1.0	Carpet Systems	404.03
	For all new and existing public and commercial buildings, each new carpet system used must be certified / accredited from Dubai Central Lab or any other source approved by Dubai Municipality (DM). **Carpet are not allowed to be used in labor accommodation, educational facilities or any other places determined by DM**	**Villas** **Residential/ Commercial** **Public Buildings** **Industrial**

2.0 Intent/Goal

- ☐ Ecology and Planning
- ☑ **Building Vitality – Hazardous Materials**
- ☐ Resource Effectiveness: Energy
- ☐ Resource Effectiveness: Water
- ☐ Resource Effectiveness: Materials and Waste

3.0 Background

Good indoor air quality can have a positive effect on the heath and wellbeing of construction workers and building occupants. A number of building products, such as carpet systems (consisting of the carpet, carpet cushion, and carpet adhesive) include compounds that have an adverse impact on indoor air quality. The most prominent of these compounds are Volatile Organic Compounds (VOCs). This regulation seeks to minimise the use of carpet systems that contain certain levels of VOCs.

The installation of some carpet systems can expose building users to contaminants that may be off-gassed from the carpet system materials. The use of carpet systems made of low-emitting materials can minimise the adverse impacts on air quality.

4.0 Applicability

Main Typology Criteria	Typology Subdivisions	New	Existing	Typology Subdivisions	New	Existing
Villa		✓	✓			
Residential/Commercial	**Residential**	✓	✓	**Commercial**	✓	✓
	Apartments	✓	✓	Hotels	✓	✓
	Offices	✓	✓	Resorts	✓	✓
	Labour Accommodation	✓	✓	Restaurants/Food Outlets	✓	✓
	Student Accommodation	✓	✓	Laboratories	✓	✓
Public Buildings	Healthcare Facilities	✓	✓	Retail Outlets	✓	✓
	Educational Facilities	✓	✓	Post Offices	✓	✓
	Government Buildings	✓	✓	Banks	✓	✓
	Worship Houses	✓	✓	Museums	✓	✓
	Petrol Stations	✓	✓	Cinema/theatres	✓	✓
	Shopping Mall	✓	✓	Historical/heritage Buildings*	✓	✓
Industrial	Workshops	✓	✓			
	Factories	✓	✓			
	Warehouses	✓	✓			

5.0 Outcome / Benefit

The use of low-VOC materials will help to minimise air quality problems in buildings. Minimising the amount of indoor air contaminants resulting from the carpets installed in buildings will reduce adverse impacts on the health and well-being of building occupants. Healthy building occupants are more productive and have less illness-related absenteeism.

6.0 Guidance

6.1 General

This regulation covers carpet systems permanently installed in buildings and does not apply to loose fitted rugs and mats.

Many new carpet systems are high emitters of VOCs, and it is important to ensure that high emitting carpet systems are not used in building interiors in Dubai.

Carpets installed in new buildings which meet the requirements of one of the following programs will be considered to have met the requirements of this regulation as it relates to carpets:

- *Carpet and Rug Institute's Green Label/Green Label Plus* Indoor Air Quality Test Program for testing of emissions in carpet; or
- *GuT Carpet Eco-Level* (European scheme); or
- Environmental Certification Scheme of the Carpet Institute of Australia; or
- Dubai Municipality recognised equivalent certification scheme.

Carpet cushions installed in new buildings which meet the requirements of the Carpet and Rug Institute's Green Label Indoor Air Quality Test Program for testing of emissions in carpet cushions or Dubai Municipality recognised equivalent will be considered to have met the requirements of this regulation as it relates to carpet cushions.

All carpet adhesives must meet the requirements included in Regulation 404.01 Low Emitting Materials: Adhesives and Sealants.

6.2 Technical Data and Specifications

Carpet and Rug Institute's (CRI) Green Label program tests carpet, cushions and adhesives to help specifiers identify products with very low emissions of VOCs. Thirteen chemicals are measured during testing of carpets and 15 chemicals for adhesives. CRI has recently launched its next series of improvements called Green Label Plus for carpet and adhesives.

The European carpet industry has taken the lead by creating GUT. In cooperation with officially recognised test houses across Europe, GUT continuously tests products against the highest standards and promotes environmentally friendly solutions for carpet installation as well as recycling projects. GUT certification addresses pollutant, emissions and odour testing. The following are considered:

- Environmentally compatible production
- The absence of any contaminants
- Minimal emissions and odours in new carpet
- Recycling of scrapped carpet and production waste.

The Australian Carpet Classification Scheme (ACCS) classifies carpet systems according to their durability and appearance retention.

- The yellow and blue labels identify carpets that have been graded for residential use. Residential ratings can have a maximum of six stars.
- The gold and black labels identify carpets graded for contract or commercial use.
- The Environmental Certification Scheme (ECS) for carpet is an extension of the Australian Carpet Classification Scheme (ACCS). The ECS has three technical criteria covering Volatile Organic Compound (VOC) emissions, noise reduction and thermal insulation properties that relate to environmental performance. ECS VOC emission limits have been set at, or lower than, the equivalent Green Label Plus limits, and additional VOC's have been added to the CRI list of 13 'chemicals of concern.'

7.0 Compliance

7.1 Responsibilities Matrix

	Consultant or Contractor	User / Operator	DM	DEWA	Other Government Department	3rd party
Design/permit application	✓		✓			
Construction	✓		✓			
Commissioning/Completion	✓		✓			
Operation						
Refurbishment	✓		✓			
Demolition						

7.2 Consultant Document Requirements

Lifecycle Stage	Document Requirements
Design/permit application	*Green Building Declaration* *Completed Self Assessment* *Technical specifications and drawings*
Construction	*Green Building Site File* with orders and delivery notes for the correctly specified materials
Commissioning/Completion	Completed *Green Building Site File*
Operation	n/a
Refurbishment	Any works requiring a building permit from DM are required to comply with the Green Buildings Regulations for Dubai.
Demolition	n/a

8.0 Common Practices / Solutions

There are many internationally recognised certification schemes which identify suitable carpets.

9.0 References.

Carpet and Rug Institute (C&RI) Green Label and Green Label Plus Testing Program, accessed at www.carpet-rug.com

Gemeinschaft umweltfreundlicher Teppichboden (GuT) Carpet Eco-Level, accessed at www.centexbel.be/Eng/product_service_certif_gut.htm

Carpet Institute of Australia (CIAL) Environmental Certification Scheme (ECS), accessed at www.carpetinstitute.com.au/environment/index.htm

1.0 Provision of Natural Daylight

405.01

For all new buildings, other than industrial buildings, provision for adequate natural daylight must be made in order to reduce their reliance on electrical lighting and to improve conditions for the building occupants and provide lighting openings in accordance with Dubai municipality building regulations and specification.

Villas

Residential/ Commercial

Public Buildings

2.0 Intent/Goal

- ☐ Ecology and Planning
- ☑ **Building Vitality – Daylight & Visual Comfort**
- ☐ Resource Effectiveness: Energy
- ☐ Resource Effectiveness: Water
- ☐ Resource Effectiveness: Materials and Waste

3.0 Background

Glazed elements that allow natural light into the interior of buildings have become one of the most important architectural features of the modern buildings of Dubai. This trend has often led to over glazed facades which result in higher cooling loads and unnecessary increased energy consumption. At the same time, large glazed surfaces in buildings can cause visual discomfort to occupants due to the excessive brightness contrast between the perimeter and the deeper areas of the building. In order to reduce the brightness contrast, occupants tend to reduce the amount of light entering the building by dropping the internal blinds and then switching on the lights. For this reason the use of tinted glass is increasingly common in new buildings in Dubai. However, heavily tinted glazing reduces the amount of light transmitted to an extent that often the interior requires electrical lighting permanently.

A well considered daylighting approach in buildings will not only reduce the incidence of glare and discomfort but also reduce the need for electrical lighting if part of an integrated daylight strategy with lighting controls. A successful daylight design can represent energy savings of 15-20%. The factors affecting the design and control of daylight in buildings include: required internal illumination, size of the windows or glazed elements, properties of the glass, surrounding obstructions, colour of the internal surfaces, and sky conditions over the year. All these factors therefore should be brought together and be considered early during the conceptual design stages. Architectural elements can also be used to divert daylight into the building.

4.0 Applicability

Main Typology Criteria	Typology Subdivisions	New	Existing	Typology Subdivisions	New	Existing
Villa		✓				
Residential/Commercial	**Residential**	✓		**Commercial**	✓	
	Apartments	✓		Hotels	✓	
	Offices	✓		Resorts	✓	
	Labour Accommodation	✓		Restaurants/Food Outlets	✓	
	Student Accommodation	✓		Laboratories	✓	

	Offices	✓		Resorts	✓	
	Labour Accommodation	✓		Restaurants/Food Outlets	✓	
	Student Accommodation	✓		Laboratories	✓	
Public Buildings	Healthcare Facilities	✓		Retail Outlets	✓	
	Educational Facilities	✓		Post Offices	✓	
	Government Buildings	✓		Banks	✓	
	Worship Houses	✓		Museums	✓	
	Petrol Stations	✓		Cinema/theatres	✓	
	Shopping Mall	✓		Historical/heritage Buildings*	✓	
Industrial	Workshops					
	Factories					
	Warehouses					

5.0 Outcome/ Benefit

Provision of daylight can reduce energy use for artificial lighting, therefore contributing to the reduction of carbon emissions and energy expenditure.

As a main contributor to a healthy environment and the wellbeing of occupants, the provision of natural light in commercial buildings can also help reduce absenteeism and increase productivity of workers. Natural light also provides occupants with a connection to the outdoor environment by allowing them to adapt to natural changes of daylight levels through the day.

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6.0 Guidance

6.1 General

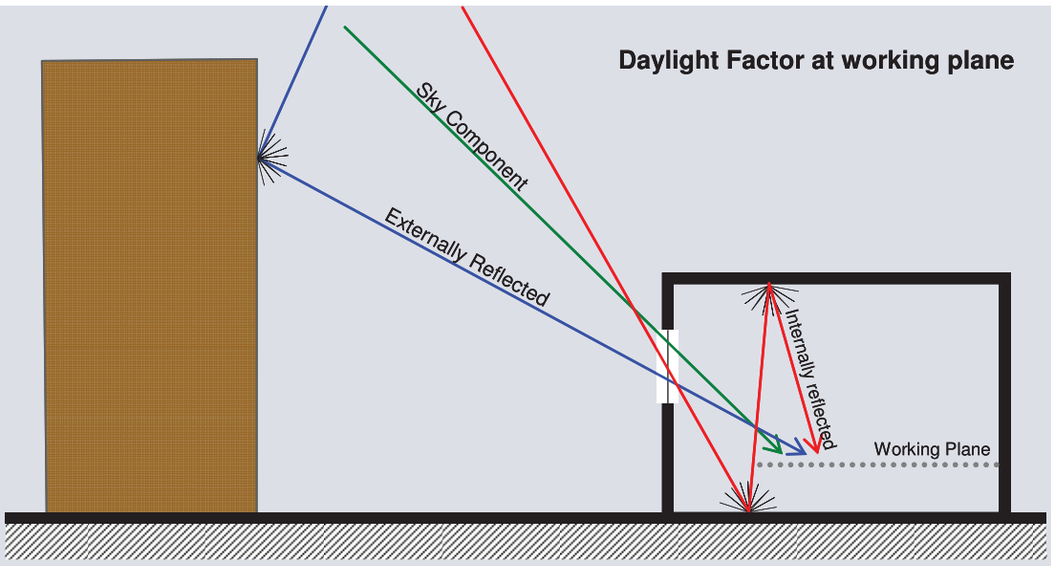
Multi-use building: For the purpose of this regulation each portion of the building with a different usage shall meet the compliance requirements for that usage type.

Daylight Factor

The Daylight Factor (DF) is the proportion of the total illumination falling at a given point in a room that comes from external illumination from an unobstructed sky. The Daylight Factor is expressed as a percentage.

The Daylight Factor is composed of three components which relate to the three possible light paths from the sky: the *Sky Component*: the amount of light coming directly from the sky based on the CIE Standard Overcast Sky; the *Externally Reflected Component*: the light from the sky that is reflected off the outside surfaces and subsequently directed into the room, and the *Internally Reflected Component* which is the proportion of light reflected from surfaces within the room.

Figure 405.01 (1): Components for Daylight Factor.



DF = Sky Component + Externally Reflected Component + Internally Reflected Component

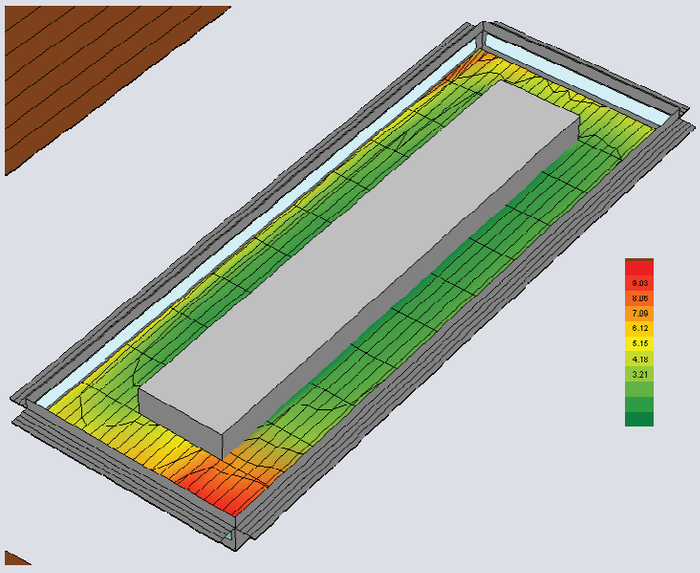
The Daylight Factor is defined as:

$$DF = \left(\frac{E_{in}}{E_{out}} \right) \times 100\%$$

Where:

E_{in} is the average interior illuminance
E_{out} is the unobstructed horizontal outdoor illuminance

Figure 405.01 (2): Use of computer modelling for the calculation of Daylight Factors.



Average Daylight Factor (ADF)

The Average Daylight Factor is the average value of the Daylight Factor within a room and can be used as an indicator of the overall daylight levels in a room. However the ADF is a single average value and does not assess whether the daylight is evenly distributed throughout the room. This can be addressed through the Brightness Contrast or the Uniformity Ratio.

The ADF within a space is a function of the size of each window, the type of glazing, the amount of sky visible from each window and the overall reflectance of the internal surfaces.

The following formula can be used to calculate the ADF:

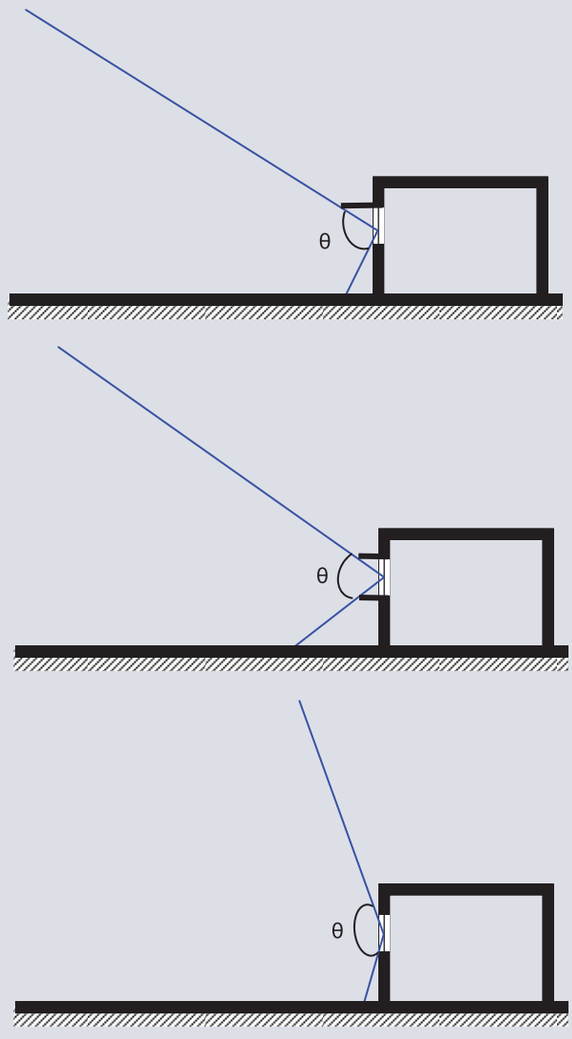
$$DF_{avg} = \sum \frac{T \times W \times \theta}{A \times (1 - R^2)}\%$$

Where:

T = Transmission of glazing (0-1). Includes corrections for dirt on glass and any blinds/curtains;
W = Net glazed area of the window (m^2);
θ = Angle of vertical view from the centre of the window (degrees),
A = Total internal surface area, wall, floors ceilings and glazing (m2), and
R = Average reflectance of surfaces (0-1).

The Angle of vertical view from the centre of the window is measured as shown in the figure below:

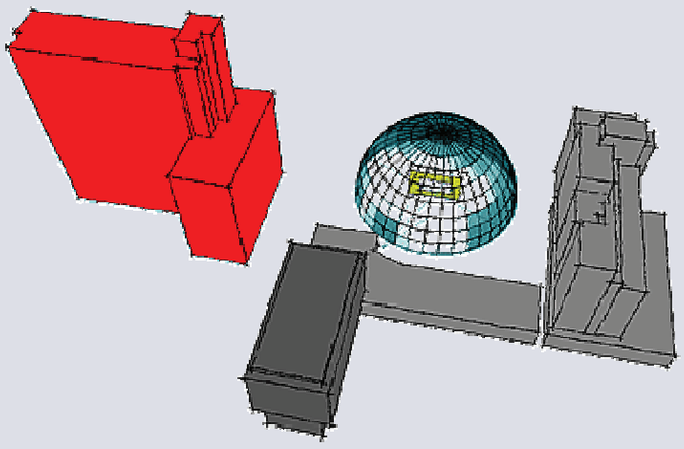
Figure 405.01 (3): θ is the angle subtended, in the vertical plane normal to the window, by sky visible from the centre of the window.



This approach can be effectively applied for hand-calculations. However greater accuracy, design efficiency, speed and flexibility can be obtained through computer modelling.

The illustration below produced by computer modelling shows a shading mask mapped over a dome. It clearly shows how the surrounding buildings produce areas of obstruction over the dome. The computer model can take into account the geometry of the zone of interest, the glazing properties, the reflectance of materials and the shape and size of external obstructions.

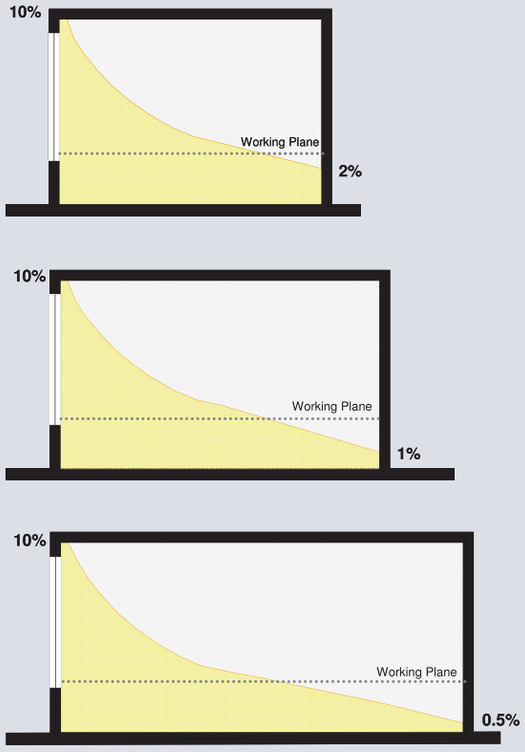
Figure 405.01 (4): Angle of visible sky modelled in a computer software. Image taken from Square1 – Ecotect v5.5



Brightness Contrast Ratio

As the distance from the window increases the Daylight Factors decrease. Consequently, the back of deep narrow rooms would be darker than at the perimeter, even if the Average Daylight Factor meets the required level. The brightness contrast ratio is defined as the ratio of the level of daylight at the back of the room to that at the front of it. The following images illustrate this concept.

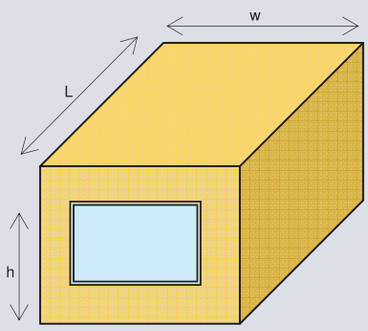
Figure 405.01 (5): Examples of brightness contrast ratio



If the room is lit from one side the following rule should apply:

The depth (L) of the room would not exceed the value given by the equation on Figure 405.01 below.

Figure 405.01 (6): The Limiting Depth Rule



$$\frac{L}{w}+\frac{L}{h}\leq\frac{2}{(1-R_b)}$$ where,

L = Depth of room (from window to back wall)
w = Width of room (across window wall)
h = height from the top of the window to the floor
R_b = Area weighted average reflectance in the back half of the room

6.2 Technical Data and Specifications

This regulation requires that the applicant undertakes daylight calculations using the principles described above. The use of computer software is encouraged because it allows easy data processing and testing of options.

Technical data for daylight calculations and guidance for interior daylighting can be found in CIBSE Application Manual, The British standard for daylighting and the other technical guidance documents listed in section 9.

7.0 Compliance

7.1 Responsibilities Matrix

	Consultant or Contractor	User / Operator	DM	DEWA	Other Government Department	3rd party
Design/permit application	✓		✓			
Construction						
Commissioning/Completion	✓		✓			
Operation						
Refurbishment	✓		✓			
Demolition						

7.2 Consultant Document Requirements

Lifecycle Stage	Document Requirements
Design/permit application	*Green Building Declaration* *Completed Self Assessment* Window schedule and calculations
Construction	n/a
Commissioning/Completion	Completed *Green Building Site File*
Operation	n/a
Refurbishment	Any works requiring a building permit from DM are required to comply with the Green Buildings Regulations for Dubai.
Demolition	n/a

8.0 Common Practices / Solutions

The main building rating systems all encourage the use of natural light within buildings. For example, LEED credits a minimum glazing factor of 2% for a minimum of 75% of occupied areas. BREEAM credits for daylight factor of 2% for 80% of work spaces.

9.0 References.

Dubai municipality building regulations and specification

The Chartered Institution of Building Services Engineers (CIBSE) Daylight and Window Design. Lighting Guide LG10: 1999.

British Standards Institution. Code of practice for daylighting. British Standard BS 8206 Part 2

Towards Green Buildings: Glass as a Building Element – The Use and Misuse in the Gulf Region. Aboulnaga M. 2005.

Site Layout Planning for Daylight and Sunlight, A Guide to Good Practice, BRE 1995.

Environmental Design Guide for Naturally Ventilated and Daylit Offices. Rennie D. & Parand F. BRE

The Chartered Institution of Building Services Engineers (CIBSE) Guide A Environmental Design, August 2001.

Daylighting in Buildings, Energy Research Group, University College of Dublin for the European Commission, Directorate-General for Energy, 1994.

1.0	Views	405.02
	All new office, residential and public buildings must provide direct line of sight (views) to the outdoor environment in accordance with Dubai municipality building regulation and specification.	Residential/ Commercial Public Buildings

2.0 Intent/Goal

- ☐ Ecology and Planning
- ☑ **Building Vitality – Daylight & Visual Comfort**
- ☐ Resource Effectiveness: Energy
- ☐ Resource Effectiveness: Water
- ☐ Resource Effectiveness: Materials and Waste

3.0 Background

The use of natural light and the access to outdoor views creates a stimulating environment for building occupants reduces eyestrain and has been shown to improve productivity in the workplace.

4.0 Applicability

Main Typology Criteria	Typology Subdivisions	New	Existing	Typology Subdivisions	New	Existing
Villa		✓				
Residential/Commercial	**Residential**			**Commercial**		
	Apartments	✓		Hotels	✓	
	Offices	✓		Resorts	✓	
	Labour Accommodation	✓		Restaurants/Food Outlets	✓	
	Student Accommodation	✓		Laboratories		
Public Buildings	Healthcare Facilities	✓		Retail Outlets	✓	
	Educational Facilities	✓		Post Offices	✓	
	Government Buildings	✓		Banks	✓	
	Worship Houses	✓		Museums	✓	
	Petrol Stations	✓		Cinema/theatres	✓	
	Shopping Mall	✓		Historical/heritage Buildings*	✓	
Industrial	Workshops					
	Factories					
	Warehouses					

5.0 Outcome/ Benefit

Regularly occupied areas of the building will have access to views of the outside. The provision of views can substantially contribute to energy conservation due to the increased natural light reducing the need for electrical lighting. The provision of views to the outside allows building occupants to connect with the outdoor environment and is known to increase building occupants' productivity and reduce eyestrain and other health problems.

6.0 Guidance

6.1 General

The following considerations should be taken into account when calculating the areas of offices from which views are provided:

- Interior office spaces. The entire area of interior office spaces may be included in the calculation if at least 75% of each area has direct line of sight to perimeter vision glazing.
- Multi-occupant spaces. The calculation shall only include the square metres with direct line of sight to perimeter vision glazing.

Regularly occupied areas in a building exclude copy/printing rooms, storage areas, mechanical spaces, restrooms, auditoria, and other intermittently or infrequently occupied spaces or spaces where daylight would interfere with the use of the space.

The following consideration should be taken into account for residential buildings:

- Areas which may be excluded from the definition of habitable spaces include interior bathrooms, laundry rooms or other service areas;
- The 90% line of sight criteria is for habitable spaces only.

The calculations must consider that line of sight can pass through interior glazing, but not through doorways with solid doors.

Views that are obstructed from the room due to interior walls, other obstructions or views through a roof or high level window are not considered "views" for the purpose of the calculations for this requirement.

6.2 Technical Data and Specifications

A direct line of sight is required through vision glazing. A line of sight may be drawn through internal glazing.

7.0 Compliance

7.1 Responsibilities Matrix

	Consultant or Contractor	User / Operator	DM	DEWA	Other Government Department	3rd party
Design/permit application	✓		✓			
Construction	✓		✓			
Commissioning/Completion	✓		✓			
Operation						
Refurbishment	✓		✓			
Demolition						

7.2 Consultant Document Requirements

Lifecycle Stage	Document Requirements
Design/permit application	*Green Building Declaration* *Completed Self Assessment* *Technical specifications and drawings*
Construction	n/a
Commissioning/Completion	Completed *Green Building Site File*
Operation	n/a
Refurbishment	Any works requiring a building permit from DM are required to comply with the Green Buildings Regulations for Dubai.
Demolition	n/a

8.0 Common Practices / Solutions

A number of building rating systems encourage the provision of views of the outside environment. For example, LEED awards credits for views from 90% of occupied areas. Similarly, BREEAM awards credits if workstations or desks are within 7 metres of a window.

9.0 References.

No documents referenced.

1.0	Legionella Bacteria and Building Water Systems	406.01

For all new and existing buildings must apply the technical guidelines issued by Dubai Municipality which includes:

A. **All water systems and networks which creates a water spray or aerosol including but not limited to cooling towers, evaporative condensers, hot and cold water systems, showers, evaporative air coolers, spas, fountains, misters, ..etc must be periodically maintained, cleaned, disinfected and checked periodically to minimize the risk of Legionella bacteria or germs contamination in accordance with the technical guidelines issued by Dubai Municipality regarding the control of Legionella bacteria in water systems.**

B. **All water systems equipments and accessories including but not limited to potable water network, hot and cold water systems, water tanks, pumps, pipes and fittings, must be maintained, cleaned and disinfected.**

C. **Sampling and testing must be carried out for the presence of bacteria / germs and Legionella bacteria**

D. **All equipments and devices of swimming pools, spa pools, whirlpool baths, hydrotherapy pools and Jacuzzi must be maintained, cleaned, disinfected and checked periodically.**

E. **All equipments and devices of irrigation system must be maintained, cleaned, disinfected and checked periodically.**

Specialized companies approved by Dubai Municipality must do water tests and sampling. All test results must be recorded and kept along with the records of maintenance and remedial works at site to be checked by Dubai Municipality

Villas

Residential/ Commercial

Public Buildings

Industrial

2.0 Intent/Goal

- ☐ Ecology and Planning
- ☑ **Building Vitality – Water Quality**
- ☐ Resource Effectiveness: Energy
- ☐ Resource Effectiveness: Water
- ☐ Resource Effectiveness: Materials and Waste

3.0 Background

Legionnaires' disease is a potentially fatal form of pneumonia which can affect anybody, but which principally affects those who are susceptible because of age, illness, immunosuppression, smoking etc. It is caused by the bacterium *Legionella pneumophila* and related bacteria. Legionella bacteria can also cause less serious illnesses which are not fatal or permanently debilitating. The collective term used to cover the group of diseases caused by legionella bacteria is legionellosis.

Legionella bacteria are common and can be found naturally in environmental water sources such as rivers, lakes and reservoirs, usually in low numbers. Legionella bacteria can survive under a wide variety of environmental conditions and have been found in water at temperatures between 6°C and 60°C. Water temperatures in the range 20°C to 45°C seem to favour their growth.

As legionella bacteria are commonly encountered in environmental sources they may eventually colonise manufactured water systems and be found in cooling tower systems, hot and cold water systems and other plant which use or store water. To reduce the possibility of creating conditions in which the risk from exposure to legionella bacteria is increased, it is important to control the risk by introducing measures which:

(a) do not allow proliferation of the organisms in the water system; and
(b) reduce, so far as is reasonably practicable, exposure to water droplets and aerosol

Legionella bacteria also require a supply of nutrients to multiply. This can include, for example, commonly

encountered organisms within the water system itself such as algae, amoebae and other bacteria. The presence of sediment, sludge, scale and other material within the system, together with biofilms, is also thought to play an important role in harbouring and providing favourable conditions in which the legionella bacteria may grow. A biofilm is a thin layer of micro-organisms which may form as a slime on the surfaces in contact with water. Such biofilms, sludge and scale can protect legionella bacteria from temperatures and concentrations of biocide that would otherwise kill or inhibit these organisms if they were freely suspended in the water.

A number of measures can be taken to prevent disease. These activities can be influenced by good engineering and maintenance practices. A variety of aerosol-producing devices have been associated with outbreaks of Legionnaires' disease including: cooling towers, evaporative condensers, showers, whirlpool spas, humidifiers, decorative fountains, and misters. Transmission via cooling towers and evaporative condensers have been the most commonly documented. This regulation focuses on two key aspects of prevention for cooling water towers: system treatment and maintenance.

4.0 Applicability

Main Typology Criteria	Typology Subdivisions	New	Existing	Typology Subdivisions	New	Existing
Villa		✓	✓			
Residential/Commercial	**Residential**	✓	✓	**Commercial**	✓	✓
	Apartments	✓	✓	Hotels	✓	✓
	Offices	✓	✓	Resorts	✓	✓
	Labour Accommodation	✓	✓	Restaurants/Food Outlets	✓	✓
	Student Accommodation	✓	✓	Laboratories	✓	✓
Public Buildings	Healthcare Facilities	✓	✓	Retail Outlets	✓	✓
	Educational Facilities	✓	✓	Post Offices	✓	✓
	Government Buildings	✓	✓	Banks	✓	✓
	Worship Houses	✓	✓	Museums	✓	✓
	Petrol Stations	✓	✓	Cinema/theatres	✓	✓
	Shopping Mall	✓	✓	Historical/heritage Buildings*	✓	✓
Industrial	Workshops	✓	✓			
	Factories	✓	✓			
	Warehouses	✓	✓			

5.0 Outcome/ Benefit

This regulation focuses on methods to minimise the Legionella bacteria contamination in building water systems, specifically in cooling towers. It provides specific environmental and operational guidelines that will contribute to the safe operation of building water systems relative to cooling towers with the intent of minimising the risk of occurrence of Legionnaires' disease.

6.0 Guidance

6.1 General

Experience has shown that cooling towers, evaporative condensers and hot and cold water systems in a wide variety of workplaces present a risk of exposure to legionella bacteria. Other systems, such as humidifiers and air washers, spa baths and pools, car/bus washes, wet scrubbers, indoor fountains and water features also present a risk.

A water system includes all plant/equipment and components associated with that system, e.g. all associated pipe-work, pumps, feed tanks, valves, showers, heat exchangers, quench tanks, chillers etc. It is important that the system is considered as a whole and not, for example, the cooling tower in isolation. Deadlegs and parts of the system used intermittently, e.g. test loops in engineering factories, injection moulding machines, also need to be included as part of the system since they can create particular problems with microbial growth going unnoticed. Once brought back on-line they can cause heavy contamination, which could disrupt the efficacy of the water treatment regime.

The key aspects of this regulation are that the water system be kept clean and that a biocidal treatment program be used.

Maintenance

Keeping the system clean reduces the nutrients available for Legionella growth. Regular visual inspections by the maintenance staff should be made. To avoid the build-up of dirt, organic matter or other debris, the cold water basin of the cooling unit should be cleaned regularly. Mechanical filtration can be used to help reduce this debris.

Operations and maintenance records should include the following information:

- System schematic;
- System water volume, with date and method of determination;
- Manufacturer's instructions for equipment operation;
- Regular water treatment procedures;
- Material Safety Data Sheets for Chemicals used (MSDS);
- Names of persons responsible for system operation and shutdown;
- Dates of inspections and results of inspections;
- Dates of routine maintenance and activities accomplished; and
- Dates of equipment repairs or modifications of work done.

Treatment

A complete water treatment programme based on the physical and operating parameters for the cooling system and a thorough analysis of the make-up water should be established. The components of the water treatment programme should be environmentally acceptable and comply with any local discharge requirements.

It is important to ensure that water treatment programmes have sufficient range of adjustment to cope with any potential variations in make-up water supply quality. This enables control to be maintained. Failure to take account of variations in quality may lead to the rapid development of uncontrolled microbiological conditions within the cooling system.

There are a number of factors which will influence the effectiveness of any treatment programme:

(a) corrosion;
(b) scale formation;
(c) fouling; and
(d) microbiological activity.

They are interrelated and failure to control any one may lead to all occurring simultaneously, resulting in an environment that encourages the growth of legionella. In setting up an effective monitoring and control system, it should be remembered that corrosion, scale formation and fouling are continuous physico-chemical processes and inhibitors to control such processes should be added on a continuous basis.

All components of the treatment programme should be preferably be dosed by pump or eductor (sometimes referred to as an ejector) systems or by a suitable halogen dosing system such as a brominator. This will minimise health and safety risks to operators and ensure that frequencies and rates of application are maintained as recommended.

Microbiological Activity

The operating conditions of a cooling system provide an environment in which micro-organisms can proliferate. The water temperatures, pH conditions, concentration of nutrients, presence of dissolved oxygen, carbon dioxide, sunlight, together with large surface areas all favour the growth of micro-organisms such protozoa, algae, fungi and bacteria, including legionella.

Problems arise when micro-organisms are allowed to grow or flourish to excess. This can result in the formation of biofilms on system surfaces which can:

(a) cause a reduction in heat transfer;
(b) harbour legionella and provide an environment for their growth;
(c) induce highly localised microbial corrosion;
(d) interfere with the effectiveness of corrosion inhibitors;
(e) trap particulate matter, increasing the problem of fouling; and
(f) disrupt water distribution within the tower.

Biocides are used to control microbiological activity. They should prevent the proliferation of micro-organisms but are not required to disinfect systems. Biocides can be oxidising or non-oxidising. Controlling biocide levels, i.e. the frequency and quantity of additions, will depend on the microbiological activity of the system.

Biocides, when correctly selected, applied and controlled, as part of a comprehensive water treatment programme, have been shown to be effective in preventing the proliferation of legionella. Many factors will influence the selection of chemicals required for the treatment programme. However, the success of the treatment programme is dependent on:

(a) compatibility of all chemical components used; and
(b) adherence at all times, to the recommended application, monitoring and control procedures.

Biocides are routinely applied at the tower sump or the suction side of the recirculating water pump but should be dosed so that the biocide will circulate throughout the cooling system. However, in air-conditioning systems, where the tower can be bypassed, the biocide needs to be added to the suction side of the recirculating pump.

It is also recommended that the services of a qualified water treatment specialist be used to define and oversee the treatment programme. If a sample of water taken from the cooling tower has a heterotrophic colony count exceeding 100,000 colony forming units per millilitre, the water of the system must be manually treated with additional quantities of biocide (or an alternative biocide). Further, the water treatment program, tower operation and maintenance program of the system must be reviewed. Any faults must be corrected and changes be made to prevent a re-occurrence of those faults. If Legionella is further detected, the responsible person must ensure the water of the cooling tower system is disinfected, cleaned and re-disinfected.

Testing is not a substitute replacement for sound maintenance practices and water treatment.

6.2 Technical Data and Specifications

For further information on the subject of water treatment, see:

Dubai Municipality technical guidelines regarding the control of Legionella bacteria in water systems>

The “Water Treatment” chapter in the Applications volume of the ASHRAE Handbook,

The American Society for Testing and Materials “Standard Guide for Inspecting Water Systems for Legionella, and Investigating Possible Outbreaks for Legionellosis (Legionnaires’ Disease or Pontiac Fever)”, or

Legionnaires’ disease – The control of Legionella bacteria in water systems, Approved Code of Practice and Guidance, (L8) Health and Safety Commission, England

7.0 Compliance

7.1 Responsibilities Matrix

	Consultant or Contractor	User / Operator	DM	DEWA	Other Government Department	3rd party
Design/permit application	✓		✓			
Construction						
Commissioning/Completion	✓		✓			
Operation						
Refurbishment	✓		✓			
Demolition						

7.2 Consultant Document Requirements

Lifecycle Stage	Document Requirements
Design/permit application	*Green Building Declaration* *Completed Self Assessment*
Construction	n/a
Commissioning/Completion	Completed *Green Building Site File*
Operation	Legionella testing record
Refurbishment	Any works requiring a building permit from DM are required to comply with the Green Buildings Regulations for Dubai.
Demolition	n/a

8.0 Common Practices / Solutions

Legionnaires' disease is recognised internationally as a serious potential health hazard. Requirements for the control of this bacterium are stricter in some countries is based on an overall risk management programme.

9.0 References.

Dubai Municipality technical guidelines regarding the control of Legionella bacteria in water systems.

ASHRAE Guideline -- Minimizing the Risk of Legionellosis Associated with Building Water Systems

American Society for Testing and Materials (ASTM) Standard Guide for Inspecting Water Systems for Legionellae, and Investigating Possible Outbreaks for Legionellosis (Legionnaires' Disease or Pontiac Fever)

Legionnaires' disease – The control of Legionella bacteria in water systems, Approved Code of Practice and Guidance, (L8) Health and Safety Commission, England

1.0	Water Quality of Water Features	406.02
	For all new and existing buildings, all Water Features with a water storage volume of over 1,000 liters and which creates a water spray or aerosol including but not limited to waterfalls, ponds, streams, ...etc must be maintained, cleaned, disinfected and checked periodically to minimize the risk of Legionella bacteria or germs contamination and not exceed the maximum limits outlined in the technical guidelines issued by Dubai Municipality	**Villas** **Residential/ Commercial** **Public Buildings** **Industrial**

2.0 Intent/Goal

- ☐ Ecology and Planning
- ☑ **Building Vitality – Water Quality**
- ☐ Resource Effectiveness: Energy
- ☐ Resource Effectiveness: Water
- ☐ Resource Effectiveness: Materials and Waste

3.0 Background

The water in water features is prone to contamination from the surrounding environment or from contact with people or animals. Regular maintenance and testing of the water is required to ensure that any contamination does not become a general health hazard.

The ambient temperatures in Dubai are within the range that encourages growth of Legionella bacteria and therefore the maintenance and testing measures required by Regulation 406.01 must also be carried out for water features covered by this regulation.

4.0 Applicability

Main Typology Criteria	Typology Subdivisions	New	Existing	Typology Subdivisions	New	Existing
Villa		✓	✓			
Residential/ Commercial	**Residential**	✓	✓	**Commercial**	✓	✓
	Apartments	✓	✓	Hotels	✓	✓
	Offices	✓	✓	Resorts	✓	✓
	Labour Accommodation	✓	✓	Restaurants/Food Outlets	✓	✓
	Student Accommodation	✓	✓	Laboratories	✓	✓
Public Buildings	Healthcare Facilities	✓	✓	Retail Outlets	✓	✓
	Educational Facilities	✓	✓	Post Offices	✓	✓
	Government Buildings	✓	✓	Banks	✓	✓
	Worship Houses	✓	✓	Museums	✓	✓
	Petrol Stations	✓	✓	Cinema/theatres	✓	✓
	Shopping Mall	✓	✓	Historical/heritage Buildings*	✓	✓
Industrial	Workshops	✓	✓			
	Factories	✓	✓			
	Warehouses	✓	✓			

5.0 Outcome / Benefit

This regulation focuses on methods to control contamination in building water features. It provides specific environmental and operational guidelines that will contribute to the safe operation of building water features relative to cooling towers with the intent of minimising the risk of occurrence of Legionnaires' disease.

6.0 Guidance

6.1 General

The key aspects of this regulation are that the water features be maintained clean and that a regular regime of testing be in place.

Keeping the system clean reduces the nutrients available for bacteria growth. Regular visual inspections should be made. To avoid the build-up of dirt, organic matter or other debris, the water basin of the water feature should be cleaned. Mechanical filtration can be used to help reduce this debris.

The need for testing is only as a check whether these actions have been performed adequately. Should non-compliant test results be obtained, the inspection, cleaning and maintenance regimes must be revised.

The test parameters have been selected as those which impact most on the quality of water in Dubai and which could indicate a potential treat to public health.

Total Chemical Oxygen Demand (TCOD) may be used to indirectly measure the amount of organic compounds in water. Monitoring levels of COD determines the amount of organic pollutants found in surface water, making COD a useful measure of water quality. It is expressed in milligrams per liter (mg/L), which indicates the mass of oxygen consumed per litre of solution.

Total Biochemical Oxygen Demand (TBOD) is a measure of the oxygen used by microorganisms including the

bacteria responsible for decomposing organic waste. If there is a large quantity of organic waste in the water, there will also be a lot of bacteria present working to decompose this waste. In this case, the demand for oxygen will be high (due to all the bacteria) so the BOD level will be high. As the waste is consumed BOD levels will begin to decline.

Coliform is a family of bacteria common in soils, plants and animals. The coliform family is made up of several groups, one of which is the fecal coliform group, which is found in the intestinal tracts of warm-blooded animals including humans. The presence of fecal coliform in drinking water or at swimming sites is evidence that human or animal waste has been or is present. This may be cause for concern because many diseases can be spread through fecal transmission.

- The presence of some fecal material in lakes, ponds and rivers is to be expected as part of the environment in which we live. As long as the level of fecal coliform bacteria is low, human contact is relatively safe.
- In drinking water, however, any fecal coliform presence is a warning sign that action should be taken.

A water feature includes all plant/equipment and components associated with that system, e.g. all associated pipe-work, pumps, feed tanks, valves etc. It is important that the system is considered as a whole and not, for example, the visible feature in isolation. Deadlegs and parts of the system used intermittently also need to be included as part of the system, since they can create particular problems with microbial growth going unnoticed. Once brought back on-line they can cause heavy contamination, which could disrupt the efficacy of the water treatment regime.

6.2 Technical Data and Specifications

The requirements of Regulation 406.01 must be met.

Testing must be carried out using methods or laboratories approved by Dubai Municipality.

7.0 Compliance

7.1 Responsibilities Matrix

	Consultant or Contractor	User / Operator	DM	DEWA	Other Government Department	3rd party
Design/permit application						
Construction						
Commissioning/Completion						
Operation		✓	✓			
Refurbishment						
Demolition						

7.2 Consultant Document Requirements

Lifecycle Stage	Document Requirements
Design/permit application	Green Building Declaration Completed Self Assessment
Construction	n/a
Commissioning/Completion	Completed Green Building Site File
Operation	Records of water testing and records of mitigation action
Refurbishment	Any works requiring a building permit from DM are required to comply with the Green Buildings Regulations for Dubai.
Demolition	n/a

8.0 Common Practices / Solutions

Water features where the water may come into contact with people are recognised as being potential health hazards. Legionnaires' disease is recognised internationally as a serious health risk.

9.0 References.

Dubai Municipality technical guidelines regarding the control of Legionella bacteria in water systems.

ASHRAE Guideline 12-2000 Minimizing the Risk of Legionellosis Associated with Building Water Systems

American Society for Testing and Materials (ASTM) Standard Guide for Inspecting Water Systems for Legionella, and Investigating Possible Outbreaks for Legionellosis (Legionnaires' Disease or Pontiac Fever)

Legionnaires' disease – The control of Legionella bacteria in water systems, Approved Code of Practice and Guidance, (L8) Health and Safety Commission, England

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Resource Effectiveness: Energy

- Conservation and Efficiency: Building Fabric
- Conservation and Efficiency: Building Systems
- Commissioning & Management
- On-Site Systems: Generation & Renewables

1.0 Minimum Envelope Performance Requirements

501.01

Villas

Residential/ Commercial

Public Buildings

Industrial

For all new air conditioned buildings, exterior building elements must have average thermal transmittance (also known as U Value) and Shading Coefficients (SC) that do not exceed the values specified and Light Transmittance greater than or equal to the values specified.

A. External Walls, Roofs, and Floors:

Building elements forming the external walls, roofs, and floors (where one side of the floor is exposed to ambient conditions) must have an average thermal transmittance (U Value) which does not exceed the following values:

Roof	U= 0.3 W/m^{2}K
External Wall	U= 0.57 W/m^{2}K

If the floor is in contact with the ground, the insulation should only be applied to one meter (1m) in from the perimeter of the building.

Glazed elements with back insulated panels must be treated as walls (and therefore must meet the performance requirement for walls).

B. Glazed Elements - Fenestration:

1. If the total area of external walls that let in light is forty per cent (40%) or less of the external wall area, then the glazing elements must meet the following performance criteria:

Thermal Transmittance (Summer U value)	U= 2.1 W/m^{2}K (max)
Shading Coefficient (SC)	0.4 (max)
Light Transmittance	0.25 (min)

2. If the total area of external walls that let in light is between forty percent (40%) and sixty percent (60%) of the external wall area, then the glazing elements must meet the following performance criteria:

Thermal Transmittance (Summer U value)	U= 1.9 W/m^{2}K (max)
Shading Coefficient (SC)	0.32 (max)
Light Transmittance	0.1 (min)

3. If the total area of external walls that let in light is sixty percent (60%) or greater of the external wall area, then the glazing elements must meet the following performance criteria:

Thermal Transmittance (Summer U value)	U= 1.9 W/m^2.K (max)
Shading Coefficient (SC)	0.25 (max)
Light Transmittance	0.1 (min)

4. **For shopfronts and showrooms, other than those at ground floor level, glazing elements must meet the following performance criteria:**

Thermal Transmittance (Summer U value)	**U= 1.9 W/m^{2}K (max)**
Shading Coefficient (SC)	**0.76 (max)**

5. **If the glazing portion of a roof is ten percent (10%) or less of the roof area then the glazing elements must meet the following performance criteria:**

Thermal Transmittance (Summer U value)	**U= 1.9 W/m^2.K (max)**
Shading Coefficient (SC)	**0.32 (max)**
Light Transmittance	**0.4 (min)**

6. **If the glazing portion of a roof is greater than ten percent (10%) of the roof area then the glazing elements must meet the following performance criteria:**

Thermal Transmittance (Summer U value)	**U= 1.9 W/m^2.K (max)**
Shading Coefficient (SC)	**0.25 (max)**
Light Transmittance	**0.3 (min)**

2.0 Intent/Goal

- ☐ Ecology and Planning
- ☐ Building Vitality
- ☑ **Resource Effectiveness: Energy – Conservation and Efficiency: Building Fabric**
- ☐ Resource Effectiveness: Water
- ☐ Resource Effectiveness: Materials and Waste

3.0 Background

Ventilation and air conditioning equipment in Dubai's buildings has been shown to account for up to 60% of the total energy consumed in buildings. The majority of this energy is used to provide cooling to achieve comfortable conditions for building users.

The thermal performance of the building envelope is one of the main drivers in determining what the cooling load and resultant energy use will be. The building envelope thermal performance is dependent upon the heat transfer characteristics of each building envelope element (U-value) i.e. walls, roof, floor and glazing.Thermal performance requirements were introduced for Dubai buildings in 2003 (DM Administrative Resolution 66 of 2003)and have resulted in much better thermal performance of buildings erected since that time. This regulation consolidates the 2003 requirements and has added light transmittance and addition values for high glazing ratios.

Building envelope thermal performance is dependent upon the heat transfer coefficient (U-value) of each building envelope element i.e. walls, roof, floor and glazing. The type of glazing systems and the percentage of the façade which is glazed have the largest impacts on the energy used in a building. Better thermal performance by the building envelope will reduce the energy demand for cooling and so these properties must be incorporated into new buildings.

Experience has shown that suitable materials to meet the requirements of this regulation are available in Dubai. Many materials with better thermal performance are also available and being used; however these are not yet available in sufficient numbers to supply all new buildings in Dubai. For this reason, most of the existing values in the 2003 regulations have not been increased in the 2009 version of the Green Building Regulations. Minimum light transmittance values have been added to the glazed elements. It is important to achieve a balance between restricting the amount of heat transmitted into the building and achieving a good level of natural light to provide suitable levels of illumination while reducing energy use. By requiring a minimum level of light transmittance to complement the shading co-efficient, a balance should be achieved.

4.0 Applicability

Main Typology Criteria	Typology Subdivisions	New	Existing	Typology Subdivisions	New	Existing
Villa		✓				
Residential/Commercial	**Residential**			**Commercial**		
	Apartments	✓		Hotels	✓	
	Offices	✓		Resorts	✓	
	Labour Accommodation	✓		Restaurants/Food Outlets	✓	
	Student Accommodation	✓		Laboratories	✓	
Public Buildings	Healthcare Facilities	✓		Retail Outlets	✓	
	Educational Facilities	✓		Post Offices	✓	
	Government Buildings	✓		Banks	✓	
	Worship Houses	✓		Museums	✓	
	Petrol Stations	✓		Cinema/theatres	✓	
	Shopping Mall	✓		Historical/heritage Buildings*	✓	
Industrial	Workshops	✓				
	Factories	✓				
	Warehouses	✓				

5.0 Outcome / Benefit

Climate is one of the largest environmental considerations in building design and construction. The external walls, roof and glazed areas must take into account the climate to maximise the thermal performance.

Improving the performance of a building's thermal envelope in Dubai's climate will result in lowered air conditioning requirements, reduced energy use, and reduced load on building machinery. This equates to reduced energy costs and lowered maintenance costs. The better the thermal performance of the building, the greater the ability to control the comfort and liveability of the building.

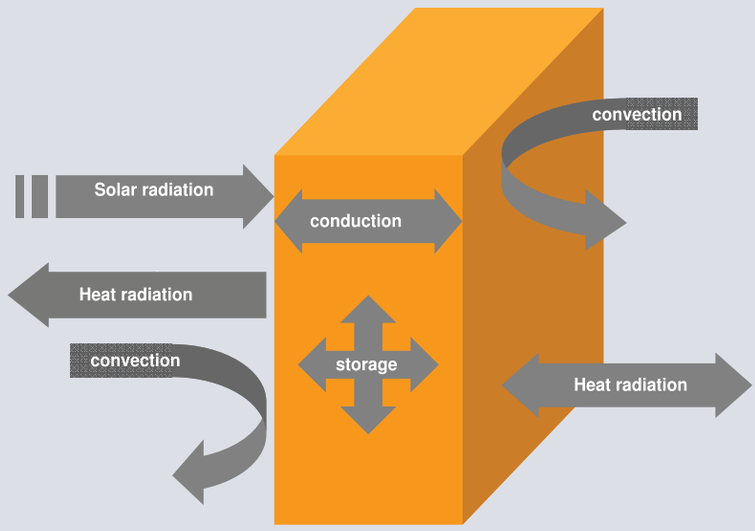
6.0 Guidance

6.1 General

The specific requirements of the U-values, shading coefficient and minimum light transmittance are detailed in this regulation.

The *U-value* or *air-to-air Thermal Transmittance* is a measure of the rate of heat transfer through a material or assembly. U-values are expressed in units of Watts per square meter per degree Kelvin (W/m^2K) which describes the amount of heat (Watts) transferred through an area (square meters) for every degree (Kelvin) difference in temperature. In the context of buildings, the higher the U-value, the greater the heat transferred between the inside and out. Heat transfer occurs due to the thermal gradient between the inside and outside.

Figure 501.01 (1): Diagram illustrating the forms of heat transfer through a wall



U-values for windows are for the entire window assembly, which includes the frame and any bridging elements. It is anticipated that if aluminium window frames are to be used, they will need to incorporate thermal breaks to meet the required standards.

Heat can also be transmitted into a building through windows by direct and indirect solar radiation. The ability to control this heat gain through windows is measured in terms of the shading coefficient (SC) and the solar heat gain coefficient (SHGC) of the window. The shading coefficient (SC) is the ratio of the amount of heat passing through glazing compared with that through a single clear pane of glass. The shading coefficient is derived by comparing the solar heat transmission, convection (through absorption and re-radiation), and conduction properties of any pane of glass (or glazing assembly).

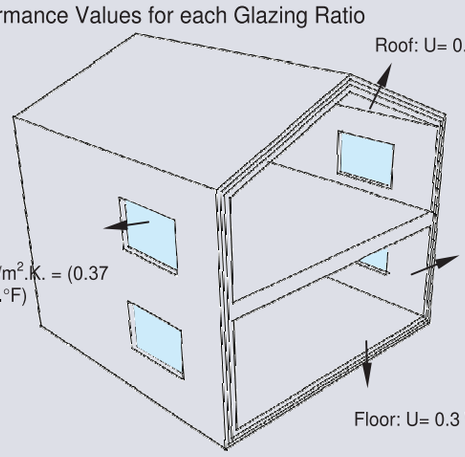
The following equation shows the relation between shading coefficient (SC) and solar heat gain coefficient (SHGC):

SGHC=SC*0.87

The SC is expressed as a number between 0 and 1. The lower a window's SHGC or SC, the less solar heat it transmits, and the greater it’s shading ability.

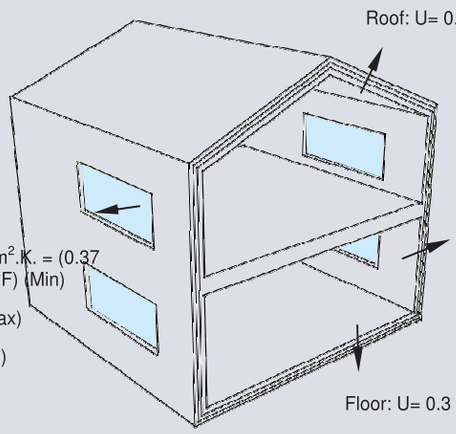
The proposed new envelope performance values recognise that the glazing area is an important consideration and that greater areas will require better glazing characteristics. The new regulations define three glazing area ranges: up to 40% of the façade, up to 60% of the façade and greater than 60%. The diagrams below illustrate graphically how the proposed values will be applied for the different glazing ratios.

Figure 501.01 (2): Envelope Performance Values for each Glazing Ratio



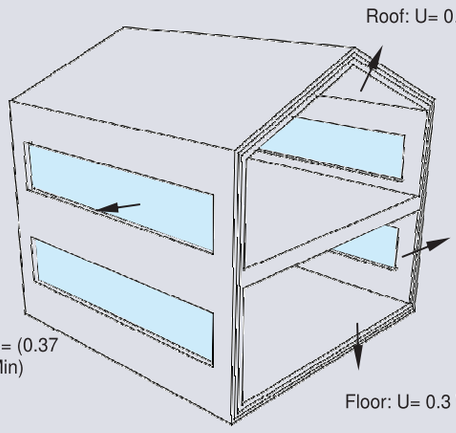
Glazing (U)	= 2.1 W/m^2.K. = (0.37 Btu/h.ft^2.°F)
Shading Coefficient (SC)	=0.4
Light Transmittance	=0.25

Glazing area <=40% Wall area



Glazing (U)	= 1.9 W/m^2.K. = (0.37 Btu/h.ft^2.°F) (Min)
Shading Coefficient (SC)	=0.32 (Max)
Light Transmittance	=0.1 (Min)

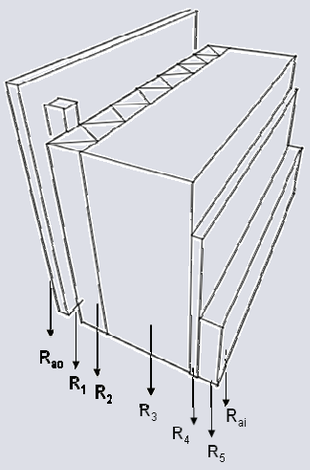
40%<Glazing area <60% Wall area



Glazing (U)	= 1.9 W/m^2.K. = (0.37 Btu/h.ft^2.°F) (Min)
Shading Coefficient (SC)	=0.25 (Max)
Light Transmittance	=0.1 (Min)

Glazing area =>60% Wall

Figure 501.01 (3): Illustration of construction layers of a building envelope element which defines the overall thermal resistance of the building.



The U value of a building element can be calculated using the following equation:

$$U = \frac{1}{R_{ao} + R_1 + R_2 + R_3 + R_4 + R_5 + R_{ai}}$$

Where U is heat transfer coefficient (W/m^2) and R is thermal resistance of the different construction layers, (m^{2}K/W). R_{ai} and R_{ao} are different values for air resistance inside and outside the wall, roof or floor. The R value for each material can be calculated with the equation:

$$R_1 = \frac{\lambda_1}{d_1}$$

Where R is the thermal resistance (m^{2}K/W), d is the thickness of material (m) and λ is the thermal conductivity (W/mK) of the material.

For further information on the calculation of U-values, refer to CIBSE Guide A3 2006.

It is recommended that the design of the building envelope aims to decrease the U values as much as possible. Typically the individual elements of the building envelope that have the greatest impact on overall thermal performance are windows, roof and walls, in that order. Therefore, these should be the order of priority for reducing the U values. In particular, it is recommended that building designers consider glazing systems with thermal performance better than required by these regulations as the savings in energy consumption and costs can be significant.

6.2 Technical Data and Specifications

Manufacturers and suppliers of building materials must provide the thermal and optical specifications for their materials to allow building designers to be able to show compliance with this regulation and to allow calculation of the performance criteria for composite building elements.

7.0 Compliance

7.1 Responsibilities Matrix

	Consultant or Contractor	User / Operator	DM	DEWA	Other Government Department	3rd party
Design/permit application	✓		✓			
Construction	✓		✓			
Commissioning/Completion	✓		✓			
Operation						
Refurbishment	✓		✓			
Demolition						

7.2 Consultant Document Requirements

Lifecycle Stage	Document Requirements
Design/permit application	Green Building Declaration Completed Self Assessment Architectural & MEP plans and specifications
Construction	n/a
Commissioning/Completion	Completed Green Building Site File
Operation	n/a
Refurbishment	Any works requiring a building permit from DM are required to comply with the Green Buildings Regulations for Dubai.
Demolition	n/a

8.0 Common Practices / Solutions

Heating or cooling of buildings are the major areas of energy use in buildings internationally. The best means of controlling energy use is by ensuring that buildings are designed and constructed to provide the most efficient thermal performance for local climatic conditions. Most countries now regulate the thermal performance of building envelopes; the requirements vary between countries based on their climate. Building rating systems usually address energy use as a total rather than the elemental envelope performance but this performance greatly affects energy used.

9.0 References

Administrative Resolution No 66 -2003 'Approving Regulations on the Thermal Specifications for Thermal Insulation Systems and Control of Energy Consumption for Air-Conditioned Buildings in the Emirate of Dubai', Dubai Municipality

The following references are examples of guidance for design specification that will assist designers in ensuring compliance with the requirements of this Regulation:

Guide for Thermal Insulation in Buildings - Dubai Municipality, 2005

CIBSE Energy efficiency in buildings' The Chartered Institution of Building Services Engineers, 2004

CIBSE Environmental Design Guide A' The Chartered Institution of Building Services Engineers, 2006 (Chapter 3 Thermal Properties of Building Structures)

1.0	Thermal Bridging	501.02
	For all new conditioned buildings, Thermal Bridges, such as connection points between concrete or steel beams, external walls and columns and around doors and windows, which enable the flow of heat from outside into the building, must be eliminated or insulated to reduce the amount of heat transfer.	Villas Residential/ Commercial Public Buildings Industrial

2.0 Intent/Goal

- ☐ Ecology and Planning
- ☐ Building Vitality
- ☑ **Resource Effectiveness: Energy – Conservation and Efficiency: Building Fabric**
- ☐ Resource Effectiveness: Water
- ☐ Resource Effectiveness: Materials and Waste

3.0 Background

Considerable effort goes into the selection and installation of the building wall and roof elements to ensure that the required level of control of thermal transfer between the outside and indoor conditions is achieved. It is important to identify building elements with high heat transfer coefficients (U-values) that potentially could provide a path for heat transfer which bypasses the main building insulation. Such elements are called 'thermal bridges'. The most effective means to control unwanted thermal transfer is to eliminate these thermal bridges. When thermal bridges cannot be eliminated, they should be insulated to reduce their impact on heat transfer.

Thermal bridges include, but are not limited to: wall/roof junctions, connection points between concrete or steel beams, external walls and columns, and around doors and windows.

4.0 Applicability

Main Typology Criteria	Typology Subdivisions	Applies to:	Typology Subdivisions	Applies to:
Villa	Private	✓		
	Investment	✓		
Residential/ Commercial	**Residential**	✓	**Commercial**	✓
	Apartments	✓	Hotels	✓
	Offices	✓	Resorts	✓
	Labour Accommodation	✓	Restaurants/Food Outlets	✓
	Student Accommodation	✓	Laboratories	✓
Public Buildings	Healthcare Facilities	✓	Retail Outlets	✓
	Educational Facilities	✓	Post Offices	✓
	Government Buildings	✓	Banks	✓
	Worship Houses	✓	Museums	✓
	Petrol Stations	✓	Cinema/theatres	✓
	Shopping Mall	✓	Historical/heritage Buildings*	✓
Industrial	Workshops	✓		
	Factories	✓		
	Warehouses	✓		

5.0 Outcome/ Benefit

The intent is to minimise the amount of heat transferred into or away from a building through elements which provide an easy route for heat transfer. Reduced thermal bridging will result in improved performance of a building's thermal envelope and, therefore, reduced energy consumption, lowered air conditioning requirements and reduced load on building machinery. By reducing heat gain into the building, it will be easier to provide an ideal indoor environmental comfort level for the building occupants.

6.0 Guidance

6.1 General

Thermal bridges must be eliminated or insulated to reduce the amount of heat transfer. The building fabric shall be constructed such that there are no readily avoidable thermal bridges in the insulation layers caused by gaps within the various elements, at joints between elements, and at the edges of elements, e.g. around door and window openings. The building fabric shall be constructed to minimise air leakage through the thermal elements.

The main purpose of thermal insulation is to reduce conductive heat flow through the building envelope, thereby reducing energy consumption associated with cooling. Insulation should be considered as an assembly instead of a material, since it is constructed in different forms for a variety of applications. In addition to the physical properties of insulation material, other design elements of the insulation are also critical for its performance, such as its location within walls and roofs, its sequencing with respect to other layers in assembly, its interface with surrounding or penetrating materials, and the continuity within and between insulating components.

When a highly conductive material, such as steel, is positioned in parallel with an insulating material, the majority of the heat transfer occurs through the metal, which offers less resistance to heat flow. The steel "bridges" across the insulation, creating an easier path for heat to flow. Therefore, thermal bridging occurs when certain building elements enable the flow of heat from outside into the building.

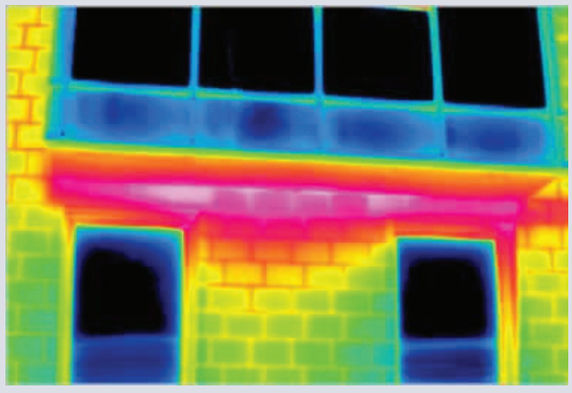


Figure 501.02(1): Thermal bridge caused by structural beam below balcony window Image courtesy of RENSolutions.co.uk

6.2 Technical Data and Specifications

U.K.'s Department for Communities and Local Government, Accredited Construction Details Guide, Section 1 - Introduction and general theory of insulation continuity and air tightness (June 2007) provides some examples of best practice in reducing the impact of thermal bridges. The document includes recommendations for several construction types (masonry walls, timber frame, and steel frame), as well as for junction types (external wall, ground floor, intermediate floor, internal wall, roof eaves, flat roof, roof gable, and windows and doors).

7.0 Compliance

7.1 Responsibilities Matrix

	Consultant or Contractor	User / Operator	DM	DEWA	Other Government Department	3rd party
Design/permit application	✓		✓			
Construction	✓		✓			
Commissioning/Completion	✓		✓			
Operation						
Refurbishment	✓		✓			
Demolition						

7.2 Consultant Document Requirements

Lifecycle Stage	Document Requirements
Design/permit application	*Green Building Declaration* *Completed Self Assessment* Architectural & *MEP plans and specifications*
Construction	*Green Building Site File* with orders and delivery notes for the correctly specified materials
Commissioning/Completion	Completed *Green Building Site File*
Operation	n/a
Refurbishment	Any works requiring a building permit from DM are required to comply with the Green Buildings Regulations for Dubai.
Demolition	n/a

8.0 Common Practices/ Solutions

There are a number of building guides which recommend means of reducing their impact., including:

Leeds Metropolitan University, Centre for the Built Environment
http://www.leedsmet.ac.uk/as/cebe/projects/lowcarb4real/lc4r_des_bridging.pdf

*BS 5250: 2002*Code of practice for control of condensation in buildings *Section 8*

9.0 References

Guide for Thermal Insulation in Buildings - Dubai Municipality, 2005

Department for Communities and Local Government, Accredited Construction Details Guide, Section June 2007) is available free on-line from http://www.planningportal.gov.uk/england/professionals/en/1115314255826.html

1.0 Air Conditioning Design Parameters

501.03

Villas

Residential/ Commercial

Public Buildings

Industrial

For all new air conditioned buildings, the heat load must be calculated in accordance with the following design parameters.

A) Outdoor Condition of the Building

Dry bulb temperature	**46°C (115°F)**
Wet bulb temperature	**29°C (85°F)**
Dubai City location latitude	**(North Latitude) 25°N**
Extent of variation in the temperature on the day of design (Outdoor Daily Range)	**13.8°C (25°F)**

B) Indoor Condition of the Building

Dry bulb temperature	**24°C (75° F)**
Relative humidity	**50% +/- 5%**

- **The heat transfer coefficients to be used in the calculations for roofs, walls, and glazed areas must be the actual design coefficients, or as set out in Regulation 501.01 Minimum Envelope Performance Requirements.**
- **When diversity factors to be used in the calculation of heat load are not known, the coefficients set out in the 2005 ASHRAE Handbook – Fundamentals must be used.**

C) The safety factor applied must be no greater than:

Sensible Heat	**10%**
Latent Heat	**5%**

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

2.0 Intent/Goal

- ☐ Ecology and Planning
- ☐ Building Vitality
- ☑ **Resource Effectiveness: Energy – Conservation and Efficiency:**
- ☐ Resource Effectiveness: Water
- ☐ Resource Effectiveness: Materials and Waste

3.0 Background

The design of the ventilation and air conditioning equipment for a building is based on the projected amount of cooling (or heating) required. The climatic conditions in Dubai have a significant impact on the cooling requirements and these must be considered when calculating the load.

The design parameters specified in this regulation are consistent with those detailed in Dubai Municipality Administrative Resolution No 66 2003, as these are still considered to be appropriate for the climate of Dubai.

The expected heat load for each building must be calculated and the details submitted to Dubai Municipality as part of the building permitting process. The designers may use the actual values for the building elements that will be used in the building. If building-specific parameters are not used, those in this regulation have been established as suitable for Dubai's conditions.

4.0 Applicability

Main Typology Criteria	Typology Subdivisions	New	Existing	Typology Subdivisions	New	Existing
Villa		✓				
Residential/ Commercial	**Residential**			**Commercial**		
	Apartments	✓		Hotels	✓	
	Offices	✓		Resorts	✓	
	Labour Accommodation	✓		Restaurants/Food Outlets	✓	
	Student Accommodation	✓		Laboratories	✓	
Public Buildings	Healthcare Facilities	✓		Retail Outlets	✓	
	Educational Facilities	✓		Post Offices	✓	
	Government Buildings	✓		Banks	✓	
	Worship Houses	✓		Museums	✓	
	Petrol Stations	✓		Cinema/theatres	✓	
	Shopping Mall	✓		Historical/heritage Buildings*	✓	
Industrial	Workshops	✓				
	Factories	✓				
	Warehouses	✓				

4.2 Effective Date: Immediate

5.0 Outcome / Benefit

When calculating the heat load during the design of a building, design parameters must be used that consider Dubai's specific climate conditions. Applying these parameters will reduce the possibility of over design of equipment, which in turn should help to reduce capital expenditure on plant equipment and also lead to energy conservation.

6.0 Guidance

6.1 General

When applying for a building permit from Dubai Municipality a number of design details are presently required. One of these requirements is a calculation of the thermal load requirements of the building.

The method of conducting the heat calculations for submittal to Dubai Municipality is detailed on the Dubai Municipality web site.

This regulation does not change the parameters to be used in the calculation and there have been no changes made to the previous design parameters detailed in Dubai Municipality Administrative Resolution No 66 2003, as these are still considered to be appropriate for the climate of Dubai.

7.0 Compliance

7.1 Responsibilities Matrix

	Consultant or Contractor	User / Operator	DM	DEWA	Other Government Department	3rd party
Design/permit application	✓		✓			
Construction	✓		✓			
Commissioning/Completion	✓		✓			
Operation						
Refurbishment	✓		✓			
Demolition						

7.2 Consultant Document Requirements

Lifecycle Stage	Document Requirements
Design/permit application	Green Building Declaration Completed Self Assessment MEP plans and specifications
Construction	Green Building Site File with orders and delivery notes for the correctly specified equipment
Commissioning/Completion	Completed Green Building Site File with the correctly specified equipment approved by DM Central Lab
Operation	n/a
Refurbishment	Any works requiring a building permit from DM are required to comply with the Green Buildings Regulations for Dubai.
Demolition	n/a

8.0 Common Practices/ Solutions

It is common practice to ensure that the design parameters used in heat load calculations reflect the climatic conditions of the country in which they are to be applied.

9.0 References

2005 ASHRAE Handbook – Fundamentals

This covers basic principles and data used in the HVAC&R industry including requirements for Load and Energy Calculations. It is available from the ASHRAE website www.ashrae.org

Administrative Resolution No 66 -2003 'Approving Regulations on the Thermal Specifications for Thermal Insulation Systems and Control of Energy Consumption for Air-Conditioned Buildings in the Emirate of Dubai', Dubai Municipality

1.0 Air Loss from Entrances — 501.04

For all new air conditioned buildings other than villas, all regularly used air conditioned entrance lobbies must be protected by a door design which acts as a barrier to the loss of conditioned air.

Residential/ Commercial

Public Buildings

Industrial

2.0 Intent/Goal

- ☐ Ecology and Planning
- ☐ Building Vitality
- ☑ **Resource Effectiveness: Energy – Conservation and Efficiency: Building Design**
- ☐ Resource Effectiveness: Water
- ☐ Resource Effectiveness: Materials and Waste

3.0 Background

The loss of cooled air from the entrance doors of an air conditioned building can result in significant increased energy use to provide replacement conditioned air. This is a particular concern in Dubai with high outside air temperatures. Entrances to buildings should be designed and installed to reduce the volume of air.

4.0 Applicability

Main Typology Criteria	Typology Subdivisions	New	Existing	Typology Subdivisions	New	Existing
Villa						
Residential/ Commercial	**Residential**			**Commercial**		
	Apartments	✓		Hotels	✓	
	Offices	✓		Resorts	✓	
	Labour Accommodation	✓		Restaurants/Food Outlets	✓	
	Student Accommodation	✓		Laboratories	✓	
Public Buildings	Healthcare Facilities	✓		Retail Outlets	✓	
	Educational Facilities	✓		Post Offices	✓	
	Government Buildings	✓		Banks	✓	
	Worship Houses	✓		Museums	✓	
	Petrol Stations	✓		Cinema/theatres	✓	
	Shopping Mall	✓		Historical/heritage Buildings*	✓	
Industrial	Workshops	✓				
	Factories	✓				
	Warehouses	✓				