حكومة رأس الخيمة
Government of Ras Al Khaimah

دائـــــرة الـبـلـديـــــة
Municipality Department

بعزجيل

Ras Al Khaimah Green Building Regulations

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Table of Contents

Table of Figures

DIVISION ONE

Abbreviations & Definitions

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Abbreviations & Definitions

101 Abbreviations

AC	Air Conditioning
ASHRAE	American Society of Heating, Refrigerating and Air Conditioning Engineers
ATTMA	Air Tightness Testing & Measurement Association
BMS	Building Management System
BSRIA	Building Services Research and Information Association
BUA	Built Up Area
CFC	Chlorofluorocarbons
CIBSE	Chartered Institution of Building Services Engineers
COP	Coefficient of Performance
CWMP	Construction Waste Management Plan
EER	Energy Efficiency Rating
ESMA	Emirates Authority for Standardization and Metrology
EV	Electric Vehicle
GFA	Gross Floor Area
GWP	Global Warming Potential
HCFC	Hydrochlorofluorocarbons
HFC	Hydrofluorocarbons
HVAC	Heating, Ventilation and Air Conditioning
IPLV	Integrated Part Load Value
LED	Light Emitting Diode

LPD	Lighting Power Density
MEP	Mechanical, Electrical and Plumbing
MERV	Minimum Efficiency Reporting Value
ODP	Ozone Depletion Potential
OWMP	Operational Waste Management Plan
RAK	Ras Al Khaimah
SHGC	Solar Heat Gain Coefficient
SRI	Solar Reflective Index
VOC	Volatile Organic Compound

102 Definitions

Adaptive Species	A plant species, not originally part of the natural ecosystem, which has evolved to a point where the environmental conditions such as soil, climate and geology allow for healthy growth with no or minimal irrigation requirements.
Air Leakage	The uncontrolled flow of air into a building through cracks or openings.
Building Commissioning	A systematic quality assurance process to ensure the systems and assemblies are designed, installed and tested as per the design intent, contract document and the owner's operational needs.
Building Envelope	The exterior elements of a building which form a barrier between the internal and external 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 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 Occupant	Persons using the building. Full-time occupants use the building for at least eight hours most days. Part-time occupants use the building for less than eight hours most days.
Building Owner	The person or establishment (or their representative) who owns the building and/or the land on which the building works (construction, refurbishing, demolition or removal of a building) are to be performed.
Building Permit	The type of authorization that must be granted by the Competent Authority before the construction of buildings can legally occur.
Building Services	All necessary services required to operate the building such as plumbing, mechanical, electrical and others.
Chlorofluorocarbons (CFCs)	CFCs are odourless, colourless, non-flammable and non-toxic chemicals used for different

	applications, e.g. as coolants in refrigerators and air conditioners. CFCs cause stratospheric ozone depletion.
Competent Authority	Any organization that has the jurisdiction and authority to implement the Green Building Regulations.
Completion Certificate	Certificate issued by the Competent Authority certifying that the project has been completed in accordance with the legal requirements.
Comprehensive Green Building Regulations	The Comprehensive Green Building Regulations, compared to the Fundamental Green Building Regulations, are more elaborate regulations intended for application to larger and more complex buildings.
Condensation	The process through which a gas or vapour changes to liquid form. May also mean the water which is produced in this process.
Construction 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 Waste.
Control Systems	Controls that allow users to change and/or adjust the level of lighting and air conditioning in a space.
Cooling Load	The rate at which heat energy must be heat energy that would need to be removed from a space to maintain the temperature in an acceptable range.
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.
Electric Vehicle (EV) Charging Station	A general term that refers to an operational site used for charge electric vehicle batteries.
Emissivity	The material's effectiveness in emitting energy as thermal radiation. It is expressed as a parameter with values between 0 and 1.
Fundamental Green Building Regulations	The Fundamental Green Building Regulations are simplified regulations for industrial buildings,

	villas and small scale residential, office and retail buildings.
Glazed Elements	All areas in the building envelope that let in light, including windows, plastic panels, skylights and glass block walls.
Global Warming Potential (GWP)	Expresses contribution of greenhouse gases released to the atmosphere in the global warming phenomenon.
Government Funded Private Villas	Villas developed by government entities for UAE nationals.
Green Roofs	A roof that is either partially or completely covered in plants. A Green Roof consists of vegetation and soil, or a growing medium, planted over a waterproof membrane. Additional layers, such as a root barrier and drainage and irrigation system may also be part of a Green Roof.
Greywater	Waste water without faecal contamination that is generated in residential, public or commercial buildings. Sources of Greywater include sinks, showers, bathtubs, clothes washing machine, dish washing machine and other kitchen appliances.
Halons	Substances used in fire suppression systems and fire extinguishers. These substances deplete the stratospheric ozone layer.
Hardscape	The area of a project site, excluding buildings, that has been built out of hard materials such as concrete. Hardscape includes roads, surface car parking, patios, courtyards and walkways.
Hazardous Waste	Any waste material that can cause substantial harm to humans, properties or to the environment due to its inherent hazardous characteristics.
Heating, Ventilation, And Air Conditioning (HVAC) System	The equipment, distribution systems and terminals that provide either individually or collectively, the processes of heating, ventilation, or air conditioning to a building or a portion of a building.
Heritage Building	A building having historical architectural elements, situated inside a Ras Al Khaimah historical area. No demolition or variation works shall be carried out on a Heritage Building except

	after obtaining approval from the Competent Authority.
Hydrochlorofluorocarbons (HCFC)	Refrigerants used in building equipment that cause the stratospheric ozone layer depletion.
Hydrofluorocarbons (HFCs)	Refrigerants that do not deplete the stratospheric ozone layer. However, some HFCs have a high Global Warming Potential.
Implementation Date	The effective date upon which the GBR enters into force.
Individual Private Villa	Villas that are developed by UAE nationals for non-commercial use.
Industrial Building	Any building directly used in manufacturing, processing, technically productive enterprises or storage. This includes workshops, factories and warehouses.
Investment Villas	Villas developed for commercial use, e.g. villas that will be rented or sold.
Land Clearing Debris	Solid waste generated solely from land-clearing activities, including brush, stumps, soil material and rocks.
Landscape	The planting of trees, ground cover, shrubbery and other plant material (Softscape), as well as the provision of man-made, non-vegetated features (Hardscape) that serve an aesthetic or functional purpose.
Legionella	Bacteria that 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.
Light-Emitting Diode (LED)	A semiconductor device that emits incoherent narrow-spectrum light.
Lighting Power Density (LPD)	Lighting Power Density (LPD) represents the maximum lighting power per unit area and is typically expressed as wattage per square meters.
Minimum Efficiency Reporting Value (MERV)	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.
Native Species	A plant species that occurs naturally within a region or ecosystem, with no human intervention.
Net Roof Area	The remaining roof area after excluding the area of any skylights, helipads and solar water heating equipment from the gross roof area of the building. The area of any sloping roofs, roof decks, terraces, swimming pools, HVAC equipment, vents and areas for maintenance access that are part of the roof must be included in the Net Roof Area.
Non-Native Species	A plant species, not native to a particular region, which has been introduced, accidentally or deliberately, by human activity and has not adapted to the environmental conditions of that particular region.
Non-Potable Water	Water that is not suitable for human consumption such as Greywater, recovered condensate water or Treated Sewage Effluent.
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.
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.
Ozone Depletion Potential (ODP)	Expresses contribution to the deterioration of the stratospheric ozone layer.
Photovoltaic (PV)	A power system designed to supply usable solar power by means of photovoltaics.
Potable Water	Water that is suitable for human consumption.
Pressure Difference	The difference in pressure between two points of a system, or two different spaces of a building.
Prevalent Usage Type	The usage type representing the highest share of Gross Floor Area (GFA) of a building compared

	to all other usage types assigned to other areas of the building.
Recycling	The processing of used materials into new products in order to prevent the waste of potentially useful materials and reduce the need for waste disposal.
Reflectivity	A measure of the ability of a material to reflect solar energy from its surface back into the atmosphere. It is expressed as a parameter with values between 0 and 1.
Refrigerants	The working fluids of refrigeration cycles, which absorb heat at low temperatures and release heat at higher temperatures.
Regularly Occupied Areas	An area where one or more individuals regularly spend time, seated or standing as they perform various activities inside a building.
Relative Humidity	The ratio of the amount of water vapour in the air at a specific temperature to the maximum amount of water vapour the air can hold at the same temperature, expressed as a percentage.
Reuse	Any activity that extends the life of an item, typically consisting of returning the item to active use in the same or related capacity.
Safety Factor	An allowance to cover any heating or cooling load greater than the design conditions.
Softscape	The planting of trees, ground cover, shrubbery and other plant material. Agricultural farming is not considered softscaping.
Solar Heat Gain Coefficient (SHGC)	Indicates the effectiveness of the glazing in rejecting solar heat gain. It ranges from 0 to 1 and the lower the SHGC the more heat is being rejected and thus less heat is being transmitted into the building. The SHGC factors in both the glass and the frame material. Since the area of a frame has a relatively low SHGC, the overall window SHGC is lower than the centre-of-glass value.
Solar Reflectance Index (SRI)	An index that combines Reflectivity and Emissivity, measuring a material's ability to reject solar heat. Materials with higher SRI absorb less heat and can reduce the heat islands effect.
Solar Zone	The area on the roof of the building or on an adjacent accessory structure (e.g. covered

	parking, service block, gazebo) that is reserved for on-site PV readiness.
Special Building	The status of a Special Building can be obtained from the Competent Authority for iconic buildings with a unique architecture or usage that are unable to comply with certain requirements of the Green Building Regulations.
Subsoil Irrigation	Uniform application of small quantities of water at frequent intervals below the soil surface from discrete emission points or line sources.
Temporary Building	Any building that will be removed within two years after its construction.
Thermal Bridge	A direct connection between the inside and outside of the building through elements that have a higher conductivity than the surrounding materials or through the junctions between various envelope elements.
Thermal Insulation	Materials, or methods and processes used to reduce heat transfer.
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/m²K. Well-insulated parts of a building have a low thermal transmittance whereas poorly insulated parts of a building have a high thermal transmittance.
Thermally Broken Frame	A frame consisting of an insulating separator material between the inner and outer frames to prevent heat transfer through the frame and condensation.
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).
Urban Heat Island Effect	This occurs when warmer temperatures are experienced in urban and/or developed areas compared to adjacent undeveloped areas due to solar energy retention on constructed surfaces. Examples of surfaces that contribute to the Urban Heat Island Effect are paved streets, sidewalks, parking lots and buildings.

Volatile Organic Compounds (VOCs)	Molecules containing carbon and varying proportions of other elements such as hydrogen, oxygen, fluorine, and chlorine. They are the “precursors” that react in sunlight and heat to form ground-level ozone.

DIVISION TWO

Preambles

DIVISION TWO

Preambles

201 Chapter 1 – General

The regulations outlined in this document represent the Ras Al Khaimah Green Building Regulations and shall be known and cited as Barjeel. Within this document they are also referred to as “the GBR”.

201.01 Purpose

The GBR intend to support the United Arab Emirates’ vision of creating more sustainable buildings, communities and cities to fulfil the social, economic, cultural and environmental requirements for the present and future generations.

The aim of the GBR is to transform the construction industry in Ras Al Khaimah to achieve the following goals:


Conservation of energy resources


Conservation of water resources


Implementation of renewable energy


Promotion of sustainable building materials and reduction of waste


Enhancement of occupants’ comfort & well-being

By conserving energy and water resources, the GBR will also result in lower operational and life-cycle costs of buildings.

201.02 Jurisdiction and Competent Authority

The GBR are applicable in the entire Emirate of Ras Al Khaimah.

Ras Al Khaimah Municipality (RAK Municipality) is the Competent Authority for the application of the GBR within the jurisdiction of RAK Municipality. The economic and free zone authorities, such as RAKEZ, Maritime City, RAK Port and RAK Airport, are the Competent Authorities for the application of the GBR within their jurisdiction.

201.03 Compatibility with Existing Regulations

The GBR complement the RAK Municipality General Building Regulations of the Emirate of Ras Al Khaimah for projects within the jurisdiction of RAK Municipality.

The provisions within the GBR shall supersede the provisions of any pre-existing regulations in case of conflict, without any effect on the continuing validity of the remaining non-conflicting provisions of the pre-existing regulations.

When the requirements of the GBR differ from the requirements of Ras Al Khaimah Civil Defence Department or differ from the requirements of local and/or federal laws, the requirements of Ras Al Khaimah Civil Defence Department as well as the requirements of the local and/or of the federal laws will prevail.

The regulations are issued in two languages, Arabic and English. The Arabic version shall prevail in any case of conflict.

201.04 Building Typology

For the purpose of the GBR, requirements are defined for the following building typologies:

Residential Buildings

Villas:
- Individual Private Villa
- Government Funded Private Villa
- Investment Villa
- Annex (for Villa)

Buildings:
- Multi-Story Residential Building
- Staff Accommodation
- Labour Accommodation
- Student Accommodation

Public Buildings
- Government Building
- Educational Facility
- Healthcare Facility
- Mosque & Worship Building
- Exhibition & Festival Center, Sport Facility
- Other Public Building (Bank, Post Office, Cinema, Theatre, Museum)

Commercial Buildings
- Office Building
- Mall & Shopping Center
- Retail & Showroom
- Laboratory (Private)

Hospitality Buildings
- Hotel
- Motel
- Resort
- Hotel Apartment

Industrial Buildings
- Factory
- Warehouse
- Workshop

201.05 Scope of Application

A. With regards to the building typologies identified above, the GBR apply to:
- New buildings, on empty plots and on occupied plots, whose Building Permit application has been submitted after the Implementation Date of the GBR
- Extensions and/or refurbishments of buildings permitted under the GBR

B. The following building types are exempt from the regulations:
- Temporary Buildings
- Heritage Buildings
- New buildings, on empty plots and on occupied plots, whose Building Permit application has been completely submitted before the Implementation Date of the GBR.
- Extensions and/or refurbishments of buildings permitted prior to the GBR

C. For mixed use buildings, when a building comprises more than one building usage type, the whole building shall comply with the requirements of the Prevalent Usage Type which is subject to the approval from the Competent Authority.

In case the Prevalent Usage Type is not clear, the applicable building usage type for the GBR shall be defined in coordination with the Competent Authority.

D. For projects comprising several buildings, each building of the project must comply with the relevant regulations for that particular building type.

201.06 Regulatory Approach and Compliance Methods

The objective of the GBR is to establish green building requirements that are applied to new buildings, extensions and refurbishments in the entire Emirate of Ras Al Khaimah. The GBR are categorised into two groups:

A. Fundamental Green Building Regulations:

The Fundamental Green Building Regulations are simplified regulations in the form of prescriptive compliance requirements with some performance-based compliance requirements. These regulations mainly focus on resource conservation and are intended for relatively small and/or simple buildings, for which compliance with the full requirements may be complex or costly.

The following building types must comply with the requirements within the Fundamental Green Building Regulations:

Table 1 Fundamental Green Building Regulations – Building Typologies

Residential	Commercial	Industrial
Individual Private Villa incl. Annex	Office Building (max. 1,000 m^2 BUA)	Workshop
Government Funded Private Villa incl. Annex	Retail & Showroom (max. 1,000 m^2 BUA)	Warehouse
Investment Villa incl. Annex	**Public**	Factory
Residential Building (max. 1,000 m^2 BUA)	Mosque & Worship Building (max. 1,000 m^2 BUA)	
Staff, Labour and Student Accommodation (max. 1,000 m^2 BUA)	Other Buildings (non-residential or commercial (max. 1,000 m^2 BUA))	

The BUA limit is calculated separately for each building.

B. Comprehensive Green Building Regulations:

The Comprehensive Green Building Regulations are more elaborate regulations focusing on performance-based compliance requirements. Apart from energy and water efficiency, they address a broader range of topics related to materials & resources and comfort & well-being of the building occupants. These regulations are intended for application to larger and more complex buildings.

The following building types must comply with the Comprehensive Green Building Regulations:

Table 2 Comprehensive Green Building Regulations – Building Typologies

Residential	Commercial	Public
Residential Building (> 1,000 m^2 BUA)	Office Building (> 1,000 m^2 BUA)	Mosque & Worship Building (> 1,000 m^2 BUA)
Staff, Labour and Student Accommodation (> 1,000 m^2 BUA)	Retail & Showroom (> 1,000 m^2 BUA)	Government Building
Hospitality	Mall & Shopping Centre	Educational Facility
Hotel, Motel	Laboratory	Healthcare Facility
Hotel Apartment		Exhibition & Festival Centre, Sports Facility
Resort		Other Public Building

The BUA limit is calculated separately for each building.

C. Special Buildings:

Buildings with exceptional architectural characteristics or special usage that are unable to comply with certain requirements may contact the Competent Authority to apply for the status as a Special Building. Special Buildings may follow an alternative approach for these requirements, which will be defined in liaison with the Competent Authority and will be meant to find compensatory measures for those requirements that cannot be fulfilled.

As an example, the following buildings might be classified as Special Buildings:

- Adventure and water parks
- Buildings with a unique and iconic architecture
- Shopping malls with ski slopes
- Hotels with helipads
- Specialty laboratories
- Skydiving buildings

Classification of a building as a Special Building for the purpose of the GBR is subject to the exclusive decision of the Competent Authority.

201.07 Structure of the Regulations

Both the Fundamental and the Comprehensive Green Building Regulations presented within this document are divided into five categories as illustrated in Figure 1.

Figure 1 GBR Categories

The categories include several articles, each article describing one regulatory item within the GBR.
The description of every regulatory item is structured as follows:

A. **Intent:** This section provides a brief of the intention behind implementing the regulatory item.

B. **Applicable Building Types:** This section lists the types of buildings which need to comply with the regulatory item.

C. **Requirements:** This section describes the minimum requirements which need to be fulfilled in order to achieve compliance with the regulatory item.

D. **Guideline:** This section provides guidance and indicates possible methods to achieve compliance with the requirements. These guidelines are for information purposes only. They do not represent any form of restriction or requirement for the building design and construction; adherence to the guidelines does not guarantee compliance with the regulations.

E. **Submission Stage and Evidence:** This section indicates the applicable submission stages and details the documentary evidence that is required to prove compliance with the regulatory item. The specified evidence shall be submitted to the Competent Authority over the course of the submission process described in Chapter 2 of this document.

202 Chapter 2 – Submission Process

Compliance with the GBR is proven through a design stage and a construction stage submission. The applicable submission stages and the required submission evidence are specified for each regulatory item.

The submission process is described in the paragraphs 202.01 and 202.02. The Competent Authority may require a different process to be applied within their jurisdiction.

202.01 Design Stage Submission

The GBR design stage evidence is to be submitted, along with the other documents and drawings required for the Building Permit application, as per the requirements of the Competent Authority.

The relevant sections demonstrating compliance with the GBR are to be clearly highlighted in documents, calculations and drawings.

The applicant has to ensure that the project fulfils all applicable requirements of the GBR without any conflict and/or contradiction with other documents and drawings required as part of the Building Permit application.

The Building Permit issuance depends on the project's compliance with the GBR along with other requirements as defined by the Competent Authority.

202.02 Construction Stage Submission

The GBR construction stage evidence shall be recorded on a monthly basis. The recorded evidence must be submitted to the Competent Authority upon request.

The Competent Authority may conduct site visits at any time to review the compliance with the GBR requirements.

The GBR construction stage evidence is to be submitted, along with the other documents and drawings required for the Completion Certification application, as per the requirements of the Competent Authority.

The relevant sections demonstrating compliance with the GBR are to be clearly highlighted in the material datasheet and technical product information documents.

The applicant has to ensure that the project fulfils all applicable requirements without any conflict and/or contradiction with the other disciplines' documents and drawings.

The Completion Certificate issuance depends on the project's compliance with the GBR along with other requirements as defined by the Competent Authority.

DIVISION THREE

Fundamental Green Building Regulations

DIVISION THREE:
Fundamental Green Building Regulations

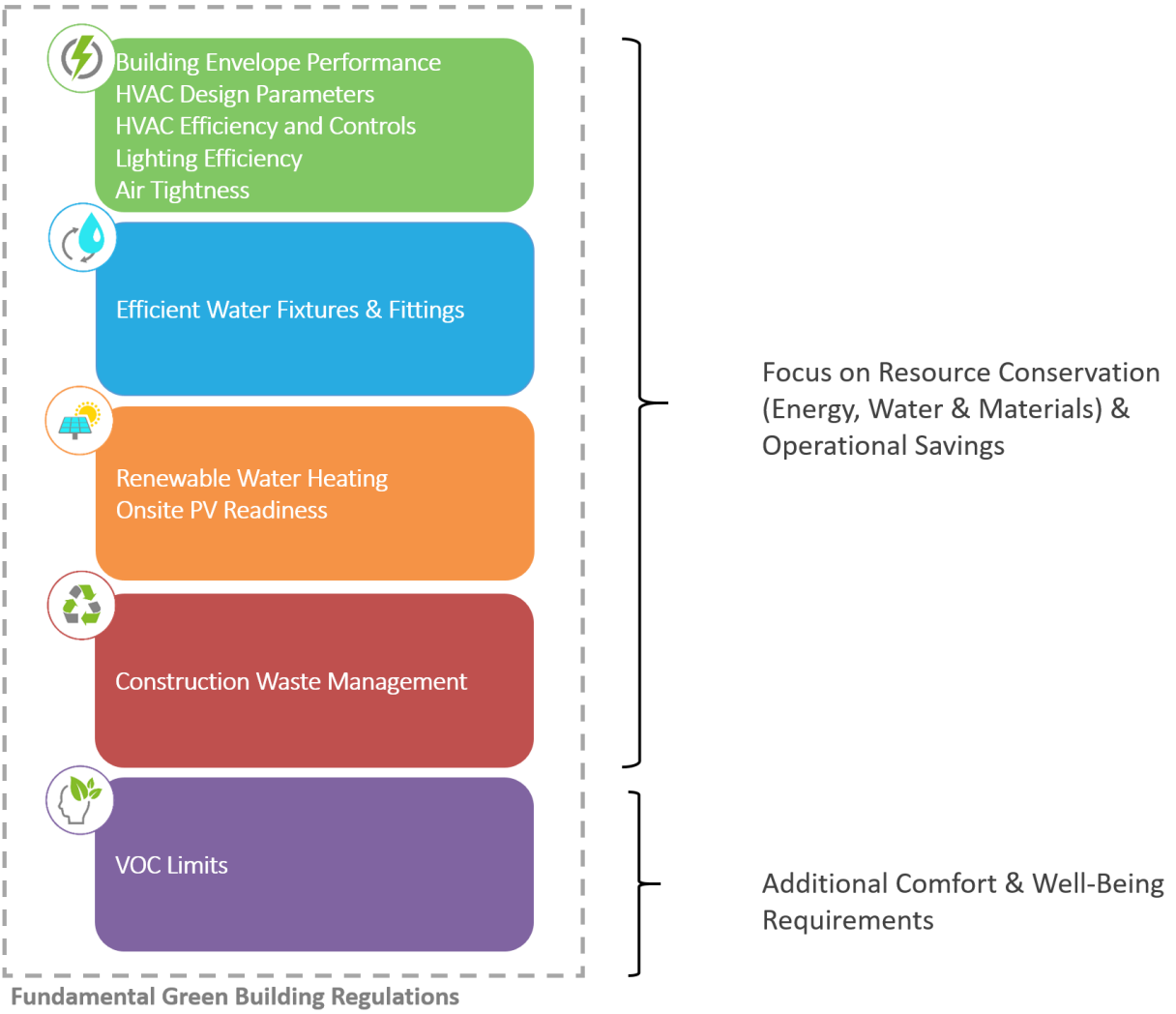
The Fundamental Green Building Regulations are applicable to the following building types:

Table 3 Fundamental Green Building Regulations – Applicable Building Types

Residential	Commercial	Industrial
Individual Private Villa incl. Annex	Office Building (max. 1,000 m^2 BUA)	Workshop
Government Funded Private Villa incl. Annex	Retail & Showroom (max. 1,000 m^2 BUA)	Warehouse
Investment Villa incl. Annex	**Public**	Factory
Residential Building (max. 1,000 m^2 BUA)	Mosque & Worship Building (max. 1,000 m^2 BUA)	
Staff, Labour and Student Accommodation (max. 1,000 m^2 BUA)	Other Buildings (non-residential or commercial (max. 1,000 m^2 BUA)	

Figure 2 lists the regulatory items of the Fundamental Green Building Regulations.

Figure 2 Fundamental Green Building Regulations – Regulatory Items



301 Chapter 1 – Energy Efficiency

301.01 Building Envelope Performance

Intent:

To reduce the heat gain through the building's façades and roof and consequently minimise the cooling load which represents a significant component of the total building energy consumption.

Applicable Building Types:

Residential		Commercial		Industrial	
Individual Private Villa incl. Annex	☑	Office Building (max. 1,000 m^2 BUA)	☑	Workshop	☒
Government Funded Private Villa incl. Annex	☑	Retail & Showroom (max. 1,000 m^2 BUA)	☑	Warehouse	☒
Investment Villa incl. Annex	☑	**Public**		Factory	☒
Residential Building (max. 1,000 m^2 BUA)	☑	Mosque & Worship Building (max. 1,000 m^2 BUA)	☑		
Staff, Labour and Student Accommodation (max. 1,000 m^2 BUA)	☑	Other Building (non-residential or commercial (max. 1,000 m^2 BUA)	☑		

Requirements:

The building envelope performance requirements are formulated separately for opaque elements (such as external walls and roofs) and glazed elements (such as windows, glazed walls and skylights).

Opaque glazed elements (with back insulated panels) are considered as opaque elements and therefore must meet the required u-value of the walls.

A. Requirements for Opaque Elements:

- The average u-value of the external walls and roofs (that are exposed to ambient conditions) must not exceed the following thresholds:
  - Average external wall u-value ≤ 0.48 W/m²K
  - Average roof u-value ≤ 0.30 W/m²K
- Individual Private Villas are exempt from the above specified external wall u-value if 200 mm thermal blocks with u-value of maximum 0.5 W/m²K are used.
- All applicable building types, except for Individual Private Villas, must insulate the external structural columns and beams to avoid heat bridges.

B. Requirements for Glazed Elements:

The optimum choice of windows is important as glazing gains and loses heat quickly and often makes up a large proportion of the building envelope.

For glazed portions of external walls and roofs, the average u-value and Solar Heat Gain Coefficient (SHGC) should not exceed the following values:

- Window centre pane u-value ≤ 1.8 W/m²K
- Skylight centre pane u-value ≤ 1.8 W/m²K

The maximum SHGC should be based on the amount of glazing as a percentage of the relevant surface area, as below:
For windows (based on external wall area)

Glazing area (% of external wall area)	Maximum SHGC
≤40%	≤0.4
40% to 60%	≤0.32
>60%	≤0.25

For shopfront glazing, a maximum SHGC of 0.76 is permitted

.

For skylights (based on roof area)

Skylight area (% of roof area)	Maximum SHGC
≤10%	≤0.32
>10%	≤0.25

Exception(s):

Buildings that are not air-conditioned do not have to comply with this article.

Guideline:

A. Opaque Elements:
The following options are likely to achieve the required roof and wall u-values:

External walls:

- Individual Private Villas:
  - 200 mm thermal blocks with a maximum u-value of 0.5 W/m²K and a 25 mm internal & external plaster.
- All other applicable building types:
  - Option 1: 200 – 250 mm thermal blocks with a 25 mm internal & external plaster. Additionally, the structural columns and beams should be insulated to avoid heat bridges and to achieve the average external wall u-value of 0.48 W/m²K.
  - Option 2: 50 – 100 mm insulation layer, bonding plaster and reinforcement mesh. The insulation layer should be applied on the hollow concrete blocks, the structural columns and beams and should be continuous and cover all gaps between the building envelope elements.

Roof:

- Combo roofing system with 30 – 50 mm insulation layer

B. Glazing Elements:
The following options are likely to achieve the required glazing properties:

- Double glazing (6 mm pane + 12 mm air gap + 6 mm pane) with a low solar coating on the interior of the outside pane

Submission Stage and Evidence:

Design Stage:

- Barjeel Tool - U-Value Calculator (not required for Individual Private Villas)
- Wall and roof cross sections showing the composition (thickness and material type) of the different wall and roof systems
- Extract of the tender specifications, material schedule or bill of quantities highlighting the required u-values and SHGC

Construction Stage:

- Technical product information or material datasheet for the insulation materials and/or thermal blocks
- Date-stamped photos showing the installation of the thermal blocks and/or insulation layers

301.02 HVAC Design Parameters

Intent:

To prevent oversizing of the air conditioning equipment by considering local weather conditions, required indoor conditions and the building envelope performance.

Applicable Building Types:

Residential		Commercial		Industrial	
Individual Private Villa incl. Annex	☒	Office Building (max. 1,000 m^2 BUA)	☑	Workshop	☑
Government Funded Private Villa incl. Annex	☑	Retail & Showroom (max. 1,000 m^2 BUA)	☑	Warehouse	☑
Investment Villa incl. Annex	☑	**Public**		Factory	☑
Residential Building (max. 1,000 m^2 BUA)	☑	Mosque & Worship Building (max. 1,000 m^2 BUA)	☑		
Staff, Labour and Student Accommodation (max. 1,000 m^2 BUA)	☑	Other Building (non-residential or commercial (max. 1,000 m^2 BUA)	☑		

Requirements:

The cooling load must be calculated in accordance with the following design parameters:

A. Building Envelope Parameters

The heat transfer coefficients for walls, roofs and glazing must be the actual design coefficients and must comply with the article 301.01 'Building Envelope Performance'.

B. Outdoor Condition of the Building

- Dry bulb temperature: 46°C
- Wet bulb temperature: 29°C
- Ras Al Khaimah City location latitude (North Latitude) 25.5°N

C. Indoor Condition of the Building

For all regularly occupied rooms, excluding spaces dedicated to manufacturing, production and storage:

- Dry bulb temperature: 24°C +/- 1°C
- Relative humidity: 50% +/- 10%

The diversity coefficients set out in the ASHRAE Fundamentals 2013 shall be used.

D. Safety Factors

The safety factors applied must be no greater than the following:

- Sensible Heat: 10%

- Latent Heat: 5%

Exception(s):

Buildings that are not air-conditioned do not have to comply with this article.

Guideline:

- The actual design heat transfer coefficients and the specified outdoor and indoor conditions should be used in the cooling load calculations.
- It is recommended to use a static or dynamic software for the cooling load calculations. These software tools can generate various reports which can be submitted to demonstrate compliance with this article.

Submission Stage and Evidence:

Design Stage:

- Simple AC drawings showing the AC type and capacity
- Cooling load calculations or simulation reports highlighting the applied design parameters

301.03 HVAC Efficiency & Controls

Intent:

To promote efficient Heating, Ventilation and Air Conditioning (HVAC) systems and to ensure adequate controls are available to the building occupants to adjust the set-point temperature and ventilation settings.

Applicable Building Types:

Residential		Commercial		Industrial	
Individual Private Villa incl. Annex	☒	Office Building (max. 1,000 m^2 BUA)	☑	Workshop	☑
Government Funded Private Villa incl. Annex	☑	Retail & Showroom (max. 1,000 m^2 BUA)	☑	Warehouse	☑
Investment Villa incl. Annex	☑	**Public**		Factory	☑
Residential Building (max. 1,000 m^2 BUA)	☑	Mosque & Worship Building (max. 1,000 m^2 BUA)	☑		
Staff, Labour and Student Accommodation (max. 1,000 m^2 BUA)	☑	Other Building (non-residential or commercial (max. 1,000 m^2 BUA)	☑		

Requirements:

A. HVAC Efficiency

All HVAC equipment and systems must comply with the minimum full load energy efficiency requirements (EER/COP) listed in Table 4, Table 5 and Table 6. Chilling packages must additionally comply with the minimum part load efficiency requirements (IPLV) specified in Table 7.

Table 4 Fundamental Green Building Regulations – Electrically Operated Unitary ACs

Equipment Type	Rated Capacity (kW at T3)	Minimum Efficiency Full Load		Rating Conditions
		Energy Efficiency Rating (EER, Btu/h/W at T3)	Coefficient of Performance (COP at T3)	
Window AC	All	7.51	2.20	Tested as per ESMA standard no. UAE.S ISO 5151:2017
Non-ducted AC	All	8.31	2.44	
Ducted split & packaged AC	RC < 40	8.80	2.58	Tested as per ISO 13253
	40 ≤ RC < 70	8.59	2.52	
	70 ≤ RC < 223	8.27	2.42	
	223 ≤ RC	7.95	2.33	

Table 5 Fundamental Green Building Regulations – Multi-Split and VRF

Equipment Type	Rated Capacity (kW at T3)	Cooling Seasonal Performance Factor (CSPF Btu/h/W at T3)	Integrated Part Load Value (IPLV at T3)	Rating Conditions
Multi Split	RC <40	NA	4.59	Tested as per ESMA standard no. UAE.S ISO 15042
	40 ≤ RC < 220	NA	4.45	
	220 ≤ RC	NA	4.35	
VRF	RC <40	14.84	NA	Tested as per ESMA UAE.S ISO 16358-2013/Amd.1:2019
	40 ≤ RC < 220	13.78	NA	
	220 ≤ RC	13.25	NA	

Table 6 Fundamental Green Building Regulations – Heat Pumps

Equipment Type	Rated Capacity (kW at T3)	Minimum Efficiency Full Load		Rating Conditions
		Energy Efficiency Rating (EER, Btu/h/W at T3)	Coefficient of Performance (COP at T3)	
Water source heat pump unit	All Capacities, entering fluid temperature of 30°C	8.35	2.45	Tested as per ESMA standard no. UAE.S ISO 13256-1:1998 & UAE.S ISO 13256-2:1998
Ground water source heat pump unit	All Capacities, entering fluid temperature of 25°C	9.2	2.7	

Table 7 Fundamental Green Building Regulations – Chilling Packages

Equipment Type	Rated Capacity (kW at T1)	Minimum Efficiency Full Load		Integrated Part Load Value (IPLV at T1)	Rating Conditions
		Energy Efficiency Rating (EER, Btu/h/W at T1)	Coefficient of Performance (COP at T1)		
Air cooled package chiller without condenser	All	11.21	3.29	4.05	Tested as per UAE.S AHRI 550/590
Air cooled package chiller with condenser	RC < 528	10.13	2.97	4.05	
	528 ≤RC	10.13	2.97	4.14	
Water cooled chiller positive displacement (reciprocating)	All	15.19	4.45	5.63	
Water cooled chiller positive displacement (rotary and scroll)	RC < 264	16.01	4.69	5.87	
	264 ≤RC<528	17.03	4.99	6.29	
	528 ≤RC<1,055	18.19	5.33	6.52	
	1,055≤RC<2,110	19.69	5.77	6.77	
	2,110 ≤ RC	21.26	6.23	7.04	
Water cooled chiller (centrifugal)	RC < 528	21.71	6.36	6.77	
	528 ≤ RC	23.51	6.89	7.04	
Air cooled absorption, single effect	All	2.05	0.60	NA	Tested as per AHRI 560
Water cooled absorption, single effect	All	2.39	0.70	NA	
Absorption double effect, indirect fired	All	3.41	1.00	1.05	
Absorption double effect, direct fired	All	3.41	1.00	1.00	

B. HVAC Controls:

- The HVAC control system of the building shall be subdivided into independent control areas, corresponding to the various regularly occupied rooms or areas of the building.
- The set-point temperature and ventilation of each control area must be independently controllable, regardless of the set-point temperature and ventilation of other control areas in the building. A thermostat must be provided in each control area to allow occupants to adjust the set-point temperature and ventilation of the area.
- The HVAC control system must be capable of shutting down and starting up the HVAC equipment for the specific control area whenever required by the occupants of the same control area.
- In case of a central building HVAC system, the HVAC control system must shut down the central cooling equipment when the set-point temperature of all control areas has been reached, or when the thermostat for all control areas has been switched off.

Guideline:

A. HVAC Efficiency

The following options are likely to achieve the required HVAC efficiency requirements:

- For window and non-ducted split AC units, use equipment that meets at least the 2-star rating standards of the Emirates Authority for Standardization and Metrology (ESMA) UAE.S 5010-1:2019.
- For ducted split and packaged AC units, use equipment which is at least 6% more efficient than the minimum efficiency standard of the ESMA UAE.S 5010-5: 2019.
- For multi-split and VRF units, use equipment which is at least 6% more efficient than the minimum efficiency standard of the ESMA UAE.S 5010-5: 2019.
- For chilling packages use equipment that meets at least the efficiencies outlined in Table 7.

B. HVAC Controls

- Provide one set-point control for each regularly occupied room, near the entrance of the room.

Submission Stage and Evidence:

Design Stage:

- Extract of the tender specifications, material schedule or bill of quantities showing the specified HVAC systems, rated capacities and associated efficiencies (COP/EER and IPLV if applicable)
- HVAC control schematics

Construction Stage:

- Technical product information or datasheet of the HVAC equipment which include the following information:
  - Rated Capacity
  - COP/EER and IPLV (IPLV only for chilling packages)
  - Testing Method

301.04 Lighting Efficiency

Intent:

To reduce the electricity consumption by mandating energy efficient lighting fixtures and lighting controls.

Applicable Building Types:

Residential		Commercial		Industrial	
Individual Private Villa incl. Annex	☒	Office Building (max. 1,000 m^2 BUA)	☑	Workshop	☑
Government Funded Private Villa incl. Annex	☑	Retail & Showroom (max. 1,000 m^2 BUA)	☑	Warehouse	☑
Investment Villa incl. Annex	☑	**Public**		Factory	☑
Residential Building (max. 1,000 m^2 BUA)	☑	Mosque & Worship Building (max. 1,000 m^2 BUA)	☑		
Staff, Labour and Student Accommodation (max. 1,000 m^2 BUA)	☑	Other Building (non-residential or commercial (max. 1,000 m^2 BUA)	☑		

Requirements:

A. Lighting Efficiency

All internal and external light fittings of the building must be Light Emitting Diodes (LEDs) or meet, at a minimum, the ESMA 3-star requirements.

B. Lighting Controls

At least one light switch or dimmer must be provided near the entrance of each room.

Exception(s):

The following lighting types are exempt from the lighting efficiency requirements:

- Lighting for specialised plant, machinery and equipment
- Coloured lighting
- Lighting for plant growth
- Lighting for visually impaired persons with special lighting needs

Guideline:

- Light Emitting Diodes (LEDs) may be preferred over incandescent lamps as LEDs are highly energy efficient and have a long life expectancy.
- It is recommended to provide dimmers or multiple light switches to allow occupants to adjust the lighting to suit their individual tasks and preferences.

Submission Stage and Evidence:

Design Stage:

- Luminaire schedule indicating the lighting fixture type, ESMA star rating (for incandescent lamps) and wattage
- Lighting control schematics

301.05 Air Tightness

Intent:

To optimise the air tightness of the buildings and minimise air leakage.

Air leakage control is essential to optimise the energy performance of the building. If the building envelope is not sufficiently airtight, cold air leaks out and hot air enters through gaps and cracks, resulting in higher energy consumption. Air leakage may also cause condensation issues, accelerating mould growth.

Applicable Building Types:

Residential		Commercial		Industrial	
Individual Private Villa incl. Annex	☒	Office Building (max. 1,000 m^2 BUA)	☑	Workshop	☒
Government Funded Private Villa incl. Annex	☑	Retail & Showroom (max. 1,000 m^2 BUA)	☒	Warehouse	☒
Investment Villa incl. Annex	☑	**Public**		Factory	☒
Residential Building (max. 1,000 m^2 BUA)	☑	Mosque & Worship Building (max. 1,000 m^2 BUA)	☑		
Staff, Labour and Student Accommodation (max. 1,000 m^2 BUA)	☑	Other Building (non-residential or commercial (max. 1,000 m^2 BUA)	☑		

Requirements:

A. Air leakage into or out of the building shall not exceed 7.5 m^3 of air per hour for each square meter of the building envelope (7.5 $m^3/hr/m^2$), at an applied pressure difference of 50 Pascal.

B. An air leakage site inspection shall be performed at approximately 60% completion of the building envelope. The air leakage site inspection shall be conducted by the supervision consultant engineer or the contracting company engineer approved by the supervision consultant engineer. The identified issues and recommended rectifications must be recorded in an air leakage site inspection report. The contractor shall rectify all major issues and provide a summary of the undertaken actions.

C. Residential projects comprising multiple identical Investment Villas shall perform an air leakage site inspection on a representative number of each villa type in accordance with Table 8. The air leakage site inspection shall be conducted by an air leakage testing company approved by the Competent Authority (for less than 10 villas, the inspection can be conducted by the supervision consultant engineer or the contracting company engineer approved by the supervision consultant engineer). The identified issues and recommended rectifications must be recorded in an air leakage site inspection report. The supervision consultant and/or contractor shall rectify all major issues and provide a summary of the undertaken actions.

D. Residential projects comprising multiple identical Government Funded Private Villas shall perform progressive sample testing on a representative number of villas (to be selected by the air leakage testing company) in accordance with Table 8, the test shall be conducted by an air leakage testing company approved by the Competent Authority. For any test failure, the testing shall be entirely repeated on a new sample of villas in accordance with Table 8, until all villas in a sample pass.

Table 8 Fundamental Green Building Regulations – Air Leakage Testing

Total No. of Villas (identical)	No. of villas to be tested for air leakage - Investment Villas	No. of villas to be tested for air leakage – Government Funded Villas
Less than 10	1	1
Between 10 and 49	2	2
Between 50 and 99	3	3
More than 100	4	4

One of the following standards shall be used for the air leakage testing:

- ATTMA Technical Standard L1. Measuring Air Permeability in the Envelopes of Dwellings
- ATTMA Technical Standard L2. Measuring Air Permeability in the Envelopes of Buildings (Non-Dwellings)
- CIBSE TM23
- ISO 9972

Guideline:

The following measures should be considered to minimise air leakage:

- Keep construction details simple and easy to follow.
- Minimise the penetration of the thermal envelope. Where penetrations are unavoidable, ensure that the penetration points are appropriately sealed.
- Weather-stripe exterior doors and operable windows.
- Caulk cracks and openings between stationary building components such as those around doors and window frames.

Submission Stage and Evidence:

Design Stage:

- Extract of the tender specifications or bill of quantities highlighting the air leakage inspection/testing requirements

Construction Stage:

- Air leakage site inspection/testing results report

302 Chapter 2 – Water Efficiency

302.01 Efficient Water Fixtures & Fittings

Intent:

To reduce potable water consumption in buildings and consequently reduce the energy needed for desalination processes.

Applicable Building Types:

Residential		Commercial		Industrial	
Individual Private Villa incl. Annex	☑	Office Building (max. 1,000 m^2 BUA)	☑	Workshop	☑
Government Funded Private Villa incl. Annex	☑	Retail & Showroom (max. 1,000 m^2 BUA)	☑	Warehouse	☑
Investment Villa incl. Annex	☑	**Public**		Factory	☑
Residential Building (max. 1,000 m^2 BUA)	☑	Mosque & Worship Building (max. 1,000 m^2 BUA)	☑		
Staff, Labour and Student Accommodation (max. 1,000 m^2 BUA)	☑	Other Building (non-residential or commercial (max. 1,000 m^2 BUA)	☑		

Requirements:

A. Option 1: Flow & Flush Rates

All water fixtures and fittings must meet the maximum allowable flush and flow rates specified in Table 8.

Table 9 Fundamental Green Building Regulations – Maximum Flow and Flush Rates

Fixture Type	Maximum Flow or Flush Rate
Shower Heads	8 litres per minute at 3 bar
Rainwater Shower Heads	10 litres per minute at 3 bar
Hand Wash Basin Faucets (private)	5 litres per minute at 3 bar
Hand Wash Basin Faucets (public)	1.9 litres per minute at 3 bar
Kitchen Sink Faucets	5 litres per minute at 3 bar
Ablution Faucets	6 litres per minute at 3 bar
Dual Flush Water Closets	4.5 litres full flush 3 litres part flush
Urinals	1 litre per flush

B. Option 2: Water Budget Calculator

Buildings unable to comply with the specified flush and flow rates must demonstrate that their estimated water consumption will not be greater than the baseline water consumption using the Barjeel Tool - Water Budget Calculator.

The baseline water consumption is calculated in accordance with the specified flush and flow rates under Option 1.

Guideline:

- Use highly efficient low-flow and low-flush sanitary fixtures and fittings to reduce potable water consumption and minimise water wastage.
- Install aerators for faucets to ensure maximum water efficiency.
- Waterless urinals are an option to further decrease the total potable water consumption.

Submission Stage and Evidence:

Design Stage:

- Extract of the tender specifications, material schedule or bill of quantities indicating the flush and flow rates
- Barjeel Tool - Water Budget Calculator (only required for Option 2)

Construction Stage:

- Technical product information or datasheet for the sanitary fixtures and fittings highlighting the flush and flow rates

303 Chapter 3 – Renewable Resources

303.01 Renewable Water Heating

Intent:

To promote renewable energy production and reduce dependence on grid electricity supply.

Solar thermal water heaters and thermodynamic water heaters present reliable and economical solutions to produce hot water with renewable energy.

Applicable Building Types:

Residential		Commercial		Industrial	
Individual Private Villa incl. Annex	☒	Office Building (max. 1,000 m^2 BUA)	☒	Workshop	☒
Government Funded Private Villa incl. Annex	☑	Retail & Showroom (max. 1,000 m^2 BUA)	☒	Warehouse	☒
Investment Villa incl. Annex	☑	**Public**		Factory	☒
Residential Building (max. 1,000 m^2 BUA)	☒	Mosque & Worship Building (max. 1,000 m^2 BUA)	☑		
Staff, Labour and Student Accommodation (max. 1,000 m^2 BUA)	☑	Other Building (non-residential or commercial (max. 1,000 m^2 BUA)	☑		

Requirements:

This article is applicable for domestic hot water and does not cover hot water required for processing or for industrial purposes.

All applicable building typologies must comply with one of the following options for the domestic hot water supply:

- Option 1: Solar thermal water heating
- Option 2: Thermodynamic water heating such as air source heat pumps or thermodynamic solar systems

For the purpose of the GBR, the average daily domestic hot water demand (Litres/day) for Investment Villas, Government Funded Private Villas and Labour Accommodations is defined as follows:

- Investment Villas and Government Funded Private Villas (including Annexes): 50 litres/day for each full bathroom, 30 litres/day for each toilet, 80 litres/day for each kitchen.
- Labour Accommodations: 20 litres/day for each person, 1,000 litres/day for the central kitchen, 600 litres/day for ablution.

The annual domestic hot water demand for Investment Villas, Government Funded Private Villas and Labour Accommodations is the daily average hot water demand multiplied by 365.

All other building types shall calculate the annual domestic hot water demand based on the 2015 ASHRAE Handbook - HVAC Application.

A. Option 1: Solar Thermal Water Heating

- A solar thermal water heating system must be installed at an appropriate location, sized to supply at least 75% of the annual domestic hot water demand.
- The solar thermal water heating system installations must be fitted with insulated hot water storage tanks and insulated pipes, which are sized and fitted as per the manufacturer's recommendations. The minimum hot water storage capacity shall be 75% of the daily domestic hot water demand.
- An auxiliary back-up heat source must be provided to supply hot water when the solar thermal supply is inadequate. This secondary heat source must also be capable to regularly boost the temperature in the hot water storage tank to 60° Celsius to limit the development of pathogens such as Legionella. The boosting shall be controlled by a thermostat.

B. Option 2: Thermodynamic Water Heating

- A thermodynamic water heating system must be installed to supply at least 75% of the annual domestic hot water demand.
- The hot water storage tank must be sized for the maximum heating capacity of the heat pump.
- An auxiliary back-up heat source must be provided if the heat pump cannot heat water up to 60° Celsius. This secondary heat source must be capable to regularly boost the temperature in the hot water storage tank to 60° Celsius to limit the development of pathogens such as Legionella. The boosting shall be controlled by a thermostat.

Exception(s):

- Buildings do not need to comply with this article if a photovoltaic (PV) system is installed at the time of construction on an area equivalent to 30% of the Net Roof Area. The PV system must be connected to the building.
- The solar thermal water heating system may provide less than 75% of the domestic hot water demand if the available Net Roof Area is not sufficient. In this case, the solar thermal water heating system must cover the total Net Roof Area excluding the areas for MEP equipment, vents and the access areas for maintenance. The Net Roof Area is defined in the article 303.02 'Onsite PV Readiness'.

Guideline:

A. Option 1: Solar Thermal Water Heating

- Minimise all other rooftop equipment and aggregate it as much as possible in a single part of the roof in order to leave ample contiguous space for the solar water heaters.
- The solar collectors should be allocated in a suitable space on the building roof that is free from shading from neighbouring buildings or adjacent structures. A shading study can help to analyse the impacts of permanent or seasonal shading on the proposed location.
- A shading structure could be provided above roof decks and terraces which is structurally capable of supporting the solar water heaters.
- The solar collectors should be directed south at an angle between 15° and 25° from the horizontal plane.
- In areas where the water quality is poor, a heat exchanger can be used to separate potable water from the fluid circulating through the collectors. In this case, a corrosion inhibiting liquid is circulated through the solar collectors and returned through the heat exchanger. The heat is transferred to the hot water storage tank by contact with a pipe.
- For split systems, the utility rooms need to be large enough to accommodate the water storage tanks, pumps, piping and controls. Ideally, the solar collectors should be located in close proximity to the hot water storage tank to minimise the transmission heat loss.
- The pipes and hot water storage tanks should be insulated to reduce heat losses.
- Possible back-up systems are electric immersion heaters, boilers and heat pumps.
- The weight of the solar thermal water heating system including the hot water storage tank is to be considered in the structural design of the roof.

- All pipes, collectors or fixings that penetrate the roof should be properly weather protected and sealed. Caulking of small gaps around the pipes is recommended to ensure the air tightness of the building.
- The solar thermal water heating system should incorporate appropriate safety devices and controls to regulate temperatures and pressures within the system. Temperature and pressure relief valves should be provided for pipes and tanks receiving hot water or steam.
- Provisions should be made to prevent scalding: A thermostatic mixing valve or a tempering valve can limit the temperature of water delivered to the bathrooms and kitchens.

B. Option 2: Thermodynamic Water Heating

- The heat pump should be located outside in close proximity to the areas of hot water use (e.g. bathroom, kitchen, ablution room) to minimise transmission losses. In case of a split system, the distance between the heat pump outside and the hot water storage tank inside should be minimal.
- The incorporation of an inverter or buffer tank is recommended to reduce the likelihood of the heat pump switching on and off unnecessarily.
- The heat pump should comply with the minimum COP specified in the article 301.03 'HVAC Efficiency & Controls'.
- Sufficient space should be left around the heat pump components to enable maintenance access.
- The heat pump should be located on a south facing wall to obtain a higher source temperature. Adequate air flow should be available around the unit.
- The pipes, ducts and hot water storage tanks should be insulated to reduce heat losses.
- Possible emergency back-up systems are electric immersion heaters and boilers.
- The heat pump and associated hot water storage tank and thermodynamic solar panels (if applicable) may change the loads imposed on the structure of the building. This should be considered in the structural design.
- All pipes, collectors or fixings that penetrate the building envelope should be properly weather protected and sealed. Caulking of small gaps around the pipes is recommended to ensure the air tightness of the building.
- Condensation disposed by the heat pump should be drained appropriately.
- The heat pump system should incorporate appropriate safety devices and controls to regulate temperatures and pressures within the system. Temperature and pressure relief valves should be provided for pipes and tanks receiving hot water or steam.
- Provisions should be made to prevent scalding: A thermostatic mixing valve or a tempering valve can limit the temperature of water delivered to the bathrooms and kitchens.

Submission Stage and Evidence:

A. Option 1: Solar Thermal Water Heating

Design Stage:

- Annual domestic hot water demand calculation
- Design calculations for the solar water heating system
- Structural dead and live load calculations demonstrating that the roof has the capacity to support the solar thermal water heaters
- Architectural drawings which indicate the location of the solar thermal water heating equipment
- Extract of the tender specifications, material schedule or bill of quantities indicating the solar thermal water heating requirement

Additional evidence if less than 75% of the domestic hot water demand is provided by the solar water heating systems (due to the limited available Net Roof Area):

- Barjeel Tool - Solar Zone Calculator
- Roof drawings indicating the following:
  - Location of the solar thermal water heaters
  - Total Net Roof Area
  - MEP equipment and vents location

- Areas reserved for maintenance
- Skylights (if applicable)
- Helipads (if applicable)

Construction Stage:

- Technical product information or datasheet of the solar thermal water heating system
- Date-stamped photos showing the installed solar thermal water heating system

B. Option 2: Thermodynamic Water Heating

Design Stage:

- Annual domestic hot water demand calculation
- Design calculations for the thermodynamic water heating system
- Structural dead and live load calculations demonstrating that the additional loads have been considered
- Architectural drawings which indicate the location of the heat pump equipment and of the thermodynamic solar panels (if applicable)
- Extract of the tender specifications, material schedule or bill of quantities indicating the thermodynamic water heating requirement

Construction Stage:

- Technical product information or datasheet of the thermodynamic water heating system
- Date-stamped photos showing the installed thermodynamic water heating system

303.02 Onsite PV Readiness

Intent:

To integrate design consideration for future photovoltaic (PV) installation into the original building design, thus improving the feasibility and potential benefits of a future rooftop PV system installation on the building.

Rooftop PV installations already offer substantial energy cost savings compared to utility power supply in many cases, and their economic and technical viability is expected to improve in the future. Investment in a solar-ready roof offers substantial cost savings compared to retrofitting an existing building roof for a PV system.

Applicable Building Types:

Residential		Commercial		Industrial	
Individual Private Villa incl. Annex	☒	Office Building (max. 1,000 m^2 BUA)	☑	Workshop	☑
Government Funded Private Villa incl. Annex	☑	Retail & Showroom (max. 1,000 m^2 BUA)	☑	Warehouse	☑
Investment Villa incl. Annex	☑	**Public**		Factory	☑
Residential Building (max. 1,000 m^2 BUA)	☑	Mosque & Worship Building (max. 1,000 m^2 BUA)	☑		
Staff, Labour and Student Accommodation (max. 1,000 m^2 BUA)	☑	Other Building (non-residential or commercial (max. 1,000 m^2 BUA)	☑		

Requirements:

A. Option 1: Solar Ready Zone

- The total area of the solar zone shall be at least 30% of the Net Roof Area of the building.
- The Net Roof Area of the building for the purpose of this calculation is the net roof area after excluding the area of any skylights, helipads and solar water heating equipment from the gross roof area of the building. The area of any sloping roofs, roof decks, terraces, swimming pools, HVAC equipment and vents and areas for maintenance access must be included in the Net Roof Area.
- The total solar zone of a building may be composed of multiple separate sub-areas. A sub-area cannot be narrower than 1.5 m in any dimension.
- The solar zone may be situated at any of the following locations:
  - Roof or overhang of the building, including roof decks or terraces
  - Roof or overhang of an accessory structure (covered parking, service block, gazebo, etc.) located within 75m of the building
- The solar zone shall be free of any pipes, exhaust or intake vents, architectural features, skylights, or other building system equipment. This requirement is in place so that the solar zone remains clear for the installation of a future PV system.
- The distance of any rooftop equipment or obstruction from the solar zone shall be at least two times the height of the highest point of the obstruction, so as to minimise the shading of the solar zone by the obstructions. This requirement does not apply to equipment or obstructions located North of the entire solar zone.
- A solar zone located on a sloping roof surface with a slope greater than 10° to the horizontal is permitted only if the roof is oriented between 100° and 260° of true north (not magnetic north). This ensures adequate exposure to direct solar radiation for a future PV system.
- A solar zone may be positioned above a usable roof deck, terrace, swimming pool or above rooftop equipment only if it is otherwise not feasible to dedicate 30% of the Net Roof Area as a solar zone. In this case, a shading structure capable of supporting a future PV installation must be considered in the design and its structural foundations must be constructed. The solar zone would be considered to be on this structure, and not directly on the roof deck, terrace, swimming pool and/or equipment.
- The weight of the PV panels (dead weight of 25 kg/m^2) must be considered in the structural design of the building, including the supporting structures (if any) above usable roof decks, terraces or above rooftop equipment.
- A pathway shall be reserved for routing an electrical conduit from the solar zone to the point of interconnection with the electrical utility service (the electricity meter room or utility area).
- An area shall be reserved for inverters and metering equipment necessary for the future PV systems, either on the roof of the building, or in the electricity meter room or utility area of the building. This area shall not count towards the total solar zone area requirement. The allocated space should be appropriately sized for a PV system that would cover the entire solar zone.

B. Option 2: PV Installation

Projects shall install a PV system on an area equivalent to 30% of the Net Roof Area. The PV system must be connected to the building.

C. Option 3: Optimised Building Envelope Performance

Projects unable to comply with Option 1 or Option 2, shall compensate with a lower average wall u-value of 0.4 W/m^2K.

Guideline:

A. Option 1: Solar Ready Zone

- Minimise all other rooftop equipment and aggregate it as much as possible in a single part of the roof in order to leave ample contiguous space for a future rooftop PV system.
- Consider the PV system weight in the structural design of the entire roof and additional terrace support structures.
- In case a sloping roof is desired, design it with maximum area of the roof sloping gently towards the south, to maximise the roof area eligible for the solar zone.

B. Option 2: PV Installation

- Calculate the Net Roof Area and identify feasible locations for the PV installation. The PV modules should be allocated in a suitable space that is free from shading from neighbouring buildings or adjacent structures. A shading study can help to analyse the impacts of permanent or seasonal shading on the proposed location.

C. Option 3: Optimised Building Envelope Performance

- Increase the wall insulation to achieve an average wall u-value of 0.4 W/m²K.

Submission Stage and Evidence:

A. Option 1: Solar Ready Zone

Design Stage:

- Barjeel Tool - Solar Zone Calculator
- Detailed roof plan indicating the following areas:
  - Solar zone
  - Total Net Roof Area
  - Shading structure (if applicable)
  - Skylights (if applicable)
  - Solar water heaters (if applicable)
  - Helipads (if applicable)
- Schematic diagram showing the pathway reserved for the electrical conduit between the PV system and the building's electrical network
- Structural dead and live load calculations demonstrating that the additional dead and live loads have been considered for the solar zone

Construction Stage:

- Date-stamped photos of the completed roof showing that the solar zone area is free of obstructions
- Date-stamped photos of the shading structure foundation (if applicable)

B. Option 2: PV Installation

Design Stage:

- Barjeel Tool - Solar Zone Calculator
- Architectural drawings which indicate the location of the PV equipment
- Design of the PV system
- Extract of the tender specifications, material schedule or bill of quantities indicating the PV requirement

Construction Stage:

- Technical product information or datasheet of the PV system
- Date-stamped photos of the installed PV system

C. Option 3: Optimised Building Envelope Performance

Refer to the design and construction stage evidence outlined in 301.01 'Building Envelope Performance'

304 Chapter 4 – Materials & Resources

304.01 Construction Waste Management

Intent:

To reduce the amount of construction waste sent to landfill, thereby reducing the demand for virgin materials.

Applicable Building Types:

Residential		Commercial		Industrial	
Individual Private Villa incl. Annex	☑	Office Building (max. 1,000 m^2 BUA)	☑	Workshop	☑
Government Funded Private Villa incl. Annex	☑	Retail & Showroom (max. 1,000 m^2 BUA)	☑	Warehouse	☑
Investment Villa incl. Annex	☑	**Public**		Factory	☑
Residential Building (max. 1,000 m^2 BUA)	☑	Mosque & Worship Building (max. 1,000 m^2 BUA)	☑		
Staff, Labour and Student Accommodation (max. 1,000 m^2 BUA)	☑	Other Building (non-residential or commercial (max. 1,000 m^2 BUA)	☑		

Requirements:

Construction waste shall be segregated on site to facilitate recycling:

- Clean construction waste such as concrete, excavated soil and grouting mixes
- Mixed recyclables such as plastic, cardboard, paper and metal
- Mixed construction waste such as contaminated plastic, rubber, foam, carpets and wood
- Hazardous waste

The waste streams must be disposed at suitable facilities designated as such by the RAK Waste Management Agency.

Guideline:

Construction waste should be segregated to comply with this article and to allow for recycling. The following steps are recommended to be undertaken:

- Ensure the site staff and sub-contractors are aware of the appropriate waste segregation and all specific waste management procedures used at the site.
- The area allocated for each construction waste stream should be clearly labelled.
- Check the segregation areas regularly to ensure the proper waste streams are going into them.
- Take date stamped photos to track progress. Discuss progress regularly at site meetings and take remediation action if construction waste is not appropriately segregated.

- Clean construction waste should be disposed at the Al Saade reclamation side and mixed construction waste at the Al Jazeera landfill. The contractor should contact the RAK Waste Management Agency to arrange the pick-up of mixed recyclables and hazardous waste. Mixed recyclables can also be directly sold.

Submission Stage and Evidence:

Construction Stage:

- Date-stamped photos showing the construction waste segregation

305 Chapter 5 – Comfort & Well-Being

305.01 VOC Limits

Intent:

To reduce the concentration of chemical contaminants that can damage air quality and human health.

Applicable Building Types:

Residential		Commercial		Industrial	
Individual Private Villa	☒	Office Building (max. 1,000 m^2 BUA)	☑	Workshop	☒
Government Funded Private Villa	☑	Retail & Showroom (max. 1,000 m^2 BUA)	☑	Warehouse	☒
Investment Villa	☑	**Public**		Factory	☒
Residential Building (max. 1,000 m^2 BUA)	☑	Mosque & Worship Building (max. 1,000 m^2 BUA)	☑		
Staff, Labour and Student Accommodation (max. 1,000 m^2 BUA)	☑	Other Building (non-residential or commercial (max. 1,000 m^2 BUA)	☑		

Requirements:

All interior wall and ceiling paints must comply with the following maximum Volatile Organic Compound (VOC) content limits:

Table 10 Fundamental Green Building Regulations – VOC Content Limit

Interior Paint Type	VOC Limit g/L
Matt (Gloss <25@60°C)	30
Glossy (Gloss >25@60°C)	100

Guideline:

- Include the VOC content limits in the tender documents and verify that procured paints are compliant with the VOC content limits.

Submission Stage and Evidence:

Design Stage:

- Extract of the tender specifications, material schedule or bill of quantities highlighting the VOC limits for paints

Construction Stage:

- Technical product information or datasheet for all interior paints highlighting the VOC content

DIVISION FOUR

Comprehensive Green Building Regulations

DIVISION FOUR:
Comprehensive Green Building Regulations

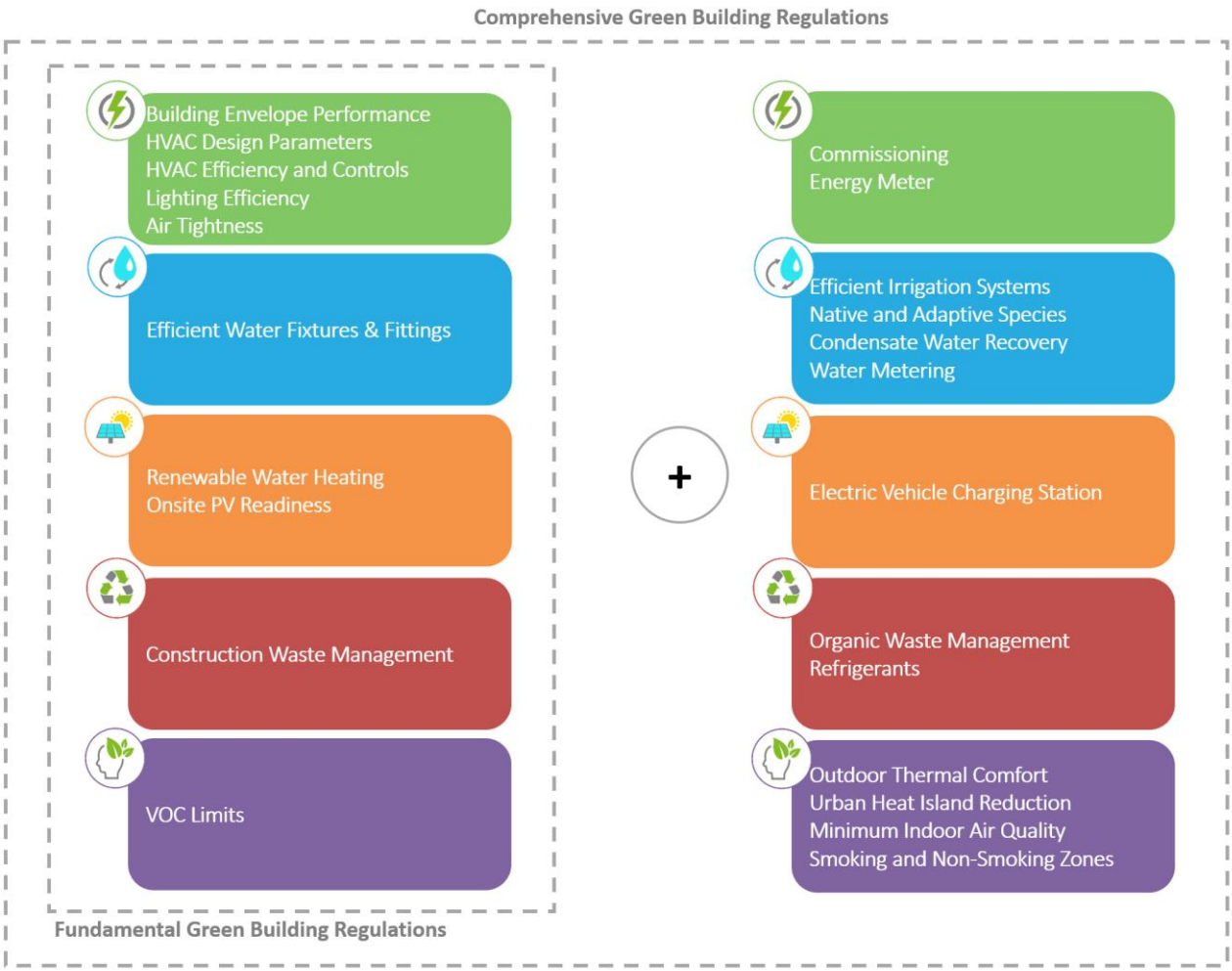
The Comprehensive Green Building Regulations are applicable to the following building types:

Table 11 Comprehensive Green Building Regulations – Applicable Building Types

Residential	Commercial	Public
Residential Building (> 1,000 m^2 BUA)	Office Building (> 1,000 m^2 BUA)	Mosque & Worship Building (> 1,000 m^2 BUA)
Staff, Labour and Student Accommodation (> 1,000 m^2 BUA)	Retail & Showroom (> 1,000 m^2 BUA)	Government Building
Hospitality	Mall & Shopping Centre	Educational Facility
Hotel, Motel	Laboratory	Healthcare Facility
Hotel Apartment		Exhibition & Festival Centre, Sport Facility
Resort		Other Public Building

Figure 3 lists the regulatory items which are part of the Comprehensive Green Building Regulations.

Figure 3 Comprehensive Green Building Regulations – Regulatory Items



401 Chapter 1 – Energy Efficiency

401.01 Building Envelope Performance

Intent:

To reduce the heat gain through the building's façades and roof and consequently minimise the cooling load which represents a significant component of the total building energy consumption.

Applicable Building Types:

Residential		Commercial		Public	
Residential Building (> 1,000 m^2 BUA)	☑	Office Building (> 1,000 m^2 BUA)	☑	Mosque & Worship Building (> 1,000 m^2 BUA)	☑
Staff, Labour and Student Accommodation (> 1,000 m^2 BUA)	☑	Retail & Showroom (> 1,000 m^2 BUA)	☑	Government Building	☑
Hospitality		Mall & Shopping Centre	☑	Educational Facility	☑
Hotel, Motel	☑	Laboratory	☑	Healthcare Facility	☑
Hotel Apartment	☑			Exhibition & Festival Centre, Sport Facility	☑
Resort	☑			Other Public Building	☑

Requirements:

The building envelope performance requirements are formulated separately for opaque elements (such as external walls and roofs) and glazed elements (such as windows, glazed walls and skylights).

Opaque glazed elements (with back insulated panels) are considered as opaque elements and therefore must meet the required u-value of the walls.

A. Requirements for Opaque Elements:

The average u-value of the external walls and roofs (that are exposed to ambient conditions) must not exceed the following thresholds:

- Average external wall u-value ≤ 0.48 W/m²K
- Average roof u-value ≤ 0.30 W/m²K

All structural columns and beams must be insulated to avoid heat bridges.

B. Requirements for Glazed Elements:

The optimum choice of windows is important as glazing gains and loses heat quickly and often makes up a large proportion of the building envelope.

For glazed portions of external walls and roofs, the average u-value and Solar Heat Gain Coefficient (SHGC) should not exceed the following values:

- Window centre pane u-value ≤ 1.8 W/m²K
- Skylight centre pane u-value ≤ 1.8 W/m²K

The maximum SHGC should be based on the amount of glazing as a percentage of the relevant surface area, as below:
For windows (based on external wall area)

Glazing area (% of external wall area)	Maximum SHGC
≤40%	≤0.4
40% to 60%	≤0.32
>60%	≤0.25

For shopfront glazing, a maximum SHGC of 0.76 is permitted

.

For skylights (based on roof area)

Skylight area (% of roof area)	Maximum SHGC
≤10%	≤0.32
>10%	≤0.25

Exception(s):

Buildings that are not air-conditioned do not have to comply with this article.

Guideline:

A. Opaque Elements:

The following options are likely to achieve the required roof and wall u-values:

External walls:

- Option 1: 200 - 250 mm thermal blocks with a 25 mm internal & external plaster. Additionally, the structural columns and beams should be insulated to avoid heat bridges and to achieve the average external wall u-value of 0.48W/m²K.
- Option 2: 50 - 100 mm insulation layer, bonding plaster and reinforcement mesh. The insulation layer should be applied on the hollow concrete blocks, the structural columns and beams and should be continuous and cover all gaps between the building envelope elements.

Roof:

- Combo roofing system with 30 – 50 mm insulation layer

B. Glazing Elements:

The following options are likely to achieve the required glazing properties:

- Double glazing (6 mm pane + 12 mm air gap + 6 mm pane) with a low solar coating on the interior of the outside pane and a thermally broken frame

Submission Stage and Evidence:

Design Stage:

- Barjeel Tool - U-Value Calculator
- Wall and roof cross sections showing the composition (thickness and material type) of the different wall and roof systems
- Extract of the tender specifications, material schedule or bill of quantities highlighting the required u-values and SHGC

Construction Stage:

- Technical product information or material datasheet for the insulation materials and/or thermal blocks
- Date-stamped photos showing the installation of the thermal blocks and/or insulation layers

401.02 HVAC Design Parameters

Intent:

To prevent oversizing of the air conditioning equipment by considering local weather conditions, required indoor conditions and the building envelope performance.

Applicable Building Types:

Residential		Commercial		Public	
Residential Building (> 1,000m^2 BUA)	☑	Office Building (> 1,000m^2 BUA)	☑	Mosque & Worship Building (> 1,000 m^2 BUA)	☑
Staff, Labour and Student Accommodation (> 1,000m^2 BUA)	☑	Retail & Showroom (> 1,000m^2 BUA)	☑	Government Building	☑
Hospitality		Mall & Shopping Centre	☑	Educational Facility	☑
Hotel, Motel	☑	Laboratory	☑	Healthcare Facility	☑
Hotel Apartment	☑			Exhibition & Festival Centre, Sport Facility	☑
Resort	☑			Other Public Building	☑

Requirements:

The cooling load must be calculated in accordance with the following design parameters:

A. Building Envelope Parameters

The heat transfer coefficients for walls, roofs and glazing must be the actual design coefficients and must comply with the article 401.01 'Building Envelope Performance'.

B. Outdoor Condition of the Building

- Dry bulb temperature: 46°C
- Wet bulb temperature: 29°C
- Ras Al Khaimah City location latitude (North Latitude) 25.5°N

C. Indoor Condition of the Building

For all regularly occupied rooms, excluding spaces dedicated to manufacturing, production and storage:

- Dry bulb temperature: 24°C +/- 1°C
- Relative humidity: 50% +/- 10%

The diversity coefficients set out in the ASHRAE Fundamentals 2013 shall be used.

D. Safety factors

The safety factors applied must be no greater than the following:

- Sensible Heat: 10%
- Latent Heat: 5%

Exception(s):

Buildings that are not air-conditioned do not have to comply with this article.

Guideline:

- The actual design heat transfer coefficients and the specified outdoor and indoor conditions should be used in the cooling load calculations.
- It is recommended to use a static or dynamic software for the cooling load calculations. These software tools can generate various reports which can be submitted to demonstrate compliance with this article.

Submission Stage and Evidence:

Design Stage:

- Simple AC drawings showing the AC type and capacity
- Cooling load calculations or simulation reports highlighting the applied design parameters

401.03 HVAC Efficiency & Controls

Intent:

To promote efficient Heating, Ventilation and Air Conditioning (HVAC) systems and to ensure adequate controls are available to the building occupants to adjust the set-point temperature and ventilation settings.

Applicable Building Types:

Residential		Commercial		Public	
Residential Building (> 1,000 m^2 BUA)	☑	Office Building (> 1,000 m^2 BUA)	☑	Mosque & Worship Building (> 1,000 m^2 BUA)	☑
Staff, Labour and Student Accommodation (> 1,000 m^2 BUA)	☑	Retail & Showroom (> 1,000 m^2 BUA)	☑	Government Building	☑
Hospitality		Mall & Shopping Centre	☑	Educational Facility	☑
Hotel, Motel	☑	Laboratory	☑	Healthcare Facility	☑
Hotel Apartment	☑			Exhibition & Festival Centre, Sports Facility	☑
Resort	☑			Other Public Building	☑

Requirements:

A. HVAC Efficiency

All HVAC equipment and systems must comply with the minimum full load energy efficiency requirements (EER/COP) listed in Table 12, Table 13 and Table 14. Chilling packages must additionally comply with the minimum part load efficiency requirements (IPLV) specified in Table 15.

Table 12 Comprehensive Green Building Regulations – Electrically Operated Unitary ACs

Equipment Type	Rated Capacity (kW at T3)	Minimum Efficiency Full Load		Rating Conditions
		Energy Efficiency Rating (EER, Btu/h/W at T3)	Coefficient of Performance (COP at T3)	
Window AC	All	7.51	2.20	Tested as per ESMA standard no. UAE.S ISO 5151:2017
Non-ducted AC	All	8.31	2.44	
Ducted split & packaged AC	RC < 40	8.80	2.58	Tested as per ISO 13253
	40 ≤ RC < 70	8.59	2.52	
	70 ≤ RC < 223	8.27	2.42	
	223 ≤ RC	7.95	2.33	

Table 13 Comprehensive Green Building Regulations – Multi-Split and VRF

Equipment Type	Rated Capacity (kW at T3)	Cooling Seasonal Performance Factor (CSPF Btu/h/W at T3)	Integrated Part Load Value (IPLV at T3)	Rating Conditions
Multi Split	RC <40	NA	4.59	Tested as per ESMA standard no. UAE.S ISO 15042
	40 ≤ RC < 220	NA	4.45	
	220 ≤ RC	NA	4.35	
VRF	RC <40	14.84	NA	Tested as per ESMA UAE.S ISO 16358-2013/Amd.1:2019
	40 ≤ RC < 220	13.78	NA	
	220 ≤ RC	13.25	NA	

Table 14 Comprehensive Green Building Regulations – Heat Pumps

Equipment Type	Rated Capacity (kW at T3)	Minimum Efficiency Full Load		Rating Conditions
		Energy Efficiency Rating (EER, Btu/h/W at T3)	Coefficient of Performance (COP at T3)	
Water source heat pump unit	All Capacities, entering fluid temperature of 30°C	8.35	2.45	Tested as per ESMA standard no. UAE.S ISO 13256-1:1998 & UAE.S ISO 13256-2:1998
Ground water source heat pump unit	All Capacities, entering fluid temperature of 25°C	9.2	2.7	

Table 15 Comprehensive Green Building Regulations – Chilling Packages

Equipment Type	Rated Capacity (kW at T1)	Minimum Efficiency Full Load		Integrated Part Load Value (IPLV at T1)	Rating Conditions
		Energy Efficiency Rating (EER, Btu/h/W at T1)	Coefficient of Performance (COP at T1)		
Air cooled package chiller without condenser	All	11.21	3.29	4.05	Tested as per UAE.S AHRI 550/590
Air cooled package chiller with condenser	RC < 528	10.13	2.97	4.05	
	528 ≤RC	10.13	2.97	4.14	
Water cooled chiller positive displacement (reciprocating)	All	15.19	4.45	5.63	
Water cooled chiller positive displacement (rotary and scroll)	RC < 264	16.01	4.69	5.87	
	264 ≤RC<528	17.03	4.99	6.29	
	528 ≤RC<1,055	18.19	5.33	6.52	
	1,055 ≤RC<2,110	19.69	5.77	6.77	
	2,110 ≤ RC	21.26	6.23	7.04	
Water cooled chiller (centrifugal)	RC < 528	21.71	6.36	6.77	
	528 ≤ RC	23.51	6.89	7.04	
Air cooled absorption, single effect	All	2.05	0.60	NA	Tested as per AHRI 560
Water cooled absorption, single effect	All	2.39	0.70	NA	
Absorption double effect, indirect fired	All	3.41	1.00	1.05	
Absorption double effect, direct fired	All	3.41	1.00	1.00	

B. HVAC Controls:

- The HVAC control system of the building shall be subdivided into independent control areas, corresponding to the various regularly occupied rooms or areas of the building.
- The set-point temperature and ventilation of each control area must be independently controllable, regardless of the set-point temperature and ventilation of other control areas in the building. A thermostat must be provided in each control area to allow occupants to adjust the set-point temperature and ventilation of the area.
- The HVAC control system must be capable of shutting down and starting up the HVAC equipment for the specific control area whenever required by the occupants of the same control area.
- In case of a central building HVAC system, the HVAC control system must shut down the central cooling equipment when the set-point temperature of all control areas has been reached, or when the thermostat for all control areas has been switched off.

C. Energy Recovery

An energy recovery system must be provided for all buildings with an outdoor air requirement of more than 1,000L/s. The energy recovery system must be capable of handling at least 50% of the total exhausted air and must have at least a 70% sensible load recovery efficiency.

Exception(s):

The following systems are exempt from the energy recovery requirement:

- Laboratory fume hood system
- Systems exhausting toxic, flammable or corrosive gases, fumes or dust
- Commercial kitchen hoods for the collection and removal of grease vapour

Guideline:

A. HVAC Efficiency

The following options are likely to achieve the required HVAC efficiency requirements:

- For window and non-ducted split AC units, use equipment that meets at least the 2-star rating standards of the Emirates Authority for Standardization and Metrology (ESMA) UAE.S 5010-1:2019.
- For ducted split and packaged AC units, use equipment which is at least 6% more efficient than the minimum efficiency standard of the ESMA UAE.S 5010-5: 2019.
- For multi-split and VRF units, use equipment which is at least 6% more efficient than the minimum efficiency standard of the ESMA UAE.S 5010-5: 2019.
- For chilling packages use equipment that meets at least the efficiencies outlined in Table 15.

B. HVAC Controls

- Provide one set-point control for each regularly occupied room, near the entrance of the room.

C. Energy Recovery

The following systems may be used to recover energy:

- Enthalpy wheel
- Run-around system
- Heat pipe

Submission Evidence:

Design Stage:

- Extract of the tender specifications, material schedule or bill of quantities showing the specified HVAC systems, rated capacities and associated efficiencies (COP/EER and IPLV if applicable), and energy recovery (if applicable)
- HVAC control schematic
- Energy recovery calculations (if applicable)

Construction Stage:

- Technical product information or datasheet of the HVAC equipment which include the following information:
  - Rated Capacity
  - COP/EER and IPLV (IPLV only for chilling packages)
  - Testing Method
- Technical product information or datasheet for the energy recovery systems (if applicable)

401.04 Lighting Efficiency

Intent:

To reduce the electricity consumption by mandating energy efficient lighting fixtures and lighting controls.

Applicable Building Types:

Residential		Commercial		Public	
Residential Building (> 1,000 m^2 BUA)	☑	Office Building (> 1,000 m^2 BUA)	☑	Mosque & Worship Building (> 1,000 m^2 BUA)	☑
Staff, Labour and Student Accommodation (> 1,000 m^2 BUA)	☑	Retail & Showroom (> 1,000 m^2 BUA)	☑	Government Building	☑
Hospitality		Mall & Shopping Centre	☑	Educational Facility	☑
Hotel, Motel	☑	Laboratory	☑	Healthcare Facility	☑
Hotel Apartment	☑			Exhibition & Festival Centre, Sports Facility	☑
Resort	☑			Other Public Building	☑

Requirements:

A. Lighting Efficiency

All internal and external light fittings of the building must be Light Emitting Diodes (LEDs) or meet, at a minimum, ESMA 4-star requirements.

Government buildings must comply with a Lighting Power Density (LPD) of 8.8 W/m^2.

B. Lighting Controls

- At least one light switch or dimmer must be provided near the entrance of each room.
- Office, residential and government buildings must provide occupancy or motion sensors in corridors, staircases and public bathrooms. The area in front of elevators and lifts is excluded from this requirement. These occupancy or motion sensors must be capable of automatically switching the lighting off when the areas are unoccupied.
- Exterior lighting must be equipped with automatic lighting controls which may be of the following two types:
  - Daylight sensor that automatically turns the exterior lights off if sufficient daylight is present.
  - Astronomical time switch or programmable schedule control that automatically turns the exterior light off during daytime hours.
- Exterior lighting and interior common area lighting must also be controllable from a central control panel or the building management system (BMS), in case of failure of the automatic controls, or for exceptional usage purposes.

Exception(s):

The following lighting types are exempt from the lighting efficiency requirements:

- Coloured lighting
- Lighting for specialised plant, machinery and equipment
- Lighting for plant growth
- Lighting for visually impaired persons with special lighting needs

- Display lighting for museums, monuments and art galleries
- Lighting for sports
- Specialised medical lighting to carry out examination or surgery e.g. in hospitals, medical centres, or doctors' and dentists' surgeries
- Stage lighting in theatres and TV studios.

Guideline:

- Light Emitting Diodes (LEDs) may be preferred over incandescent lamps as LEDs are highly energy efficient and have a long life expectancy.
- It is recommended to provide dimmers or multiple light switches to allow occupants to adjust the lighting to suit their individual tasks and preferences.
- Recommendation for the LPD calculation for government buildings:
  - Calculate the LPD for each building area (such as offices, toilets, corridor etc.). The LPD is the number of lighting fixtures multiplied by the wattage and divided by the total building gross floor area.
  - Sum the LPD for all building areas (such as offices, corridor, toilets etc.)

Submission Stage and Evidence:

Design Stage:

- Luminaire schedule indicating the lighting fixture type, ESMA star rating (for incandescent lamps) and wattage
- Lighting control schematics
- LPD calculations (for government buildings only)

401.05 Energy Metering

Intent:

To monitor the energy performance of the building and provide data that is critical in identifying improvement opportunities in energy consumption and understanding energy usage patterns.

Applicable Building Types:

Residential		Commercial		Public	
Residential Building (> 1,000 m^2 BUA)	☑	Office Building (> 1,000 m^2 BUA)	☑	Mosque & Worship Building (> 1,000 m^2 BUA)	☑
Staff, Labour and Student Accommodation (> 1,000 m^2 BUA)	☑	Retail & Showroom (> 1,000 m^2 BUA)	☑	Government Building	☑
Hospitality		Mall & Shopping Centre	☑	Educational Facility	☑
Hotel, Motel	☑	Laboratory	☑	Healthcare Facility	☑
Hotel Apartment	☑			Exhibition & Festival Centre, Sports Facility	☑
Resort	☑			Other Public Building	☑

Requirements:

- All buildings must be fitted with energy meters (of tariff class accuracy) to measure electricity consumption of the facility as a whole.
- Energy meters must be installed for each tenant unit in multi-tenant buildings.
- For buildings where chilled water is produced internally or externally procured and supplied to individual tenants or building areas, individual chilled water meters must be installed to measure the supply of chilled water to each unit.
- Energy sub-meters shall be installed for government buildings and for hotels with more than 150 rooms. The energy sub-meters must use the BMS, wireless network or other comparable communication infrastructure. The energy sub-meters shall monitor the following main energy consuming systems:
  - Cooling and fans
  - Domestic hot water
  - Lighting and other equipment can be monitored on the same sub-meter(s). Each floor has to be monitored separately.

Guideline:

- Install energy meters and chilled water meters in easily accessible locations for readings and maintenance.
- It is recommended to connect the energy and chilled water meters to the BMS system (if available) to allow ongoing monitoring of the energy consumption.

Submission Stage and Evidence:

Design Stage:

- Energy metering schematics
- Energy metering strategy description

401.06 Air Tightness

Intent:

To optimise the air tightness of the building and minimise air leakage.

Air leakage control is essential to optimise the energy performance of the building. If the building envelope is not sufficiently airtight, cold air leaks out and hot air enters through gaps and cracks, resulting in a higher energy consumption. Air leakage may also cause condensation issues, accelerating mould growth.

Applicable Building Types:

Residential		Commercial		Public	
Residential Building (> 1,000 m^2 BUA)	☑	Office Building (> 1,000 m^2 BUA)	☑	Mosque & Worship Building (> 1,000 m^2 BUA)	☑
Staff, Labour and Student Accommodation (> 1,000 m^2 BUA)	☑	Retail & Showroom (> 1,000 m^2 BUA)	☑	Government Building	☑
Hospitality		Mall & Shopping Centre	☑	Educational Facility	☑
Hotel, Motel	☑	Laboratory	☑	Healthcare Facility	☑
Hotel Apartment	☑			Exhibition & Festival Centre, Sports Facility	☑
Resort	☑			Other Public Building	☑

Requirements:

This requirement is applicable to all government buildings and to all applicable building types exceeding 5,000 m^2 BUA.

A. An air leakage site inspection shall be performed at approximately 60% completion of the building envelope. The air leakage site inspection shall be conducted by an air leakage testing company approved by the Competent Authority. The identified issues and recommended rectifications must be recorded in an air leakage site inspection report. The contractor shall rectify all major issues and provide a summary of the undertaken actions.

B. Government buildings (regardless of the built-up area) and other building types exceeding 5,000 m^2 BUA or with a cooling load of 1 megawatt (MW) or greater shall be tested at completion of building envelope for air leakage in addition to an air leakage site inspection. The air leakage into or out of the building shall not exceed 7.5 m^3 of air per hour for each square meter of the building envelope (7.5m^3/hr/m^2), at an applied pressure difference of 50 Pascal. The air leakage inspection and test shall be conducted by an air leakage testing company approved by the Competent Authority.

One of the following standards shall be used for the air leakage testing:

- ATTMA Technical Standard L1. Measuring Air Permeability in the Envelopes of Dwellings
- ATTMA Technical Standard L2. Measuring Air Permeability in the Envelopes of Buildings (Non-Dwellings)
- CIBSE TM23
- ISO 9972

Guideline:

- The following measures should be considered to minimise air leakage:
  - Keep construction details simple and easy to follow.

- Provide an air barrier to restrict the passage of air between the internal and external environments.
- Minimise the penetration of the thermal envelope. Where penetrations are unavoidable, ensure that the penetration points are appropriately sealed.
- Weather-stripe exterior doors and openable windows.
- Caulk cracks and openings between stationary building components such as those around doors and window frames.

Submission Stage and Evidence:

Design Stage:

- Extract of the tender specifications or bill of quantities highlighting the air leakage site inspection and, for government buildings and other building types exceeding 5,000 m^2 BUA or with a cooling load of 1 megawatt (MW) or greater, the air leakage testing requirements.

Construction Stage:

- Air leakage site inspection report
- Additional for government buildings and other building types exceeding 5,000 m^2 BUA or with a cooling load of 1 megawatt (MW) or greater: Air leakage testing report

401.07 Building Commissioning

Intent:

To ensure that all the energy and water related building systems are installed correctly and commissioned in accordance with the building owner's project requirements and tender documents.

Applicable Building Types:

Residential		Commercial		Public	
Residential Building (> 1,000 m^2 BUA)	☑	Office Building (> 1,000 m^2 BUA)	☑	Mosque & Worship Building (> 1,000 m^2 BUA)	☑
Staff, Labour and Student Accommodation (> 1,000 m^2 BUA)	☒	Retail & Showroom (> 1,000 m^2 BUA)	☑	Government Building	☑
Hospitality		Mall & Shopping Centre	☑	Educational Facility	☑
Hotel, Motel	☑	Laboratory	☑	Healthcare Facility	☑
Hotel Apartment	☑			Exhibition & Festival Centre, Sports Facility	☑
Resort	☑			Other Public Building	☑

Requirements:

A. A commissioning company or FEWA approved engineer (thereafter referred to as 'Commissioning Agent') shall be engaged during construction and building commissioning. The commissioning process managed by the commissioning agent must include as a minimum the following building systems:

- HVAC systems
- Renewable energy systems

- Electrical systems
- Domestic hot and cold water systems
- On-site water treatment systems (if applicable)
- Building Management Systems (if applicable)

B. During the construction stage, the commissioning agent shall develop a commissioning plan which includes:

- Overview of the commissioning process
- Roles and responsibilities related to building commissioning
- Detailed description of the commissioning activities and a schedule of commissioning activities
- List of commissioned systems and description of evaluation procedures
- Format for the commissioning evaluation checklists and testing forms, and issues and resolutions log

C. The commissioning agent shall also review the following documents:

- Shop drawings
- Equipment submittals
- Installation method statements

D. The building commissioning shall be executed after obtaining the utility connection and shall be managed by the commissioning agent. The testing activity may be executed by the building contractor; however, the presence of the commissioning agent is required to oversee the correct execution of each test and to document the testing results. All issues identified during the commissioning shall be documented in the issues and resolutions log.

E. The commissioning agent shall issue a final commissioning report, including at least the following:

- List of the commissioned systems
- Copy of the evaluation checklists and testing forms completed for the commissioned systems
- Copy of the issues and resolutions log, detailing open and closed issues
- Resolution plan for open items

Guideline:

Use the following references for commissioning processes and required tools:

- ASHRAE Standard 202-2013: Commissioning Process for Buildings and Systems, ASHRAE Guideline 0-2005: The Commissioning Process & ASHRAE Guideline 1.1-2007: HVAC and R Technical Requirements for the Commissioning Process.
- CIBSE (Chartered Institution of Building Services Engineers) Commissioning Codes.
- BSRIA (Building Services Research and Information Association) – BG2 Commissioning water systems
- BSRIA – BG11-2010 Commissioning job book, BSRIA – BG29-2012 Pre Commissioning cleaning & BSRIA – BG49-2013 Commissioning air

Submission Stage and Evidence:

Design Stage:

- Extract of the tender specifications or bill of quantities demonstrating the commissioning requirements

Construction Stage:

- Initial commissioning plan
- Commissioning agent's comments on the shop drawings, equipment submittals and installation method statements
- Developer's letter of commitment to issue the final commissioning report after obtaining the utility connection and once the commissioning has been conducted
- Final commissioning report (can be submitted at a later stage if it is not yet available for the construction stage submission)

402 Chapter 2 – Water Efficiency

402.01 Efficient Water Fixtures & Fittings

Intent:

To reduce potable water consumption in buildings and consequently reduce the energy needed for desalination processes.

Applicable Building Types:

Residential		Commercial		Public	
Residential Building (> 1,000 m^2 BUA)	☑	Office Building (> 1,000 m^2 BUA)	☑	Mosque & Worship Building (> 1,000 m^2 BUA)	☑
Staff, Labour and Student Accommodation (> 1,000 m^2 BUA)	☑	Retail & Showroom (> 1,000 m^2 BUA)	☑	Government Building	☑
Hospitality		Mall & Shopping Centre	☑	Educational Facility	☑
Hotel, Motel	☑	Laboratory	☑	Healthcare Facility	☑
Hotel Apartment	☑			Exhibition & Festival Centre, Sports Facility	☑
Resort	☑			Other Public Building	☑

Requirements:

A. Option 1: Flow & Flush Rates

All water fixtures and fittings must meet the maximum allowable flush and flow rates specified in Table 14.

Table 16 Comprehensive Green Building Regulations – Maximum Flow and Flush Rates

Fixture Type	Maximum Flow or Flush Rate
Shower Heads	8 litres per minute at 3 bar
Rainwater Shower Heads	10 litres per minute at 3 bar
Hand Wash Basin Faucets (private)	5 litres per minute at 3 bar
Hand Wash Basin Faucets (public)	1.9 litres per minute at 3 bar
Kitchen Sink Faucets	5 litres per minute at 3 bar

Fixture Type	Maximum Flow or Flush Rate
Ablution Faucets	6 litres per minute at 3 bar
Dual Flush Water Closets	4.5 litres full flush 3 litres part flush
Urinals	1 litre per flush

B. Option 2: Water Budget Calculator

Buildings unable to comply with the specified flush and flow rates must demonstrate that their estimated water consumption will not be greater than the baseline water consumption using the Barjeel Tool - Water Budget Calculator.

The baseline water consumption is calculated in accordance with the specified flush and flow rates under Option 1.

Guideline:

- Use highly efficient low-flow and low-flush sanitary fixtures and fittings to reduce potable water consumption and minimise water wastage.
- Install aerators for faucets to ensure maximum water efficiency.
- Waterless urinals are an option to further decrease the total potable water consumption.

Submission Stage and Evidence:

Design Stage:

- Extract of the tender specifications, material schedule or bill of quantities indicating the flush and flow rates
- Barjeel Tool - Water Budget Calculator (only required for Option 2)

Construction Stage:

- Technical product information or datasheet for the sanitary fixtures and fittings highlighting the flush and flow rates

402.02 Efficient Irrigation Systems

Intent:

To increase irrigation water efficiency and promote the use of alternative water sources such as recovered greywater or Treated Sewage Effluent (TSE).

Landscape irrigation particularly consumes large quantities of potable water, and the use of water efficient irrigation and alternative water sources can drastically reduce the potable water consumption.

Applicable Building Types:

Residential		Commercial		Public	
Residential Building (> 1,000 m^2 BUA)	☑	Office Building (> 1,000 m^2 BUA)	☑	Mosque & Worship Building (> 1,000 m^2 BUA)	☑
Staff, Labour and Student Accommodation (> 1,000 m^2 BUA)	☒	Retail & Showroom (> 1,000 m^2 BUA)	☑	Government Building	☑
Hospitality		Mall & Shopping Centre	☑	Educational Facility	☑
Hotel, Motel	☑	Laboratory	☒	Healthcare Facility	☑
Hotel Apartment	☑			Exhibition & Festival Centre, Sports Facility	☑
Resort	☑			Other Public Building	☑

Requirements:

- All softscaping (including green roofs), excluding lawns, must be irrigated with drip or subsoil irrigation systems. Sprinkler irrigation systems may only be used for the irrigation of lawn.
- For hotels, the softscaping must be irrigated using non-potable water, such as recovered condensate water, greywater or TSE, if the costs for non-potable water irrigation do not exceed the costs for potable water irrigation.

Guideline:

- Design dual watering systems with sprinklers for lawns and drip or sub-soil irrigation for flowers, trees, and shrubs.
- For hotels, evaluate the feasibility and costs of using non-potable water for irrigation purposes.

Submission Stage and Evidence:

Design Stage:

- Irrigation drawings showing the irrigation systems

Additional requirements for hotels:

- Irrigation drawings showing the condensate and/or greywater recovery systems and/or TSE connection (if applicable)
- Techno-economic evaluation of non-potable water irrigation systems versus potable water irrigation systems (if a potable water irrigation system is provided)

402.03 Native or Adaptive Species

Intent:

To limit the water demand for irrigation, by mandating the use of native or adaptive species of plants which thrive well in the climate of Ras Al Khaimah without the need for excessive irrigation.

Applicable Building Types:

Residential		Commercial		Public	
Residential Building (> 1,000 m^2 BUA)	☑	Office Building (> 1,000 m^2 BUA)	☑	Mosque & Worship Building (> 1,000 m^2 BUA)	☑
Staff, Labour and Student Accommodation (> 1,000 m^2 BUA)	☒	Retail & Showroom (> 1,000 m^2 BUA)	☑	Government Building	☑
Hospitality		Mall & Shopping Centre	☑	Educational Facility	☑
Hotel, Motel	☑	Laboratory	☒	Healthcare Facility	☑
Hotel Apartment	☑			Exhibition & Festival Centre, Sports Facility	☑
Resort	☑			Other Public Building	☑

Requirements:

For projects with total softscape areas exceeding 1,000 m^2, a minimum of thirty percent (30%) of the total softscape area, including lawns, must be landscaped using plant or tree species that are native or adapted to the climate and soil of Ras Al Khaimah.

Guideline:

Examples of suitable native plants for landscaping are listed below:

Scientific Name	English Name	Arabic Name	Growth Form	Native/ Adaptive
Acacia tortilis	Umbrella thorn	Samr, salam	Tree	Native
Aerva javanica	Kapok bush	Alara, twaim, efhe, tirf	Bush	Native
Cenchrus ciliarus	Foxtailgrass, buffel grass, sand burr	Gharaz-drab labaytad	Grass	Native
Chloris virgata	Feathrfinger grass	Khazamzam	Grass	Native
Cistanche tubulosa	Desert hyacinth	Thanoon, tartooth-basul, dhamin	Parasitic flower	Native
Citrullus colocynthis	Desert squash, bitter gourd	Shary, handhal, murrah, serew, Hanzal,suri,hedge	Ground cover	Native
Convolvulus virgatus	Morning glory family	Hub alrisha, adlam	Bush	Native

Scientific Name	English Name	Arabic Name	Growth Form	Native/ Adaptive
Cymbopogon commutatus	Incense grass	Alklathgar, sakhbar, grass hamra, idhkhir, khasaab	Grass	Native
Euphorbia larica	Euphorbia	Isbaq, ibiq	Bush	Native
Leptadenia pyrotechnica	Firemaker/broom bush	Markh,ma'aleet	Bush	Native
Nerium oleander	Oleander	Defla, haban	Tree	Native
Phoenix dactylifera	Date palm	Nakhl, amm-amm	Palm	Native
Prosopiis cineraria	Mimosa family	Ghaf, harb, awd, hadheeb, shibhan	Tree	Native
Reseda aucheri	Mignonette family	Dhaub-nabmm,zinban	Bush	Native
Stipagrostis plumosa	Plumose triple awned grass	Nussi, sabat, rahim, bathoot, tubaynee, shbhan	Tree	Native
Sporobolus spicatus	Drop seed grass	Dhafrem, defera, sakham, Rashad, halfa, barri	Grass	Native
Sueda vermiculata	Sea blite	Tuwaim, girm, hamd, tahmar	Bush	Native
Tamarix nilotica/Arabica	Tamrisk	Tarfa, athl	Tree	Native
Zizyphus spina christi	Christ thorn	Sidr, ber , ilb zaqa, fruit: Nabaq,dum	Tree	Native
Zygophyllum qatarense	Bean caper	Haram, rotreet, balbal, theromet	Bush	Native

Other plants notified as such by the Environmental Protection and Development Agency (EPDA) of Ras Al Khaimah may also be used as native or adaptive plants for landscaping.

Xeriscaping can further reduce or eliminate the need for supplemental water for irrigation.

Submission Stage and Evidence:

Design Stage:

- Landscape drawings highlighting the different Softscaping areas and identifying the species used in each area
- Barjeel Tool - Plant Species Calculator

402.04 Condensate Water Recovery

Intent:

To mandate proper collection, disposal and reuse of condensate water to reduce the potable water consumption and ensure a healthy environment.

Condensate water has the potential to damage the building and also poses health hazards as it can be a breeding ground for insects and mould.

Applicable Building Types:

Residential		Commercial		Public	
Residential Building (> 1,000 m^2 BUA)	☒	Office Building (> 1,000 m^2 BUA)	☒	Mosque & Worship Building (> 1,000 m^2 BUA)	☒
Staff, Labour and Student Accommodation (> 1,000 m^2 BUA)	☒	Retail & Showroom (> 1,000 m^2 BUA)	☒	Government Building	☑
Hospitality		Mall & Shopping Centre	☒	Educational Facility	☒
Hotel, Motel	☒	Laboratory	☒	Healthcare Facility	☒
Hotel Apartment	☒			Exhibition & Festival Centre, Sports Facility	☒
Resort	☒			Other Public Building	☒

Requirements:

- Government buildings with a BUA of at least 2,000m^2 shall recover condensate water from all air conditioning equipment units handling outside air. The recovered condensate water must be used on-site for either irrigation or toilet flushing or for any other purpose for which it will not come in contact with the human body.
- Unrecovered condensate water must be discharged to the wastewater system. Connection of condensate drainage with the wastewater system must incorporate a minimum air break of 25 mm between the condensate piping and the wastewater piping, and a properly sized water trap.

Guideline:

- Identify locations where condensate may occur in the building, such as air handling units and air conditioning systems.
- Incorporate adequate slopes in all condensate collection pans and pipes to allow gravity driven drainage of condensate water to the wastewater system. Incorporate a water trap in the connection to the wastewater system.

Submission Stage and Evidence:

Design Stage:

- MEP report
- Plumbing design drawings

402.05 Water Metering

Intent:

To monitor the water consumption of the building and provide data that is critical in identifying improvement opportunities and understanding water usage patterns.

Applicable Building Types:

Residential		Commercial		Public	
Residential Building (> 1,000 m^2 BUA)	☑	Office Building (> 1,000 m^2 BUA)	☑	Mosque & Worship Building (> 1,000 m^2 BUA)	☑
Staff, Labour and Student Accommodation (> 1,000 m^2 BUA)	☑	Retail & Showroom (> 1,000 m^2 BUA)	☑	Government Building	☑
Hospitality		Mall & Shopping Centre	☑	Educational Facility	☑
Hotel, Motel	☑	Laboratory	☑	Healthcare Facility	☑
Hotel Apartment	☑			Exhibition & Festival Centre, Sports Facility	☑
Resort	☑			Other Public Building	☑

Requirements:

- All buildings must be fitted with water meters (of tariff class accuracy) to measure water consumption of the building as a whole.
- Water meters must be installed for each tenant unit in multi-tenant buildings.
- Water sub-meters must be installed for each swimming pool, and for irrigation if the Softscape area exceeds 1,000 m^2.

Guideline:

- Install water meters in easily accessible locations for readings and maintenance.
- Connect the water meters to the BMS system (if available) to allow for ongoing monitoring of the water consumption.

Submission Stage and Evidence:

Design Stage:

- Metering schematics
- Water metering strategy description

403 Chapter 3 – Renewable Resources

403.01 Renewable Water Heating

Intent:

To promote renewable energy production and reduce dependence on grid electricity supply.

Solar water heaters and thermodynamic water heaters present reliable and economical solutions to produce hot water with renewable energy.

Applicable Building Types:

Residential		Commercial		Public	
Residential Building (> 1,000 m^2 BUA)	☒	Office Building (> 1,000 m^2 BUA)	☑	Mosque & Worship Building (> 1,000 m^2 BUA)	☑
Staff, Labour and Student Accommodation (> 1,000 m^2 BUA)	☑	Retail & Showroom (> 1,000 m^2 BUA)	☒	Government Building	☑
Hospitality		Mall & Shopping Centre	☑	Educational Facility	☑
Hotel, Motel	☑	Laboratory	☑	Healthcare Facility	☑
Hotel Apartment	☑			Exhibition & Festival Centre, Sports Facility	☒
Resort	☑			Other Public Building	☑

Requirements:

This article is applicable for domestic hot water and does not cover hot water required for processing or for industrial purposes.

All applicable building typologies must comply with one of the following options for the domestic hot water supply:

- Option 1: Solar thermal water heating
- Option 2: Thermodynamic water heating such as air source heat pumps or thermodynamic solar systems

For the purpose of the GBR, the average daily domestic hot water demand (Litres/day) for Labour Accommodations is defined as follows:

- Labour Accommodations: 20 litres/day for each person, 1,000 litres/day for the central kitchen, 600 litres/day for ablution.

The annual domestic hot water demand for Labour Accommodations is the daily average hot water demand multiplied by 365.

All other building types shall calculate the annual domestic hot water demand based on the 2015 ASHRAE Handbook - HVAC Application.

A. Option 1: Solar Thermal Water Heating

- A solar thermal water heating system must be installed at an appropriate location, sized to supply at least 75% of the annual domestic hot water demand.
- The solar thermal water heating system installations must be fitted with insulated hot water storage tanks and insulated pipes, which are sized and fitted as per the manufacturer's recommendations. The minimum hot water storage capacity shall be 75% of the daily domestic hot water demand.
- An auxiliary back-up heat source must be provided to supply hot water when the solar thermal supply is inadequate. This secondary heat source must also be capable to regularly boost the temperature in the hot water storage tank to 60° Celsius to limit the development of pathogens such as Legionella. The boosting shall be controlled by a thermostat.

B. Option 2: Thermodynamic Water Heating

- A thermodynamic water heating system must be installed to supply at least 75% of the annual domestic hot water demand.
- The hot water storage tank must be sized for the maximum heating capacity of the heat pump.
- A secondary heat source must be provided if the heat pump cannot heat water up to 60° Celsius. This secondary heat source must be capable to regularly boost the temperature in the hot water storage tank to 60° Celsius to limit the development of pathogens such as Legionella. The boosting shall be controlled by a thermostat.

Exception(s):

- Buildings do not need to comply with this article if a photovoltaic (PV) system is installed at the time of construction on an area equivalent to 30% of the Net Roof Area. The PV system must be connected to the building.
- The solar thermal water heating system may provide less than 75% of the domestic hot water demand if the available Net Roof Area is not sufficient. In this case, the solar thermal water heating system must cover the total Net Roof Area excluding the areas for MEP equipment, vents and the access areas for maintenance. The Net Roof Area is defined in the article 403.02 'Onsite PV Readiness'.

Guideline:

A. Option 1: Solar Thermal Water Heating

- Minimise all other rooftop equipment and aggregate it as much as possible in a single part of the roof in order to leave ample contiguous space for the solar water heaters.
- The solar collectors should be allocated in a suitable space on the building roof that is free from shading from neighbouring buildings or adjacent structures. A shading study can help to analyse the impacts of permanent or seasonal shading on the proposed location.
- A shading structure could be provided above roof decks and terraces which is structurally capable of supporting the solar thermal water heaters.
- The solar collectors should be directed south at an angle between 15° and 25° from the horizontal plane.
- In areas where the water quality is poor, a heat exchanger can be used to separate potable water from the fluid circulating through the collectors. In this case, a corrosion inhibiting liquid is circulated through the solar collectors and returned through the heat exchanger. The heat is transferred to the hot water storage tank by contact with a pipe.
- For split systems, the utility rooms need to be large enough to accommodate the water storage tanks, pumps, piping and controls. Ideally, the solar collectors should be located in close proximity to the hot water storage tank to minimise the transmission heat loss.
- The pipes and hot water storage tanks should be insulated to reduce heat losses.
- Possible back-up systems are electric immersion heaters, boilers and heat pumps.
- The weight of the solar thermal water heating system including the hot water storage tank is to be considered in the structural design of the roof.

- All pipes, collectors or fixings that penetrate the roof should be properly weather protected and sealed. Caulking of small gaps around the pipes is recommended to ensure the air tightness of the building.
- The solar thermal water heating system should incorporate appropriate safety devices and controls to regulate temperatures and pressures within the system. Temperature and pressure relief valves should be provided for pipes and tanks receiving hot water or steam.
- Provisions should be made to prevent scalding: A thermostatic mixing valve or a tempering valve can limit the temperature of water delivered to the bathrooms and kitchens.

B. Option 2: Thermodynamic Water Heating

- The heat pump should be located outside in close proximity to the areas of hot water use (e.g. bathroom, kitchen, ablution room) to minimise transmission losses. In case of a split system, the distance between the heat pump outside and the hot water storage tank inside should be minimal.
- The incorporation of an inverter or buffer tank is recommended to reduce the likelihood of the heat pump switching on and off unnecessarily.
- The heat pump should comply with the minimum COP specified in the article 401.03 'HVAC Efficiency & Controls'.
- Sufficient space should be left around the heat pump components to enable maintenance access.
- The heat pump should be located on a south facing wall to obtain a higher source temperature. Adequate air flow should be available around the unit.
- The pipes, ducts and hot water storage tanks should be insulated to reduce heat losses.
- Possible emergency back-up systems are electric immersion heaters and boilers.
- The heat pump and associated hot water storage tank and thermodynamic solar panels (if applicable) may change the loads imposed on the structure of the building. This is to be considered in the structural design.
- All pipes, collectors or fixings that penetrate the building envelope should be properly weather protected and sealed. Caulking of small gaps around the pipes is recommended to ensure the air tightness of the building.
- Condensation disposed by the heat pump should be drained appropriately.
- The heat pump system should incorporate appropriate safety devices and controls to regulate temperatures and pressures within the system. Temperature and pressure relief valves should be provided for pipes and tanks receiving hot water or steam.
- Provisions should be made to prevent scalding: A thermostatic mixing valve or a tempering valve can limit the temperature of water delivered to the bathrooms and kitchens.

Submission Stage and Evidence:

A. Option 1: Solar Thermal Water Heating

Design Stage:

- Annual domestic hot water demand calculation
- Design calculations for the solar thermal water heating system
- Structural dead and live load calculations demonstrating that the roof has the capacity to support the solar thermal water heaters
- Architectural drawings which indicate the location of the solar thermal water heating equipment
- Extract of the tender specifications, material schedule or bill of quantities indicating the solar thermal water heating requirement

Additional evidence if less than 75% of the domestic hot water demand is provided by the solar thermal water heating systems (due to the limited available Net Roof Area):

- Barjeel Tool - Solar Zone Calculator
- Roof drawings indicating the following:
  - Location of the solar thermal water heaters
  - Total Net Roof Area
  - MEP equipment and vents location

- Areas reserved for maintenance
- Skylights (if applicable)
- Helipads (if applicable)

Construction Stage:

- Technical product information or datasheet of the solar thermal water heating system
- Date-stamped photos showing the installed solar thermal water heating system

B. Option 2: Thermodynamic Water Heating

Design Stage:

- Annual domestic hot water demand calculation
- Design calculations for the thermodynamic water heating system
- Structural dead and live load calculations demonstrating that the additional loads have been considered
- Architectural drawings which indicate the location of the thermodynamic water heating equipment
- Extract of the tender specifications, material schedule or bill of quantities indicating the thermodynamic water heating requirement

Construction Stage:

- Technical product information or datasheet of the thermodynamic water heating system
- Date-stamped photos showing the installed thermodynamic water heating system

403.02 Onsite PV Readiness

Intent:

To integrate design consideration for future photovoltaic (PV) installation into the original building design, thus improving the feasibility and potential benefits of a future rooftop PV system installation on the building.

Rooftop PV installations already offer substantial energy cost savings compared to utility power supply in many cases, and their economic and technical viability is expected to improve in the future. Investment in a solar-ready roof offers substantial cost savings compared to retrofitting an existing building roof for a PV system.

Applicable Building Types:

Residential		Commercial		Public	
Residential Building (> 1,000 m^2 BUA)	☑	Office Building (> 1,000 m^2 BUA)	☑	Mosque & Worship Building (> 1,000 m^2 BUA)	☑
Staff, Labour and Student Accommodation (> 1,000 m^2 BUA)	☑	Retail & Showroom (> 1,000 m^2 BUA)	☑	Government Building	☑
Hospitality		Mall & Shopping Centre	☑	Educational Facility	☑
Hotel, Motel	☑	Laboratory	☑	Healthcare Facility	☑
Hotel Apartment	☑			Exhibition & Festival Centre, Sports Facility	☒
Resort	☑			Other Public Building	☑

Requirements:

A. Option 1: Solar Ready Zone

- The total area of the solar zone shall be at least 30% of the Net Roof Area of the building.
- The Net Roof Area of the building for the purpose of this calculation is the net roof area after excluding the area of any skylights, helipads and solar water heating equipment from the gross roof area of the building. The area of any sloping roofs, roof decks, terraces, swimming pools, HVAC equipment and vents and areas for maintenance access must be included in the Net Roof Area.
- The total solar zone of a building may be composed of multiple separate sub-areas. A sub-area cannot be narrower than 1.5 m in any dimension.
- The solar zone may be situated at any of the following locations:
  - Roof or overhang of the building, including roof decks or terraces
  - Roof or overhang of an accessory structure (covered parking, service block, gazebo, etc.) located within 75m of the building
- The solar zone shall be free of any pipes, exhaust or intake vents, architectural features, skylights, or other building system equipment. This requirement is in place so that the solar zone remains clear for the installation of a future PV system.
- The distance of any rooftop equipment or obstruction from the solar zone shall be at least two times the height of the highest point of the obstruction, so as to minimise the shading of the solar zone by the obstructions. This requirement does not apply to equipment or obstructions located North of the entire solar zone.
- A solar zone located on a sloping roof surface with a slope greater than 10° to the horizontal is permitted only if the roof is oriented between 100° and 260° of true north (not magnetic north). This ensures adequate exposure to direct solar radiation for a future PV system.
- A solar zone may be positioned above a usable roof deck, terrace, swimming pool or above rooftop equipment only if it is otherwise not feasible to dedicate 30% of the Net Roof Area as a solar zone. In this case, a shading structure capable of supporting a future PV installation must be considered in the design and its structural foundations must be constructed. The solar zone would be considered to be on this structure, and not directly on the roof deck, terrace, swimming pool and/or equipment.
- The weight of the PV panels (dead weight of 25 kg/m^2) must be considered in the structural design of the building, including the supporting structures (if any) above usable roof decks, terraces or above rooftop equipment.
- A pathway shall be reserved for routing an electrical conduit from the solar zone to the point of interconnection with the electrical utility service (the electricity meter room or utility area).
- An area shall be reserved for inverters and metering equipment necessary for the future PV systems, either on the roof of the building, or in the electricity meter room or utility area of the building. This area shall not count towards the total solar zone area requirement. The allocated space should be appropriately sized for a PV system that would cover the entire solar zone.

B. Option 2: PV Installation

Projects shall install a PV system on an area equivalent to 30% of the Net Roof Area. The PV system must be connected to the building.

C. Option 3: Optimised Building Envelope Performance

Projects unable to comply with Option 1 or Option 2, shall compensate with a lower average wall u-value of 0.4 W/m²K.

Exception(s):

Residential and commercial buildings with more than 10 floors do not have to comply with this requirement.

Guideline:

A. Option 1: Solar Ready Zone

- Minimise all other rooftop equipment and aggregate it as much as possible in a single part of the roof in order to leave ample contiguous space for a future rooftop PV system.
- Consider the PV system weight in the structural design of the entire roof and additional terrace support structures.

- In case a sloping roof is desired, design it with maximum area of the roof sloping gently towards the south, to maximise the roof area eligible for the solar zone.

B. Option 2: PV Installation

- Calculate the Net Roof Area and identify feasible locations for the PV installation. The PV modules should be allocated in a suitable space that is free from shading from neighbouring buildings or adjacent structures. A shading study can help to analyse the impacts of permanent or seasonal shading on the proposed location.

C. Option 3: Optimised Building Envelope Performance

- Increase the wall insulation to achieve an average wall u-value of 0.4 W/m²K.

Submission Stage and Evidence:

A. Option 1: Solar Ready Zone

Design Stage:

- Barjeel Tool - Solar Zone Calculator
- Detailed roof plan indicating the following areas:
  - Solar zone
  - Total Net Roof Area
  - Shading Structure (if applicable)
  - Skylights (if applicable)
  - Solar water heaters (if applicable)
  - Helipads (if applicable)
- Schematic diagram showing the pathway reserved for the electrical conduit between the PV system and the building's electrical network
- Structural dead and live load calculations demonstrating that the additional dead and live loads have been considered for the solar zone

Construction Stage:

- Date-stamped photos of the completed roof showing that the solar zone area is free of obstructions
- Date-stamped photos of the shading structure foundation (if applicable)

B. Option 2: PV Installation

Design Stage:

- Barjeel Tool Solar Zone Calculator
- Architectural drawings which indicate the location of the PV equipment
- Design of the PV system
- Extract of the tender specifications, material schedule or bill of quantities indicating the PV requirement

Construction Stage:

- Technical product information or datasheet of the PV system
- Date-stamped photos of the installed PV system

C. Option 3: Optimised Building Envelope Performance

Refer to the design and construction stage evidence outlined in 401.01 'Building Envelope Performance'

403.03 Charging Facilities for Electric and Hybrid Vehicles

Intent:

To encourage public adoption of Electric Vehicles (EVs) and hybrid vehicles by ensuring the availability of EV charging facilities at major public, commercial, residential and recreational buildings.

EVs emit significantly less greenhouse gas emissions than conventional gasoline or diesel-powered vehicles. Thus, EVs directly improve the air quality of urban areas and can mitigate climate change. EVs are expected to become a mainstream technology, and the widespread presence of EV charging facilities is an enabler of large-scale EV adoption.

Applicable Building Types:

Residential		Commercial		Public	
Residential Building (> 1,000 m^2 BUA)	☒	Office Building (> 1,000 m^2 BUA)	☒	Mosque & Worship Building (> 1,000 m^2 BUA)	☒
Staff, Labour and Student Accommodation (> 1,000 m^2 BUA)	☒	Retail & Showroom (> 1,000 m^2 BUA)	☒	Government Building	☑
Hospitality		Mall & Shopping Centre	☑	Educational Facility	☒
Hotel, Motel	☑	Laboratory	☒	Healthcare Facility	☒
Hotel Apartment	☑			Exhibition & Festival Centre, Sports Facility	☒
Resort	☑			Other Public Building	☒

Requirements:

- All building types must provide EV charging provisions in accordance with Table 17. In addition to this, government buildings shall provide EV charging stations in accordance with Table 17.
- For EV charging provisions, the electrical load for future EV charging stations shall be considered and electrical cabling has to be provided. However, the EV charging unit does not yet need to be installed.
- The spaces with EV charging units shall be available to all building visitors and occupants, and must not be reserved for any specific personnel, building occupants or any other purpose.
- Provision of adequate signage for the EV parking spots.

Table 17 Comprehensive Green Building Regulations – EV Charging Stations

Total No. of Car Parking Spaces	Minimum No. of EV Charging Provisions - For All Building Types	Minimum No. of Parking Spaces with EV Charging - For Government Buildings Only
Less than 20	0	0
Between 20 and 49	0	1
Between 50 and 99	1	1
Between 100 and 200	3	1
More than 200	4	2

Guideline:

- Calculate the total number of car parking spaces as per the regulations to determine the minimum number of EV charging stations and EV charging provisions as per Table 17.
- Indicate and label the location of the EV charging station and EV charging provisions in the car parking plans. It is recommended to provide the EV charging spots near the entrances to further encourage EV adoption.
- The impact of the EV charging station should be included in the electrical load calculations to ensure the electrical system will handle the extra load from the EV charging stations.
- Comply with the relevant requirements (if any) of the utility provider before installing EV charging stations.

Submission Stage and Evidence:

Design Stage:

- Barjeel Tool - EV Charging Station Calculator
- Car parking plan indicating the EV charging stations and EV charging provisions
- Electrical plans showing the point of connection to the power supply and the EV charging station and EV charging provisions
- Extract of the tender specifications or bill of quantities indicating the EV charging station requirements

Construction Stage:

- Technical product information or datasheet of the EV charging stations
- Date-stamped photos of installed EV charging units at the indicated parking locations

404 Chapter 4 – Materials & Resources

404.01 Construction Waste Management

Intent:

To reduce the amount of construction waste sent to landfill, thereby reducing the demand for virgin materials.

Applicable Building Types:

Residential		Commercial		Public	
Residential Building (> 1,000 m^2 BUA)	☑	Office Building (> 1,000 m^2 BUA)	☑	Mosque & Worship Building (> 1,000 m^2 BUA)	☑
Staff, Labour and Student Accommodation (> 1,000 m^2 BUA)	☑	Retail & Showroom (> 1,000 m^2 BUA)	☑	Government Building	☑
Hospitality		Mall & Shopping Centre	☑	Educational Facility	☑
Hotel, Motel	☑	Laboratory	☑	Healthcare Facility	☑
Hotel Apartment	☑			Exhibition & Festival Centre, Sports Facility	☑
Resort	☑			Other Public Building	☑

Requirements:

A. At least 25% (by weight or volume) of all construction and demolition waste must be recycled or reused. This requirement applies to all construction waste excluding excavated soil and land-clearing debris.

Construction waste shall be segregated at source to facilitate recycling:

- Clean construction waste such as concrete, excavated soil and grouting mixes
- Mixed recyclables such as plastic, cardboard and paper
- Mixed construction waste such as contaminated plastic, rubber, foam and carpets
- Metal
- Wood
- Hazardous waste

Construction waste must be disposed at suitable facilities designated as such by the RAK Waste Management Agency.

Guideline:

- The following measures can reduce the amount of construction waste:
  - Design for standard length to minimise cut-offs.
  - Avoid over ordering of construction materials.

  - Coordinate with suppliers to minimise unnecessary packaging of construction materials for materials that are not vulnerable to weather damage. Check with suppliers for return of packaging.
  - Store materials appropriately and keep the protective packaging on to avoid damages to the stored materials. Just in time delivery can also reduce the risk of improper storage and weather damage.
  - Carry out works in the correct order to minimise the need for remedial actions.
- The following options could be considered to promote the re-use of materials:
  - Consider options to balance cut and fill quantities on site.
  - Pouring concrete could be phased to allow the re-use of shuttering on the remaining sections.
  - Use cut-offs instead of virgin materials. Ensure cut-offs are stored appropriately so that they are not damaged and can be re-used.
- Construction waste should be segregated to comply with the regulations and to allow for recycling. The following steps should be undertaken:
  - The area allocated for each construction waste stream should be clearly labelled.
  - Ensure the site staff and sub-contractors are aware of the appropriate waste segregation and all specific waste management procedures used at the site.
  - Check the construction waste segregation regularly to ensure the proper waste streams are going into them.
  - Take date stamped photos to track progress. Discuss progress regularly at site meetings and take remediation action if construction waste is not appropriately segregated.
  - All construction waste leaving the site should be tracked. It is recommended to use the Barjeel Tool - Construction Waste Management Tracker to enable accurate tracking of construction waste removed from site.
  - The results of the Construction Waste Management Tracker should be reviewed periodically to ensure the recycling target will be achieved. The waste hauler receipts should be kept for documentation.
  - Clean construction waste should be disposed at the Al Saade reclamation site, mixed construction waste at the Al Jazeera landfill and wood at the cement factories. The contractor should contact the RAK Waste Management Agency to arrange the pick-up of mixed recyclables and hazardous waste. Mixed recyclables can also be directly sold.

Submission Stage and Evidence:

Construction Stage:

- Date-stamped photos showing the construction waste segregation
- Barjeel Tool - Construction Waste Management Tracker

  Waste hauler receipts for recycled waste streams and landfilled waste

404.02 Organic Waste Management

Intent

To reduce the amount of food waste sent to landfill.

Applicable Building Types:

Residential		Commercial		Public	
Residential Building (> 1,000 m^2 BUA)	☒	Office Building (> 1,000 m^2 BUA)	☒	Mosque & Worship Building (> 1,000 m^2 BUA)	☒
Staff, Labour and Student Accommodation (> 1,000 m^2 BUA)	☒	Retail & Showroom (> 1,000 m^2 BUA)	☒	Government Building	☒
Hospitality		Mall & Shopping Centre	☑	Educational Facility	☒
Hotel, Motel	☑	Laboratory	☒	Healthcare Facility	☑
Hotel Apartment	☑			Exhibition & Festival Centre, Sports Facility	☒
Resort	☑			Other Public Building	☒

Requirements

4- & 5-star hotels, malls and shopping centres with food courts and healthcare facilities that provide food must provide a techno-economic evaluation for an on-site organic waste management equipment such as a composter, a digester or a liquefier. The evaluation shall contain the following:

- Waste arising model with the total estimated food waste
- Simple payback time calculation

The evaluated on-site organic waste management option must be implemented if the payback time is less than 7 years.

Guideline

- Estimate the organic waste generation (in kg/day) based on local and international waste generation rates and analyse the estimated cost for organic waste disposal.
- Obtain quotes for organic waste management equipment.
- Calculate the payback time and summarize your findings in a report.

Submission Stage and Evidence:

Design Stage:

- Waste arising model which includes the following:
  - Total estimated food waste
  - Underlying assumptions such as waste generation rates
- Quotations of the selected on-site organic waste management option highlighting the initial investment cost
- Simple payback time calculation which, at a minimum, includes the following:
  - Investment costs in AED

- Annual savings in waste haulage fees in AED
- Expected lifetime of the waste management equipment
- Annual operating costs for the on-site organic waste management equipment in AED

Additional evidence if payback time is less than 7 years:

- Architectural drawing indicating the location of the selected on-site organic waste management equipment
- Extract of the tender specifications or bill of quantities highlighting the on-site organic waste management equipment requirements

Construction Stage:

- Technical product information or datasheet of the on-site organic waste management equipment
- Date-stamped photos of the installation of the on-site organic waste management equipment

404.03 Refrigerant Requirements

Intent:

To minimise the environmental impact of refrigerants.

Refrigerants can have a significant Global Warming Potential (GWP) and/or Ozone Depletion Potential (ODP).

Applicable Building Types:

Residential		Commercial		Public	
Residential Building (> 1,000 m^2 BUA)	☑	Office Building (> 1,000 m^2 BUA)	☑	Mosque & Worship Building (> 1,000 m^2 BUA)	☑
Staff, Labour and Student Accommodation (> 1,000 m^2 BUA)	☑	Retail & Showroom (> 1,000 m^2 BUA)	☑	Government Building	☑
Hospitality		Mall & Shopping Centre	☑	Educational Facility	☑
Hotel, Motel	☑	Laboratory	☑	Healthcare Facility	☑
Hotel Apartment	☑			Exhibition & Festival Centre, Sports Facility	☑
Resort	☑			Other Public Building	☑

Requirements:

- All HVAC & R (HVAC and Refrigeration) equipment and systems must contain refrigerants with zero ODP or with GWP less than 100.
- Fire-fighting equipment must not contain any ozone-depleting substances (such as CFCs, HCFCs, or halons).

Guideline:

- Choose refrigerants with a low ODP and GWP. Assume the ODP and GWP listed in Table 18.
- All CFCs and HCFC-22 do not comply with the ODP and GWP limits and cannot be used for HVAC & R.

Table 18 Comprehensive Green Building Regulations – Refrigerant ODP and GWP

Chlorofluorocarbons (CFCs)	ODP	GWP
CFC-11	1.0	4,680
CFC-12	1.0	10,720
CFC-114	0.940	9,800
CFC-500	0.605	7,900
CFC-502	0.221	4,600
Hydrochlorofluorocarbons (HCFC)	**ODP**	**GWP**
HCFC-22	0.040	1,780
HCFC-123	0.020	76
Hydrofluorocarbons (HFC)	**ODP**	**GWP**
HFC-23	0	12,240
HFC-134a	0	1,320
HFC-245fa	0	1,020
HFC-404A	0	3,900
HFC-407A	0	1,700
HFC-410A	0	1,890
HFC-507A	0	3,900
Natural Refrigerants	**ODP**	**GWP**
Carbon Dioxide (CO_2)	0	1.0
Ammonia (NH_3)	0	0
Propane	0	3

Submission Evidence:

Design Stage:

- Extract of the tender specifications or bill of quantities highlighting the refrigerant requirements

Construction Stage:

- Technical product information or datasheet of the HVAC equipment and of the fire-fighting systems indicating the refrigerant

405 Chapter 5 – Comfort & Well-Being

405.01 VOC Limits

To reduce the concentration of chemical contaminants that can damage air quality and human health.

Applicable Building Types:

Residential		Commercial		Public	
Residential Building (> 1,000 m^2 BUA)	☑	Office Building (> 1,000 m^2 BUA)	☑	Mosque & Worship Building (> 1,000 m^2 BUA)	☑
Staff, Labour and Student Accommodation (> 1,000 m^2 BUA)	☑	Retail & Showroom (> 1,000 m^2 BUA)	☑	Government Building	☑
Hospitality		Mall & Shopping Centre	☑	Educational Facility	☑
Hotel, Motel	☑	Laboratory	☑	Healthcare Facility	☑
Hotel Apartment	☑			Exhibition & Festival Centre, Sports Facility	☑
Resort	☑			Other Public Building	☑

Requirements:

All interior wall and ceiling paints must comply with the following maximum Volatile Organic Compound (VOC) content limits:

Table 19 Comprehensive Green Building Regulations – VOC Content Limit

Interior Paint Type	VOC Limit g/L
Matt (Gloss <25@60°C)	30
Glossy (Gloss >25@60°C)	100

Guideline:

- Include the VOC content limits in the tender documents and verify that procured paints are compliant with the VOC content limits.

Submission Stage and Evidence:

Design Stage:

- Extract of the tender specifications, material schedule or bill of quantities highlighting the VOC limits for paints

Construction Stage:

- Technical product information or datasheet for all interior paints highlighting the VOC content

405.02 Urban Heat Island Effect Reduction

Intent:

To improve outdoor comfort in urban areas by limiting the Urban Heat Island Effect through surface reflectivity and shading requirements.

Applicable Building Types:

Residential		Commercial		Public	
Residential Building (> 1,000 m^2 BUA)	☑	Office Building (> 1,000 m^2 BUA)	☑	Mosque & Worship Building (> 1,000 m^2 BUA)	☑
Staff, Labour and Student Accommodation (> 1,000 m^2 BUA)	☒	Retail & Showroom (> 1,000 m^2 BUA)	☑	Government Building	☑
Hospitality		Mall & Shopping Centre	☑	Educational Facility	☑
Hotel, Motel	☑	Laboratory	☑	Healthcare Facility	☑
Hotel Apartment	☑			Exhibition & Festival Centre, Sports Facility	☒
Resort	☑			Other Public Building	☑

Requirements:

- A minimum of 75% of the building's opaque roof surfaces, excluding roof skylights, green roofs and building equipment (such as solar water heaters, PV equipment, HVAC equipment), must have a minimum initial Solar Reflectance Index (SRI) value as specified below:
  - Sloped Roofs steeper than 1:6: ≥ 29
  - Flat and Low Sloped Roofs: ≥ 78
- The initial SRI of at least 50% of the hardscape area must be ≥ 29.

Guideline:

- Use light coloured roof materials with a high SRI. The indicative SRI values for different coloured materials are listed below:
  - White colour materials (SRI ~ 90)
  - Beige colour materials (SRI ~ 80)
  - Light yellow or light grey materials (SRI ~ 75)

- Use light coloured hardscape materials with a high SRI. The indicative SRI values for different coloured materials are listed below:
  - Typical grey concrete (SRI ~ 35)
  - Typical white concrete (SRI ~ 86)
  - Asphalt (SRI ~ 0)
- Use green roofs

Submission Stage and Evidence:

Design Stage:

- Barjeel Tool - SRI Calculator
- Hardscape drawings indicating the different hardscape materials with the associated hardscape SRI
- Roof drawings indicating the different roof materials and associated SRI
- Extract of the tender specifications, material schedule or bill of quantities highlighting the required SRI

Construction Stage:

- Technical product information or material datasheet indicating the SRI

405.03 Minimum Indoor Air Quality

Intent:

To assure a high degree of indoor air quality for building occupants.

Applicable Building Types:

Residential		Commercial		Public	
Residential Building (> 1,000 m^2 BUA)	☑	Office Building (> 1,000 m^2 BUA)	☑	Mosque & Worship Building (> 1,000 m^2 BUA)	☑
Staff, Labour and Student Accommodation (> 1,000 m^2 BUA)	☒	Retail & Showroom (> 1,000 m^2 BUA)	☑	Government Building	☑
Hospitality		Mall & Shopping Centre	☑	Educational Facility	☑
Hotel, Motel	☑	Laboratory	☑	Healthcare Facility	☑
Hotel Apartment	☑			Exhibition & Festival Centre, Sports Facility	☑
Resort	☑			Other Public Building	☑

Requirements:

All air-conditioned buildings must comply with the minimum ventilation rates of ASHRAE Standard 62.1- 2013.

All particulate matter filters or air cleansers shall have a Minimum Reporting Efficiency Rating (MERV) of 6.

Guideline:

- Complete the Barjeel Tool - Ventilation Calculator.

- If the ventilation calculations indicate that the design does not provide enough outdoor air to meet the ASHRAE 62.1-2013 requirements, revise the design and update the Barjeel Tool - Ventilation Calculator accordingly to confirm compliance.
- Ensure all particulate matter filters and air cleansers achieve at least a rating of MERV 6.

Submission Stage and Evidence:

Design Stage:

- Barjeel Tool - Ventilation Calculator
- Architectural drawings highlighting the occupied areas. The room/space ID in the architectural drawings should be corresponding with the room/space ID in the Barjeel Tool - Ventilation Calculator.
- Extract of the tender specifications, material schedule or bill of quantities highlighting the MERV rating of all particulate matter filters or air cleansers

Construction Stage:

- Technical product information or datasheet indicating the MERV rating of particulate matter filters and/or air cleansers

405.04 Outdoor Thermal Comfort

Intent:

To improve outdoor thermal comfort and minimise outdoor thermal discomfort especially during summer months in public spaces and walkways.

Applicable Building Types:

Residential		Commercial		Public	
Residential Building (> 1,000 m^2 BUA)	☑	Office Building (> 1,000 m^2 BUA)	☒	Mosque & Worship Building (> 1,000 m^2 BUA)	☒
Staff, Labour and Student Accommodation (> 1,000 m^2 BUA)	☒	Retail & Showroom (> 1,000 m^2 BUA)	☒	Government Building	☑
Hospitality		Mall & Shopping Centre	☑	Educational Facility	☑
Hotel, Motel	☑	Laboratory	☒	Healthcare Facility	☑
Hotel Apartment	☑			Exhibition & Festival Centre, Sports Facility	☒
Resort	☑			Other Public Building	☑

Requirements:

The following minimum percentages of shading at 13:00 on equinox must be provided for the listed hardscape areas:

Table 20 Comprehensive Green Building Regulations – Outdoor Shading Requirements

Outdoor Space Type	Minimum% shading
Exterior Surface Parking with more than 10 spaces (including parking on roof surfaces)	45% (30% for all hospitality building types with 3 stars or less) of all parking spaces
Primary Pedestrian Walkways	75%
Playgrounds	50%

Primary pedestrian walkways are defined as walkways connecting the car parking spaces with the main entrances to the buildings.

Where cover is provided by structures such as canopies or other architectural elements, the outer surface of the shading element must have a minimum Solar Reflectance Index (SRI) of 29.

Shade from trees is to be measured at 5-year growth.

Guideline:

- Plant trees or provide shading canopies along primary pedestrian walkways as well as in and around playgrounds.
- Provide shading canopies with an SRI of at least 29 for exterior car parking. Shading canopies could also be used for primary pedestrian walkways and playgrounds.

Submission Stage and Evidence:

Design Stage:

- Site plan indicating the following:
  - Playgrounds
  - Exterior car parking
  - Primary walkways
  - Shading devices and trees
- Extract of the tender specifications or bill of quantities highlighting the SRI of the shading devices
- Barjeel Tool - Outdoor Shading Calculator

Construction Stage:

- Technical product information or datasheet of the shading devices including their SRI

405.05 Smoking and Non-Smoking Zones

Intent:

To improve the well-being of building occupants by eliminating or minimizing exposure to the harmful effects of tobacco smoke.

Applicable Building Types:

Residential		Commercial		Public	
Residential Building (> 1,000 m^2 BUA)	☑	Office Building (> 1,000 m^2 BUA)	☑	Mosque & Worship Building (> 1,000 m^2 BUA)	☑
Staff, Labour and Student Accommodation (> 1,000 m^2 BUA)	☑	Retail & Showroom (> 1,000 m^2 BUA)	☑	Government Building	☑
Hospitality		Mall & Shopping Centre	☑	Educational Facility	☑
Hotel, Motel	☑	Laboratory	☑	Healthcare Facility	☑
Hotel Apartment	☑			Exhibition & Festival Centre, Sports Facility	☑
Resort	☑			Other Public Building	☑

Requirements:

Projects shall comply with the Federal Law No. 15 (year 2009) on tobacco control.

Guideline:

- Develop a non-smoking policy for the building and assign designated smoking areas (if required).
- Indoor smoking areas should be provided with self-closing doors
- The outdoor smoking areas should not be located in close proximity to any entrance or air intake to avoid smoke entering the building.

Submission Stage and Evidence:

Design Stage:

- Site plan indicating the designated smoking areas (if any) and their distance to the closest entrance and air intake.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