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	✓				

5.0 Outcome/ Benefit

Reducing the loss of cooled air from building entrances, will in turn reduce the energy losses from the building. Reduction in air loss from entrances results in energy savings through the reduction of heat transfer between the internal building area and external spaces.

6.0 Guidance

6.1 General

This regulation applies to buildings which have an entrance lobby, i.e. the space immediately between the entrance-door and the interior, which acts as a transition area into the building. It also applies to the main entrances into showrooms.

Main external entrances must include a door design which acts as a barrier to the loss of conditioned air. The building design must consider the door's function, location, and traffic in order to evaluate the best door design to minimise air loss. Some suitable door designs are listed below:

- Revolving doors that minimise heating/cooling losses from air movement and reduce wind effects on door operability.
- An enclosed double door vestibule, with all doors opening into and out of the vestibule equipped with self-closing devices. Vestibules shall be designed so that in passing through the vestibule it is not necessary for the interior and exterior doors to open at the same time. Interior and exterior doors shall have a minimum distance between them of not less than 2 metres when in the closed position.
- Air curtains which only operate when the door is open.
- Any other door designed to protect against loss of air and approved by Dubai Municipality

Note that Dubai Civil Defence has requirements for doors which are suitable for exiting from a building in the event of fire. This regulation does not replace nor supersede any fire egress requirements and additional doors may be required to meet these needs. Additional doors may also be required to provide enabled access.

6.2 Technical Data and Specifications

Door design must be approved by Dubai Municipality.

ASHRAE 90.1 2007 5.4.3.2 specifies that air leakage shall not exceed 5.0 L/s·m2 for glazed swinging entrance doors and for revolving 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 *and façade 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

Many countries encourage door design to minimise the loss of conditioned air from entrance doors. This is even more important in cold countries where the energy required to heat air is even greater than the cooling requirement in Dubai.

9.0 References

ASHRAE 90.1-2007 Energy Standard for Buildings Except Low-Rise Residential Buildings. It is available from the AHRAE website www.ashrae.org

1.0 Air Leakage — 501.05

All new air conditioned buildings with a cooling load of 1 megawatt (MW) or greater must be tested to demonstrate that air leakage does not exceed ten (10) cubic metres of air per hour for each square metre of building envelope (10m3/hr/m^2) into or out of the building, at an applied pressure difference of fifty (50) Pascal (Pa).

Testing must be carried out in accordance with a method approved by Dubai Municipality (DM).

Work must be carried out by a company approved by Dubai Municipality (DM).

Villas

Residential/ Commercial

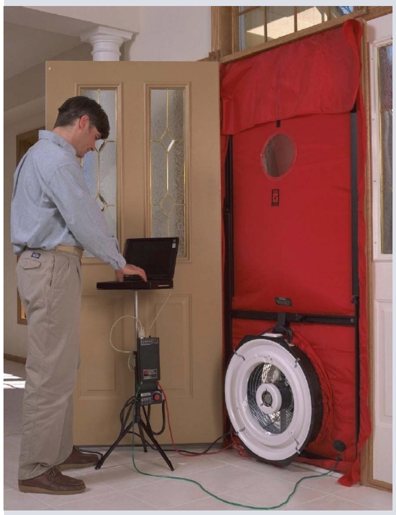
Public Buildings

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



Air leakage for the interior of a building can occur through gaps, holes or cracks in the fabric of the building envelope which are not easily visible. Leakage of conditioned air directly represents a waste of energy, due to the energy consumed in conditioning the lost air, as well as the additional energy requirement in compensating for the lost volume of air. Air leakage affects the building's performance and therefore its control is important in the conservation of energy.

Leaks in the building fabric can occur for a number of reasons such as structural stress, poor workmanship and components, and misalignment of designed building elements.

With the dependence of buildings in Dubai on air conditioning it is important to minimise air loss out of the building.

Leaks in the building fabric will also allow unconditioned air into the building bypassing the ventilation system. In Dubai this can lead to high internal humidity and result in condensation forming and the growth of mould.

A means of checking the amount of air leakage from a building is to apply a pressure test and measure the rate of leakage.

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	✓				

Note: This regulation only applies to buildings with a cooling load of 1 MW or greater.

5.0 Outcome / Benefit

This regulation seeks to control air leakage from and into buildings, which will reduce energy waste and mould growth.

6.0 Guidance

6.1 General

A high quality of building construction and the use of high quality components will reduce the amount of building air leakage The fabric of the building should be constructed so that there are no gaps in the exterior envelope or between conditioned and un-conditioned spaces. The most common air leakage paths are gaps in and around floors, leaky windows or doors, pathways through floor/ceiling voids and then to the outside, gaps around windows, gaps at the ceiling to wall joint at the eaves, service penetrations through ceilings, vents penetrating the ceiling or floor, bathroom wall vents or extract fans, gaps around bathroom waste pipes, kitchen wall vents or extractor fan, gaps around kitchen waste pipes, gaps around floor to wall joints and gaps in/around electrical fittings.

The pressure testing of complete new buildings is now required in many countries while others require components such as window assemblies to be tested for leakage. This regulation has been based on the requirements in the United Kingdom.

To increase the understanding of how to restrict air leakage, the UK Department for Communities and Local Government in conjunction with the Energy Trust have produced a document entitled 'Accredited Construction Details' (ACDs). This is a guide intended to assist the construction industry to comply with the performance standards published in the UK Building Regulations Part L Approved Documents that came into force on 06 April 2006. It focuses on issues concerning insulation continuity and airtightness and is presented in two sections.

Section 1 discusses the general theory of insulation continuity and airtightness in construction. A common approach to the design, construction and testing methodology is considered and suggestions made for the general improvement of the process.

Section 2 provides large scale indicative detail drawings of thermal insulation and airtightness provisions for specific construction interfaces. The details are accompanied by comments and checklists to assist the Designer and Constructor to achieve compliance at various stages throughout construction.

This document is recommended as a guide to be followed in Dubai although other guides toward achieving high quality construction are also available.

The airtightness of a dwelling, or its air permeability, is expressed in terms of air leakage in cubic metres per hour per square metre of external surface area when the building is subjected to a differential pressure of 50 Pascals (m3/(h.m2) @5OPa). Air leakage is defined as the flow of air through gaps and cracks in the building fabric.

The air permeability of a building can be determined by means of a pressure test. ATTMA TS1: 2006 which discusses the methodology for air pressure testing including the test procedures, requirements and conditions of reporting.

All air conditioned buildings with a cooling load of 1 megawatt (MW) or greater must be tested, with the following exceptions:

- Large, complex buildings, where due to building size or complexity, it may be impractical to carry out pressure testing of the whole building. The ATTMA publication indicates those situations where such considerations might apply. Before adopting this procedure, developers must produce, in advance of construction work in accordance with the approved procedure, a detailed justification to Dubai Municipality of why pressure testing is impractical. This must be endorsed by a suitably qualified person approved for pressure testing. In such cases, a way of showing compliance would be to appoint a suitably qualified person to undertake a detailed programme of design development, component testing and site supervision to give confidence that a continuous air barrier will be achieved. In such cases it must be certified that air permeability better than 10.0m^3/hour.m^2 at 50Pa has been achieved.
- Compartmentalised buildings, where because the buildings are compartmentalised into self-contained units with no internal connections, it may be impractical to carry out whole building pressure tests. In such cases reasonable provision would be to carry out a pressure test on a representative area of the building as detailed in the ATTMA guidance.

An example of a suitably qualified person would be an ATTMA, CIBSE-accredited assessor or other competent person certified by DM. The 10.0m^3/hour.m^2 at 50Pa limit has been set because this should be achievable based on standard international building practices.

CIBSE Technical Manual TM23 2000 Testing Buildings for Air Leakage, or other standard approved by DM may be used as an alternative to the ATTMA guidance.

6.2 Technical Data and Specifications

The requirements for leakage testing of buildings are detailed in the documentation which supports the acceptable test methods:

The Air Tightness and Measuring Association (ATTMA) Technical Standard ‘Measuring Air Permeability of Building Envelopes’ and

CIBSE Technical Manual TM23 2000 Testing Buildings for Air Leakage are referred in the Regulation as the standards to be used for testing.

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	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

Pressure testing of buildings is required in the United Kingdom but not in many other countries. In Singapore, the window assemblies only must be leak tested.

The UK Building Regulations indicate that reasonable provision for airtightness is to achieve a pressure test result no worse than 10m3/(h.m2) @5OPa. Current good practise for energy efficient dwellings in the UK includes achieving airtightness of 7m3/ (h.m2) @5OPa and best practise is 3m3/ (h.m2) @5OPa.

9.0 References

ATTMA The Air Tightness and Measuring Association Technical Standard 'Measuring Air Permeability of Building Envelopes' which can be obtained from:
http://www.attma.org/ATTMA_TS1_Issue2_July07.pdf

CIBSE Technical Manual TM23 2000 Testing Buildings for Air Leakage.

Accredited Construction Details, Section 1 and Section 2. Published by the Department for Communities and Local Government, London, UK.

This guide is intended to assist the construction industry relative to insulation continuity and airtightness. It is presented in two sections. Section 1 provides details of these two aspects, as well as providing methods to avoid common problems. Section 2 provides large scale indicative detail drawings of thermal insulation and airtightness provisions for specific construction interfaces.

It is available free on line at: http://www.planningportal.gov.uk/uploads/br/accredconbk.pdf
Or from:
Communities and Local Government Publications,
PO Box 236, Wetherby, West Yorkshire LS23 7NB, United Kingdom

1.0	Energy Efficiency – HVAC Equipment and Systems	502.01
		Villas
		Residential/ Commercial
		Public Buildings
		Industrial

For all new air conditioned buildings, heating, ventilating and air conditioning equipment and systems must comply with the minimum energy efficiency requirements and test procedures listed in Reference Tables 502.01(1) and 502.01(2) or any test procedure approved by Dubai Municipality.

REFERENCE TABLE 502.01 (1)

Minimum Efficiency Requirements for Unitary Air Conditioners and Condensing Units

Equipment Type	Size Category	Heating Section Type	Subcategory or Rating Condition	Minimum Efficiency (T1)	Minimum Efficiency (T3)	Test Procedure
Air Conditioners, air cooled	<65,000 Btu/h	All	Split System	9.5 EER	6.6 EER	T1-ARI 210/240 T3-ISO5151
			Single Package	9.5 EER	6.6 EER	
Through-the-wall, air cooled	<=30,000 Bth/h	All	Single Package	8.0 EER	5.7 EER	
Small-duct high-velocity air cooled	<65,000 Bth/h	All	Split System	9.2 EER	6.4 EER	
Air Conditioners, air cooled	>=65,000 Btu/h and <135,000 Btu/h	Electric resistance (or none)	Split System and Single Package	9.5 EER	6.6 EER	T1-ARI 340/360 T3-ISO5151
		All other	Split System and Single Package	9.5 EER	6.6 EER	
	>=135,000 Btu/h and <240,000 Btu/h	Electric resistance (or none)	Split System and Single Package	9.5 EER	6.6 EER	
		All other	Split System and Single Package	9.5 EER	6.6 EER	
	>=240,000 Btu/h and <760,000 Btu/h	Electric resistance (or none)	Split System and Single Package	9.5 EER	6.6 EER	
		All other	Split System and Single Package	9.5 EER	6.6 EER	
	>=760,000 Btu/h	Electric resistance (or none)	Split System and Single Package	9.0 EER	6.3 EER	
		All other	Split System and Single Package	9.0 EER	6.3 EER	
Air conditioners, water and evaporatively cooled	<65,000 Btu/h	All	Split System and Single Package	14.0 EER		ARI 210/240
	>=65,000 Btu/h and <135,000 Btu/h	Electric resistance (or none)	Split System and Single Package	14.0 EER		ARI 340/360
		All other	Split System and Single Package	14.0 EER		

	>=135,000 Btu/h and <240,000 Btu/h	Electric resistance (or none)	Split System and Single Package	14.0 EER		
		All other	Split System and Single Package	14.0 EER		
	>=240,000 Btu/h	Electric resistance (or none)	Split System and Single Package	14 EER 12.4 IPLV		
		All other	Split System and Single Package	14 EER		
Condensing units, air cooled	>=135,000 Btu/h			11.5 EER	7.8 EER	T1-ARI 365 T3-ISO5151
(a) Integrated Part Load Values (IPLVs) and part rating conditions are only applicable to equipment with capacity modulation. (b) Test Procedure (T3) in accordance with ISO5151						

REFERENCE TABLE 502.01 (2)

Water Chilling Packages - Minimum Efficiency Requirements				
Equipment Type	**Size Category**	**Minimum Efficiency (T1)**	**Minimum Efficiency (T3)**	**Test procedure**
Air cooled, with condenser, electrically operated	All capacities	2.8 COP 3.05 IPLV	1.9 COP	T1-ARI 550/590 T3-ISO 5151
Air cooled, without condenser, electrically operated	All capacities	3.1 COP 3.45 IPLV	2.1 COP	
Water cooled, electrically operated, positive displacement (reciprocating)	All capacities	4.2 COP 5.05 IPLV	2.75 COP	T1-ARI 550/590 T3-ISO 5151
Water cooled, electrically operated, positive displacement (rotary screw and scroll)	<150 tons	4.45 COP	2.9 COP	T1-ARI 550/590 T3-ISO 5151
	>=150 tons and <300 tons	4.9 COP	3.2 COP	
	>= 300 tons	5.6 COP	3.6 COP	
Water cooled, electrically operated, centrifugal	<150 tons	6.0 COP		T1-ARI 550/590
	>=150 tons and <300 tons	6.5 COP 7.1 IPLV		
	>=300 tons	6.5COP 7.68 IPLV		
Air-cooled absorption single effect	All capacities	0.7 COP		ARI 560
Water-cooled absorption single effect	All capacities	0.7 COP		
Absorption double effect, indirect-fired	All capacities	1.1 COP 1.1 IPLV		
Absorption double effect, direct-fired	All capacities	1.2 COP 1.2 IPLV		
	(a) The chiller equipment requirements applies to all chillers, including where the design leaving fluid temperature is <4.5°C.			

2.0 Intent/Goal

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

3.0 Background

It is estimated that the operation of ventilation and air conditioning equipment accounts for up to 60% of the total energy consumed in buildings in Dubai. Therefore, it is important that air conditioning equipment operates as efficiently as possible. In order to ensure that the best equipment is used, compliance should be achieved with Dubai Municipality set of minimum standards for energy efficiency. Most manufacturers of ventilation and air conditioning equipment produce machinery which meets the requirements as outlined above.

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	✓				

5.0 Outcome/ Benefit

This regulation will ensure that HVAC equipment used in Dubai is manufactured and operates to Dubai Municipality standards for minimum energy efficiency

6.0 Guidance

6.1 General

While there are other standards detailing minimum equipment efficiencies, Dubai Municipality minimum energy efficiency was develop to reflect the local market special requirements and situation and all major international manufacturers available in Dubai produce equipment which meet these standards.

The equipment manufacturers will provide Dubai Central Lab certification of the efficiencies of their products.

Dubai Municipality Central Lab will establish a database of manufacturers and models which they have certified as meeting these requirements.

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	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

ASHRAE 90.1 specifies minimum energy efficient coefficients of performance (CoP) for many types of HVAC equipment and is recognised as a good example of best practice. Dubai has targeted different levels of performance for some types of equipment.

9.0 References

ASHRAE 90.1-2007 Energy Standard for Buildings Except Low-Rise Residential Buildings. It is available from the AHRAE website www.ashrae.org

Air-Conditioning, Heating and Refrigeration Institute

- ARI 210/240-2005 Unitary Air-Conditioning and Air-Source Heat Pump Equipment
- ARI 340/360-00 Commercial and Industrial Unitary Air-Conditioning and Heat Pump Equipment
- ARI 550/590-2003 Water Chilling Packages Using The Vapor Compression Cycle
- ARI 560 Absorption Water Chilling and Water Heating Packages

ISO 13256-1:1998 Water-source heat pumps -- Testing and rating for performance -- Part 1: Water-to-air and brine-to-air heat pumps

1.0	Demand Controlled Ventilation	502.02
	For all new air conditioned buildings with mechanical ventilation and existing building types determined by Dubai Municipality, Demand Controlled Ventilation (DCV) using a concentration of Carbon Dioxide (CO2), or other means to measure occupancy, must be used in spaces larger than one hundred (100) square metres (m2) and having a maximum design occupancy density greater than or equal to twenty five (25) people per hundred meter squares (100m2). The default occupancy density values in ASHRAE 62.2-2007 Table 6.1 should be used when the actual occupancy is not known. **The CO2 concentration should be kept below eight hundred (800) parts per million (ppm).** **An alarm must be triggered if CO2 concentration rises above hundred (1000) ppm. This alarm is to be either automatically monitored by a central control system, if available, or give a local audible or visual indication when activated.** **For all buildings, including existing with DCV, the CO2 sensors and systems must be checked and recalibrated as per manufacturer recommendations but not to exceed twelve (12) months by a contractor approved by Dubai Municipality.**	Villas Residential/ Commercial Public Buildings Industrial

2.0 Intent/Goal

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

3.0 Background

This regulation recognises that areas in some buildings must be designed to provide sufficient ventilation to cater for maximum occupancy but that the maximum level of occupancy if often not achieved. This occurs in spaces such as meeting rooms and education facilities.

Most heating, ventilation, and air conditioning systems re-circulate a substantial proportion of the indoor air in order to maintain the occupants' comfort level whilst minimising energy costs associated with heating or cooling outside air. Ventilation systems are designed to provide sufficient fresh air when a building or room is occupied by the maximum allowable number of people. Many of these areas will normally have fewer occupants than the maximum design population and may sometimes be unoccupied. As human occupants exhale carbon dioxide, a measure of the CO_2 in the room air is an acceptable indicator of the occupancy levels. Camera systems can also be used to count the number of people in a space as an alternative means of recording occupancy levels.

By measuring the actual occupancy the volumes of fresh outside air which needs to be brought into the space and conditioned can be matched to actual demand by using modulating dampers or variable speed fan drives.

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	✓				

Note: Only applies to air conditioned in spaces larger than one hundred (100) square metres (m^2) and having a maximum design occupancy density greater than or equal to twenty five (25) people per hundred meter squares ($100m^2$).

5.0 Outcome/ Benefit

Energy savings will be achieved by only providing the amount of outdoor air required to maintain satisfactory indoor air quality.

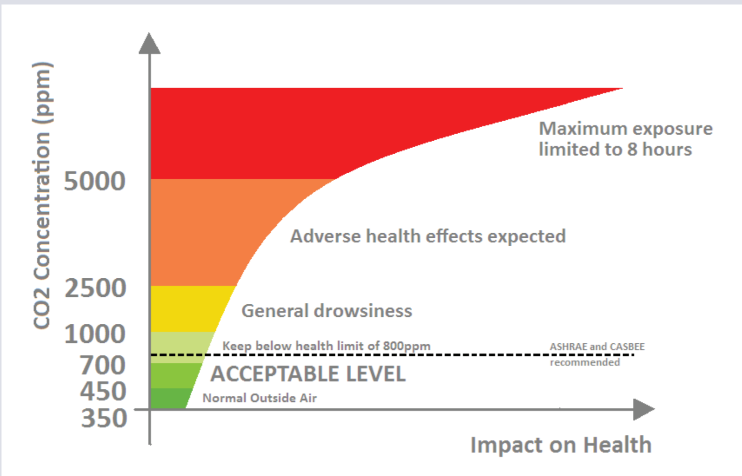
6.0 Guidance

6.1 General

Demand Controlled Ventilation (DCV) allows end users to maintain proper ventilation and improve air quality levels through the use of CO2 sensors. The sensors operate as "people meters" to maintain ventilation based on the actual occupancy of the space.

The Demand Controlled Ventilation system is flexible, adapting as needed to the movement of people within the building and providing a high comfort level. As more people occupy a space, the system increases the terminal airflow until either the ventilation requirement is satisfied.

For spaces with mechanical ventilation, carbon dioxide (CO_2) concentrations shall be monitored with permanent CO_2 monitoring systems that record ventilation performance within all occupied spaces having design occupancy of 25 or more people per 100 square metres.



CO_2 is heavier than air and is stratified at lower levels of a room. CO_2 sensors shall be positioned in the room between 1 metre and 1.8 metres above the floor, to most accurately determine the quality of the air breathed by the occupants (breathing zone). Alternatively, the sensor may be installed in the exhaust air duct of the monitored room.

An alarm must be triggered if CO_2 concentration rises above 1000 ppm. When an alarm is activated the ventilation system must not shut down.

The measurement and control systems required to meet the requirements of this regulation are widely available in Dubai and are presently installed in many of the buildings of the size and type that are referred to in this regulation. The best technology to ensure maximum energy savings is by using variable speed drives on the ventilation fans as this not only reduces the amount of cooling required but significantly drops the energy used by the fan.

6.2 Technical Data and Specifications

The CO_2 monitoring requirements to keep CO_2 levels below 900ppm and for an alarm to sound when CO_2 levels are higher than 1000ppm are based on internationally recognised standards for adequate indoor air quality (CISBE Guide B-2, ASHRAE 62.1-2007).

The design minimum outdoor air rate will be as required by ASHRAE 62.1-2007.

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 Drawings and specifications
Construction	n/a
Commissioning/Completion	Completed Green Building Site File
Operation	Green Building Site File showing approved contractor testing reports at least every 12 months.
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 use of Demand Control Ventilation is becoming more common as its ability to save energy while maintaining air quality is increasingly recognised and the control systems become more cost-effective.

9.0 References.

The Chartered Institution of Building Services Engineers (CISBE) Guide B-2 Ventilation and Air Conditioning, August 2001.
American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE) Standard 62.1-2007 Ventilation for Acceptable Indoor Air Quality.

1.0	Elevators and Escalators	502.03

Villas | Residential/ Commercial | Public Buildings | Industrial

For all new buildings:

A. Escalators -Escalators must be fitted with controls to reduce speed or to stop when no traffic is detected. Escalators shall be designed with energy savings features as described below:

1. **Reduced speed control: The escalator shall change to a slower speed when no activity has been detected for a period of a maximum of three (3) minutes. Detection shall be by photocell activation at the top and bottom landing areas.**
2. **Use on demand: The escalator shall shut down when no activity has been detected for a period of a maximum of fifteen (15) minutes. Use on demand escalators must be designed with energy efficient soft start technology. The escalator shall start automatically when required; the activation shall be by photocells installed in the top and bottom landing areas.**

B. Elevators (lifts) - Elevators (lifts) must be provided with controls to reduce the energy demand. To meet this requirement, the following features must be incorporated in traction drive elevators:

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

2.0 Intent/Goal

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

3.0 Background

Elevator and escalator energy consumption in high rise buildings and large shopping malls is generally considered to account for about 5%-15% of building electricity use. In general, hydraulic elevators used in relatively low-rise buildings are much less efficient than the traction elevators used in mid to high-rise buildings but are often selected to reduce capital costs.

New technologies, including software, promise energy efficiency gains of up to 30–40% from elevators consumption.

This regulation focuses on this type of technologies but other energy saving technologies could be considered when designing the vertical transportation aspects of new buildings.

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

As elevator and escalator usage represents a proportion of a building's electrical load, use of efficient controls and practices can have a significant beneficial impact on total energy demand. Efficient elevators ensure that building accessibility is maintained which is an important part of the social context of sustainability.

6.0 Guidance

6.1 General

Many codes of practice and guidance documents which detail modern elevator and escalator design are available. In addition, Technical advices are being provided by manufacturers. Two guides which are recognized in the industry as providing good practice advice have been developed by the Chartered Institution of Building Services Engineers (CIBSE) and the Electrical and Mechanical Services Department of the Government of Hong Kong (EMSD)

- CIBSE Guide D - Transportation Systems In Buildings
- EMSD - The Code of Practice for Energy Efficiency of Lift & Escalator Installations

There are a wide range of methods to increase the energy efficiency of escalator and elevator available. Suppliers of the equipment or specialized escalator and elevator companies can provide the technical data. The solution will vary greatly depending upon the building size, type and application.

AC Variable-Voltage and Variable-Frequency (VVVF) drives give a very smooth start, reducing the mechanical shock to the equipment components. Those equipments run at a high power factor, even under no load and they reduce the starting current to around 1.5 times the full load current, instead of the more typical 5 times the full load current. Another advantage is that a standard motor can be used and there is no need to use a pole changing two-speed motor to achieve maintenance speed, as this can be done via the inverter.

Other technologies which should be considered include:

- A control system that provides the most cars where they will be needed while reducing unnecessary travel. Some elevator systems reduce energy use by limiting excess passenger trips through the use of destination control software. These systems direct passengers to elevators based on their desired floors, grouping passengers according to destination. For example, rather than stopping at multiple floors for various individuals, the destination dispatch system groups all passengers traveling to a specific floor in one trip. This drastically reduces user wait-time, increasing handling capacity by up to thirty percent. Environmental benefits are abundant as well, decreasing the amount of wasted energy expense by maximizing elevator efficiency through passenger destination selection.

- LED-style lights last longer than incandescent lights and consume less energy, reducing costs and environmental impact. Although the fixtures produce less light inside the elevator, LEDs do not sacrifice passenger visibility and comfort. Not only applicable to interior lights, LEDs can also replace bulbs in floor indicators, call buttons and arrows. LED lights benefit more than just the environment. These lights require less installation time and less long-term maintenance than incandescent lights, saving building owners time and money.

- Regenerative braking systems can recover up to 25 percent of the total energy used with the counterweight or elevator car becoming the motor, and the hoisting system becoming a generator and converting the power into current.

6.2 Technical data and Specifications

As specified in the Regulation. In addition, the following references were included in the Practice Guide as best practices for design specification regarding lift and escalator energy efficiency:

- CIBSE Guide D - Transportation Systems In Buildings
- EMSD - The Code of Practice for Energy Efficiency of Lift & Escalator Installations developed by The Electrical and Mechanical Services Department of the Government of Hong Kong

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	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 design and selection of vertical transportation has developed into a specialised discipline as they are recognised as both a major use of energy and as one of the most important interfaces with the building users. Singapore and BREEAM award credits for escalators which slow down or stop when not required and elevators that have a stand-by mode, use modern drives, regenerative braking or energy efficient lighting.

9.0 References

- CIBSE Guide D – Transportation Systems In Buildings. This can be obtained from http://www.cibse.org/
- EMSD - The Code of Practice for Energy Efficiency of Lift & Escalator Installations. The Electrical and Mechanical Services Department of the Government of Hong Kong. This can be obtained, free of charge, from http://www.emsd.gov.hk/emsd/e_download/pee/lift_esccop.pdf

1.0 Lighting Power Density - Interior 502.04

Villas | Residential/Commercial | Public Buildings | Industrial

For new buildings, the average Lighting Power Density for the interior connected lighting load for specific building types must be no more than the watts per square metre of gross floor area given in Table 502.04 (1).

Table 502.04(1) – Interior Lighting Power Density

Building Type	Maximum average Watts per square metre (W/ m^2) across total building area
Commercial/Public: Offices, Hotels, Resorts, Restaurants	10
Educational Facilities	12
Manufacturing Facilities	13
Retail Outlets, Shopping Malls, Workshops	14
Warehouses	8

Lighting Power Densities for building types not listed in Table 502.04 (1) should be no greater than those values given in ASHRAE 90.1-2007 Table 9.5.1. or equivalent as approved by DEWA.

2.0 Intent/Goal

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

3.0 Background

Lighting loads in buildings can constitute up to 30% of the total electricity requirement when the resultant cooling load due to the heat generated by light fittings is added to the electricity required.

By imposing a maximum average power density for lighting significant energy savings will 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

The intent is to control the electricity used in buildings by restricting the amount of electricity which is used to provide adequate lighting and to encourage the use of energy efficient lamps and luminaries. This regulation also considers the provision of adequate lighting for task illumination whilst exercising efficient energy consumption practices.

6.0 Guidance

6.1 General

The Lighting Power Density (LPD) limits in this regulation are the average values for the whole building or application. This allows a variety of light fixtures to be used in different areas.

When buildings are designed a lighting schedule will be produced. The LPD load can be determined by counting the number of interior lighting fixtures and identifying their designed electricity consumption. The electricity used by controls and ballasts must be included to obtain the total connected load. The total energy load is then applied to the gross floor area of the building to give the average lighting power density.

The following exceptions are made to this requirement:

1) Emergency lighting which is switched off during normal building operation
2) Lighting that is required by a health or safety regulation

Note that when designing the interior lighting of buildings, consideration must be taken of the requirements of regulation 502.06 Lighting Controls.

By using modern, efficient lighting fixtures, all new buildings in Dubai impacted by this regulation will be able to meet the required lighting power density with little care when selecting lighting fixtures and lamps and the following guidelines are provided to highlight the types of information which should be obtained from the suppliers when selecting equipment.

Lighting Efficiency

Because there is a wide range of quality in lamps and luminaire manufacturers internationally, it is important that only high quality lighting equipment is used in Dubai. A measure of the efficiency of lighting is the 'luminous efficacy', which could be applied to the complete fitting (luminaire) or just to the lamp.

Luminaire Efficacy

This measures the output of the complete fixture and so incorporates the efficiency of both the lamp and the fixture. It is therefore a better measure than just considering the efficacy of the lamp.

It is important that the efficiency of the total luminaire (lighting fixture) be considered when selecting equipment.

Lamp Efficacy

Although the efficacy of the luminaire is the best measure of light output, the light efficacy of the lamp is still a useful measure of quality and possible energy savings.

Lamp Selection

The type of lamp used will have a major impact on the amount of electricity used and care must be taken when selecting fittings and their lamps. Conventional incandescent bulbs are the most inefficient means of producing light as most of the electricity consumed is converted to heat rather than to light. This means that they use much more electricity to provide a certain level of illuminance compared with other forms of lamps, and the heat produced increases the cooling load. Incandescent bulbs should not be used in new buildings.

Table 504.04(2) – General guidelines for lamp selection

Objective	Recommendation
Most efficient use of energy	Use fluorescent lamps or light emitting diodes (LEDs)
Fixtures that are switched on for a substantial part of the day	Use compact fluorescent lamps (CFLs) rather than incandescent lamps
When dimming lights are required	Use LEDs, or fluorescent lamps
Where high levels of illumination are required	Use high intensity discharge (HID) lamps such as high pressure sodium (HPS) or metal halide (MH) lamps

For building types for which maximum lighting power densities are not specified, care should be taken to ensure that modern, high efficiency lamps and fittings are used.

6.2 Technical Data and Specifications

The values in this regulation are the maximum allowed and lower levels of energy use should be targeted.

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 drawings 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

Many building codes are using Lighting Power Densities as a tool to require building designers to adopt modern lighting technologies which are energy efficient. The values developed for this regulation reflect current international requirements.

9.0 References

UK Building Regulation L2A ‘Conservation of Fuel and Power in New Buildings other than Dwellings’

ASHRAE 90.1-2007. Energy Standard for Buildings Except Low-Rise Residential Buildings, Table 9.5

1.0 Lighting Power Density - Exterior 502.05

Villas | Residential/Commercial | Public Buildings | Industrial

For all new buildings, the average Lighting Power Density for the exterior connected lighting load must be no more than the values given in Table 502.05 (1).

Table 502.05(1) – Building Exterior Lighting Power Density

Building Area	Maximum Watts per square metre or linear metre
Uncovered parking lots and drives	1.6 W/m²
Walkways less than 3 metres wide	3.3 W/linear metre
Walkways 3 metres wide or greater	2.2 W/m²
Outdoor Stairways	10.8 W/m²
Main entries	98 W/linear metre of door width
Other doors	66 W/linear meter of door width
Open sales areas (including vehicle sales lots)	5.4 W/m²
Building Facades	2.2 W/m² for each illuminated wall or surface or 16.4 W/linear metre for each illuminated wall or surface length
Entrances and gatehouse inspection stations at guarded facilities	13.5 W/m²
Drive-up windows at fast food restaurants	400 W per drive-through

Lighting Power Densities for exterior areas not listed in Table 502.05 (1) should be no greater than those values given in ASHRAE 90.1-2007 Table 9.4.5. or equivalent as approved by DEWA.

2.0 Intent/Goal

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

3.0 Background

Lighting loads in buildings can constitute up to 30% of the total electricity requirement, when the resultant cooling load due to the heat generated by light fittings is added to the electricity required.

By imposing a maximum average power density for lighting significant energy savings will 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

The intent is to control the electricity used on the exterior of buildings and within its grounds by restricting the amount of electricity which is be used to provide adequate lighting and to encourage the use of energy efficient lamps and luminaries.

6.0 Guidance

6.1 General

The Lighting Power Density (LPD) limits in this regulation are the average values for the specified applications. This allows a variety of light fixtures to be used in different areas.

When buildings are designed a lighting schedule will be produced, which should include exterior lighting. The LPD load can be determined by counting the number of lighting fixtures for each application and identifying their designed electricity consumption. The electricity used by controls and ballasts must be included to obtain the total connected load. The total energy load is then applied to the area illuminated to give the average lighting power density. Some densities are measured in relation to the size of the area illuminated while others are based on width illuminated.

The following exceptions are made to this requirement:

1) Emergency lighting which is switched off during normal building operation
2) Lighting that is required by a health or safety regulation

Note that when designing the exterior lighting of buildings, consideration must be taken of the requirements of the following regulations:

- 502.06 Lighting Controls
- 504.02 Outdoor Lighting

All exterior lighting should be fitted with controls which do not allow them to operate in daylight.

By using modern, efficient lighting fixtures, all new buildings in Dubai impacted by this regulation will be able to meet the required lighting power density with little care when selecting lighting fixtures and lamps and the following guidelines are provided to highlight the types of information which should be obtained from the suppliers when selecting equipment.

Lighting Efficiency

Because there is a wide range of quality in lamps and luminaire manufacturers internationally, it is important that only high quality lighting equipment is used in Dubai. A measure of the efficiency of lighting is the 'luminous efficacy', which could be applied to the complete fitting (luminaire) or just to the lamp.

Luminaire Efficacy

This measures the output of the complete fixture and so incorporates the efficiency of both the lamp and the fixture. It is therefore a better measure than just considering the efficacy of the lamp.

It is important that the efficiency of the total luminaire (lighting fixture) be considered when selecting equipment.

This allows design flexibility to vary the light output ratio of the luminaire and the luminous efficacy of the lamp.

Lamp Efficacy

Although the efficacy of the luminaire is the best measure of light output, the light efficacy of the lamp is still a useful measure of quality and possible energy savings.

Lamp Selection

The type of lamp used will have a major impact on the amount of electricity used and care must be taken when selecting fittings and their lamps.

Conventional incandescent bulbs are the most inefficient means of producing light as most of the electricity consumed is converted to heat rather than to light. This means that they use much more electricity to provide a certain level of illuminance compared with other forms of lamps, and the heat produced increases the cooling load. Incandescent bulbs should not be used in new buildings.

Table 504.04(2) – General guidelines for lamp selection

Objective	Recommendation
Most efficient use of energy	Use fluorescent lamps or light emitting diodes (LEDs)
Fixtures that are switched on for a substantial part of the day	Use compact fluorescent lamps (CFLs) rather than incandescent lamps
When dimming lights are required	Use LEDs, or fluorescent lamps
Where high levels of illumination are required	Use LEDs , or high intensity discharge (HID) lamps such as high pressure sodium (HPS) or metal halide (MH) lamps

For building types for which maximum lighting power densities are not specified, care should be taken to ensure that modern, high efficiency lamps and fittings are used.

6.2 Technical Data and Specifications

The values in this regulation are the maximum allowed and lower levels of energy use should be targeted.

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 drawings 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

Many building codes are using Lighting Power Densities as a tool to require building designers to adopt modern lighting technologies which are energy efficient within the building. Some also set LPD values for exterior lighting. The values developed for this regulation reflect current international requirements.

9.0 References

UK Building Regulation L2A ‘Conservation of Fuel and Power in New Buildings other than Dwellings’

ASHRAE 90.1-2007. Energy Standard for Buildings Except Low-Rise Residential Buildings, Table 9.4.5.

1.0 Lighting Controls 502.06

For all new buildings other than villas and industrial buildings:

Residential/ Commercial

Public Buildings

A. Occupant Lighting Controls must be provided so as to allow lighting to be switched off when daylight levels are adequate or when spaces are unoccupied and to allow occupants control over lighting levels.

B. Common areas which are not regularly occupied, such as corridors and lobbies, should reduce lighting levels to no more than twenty five percent (25%) of normal when unoccupied.

C. In offices and education facilities all lighting zones must be fitted with occupant sensor controls capable of switching the electrical lights on and off, according to occupancy unless lighting is required for safety purposes.

D. In offices, if the average design lighting power density is less than six (6) Watts per square metre of gross floor area (GFA), the control requirements of parts C and E of this regulation need not apply.

E. It is recommended (optional) that, in offices, the artificial lighting in spaces within six (6) meters in depth from exterior windows must be fitted with lighting controls incorporating photocell sensors capable of adjusting the level of electric lighting to supplement natural daylight only when required. The combined artificial and daylight must provide an illumination level at the working plane between four hundred (400) and five hundred (500) lux. When there is a hundred percent (100%) daylight, the lux levels may exceed five hundred (500) lux.

2.0 Intent/Goal

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

3.0 Background

The correct control of lighting can lead to increased occupant comfort and wellbeing as each group of occupants can exert control over the conditions of their work space to suit their preferences or needs The ability to turn off lights when not required will also reduce the amount of electricity used.

Daylighting is the use of natural light from the sun or sky to provide illumination in interior spaces. The use of natural light creates a stimulating environment for building occupants and it is known to significantly improve productivity. A well-designed daylit building can result in a lighting energy use reduction ranging from 20% to 60%.

Due to the high sunlight factor in Dubai, daylight is usually available in the area near exterior windows in buildings. The level of daylight provided will depend on the weather conditions and time of day. Use should be made of the natural light to reduce the energy used to produce artificial light. However, the lighting energy reduction should not be source for extra cooling load since sunlight is twined with undesired heat gain.

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					

Note: Parts A and B apply to all new buildings other than Villas and Industrial buildings. Parts C, D and E apply only to offices.

5.0 Outcome / Benefit

The provision of a level of lighting control by single occupants and within multi-occupant spaces, such as conference rooms or classrooms and the use of daylight can contribute to energy conservation; through switching off unnecessary lighting will reduce costs and avoid wasted electricity. Provision of controls for lighting will also lead to increased occupant comfort, productivity and wellbeing, as each individual or group of occupants can tailor the conditions of their individual or common work or living space to their preferences or needs.

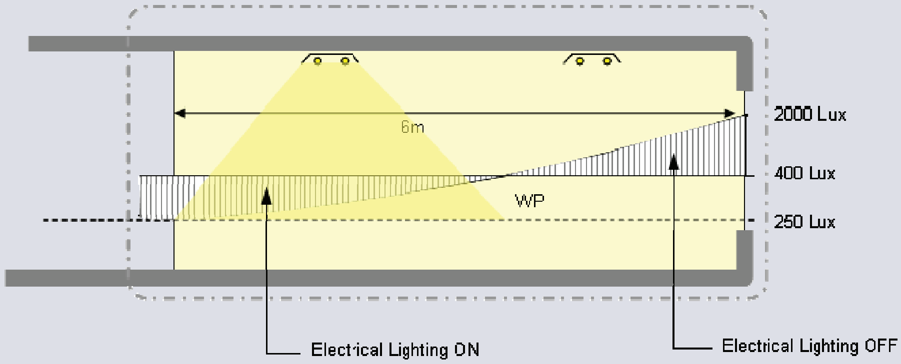
6.0 Guidance

6.1 General

Occupant Lighting. Lighting controls must be provided for all spaces to allow for lighting adjustments according to the occupants' needs and preferences or for lighting to be turned off when a space is unoccupied. The occupants should have access to adequate controls to provide functionality to suit their activities. Lighting controls may be operated manually or automatically by occupancy or daylight sensors.

Unless automatic zone lighting controlled by sensors is installed, local switches must be installed in easily accessible positions within each working area. Alternatively they should be installed at boundaries between working areas and general circulation routes that can be manually operated by the occupants. Switches can include dimming devices.

Individual offices are defined as a single working area. In large spaces, such as open plan offices, the distance from any local switch to any lighting controls should generally be not more than ten metres. Where a space is a daylit space served by side windows, the perimeter rows of light within six metres of the window must be separately switched or dimmed.



Lighting control zone in office buildings

Multi-occupant spaces, such as conference rooms or classrooms and spaces which are not normally occupied, must have lighting controls which allows the lighting in the space to be switched off or reduced when not occupied.

Occupants must be educated on the design and function of lighting controls, in order to avoid abuse of personal controls (such as leaving the lights on when not in the room) and to avoid increased overall energy cost. The lighting designer will specify the switching protocol to be used.

Perimeter Lighting Control. Modern lighting control systems combined with daylight sensors and dimming lights must be used in the zones near exterior windows to maintain the illumination level between 400 and 500 lux at floor level or at desktop. Consideration should be given to adjusting the level of dimming of lights, so that those lights closer to the window are dimmed to a greater extent than those further into the building where there is less daylight. The controls are not required where perimeters walls have few or no windows.

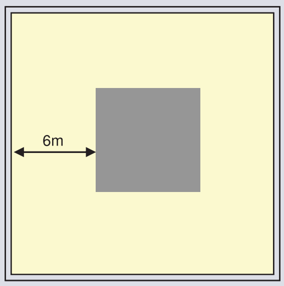
Normally occupied spaces do not include: copy/printing rooms, storage areas, mechanical spaces, restrooms, auditoria, and other intermittently or infrequently occupied spaces or spaces where daylight would interfere with the use of the space.

Consideration should be given to incorporating into the building design various passive means of increasing the transfer of daylight into the building, e.g. through the use of sunpipes. This will result in reduced energy loads for both lighting and cooling.

There are many guidelines available detailing passive daylighting systems. One example is Daylight in Buildings: A Source Book on Daylighting Systems and Components, which has been produced as a result of the International Energy Agency (IEA) Solar Heating and Cooling Programme, Energy Conservation in Buildings & Community Systems.

The required illumination level between 400 and 500 lux has been chosen because 400 lux is internationally agreed as the level of lighting required for working in an office situation or for educational buildings. The 500 lux maximum will allow for some changes in lighting intensity without continual adjustment of the lighting controls.

A 6 metre deep zone is based on the assumption that this would include, at least, the first two rows of lights near the window. Depending on the amount of daylight entering a building, consideration should be given to fitting controls over a deeper zone than 6 metres.



Lighting control zone in office buildings

Any light fitting within 6 metres of the perimeter wall, other than emergency lights, are to be fitted with daylight responsive controls.

6.2 Technical Data and Specifications

Some of the lighting control devices that may be used to comply with this regulation include dimming ballast controls, light level sensors, occupancy sensors, time switches, and photocell switches.

The Practice Guide gives one example of design guidelines detailing passive daylighting systems: Daylight in Buildings: A Source Book on Daylighting Systems and Components, which has been produced as a result of the International Energy Agency (IEA) Solar Heating and Cooling Programme, Energy Conservation in Buildings & Community Systems.

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 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

Encouraging the use of natural daylight and using lighting control systems is common. The UK requires in Building Regulations Approved Document L2A, Clause 54 that "Lighting controls should be provided so as to avoid unnecessary lighting during the times when daylight levels are adequate or when spaces are unoccupied." ASHRAE specifies the provision of time or occupancy sensor control and controls in rooms that are automatic or occupier controlled.

9.0 References

Daylight in Buildings: A Source Book on Daylighting Systems and Components, Lawrence Berkeley National Laboratory. This report can be downloaded without cost at: http://gaia.lbl.gov/iea21/

The Building Regulations 2002 Approved Document L2A, Conservation of fuel and power, The Office of the Deputy Prime Minister, UK

1.0	Electronic Ballasts	502.07
	For all new buildings, high frequency electronic ballasts must be used with fluorescent lights and metal halide of 150 W and less. **High frequency electronic ballasts must be labelled as conforming to an international standard approved by the DEWA / Dubai Municipality**	Villas Residential/ Commercial Public Buildings Industrial

2.0 Intent/Goal

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

3.0 Background

High-efficiency, high frequency electronic ballasts offer superior lighting performance and energy savings, making their use cost-effective. High frequency lamp operation produces light more efficiently while eliminating visible flicker and audible noise. Electronic ballasts are available as fixed light level models, as well as full range dimming models. The life of fluorescent lights will also increase when electronic ballasts are used

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

Electronic ballasts reduce the amount of energy required when operating fluorescent lights and promote a longer lamp life, thereby minimising the use of energy. The use of electronic ballasts provides energy savings and ensures that fluorescent lights operate with optimum performance. In addition, electronic ballasts improve working conditions by reducing light flicker

6.0 Guidance

6.1 General

Electronic ballasts with the following certification schemes are considered acceptable :

- American National Standards Institute (ANSI),
- European Electronic Ballast Standard,
- Certified Ballast Manufacturers (CBM) standards, or other standard approved by the Dubai Municipality. (If CBM standards are used, the certified ballast must meet the electrical requirements as specified by the appropriate section of C82.1 or C82.11 and C78 series.)

The proof of certification printed on the ballast is to be the means of showing compliance with this regulation.

Certification would normally be the responsibility of the manufacturer. and compliance shown by the use of a certification mark such as DIN, CE, VDE, EMC, cUL, CBM or UL printed on the outside of the ballast. The manufacturer's specification sheets should also show whether their products are compliant.

Some advantages of using electronic ballast are shown in table 502.07(1).

Table 502.07(1) – Benefits of using electronic ballasts

	Conventional Ballast	Electronic Ballast
Heat	Wastes internal energy which generates more heat	Reduced heat. Internal losses less than 8 watts results in 5-10 percent less air conditioning costs
Light Flicker	50 Hz frequency causes light flicker levels of 30 percent or higher; can cause headaches and nausea	20,000-25,000 Hz produces virtually no detectable flicker; does not cause headaches and nausea
Noise	Vibration of electromagnetic field causes humming noise	No audible noise, less distracting
Weight	Heavy components coated in heavy protective material	Weighs about half as much as electromagnetic type
Energy	Requires 30-40 percent more input than electronic ballasts for the same amount of light output	Requires 30-40 percent less input than conventional ballasts for the same amount of light output

6.2 Technical Data and Specifications

The Ballast shall satisfy the performance requirements at the rated/nominal voltage . Should a dimming light be used special ballast must be specified.

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* *Lighting 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

Use of high frequency electronic ballasts to be used with fluorescent lights.

9.0 References

Present regulation.

These following standards are examples used by the manufacturers and testing laboratories and are not required by lighting designers or installers in Dubai. However, they are provided for reference

ANSI

The American National Standards Institute (ANSI) has published a number of Standards which relate to the manufacture and operation of electronic ballasts. These include ANSI C82.11-1993, which describes recommendations for high-frequency operation of fluorescent lamp ballasts.

European Electronic Ballast Standard

There are number of European Standards which relate to the manufacture and operation of electronic ballasts, such as BS:EN 60928:1995.Auxiliaries for Lamps. AC-supplied Electronic Ballasts for Tubular Fluorescent Lamps. General and Safety requirements. IEC 60929 ,EN 50924, ENEN 50294.Test standards

1.0 Control Systems for Heating, Ventilation and Air Conditioning (HVAC) Systems — 502.08

For all new buildings other than villas, all Heating, Ventilation, and Air Conditioning (HVAC) systems must be provided with controls to guarantee the achievement of energy efficiency in use in accordance with the American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) 90.1-2007, Section 6.4.3. or equivalent as approved by DM/DEWA.

As a minimum, the following control features must be incorporated:

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

Residential/ Commercial

Public Buildings

Industrial

2.0 Intent/Goal

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

3.0 Background

The HVAC systems are the largest single user of energy in a building. By applying suitable control requirements there can be reductions in energy used from operation. The purpose of this regulation is to ensure that zones within a building which have different heating or cooling requirements can be controlled specifically to meet those requirements and only be used when required.

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

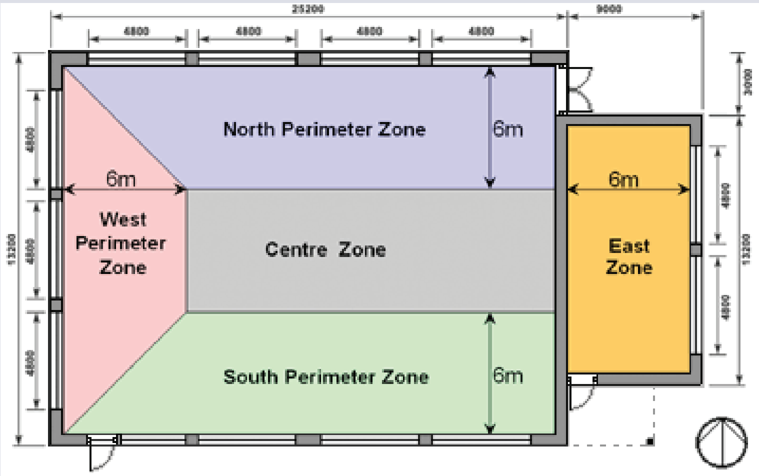
5.0 Outcome / Benefit

The conditions inside buildings will be controlled to suit the occupants while minimising energy requirements.

6.0 Guidance

6.1 General

A ‘control zone’ (for HVAC) is a space or group of spaces with heating or cooling requirements that are sufficiently similar so that desired conditions (e.g. temperature) can be maintained throughout by using a single controller. The zone may be part of a larger space, an individual office or a small dwelling and should be defined at the building design stage from expected occupancy patterns and incidence of heat gains. These zones must be identified during the design of the HVAC systems.



Modern smaller equipment is likely to have built-in individual controls to meet these requirements, while Building Management Systems can provide control solution for the total building.

Energy savings may be achieved with air conditioning systems by fitting setback thermostats which allow for an increased cooling set point when unoccupied or during periods when lesser demand is acceptable.

American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) 90.1-2007, Section 6.4.3 describes control protocols in more detail than given in this regulation and these requirements must also be applied to new buildings.

For the purposes of applying the control requirements of ASHRAE 90.1.2007, Dubai is regarded as being in Climate Zone 1A.

6.2 Technical Data and Specifications

When designing HVAC control systems regard must also be taken of Regulation 503.05 which requires that all new buildings with a cooling load of one (1) megawatt (MW) or greater must have a central control and monitoring system.

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 drawings 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

ASHRAE 90.1 is recognised as a good example of best practice.

'British Building Code Approved Documents - Part L – Conservation of Fuel and Power' also details control best practice.

9.0 References

ASHRAE 90.1-2007 – Energy Standard for Buildings Except Low-Rise Residential Buildings.

1.0 Control Systems for Hotel Rooms — 502.09

Commercial

For all new hotels, guest rooms must incorporate, in each room, controls systems which are able to turn off the lighting, air conditioning and power when the room is not occupied.

In addition, it is recommended (optional) that each guest room should incorporate control system to enable to turn off the air conditioning when the balcony door / window is kept open.

2.0 Intent/Goal

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

3.0 Background

Hotel guest rooms are often unoccupied for long periods and considerable amounts of energy can be wasted if lights and air conditioning are left running during these periods. Room access cards or occupancy sensors can be used as the means of providing this control. Building Management Systems (BMS) may be used to provide the level of control and monitoring required. If a BMS system is not installed, standalone controls are readily available for installation in individual rooms.

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					

Note: Applies only to new hotels and resorts.

5.0 Outcome/ Benefit

This regulation will reduce the energy used in hotel guest rooms by ensuring that lights, power and air conditioning are turned off when the rooms are not occupied. This encourages energy conservation and savings behaviour which may not otherwise be easy to control.

6.0 Guidance

6.1 General

The on/off control system, e.g. a room access card, occupancy sensor or other suitable control, should meet the following requirements:

1. Be located at the room entrance so that the guest can operate the system as soon as the room is entered.

2. Have a delay of a maximum of 1 minute once the control system is deactivate to enable the guest to vacate the room safely.

3. The socket outlet for refrigerator are to remain live at all times and not be controlled; and

4. Have a window contact to ensure the air conditioning is switched Off if the window is opened.

A card control located adjacent to the entrance door

There are a wide range of controls available for use with hotel air conditioning and lighting systems. Controls may be standalone for each room or be connected into the BMS. Suppliers of the equipment or specialised control companies are able to provide technical support as required.

6.2 Technical Data and Specifications

This regulation only applies to guest rooms; all other areas of the hotel must meet the requirements of Regulations 502.06 Lighting Controls and 502.08 Control Systems for HVAC Systems.

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 drawings 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

The types of room control systems required by this regulation are common practice in most new hotels and are often retro-fitted to existing hotels.

9.0 References

No References.

1.0 Exhaust Air Energy Recovery Systems — 502.10

Villas | Residential/Commercial | Public Buildings | Industrial

For all new buildings with a requirement of treated outdoor air of over one thousand (1,000) litres per second (l/s), energy recovery systems must be provided to handle at least fifty percent (50%) of the total exhausted air. The energy recovery systems must have at least seventy percent (70%) sensible load recovery efficiency.

2.0 Intent/Goal

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

3.0 Background

In hot climates, the air conditioning systems are typically cooling the incoming outside air and exhausting excess air which has already been cooled. By using a Heat Recovery System, it is possible to use the cooled air being exhausted from the building to pre-cool incoming air and reduce the energy expended in cooling the new air.

Energy recovery is most economical when there is a large temperature differential between the incoming and outgoing airstreams, such as exists in Dubai.

4.0 Applicability

4.1

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	✓				

Note: Applies to new buildings with a requirement of treated outdoor air of over one thousand (1,000) litres per second (l/s).

5.0 Outcome/ Benefit

The intent of this regulation is to recover cooled air that is being exhausted and use it in a productive manner. By using already-conditioned air to pre-cool outside air coming into the building's ventilation system, the energy requirement for cooling the incoming air will be less. The total HVAC system capital expenditure may be lower because the central cooling requirement may be reduced in size.

6.0 Guidance

6.1 General

This regulation applies only new buildings with a requirement of treated outdoor air of over one thousand (1,000) litres per second (l/s) to ensure that systems which require exhaust air energy recovery are large enough to achieve cost-effective energy savings. This figure is based on those specified by ASHRAE and is considered to be applicable in Dubai and remove the need for smaller systems to meet the requirements of this regulation.

The energy recovery system must handle at least 50% of the exhausted air and be able to recover at least 70% sensible load. Seventy percent sensible load recovery effectiveness means that the change in the enthalpy of the outdoor air supply is equal to 70% of the difference between the outdoor air and return air at design conditions.

The following systems are exempt from the requirements of this regulation:

a. Laboratory fume hood systems
b. Systems serving spaces that are not cooled
c. Systems exhausting toxic, flammable, paint, or corrosive fumes or dust
d. Commercial kitchen hoods used for collecting and removing grease vapours and smoke

There are a number of heat exchange systems which can be used in Dubai. A brief description of three of the most commonly used systems is given below:

Enthalpy Wheel

A heat exchange enthalpy wheel, also known as a rotary energy wheel, has a revolving cylinder filled with an air-permeable medium with a large internal surface area. Adjacent airstreams pass through opposite sides of the exchanger in a counter flow pattern. Heat transfer media may be selected to recover heat only or sensible plus latent heat. Rotary exchangers have a counter flow configuration and normally use small-diameter flow passages. They are quite compact and can achieve high transfer effectiveness.

Run-Around Systems

A typical coil energy recovery loop places an extended surface and finned tube coils in the supply and exhaust airstreams of a building or process. The coils are connected in a closed loop via counter flow piping through which an intermediate heat transfer fluid (typically water or an antifreeze solution) is pumped. An expansion tank must be included to allow fluid expansion and contraction.

Heat Pipe

A typical heat pipe consists of a sealed pipe or tube made of a material with high thermal conductivity such as copper or aluminium. A vacuum pump is used to exclude all fluids (both gases and liquids) from the empty heat pipe, and then the pipe is filled with a fraction of a percent by volume of working fluid, (or coolant), chosen to match the operating temperature. Due to the partial vacuum that is near or below the vapour pressure of the fluid, some of the fluid will be in the liquid phase and some will be in the gas phase. Inside the pipe's walls, an optional wick structure exerts a capillary pressure on the liquid phase of the working fluid. The heat pipe may not need a wick structure if gravity or some other source of acceleration is sufficient to overcome surface tension and cause the condensed liquid to flow back to the heated end.

6.2 Technical Data and Specifications

Designers and suppliers of HVAC equipment will be able to assist with the correct selection of heat recovery equipment

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 drawings 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

As awareness of the need to conserve energy grows, the use of exhaust air energy recovery systems has increased. It is now best practice for buildings in Dubai and many other countries around the world.

9.0 References

ASHRAE 90.1-2007 Energy Standard for Buildings Except Low-Rise Residential Buildings. Available from the AHRAE website www.ashrae.org

1.0 Pipe and Duct Insulation

502.11

Villas

Residential/ Commercial

Public Buildings

Industrial

For all new buildings, all pipes carrying refrigerant, hot water or chilled water and ducts, including prefabricated ducts, supplying conditioned air must be insulated to minimise heat loss and prevent condensation.

1. **Pipes and ducts passing through conditioned spaces must be insulated in accordance with BSI British Standard BS 5422:2009 or other insulation standards approved by Dubai Municipality.**

2. **Pipes passing through outside or unconditioned spaces must be insulated with the minimum insulation thickness specified in Table 502.11 (1).**

Table 502.11 (1) Minimum insulation thickness for pipes passing through unconditioned s•aces

Steel pipe nominal pipe size (mm)	Temperature of contents (°C)					
	10°C		5°C		0°C	
	Minimum Insulation thickness (mm)					
	λ = 0.018 W/mK	λ = 0.038 W/mK	λ = 0.018 W/mK	λ = 0.038 W/mK	λ = 0.018 W/mK	λ = 0.038 W/mK
15	30	45	30	45	30	50
20	30	45	30	55	30	60
25	30	55	35	55	40	60
32	30	55	35	55	40	65
40	30	55	35	60	40	65
50	30	60	40	60	45	70
65	40	60	40	60	45	70
80	40	60	40	65	45	75
100	40	70	40	65	45	75
150	40	75	45	80	50	90
200	45	75	45	80	55	90
250	45	75	55	80	55	100
300+	70	80	75	100	80	100

λ = thermal conductivity of insulating materials at a mean temperature of 10°C.

3. **Ducts passing through outside or unconditioned spaces must be insulated with the minimum insulation thickness specified in Table 502.11 (2).**

Table 502.11 (2) Minimum insulation thickness for ducts passing through unconditioned spaces

Minimum air temperature inside duct (°C)							
15		10		5		0	
Minimum thickness of insulating material (mm)							
λ = 0.018 W/mK	λ = 0.038 W/mK	λ = 0.018 W/mK	λ = 0.038 W/mK	λ = 0.018 W/mK	λ = 0.038 W/mK	λ = 0.018 W/mK	λ = 0.038 W/mK
42	61	48	84	57	107	66	127

λ = thermal conductivity of insulating materials at a mean temperature of 10°C.

Insulation materials used must meet the requirements of regulation 701.01, Thermal and Acoustical Insulation Materials or BS 5422:2009, whichever is the more stringent.

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

2.0 Intent/Goal

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

3.0 Background

In buildings with central chiller and ventilation systems, there may be considerable lengths of pipework carrying water from the chiller to devices such as fan coil units or ducts carrying air which has been cooled at a main air handling unit or a secondary device. If pipes and ducts are not suitably insulated, the temperature of the water or air will increase before its destination. Such losses require additional energy use to provide extra cooling.

When warm humid air, such as is common in Dubai, is in contact with a colder object, it may cool to form condensation. Such water can become a nuisance and cause damage to building elements. The best means of preventing condensation of airborne water vapour is by providing insulation which prevents the air from coming into contact with cold surfaces.

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 provision of suitable pipe and duct insulation will reduce the amount of heat loss in distributing chilled water or conditioned air and eliminate condensation forming on chilled surfaces. Proper insulation is one of the primary ways in which to prevent moisture and thus prevent mould.

6.0 Guidance

6.1 General

The British Standard BS 5422-2009: Method for Specifying Thermal Insulating Materials for Pipes, Tanks, Vessels, Ductwork and Equipment, has been selected as providing the insulation requirements for pipe and ducts passing through conditioned spaces. For pipes and ducts which pass through ambient temperature spaces which are not conditioned, insulation requirements have been selected which are suitable for Dubai conditions. All other requirements of BS 5422-2009 must be complied with.

All materials used for insulation must be fire retardant and inhibit or resist the spread of fire. In the event of fire, the insulation material must not emit toxic fumes. The above standard covers water vapour permanence, vapour barriers, thickness, temperature limitations and fire retardant properties.

The technical data available in BS 5422-2009 covers a large number of solutions and applications and should be referred to as supplementary to this guideline. Also refer to this standard for detailed information on the specific application and environmental conditions.

6.2 Technical Data and Specifications

The insulation requirements are specified for different thermal conductivity (lambda λ) values of insulating materials. This allows the designer to select the most suitable insulating material for specific applications. There are many materials with different thermal conductivities that can be used for insulation. The lower the thermal conductivity the better the insulation value and each insulant can be designed to achieve a specific value by specifying adequate thickness.

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* *A/C drawing sheet*
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 Best Practice

The insulation of pipes and ductwork is already common practice. The requirement of this regulation to use the type and amount of insulation detailed in a recognised Standard is already good practice in many countries.

9.0 References

British Standard BS5422-2009, Method for Specifying Thermal Insulating Materials for Pipes, Tanks, Vessels, Ductwork and Equipment. The standard can be obtained from: http://www.bsi-global.com/en/