE 90.1 Clause 6.4.1.2.1 is allowed for determination of the rated EER at T1 conditions.*

2.2.5 MEPS for Absorption chillers

Table 5: MEPS for Absorption chillers

Air-conditioner / Appliance Type	Rated CoolingCapacity (Btu/h)	Testing Method	EER (T1) (Btu/W.h)
Air-cooled absorption, single effect	All Capacities	ANSI/AHRI 560	2.0
Water-cooled absorption, single effect	All Capacities		2.4
Absorption double effect, indirect fired	All Capacities		3.4
Absorption double effect, direct fired	All Capacities		3.4

2.2.6 MEPS for Electrically Operated Variable-Refrigerant-Flow (VRF) Air Conditioner Systems

Table 6: MEPS for Electrically Operated Variable Refrigerant Flow (VRF) Air Conditioner

Air-conditioner / Appliance Type	Rated Cooling Capacity (Btu/h) [kW]	Testing Method	EER (T1) (Btu/W.h)
VRF multi split Air-Conditioners,air cooled	> 65,000 [19.05 kW] and ≤ 135,000 [39.56 kW]	ANSI/AHRI 1230 or ISO 15042	12.5
	> 135,000 [39.56 kW] and ≤ 240,000 [70.32 kW]		12.0
	> 240,000 [70.32 kW]		10.0
VRF multi split Air-Conditioners,heat pumps	> 65,000 [19.05 kW] and ≤ 135,000 [39.56 kW]		12.0
	> 135,000 and ≤ 240,000 [70.32 kW]		11.5
	> 240,000 [70.32 kW]		10.0
VRF multi split Air-Conditioners,water cooled	> 65,000 [19.05 kW] and ≤ 135,000 [39.56 kW]		12.0
	> 135,000 [39.56 kW] and ≤ 240,000 [70.32 kW]		10.0
	> 240,000 [70.32 kW]		10.0

2.2.7 MEPS for Close Control ACs and Condensing Units Serving Computer Rooms

Table 7: Computer and Data Processing Room Air-Conditioners

EquipmentType	Net Sensible Cooling Capacity (Btu/h) [kW]	Standard Model	Minimum Net Sensible COP(NsensCOP)			Test Procedure
			Minimum Net Sensible COP(NsensCOP)			
			Class 1	Class 2	Class 3	
			23.9 °C / 11.1 °C (75 °F / 52°F)	29.4 °C / 11.1 °C (85 °F / 52°F)	35 °C / 11.1 °C (95 °F / 52°F)	
Air Cooled	>65,000 [19.05 kW] and <240,000 [70.32 kW]	Down-Flow Unit		2.20		AHRI 1360
		Up-Flow Unit (Ducted)		2.05		
		Up-Flow Unit (Non-Ducted)	1.99			
		Horizontal-Flow Unit			2.35	
	≥240,000 [70.32 kW]	Down-Flow Unit		2.00		
		Up-Flow Unit (Ducted)		1.85		
		Up-Flow Unit (Non-Ducted)	1.79			
		Horizontal-Flow Unit			2.15	
Water Cooled	>65,000 [19.05 kW] and <240,000 [70.32 kW]	Down-Flow Unit		2.40		AHRI 1360
		Up-Flow Unit (Ducted)		2.20		
		Up-Flow Unit (Non-Ducted)	2.15			
		Horizontal-Flow Unit			2.60	
	≥240,000 [70.32 kW]	Down-Flow Unit		2.25		
		Up-Flow Unit (Ducted)		2.10		
		Up-Flow Unit (Non-Ducted)	2.05			
		Horizontal-Flow Unit			2.45	
Water Cooled with Fluid Econom-izer	>65,000 [19.05 kW] and <240,000 [70.32 kW]	Down-Flow Unit		2.35		AHRI 1360
		Up-Flow Unit (Ducted)		2.15		
		Up-Flow Unit (Non-Ducted)	2.10			
		Horizontal-Flow Unit			2.55	
	≥240,000 [70.32 kW]	Down-Flow Unit		2.20		
		Up-Flow Unit (Ducted)		2.05		
		Up-Flow Unit (Non-Ducted)	2.00			
		Horizontal-Flow Unit			2.40	

Equipment Type	Net SensibleCooling Capacity (Btu/h) [kW]	Standard Model	Minimum Net Sensible COP (NsensCOP)			Test Procedure
			Minimum Net Sensible COP			
				(NsensCOP)		
			Class 1	Class 2	Class 3	
			23.9 oC / 11.1 oC (75 oF / 52oF)	29.4 oC / 11.1 oC (85 oF / 52oF)	35 oC / 11.1 oC (95 oF / 52oF)	
Glycol Cooled	>65,000 [19.05 kW] and <240,000 [70.32 kW]	Down-Flow Unit		2.05		AHRI 1360
		Up-Flow Unit (Ducted)		1.85		
		v	1.85			
		Horizontal-Flow Unit			2.15	
	≥240,000 [70.32 kW]	Down-Flow Unit		1.95		
		Up-Flow Unit (Ducted)		1.80		
		Up-Flow Unit (Non-Ducted)	1.75			
		Horizontal-Flow Unit			2.10	
Glycol Cooled with Fluid Economizer	>65,000 [19.05 kW] and <240,000 [70.32 kW]	Down-Flow Unit		1.95		AHRI 1360
		Up-Flow Unit (Ducted)		1.80		
		Up-Flow Unit (Non-Ducted)	1.75			
		Horizontal-Flow Unit		2.10	2.10	
	≥240,000 [70.32 kW]	Down-Flow Unit		1.90		
		Up-Flow Unit (Ducted)		1.80		
		Up-Flow Unit (Non-Ducted)	1.70			
		Horizontal-Flow Unit			2.10	

2.2.8 Recommended AC Operational Measures:

3. Thermostat settings of all air-conditioning unit / system should be kept at 24-25 degrees maximum.

4. In central air-conditioning, wherever possible arrangements may be made to stop air handling units (AHU's) after office working hours. Otherwise, programmable thermostats shall be installed to maintain temperature of 24-25 degrees during working hours and higher temperature after working hours.

5. Air handling Units (AHU's) & chilled water pumps should be provided with variable speed drive (VSD's) to control the flow of air/water into the air-conditioned place as per the load requirement.

6. Fresh air damper of AHU's should be kept at the required opening to ensure proper indoor air quality. Running of exhaust fans should be controlled to avoid loading of air-conditioning system.

7. Maintenance of central air-conditioning system, window, and split units should be carried out regularly. Filters of split & window units should be checked and cleaned at fortnightly intervals.

8. Damaged & clogged condenser of AC plant should be replaced to maintain efficient running of the units.

9. Very old inefficient AC units & systems should be replaced with more efficient ones. Operation and maintenance data should be logged periodically, and a decision must be taken to replace units when deterioration in efficiency become noticeable.

10. Staff may be advised to switch off their individual window, split, and FCU units in their offices when leaving after duty hours. They should not depend on housekeeping staff to switch off them.

11. Ensure that all air-conditioned areas are kept closed to avoid infiltration of outside air through doors and windows.

2.3 District Cooling

Existing buildings where the chillers are at the verge for replacement due to ageing is advised to connect to district cooling if the network is available in their blocks.

All new buildings developed in the blocks in which district cooling infrastructure is available are advised to connect to district cooling network.

LIGHTING

3. Fixed Lighting Installations

3.1 Illumination Level

Lighting Power Density (LPD) is the electrical power consumed (W) by lighting installations per unit floor area (m^2) of an illuminated space.

For a building that comprises of one or more spaces as listed in the following Tables the lighting power density of each space shall not exceed the corresponding maximum allowable values given below and as per BS EN 12464-1.

Location / Room Type	Light Level (Lux)	Lighting Power density (LPD) (Wats/Sq.m)
Traffic zones inside buildings		
Circulation areas and corridors	100	7
Stairs, escalators, travelators	100	7
Elevators, lifts	100	7
Loading ramps/bays	150	10
Parking -Interior	50-100	2-5
General areas inside buildings – Rest, sanitation and first aid rooms		
Canteens, pantries	200	10
Rest rooms	100	7
Cloakrooms, washrooms, bathrooms, toilets	200	10
Rooms for medical attention	500	13
General areas inside buildings – Control rooms		
Rooms for medical attention	200	9
Switchboard	500	13

General areas inside buildings – Storerooms, cold stores		
Store and stockrooms	100	7
Dispatch packing handling areas	300	10
General areas inside buildings – Storage rack areas		
Gangways: unmanned	20	2
Gangways: manned	150	7
Control stations	150	7
Storage rack face	200	9
Offices		
Office - Open	300-500	10
Office - Private	300-500	12
Filing, copying, etc.	300	10
Writing, typing, reading, data processing	500	13
Technical drawing	750	15
CAD workstations	500	13
Conference and meeting rooms	500	13
Reception desk	300	10
Archives	200	9
Retail premises		
Sales area	300	10
Till area (Counter/Cash reg)	500	13
Wrapper table	500	13
Places of public assembly – General areas		
Entrance halls	100	7
Cloakrooms	200	9
Lounges	200	8
Ticket offices	300	10
Places of public assembly – Restaurants and hotels		
Reception/cashier desk, porters' desk	300	10
Kitchen	500	13
Self-service restaurant	200	9
Buffet	300	10
Conference rooms	500	13
Corridors	100	7

Places of public assembly – Theatres, concert halls, cinemas, places for entertainment		
Practice rooms	300	10
Dressing rooms	300	10
Seating areas – maintenance, cleaning	200	9
Stage area - rigging	300	10
Places of public assembly – Trade fairs, exhibition halls		
General lighting	300	10
Places of public assembly – Libraries		
Bookshelves	200	9
Reading area	500	13
Counters	500	13
Places of public assembly – Public car parks (indoor)		
In/out ramps (during the day)	300	10
In/out ramps (at night)	75	5
Traffic lanes	75	5
Parking areas	75	5
Ticket office	300	10
Educational premises – Nursery school, play school		
Play room	300	10
Nursery	300	10
Handicraft room	300	10
Educational premises – Educational buildings		
Classrooms, tutorial rooms	300	10
Classroom for evening classes and adults education	500	13
Auditorium, lecture halls	500	13
Black, green and white boards	500	13
Demonstration table	500	13
Art rooms	500	13
Technical drawing rooms	750	15
Practical rooms and laboratories	500	13
Handicraft rooms	500	13
Teaching workshop	500	13
Music practice rooms	300	10
Computer practice rooms	300	10
Preparation rooms and workshops	500	13
Entrance halls	200	9
Circulation areas, corridors	100	8
Stairs	150	7
Student common rooms and assembly halls	200	9

Health care premises – Rooms for general use

Waiting rooms	200	9
Corridors: during the day	100	7
Corridors: cleaning	100	7
Corridors: during the night	50	4
Corridors with multi-purpose use	200	9
Day rooms	200	9
Elevators, lifts for persons and visitors	100	7
Service lifts	200	9
Staff office	500	13
Staff rooms	500	13
General lighting	100	7
Reading lighting	300	10
Simple examinations	300	10
Examination and treatment	1000	24
Bathrooms and toilets for patients	200	9

References:
BS EN 12464-1 – 2011
IECC – 2021 – Chapter 4 (CE) Commercial Energy Efficiency

3.2 Lighting Controls

Lighting Control Point is a lighting control device designed for use by the occupants of a space.
If a lighting installation is designed for operation by occupants of a space, the lighting control points should be located at positions that are easily accessible to the occupants.
For any space that is classified as an open plan office, a cellular office or a drawing office, the minimum number of lighting control points for that office space is given in the following Table.

Minimum Number of Lighting Control Points for Office Space

Space Code	Space Area A (m^2)	Minimum No. of Lighting Control Points
1	$A \leq 10\ m^2$	1
2	$10\ m^2 < A \leq 20\ m^2$	2
3	$20\ m^2 < A \leq 30\ m^2$	3
4	$10 \times (N-1)\ m^2 < A \leq 10 \times N\ m^2$	N: integer < 20
5	$50 \times (N-20) + 200\ m^2 < A \leq 50 \times (N-19) + 200\ m^2$	N: integer ≥ 20

"Area of a Space (unit: m^2)" is measured based on the space internal dimensions excluding wall thickness.

3.3 Energy Efficient Features

Energy-efficient lighting features such as on-off programming, timer-control, photo sensor, automatic dimming, occupancy-sensors etc. should be installed and integrated with BMS as appropriate for efficient control of lighting.

3.4 General Guidelines

1. Use EWA certified LED lamps & luminaires for all indoor & outdoor lighting installations.
2. Use occupancy sensors in places where occupants are present only occasionally and if place remains unoccupied for considerable periods such as toilets, meeting rooms, halls etc.
3. Use motion sensors in corridors, concourse, staircase and other common areas.
4. It is recommended to use smart automatic lighting system or Building Management System (BMS) if available for controlling individual and group of lights.
5. Use timers or photocells for controlling outdoor lights.
6. All lamps and fittings should comply to Bahrain's Lamp regulation no. 3/2015.
7. Except for security reasons, all lights should be kept off when not needed during weekends and public holidays and after working hours.
8. Lights should be kept off in closed plant rooms/ switch rooms/ empty office rooms / etc. and open corridors where enough natural light is present during daytime.

THERMAL INSULATION

4. Thermal Insulation

All new buildings should be constructed as per thermal insulation order No. 149/2018 And as per the following requirements:

Maximum Limit for Transmittance Value / Overall U Value ($W/m^2.C$)	
Roofs	0.3
Walls	0.57

Percentage of Glass Area Compared with Overall Façade Area	Max. U-Value ($W/m^2.C$)	Max. Shading Coefficient	Min. Light Transmission
less than or equal 40%	2.1	0.4	0.25
More than 40%	1.9	0.3	0.20
Skylights & Roof Openings	1.9	0.25	0.10
Shopfronts and Showrooms	1.9	0.76	-

Roofs shall be prepared or coated to reflect sun rays and became of cool roof types. Solar reflectance should not be less than 0.65 and the thermal emittance should not be less than 0.75. Roofs containing photovoltaic panels may be exempted from this condition.

WATER HEATERS

5. MEPS for Storage Water Heaters (As per SASO-2884-ed.1)

Table 1 MEPS Storage Water Heaters

Minimum Energy Efficiency (nwh) in%										
Declared Load Profile	3XS	2XS	XS	S	M	L	XL	2XL	3XL	4XL
Energy Efficiency	53	55	63	63	73	73	79	79	79	79

5.1 Recommended Operational Measures for Water Heaters

1. Select modern electric water heaters equipped with thermostat and timer or programmer and with energy efficiency values exceeding the MEPS indicated above.
2. Set the thermostat at a moderate temperature, not exceeding 60^0C. This will also reduce electricity consumption. High water temperature may accidently lead to scalding.
3. Insulate hot water pipes properly.
4. Insulate hot water tanks properly.
5. Install timer to control the operating hours of the water heater.
6. Installation of solar water heater may be considered if feasible.

REFREGATORS & FREEZERS

6. MEPS for Refrigerators, Refrigerators – freezers & Freezers (As per SASO 2892-2018)

Refrigerating appliances with a storage volume equal to or higher than 10 liters shall comply with the energy efficiency index limits in the given table.

Table: MEPS Refrigerators, Refrigerators - Freezers & Freezers

Minimum Energy Efficiency Index (MEPS)	EEI < 45

6.1 Recommended Operational Measures for Refrigerators – Refrigerators, freezers & Freezers

1. Keep the refrigerators at least 6 to 8 inches away from the wall for good air circulation & efficient running.
2. Clean the condenser coils once in a year to improve efficiency.
3. Do not keep the door open for long time.
4. Defrost the refrigerators regularly.
5. Let the food cool down before storing in the refrigerators.
6. Check the door seal & ensure that door is properly closing.

OTHER EQUIPMENT

7. Office Equipment

Select highly rated EWA certified appliances. If EWA certification was not available, other acceptable ratings, such as Energy Star, may be used.

Energy star certified office equipment such as computers, monitors, imaging equipment such as printers & copiers save energy through efficient design and power management options. They use less energy to perform regular tasks and when not in use automatically enter into low power modes.

Staff may be advised to switch off their computers, monitors, printer, copiers etc. after duty hours instead of keeping in the sleep mode.

8. Power Factor

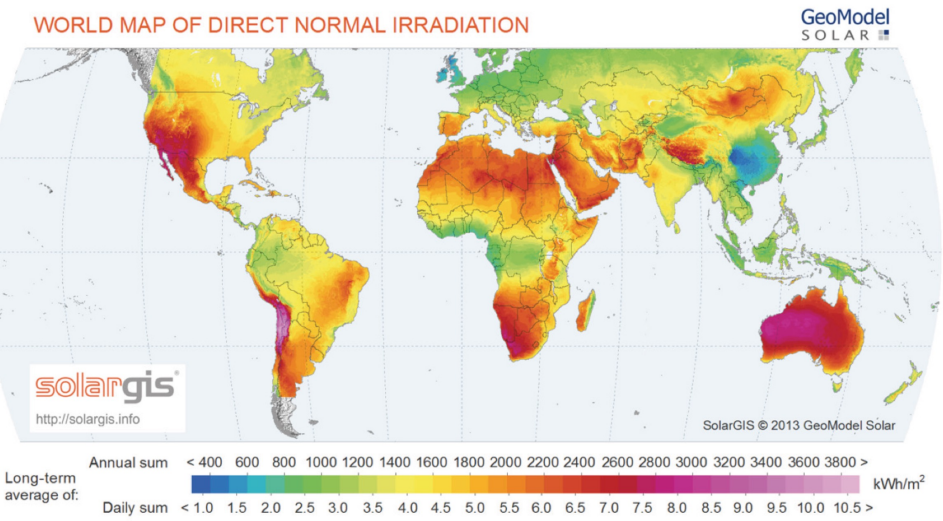
Power factor must be maintained above 0.9 as per EWA guidelines to avoid payment of reactive power charges and to reduce power losses. If required, power factor correction capacitor may be installed to maintain it above 0.9 and as close as possible to unity. Only EWA approved contractors and equipment may be used. Following web link / QR code provide links to approved lists.

https://bit.ly/3ci7xqB

RENEWABLE ENERGY

9. Renewable Energy

Kingdom of Bahrain is located in the Arabian Gulf at a latitude of 26.0667 and a longitude of 50.5577. Bahrain enjoys a high level of solar irradiation reaching more than 2000 KWh/m^2 per year, as it is shown from the map below.



Therefore, It is recommended to use renewable energy feasible applications such as lighting and water heating. Solar lighting system should be considered particularly for outdoor lighting. It is recommended to use car park area & roof top for installation of solar PV panels.

Following web link / QR code provide information related to EWA's solar PV connection process, net metering, approved PV equipment, contractor list, technical documentation and other necessary details.

https://bit.ly/39nvpaG

EWA
هيئة الكهرباء والماء
Electricity & Water Authority

APPENDICES

THERMAL INSULATION IN BUILDINGS

Technical Regulation

EWA
هيئة الكهرباء والماء
Electricity & Water Authority

THERMAL INSULATION REGULATION

1. OBJECTIVE
2. DEFINITIONS
3. MEASUREMENTS & CALCULATIONS NEEDED TO IMPLEMENT THERMAL INSULATION
4. REQUIREMENTS FOR THERMAL INSULATION IN BUILDINGS
5. PROPERTIES & SPECIFICATIONS OF THERMAL INSULATION ATERIALS
6. REQUIRED TEMPLATES & CALCULATIONS

1. Objective:

Energy inside buildings is consumed for various purposes, perhaps the most important of which is air conditioning, which consumes the largest part in buildings of the Kingdom of Bahrain, as the temperature rises to record levels during summer months.

The morphology of a building, its planning, design and the characteristics of materials used in it have a great impact on determining the electrical energy requirements of the building. Also, proper planning of the thermal properties of the building envelope is most effective in improving the efficiency of the building. Therefore, this regulation for thermal insulation has been prepared with the aim of improving the thermal performance of buildings that are being constructed or reconstructed in the Kingdom of Bahrain. This goal is achieved in the articles of this regulation by specifying the thermal properties of the building envelope, i.e. roofs, external walls and external glazed surfaces.

2. Definitions:

Overall heat Transfer Coefficient (U_T)

The overall heat transfer coefficient (U_T) is the term associated with the rate of heat transfer through the building envelope, which is the rate of passage of a heat unit through a unit area of materials that constitute the envelope of the building starting with the air layer in contact with the hot surface and ending with the air layer in contact with the cold surface . The lower its value, the better the thermal performance of the building. The unit of measurement for the thermal heat transfer coefficient is $W/m^2.K$.

Thermal Conductivity (k)

Thermal Conductivity is the rate of heat transfer per unit thickness of a homogeneous material when there is a difference of one degree in temperature between the two surfaces of the material. The value of thermal conductivity depends on the density of the material, its porosity, moisture content, and specific heat. The unit of measurement for thermal conductivity is W/m.K.

Thermal Resistivity (r)

Thermal Resistivity, also called specific thermal resistance or thermal density, is a measure of the resistance to the transfer of heat through a unit thickness of a homogeneous material when there is a difference in temperature between the two surfaces of the material. The unit of measurement for the thermal resistivity is m.K/W.

Thermal Conductance (C)

Thermal Conductance is the rate of heat transfer through a material or substances that constitute it through a unit area when there is a difference of one-degree temperature. It is calculated by dividing the Thermal Conductivity (k) by the thickness of the material: (C = k / d).

Thermal Resistance (R)

It is the resistance to the flow of heat through a unit area of a homogeneous material when there is a difference in temperature between the two surfaces of the material. It is the inverse of the thermal conductivity, and its unit of measurement m^2.K/w. It is calculated by dividing the thickness of the material by the thermal conductivity: (R = d / k).

Surface Thermal Resistance (Rs)

It is the resistance of the air layer in contact with the surface of the material for the transfer of heat through it and its unit of measurement is m^2.K/w. It is divided into two parts: Ri the resistance of the air layer in contact with the inner surface and Ro the resistance of the air layer in contact with the outer surface. The table below, Table (1), shows the appropriate values to be used in the Kingdom of Bahrain.

Cavity Thermal Resistance (Rc)

It is the resistance of the air space or vacuum separating two materials to the transfer of heat through it. The resistance of the air vacuum depends on several factors, the most important of which is the thickness of the air space and the properties of the two opposite surfaces of the two materials. The unit of measurement is m^2.K/w.

Total Thermal Resistance (RT)

It is the sum of the thermal resistances of the different layers composing a structure, starting with the air layer in contact with the outer surface to the air layer in contact with the inner surface. The unit of measurement is m^2.K/w.

Coefficient of Reflectance

It is a measure of the ability of a surface to reflect sun rays. Its value ranges from 0 to 1. The higher the reflection coefficient, the better the surface in reflecting the sun rays.

Coefficient of Emittance

It is the ability of materials to emit or get rid of the heat absorbed in, and its value ranges from 0 to 1. The higher the value of the coefficient, the better the surface in losing heat.

3. Measurements & Calculations Needed to Implement Thermal Insulation:

Calculations are made considering the interpretation of the acronyms and definitions mentioned above and as described below:

- Watt = W
- Meter = m
- Square meter = m^2
- Kelvin = K
- British thermal unit = Btu
- Inch = in
- Hour = hr
- Foot = ft.
- Square foot = ft^2
- Fahrenheit = F

Calculations shall be made according to the following equations:

1. Thermal Conductivity (k)

$$K\ or = \frac{W}{m.K}\ or\ \frac{Btu.In}{hr.ft^2.F}$$

2. Thermal Resistivity (r)

It is the reciprocal of the coefficient of thermal conductivity, i.e. 1/K

$$\frac{W}{m.K}\ or\ \frac{hr.ft^2.F}{Btu.in}$$

3. Thermal Resistance (R)

$$\frac{K.m^2}{W} \; or \; \frac{ft^2.hr.F}{Btu}$$

To calculate R:

R=L x r

(r) is the specific thermal resistance of the material (L) is the thickness of the material Noting that the higher the thermal resistance of the material, the better it is in terms of thermal insulation.

4. Total Thermal Resistance (RT)

$R_T = R_1 + R_2 + \ldots + R_i + R_o$

Ri: the air layer close to the inner surface Ro: the outer air layer.

The table below shows the values of Ri and Ro

Thermal resistance of the adjacent air layer		Type of Facade
Internal thermal resistance (R_i)	External thermal resistance (R_o)	
0.121	0.059	Wall
0.166	0.059	Roof

5. Overall heat Transfer Coefficient (U_T)

It is the reciprocal of the total thermal resistance (R_T)

$$U = \frac{1}{RT}$$

Its unit is usually interpreted as $W/m^2.k$ or Btu / ft^2. hr. f.

Noting that the lower the U value of a facade, the better it is in terms of thermal insulation.

6. Weighted Average Heat Transfer Coefficient UWA

When using different thermal insulation systems in external walls, weighted average must be calculated by taking the average heat transfer coefficient for all these parts according to their areas as follows:

U_{WA} = SUM (A1 * U1 + A2 * U2 + …… + AN * UN) / SUM (A1 + A2 +… .. + A_N)

7. Resistance of Air Cavity (R_c)

The following values may be used for thermal resistance (R_c).

Cavities with thicknesses 5 to 20 mm	Cavities with thicknesses Higher than 20 mm
(R_c) = 0.11 m^2.K / W	(R_c) = 0.18 m^2.K / W

4. Requirements for Thermal Insulation in Buildings:

When implementing thermal insulation, the following guidelines and conditions must be observed:

1. The value of the overall heat transfer coefficient (U_T) shall not exceed 0.3 W/m^2.K for roofs.

2. The value of the overall heat transfer coefficient (U_T) shall not exceed 0.57 W/ m^2.K for walls .

3. High performance glass (insulated) should be used in windows / glazed surfaces of building according to the following schedule:

Maximum Limit Light Transmission	Maximum Limit Shading Coefficient	Maximum Limit (W/m^2.C) U Value	Cases
0.25	0.4	2.1	Glass area ratio is less or equal to 40%
0.20	0.3	1.9	Glass area ratio above 40%
0.10	0.25	1.9	Skylight / roof openings
-	0.76	1.9	Shopfronts and Showrooms

Reflectance	Emittance
0.65 Minimum	0.75 Minimum

5. Properties and specifications of thermal insulation materials:

1. All materials to be used in the building envelop must be certified and approved by the Electricity & Water Authority.

2. Thermal insulation materials used internally in ceilings and walls must be fire retardant and should not produce any toxic gases when exposed to fire. The endorsement of the concerned authority, the General Administration of Civil Defense, must be sought in this regard.

3. When calculating UT / U value for materials used in exterior surfaces and walls, only data issued by EWA should be used. EWA's endorsed data are based on accredited test reports. The Electricity and Water Authority may visit sites and take the necessary samples, if necessary, to verify the validity of submitted data.

4. During the implementation of thermal insulation, the following must be considered:

    1. Insulation materials intended for use should be stored, protected and dry.

    2. Ensure, before installing the materials, that they are intact and free from any cracks, holes, scrapes or grease.

    2. Cover installed materials on both sides of walls with a moisture-proof cover, in accordance with the appropriate installation method as approved by the Electricity and Water Authority.

    3. Cover installed materials on both sides of insulation materials used in roof with a barrier or a cover on top. The bottom side should be covered with a water- proof material, as per the appropriate installation method approved by EWA.

6. Required Templates & Calculations:

The following templates need to be filled by a certified engineering office / consultant and then attached to the Building Permit request / application.

1. Roof Template

Sr. No.	Description of materials used in Roof	Density kg/m^3	Thickness (l) m	r m.k w	R $m^2.k$ w	Remarks
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
Total thermal resistances for materials used in Roof (R_T):						

U-Value = W/m.^{2o}C

2. Wall Template

Sr. No.	Description of materials used in Roof	Density kg/m^3	Thickness (l) m	r m.k w	R $m^2.k$ w	Remarks
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
Total thermal resistances for materials used in Roof (R_T):						

U-Value = W/m.^{2o}C

3. Windows and Glazed Surfaces

The details of windows and glazing to be used on external surfaces, including design, layout, and shading (if available) should be attached. Dimensions and properties of materials must be specified as per the following schedules:

Location	Windows & Doors	Curtain Wall	Sky Light	Total Glass F Area (M^2)	Total acade Area (M^2)	Glass %
Glass Area (M^2)						

Location	Glass Type & Description		Thickness (mm)			Summer U-VALUE (W/M^2 C_o)	Shading Coefficient (SC)	Light Transmission %
	Outer Pane	Inner Pane	Outer Pane	Air Pane	Inner Pane			
Windows & Doors								
Curtain Walls								
Sky Light								

Designs, types, and specifications of both door and window frames should be submitted to EWA through a certified engineering office for approval before installation on site, and as per declared procedures.

REGULATION ON ENERGY LABELLING AND MINIMUM ENERGY PERFORMANCE REQUIREMENTS FOR AIR-CONDITIONERS

EWA
هيئة الكهرباء والماء
Electricity & Water Authority

AIR CONDITIONING REGULATIONS

1. Scope & Objective

1.1 Scope

This regulation specifies the energy labelling requirements and the Minimum Energy Performance Standard (MEPS) requirements for single-package (such as window type) and split-system non-ducted air conditioners using air- and water-cooled condensers and heat pumps employing air-cooled condensers and ducted air-conditioners using air-to-air heat pumps for residential, commercial and industrial sector as applicable in accordance with Bahrain standards.

1.2 Objective

The objective of this regulation is to:

1. Provide detailed information on the performance and energy labeling requirements which an air-conditioning appliance has to meet in order to carry a valid energy efficiency label; and

2. Provide detailed information on the performance requirements which an air-conditioning appliance has to meet in order to meet minimum energy performance standard requirements.

2. Normative References

Updated editions of the following normative references are applied (Including any changes on these normative references).

2.1 GSO ISO 5151 “Non-ducted air conditioners and heat Pumps -Testing and rating for Performance”

2.2 GSO ISO 13253 “Ducted air-conditioners and air-to-air heat Pumps - Testing and rating for Performance”.

3. Terms & Conditions

For the purposes of this regulation, the terms and definitions given in standards mentioned in sub-clauses 2.1 and 2.2 and those below are considered.

3.1 Ducted air conditioner

An air conditioner model configuration where the indoor side is situated remote to the space to the conditioned. The conditioned air is supplied or extracted via a duct.

3.2 Non-ducted air conditioner

An air conditioner model configuration where the indoor side is situated partly or wholly within the space to be conditioned. The conditioned air is supplied and extracted directly to and from the conditioned space.

3.3 Rated capacity

The nominal rated capacity claimed by the manufacturer of an air conditioner model determined as follows, as applicable:

a) Rated total cooling capacity as claimed by the manufacturer for tempera- ture condition T1 and T3. (Units: Btu/h).

b) Rated heating capacity as claimed by the manufacturer for indicated heating capacity test conditions specified in the normative references in clause (2). (Units Btu/h).

c) The rated capacity appears on the energy label as 'Capacity Output' (heating and/or cooling as applicable. (Units: Btu/h).

3.4 Rated Power

Effective power input of the air conditioner model as claimed by the manufacturer during the determination of rated cooling capacity and rated heating capacity, as applicable. (Units: W or kW.)

3.5 Split System

An air conditioner with separate indoor and outdoor components that are connect- ed with refrigerant piping. The indoor unit usually lies within the conditioned space and may be installed or portable / mobile.

3.6 Star rating

The number of stars displayed on the energy label. Available stars are between a minimum of one and a maximum of six. It is considered as an indication of the claimed energy efficiency of a model at rated conditions. A higher star rating indicates a higher energy efficiency. It is derived from the measured EER.

3.7 Estimated annual energy consumption

Estimated annual energy consumption at rated power will be kWh consumed in 2700 hours at full load.

4. Registration Requirements

4.1 The registration requirement and information about energy labeling and MEPS will be available at Electricity & Water Authority (EWA).

4.2 For registration of an air conditioner for energy labeling and MEPS with a test report in accordance with recent edition of GSO ISO 1515 or GSO ISO 13253, as applicable. An application shall be provided for each model, in accordance with Appendix A, and submitted to the Electricity & Water Conservation Directorate, Electricity & Water Authority, and (EWA).

4.3 Energy Label Validity (Check Testing)

The energy label shall be accepted as valid when a single sample of an appliance or unit model, tested for an initial screening test, meets the following criteria for cooling and heating, as applicable:

1. Tested effective power input… ≤ 1.05 x rated power.
2. Tested cooling and heating capacity… ≤ 0.95 x rated capacity.
3. Tested EER… ≤ 0.95 x rated EER.
4. Tested COP… ≤ 0.95 x rated COP.
5. Tested voltage… 230 volt single phase or 400 volt three phase.
6. Tested frequency… 50 Hz.
7. Testing conditions (T1)… (Refer to the standards mentioned in clause 2).

5. MEPS

The minimum energy performance standard MEPS value for the air conditioner in the scope of this regulation shall be greater than or equal to the value of Energy Efficiency Ratio (EER), when calculating the cooling capacity at test conditions (T1) and test condition (T3) as follows:

Air Conditioner Appliance Type	Cooling Capacity Limit (CC) (Btu/h) at test condition(T1)	(EER) Value (Btu/h)/watt to be applied mandatorystarting from the beginning of July 2016		(EER) Value (Btu/h)/watt to be applied mandatorystarting from the beginning of July 2016	
		T1	T3	T1	T3
Window Type	CC < 18000	8.5	6.12	9.8	7.06
	18000 ≤ CC < 24000	8.5	6.12	9.7	6.98
	CC 18000	8.5	6.12	8.5	6.12
Split Type & the other types	All Capacities	9.5	6.84	11.5	8.28

6. Name Plate and Instruction Sheet or Manual

In addition to any information needed to be displayed on the air-conditioner unit, the following information shall be marked on the name plate of the air-conditioner, in Arabic or English or both. The marking shall not be on a detachable part of the unit and shall be indelible, durable and easily legible.

Any energy / performance related information that is attached or displayed on any part of the air-conditioner unit or packaging must be justified and free from misstatements and according to the normative reference standards mentioned in the clause (2).

6.1 The information on the name plate shall include at minimum, the following:

- Manufacturer's name and/or trademark.
- Country of origin.
- Manufacturer's model or type reference and serial number of the unit.
- Rated voltage or rated voltage range (Volts).

- Rated frequency (Hz).
- Rated current in Amperes.
- Rated power input in watts or kilowatts.
- Net total room cooling capacity in Btu/h.
- Energy Efficiency Ratio (EER) in (BTU/h)/Watt.
- Heating capacity in W (Applicable to heating units only).
- Coefficient of Performance (COP) (watt/watt). (Applicable to heating units only)
- Refrigerant used and mass of refrigerant charge in kg.

6.2 An instruction sheet or manual in both Arabic and English shall be delivered with each air-conditioner, including the following information:

- The information specified in clause 6.1.
- Dimensions of the unit and its method of mounting.
- Minimum clearances between the various parts of the unit and the surrounding framework.
- Instructions necessary for the correct operation of the unit and any special precautions to be observed to ensure its safe use and maintenance.
- Instruction for packing and unpacking the unit.
- Weight of the unit.
- Any other additional information.
- Annual energy consumption as stated in clause 3.7.

7. Energy Rating Classification

7.1 The energy efficiency class rating is used for the comparative label used with window type and split type air-cooled air-conditioner with cooling capacity less than and including 70000 Btu/h (20000 W).

7.2 The energy efficiency class is then determined in accordance with the following table, where the EER (energy efficiency ratio) is determined in accordance with the test procedures of the harmonized regulation referred to in clause 2 at condition T_1 .

EER Limits (Btu/h)/w at T_1	Star Rating
EER > 10	6
10 EER > 9.5	5
9.5 EER > 9	4
9 EER 8.5	3
8.5 > EER > 7.5	2
EER ≤ 7.5	1

8. Energy Labelling Requirements

8.1 Information and Values Contained in the Energy Labels

The required fonts are "Simplified Arabic" for Arabic and "Times New Roman" for English as illustrated in the Figures 2 and 3. The fields (a), (b), (c), (d) of Figure 1 shall comply with the following requirements:

a) *Field a* This band shall terminate according to the appliance's star rating for a rating of only full stars, bisecting the gap between the relevant star and the next higher on the scale.

b) *Field b* The brand and the model designation shall be inserted here. The wording should be complete and concise. They should have normal spacing of letter, line and word in the specified area. In the case of split systems, where the indoor and outdoor components have different model numbers, model numbers for both shall appear on the label.

c) *Field c* This band shall include the total rated cooling capacity (output capacity) and the annual energy consumption.

d) *Field d* This area shall contain the rated total heating capacity (if applicable), and the power input for heating. The Figures that apply to the particular appliance shall be of the font indicated and shall be centered in the red area for heating.

e) *Field e* This band shall include the energy efficiency ratio (EER) for the appliance.

Note: The cooling capacity and power input values shown on the energy label are based on the rated cooling capacity and the rated power, as declared by the manufacturer and shown in the nameplate for condition T1 for cooling capacity in accordance with the standards mentioned in clause 2.

8.2 Sample Labels

Examples of printed energy label for air-conditioning appliances are shown in Figures 2 and 3.

8.3 Dimensions of Labels

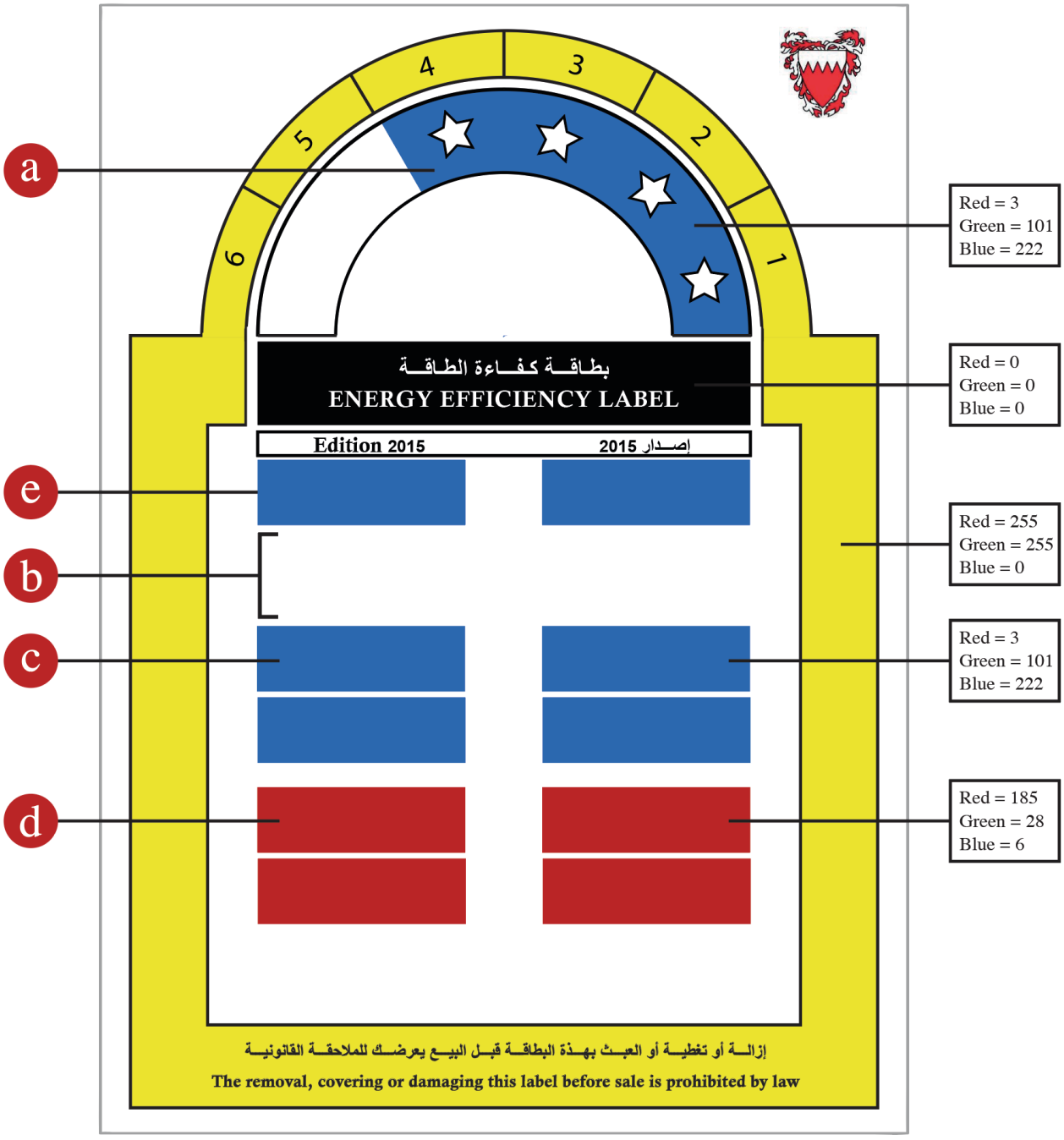
Figure 4 shows the dimensions of label.

8.4 Placement of Energy Labels

The label shall be fixed, or attached as a tag, on the front of the unit. Additional label may be attached to the exterior of the packaging. The label shall remain on the unit when the unit is removed from its packaging for display purposes.

8.5 Material and Shape of Energy Labels

The label shall be of durable cardboard, if it is to be attached as a tag, or be self-adhesive, and shall be cut to the outline shown in Figure 1. A trim or die cut margin of up to 5 mm around the label is acceptable


a
e
b
c
d
1
2
3
4
5
6
بطاقــة كفــاءة الطاقــة
ENERGY EFFICIENCY LABEL
Edition 2015
إصــدار 2015
إزالــة أو تغطيــة أو العبــث بهــذة البطاقــة قبــل البيــع يعرضــك للملاحقــة القانونيــة
The removal, covering or damaging this label before sale is prohibited by law
Red = 3
Green = 101
Blue = 222
Red = 0
Green = 0
Blue = 0
Red = 255
Green = 255
Blue = 0
Red = 3
Green = 101
Blue = 222
Red = 185
Green = 28
Blue = 6

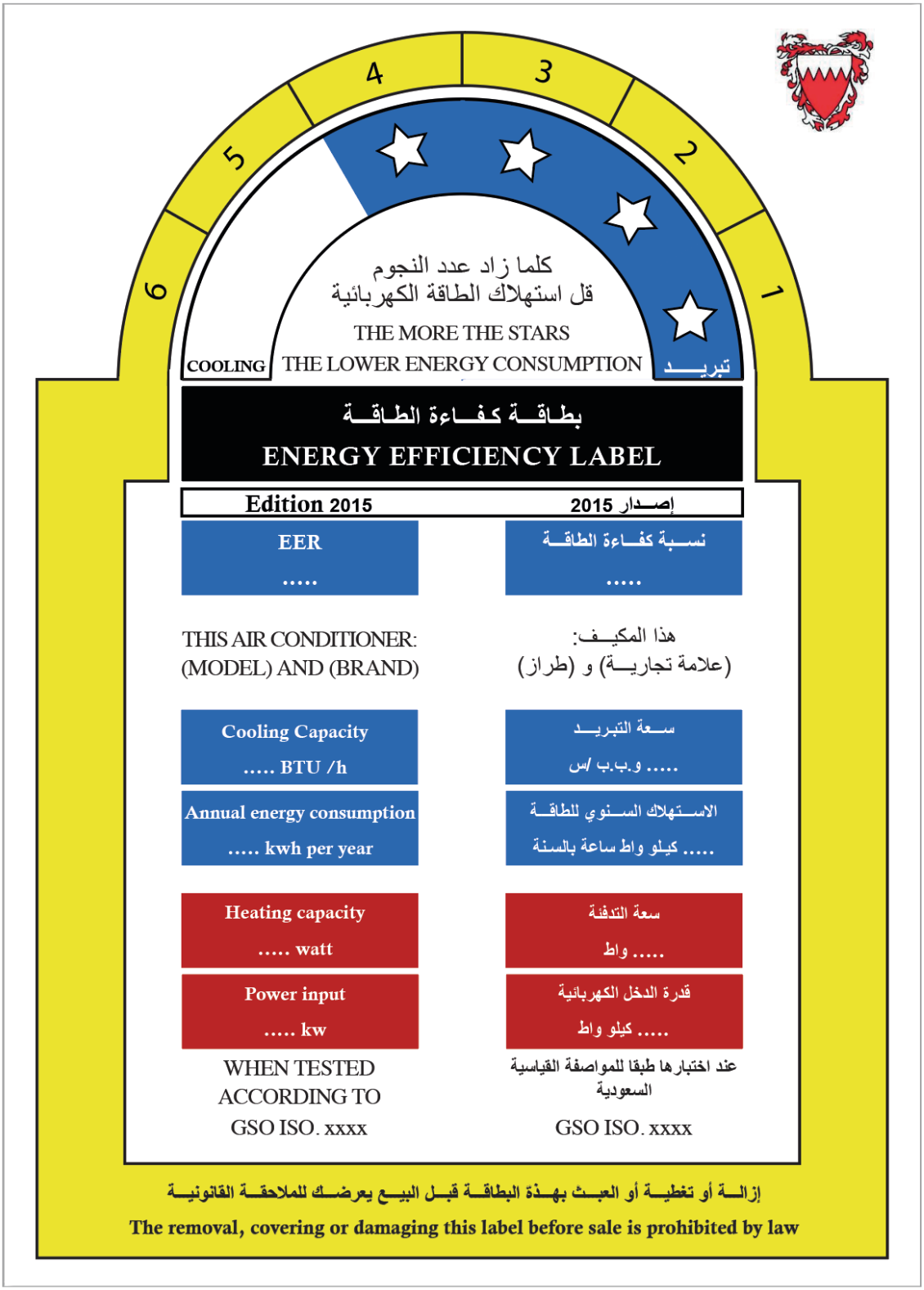


Figure 2: Example of label – Heating & Cooling Unit

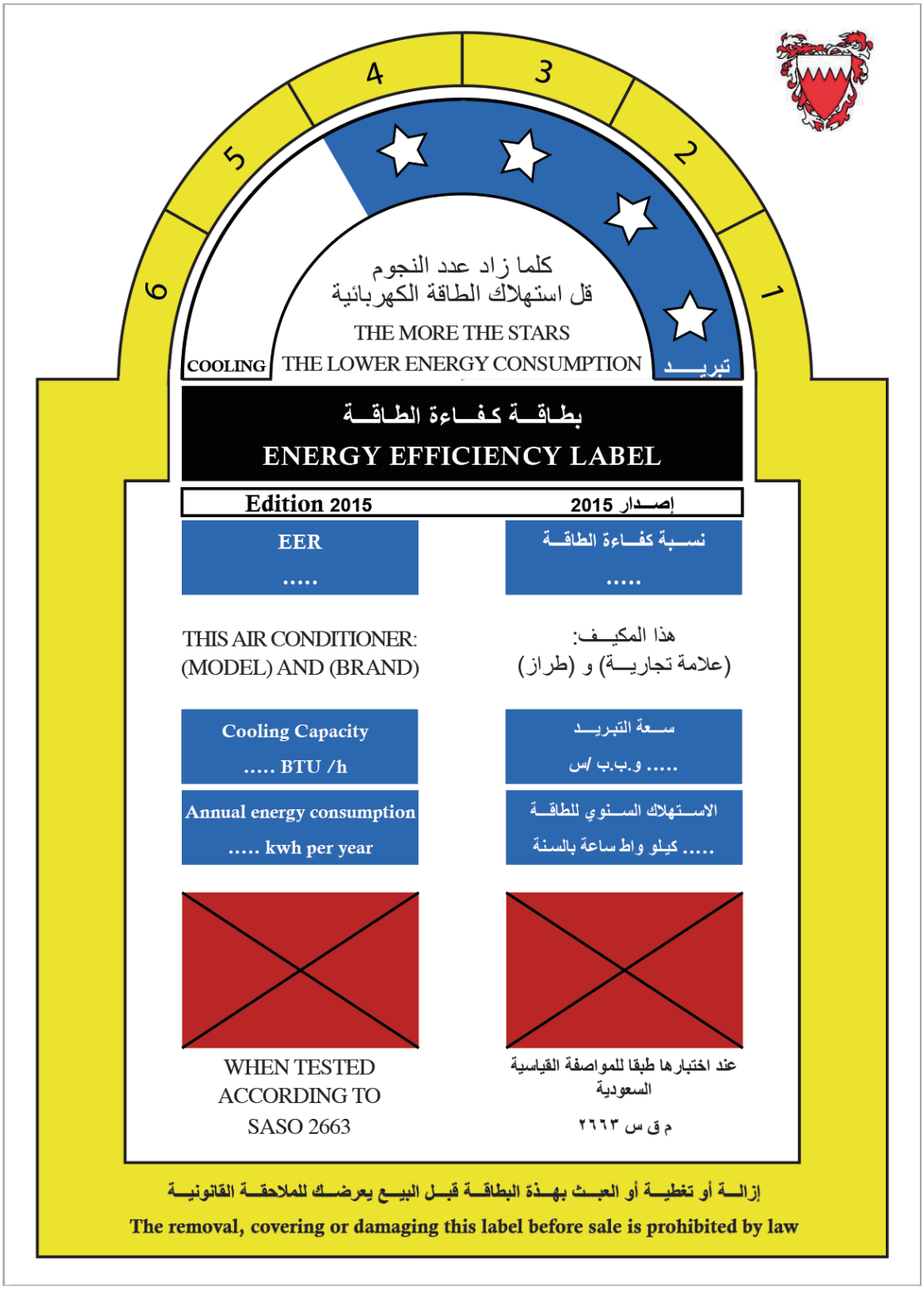


Figure 3: Example of label – Cooling Only

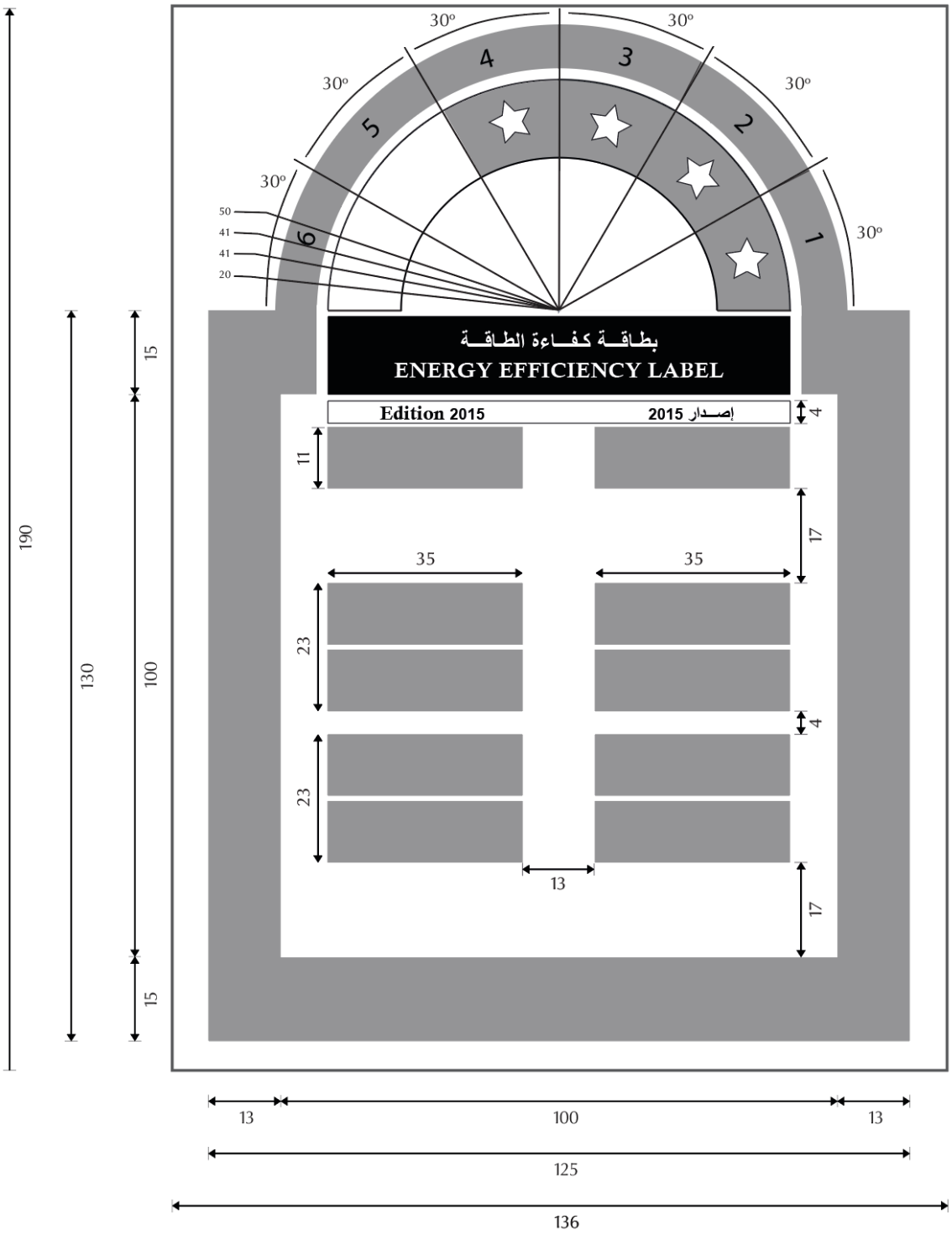


Figure 4: Dimensions of label

APPENDIX A APPLICATION FOR REGISTRATION OF AIR-CONDITIONERS FOR ENERGY LABELLING AND MEPS

(Please type or print)

This Appendix sets out the required format for submitting an application for registration.

Application for registration of an air-conditioner for energy efficiency.

I hereby apply for registration of an electrical appliance/s for the purpose of energy labeling. In the Country of

.....

(Specify the country in which this application is made)

PART 1 APPLICANT INFORMATION

Applicant Name: .....

Company Name:.....

Company Address:.....

P.O.Box:..... Post Code: .....

Contact Person: (Name and Address in Kingdom of Bahrain)

Job Title:.....

Phone:..... Fax:..... Electronic Mail:.....

Supplier or Vendor in Kingdom of Bahrain

No.	Supplier or Vendor Name	Contact Address (Mail Address, Phone, Fax, Electronic Mail)	License Number or Commercial Licenses (related to import and sale ofgoods in the Kingdom.

Part 2 DESCRIPTION OF THE APPLIANCE

Model Name (if available)		
Model Number or Family Number:		
Model Number: (on indoor unit for split systems)		
Model Number on Outdoor Unit:(split systems only)		
Other Model Numbers to be included under thisregistration:		
Country of Manufacture:		
Year in which model first available in Kingdom ofBahrain:		
Model Number(s) to appear on the Energy Label:		
Date of manufacture traceability (of package unit or indoor unit if split system): Is the date of manufacture permanently marked on the rating plate in a non-encrypted format? If yes, provide an example of the date format. If no, provide details on how to determine (from the serial number or other permanent markings for thismodel)	Yes Date format:	No Provide details:
'Date of manufacture traceability (of outdoor unit if split system): Is the date of manufacture permanently marked on the rating plate in a non-encrypted format? If yes, provide an example of the date format. If no, provide details on how to be determined (from the serial number or other permanent markings for this model)	Yes Date format:	No Provide details:
Does this model or family replace or supplementanother model or family with identical energyconsumption and energy efficiency rating? (indicate correct answer)	Yes	No
If yes, indicate relevant details:	Model Name	Registration Number
Information about the components used in the manufacturing: There must be complementary documents for the materials used in the Manufacturing including drawings and figures and technical specifications and product model accreditation (if any) for each of the components mentioned here.	1. Compressor Country of origin: ..... Name of Manufacturer or trading mark: ..... Compressor model number: ..... Compressor type: ..... 2. Fan Country of origin: ..... Name of Manufacturer or trading mark: ..... Fan Model number: ..... Fan type: ..... 3. Heat Exchanger	

3 TESTING AND TEST REPORT

Test Laboratory Type: (put ( ) inside the appropriate box)	☐ Own 'in-house' laboratory: ☐ Independent laboratory:		
Test Laboratory Name:			
Test Laboratory Address:			
Test Laboratory Accreditation:			
Test Standard Used:	☐ The standard mentioned in 2.1The ☐ standard mentioned in 2.2 Other— (please specify)		
Does this air conditioner have separate indoorand outdoor units	☐ Yes ☐ No		
Serial number of test units/s and date tested:	SERIAL NUMBER Unitaryunitorindoor unit if split system	SERIAL NUMBER Outdoor unit ifsplit system	Test Date
Rated voltage and frequency of tested unit	Package Unit	Unitary unit or indoor unit ifsplit system	Outdoor unit ifsplit system
	Rated voltage or Rated voltagerange (V)		
	Rated frequency (Hz)		
Tested voltage and frequency of tested unit		Unitary unit or indoor unit if split system	Outdoor unit ifsplit system
	Tested voltage (V)		
	Test frequency (Hz)		

Part 4 SPECIFIC APPLIANCE DETAILS

Air-conditioner dimensions (Advisory only): (for split systems note only dimensions ofthe internal unit)	Width (mm):	Height (mm):	Depth (mm):
Air-conditioner type:	☐ Cooling only ☐ Reverse cycle ☐ Heating only ☐ Other (please specify)		
Power supply: Rated Voltage (V):	☐ Single-phase ☐ Three-phase		
Rated Frequency (Hz):			
Refrigerant Type:	☐ R22 ☐ Other (Please Specify)		
A/C Configuration 1—Air Distribution	☐ Ducted ☐ Non Ducted		
A/C Configuration 2—Type	☐ Window/Wall, Spot ☐ cooler, Portable ☐ cooler, Single split ☐ system ☐ Double/triple split system, ☐ Multiple split system, ☐ Packaged		
Does this air-conditioner use a variablespeed drive?	☐ Yes ☐ No		

Part 5 TEST RESULTS

TEST RESULTS—COOLING—CONDITION T1		
COOLING POWER	Rated Effective Power Input(kW)*	
	Tested Cooling Power Input(kW)**	
COOLING CAPACITY	Rated Total Cooling Capacity(Btu)*	
	Tested Total Cooling Capacity(Btu)**	
EER (Btu/h)/W	Rated EER **	
	Tested EER **	

The Star rating according to cluse 7 of this regulation

* To 2 decimal places

** To 3 decimal places

Part 5 TEST RESULTS

TEST RESULTS—COOLING—CONDITION T3

COOLING POWER	Rated Effective Power Input(kW)*	
	Tested Cooling Power Input(kW)**	
COOLING CAPACITY	Rated Total Cooling Capacity(Btu)*	
	Tested Total Cooling Capacity(Btu)**	
EER (Btu/h)/W	Rated EER **	
	Tested EER **	
The star rating according to clause 7 of this regulation.		

* To 2 decimal places

** To 3 decimal places

TEST RESULTS - HEATING		
Does this model incorporate electric resistance heating?	☐ Yes ☐ No	
COOLING POWER	Rated Effective Power Input(kW)*	
	Tested Cooling Power Input(kW)**	
COOLING CAPACITY	Rated Total Cooling Capacity(Btu)*	
	Tested Total Cooling Capacity(Btu)**	
EER (Btu/h)/W	Rated EER **	
	Tested EER **	

DECLARATION

I declare that the details stated above are correct.

Signature of Applicant: ..... Date: .....

Office use only

Date received: ..... Registration number: .....

REGULATION FOR NON-DIRECTIONAL HOUSEHOLD LAMPS

EWA
هيئة الكهرباء والماء
Electricity & Water Authority

NON-DIRECTIONAL LAMPS REGULATION

1. SCOPE
2. DEFINITIONS
3. LAMP EFFICACY REQUIREMENTS
4. LAMP FUNCTIONALITY REQUIREMENTS
5. MERCURY LIMITS
6. PRODUCT INFORMATION REQUIREMENTS
7. MONITORING, VERIFICATION AND EVALUATION (MVE)

1. Scope:

This Regulation establishes requirements for the placing on the market of non-directional household lamps, including when they are marketed for non-household use or when they are integrated into other products. It also establishes product information requirements for special purpose lamps.

The requirements set out in this Regulation shall not apply to the following household and special purpose lamps:

1. Lamps having the following chromaticity coordinates x and y:

    a) $x < 0.200$ or $x > 0.600$
        a) $y < -2.3172x^2 + 2.3653x - 0.2800$ or $y > -2.3172\ x^2 + 2.3653\ x - 0.1000$

    b) Directional lamps

    c) Lamps having a luminous flux below 60 lumens or above 12,000 lumens

    d) Lamps having:

        - 6% or more of total radiation of the range 250-780nm in the range of 250-400nm

        - The peak of the radiation between 315-400nm (UVA) or 280-315nm (UVB)

    e) Fluorescent lamps without integrated ballast

    f) High-intensity discharge lamps

    g) Incandescent lamps with E14/E27/B22/B15 caps, with a rated voltage equal to or below 60 volts and without integrated transformer.

For special purpose lamps, the following information shall be clearly and prominently indicated on their packaging and in all forms of product information accompanying the lamp when it is placed on the market:

a) Their intended purpose; and

b) That they are not suitable for household room illumination.

2. Definitions:

1. General Definitions

General definitions are as follows:

1. ‘household room illumination’ means the full or partial illumination of a household room, by replacing or complementing natural light with artificial light, in order to enhance visibility within that space.

2. ‘lamp’ means a source made in order to produce an optical radiation, usually visible, including any additional components necessary for starting, power supply or stable operation of the lamp or for the distribution, filtering or transformation of the optical radiation, in case those components cannot be removed without permanently damaging the unit.

3. ‘household lamp’ means a lamp intended for household room illumination; it does not include special purpose lamps.

4. ‘special purpose lamp’ means a lamp not intended for household room illumination because of its technical parameters or because the related product information indicates that it is unsuitable for household room illumination. Special purpose lamps do not include rough service lamps, vibration lamps, heavy duty lamps and similar. These types of lamps are expressly included in the scope of this regulation.

5. ‘directional lamp’ means a lamp having at least 80 % light output within a solid angle of π steradians (corresponding to a cone with angle of 120°).

6. ‘non-directional lamp’ means a lamp that is not a directional lamp.

7. ‘filament lamp’ means a lamp in which light is produced by means of a thread-like conductor which is heated to incandescence by the passage of an electric current. The lamp may or may not contain gases influencing the process of incandescence.

8. ‘incandescent lamp’ means a filament lamp in which the filament operates in an evacuated bulb or is surrounded by inert gas.

9. ‘tungsten halogen lamp’ means a filament lamp in which the filament is made of tungsten and is surrounded by gas containing halogens or halogen compounds. Tungsten halogen lamps are supplied either with or without integrated power supply;

10. ‘discharge lamp’ means a lamp in which the light is produced, directly or indirectly, by an electric discharge through a gas, a metal vapour or a mixture of several gases and vapours.

11. ‘fluorescent lamp’ means a discharge lamp of the low-pressure mercury type in which most of the light is emitted by one or several layers of phosphors excited by the ultraviolet radiation from the discharge. Fluorescent lamps are supplied either with or without integrated ballasts.

12. ‘ballast’ means a device which serves to limit the current of the lamp(s) to the required value in case it is connected between the supply and one or more discharge lamps. It may also include means for transforming the supply voltage, dimming the lamp, correcting the power factor and, either alone or in combination with a starting device, providing the necessary conditions for starting the lamp(s). It can be integrated or external to the lamp.

13. ‘power supply’ means a device which is designed to convert alternating current (AC) power input from the mains power source input into direct current (DC) or another AC output.

14. ‘compact fluorescent lamp’ means a unit which cannot be dismantled without being permanently damaged, provided with a lamp cap and incorporating a fluorescent lamp and any additional components necessary for starting and stable operation of the lamp.

15. ‘fluorescent lamp without integrated ballast’ means a single and double capped fluorescent lamp without integrated ballast.

16. ‘high intensity discharge lamp’ means an electric discharge lamp in which the light producing arc is stabilized by wall temperature and the arc has a bulb wall loading in excess of 3 watts per square centimeter.

17. ‘light emitting diode’ or ‘LED’ means a solid-state device embodying a p-n junction, emitting optical radiation when excited by an electric current.

18. ‘LED lamp’ means a lamp incorporating one or several LED.

19. ‘MOIC’ is an abbreviation for Ministry of Industry & Commerce.

2. Technical Definitions

For the purposes of compliance and verification of compliance with the requirements of this Regulation, the parameters below shall be established by reliable, accurate and reproducible measurement procedures, which take into account the generally recognized state of the art measurement methods:

a) ‘Lamp efficacy’ (η_{lamp}), which is the quotient of the luminous flux emitted (Φ) by the power consumed by the lamp (P_{lamp}). $\eta_{lamp} = \Phi / P_{lamp}$ (unit: lm/W). The power dissipated by non-integrated auxiliary equipment, such as ballasts, transformers or power supplies, is not included in the power consumed by the lamp.

b) ‘Lamp lumen maintenance factor’ (LLMF), which is the ratio of the luminous flux emitted by the lamp at a given time in its life to the initial (100 hour) luminous flux.

c) ‘Lamp survival factor’ (LSF), which is the defined fraction of the total number of lamps that continue to operate at a given time under defined conditions and switching frequency.

d) ‘Lamp lifetime’, which is the period of operation time after which the fraction of the total number of lamps which continue to operate corresponds to the lamp survival factor of the lamp, under defined conditions and switching frequency

e) ‘Chromaticity’, which is the property of a colour stimulus defined by its chroma ticity coordinates, or by its dominant or complementary wavelength and purity taken together;

f) ‘Luminous flux’ (Φ), which is a quantity derived from radiant flux (radiant power) by evaluating the radiation according to the spectral sensitivity of the human eye, measured after 100 hours of lamp running time.

g) ‘Correlated colour temperature’ (Tc [K]), which is temperature of a Planckian (black body) radiator whose perceived colour most closely resembles that of a given stimulus at the same brightness and under specified viewing conditions.

h) ‘Colour rendering’ (Ra), which is the effect of an illuminant on the colour appearance of objects by conscious or subconscious comparison with their colour appearance under a reference illuminant.

i) ‘Specific effective radiant ultraviolet power’, which is the effective power of the ultraviolet radiation of a lamp weighted according to the spectral correction factors and related to its luminous flux (unit: mW/klm).

j) ‘Lamp start time’, the time needed, after the supply voltage is switched on, for the lamp to start fully and remain alight.

k) ‘Lamp warm-up time’, which is the time needed for the lamp after start-up to emit a defined proportion of its stabilized luminous flux.

l) ‘Power factor’, which is the ratio of the absolute value of the active power to the apparent power under periodic conditions.

m) ‘Luminance’, which is the amount of light, per unit of apparent surface, that is emitted by or reflected by a particular area within a given solid angle (unit: cd/m^2).

n) ‘Lamp mercury content’, which is the mercury contained in the lamp and is measured according to the relevant IEC standards.

15. Other Definitions

Other definitions are as follows:

a) a ‘rated value’ is the value of a quantity used for specification purposes, established for a specified set of operating conditions of a product. Unless stated other- wise, all requirements are set in rated values.

b) a ‘nominal value’ is the value of a quantity used to designate and identify a product.

c) ‘Second lamp envelope’ is a second outer lamp envelope which is not required for the production of light, such as an external sleeve for preventing mercury and glass release into the environment in case of lamp breakage, for protecting from ultraviolet radiation or for serving as a light diffuser.

d) ‘Clear lamp’ is a lamp (excluding compact fluorescent lamps) with a luminance above 25000 cd/m^2 for lamps having a luminous flux below 2000 lm and above 100000 cd/m^2 for lamps having more luminous flux, equipped with only transparent envelopes in which the light producing filament, LED or discharge tube is clearly visible.

e) ‘Non-clear lamp’ is a lamp that does not comply with the specifications under point (d) including compact fluorescent lamps.

f) ‘Switching cycle’ is the sequence of switching on and switching off the lamp with defined intervals.

g) ‘Premature failure’ is when a lamp reaches its end of life after a period in operation which is less than the rated lifetime stated in the technical documentation.

h) ‘Lamp cap’ means that part of a lamp which provides connection to the electrical supply by means of a socket or lamp connector and, in most cases, also serves to retain the lamp in the socket.

i) ‘Lamp holder’ or ‘socket’ means a device which holds the lamp in position, usually by having the cap inserted in it, in which case it also provides the means of connecting the lamp to the electric supply.

3. Lamp Efficacy Requirements

The maximum rated power (P_{max}) for a given rated luminous flux (Φ) is as follows:

Clear lamps: $P_{max} \leq 0.8 \times (0.88\sqrt{\Phi} + 0.049\Phi)$
Non-clear lamps: $P_{max} \leq 0.24\sqrt{\Phi} + 0.0103\Phi$

The following correction factors are cumulative where appropriate:
Filament lamp requiring external power supply:

Maximum rated power = $P_{max} / 1.06$

Discharge lamp with cap GX53:

Maximum rated power = $P_{max} / 0.75$

Non-clear lamp with colour rendering index ≥ 90 and $P \leq 0.5 * (0.88\sqrt{\Phi} +0.049 \Phi)$:

Maximum rated power = $P_{max} / 0.85$

Discharge lamp with colour rendering index ≥ 90 and Tc ≥ 5000K:

Maximum rated power = $P_{max} / 0.76$

Non-clear lamp with second envelope and $P \leq 0.5 * (0.88\sqrt{\Phi} +0.049 \Phi)$:

Maximum rated power = $P_{max} / 0.95$

LED lamp requiring external power supply:

Maximum rated power = $P_{max} / 1.1$

4. Lamp Functionality Requirements

For the purposes of testing the number of times the lamp can be switched on and off before failure, the switching cycle shall consist of periods comprising 1 minute on and 3 minutes off. For the purposes of testing lamp lifetime, lamp survival factor, lumen maintenance and premature failure, and for other test conditions, relevant IEC and European standards and directives should be used.

Functionality requirements for compact fluorescent lamps are given in the following table.

Table 1 - Functionality requirements for compact fluorescent lamps

Functionality Parameter	Requirements
Lamp survival factor at 6000h	Lamp survival factor at 6000h
Lumen maintenance	At 2000h: ≥ 88% (≥ 83% for lamps withsecond lamp envelope) At 6000h: ≥70%
Number of switching cycles before	≥ lamp lifetime expressed in hours ≥ 30,000 if lamp starting time > 0.3s

Functionality Parameter	Requirements
Starting Time	<1.5s if P<10 W <1.0s if P≥10 W
Lamp warm-up time to 60% Φ	<40s or <100s for lamps containing mercuryin amalgam form
Premature failure rate	≤ 2.0% at 400h
UVA + UVB radiation	≤ 2.0 mW/klm
UVC radiation	≤ 0.01 mW/klm
Lamp power factor	≥ 0.55 if P < 25 W ≥ 0.90 if P ≥ 25 W
Colour rendering (Ra)	≥ 80

Functionality requirements for lamps excluding compact fluorescent lamps and LED lamps are given in the following table.

Table 2 - Functionality requirements for lamps excluding compact fluorescent lamps and LED lamps

Functionality Parameter	Requirements
Rated lamp lifetime	≥ 2000h
Lumen maintenance	≥ 85% at 75% of rated average lifetime
Number of switching cycles before failure	≥ four times the rated lamp lifetime expressed in hours
Starting time	< 0.2s
Lamp warm-up time to 60% Φ	< 1.0s
Premature failure rate	≤ 5.0% at 200h
Lamp power factor	≥ 0.95

Functionality requirements for non-directional LED lamps are given in the following table.

Table 3 - Functionality requirements for non-directional LED lamps

Functionality Parameter	Requirements
Lamp survival factor at 6000 h	≥ 0.90
Lumen maintenance at 6000 h	≥ 0.80
Number of switching cycles before failure	≥ 15,000 if rated lamp life ≥ 30,000h otherwise: ≥ half the rated lamp life expressed inhours
Starting time	< 0.5s
Lamp warm-up time to 95% Φ	< 2.0s
Premature failure rate	≤ 5.0% at 1000h
Colour rendering (Ra)	≥80 ≥ 65 if the lamp is intended for outdoor or industrial applications
Colour rendering (Ra)	Variation of chromaticity coordinates within a six-step MacAdam ellipse or less.
Colour rendering (Ra)	P ≤ 2W: no requirement 2W < P ≤ 5W: PF > 0.4 5W < P ≤ 25W: PF > 0.5P > 25 W: PF > 0.9

5. Mercury Limits

The mercury limits for compact fluorescent lamps are given in the table below.

Table 4 - Mercury limits

Lamp Type	Limit
≥30 W and <150 W	5 mg
<30 W	2.5 mg
<30 W with long lifetime (> 15 khrs)	3.5 mg

Any mercury contained in compact fluorescent lamps shall be in amalgam form.

6. Product Information Requirements

For special purpose lamps, the following information shall be clearly and prominently indicated on their packaging and in all forms of product information accompanying the lamp when it is placed on the market:

a) Their intended purpose; and

b) That they are not suitable for household room illumination.

The following information is to be visibly displayed prior to purchase to end-users on the packaging and on free access websites (the information does not need to be specified using the exact wording of the list below - it may be displayed using graphs, figures or symbols rather than text):

a) Nominal lamp power

b) Nominal luminous flux

c) Nominal lifetime of the lamp in hours (not higher than the rated lifetime)

d) Number of switching cycles before premature lamp failure

e) Color temperature (also expressed as a value in Kelvins)

f) Warm-up time up to 60 % of the full light output (may be indicated as ‘instant full light’ if less than 1 second)

g) A warning if the lamp cannot be dimmed or can be dimmed only on specific dimmers

h) If designed for optimal use in non-standard conditions (such as ambient temperature Ta ≠ 25 °C) information on those conditions

i) Lamp dimensions in millimeters (length and diameter)

j) If equivalence with an incandescent lamp is claimed on the packaging, the claimed equivalent incandescent lamp power (rounded to 1 W) shall be that corresponding in the table below to the luminous flux of the lamp contained in the packaging. The intermediate values of both the luminous flux and the claimed incandescent lamp power (rounded to 1W) shall be calculated by linear interpolation between the two adjacent values.

Table 5 - Equivalence Values

Rated lamp luminous flux (lm) Φ			Claimed equivalent incandescentlamp power (W)
CFL	Halogen	LED and other lamps	
125	119	136	15
229	217	249	25
432	410	470	40
741	702	806	60
970	920	1055	75
1398	1326	1521	100
2253	2137	2452	150
3172	3009	3452	200

k) The term ‘energy saving lamp’ or any similar product related promotional statement about lamp efficacy may only be used if the lamp complies with the efficacy requirements applicable to non-clear lamps.

l) If the lamp contains mercury:

   a) Lamp mercury content as X,X mg

   b) Indication of website to consult in case of accidental lamp breakage to find instructions on how to clean up the lamp debris.

The following information is to be made publicly available on free-access websites (as a minimum, the following information shall be expressed at least as values):

a) The packaging information specified above

b) Rated wattage (0.1 W precision)

c) Rated luminous flux

d) Rated lamp lifetime

e) Lamp power factor

f) Lumen maintenance factor at the end of the nominal life

g) Starting time (as X,X seconds)

h) Color rendering.

i) If the lamp contains mercury:

    1. Instructions on how to clean up the lamp debris in case of accidental lamp breakage.

    2. Recommendations on how to dispose of the lamp at its end of life.

7. Monitoring, Verification and Evaluation (MVE)

Pre-approval Process

The proposed MVE process is presented below.

Organization	Task	Description
Importer	Application	•Submit product application complete with certificates/ test reports
MOIC	Verification	• Assess application against technical specifications • Grant approval or reject application
Importer	Import lamps	
Customs	Border check	• Check imported lamps reference to Approval • If approved, release lamps into Bahrain

Lamp Efficacy Requirements

The Authorities shall have the right to take samples of the product and subject them to examination and testing according to the requirements stated in this regulation.

Penalties

Companies or individuals who are found to be importing or selling non-compliant products would be liable in accordance with the provision of the laws and regulations of the kingdom of Bahrain.

Electricity & Water Authority

Electricity & Water Conservation Directorate Tel: 17991501, Fax: 17212559 - www.ewa.bh