GREEN BUILDING MANUAL
(Law 212, 2019)
CHAPTER ONE
GENERAL PROVISIONS
ARTICLE (1)

DEFINITIONS

For the purposes of this manual, the following terms and expressions shall have the meanings assigned thereto unless otherwise dictated by the context:

"**the Kingdom**": Kingdom of Bahrain.

"**the Manual**": The Green Building Manual in the Kingdom.

"**the Competent Authority** ": the Ministry of Works, Municipalities Affairs & Urban Planning.

"**Green Building**": practices under which structures are made and installations built in a way that increases the efficiency of materials, including energy, water and materials, and minimizing the effects on human being health and environment throughout the various cycles of building, by selecting the best locations, designs, construction, operations, maintenance, demolition and removal of debris.

"Addition or Expansion": An extension or increase in floor area or height of a building outside of the existing building envelope (walls and roofs).

"Adhesive": Material used to bond one sur face to another by attachment.

"Acoustical control": Controlling noise sources, transmission path, and/or receiver in order to reach an acceptable noise environment for a particular space.

"Air break": A piping arrangement where a drain from an appliance or fixture discharges into an airspace and then into another fixture, receptacle, or interceptor; used to prevent back siphon age or backflow.

"Air contaminants": Unwanted airborne constituent that may reduce acceptability or adequacy of the air quality.

"Air leakage": Air that escapes from a building through a joint, coupling

"Air tightness of a building"

The property of an enclosure or barrier that precludes the passage of air.

"Air volume": The amount (volume) of air delivered to a space through ventilation, typically specified in liters per second or cubic meters per minute.

"Ventilation": The share of supply air that is outdoor air, plus any recirculated air that has been filtered or otherwise treated to maintain acceptable indoor air quality.

"Airborne sound insulation": Insulation against noise originating in air, such as voices, music, motor traffic and wind.
"Architecture Accent Lighting": Lighting that highlights an area or object of a building to emphasize that area or object.
"Brightness contrast ratio": The ratio of illuminance between the highest and lowest illuminance value in a room.
"**Building commissioning**": The process of ensuring that all building systems are designed, installed, tested, and operated in conformity with design intent.
"Building completion certificate": Certificate issued by Municipalities in Bahrain, as soon as the entire construction work has been carried out, inspected and approved by Municipalities in Bahrain.
"Building envelope": The exterior elements of a building which form a barrier between the internal and exterior spaces. For an air-conditioned building, the building envelope is defined as the elements of a building that separate conditioned spaces from the exterior.
"Building fabric": Refers to the ceiling, walls, windows, floors and doors of a building, which play a major role in the energy efficiency of a structure.
"Building Management System (BMS)": A computer-based control system installed in buildings that controls and monitors the building's mechanical and electrical equipment, such as ventilation, lighting, power systems, fire systems, and security systems.
"Building metering": The use of meters to track the use of utilities (such as water and electricity) per building unit.
"Building occupants (also building users)": the persons who occupy the building or reside therein on a full-time basis and utilize the building for at least eight hours per day.
"Building operator": the he person who has full operational control of the place (the land or building or any part thereof), whether owner or tenant or holder or any other capacity by which he is authorized to occupy the place
"Building owner": The person or institution (government or private) that owns the building and/or the land on which the building work (construction, refurbishing, demolition, or removal of a building) is to be performed or their representative.
"**Contractor**": a natural person or a body corporate licensed to practice construction work in the Kingdom.
"Public building": A building which provides access to the general public. This building typology includes healthcare facilities, educational facilities, governmental buildings, worship houses, petrol stations, shopping malls,

retail outlets, post offices, banks, museums, cinema/theatres, and historical/heritage buildings.

"Residential/ Commercial Building": This building typology includes: apartments, labor accommodations, student accommodations, offices, hotels, resorts, restaurants/ food outlets and laboratories.

"Regularly occupied areas (non-residential buildings)": Those areas within non-residential buildings where building users are seating or standing, as they work inside of a building or use the building space.

"Construction activity": Includes all activities that are part of new construction, alteration, repair, maintenance, refurbishing, and any other physical changes to a building.

"Construction and demolition waste": Waste generated from construction, renovation, and demolition or deconstruction of structures. Land clearing debris including soil, vegetation and rocks are typically not considered construction and demolition waste.

"Building permit": Permit issued by the Municipalities in Bahrain.

"Building services": All necessary services required to operate the building such as plumbing, mechanical, electrical and others

"Built Up Area (Total Floor Area)": The grand total of the covered area in a building or structure measured between the outer sides of the building borders, including terraces, balconies, protrusions and any other covered parts like car parking circulation passages, air wells, unloading bays, service floors, swimming pools and any other structure on the plot.

"Central Business District (CBD)": The old area of Bahrain defined in Building Specifications and Regulations.

"Heritage building": A building having historical architectural elements, situated inside a Bahrain historical area. No demolition or variation works shall be carried out on a Heritage building except after obtaining approval from the Competent Authority.

"Central Control and Monitoring System (CCMS)": A computer-based control system that controls and monitors the mechanical and electrical equipment, such as ventilation, lighting, power systems, fire systems, and security systems in a building or controlling and monitoring a number of buildings.

"Central plant": The main equipment within a building or series of buildings which provides cooling, ventilation, heating, water, and other services to the whole building or buildings. The central plant is typically in a central location.

"Carpet": A fixed floor covering of natural or synthetic material that is woven onto a batting. This excludes rugs and other non-permanent woven coverings.

"Certified timber": Timber certification is a process that results in a certificate (written statement) attesting to the origin of wood raw material and its status and/or qualifications, often following validation by an independent third party. Certification is intended to allow participants to measure their forest management practices against standards and to demonstrate compliance with those standards. Timber certification generally includes two main components: certification of sustainability of forest management (which occurs in the country of origin) and product certification (which covers the supply chain of domestic and export markets).
"Composite wood products": Products such as plywood, panel substrates, door cores, particle board, and medium density fiber board.
"Condensation": The process through which a gas or vapor changes to liquid form. Also defined as the water which is produced in this process.
"Control systems": Controls that allow users to change/adjust the level of lighting and air conditioning in a space.
"Control zone (HVAC)": A space or group of spaces with heating or cooling requirements that is sufficiently similar so that desired conditions (e.g. temperature) can be maintained throughout by using a single controller. The zone may be part of a larger space, an individual office or a small dwelling.
"Cooling coil": A coiled arrangement of tubing or pipe for the transfer of heat between a cold fluid and air.
"Cooling load": The amount of cooling that a building will require to meet the conditions specified by the Electricity& Water Authority (EWA). The cooling load will be determined by the output of the Heat Load Calculation required by building consultant approved by EWA.
"Cooling tower" : Heat removal devices used to transfer process waste heat to the atmosphere. Cooling towers may either use the evaporation of water or rely solely on air to cool the working fluid. Common applications include removing heat from the water used to cool refrigeration chillers.
"Corrective maintenance": Maintenance service or procedures intended to fix equipment failure or damage. This service is carried out in response to a fault and not planned in advance.
"Cycles of concentration": The level of solids in the re-circulating cooling tower water in comparison to the level of solids of the original raw make up water. If the circulating water has three times the solids concentration of the makeup water, then the cycles of concentration are three (3).
"District cooling": A district cooling system distributes thermal energy, in the form of chilled water or other media, from a central source to

multiple buildings or facilities through a network of underground pipes for use in space and process cooling. The cooling (or heat rejection) is usually provided from a central, dedicated cooling plant, which eliminates the need for separate systems in individual buildings. A district cooling system consists of three primary components: the central plant (which may include the cooling equipment, power generation and thermal storage), the distribution network, and the consumer system (typically comprising of air handling units and chilled water piping in the building).

"Diversity factor": Relates to the thermal characteristics of the building envelope, temperature swings and occupancy load.

"Drip water delivery system (drip irrigation)": A high-efficiency irrigation method where water is delivered at low pressure through buried pipes and sub-pipes, which in turn distribute water to the soil from a network of perforated tubes or emitters.

"Plumbing system": Permanently installed piping, pumps, valves, tanks, taps, controls and other devices used in distributing water into, within and away from a building.

"Dual plumbed": A building or structure with two sets of cold-water pipes: one for drinking water and one for recycled or greywater.

"Greywater (grey water, graywater)" Untreated household wastewater which has not come into contact with toilet waste. Greywater includes used water from showers, wash basins, bathtubs, laundry sinks and clothes washers.

"Power System": installed wires, switchboards, distribution boards, transformers and control and other devices used for distribution of electric current over a building.

"Electrical sub-metering": The installation of separate meters to allow the measurement of electricity used in specific areas or individual items of equipment.

"Electronic ballast": A piece of equipment required to control the starting and operating voltages of fluorescent lights. Electronic lighting ballasts use solid state circuitry and can greatly reduce or eliminate any flicker in the lamps.

"Enabled access": Project design that incorporates accessibility for disabled people to and within a building.

"Environmental tobacco smoke (ETS) (second hand smoke)": Airborne particles emitted from the burning of cigarettes, pipes, cigars, or shishas and from a smoker's exhaled air.

"Entrance lobby": Space immediately between the entrance-door and the interior of a building which acts as a transition area into the building.

"Equivalent": Measure, standard, or reference material that has been deemed to be equal or better by Municipalities in Bahrain.
"Facilities operator": Party responsible for the maintenance and operation of a building or facility.
"Fan systems": A system of fans used to supply or exhaust air to/from a building space.
"Fenestration": Another name for 'glazed elements'.
"Glazing area": The area of glazed elements in the exterior walls of a building.
"Global Warming Potential (GWP)": Expresses contribution to the global warming phenomenon of greenhouse gases released to the atmosphere.
"Hardscape": The area of a project site, excluding buildings, made with hard materials, including roads, car parks, patios, courtyards and walkways.
"Hazardous fumes or chemicals": Fumes/gases or chemicals that can adversely impact human health when inhaled or when they come into contact with a person's skin; also includes fumes/gases and chemicals that can create a hazardous condition (such as explosive or flammable substances).
"Hazardous waste": Any waste material that can cause substantial harm to humans, properties or to the environment due to its inherent hazardous characteristics. Hazardous waste takes the form of solid, liquid, sludge, gas or any combination thereof.
"Toxic waste": Waste containing poisonous substances. These substances may have acute effects (causing death or violent illness) or chronic effects (slowly causing irreparable harm) even in very small or trace amounts.
"Heat Island Effect (HIE)": Heat Island Effect occurs when warmer temperatures are experienced in urban/developed areas compared to adjacent undeveloped areas due to solar energy retention on constructed surfaces, and heat rejected by cooling towers and other such equipment. Some of the surfaces that contribute to the Heat Island Effect are paved streets, sidewalks, parking lots and buildings.
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"Heat load calculation": Calculations which must be submitted to Municipalities in Bahrain for approval. These calculations must be based

on the design of the building to be constructed and follow the form and use the parameters required by Municipalities in Bahrain.

"Heat load calculation parameters": The design parameters used in Heat Load calculation according to Municipalities in Bahrain requirements.

"Heating, ventilation, and air conditioning (HVAC) system": The equipment, distribution systems, and terminals that provide either individually or collectively, heating, ventilating, or air conditioning to a building or a portion of a building.

"Heat Rejection Equipment": Equipment which is used to disperse the heat produced in the air conditioning process. Heat rejection equipment, such as cooling towers, may be located outside of the building envelope; however, it may also be a component of the air conditioning equipment, such as with window or split systems.

"Heavy metals": Heavy metals include: cadmium, chromium, mercury, and arsenic.

"Heritage building": A building having historical architectural elements, situated inside a Bahrain historical area. No demolition or variation works shall be carried out on a Heritage building except after obtaining approval from the Competent Authority.

"Hydraulic elevator": An elevator operated using liquid pressure.

"Hydrochlorofluorocarbons (HCFC)": Refrigerants used in building equipment that deplete the stratospheric ozone layer, but to a lesser extent than CFCs.

"Hydrofluorocarbons (HFCs)": Refrigerants that do not deplete the stratospheric ozone layer. However, some HFCs have a high Global Warming Potential.

"Asbestos": A group of impure magnesium silicate minerals which occur in fibrous form. Asbestos has been used in a variety of building construction materials for insulation and as a fire-retardant. However, long-term exposure to World Health Organization specified amounts of asbestos can have severe health impacts, such as chest and abdominal cancers and lung diseases. Therefore, the use of asbestos products has been restricted and/or banned in many countries.

"Legionella bacteria": Legionella bacteria are the causative agent of Legionnaires' disease and its lesser form, Pontiac fever. The bacteria grow in water between 20 and 45 degrees Celsius and can be spread by water droplets.

"Industrial building": Any building directly used in manufacturing, processing, technically productive enterprises or storage. This includes workshops, factories and warehouses.

"Land clearing debris": Solid waste generated solely from land-clearing activities, including brush, stumps, soil material and rocks.
"Land disturbance": Any project that changes the physical conditions of land form, vegetation and hydrology, creates bare soil, or otherwise may cause erosion or sedimentation. The activities include, but are not limited to, clearing of land, removal of vegetation, stripping, grading, excavating, filling and storing of materials.
"Light fixture": The component of a luminaire that houses the lamp(s), positions the lamp, shields it from view, and distributes the light. The fixture also provides for connection to the power supply, which may require the use of ballast.
"Lighting Power Density (LPD)": The maximum lighting power per unit area.
"Light Reflective Value (LRV)": A measure of the total quantity of useable and visible light reflected by a surface in all directions on a scale from 0% to 100%. Zero percent is assumed to be an absolute black and 100% represents an assumed perfectly reflective white. The blackest achievable wall finish has a LRV of approximately 5% and the whitest available finish approximately 85%.
"Light Transmittance": The percentage of incident light that passes through the glazing elements. When this percentage increases the daylight amount into the building will increase.
"Lux": The International System unit of illumination, equal to one lumen per square meter.
"Line of sight": An imaginary line from the eye to a perceived object or view.
"Local Species": Local plants and adapted plants to the local environment.
"Mechanical system": Those systems within a building which include components of mechanical plant or machinery. These systems include, but are not limited to, the HVAC system of a building.
"Monitoring equipment": Equipment used to measure and record status or conditions related to a building or to verify pre-set conditions and provide control or alarm functions if conditions vary.
"Minimum Efficiency Reporting Value (MERV)": Air Filter Minimum Efficiency Reporting Value (MERV) is an expression of the filtering efficiency of an air filter that has been evaluated using the ASHRAE Standard 52.2 Test Procedure. An air filter's performance is determined by comparing airborne particle counts upstream and downstream of the air filter (or other air cleaning device) under test conditions. A higher MERV rating equates to higher air filtration efficiency.

"Ventilation": The process of supplying air to or removing air from a space in order to control air contaminant levels, humidity, or temperature within the space.
"Variable air volume system": An air handling system that conditions the air to a constant temperature and varies the outside airflow to ensure thermal comfort.
"Exhaust air": Air removed from a building space and discharged to the outside of the building through a mechanical or natural ventilation system.
"Fresh air": Outside air supplied to a building space through mechanical or natural ventilation to replace air in the building that has been exhausted.
"Mechanical ventilation (active ventilation)": Ventilation provided by mechanically powered equipment, such as fans.
"Mixed mode ventilation": A combination of mechanical and natural ventilation.
"Natural ventilation (passive ventilation)": Ventilation provided by stack effect or cross ventilation through windows, doors, or other openings in the building.
"Daylighting": The direct or indirect use of natural light from the sun or sky to provide illumination in interior spaces.
"Demand Controlled Ventilation (DCV)": A ventilation system that provides for the automatic reduction of outdoor air intake below design rates, when the actual occupancy of spaces served by the system is less than design occupancy. Demand is often assessed by using the measure of the amount of carbon dioxide (CO2) in a space to reflect occupancy levels.
"Ductwork": Air-tight channels that carry conditioned air throughout the building. This includes terminal fixtures to distribute air.
"Ductwork leakage": The outcome of air conditioning ductwork that is leaking, and therefore lets air leak through cracks and gaps. Ductwork leakage will result in an increase in energy consumption of the supply and return air fans.
"Balancing (air system)": To ensure that correct volumes of air are supplied by adjusting airflow rates through air distribution system devices (such as fans and diffusers) by manually adjusting the position of dampers, splitter vanes, extractors, etc. or by using automatic control devices, such as constant air volume or variable air volume boxes.
"Carpool vehicles": Shared vehicle used especially for commuting to work and often by people who each have a car but travel together to save cost, to reduce driving stress and to promote other socio-

environmental benefits. Vehicles must be registered with the Bahrain Road and Transport Authority (RTA).

"Low emitting and fuel-efficient vehicle": A vehicle approved by Bahrain Road Transport Authority (RTA) as being low emitting or fuel efficient.

"Parking ventilation": Ventilation which is required to maintain a satisfactory level of air quality within a vehicle parking facility.

"Designated preferred parking spaces": Parking spaces that are closest to the main entrance of a building exclusive of spaces designated for disabled parking. Alternatively, these can be parking spaces closest to the pedestrian exit leading from the parking area.

"Parking area – Enclosed": Area of a building which is used for parking of motor vehicles but is not an open parking area.

"Parking area – Open": Area of a building which is used for parking of motor vehicles.

"Total vehicle parking capacity": Total number of parking spaces within the site as specified by Municipalities in Bahrain.

"Secure bicycle racks or storage areas": Structures where individual bicycles can be locked and/or stored. Such structures should be inside, or shaded if outdoors.

"Negative pressure" Pressure less than that in adjoining spaces.

"Positive pressure" Pressure greater than that in adjoining spaces.

"Pressure differential": The difference in pressure between two points of a system, or two different spaces of a building.

"Occupancy sensor": A device that detects the presence or absence of people within an area and causes lighting, equipment, or appliances to be regulated accordingly.

"Occupant Lighting Controls": A means of controlling the level of lighting which is easily accessible to a building occupant. Includes on/off switches.

"Office": A building in which official, business, clerical, or professional activities are conducted.

"Opaque": All areas of a building envelope which do not transmit light. Fenestration and building service openings, such as vents and grilles, are not opaque.

"Open grid pavement": Pavement surfaces composed of structural units with void areas that are filled with pervious materials, such as sand or grass turf.

"Outdoor environment": The environment outside of buildings, not enclosed by walls.

"Ozone Depletion Potential (ODP) ": Expresses contribution to the deterioration of the stratospheric ozone layer.

"Perimeter zone": The interior space adjacent to the perimeter walls of a building.
"Potable water": Water that is suitable for human consumption.
"Preventative maintenance": Maintenance service or procedures intended to prevent or reduce equipment failure or damage
"Primer": Material applied to a surface to improve adhesion of a subsequently applied paint or adhesive.
"Radiant heat/temperature": Thermal radiation is the heat that radiates from a warm object. Radiant heat may be present if there are heat sources in an environment. Examples of radiant heat sources include: the sun, fire, ovens, driers, hot surfaces and machinery, etc.
"Reflectivity (solar reflectance)": Reflectivity measures how well a material bounces back solar radiation.
"Refrigerants": Working fluids of refrigeration cycles, which absorb heat at low temperatures and reject heat at higher temperatures.
"Refurbish (Retrofit) ": The substantial alteration of a building or building services to replace or improve the quality of the building. This may occur when a new tenant occupies the building or part of the building.
"Regional materials": Materials that were extracted, processed, and/or manufactured within the Gulf Cooperation Council (GCC) area.
"Relative humidity": Ratio of partial density of water vapour in the air to the saturation density of water vapour at the same temperature and the same total pressure.
"Retail": Business dedicated to the sale of goods or commodities in small quantities directly to consumers.
"Reuse": Any activity that lengthens the life of an item, typically consisting of returning the item to active use in the same or related function.
"Recycling": Processing used materials into new products in order to prevent the waste of potentially useful materials, reduce the consumption of fresh raw materials, reduce energy usage, reduce air pollution and water pollution by reducing the need for “conventional” waste disposal.
"Safety factor": An allowance to cover any heating or cooling load greater than the design conditions.
"Sealants": Material with adhesive properties that is used for the general purpose of filling, sealing, or waterproofing gaps or joints between two surfaces.
"Service log book": A book where all maintenance works for a specific site or piece of equipment is recorded in detail (including dates and

specific information regarding what service was performed and who carried out the work).

"Shading Coefficient (SC)": A measure of the amount of heat passing through glazing compared with the heat passing through a single clear glass. It is the ratio of solar heat gain at normal incidence through glazing to that occurring through an approximately 3 millimeter (1/8th inch) thick clear, double-strength glass.

"Showroom": Any space allocated for conducting a commercial business such as displaying commodities for purpose of wholesale or retail sale, and has a road front façade not less than nine (9) meters wide.

"Solar Reflectance Index (SRI) ": The SRI is an index that combines reflectivity and emissivity, measuring a material's ability to reject solar heat. SRI is defined so that a standard black (reflectance 0.05 and emittance 0.90) is 0 and a standard white (reflectance 0.80 and emittance 0.90) is 100. Materials with higher SRI absorb less heat and can reduce the heat island effect.

"Substrate": The base material to which a process, such as painting, is applied to produce new films or layers of a different material.

"Thermal bridges": Component, or assembly of components, in a building envelope, where the insulation is not continuous and through which heat is transferred at a substantially higher rate than through the surrounding envelope area; such as a metal fastener, concrete beam, slab or column.

"Thermal comfort": A condition experienced by building occupants satisfied with their thermal environment.

"Thermal insulation": Materials, or the methods and processes used to reduce heat transfer. Heat energy can be transferred by conduction, convection or radiation. The flow of heat can be delayed by addressing one or more of these mechanisms and is dependent on the physical properties of the material employed to do this.

"Thermal transmittance": Also known as U-value is the rate of transfer of heat (in watts) through one square meter of a structure divided by the difference in temperature across the structure. It is expressed in watts per square meter per degree kelvin, or W/m^2K. Well-insulated parts of a building have a low thermal transmittance whereas poorly-insulated parts of a building have a high thermal transmittance.

"Total planted area": The total external landscaped area of a building plot, including landscaped areas on roofs (vegetated roofs).

"Vegetated roof (green roof) ": A vegetated roof consists of vegetation and soil or a growing medium, planted over a waterproofing membrane on rooftops. Vegetated roofs may also include additional layers, such as a root barrier and drainage and irrigation systems. The use of vegetated

roofs may have different purposes, from energy savings to storm water management and aesthetics benefits.

"Totalizing meter": Measures the flow and provides a total of the quantity which has passed through the meter. This is indicated in the form of a numeric readout.

"Treated sewage effluent (TSE)": The product of the process of removing physical, chemical and biological contaminants from wastewater. The process produces treated effluent suitable for reuse or discharge into the environment and solid waste (or sludge).

"Volatile Organic Compound (VOC) ": Organic chemicals that have a high vapour pressure and easily form vapors at normal temperature and pressure. The term is generally applied to organic solvents, certain paint additives, aerosol spray can propellants, fuels (such as gasoline, and kerosene), petroleum distillates, dry cleaning products and many other industrial and consumer products ranging from office supplies to building materials.

"Wall Washing Light": Light fixture used for architectural or aesthetic purposes transmitting light to an internal or external wall

"Warehouse": A place in which goods or merchandise are stored; a storehouse.

"Water feature": Features within a range of man-made fountains, ponds, cascades, waterfalls, and streams, not intended for human contact with the water. Therefore, for these Regulations, the definition of water features excludes swimming pools and spas.

Article (2)
Purpose

The purpose of the manual is to improve the performance of buildings in Bahrain by reducing the consumption of energy, water and materials, coupled with reduced GHG emissions, improving public health, safety and general welfare and by enhancing the planning, design, construction and operation of buildings to create an excellent city that provides the essence of success and comfort of living.

The manual also aims at supporting Bahrain's Strategic planning, creating a more sustainable urban environment and extending the ability of the Kingdom of Bahrain' infrastructure to meet the needs of future development.

It is intended to set a guideline for developers, owners, operators, designers and for those involved in construction, who seek to abide by the rules and regulations of this manual.

This manual is not intended to provide detailed design information or to be an alternative information for the expertise of building designers and contractors, nor to provide detailed design information or an alternative for the experience and expertise required from building designers and contractors.

Article (3)
Assignment of Certain Specialties

The Competent Authority may assign some of its powers provided for herein to any other authority in the Kingdom, including regulators of free zones and other third parties.

Article (4)
Scope of Application

The provisions of this manual shall apply to all buildings in the Kingdom of Bahrain, including free zones, subject to the following classification:

1. Villas, including:
   (a) Investment villas;
   (b) Private villas; and,
   (c) Arabian style residences; this means traditional houses constructed according to traditional urban style.
2. Residential buildings, including:
   (a) Apartments;
   (b) Labour accommodation; and,
   (c) Hostels;
3. Commercial building, including:
   (a) Hotels, motels and furnished apartments;
   (b) Laboratories;

(c) Offices;
(d) Resorts; and,
(e) Restaurants and foodstuff outlets.

4. Public buildings, including:
   (a) Banks;
   (b) Cinemas/theaters;
   (c) Educational facilities;
   (d) Government buildings;
   (e) Healthcare buildings;
   (f) Historical/heritage buildings;
   (g) Museums;
   (h) Service stations;
   (i) Post offices;
   (j) Retail outlets;
   (k) Malls; and,
   (l) Masjid (Mosques) and Worship Houses
5. Industrial installations, including:
   (a) Factories;
   (b) Warehouses;
   (c) Workshops.

Article (5)
Manual Sections
Sections of the Manual

For the purposes of identifying the extent of application of the provisions herein to a particular type of building, each of the main sections herein has been divided to particular subsections and clauses. This is a table preceding each section to define the clauses applicable to each type of buildings, as follows:

1. **Applicability**
   (a) All new buildings.
   (b) Additions, extensions, and refurbishment of existing buildings which require a building permit from the relevant Authorities in Bahrain
   (c) Existing portions of any building, which need to be refurbished where the performance of the additional, extended or refurbished portion of an existing building is less efficient in power consumption in comparison with the previous situation as a result of addition or extension. Any development required must entail the reconstruction of the building to at least the level of power efficiency before addition or extension.
   (d) Existing building where specified.
2. **Mixed Use Buildings**
   When a building combines more than one use, each portion of the building must comply with the relevant manual requirements for that particular building type.
3. **Change of Use**
   When there is a change of use for a building (for example, the change in use from a residential villa to a school); these regulations apply to the new use.

Article (6)
Exemptions

The following buildings are exempted from the application of this manual:

1. Temporary buildings, which will be demolished with two years of construction.
2. Special Projects and Applications

Major projects of special nature, to which some of the provisions herein are difficult to apply, such as tall buildings, major malls, hospitals, laboratories; for such projects, an application may be submitted to the relevant authority requesting exemption for certain clauses of this manual, if justifiable. However, the relevant authority reserves the right to ask for any reasonable

action to achieve the objectives of this manual. The relevant authority may require the private building projects to connect such projects to a district cooling system in Bahrain and to utilize the same for such buildings, in coordination with relevant authorities.

3. Heritage Buildings

The heritage building specified by the relevant authorities, to which certain provisions herein are inapplicable, are exempted from these provisions for the purpose of preserving their architectural character. For such projects, application may be submitted to the concerned authorities requesting an exemption from the requirements herein, if it is possible to explain the impossibility of such requirements. The relevant authorities may ask to take any reasonable action to achieve the objective of this manual.

Article (7)
Applicability

The provisions of this manual shall apply to all new buildings of the type shown on these effective dates in Schedule (1) hereunder.

Where buildings of the size indicated in this schedule are undergoing renovations or extensions, the total renovated areas or extensions shall comply with these provisions effective the dates specified in following Schedule (1):

Building Types and Starting Implementation Dates	Villa			Residential			Commercial					Public Building												Industrial		
	Investment villas	Private villa	Arabic House	Apartments	Labour Accomodation	Student Accomodation	Hotels, Motels, Furnished Apartments	Laboratories	Offices	Resorts	Restaurants, Food Outlets	Banks	Cinema / Theatres	Educational Facilities	Government buildings	Health Care Facilities	Historical/Heritage Buildings	Museums	Petrol Stations	Post Offices	Retail Outlets	Shopping Malls	Masjid and Worship Houses	Factories	Warehouses	Workshops
September, 2019	Bahrain Green Building Code Launch Date																									
November 1st, 2019															x			x		x						
May 1st, 2020*	x			x	x	x	x	x	x	x	x	x	x	x	x	x		x	x	x	x	x	x	x	x	x
November 1st, 2020**	x			x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
May 1st, 2021***	x			x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
November 1st, 2021***	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x

Table (1) Effective Dates by building type and size

*** Applicable buildings above 1,000m^2**

**** Applicable buildings above 500m^2**

***** All building types and sizes**

Article (8)
Specific Provision

Where a specific provision differs from a general provision, the specific provision shall apply.

Article (9)
Conflicts

1. When the requirements of the Regulations differ from the requirements of standard reference documents, the requirements of the Regulations shall prevail.
2. When the requirements of the Regulations differ from the requirements of Bahrain Civil Defence, the requirements of Bahrain Civil Defence will prevail.

Article (10)
Alternative Materials, Designs and Methods of Construction and Equipment

The provisions of the manual actively encourage innovation and are not intended to prevent the use of any suitable alternate material, appliance, installation, device, arrangement, design, or method of construction that is not specifically prescribed by the Regulations. However, approval of the alternatives will be required by the Competent Authority.

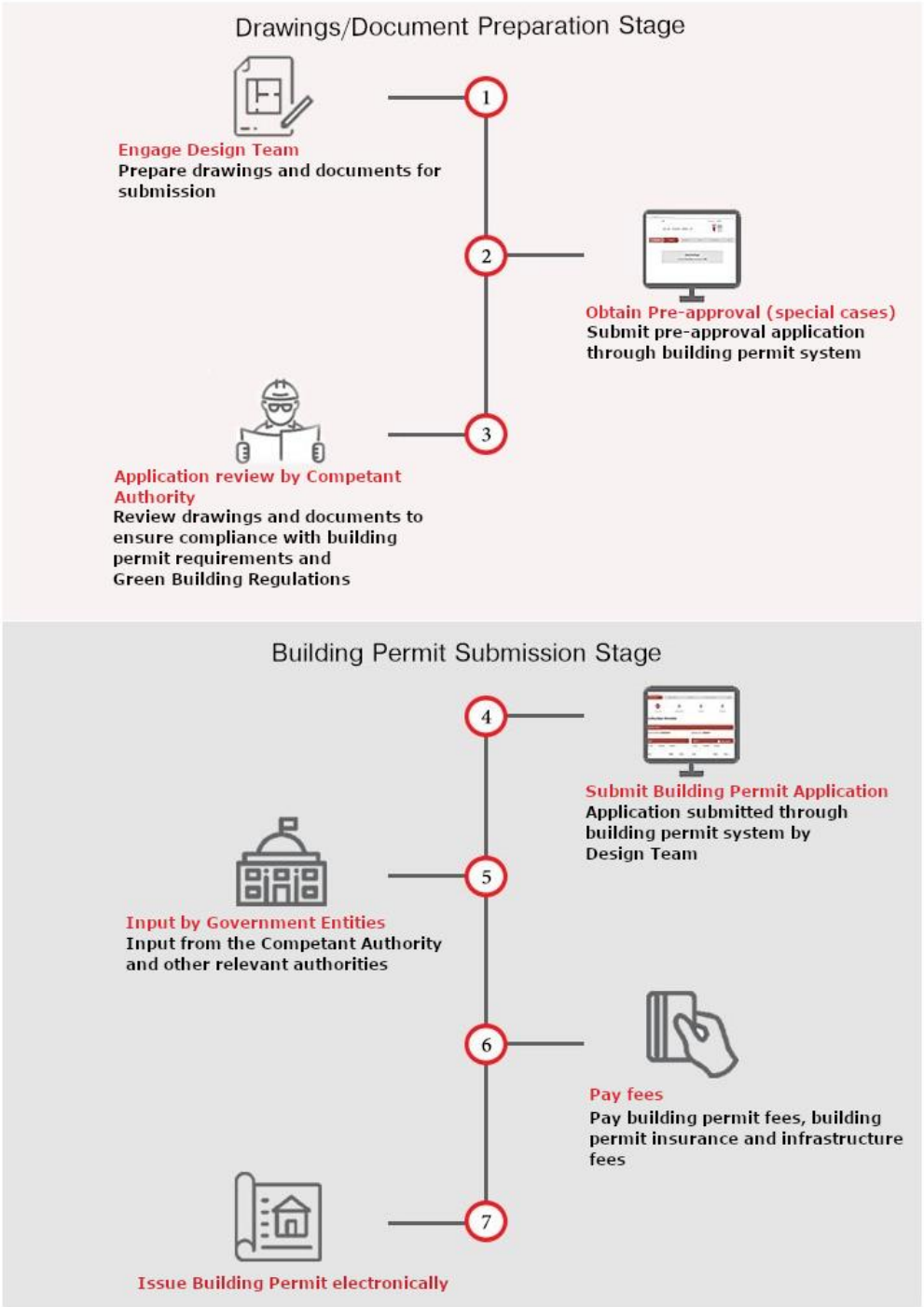
Article (11)
Use of the Green Building Manual

All provisions herein, which indicate the Individual sustainable features of buildings, sites or environment, require familiarity for the optimum utilization of each. The manual illustrates the instances of the obligatory or possible application of these provisions, as the case may be. The specified description of the classification program of building will be published as a follow-up to the practice guide.

CHAPTER TWO
ADMINISTRATIVE & TECHNICAL PROCEDURES
Section One

Building Control Process
Article (12)

Building Permits Process Diagram



Section 2

Documentation and Calculation

Article (13)

Energy Compliance Method

There are two compliance routes for energy performance in buildings. The standard method is referred to as the Elemental Method; the alternative method is referred to as the Performance Method.

1. Elemental Method: The building must comply with each of the Regulations as described in Table (2) herein. If the designer opts for the Elemental method, an online calculator will be provided for this purpose.
2. Performance Method: Alternatively, a calculation method may be employed for a building which may not comply with all the elemental requirements of those Articles listed in Table (2).

The Performance Method, using a calculation tool for smaller buildings with no complex or non-linear airflows, e.g. Atria, such as a Whole Building Transmission Heat Loss calculation or Overall Heat Loss calculation must compare the annual energy consumption of the proposed building with that of a reference building which meets all the elemental requirements listed in Table (2). The reference building must be equal in shape, size and operational patterns to the proposed building.

1. For buildings over 1,000m^2 with complex airflows, a suitable Dynamic Simulation Modelling Software System must be used to show compliance with the Regulations. The model will show compliance if the overall energy usage is less than that of the reference building. This software system must be in use internationally and approved by the Competent Authority. On submission of the results of such simulations to the Competent Authority, the global parameters used, geometry, HVAC and lighting specified during the energy model creation must be clearly indicated. The use of Ideal loads in place of the actual or planned HVAC systems is not acceptable.

2. Compliance with the provisions herein will be demonstrated if the annual energy consumption of the proposed building is equal to or

lower than the annual energy consumption of the reference building.

Table No. (2) Method of Compliance with the Energy Consumption

Article	Description
29	Orientation of Glazed Facades
54	Minimum Envelope Performance Requirements
59	Energy Efficiency– HVAC Equipment and Systems
62	Lighting Power Density - Interior

Article (14)

Water Compliance Method

There are two compliance routes for water performance in buildings. The standard method is referred to as the Elemental Method; the alternative method is referred to as the Performance Method.

1. Elemental Method: The building must comply with each of Regulations as described in Table (3) hereunder.
2. Performance Method: Alternatively, a calculation method may be employed for a building which may not comply with the elemental requirements for water efficiency detailed in Table (3). The Performance Method, using a calculation tool, must compare the annual water consumption of the proposed building with that of a reference building which meets all the elemental requirements detailed in Table (3). The reference building must be equal in shape, size and operational patterns to the proposed building.
3. Compliance with the requirements herein will be demonstrated if the annual water consumption of the proposed building is equal to or lower than the annual water consumption of the reference building.

Compliance with the instructions above must be in accordance with Table (3) hereunder:

Table (3) Method of Water Compliance

Article	Description
81	Water Efficient Fittings
82	Condensate Drainage
83	Condensate Recovery

Article (15)

Drawings, Plans and Calculation Documents

1. Construction documents shall be of sufficient clarity to indicate the location, nature and scope of the proposed Green Building feature and show that it will conform to the provisions of these Regulations and other relevant laws, ordinances, rules and regulations, as determined by the Competent Authority.
2. The legibility and clarity of information is the responsibility of the applicant
3. Submissions will be made as per the approved template, available online on the website of the Competent Authority. Submissions should include a signed and stamped Green Building Declaration.

Article (16)

Green Building Declaration

1. Each building permit application must have a completed declaration appended to it, indicating compliance with the Green Building Regulations.
2. The Green Building Declaration is an unconditional commitment from the development team to meet the requirements herein.
3. Each applicable regulation must be acknowledged with a tick in the appropriate column in the Declaration, stamped and signed by the consultant.

Article (17)

Verification of Implementing Green Building Regulation

1. Evidence of compliance for all applicable regulations herein shall be provided to the Competent Authority.
2. Alternative methods of documentation shall be acceptable (with appropriate discretion) when the Competent Authority finds that the proposed alternate documentation is satisfactory to demonstrate substantial conformance with the regulations herein.

Section 3

Green Building Regulations in Bahrain

Article (18)

Green Building Regulations

1. The Regulations herein form the basis of applying a rating system to buildings in Bahrain. The objective of this Rating System is to promote and encourage the creation of more sustainable buildings and to reward and acknowledge the use of better construction and more efficient plant in those buildings.
2. These regulations may include similar subjects or focus upon certain international elective rating systems of more sustainable buildings.
3. Rating system shall be an Asset Rating System meaning the building fabric and plant is assessed for its potential to operate in an efficient manner based on standardised occupancy patterns and activities
4. Building Operational Ratings will also form part of the Bahrain Green Building Rating System. An Operational Rating refers to a standardised measure of how effectively the building asset is being operated, based on actual measured energy and water usage data. The Bahrain Green Building Rating System will apply to all building types as specified in the Ratings Practice Guide.
5. Compliance with the Regulations is not intended as a substitute for any measure or credit with any of the non-Bahraini rating systems.
6. The Bahrain Green Building Rating System is independent of any third party or international Green Building Rating system.

Article (19)

Green Building Regulation Articles

The first version of the Green Building manual contains the initial approved list of sustainable Articles. The list does not represent an exhaustive set of such building or site attributes, but represent a starting point for Bahrain and its various Ministries to collectively participate in and manage the Green Building Agenda in which various commitments have been made.

The numbered Articles are divided into various groupings under commonly sustainable building headings. The Practice Guide is intended to give the user a brief explanation of what is required to meet the Article's requirement. The description is not intended and should not be used as an alternative.

At the head of each Section of Articles, the buildings to which those particular Articles apply are indicated. These are the applicable Articles for the designated buildings as of the date shown of this version of the regulations.

Chapter Three
Ecology and Planning
Section One

Article (20)
This Article is reserved for Future Use

Section Two
Article (A1)
Article Applicability

Table (4) hereunder is applicable to verify the extent of applicability by ecology and planning articles to each type of building

Table (4) - Building Type Applicability by Ecology and Planning Articles

Building Types and Applicable Green Building Articles			Villa			Residential			Commercial					Public Building												Industrial		
			Investment villas	Private villa	Arabic House	Apartments	Labour Accomodation	Student Accomodation	Hotels, Motels, Furnished	Laboratories	Offices	Resorts	Restaurants, Food Outlets	Banks	Cinema / Theatres	Educational Facilities	Government buildings	Health Care Facilities	Historical/Heritage Buildings	Museums	Petrol Stations	Post Offices	Retail Outlets	Shopping Malls	Masjid and Worship Houses	Factories	Warehouses	Workshops
Ecology and Planning	Access and Mobility	21				X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
		22				X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
		23					X	X																	X	X		
	Ecology and Landscaping	24	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	Neighborhood Light Pollution	25	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	Microclimate and Outdoor Comfort	26	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
		27	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
		28	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
		29	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X				
		30	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
		31				X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	Responsible Construction	32	X	X	x	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	Environmental Impact Assessment	33				X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

Access and Mobility
Article (21)
Preferred Parking

All designated buildings with 20 or more car parking spaces, must provide designated preferred parking for a combination of low or zero-emitting, fuel-efficient and carpool vehicles. This requirement is in addition to any requirements outlined in the Unified Manual of the Requirements of Building Permits. Preferred parking cannot be shared with parking for people with special needs.

Article (22)
Enabled Access

All designated buildings must comply with the Unified Manual of the Requirements of Building Permits, with regard to special needs users. They must be enabled in their access, internal movement and ability to engage with the building functions as required herein.

Article (23)
Bicycle Storage

secure and covered racks or storage areas for bicycles within the building or within a shaded area must be provided.

Section Three
Landscaping

Article (24)
Local Species

For all designated buildings, the percentage of the total planted area within a building plot, including vegetated roofs, must utilize at least the figure indicated of indigenous plant and tree species or species adapted to Bahrain's climate and the region in general, which is not less than 25%.

Section Four
Neighborhood Pollution

Article (25)
Exterior Light Pollution and Controls

For all designated buildings, permanently installed exterior lighting must comply with the following specifications:

1. All exterior light fixtures on the building site, other than architectural accent lighting and Civil Aviation safety lighting, must be shielded so that all of the light emitted by the fixture, either directly or indirectly by reflection or refraction from any part of the fixture, is projected below the horizontal plane passing through the lowest part of the fixture;
2. Architectural accent lighting must be aimed or shielded to prevent the lighting of the night sky. The percentage of wall wash lighting spilling to the sky must be maintained under the indicated level: 10%;

3. Downward directed lighting must be used for lighting of signage;
4. Automatic control of all exterior lighting must ensure lighting does not operate during daylight hours.

Section Five
Microclimate and Outdoor Comfort

(Article 26)
Urban Heat Island Effect

For all designated buildings:

1. All opaque external roofing surfaces must comply with a minimum Roof Solar Reflective Index (SRI) value according to those limits indicated:
   (a) Steeply sloped roofs (steeper than 1:6) ≥ 29;
   (b) Flat and low sloped roofs ≥ 78.
2. Individual cooling plant units above the indicated power rating, externally exhausting, must be configured and installed to exhaust at not less than the height indicated:
   (a) 50kW rating 3.0m above pavement level.

Article (27)
Green Roofs

For all buildings, the requirements of Part 1 of Article 26 hereof may be waived, if the roof of the building is provided with a full or partially vegetated roof (green roof), the minimum percentage of which is indicated: 30%.

Article (28)
Light Colours on the Outside of Buildings

A minimum area of externally painted walls must have a minimum Light Reflectance Value as indicated:
75% of external painted walls must have a Light Reflectance Value (LRV) ≥ 45%.

Article (29)
Orientation of Glazed Façades

A percentage of the total glazed surface area of the building, (excluding glazed areas with back insulated panels), must have a north orientation which includes a **1**35-degree angle, starting from east toward North West as indicated: 50% of the glazed surface.

Article (30)
Hardscape

For all designated buildings, a prescribed percentage of the hardscape of the development must comply with one of the following specifications:

1. Demonstrate a minimum Solar Reflective Index (SRI) of ≥ 29;
2. Use an open grid pavement system;
3. Be shaded by vegetation;
4. Be shaded by materials with an SRI equal to or greater than those specified in Article 26 hereof.

Article (31)
Shading of Public Access Areas

For all buildings, all pedestrian linkages within the plot area must be shaded, using materials with a Solar Reflectance Index (SRI) equal to or greater than those specified in Article 26 hereof.

Section Six
Responsible Construction

Article (32)
Impact of Construction, Demolition and Operational Activities

All designated buildings must comply with the Unified Manual of the Requirements of Building Permits, local orders and associated executive orders, technical guidelines and guides applied in the Kingdom of Bahrain, in addition to the following requirements:

1. Neither the construction activity nor the operation of the building may cause land disturbances, surface runoff, soil erosion or sedimentation on any other property beyond the boundary of the plot.
2. Drainage must avoid pollution of watercourses and groundwater. Discharges must be made directly to ground, storm or marine waters.
3. Dust suppression techniques must ensure that dust generated by construction and demolition is properly controlled.
4. Construction waste materials generated on site must be segregated and stored on site prior to collection. Segregation must, at a minimum, include labelled storage for inert aggregates, metals, timber, dry recyclables and hazard material.
5. For the disposal of hazardous waste, a permit must be prepared and obtained from the Competent Authority or Environment Department of Environment Council. The hazardous waste must be transported in accordance with the requirements of the Unified Manual of the Requirements of Building Permits.

6. With the exclusion of human consumption, toilet activities and concrete works, potable water cannot be used for construction activities on any project site
7. Construction and demolition noise must be no greater than that detailed in the Unified Manual of the Requirements of Building Permits.
8. Chemicals, fuels, solvents or hazardous wastes must be stored in accordance the Unified Manual of the Requirements of Building Permits.
9. Light pollution from the construction site must be minimized by ensuring that light sources are directed inwards and angled down so that no light is emitted above the horizontal plane. Lux levels should meet the requirements of the Unified Manual of the Requirements of Building Permits.

Section Seven

Article (33)
Environmental Impact Assessment

An Environmental Impact Assessment (EIA) and/or a Construction Environmental Management Plan (CEMP) is required to be submitted to the Concerned Authority and obtain approval, if one of the following criteria is applicable:

1. If the building is intended as an industrial building;
2. If the building has the potential to generate hazardous or toxic wastes such as laboratories, waste recycling or waste treatment.

Chapter Four
Building Vitality

Article (A2)
Article Applicability

Table (5) hereunder is applicable to verify the extent of applicability of Building Vitality articles to each type of building

Table (5) - Building Type Applicability by Building Vitality

Building Types and Applicable Green Building Articles			Villa			Residential			Commercial					Public Building													Industrial		
			Investment villas	Private villa	Arabic House	Apartments	Labour Accomodation	Student Accomodation	Hotels, Motels, Furnished	Laboratories	Offices	Resorts	Restaurants, Food Outlets	Banks	Cinema / Theatres	Educational Facilities	Government buildings	Health Care Facilities	Historical\Heritage Buildings	Museums	Petrol Stations	Post Offices	Retail Outlets	Shopping Malls	Masjid and Worship Houses	Factories	Warehouses	Workshops
Building Vitality	Ventilation and Air Quality	34				x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
		35				x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
		36				x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
		37				x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
		38	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
		39	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
		40				x	x	x	x					x	x	x	x	x						x	x			
		41				x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
		42				x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
		43				x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
	Thermal Comfort	44	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
	Acoustic Comfort	45	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
	Hazardous Materials	46	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
		47	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
		48	x	x	x				x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
	Day lighting and Visual Comfort	49	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x			
		50				x	x	x			x			x	x	x	x	x	x	x	x	x	x	x	x			
	Water Quality	51	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
		52	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x

Section One
Ventilation

Article (34)
Minimum Ventilation Requirements for Adequate Indoor Air Quality

All designated air-conditioned buildings must be mechanically, or mixed mode ventilated and must comply with the minimum requirements as specified in ASHRAE Standard 62, 2007. Occupancy density for each space is determined based on its activity in accordance with the requirements of the Unified Manual of the Requirements of Building Permits, if any, or using the default occupancy density values indicated in ASHRAE Standard 62, 2007.

Article (35)
Air Quality during Construction, Renovation or Decoration

1. For all designated buildings under construction or renovation, building occupants and systems must be protected from airborne contaminants, which are generated or spread during construction or renovation inside the buildings, including toxic substances or substances harmful to the human body, such as asbestos, lead, pesticides, heavy metals, mold, dust, fumes, paint, etc., as specified in the Unified Manual of the Requirements of Building Permits or other internationally accepted standards.
2. Unless it is required to provide ventilation during construction, the supply and return heating, ventilation, and air conditioning (HVAC) system openings must be closed and protected from contamination. All ducts and other related air distribution component openings must be covered with tape, plastic, sheet metal or other methods to prevent dust or debris from collecting in the system.
3. If the HVAC system is used during construction or renovation, temporary return air filters must be installed with a Minimum Efficiency Reporting Value (MERV) in accordance with the Unified Manual of the Requirements of Building Permits or ASHRAE 52.2, 2007 or an equivalent standard. Immediately prior to occupancy, the temporary return air filters must be removed and replaced with permanent filters having Minimum Efficiency Reporting Value (MERV) in accordance with ASHRAE Standard 52.2, 2007 or an equivalent standard.

Article (36)
Air Inlets and Exhausts

For all designated buildings:

1. All ventilation system outdoor air intakes, including doors and operable windows, that are part of a mixed mode ventilation system, must be located at suitable distance from potential sources of contamination to reduce the possibility of odour, smoke or other air contaminants entering the ventilation system as required by the Unified Manual of the Requirements of Building Permits, if applicable, or ASHRAE Standard 62, 2007 (Table 5).
2. Exhausted air must be discharged in a manner to avoid it being drawn back into the building or the building ventilation system and to ensure that it does not become a nuisance to the building occupants or other buildings occupants or pedestrians.

Article (37)
Isolation of Pollutant Sources

For all designated buildings, where activities produce hazardous fumes or chemicals, spaces must be provided with separate air extraction systems to create negative pressure and exhaust the fumes or chemicals to ensure they do not enter adjacent rooms. Dangerous Goods must be stored in accordance with the Unified Manual of the Requirements of Building Permits.

Article (38)
Openable Windows

For all designated buildings, opening windows must be provided in accordance with the Unified Manual of the Requirements of Building Permits.

Article (39)
Indoor Air Quality Compliance - New Buildings

For all designated buildings, suitable ventilation is required for the building occupants ensuring the air quality in accordance with the technical guidelines specified in the Unified Manual of the Requirements of Building Permits. Alternatively, prior to occupation, a building may be tested for Indoor Air Quality according to the following limits:

1. A report assuring compliance with these requirements must be submitted to the competent authority;
2. Air Quality testing must be carried out by an air testing company or a laboratory accredited by the Competent Authority. The compliant test results must be submitted to the Competent Authority.
3. The air quality testing equipment must have initial and periodical calibration certificate as per manufacturer requirement from an external calibration facility accredited by the Competent Authority or at least an annual calibration certificate. The initial and periodical calibration certificates must be saved in a special register to be checked by the Competent Authority in order to ensure the accuracy of the readings as condition of renewal the indoor air quality certificate.
4. The maximum limit for indoor air contaminants must not exceed the maximum indicated in Table (6) hereunder:

Table (6)

Sampling Schedule	Type of Samples	Maximum Acceptable (ppm)	Sampling Duration
Pre-occupation	Formaldehyde	< 0.08 ppm	8- hour continuous monitoring (8-hour time-weighted average}
	Total Volatile Organic Compound	< 300 µgr/m3	
	Respirable Dust (>10 microns)	< 150 µgr/ m3	

Article (40)

Indoor Air Quality Compliance - Existing Buildings

Suitable ventilation must be provided for the building occupants and to ensure that the air quality is in accordance with the Unified Manual of the Requirements of Building Permits. Alternatively, a building may be tested for Indoor Air Quality according to Schedule (7) hereunder.

1. Indoor air testing for the contaminants listed in Table (7) must be carried out to ensure the air quality in a building is suitable for occupation. The maximum limit for indoor air contaminants included in Table (7) must not be exceeded:

Table (7)

Sampling Schedule	Type of Samples	Maximum Acceptable	Sampling Duration
Initial test completed by 31st December Further testing within 5 years of last compliant test.	Formaldehyde	< 0.08% ppm	8- hour continuous monitoring (8-hour time-weighted average)
	Total Volatile Organic Compound	< 300 µgr/m3	
	Respirable Dust	< 150 µgr/ m3	
	Ozone	0.06 ppm (120 µgr/ m3)	
	Carbon Monoxide	9 ppm	
	Bacteria	500 CFU/ m3 Agar Plate	
	Fungi	500 CFU/ m3 Agar Plate	

2. Air Quality testing must be carried out by an air testing company or laboratory accredited by the Competent Authority and the compliant result must be submitted to the Competent Authority
3. Air quality testing equipment must have initial and periodical calibration certificates as per manufacturer requirement from an external calibration facility accredited by the Competent Authority or at least annual calibration certificate. The initial and periodical calibration certificates must be saved in a special register to be checked by the Competent Authority in order to ensure the accuracy of the readings as a condition for renewal of the indoor air quality certificate.

Article (41)
Inspection and Cleaning of HVAC Equipment

For all designated buildings, the cleanness of HVAC equipment and systems must be maintained and all its parts must be inspected and cleaned in accordance with the standard specifications approved by the Unified Manual of the Requirements of Building Permits. Inspection and cleaning must be carried out by credited specialized maintenance companies approved by the Competent Authority, or provide a proof that maintenance is carried out by the building operator if such an operator has a qualified personnel and equipment to do so.

Article (42)
Parking Ventilation

For designated buildings with enclosed public parking:

1. Mechanical ventilation must be provided to ensure that the Carbon Monoxide (CO) concentration in the enclosed parking area is maintained below fifty parts per million (50 ppm) by either providing a minimum of six (6 No.) outside air changes per hour, or Installing a variable volume ventilation system controlled in response to input from a minimum of one Carbon Monoxide sensor per four hundred square meters (400 m^2) floor area of parking.

2. A supply of outdoor air must be provided to each parking level.
3. Occupied areas such as offices, shopping centres, hotels, waiting rooms, and ticket booths connected to enclosed parking, must be supplied with conditioned air under positive pressure compared with adjoining parking areas

4. Ventilation systems must be capable of providing ten (10 No.) air changes per hour for smoke clearance purposes in case of a fire incident
5. Carbon Monoxide monitoring equipment must be installed with a minimum of one carbon monoxide sensor per four hundred square meters (400 m^2) floor area of parking. Sound alarm triggers when the Carbon Monoxide concentration reaches or exceeds seventy-five (75) ppm in, at least, five percent (5%) of the monitored locations
6. Where a Building Management System (BMS) or Central Control and Monitoring System (CCMS) is installed, the Carbon Monoxide concentration must be monitored to allow real-time profiling and management of air quality.
7. Carbon Monoxide monitoring equipment must be checked and recalibrated every six (6) months or according to manufacturer specification by a specialized calibration company certified by the Competent Authority. Test results and calibration certificates must be kept onsite and be readily available for inspection by the Competent Authority staff.

Article (43)
Environmental Tobacco Smoke

1. Smoking is strictly prohibited in all public, including but not limited, to shopping centres, hotels, restaurants, government buildings, hospitals, healthcare facilities, commercial buildings, common accommodation, coffee shops and amusement and entertainment or any other places determined by the Competent Authority except for places in which smoking is permitted
2. Places in which smoking is permitted are determined in accordance with the conditions listed in the Manual of Regulating Smoking in Public Places issued by the Competent Authority in which public places where smoking is strictly prohibited and places where smoking is permitted are determined according to specific conditions.
3. Smoking designated areas must be placed at a minimum distance, as prescribed by the Competent Authority, from building entrances, doors, operable windows and ventilation system outdoor air intakes
4. An annual permit is issued from the Public Health and Safety Department of the relevant Ministry for all places in which smoking is permitted after providing all required documents and drawings.

Section TWO
Thermal Comfort

Article (44)
Thermal Comfort

For all designated buildings, the heating, ventilation and air conditioning (HVAC) system must be capable of providing Thermal Comfort conditions as prescribed in Table (8) hereunder:

Table (8)

95% of the year	Lower Limit	Upper Limit
Dry Bulb Temperature	22.5°C	25.5°C
Relative Humidity	30%	60%

Section Three
Acoustic Comfort

Article (45)
Acoustical Control

For all designated buildings, the acoustic performance relating to Internal Noise Criteria from External Noise Sources, Internal Noise Criteria from Mechanical Services Noise, Internal Airborne Sound Insulation Guidance Values, and Internal Impact Sound Pressure Levels must meet the control requirements set out in Table (9) hereunder:

Table (9)

Building Type	Document Reference
Residential	Building Regulations Approved Document E (revised 2003) (UK)
Healthcare	Health Technical Memorandum 08-01 (UK)
Educational	BS No. 93 Sound insulation and noise reduction for schools – code of practice". (UK)
Commercial	BS 8233:1999 "Sound insulation and noise reduction for buildings – code of practice". (UK)
Industrial	BS 8233:1999 "Sound insulation and noise reduction for buildings – code of practice". (UK)
Public	BS 8233:1999 "Sound insulation and noise reduction for buildings – code of practice". (UK)

Section Four
Hazardous Materials

Article (46)
Paints and Coatings

For all designated buildings, including new uses in existing buildings, all paints and coatings used in the building should not exceed allowed limits of Volatile Organic Compound (VOC), these paints and coatings must be accredited/certified from Bahrain Central Lab or any source approved by the Competent Authority.

NON-FIRE RATED or NON-FIRE-RESISTANT FAÇADE CLADDING MATERIAL is not allowed

Article (47)
Adhesives and Sealants

For all designated buildings, including new applications in existing buildings, all adhesives, adhesive bonding primers, adhesive primers, sealants and sealant primers used in the building should not exceed allowed limits of Volatile Organic Compound (VOC), these materials must be accredited/certified from Central Lab of Ministry of Works or any source approved by the Competent Authority.

Article (48)
Carpet Systems

For all designated buildings, each new carpet system used must be certified / accredited by the Central Laboratory of the Ministry of Works or by any other source approved by the Competent Authority.

Section Five
Day lighting and Visual Comfort

Article (49)
Provision of Natural Daylight

For all designated buildings, provision for adequate natural daylight must be made in order to reduce reliance on electrical lighting and to improve conditions for the building occupants and provide lighting openings in accordance with the Unified Manual of the Requirements of Building Permits.

Article (50)
Views

All designated buildings must provide direct line of sight (views) to the outdoor environment in accordance with the Unified Manual of the Requirements of Building Permits and in accordance with all relevant provisions issued by the Competent Authority.

Section Six
Water Quality

Article (51)
Legionella Bacteria and Building Water Systems

All designated buildings must apply the technical guidelines in the Unified Manual of the Requirements of Building Permits which includes:

1. All water systems and networks which creates a water spray or aerosol including but not limited to cooling towers, evaporative condensers, hot and cold water systems, showers, evaporative air coolers, spas, fountains, misters, etc. must be periodically maintained, cleaned, disinfected and checked periodically to minimize the risk of Legionella bacteria or germs contamination in accordance with the technical guidelines issued by the Competent Authority regarding the control of Legionella bacteria in water systems.
2. All water systems equipment and accessories including but not limited to the potable water network, hot and cold-water systems, water tanks, pumps, pipes and fittings must be maintained, cleaned and disinfected.
3. Sampling and testing must be carried out for the presence of bacteria/germs and Legionella bacteria.
4. All equipment and devices of swimming pools, spa pools, whirlpool baths, hydrotherapy pools and Jacuzzi must be maintained, cleaned, disinfected and checked periodically.
5. All equipment's and devices of irrigation system must be maintained, cleaned, disinfected and checked periodically.
6. Specialized companies approved by the Competent Authority must do water tests and sampling. All test results must be recorded and kept along with the records of maintenance and remedial works at site to be checked by the Competent Authority or its approved agents.
7. For healthcare facilities and hospitals only, Health Technical Memorandum No. 04-01 & HTM 04-02 (UK), must be complied with.

Article (52)

Water Quality of Water Features

For all designated buildings, all water features with a water storage volume over 1,000 liters, and which creates a water spray or aerosol including but not limited to waterfalls, ponds, streams, etc. must be maintained, cleaned, disinfected and checked periodically to minimize the risk of Legionella bacteria or germs contamination and not exceed the maximum limits outlined in the technical guidelines in the Unified Manual of the Requirements of Building Permits.

Chapter Five
Resource Effectiveness – Energy
Section One
Conservation and Efficiency: Envelope

Article (53)
This Article is reserved for Future Use

Article (A3)
Article Applicability

The following Table (10) is used to verify that buildings meet with energy efficiency requirements.

Table (10) of applicability of articles to the types of buildings by resource-Energy efficiency

Building Types and Applicable Green Building Articles			Villa			Residential			Commercial					Public Building												Industrial		
			Investment villas	Private villa	Arabic House	Apartments	Labour Accomodation	Student Accomodation	Hotels, Motels, Furnished	Laboratories	Offices	Resorts	Restaurants, Food Outlets	Banks	Cinema / Theatres	Educational Facilities	Government buildings	Health Care Facilities	Historical/Heritage Buildings	Museums	Petrol Stations	Post Offices	Retail Outlets	Shopping Malls	Masjid and Worship Houses	Factories	Warehouses	Workshops
Resource Effectiveness – Energy	Conservation and Efficiency: Building Fabric	53																										
		54	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
		55	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
		56	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X			
		57				X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X			
		58				X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X			
	Conservation Efficiency of Building Systems	59	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
		60	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X			
		61				X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X			
		62	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
		63	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
		64				X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X			
		65	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
		66				X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
		67							X																			
		68	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
		69	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
		70				X	X	X	X		X	X			X	X	X	X		X			X	X		X	X	X
		71	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
		72	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	Commissioning and Management	73				X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
		74				X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
		75				X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
		76				X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
		77				X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	Onsite Systems – Generation & Renewable Energy	78	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
		79	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
		80																										

Article (54)
Minimum Envelope Performance Requirements

For all designated buildings, exterior building elements (excluding glazing elements) must have an average thermal conductance (also known as U Value) that does not exceed the values specified in Table (11/A).

Glazing U-Value parameters and Shading Coefficients (SC) must not exceed those listed in Table (11/B), while Light Transmittance must be greater than or equal to those values shown.

1. **External Walls, Roofs, and Floors:**
   Building elements forming the external walls, roofs, and floors (where one side of the floor is exposed to ambient conditions) must have an average thermal transmittance (U Value) which does not exceed those specified in Table (11/A) hereunder:

   Table(11/A) – Roof and External Wall U-Value maximum values

Roof	**U= 0.3 W/m2K**
External Wall	**U=0.57 W/m2K**

   If the floor is in contact with the ground, the insulation should only be applied to one meter (1m) in from the perimeter of the building. Glazed elements with back insulated panels must be treated as walls (and therefore must meet the performance requirement for walls).

2. **Glazed Elements - Fenestration:**
   If the percentage glazing area of total façade area is the indicated range, then those values of U-Value, Shading Coefficient and Light Transmittance will apply, in accordance with Table (11/B) hereunder:

   Table (11/B): Glazing Elements: Maximum Thermal Transmittance and Shading Coefficient values and minimum Light Transmittance values

Total area of glazing ≤ 40% of total external facade area	
Thermal Transmittance (Summer U value)	U= 2.1 W/m²K (max)
Shading Coefficient	0.4 (max)
Light Transmittance	0.25 (min)
Total area of glazing >40% and ≤ 60% of total external facade area	
Thermal Transmittance (Summer U value)	U= 1.9 W/m2K (max)
Shading Coefficient	0.30 (max)
Light Transmittance	0.2 (min)
Total area of glazing > 60% of total external facade area	

Thermal Transmittance (Summer U value)	U= 1.9 W/m²K (max)
Shading Coefficient	0.25 (max)
Light Transmittance	0.2 (min)
For shopfronts and showrooms, other than ground floor	
Thermal Transmittance (Summer U value)	U= 1.9 W/m²K (max)
Shading Coefficient	0.76 (max)
Portion of roof glazed ≤ 10% of roof area	
Thermal Transmittance (Summer U value)	U= 1.9 W/m²K (max)
Shading Coefficient	0.25. (max)
Light Transmittance	0.4 (min)
Portion of roof glazed > 10% of roof area	
Thermal Transmittance (Summer U value)	U= 1.9 W/m²K (max)
Shading Coefficient	0.25 (max)
Light Transmittance	0.3 (min)

Guidance methods for the calculation of average building element U-Values, based on International Best Practice, are included for:

a) External Walls
b) Glazing Systems
c) Roofs
d) Thermal Bridging calculations where appropriate

3. Compliance Methods

The calculation tools referenced within the Performance Method will be described as part of the Green Building Rating Scheme and may include online calculation tools issued and approved by the Competent Authority, and the Sustainable Energy Authority.

Article (55)
Thermal Bridging

For all designated buildings, Thermal Bridges, such as connection points between concrete or steel beams, external walls and columns and around doors and windows, which enable the flow of heat from outside into the building, must be eliminated or insulated to reduce the amount of heat transfer. The method employed to reduce or eliminate these thermal bridges must be outlined along with the building permit application to the Competent Authority. Where this is not possible, a calculation tool will be provided within the Green Building Practice Guide to identify the effects of the particular thermal bridge proposed in a building design.

Article (56)
Air Conditioning – Design Parameters

For all designated buildings, the heat load must be calculated in accordance with the design parameters specified within the Green Building Practice Guide.

The heat transfer coefficients to be used in the calculations for roofs, walls and glazed areas must be the actual design coefficients, or as set out in the Minimum Envelope Performance Requirements.

When diversity factors to be used in the calculation of heat load are not known, the coefficients set out in the ASHRAE Fundamentals Handbook, 2005 must be used.

The following table should be used for calculating the thermal load:

Table (12/A): Outdoor Conditioning Value

Dry Bulb Temperature	46°C (115°F)
Wet Bulb Temperature	29°C (85°F)
Bahraini Cities Location Latitude	26°North
Outdoor daily Temperature Range on Design Day	13.8°C (25°F)

Table (12/B): Indoor Condition of the Building

Dry Bulb Temperature	24°C (75°F)
Relative Humidity	50% ± 5%

Table (12/C) - Sensible and Latent Heat Safety Factors

Sensible Heat	10%
Latent Heat	5%

Heat loads for buildings must be calculated for each air-conditioned space at the hour of peak load incidence in that space, using software registered in the Competent Authority.

Article (57)
Air Loss from Entry and Exit

For all designated buildings, all regularly used air-conditioned entrance lobbies must be protected by a door design which acts as a barrier to the loss of conditioned air in accordance with guidance in the Unified Manual of the Requirements of Building Permits.

Article (58)
Air Leakage

All designated buildings with a cooling load greater than 1MW must be tested to demonstrate that air leakage does not exceed $10m^3/hr/m^2$ into or out of the building at an applied pressure difference of 10 pascal. Testing must be carried out in accordance with a method approved by the Competent Authority. Work must be carried out by a company registered with the Competent Authority.

Section Two
Conservation Efficiency of Building Systems

Article (59)
Energy Efficiency – HVAC Equipment and Systems

For all designated buildings, heating, ventilating and air conditioning equipment and systems must comply with the minimum energy efficiency requirements listed in Table No. (13/A) and test procedures approved by Competent Authority.

1. Integrated Part Load Values (IPLVs) and part rating conditions are only applicable to equipment with capacity modulation.
2. All units in Table (13/B) Test Procedure (T1 & T3) in accordance with the relevant sections of ARI 365 and of ISO5151

The chiller equipment requirements apply to all chillers, including where the design leaving fluid temperature is <4.5°C.

The following table is used for efficiency requirements for air-conditioners and condensers and water chillers, in the manner provided for in the two following tables:

Table (13/A): Minimum Efficiency Requirements for Unitary AC Plant and Condensing Units

Minimum Efficiency Requirements for Unitary Air Conditioners and Condensing Units					
Equipment Type	Size Category	Heating Section Type	Subcategory or rating condition	Min Efficiency (T1)	Min Efficiency (T3)
Air Conditioners (air cooled)	<65,000 BTU/h	ALL	Split System	9.5 EER	6.6 EER
Air Conditioners (air cooled	<65,000 BTU/h	ALL	Split System	9.5 EER	6.6 EER
Through Wall (air cooled)	≤30,000 BTU/h	ALL	Split System	8.0 EER	5.7 EER
Small duct, high velocity (air cooled)	<65,000 BTU/h	ALL	Single Package	9.2 EER	6.4 EER
Air Conditioners (air cooled)	≥65,000, <135,000 BTU/h	Electric Resistance (or none)	Split System and Single Package	9.5 EER	6.4 EER
	≥65,000, <135,000 BTU/h	All other	Split System and Single Package	9.5 EER	6.4 EER
	≥135,000, <240,000 BTU/h	Electric Resistance (or none)	Split System and Single Package	9.2 EER	6.4 EER
	≥135,000, <240,000 BTU/h	All other	Split System and Single Package	9.2 EER	6.4 EER
	≥240,000, ≥760,000 BTU/h	Electric Resistance (or none)	Split System and Single Package	9.2 EER	6.4 EER

	≥240,000, ≥760,000 BTU/h	All other	Split System and Single Package	9.2 EER	6.4 EER
	≥760,000 BTU/h	Electric Resistance (or none)	Split System and Single Package	9.0 EER	6.3 EER
	≥760,000 BTU/h	All other	Split System and Single Package	9.0 EER	6.3 EER
Air Conditioners water and evaporatively cooled	<65,000 BTU/h	All other	Split System and Single Package	14.0 EER	
	≥65,000, <135,000 BTU/h	Electric Resistance (or none)	Split System and Single Package	14.0 EER	
	≥65,000, <135,000 BTU/h	All other	Split System and Single Package	14.0 EER	
	≥135,000, <240,000 BTU/h	Electric Resistance (or none)	Split System and Single Package	14.0 EER	
	≥135,000, <240,000 BTU/h	All other	Split System and Single Package	14.0 EER	
	≥240,000 BTU/h	Electric Resistance (or none)	Split System and Single Package	14.0 EER 12.4 PLV	
	≥240,000 BTU/h	All other	Split System and Single Package	14.0 EER	
Condensing Units, air cooled	≥135,000 BTU/h			11.5 EER	7.8 EER

Table (13/B): Minimum Efficiency Requirements for Water Chilling Packages

Equipment Type	Size Category	Min Efficiency (T1)	Min Efficiency (T3	Test Procedure
Air Cooled with condenser, electric	All capacities	2.8 COP 3.05 IPLV	1.9 COP	T1 – ARI 210/240
Air Cooled without condenser, electric	All capacities	3.1 COP 3.45 IPLV	2.1 COP	T1 – ARI 210/240
Water Cooled, electric, +ive displacement	All capacities	4.2 COP 5.05 IPLV	2.75 COP	T1 – ARI 550/590 T3 – ISO 5151
Water Cooled, electric, +ive displacement, rotary screw & scroll	<150 tons	4.45 COP	2.9 COP	T1 – ARI 550/590 T3 – ISO 5151
	≥150tons <300 tons	4.9 COP	3.2 COP	
	≥300tons	5.6 COP	3.6 COP	
Water Cooled, electric, centrifugal	<150 tons	6.0 COP		T1 – ARI 550/590
	≥150tons <300 tons	6.5 COP 7.1 IPLV		
	≥300tons	6.5 COP 7.68 IPLV		
Air Cooled Absorption, single effect	All capacities	0.7 COP		ARI 560
Water Cooled Absorption, single effect	All capacities	0.7 COP		
Absorption, double effect, indirect fire	All capacities	1.1 COP 1.1 IPLV		

Absorption, double effect, direct fire	All capacities	1.2 COP 1.2 IPLV		

Article (60)
Demand Controlled Ventilation

For all designated buildings with mechanical ventilation and existing building types determined by the Competent Authority, Demand Controlled Ventilation (DCV) using a concentration of Carbon Dioxide (CO_2), or other means to measure occupancy, must be used in single spaces larger than 100m^2 and with a maximum design occupancy density greater than 25 persons per 100m^2. Where the occupancy is not known, ASHRAE 62.2, 2007 Table 6.1 should be used as reference. It is recommended that the CO_2 concentration is maintained below 1,000 ppm.

An alarm must be triggered if CO_2 concentration rises above 1,250ppm. This alarm is to be either automatically monitored by a central control system, if available, or give a local audible or visual indication when activated.

For designated buildings, including existing with DCV, the CO_2 sensors and systems must be checked and recalibrated as per manufacturer recommendations at a time interval and by a contractor approved by the Competent Authority.

Article (61)
Elevators and Escalators

For all designated buildings, where used and applicable:

1. Escalators - Escalators must be fitted with controls to reduce speed or to stop when no traffic is detected. Escalators shall be designed with energy savings features as indicated:
   (a) Reduced speed control: The escalator shall change to a lower speed when no activity has been detected for a maximum period of 3 minutes.
   (b) Use on demand: The escalator shall shut down when no activity has been detected for a maximum period of 15 minutes. The escalator shall restart by detector using soft start technology
2. Elevators (lifts) must be provided with controls to reduce the energy demand. Elevators shall be designed with energy savings features as listed:

(a) Use of AC Variable-Voltage and Variable-Frequency (VVVF) drives on non- hydraulic elevators.
(b) Energy efficient lighting inside the elevator including controls to turn lights off when the elevator has been inactive for a maximum period of 5 minutes.

Article (62)
Lighting Power Density – Interior

For designated buildings, and in compliance with any relevant recommendations in the Unified Manual of the Requirements of Building Permits, the average Lighting Power Density for the interior connected lighting load for specific building types, must be not be more than that indicated in following Table (14).

Table(14)

Building Type	Maximum Average W/M² Across Total Building Area
Commercial/Public, Offices, Hotels, Resorts, Restaurants	10
Educational Facilities	12
Manufacturing Facilities	13
Retail Outlets, Shopping Malls, Workshops	14
Warehouses	8

Lighting power densities for building types not shown in Table (14) should be no greater than those values given in ASHRAE 90.1, 2007 or equivalent, as approved by the relevant Authority in the Kingdom.

Article (63)
Lighting Power Density – Exterior

For all designated buildings, the average Lighting Power Density for the exterior connected lighting load must be no more than that indicated in Table (15) hereunder and in compliance with the Unified Manual of the Requirements of Building Permits.

Table (15)

Building Type	Maximum average W/m2 or W/m across total building area
Uncovered parking Lots and Drives	1.6 W/m2
Walkways < 3m wide	3.3 W/m2
Walkways ≥ 3m wide	2.2 W/m2
Outdoor Stairways	10.8 W/m2
Main Entries	98 W/m2
Other Doors	66 W/m2
Building Facades	2.2 W/m2 for each illuminated wall or surface or 16.4 W/m for each illuminated wall or surface length
Entrance and Gatehouse Inspection Stations at guarded facilities	13.5 W/m2

Drive-up windows at service outlets (incl. fast food)	**400W per drive-through channel**

Lighting power densities for building types not shown in Table (14) should be no greater than those values given in ASHRAE 90.1, 2007 Table 9.5.1 or equivalent as approved by the Competent Authority.

Article (64)
Lighting Controls

For all designated buildings:

1. Presence Lighting Controls must be provided so as to allow lighting to be switched off when daylight levels are adequate or when spaces are unoccupied and to allow occupants control over lighting levels
2. Common areas which are not regularly occupied, such as corridors and lobbies, should reduce lighting levels to not more than 25% of normal when unoccupied
3. In offices and education facilities all lighting zones must be fitted with occupant sensor controls capable of switching the electrical lights on and off, according to occupancy unless lighting is required for safety purposes
4. In offices, if the average design lighting power density per square meter of gross floor area (GFA) is less than $6W/m^2$, the control requirements of parts (b) and (c) of this regulation do not apply
5. It is recommended that, in offices, the artificial lighting in spaces within six (6) meters in depth from exterior windows must be fitted with lighting controls incorporating photocell sensors capable of adjusting the level of electric lighting to supplement natural daylight only when required. The combined artificial and daylight must provide an illumination level at the working plane between four hundred (400) and five hundred (500) lux. When there is a hundred percent (100%) daylight, the lux levels may exceed five hundred (500) lux.

Article (65)
Electronic Ballasts

For all designated buildings, high frequency electronic ballasts must be used with fluorescent lights and metal halides of 150 W or less. High frequency electronic ballasts must be labelled as conforming to an international standard approved by the Competent Authority.

Article (66)

Control systems for Heating, Ventilation and Air Conditioning (HVAC) Systems

For all designated buildings, all Heating, Ventilation, and Air Conditioning (HVAC) systems must be provided with controls to guarantee the achievement of energy efficiency in use in accordance with ASHRAE 90.1, 2007, Section 6.4.3 or the equivalent guidance approved by the Competent Authority.

As a minimum and depending on relevant guidance in the Unified Manual of the Requirements of Building Permits, the following control features must be incorporated:

1. Thermal Zoning: Sub-division of systems into separate control zones to correspond with each area of the building that has a significantly different solar exposure, or cooling load, or type of use.
2. All separate control zones must be capable of:
   (a) Independent temperature control;
   (b) Inactivation when the building, or part of building served by the system, is not occupied
3. The operation of central plant only when the zone systems require it.

Article (67)

Control systems for Hotel Rooms

For all new hotels and in accordance with guidance in the Unified Manual of the Requirements of Building Permits, guest rooms must incorporate, in each room, controls systems which are able to turn off the lighting, air conditioning and power when the room is not occupied.

In addition, it is recommended that each guest room should incorporate control system to enable the turning off of local air conditioning systems or fan-coils when the balcony door/window is left open.

Article (68)

Exhaust Air Energy Recovery systems

For all designated buildings with a requirement of treated outdoor air of over 1,000 liters/s, energy recovery systems must be provided to handle a minimum percentage of 50% of the total exhausted air. The energy recovery systems must have at least 70% sensible load recovery efficiency.

Article (69)

Pipe and Duct Insulation

For all designated buildings and in accordance with the Unified Manual of the Requirements of Building Permits, all pipes carrying refrigerant, hot water or chilled water and ducts, including prefabricated ducts, supplying conditioned air must be insulated to minimize heat loss and prevent condensation.

1. Pipes and ducts passing through conditioned spaces must be insulated in accordance with insulation standards such as BS 5422:2009 or other equivalent standard approved by the Competent Authority
2. Pipes passing through outside or unconditioned spaces must be insulated with the minimum insulation thickness specified in Table (16A) hereunder:

Table (16/A) - Pipe and Duct Insulation

Steel Pipe Size (mm)	Temperature of Pipe Contents (°C)					
	10 °C		5 °C		0 °C	
	Minimum Insulation Thickness (mm					
	0.018W/m.K	0.038W/m.K	0.018W/m.K	0.038W/m.K	0.018W/m.K	0.038W/m.K
15	50	30	45	30	45	30
20	60	30	55	30	45	30
25	60	40	55	35	55	30
32	65	40	55	35	55	30
40	65	40	60	35	55	30
50	70	45	60	40	60	30
65	70	45	60	40	60	40
80	75	45	65	40	60	40
100	75	45	65	40	70	40
150	90	50	80	45	75	40
200	90	55	80	45	75	45
250	100	55	80	55	75	45
+300	100	80	100	75	80	70

3.Ducts passing through outside or unconditioned spaces must be insulated with the minimum insulation thickness specified in Table 16/B) hereunder:

Table (16/B) - Minimum duct air temperature per thicknesses

Minimum air temperature inside duct (°C)					
15 °C		10 °C		5 °C	
Minimum Insulation Thickness (mm)					
0.018W/m.K	0.038W/m.K	0.018W/m.K	0.038W/m.K	0.018W/m.K	0.038W/m.K
42	61	48	84	57	107

Insulation materials used must meet the requirements of Article (88) hereof, Thermal and Acoustical Insulation Materials or BS 5422:2009, whichever is the more stringent.

All insulation installations must have a suitable vapor barrier and protection from Ultra Violet (UV) light.

Article (70)
Thermal Storage for District Cooling

All new district cooling plants must incorporate a Thermal Energy Storage (TES) facility with a minimum capacity as specified in the Unified Manual of the Requirements of Building Permits.

Article (71)
Ductwork Air Leakage

For all designated buildings, air ductwork must be designed, built and installed to ensure that air leakage is minimized.

Ductwork, with equipment attached to it, with an external static pressure exceeding that specified in the Unified Manual of the Requirements of Building Permits and all ductwork exposed to external ambient conditions or within unconditioned spaces must be pressure tested prior to occupancy in accordance with a method approved by the Competent Authority and a compliant amount of air leakage achieved.

Ductwork leakage testing must be carried out by a company approved by the Competent Authority to conduct commissioning of buildings.

Article (72)
Maintenance of Mechanical Systems

For all designated buildings, the mechanical-electrical and plumbing systems in buildings must be serviced and maintained regularly in accordance with guidance contained in the Green Building Practice Guide and the Unified Manual of the Requirements of Building Permits, and subject to:

1. To allow the mechanical services to be maintained, they must be installed so that adequate access is available to allow regular inspection, maintenance and cleaning of the equipment without the need to remove or dismantle any building components.
2. The building owner must ensure that a maintenance manual and schedule is developed for the building based on the instructions

for preventative maintenance or service from the manufacturers or suppliers of equipment or according to ASHRAE 62.1, 2007 or equivalent as approved by the Competent Authority.

3. The building owner must enter into a service contract with a maintenance company approved by Municipalities in Bahrain or provide evidence that equipment will be properly maintained by competent members of their own staff.
4. Service records in the form of a service logbook including details of both preventative and corrective maintenance must be kept onsite and be readily available for inspection by the Competent Authority or its Agents.

Section Three
Commissioning and Management

Article (73)
Commissioning of Building Services – New Buildings

For all designated buildings, with a cooling load equal to or greater than 1MW, the commissioning of air distribution systems, water distribution systems, lighting, central control and building management systems, refrigeration systems and boilers must be carried out before a completion certificate will be issued by the relevant authorities.

1. Commissioning must be carried out in accordance with the CIBSE Codes listed below or any other commissioning Standard or Code approved by the Competent Authority.
   (a) The Chartered Institution of Building Services Engineers (CIBSE) Commissioning Code, Air Distribution Systems, Code A-2006
   (b) CIBSE Commissioning Code, Water Distribution Systems, Code W-2003.
   (c) CIBSE Commissioning Code, Lighting, Code L-2003.
   (d) CIBSE Commissioning Code, Automatic Controls, Code C-2001' for central control and Building Management System (BMS).
   (e) CIBSE Commissioning Code R: 2002 Refrigeration Systems.
   (f) CIBSE Commissioning Code B: 2002 Boilers

2. Work must be carried out by a company approved by the Competent Authority to conduct commissioning of buildings.
3. Commissioning results must be recorded and available for inspection by the Competent Authority
4. A systems manual, documenting the information required to allow future operations staff to understand and optimally operate the

commissioned services, must be developed and provided to the building owner or facilities operator following commissioning.

Article (74)
Re-commissioning of Building Services – Existing Buildings and Public Buildings

For all designated buildings, with a cooling load of 2MW or greater, the re-commissioning of ventilation, water systems central plant, lighting and control systems must be carried out at least once every five (5) years. Where possible, the re-commissioning should be carried out in accordance with the requirements of Article "Commissioning of Building Services – New Buildings" but at a minimum, systems are required to be re-commissioned to ensure that:

1. The amount of fresh air supplied from each ventilation outlet is within ±5% of the design volume
2. The volume of the chilled water supplied to any cooling coil is within ±5% of the design volume
3. All mechanical devices, including but not limited to dampers, valves, fans, pumps, motors and actuators, operate freely and as required;
4. Filters and filter housings are sound and secure and that no unfiltered air bypasses the filter assembly
5. Heat recovery systems are operating as designed
6. Central plant equipment is tested to ensure that it operates through the full range of its capacity and that all design parameters are achieved
7. All lighting systems and their controls operate as designed and that required levels of illumination are provided
8. Controls are checked and re-calibrated for operation as designed and to ensure that any remote devices respond as required
9. Pipe and ducts are inspected to ensure there is no air or liquid leakage

   commissioning results must be recorded and available for inspection by the Competent Authority or its approved Agent. Work must be carried out by a contractor certified by the Competent Authority to conduct commissioning of building services. Where original design requirements are not available, the contractor is to certify that, following re-commissioning, the systems are installed and operating correctly based on their experience and understanding of the systems.

Article (75)
Electricity Metering

For all designated buildings, and in accordance with guidance provided in the Unified Manual of the Requirements of Building Permits, meters must be fitted to measure and record electricity demand and consumption of the facility as a whole and to provide accurate records of consumption.

1. For all buildings above 5,000 m^2 in GFA or above a 1MW cooling load, additional electrical sub-metering (of tariff class accuracy) must be installed to record demand and consumption data for each major energy-consuming system in the building. At a minimum, all major energy consuming systems greater than 100 kW must be sub-metered.
2. The building operator shall be responsible for recording details of the energy consumption for the building and ensuring that major electricity uses are sub-metered and that this data is logged on a sub-hourly basis. Electronic data records must be kept for five years or until collected by the Competent Authority
3. Each individual tenancy in the building must have a sub-meter installed when a building tariff meter is not present. These sub-meters can be used for billing, demand management and electricity cost allocation purposes
4. Where a Building Management System (BMS) or Central Control and Monitoring System (CCMS) is installed, metering must be connected to allow real-time profiling, management and sub-hourly logging of energy consumption
5. All meters must be capable of remote data access and must have data logging capability and complying with the Unified Manual of the Requirements of Building Permits specifications. All meters should be approved by the relevant authority

Article (76)
Air Conditioning Metering

For all designated buildings, which are supplied by a central air conditioning source (such as a chiller plant or district cooling), and where cooling energy is delivered individually to several consumers, meters must be fitted to measure and permanently record chilled water supply to air conditioning units and to provide accurate records of consumption.

1. Energy meters designed to measure the supply of chilled water must be installed for each dwelling unit, office, or tenant. The measuring device must measure the water flow and supply and return temperatures to determine the temperature differential and calculate the amount of cooling energy consumed
2. Where a Building Management System (BMS) or Central Control and Monitoring System (CCMS) is installed, metering must be connected to allow real-time profiling, management and sub-hourly logging of energy consumption
3. Meters used must be specifically designed for the measurement of chilled water rather than for hot water
4. All meters must be capable of remote data access and must have data logging capability
5. Virtual meters using run-hours are not acceptable as sub-meters
6. The meter readings and actual consumption details can be used for billing, demand management and cost allocation purposes.

Article (77)
Central Control and Monitoring System

For all designated buildings above 5,000 m^2 in GFA or above a 1MW cooling load, the building must have a central control and monitoring system capable of ensuring that the building's technical systems operate as designed and as required during all operating conditions, and that the system provides full control and monitoring of system operations, as well as diagnostic reporting.

At a minimum, the system must control the chiller plant, heating, ventilation and air conditioning (HVAC) equipment, record energy and water consumption, and monitor and permanently record the performance of these items.

Section Four
Onsite Systems – Generation & Renewable Energy

Article (78)
Onsite Renewable Energy – Small to Medium Scale Embedded Generators

For all designated buildings, which have small or medium renewable power generators of energy and using renewable energy sources, the connection specifications must be subject to the contents of Decree 2017-2 regarding the Net-Metering Resolution.

Proposals must be submitted by members of the EWA Approved Installers/Contractors/Consultants List, for the installation of onsite generation in the form of Photovoltaic panels, should be submitted to the Competent Authority for all buildings over 1,000 m^2 Gross Floor Area, where the generation process is technically feasible, e.g. roof area is sufficiently large, building sufficiently exposed to solar radiation.

Article (79)
Onsite Renewable Energy – Outdoor Lighting

For all designated buildings, where the light power density of external lighting exceeds that specified in Table (15), the additional lighting load must be powered entirely through renewable electricity sources such as photovoltaic systems.

Article (80)
Onsite Renewable Energy – Solar Water Heating System

For all designated accommodations, a solar water heating system must be installed to provide a to-be-determined percentage of domestic Hot Water (DHW) requirements. Solar water heating installations must be fitted with insulated storage tanks and pipes, sized and fitted in accordance with the solar panel manufacturer's requirements for each specific application. The supplementary heating system shall be controlled so as to obtain maximum benefit from the solar heater before operating.

Where solar water heaters are being installed, the equipment, installation, operation and maintenance of the system must be:

1. Designed and installed by an installation company approved by the Competent Authority
2. Equipment must be approved by the Competent Authority; and
3. Regularly cleaned and maintained to ensure continuous efficient operation.

Chapter Six
Resource Effectiveness – Water
Section One
Conservation and Efficiency – Water

Article (A4)
Application of Articles

Table (17) Applicability of articles to the types of buildings by Water resource

Building Types and Applicable Green Building Articles			Villa			Residential			Commercial					Public Building													Industrial		
			Investment villas	Private villa	Arabic House	Apartments	Labour Accomodation	Student Accomodation	Hotels, Motels, Furnished	Laboratories	Offices	Resorts	Restaurants, Food Outlets	Banks	Cinema / Theatres	Educational Facilities	Government buildings	Health Care Facilities	Historical/Heritage Buildings	Museums	Petrol Stations	Post Offices	Retail Outlets	Shopping Malls	Masjid and Worship Houses	Factories	Warehouses	Workshops
Resource Effectiveness - Water	Conservation and Efficiency - Water	81	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
		82	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
		83	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
		84	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	Commissioning and Management	85	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	Onsite Systems - Recovery and Treatment	86	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
		87	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

Article (81)
Water Efficient Fittings

For all designated buildings: the use of water efficient fittings should follow the relevant up-to-date Water Byelaws as outlined in the Unified Manual of the Requirements of Building Permits, taking into consideration:

1. Water-conserving fixtures must be installed meeting the minimum requirements provided for in Table (18) hereunder:

Table(18) - Maximum water usage per fixture type

Fixture Type	Maximum Flow Rate
Showerheads	8 l/m (liters per minute)
Wash hand basins	6 l/m
Kitchen sinks	7 l/m
Dual flush toilets	6 liters full flush, 3 liters part flush
Urinals	1 liter per flush or waterless

2. Dual Flush toilets must be used
3. Automatic (proximity detection) / push button faucets must be installed in all public facilities

4. Cisterns serving single or multiple urinals in public, commercial, and industrial buildings must be fitted with manual or automatic flush controls that are responsive to usage patterns. Only sanitary flushing is acceptable during building closure or shutdown (including overnight); and
5. Faucets installed as a component of a specialized application may be exempt from the flow rates upon application to the Competent Authority

Article (82)
Condensate Drainage

For all designated buildings, at all points where condensate is produced by the operation of air conditioning equipment, there must be a means of collecting and disposing of the water. Condensate collection pans and drainage pipes must be installed to prevent standing water and to provide drainage. Minimum air break of 25 mm or as specified in the Unified Manual of the Requirements of Building Permits must be provided between the condensate piping and the wastewater pipe. If the condensate is not to be reused, it must be discharged to the wastewater system through a properly sized water trap.

Article (83)
Condensate Recovery

For all new buildings with a cooling load equal to or greater than 100 kW, condensate water from all air conditioning equipment units handling outside air, or a mixture of return air and outside air where the outside air is not preconditioned, must be recovered and used for irrigation, toilet flushing, or other onsite purpose where it will not come into contact with the human body.

Article (84)
Water Efficient Irrigation

For all designated buildings, all **(100%)** of the total exterior landscaping must be irrigated using non-potable water or drip or subsoil water delivery systems. The landscaping includes green roofs.
All irrigation systems must incorporate, at any point that they connect to a portable water supply, backflow prevention devices which must be checked at **12-month** intervals. Testing must be in line with the manufacturer's recommended practice for field testing or any other testing regime approved by the Competent Authority.

Section Two
Commissioning and Management

Article (85)
Water Metering

For all designated buildings, meters must be fitted to measure and permanently record water demand and consumption of the facility as a whole and to provide accurate records of consumption (tariff class meters):

1. For all designated buildings with a cooling load above 350kW or a gross floor area of greater than 5,000 m^2, additional water metering must be installed to permanently record consumption data for major water use of the building and major water uses in and around the building.
2. The building operator shall be responsible for automatically and electronically recording water consumption for each individual meter on a sub-hourly basis. Records must be kept for a prescribed period or until logged consumption data is collected by the Competent Authority or its Agent.
3. Each individual tenancy in the building must have a sub-meter installed when a building tariff meter is not present.
4. Where a Building Management System (BMS) or Central Control and Monitoring System (CCMS) is installed, metering must be integrated into the system to allow real time profiling, management and permanent sub-hourly logging of water demand and consumption. Data records must be maintained in electronic form until collected by the Competent Authority or its Agent.
5. All meters must be capable of remote data access and must have data logging capability and complying with specifications and approvals covered by the Bahrain Electricity and Water Authority.
6. Virtual meters using run-hours are not acceptable as sub-meters.
7. The sub-meters should be used for demand management and cost allocation purposes.

Section Three
Onsite Systems - Recovery and Treatment

Article (86)
Wastewater Reuse

For all designated buildings, and in accordance with all guidance provided in the Unified Manual of the Requirements of Building Permits, if a system is installed for the collection and reuse of greywater produced within the building or for the use of Treated Sewage Effluent (TSE) from an external source, the following is required:

1. The building must be dual-plumbed for the collection and recycled use of drainage water (greywater). Any pipes which transport greywater must be color-coded differently from pipes that are used for potable (drinking standard) water and be labelled 'Not Suitable for Drinking'
2. There must be a minimum air break as prescribed between any potable water sources and greywater collection systems as prescribed in the Unified Manual of the Requirements of Building Permits
3. Greywater must not be used for purposes where it will come into contact with the human body. It must be treated to the standard required by the Unified Manual of the Requirements of Building Permits and the Competent Authority
4. For all new commercial car washing facilities, fifty percent **(50%)** of the wastewater must be recovered and reused within the facility.

Article (87)
Consumption in Heat Rejection and Cooling Towers

1. Potable water supplied by the Electricity and Water Authority (EWA) must not be used for heat rejection purposes
2. Where cooling towers are used, Treated Sewage Effluent (TSE), seawater or recycled water must be used to meet the water demand for all heat rejection purposes. Secondary water sources must be approved by the Competent Authority or EWA.
3. A separate totalizing meter must be fitted on the water supply to individual cooling towers and a daily electronic permanent log of water use must be kept.
4. In all buildings where a new or upgraded Building Management System (BMS) or Central Control and Monitoring System (CCMS) is being installed, metering must be integrated into the system to allow real time profiling, management and permanent sub-hourly

logging of water demand and consumption. Data records must be maintained in electronic form until collected by the Competent Authority.

Chapter Seven
Resource Effectiveness: Materials and Resources

Article (A5)
Article Application

Table (19) of applicability of articles to the types of buildings by resource efficiency – Materials & Resources

Building Types and Applicable Green Building Articles			Villa			Residential			Commercial						Public Building													Industrial		
			Investment villas	Private villa	Arabic House	Apartments	Labour Accomodation	Student Accomodation	Hotels, Motels, Furnished Apartments	Laboratories	Offices	Resorts	Restaurants, Food Outlets	Banks	Cinema / Theatres	Educational Facilites	Government buildings	Health Care Facilites	Historical/Heritage Buildings	Museums	Petrol Stations	Post Offices	Retail Outlets	Shopping Malls	Masjid and Worship Houses	Factories	Warehouses	Workshops
Resource Effectiveness: Materials and Resources	Materials and Resources	88	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
		89	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
		90	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
		91	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
		92	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
		93	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
		94	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
		95	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
	Waste Management	96	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
		97				x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
		98	x	x	x	x	x	x																						
		99	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
		100				x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x

Section One
Materials and Resources

Article (88)
Thermal and Acoustic Insulation Material

For all designated buildings: insulation materials to be incorporated into the building must be certified by an International body approved/certified by the Competent Authority:

1. Be manufactured without the use of Chlorofluorocarbons (CFC's);
2. Be non-toxic and not release toxic fumes during combustion;
3. Have 0.05 (part per million) ppm or less of added formaldehyde
4. Have a Threshold Limit Value (TLV) of 0.1 ppm or less of individual Volatile Organic Compounds
5. Be fire resistant in accordance with the requirements of Bahraini Civil Defense and any relevant requirements of the Unified Manual of the Requirements of Building Permits

6. Be accredited/certified from Laboratory or any source approved by Competent Authority.
7. Achieve all the requirements of the approved specifications by the Competent Authority
8. All thermal and acoustical insulation must be installed as per the manufacturer's instructions after approval from the Competent Authority.

Article (89)
Certified/Accredited Timber

Shall be certified/accredited by an Internationally recognized or equivalent body. For all designated buildings, **25%** minimum by volume, of the timber and timber-based products used during construction and permanently installed in the building must be from certified / accredited sources approved by the Competent Authority.

Article (90)
Asbestos Containing Materials

For all designated buildings and for the maintenance, addition or alteration of existing buildings, materials containing asbestos must not be used.

Article (91)
Lead or Heavy Metal containing Materials

1. For all designated buildings and for the maintenance, addition or alteration of existing buildings, paints, or other materials, containing lead or other heavy metals with percentage more than the approved specifications by the Competent Authority must not be used unless the metal is encapsulated in a system such as a photovoltaic cell.
2. All paints and materials containing lead or other heavy metals must be accredited / certified from Bahrain Central Lab or any source approved by the Competent Authority.

Article (92)
Ozone Depletion Potential

1. For all designated buildings:
   (a) Installations of heating, ventilation, and air conditioning (HVAC) and refrigeration equipment must contain refrigerants with zero ozone depletion potential (ODP) or with global warming potential (GWP) less than 100, with the exception of equipment containing less than 0.23 kg of refrigerant.

(b) Fire suppression systems must not contain any ozone-depleting substances (Chlorofluorocarbons or CFCs, Hydro chlorofluorocarbons or HCFCs, or Halons).

2. For existing equipment:
   (a) CFC and halon-based materials are not to be used for any purposes.
   (b) From 1 January 2030, HCFC based materials or any other material having any ODP are not to be used for any purposes.
   (c) The venting or direct discharging of any refrigerants during equipment maintenance is strictly prohibited.
   (d) The recovery, reclamation, recycling and reuse of refrigerants must be practiced at all times.

Article (93)
Recycled Content

For all designated buildings, recycled content must account for a minimum of **5%** of the total volume of materials used in the construction of the building.

Article (94)
Composite Wood Materials

For all designated buildings, composite wood products used in the interior of the building must not contain added urea-formaldehyde resins.

Article (95)
Regional Materials

For all designated buildings, building materials available regionally must comprise minimum of **5%** of the total volume of materials used in the construction of the building. Regionally shall be taken to mean within the GCC region. Where possible, materials manufactured and freely available in Bahrain must be used in place of imports, where it is shown that these materials sourced in Bahrain are within **5%** of the price of the imported material. Manufactured shall mean to process or fabricate a raw material into a finished product. Simple assembly of pre-fabricated components does not qualify.

Section Two
Waste Management

Article (96)
Construction and Demolition Waste

1. For all designated buildings except buildings in CBD area, a minimum of **50%** by volume or weight of waste material generated during the construction and/ or demolition of buildings must be diverted from disposal in landfills. Diverted materials must be recycled or reused. This should be achieved through the following three paths:
   (a) Concrete waste must be diverted to the Construction Waste Treatment Plant.
   (b) Excavated soil, land-clearing debris and hazardous waste must be diverted to places designated by the Competent Authority.
   (c) Other recyclable materials such as woods plastics and metals can be used at site
2. The following materials are exempt from the calculation of the percentage of waste diverted from disposal at landfill facilities:
   (a) Excavated soil and land-clearing debris
   (b) Hazardous waste

Article (97)
Bulk Waste Collection

For all designated buildings:

1. An area must be provided for residents to place items of bulky waste such as furniture, electrical appliances and sanitary ware. The area provided must cover an area of approximately 10 m^2 . The area does not have to be designated solely for the purpose of bulk waste collection (e.g. set aside area to the car park).
2. The bulk waste storage area must be reachable, must not restrict access to the building and comply with safety and fire requirements as specified in the Unified Manual of the Requirements of Building Permits.

Article (98)
Waste Storage

For all new villas and apartments, domestic kitchens must be provided with a Bahrain Municipalities prescribed minimum storage facility for waste receptacles clearly labelled for ‘recyclable’ and ‘non-recyclable’. The storage facility should be in a properly designated location within the kitchen.

Article (99)
Waste Collection

All designated buildings which require a chute for general waste, in accordance with the Competent Authority and the Unified Manual of the Requirements of Building Permits, one of the following must be provided:

1. A second chute must be provided to handle recyclable material and discharge into a separate receptacle within the waste management area
2. The garbage room on each floor must have a minimum floor area of **$2m^2$** where recyclable waste can be stored until collected daily by the building operator. Waste must be transported in a service lift and discharged into a designated receptacle within the waste management area

All designated buildings which do not require a chute for general waste, in accordance with the Competent Authority and the Unified Manual of the Requirements of Building Permits, the garbage room on each floor must have a minimum floor area of $3m^2$ where non-recyclable and recyclable waste can be stored until collected daily by the building operator. Waste must be transported in a service lift and discharged into a designated receptacle within the waste management area.

Article (100)
Recyclable Waste Management Facilities

1. For all designated buildings, a sorting and storage facility for recyclable materials must be provided. This facility must be easily accessible and comply with the requirements of the location, access and specifications of general waste areas in accordance with the Competent Authority and the Unified Manual of the Requirements of Building Permits.
2. The sorting and storage facility may be part of the general waste management facility or a separate facility.
3. Recycled waste facility incorporated into the general waste collection: The size of the room must be increased by 10% and not less than $5m^2$, to allow additional room to sort and store the recyclable waste
4. The recycled waste facility must be sized as a percentage of the total Built Up Area (BUA). The linear interpolation must be used to determine an appropriate percentage area for the recyclable storage space, as per Table (20):

Table No. (20): Total Built up areas per storage areas

Built up Area (BUA) (sqm)	Minimum Space for Storage of Recyclables
< 500 m2	7.5 m2
≥500 and < 1,000 m2	1.5% of BUA
≥ 1,000 and < 5,000 m2	0.8% of BUA
≥ 5,000 and < 10,000 m2	0.35% of BUA
≥ 10,000 m2	0.25% of BUA