

# CRITERIA FOR GREEN BUILDINGS IN LEBANON





# CRITERIA FOR GREEN BUILDINGS IN LEBANON

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Message of the President  
of Federation  
of Lebanese Engineers

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## Message of the President of Federation Federation of Lebanese Engineers

The world is entering a cycle of unruly speed to participate in competitions in every single field, as if the world was about to end. Many do not notice the impacts resounding under every roof, impacts born from breaking, unnoticed and unpunished, a lot of the existing rules. It appears like some persons are summoning the past, the present and the future to the palms of their hands in order to prevent others from living a serene and peaceful life.

This egoism came to light when the persons involved realized that the environment does not belong to anyone. The environment is a gift, a present no one should ever change irreversibly. This principle of reversibility clears the way for a great rebirth, imposing in the process a new reality on international policies. This principle is an eternal reminder that we should take care of the environment, in order to ensure a decent life for future generations...

Green building and everything related to it puts a great amount of responsibility on our shoulders. It is not a temporary episode, it is a treasure of responsible engineering and architecture as we can see in the "Guideline Book" that provides a good start to a new, serious work.

And I, as the president of the Order of Engineers and Architects of Beirut, always supported the research that could provide us with the manpower and expertise we need to help us write new specifications and criteria for every field. I gave green building a greater importance by insisting on establishing broad-based rules for a healthy structure, in order to follow new terms in the sustainable building field and to interact with the laws that should be implemented to serve people.

Every building consumes natural resources. The numbers related to this subject are still shocking. We can, with a simple measure taken on a wise and responsible basis, reduce the waste and the consequences observed in every single field.

Extracting, manufacturing and rehabilitating natural resources, in order to be consumed in a right, safe way in production, transportation, operation, installation and use through the consumption of energy and the pollution of the environment are subjects that are gaining in importance every time an engineer or an architect takes into account all the aspects concerning these various applications.

Now is the time to stand for a great responsibility. We should read this book and obey by its content. What you will find in these pages are preliminary criteria guidelines for green buildings in Lebanon. We do not see this book as an accomplished goal, but we want it to be the starting point of the road to our honorable goals: acting in the best way possible to strengthen our profession and show its positive impacts on everything surrounding us and avoiding everything hindering the development deeply rooted in the serious and creative field of work for the wellbeing of the society and the people.

*Federation of Lebanese Engineers  
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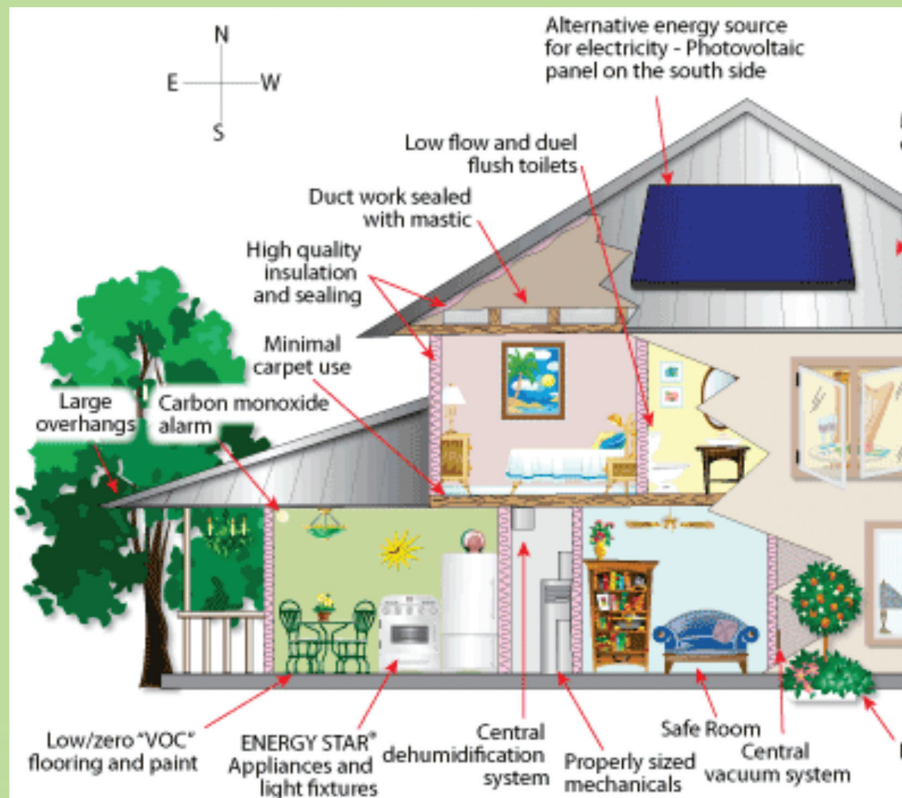
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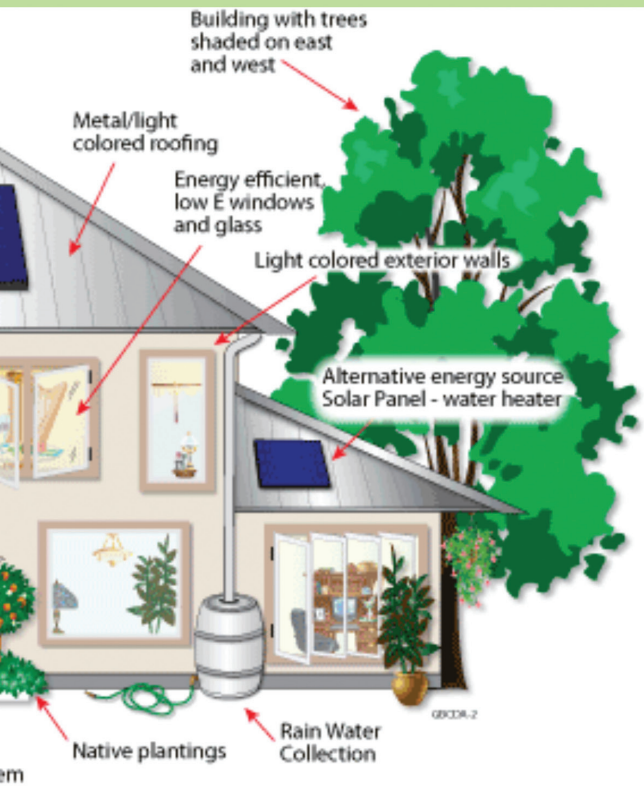
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# Green Building Criteria

## Energy

## Indoor Environmental Quality





## Water Use Efficiency

## Environmental Impact





## A. Introduction



## A. Introduction

### 1. Reason to prepare the criteria

As a direct reflection of global concerns, the past few decades have witnessed increasing efforts to build sustainable living environments for future generations. However, this growing awareness of ecologically responsible and climate responsive architectural design and building construction is at present primarily limited to academics and a modest number of design and construction professionals.

The criteria in this document constitute reference standards and codes that are applicable to all Projects. These Projects will promote environment-friendly sustainable planning and design. Large scale Projects as per Decrees 2192, 3659 and 12025 as well as the decision of the higher council dated 18 / 7 / 2012 could be subjected to additional requirements as presented in Appendix 2 of this document.

### 2. Climate zones adopted for the Criteria

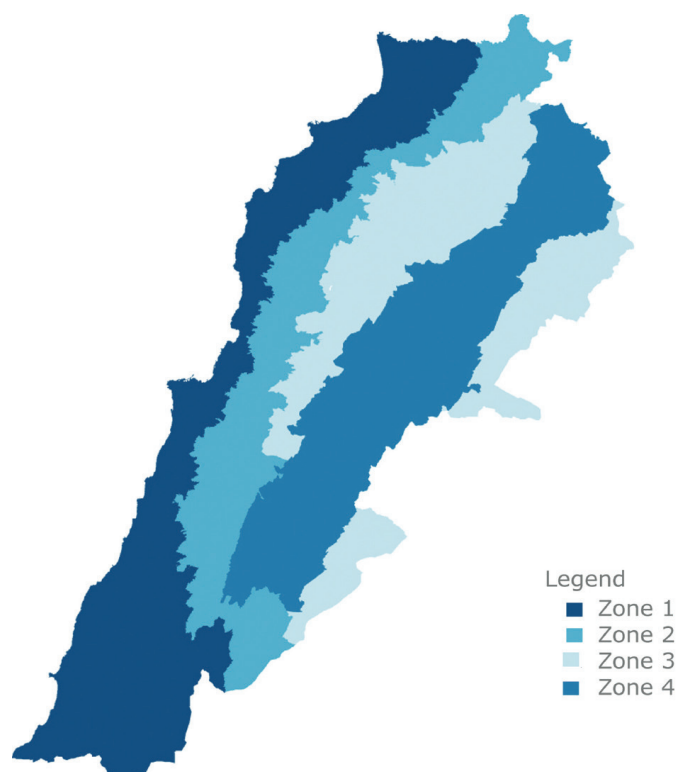
The Climate Study undertaken in 2005 resulted in the identification of four zones in Lebanon based on the altitude threshold and degree-day limits for each zone, as follows:

**Table 7 – Approximate Altitude and Degree-day Threshold for Four Zones**

Climatic Zone	Approximate Altitude range	Approximate HDD(18) and CDD(21) Thresholds
Zone 1: Coastal	0-700 m	300 < HDD < 1200 120 < CDD < 1050
Zone 2: Western Mid-Mountain	700-1400 m	1200 < HDD < 2000 0 < CDD < 120
Zone 3: Inland Plateau	700-1150 m	1200 < HDD < 1800 120 < CDD < 600
Zone 4: High Mountain	Littoral side +1400m	HDD > 2000 CDD = 0
	Inland side +1150 m	HDD > 1800 0 < CDD < 120

(Reference: Climate zoning, Thermal Standards for Buildings in Lebanon, Copyright © UNDP/GEF and MPWT/DGU – 2005)

Since altitude is one of the most important parameters that has an impact on dry-bulb temperature and the thermal envelope energy requirements of a building, it was used as an indicator to define the climatic regions.



*(Reference: Thermal Standards for Buildings in Lebanon, Copyright © UNDP/GEF and MPWT/DGU – 2005)*

Each criterion lists the new building types that are addressed and points out exceptions that are applicable.

### 3. Developing the Criteria

The document presented here. May be revised and modified based on merits, deficiencies or omissions that could be observed during its application.

It is to be hoped that eventually, as this living document evolves, its criteria become (s) an integral part of the building regulations.

If a new construction project is registered and committing to seek LEED,



BREEAM, HQE or other approved International Green Building Certification, it is considered as compliant to the “Criteria for Green Buildings in Lebanon”

#### 4. Building typologies

Each criterion lists the new building types that are addressed and points out exceptions that are applicable.

The building types mentioned in the document are as follows:

- Residential typologies including:
  - ☐ Residential apartment buildings
  - ☐ Individual residences
  - ☐ Secondary residences (chalets)
  - ☐ Dormitories.
- Non-residential building types are the typologies referred to in the Thermal Standard for Buildings in Lebanon (Criterion 1.1) include:
  - ☐ Hospitality types,
  - ☐ Hospitals and Health care,
  - ☐ Commercial / retail,
  - ☐ Educational
  - ☐ Institutional
  - ☐ Buildings accommodating indoor sports activities.
- Other typologies mentioned under different criteria include:
  - ☐ Industrial
  - ☐ Warehouses typologies
  - ☐ Hotels & furnished apartments
  - ☐ Office building
  - ☐ Car park building
  - ☐ Building receiving public such as Cinemas, Theaters arenas, Prayer places, Restaurants and Night clubs.
  - ☐ Mixed use.
- Large complex projects: Designates projects that are consistent with the description presented in Decrees 2192, 3659 and 12025 as well as the decision of the higher council DGU dated 18 / 7 / 2012.
- ☐ All: refers to all building types

**Note 1:** All terms in italic font are defined in Section “C” – Definitions.



## B. Green Building Criteria



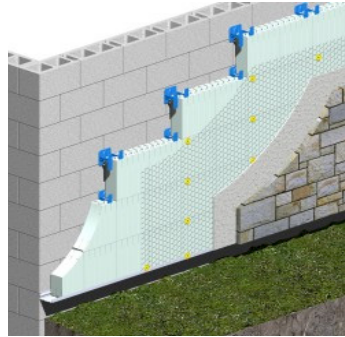
## B. Green Building Criteria

### 1. Energy

#### 1.1. Building Envelope

Buildings envelopes shall be in accordance with the requirements of the “Thermal Standard for Buildings in Lebanon” (TSBL) issued by the Ministry of Public Works and Transport – General Directorate of Urban Planning – in year 2005.

Included buildings are all air conditioned or heated buildings, residential and non-residential, except for the following:



- Buildings and parts of buildings that are intended for uses other than basic human occupancy, such as manufacturing, industrial processing, storage, etc.;
- Buildings and parts of buildings that require particular indoor environmental conditions such as greenhouses, warehouses, etc.;
- Places of worship;

These requirements shall apply to:

- External walls, roofs, and floors (where one side of the floor is exposed to ambient conditions)
- *Glazed elements*

The characteristics and altitude thresholds of the climatic zones, as well as the administrative districts related to each climatic zone are presented in the “Technical Guide for the application of the Thermal Standard for Buildings in Lebanon”.

**Reference code / standard:** TSBL 2005 available for free download at:  
[http://www.lcecp.org.lb/uploads/policies/Thermal\\_Standard\\_2005.pdf](http://www.lcecp.org.lb/uploads/policies/Thermal_Standard_2005.pdf)

The latest official reviews or modifications of TSBL 2005 will be applicable.

**Building types:** As per the TSBL 2005

**Climate zones:** All, as per TSBL 2005

## 1.2. Energy Efficiency

All buildings installing one or more of the following HVAC and domestic water heating systems shall comply with the requirements below, as applicable:

### a) DX Air conditioners:

For all DX air conditioned buildings, DX air conditioning equipment shall comply with the minimum energy efficiency requirements and test procedures as indicated in Table 1.1.



### b) Water chilling packages:

Water chilling packages shall comply with the minimum energy efficiency requirements and test procedures as indicated in Tables 1.2 and 1.3.

**Note:** Equipment types not listed in Tables 1.1, 1.2 and 1.3 should not be greater than the values presented in ASHRAE 90.1-2007 Table 6.8.1 (where applicable, values for before 1/1/2010).

Equivalent "Eurovent" certified ratings are acceptable.

### c) Fuel Boilers:

Boilers shall comply with the minimum energy efficiency requirements and test procedures as indicated in Table 1.4.

**Note 1:** Boilers compliant with the requirements of ASHRAE 90.1-2007 Table 6.8.1F are acceptable.

**Note 2:** Gas boilers and biomass boilers, when used, are exempted from the minimum energy efficiency requirements requested indicated in Table 1.4.



### d) Service Water Heating:

Hot water heaters shall comply with the maximum energy losses per 24 hours as indicated in Table 1.5 depending on heater volume V in liters.

**Note 1:** Hot water heaters compliant with the requirements of *ASHRAE* 90.1-2007 Table 7.8 are acceptable.

**Reference code / standard:** *ASHRAE* 90.1 2007 - French regulation RT 2005

**Building types:** All

**Climate zones:** All

### 1.3. Elevators and Escalators

For all buildings:

#### A. Escalators:

Escalators shall be fitted with controls to reduce speed or to stop when no traffic is detected. Escalators shall be designed with energy saving 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.

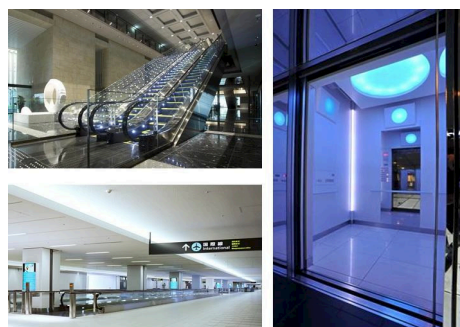
And / Or,

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 shall 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

In all buildings, elevators (lifts & service lifts) shall be provided with features and / or controls to reduce the energy demand. To meet this requirement, the following features shall be incorporated in traction drive elevators:

1. Use of AC Variable-Voltage and Variable-Frequency (VVVF) drives in buildings with more than or equal to 4 floors (5 stops).



2. Use of soft start drives in buildings with less than or equal to 3 floors (4 stops).
3. Use of energy efficient lighting inside the elevator including controls to turn lights and fan off when the elevator has been inactive for a maximum period of five (5) minutes.

**Note 1:** Hydraulic lifts are exempted from items 1 & 2.

**Reference code / standard:** -

**Building types:** All

**Climate zones:** All

#### 1.4. Artificial Lighting

The average *Lighting Power Density* for the interior and exterior connected lighting load shall be no more than the values specified in tables 1.6 and 1.7.

All exterior lighting must be fitted with automatic controls to ensure that lights do not operate during daylight hours (i.e. daylight sensor or timer)

**Reference code:** *Ashrae* 2007-90.1 or *RT* 2005

**Building types:** All

**Climate zones:** All

#### 1.5. Occupancy / Motion Sensors

Common areas which are not regularly occupied shall be equipped with occupancy / Motion sensors.

These sensors shall reduce the lighting levels to no more than 25 % of the normal lighting level when occupied.

Common areas which are not regularly occupied including but not limited to:

- Parking spaces
- Common lobbies
- Common Circulation areas
- Common stairs

Wherever applicable, life safety requirements for means of egress shall supersede the above requirements.





**Reference code / standard:** -

**Building types:** All

**Climate zones:** All

### 1.6. Electronic Ballasts

High frequency *electronic ballasts* shall be used with fluorescent lights and metal halide lights of 150 W or less.

High frequency *electronic ballasts* shall be labeled as conforming to IEC 60598 Luminaires general requirement, IEC 60929 Harmonics, IEC 55015 Radio interference, IEC 61547 Immunity.



**Reference code / standard:** - IEC

**Building types:** All

**Climate zones:** All

### 1.7. Control System:

1. In air conditioned buildings, each enclosed room shall have its own temperature *control system*.

This control shall be capable of:

- Independent temperature control of the room.
- Activation / Deactivation of A/C system of the room



2. In hotel rooms, dormitories and furnished apartments a control system is required capable of the following:

- Automatically turning off the A/C or setting back the room temperature set point, when the room is unoccupied.
- Automatically turning off the lighting when the room is unoccupied.
- Automatically turning off the A/C, when the window / balcony doors are open.

3. Thermostatic Valves:

Whenever radiators are installed, thermostatic valves shall be used. The thermostatic valves shall allow the following setting.



- a. Switch off
- b. Temperature set point
- c. Antifreeze for climatic zones 2, 3, & 4

When radiators are recessed or enclosed, thermostatic valves with remote sensors shall be used.

Radiators controlled via motorized valves are considered as compliant with this requirement

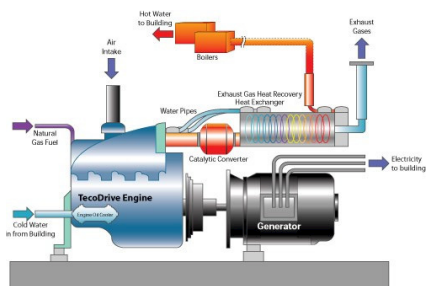
**Reference code / standard:**

**Building types:** All

**Climate zones:** All

### 1.8. Heat Recovery

1. Buildings with a total cooling load equal to or greater than seven hundred (700) kW cooling (200 tons refrigeration) or spaces served by 100% outdoor air units shall be provided with a heat recovery system.
2. The intension is to recover the cooling capacity of the exhausted air from spaces served mainly with 100% fresh air units. Recovery system efficiency should not be less than 40%.



The following building types shall be provided with a heat recovery system on the generators:

- Hotels or furnished apartments with more than 100 rooms.
- Hospitals or medical care centers with more than 100 beds or  $\geq 1000 \text{ m}^2$
- Industrial facilities with more than  $600 \text{ m}^2$ , and requiring heating for their industrial process.
- Schools and universities having an area of more than  $1500 \text{ m}^2$ .

The energy can be recovered from the exhaust gas and / or from the radiator jacket cooling. It shall be able to:

- Meet at least 20% of the total heating demand (Space heating + hot water tanks + pool heating + space reheat...)

Or

- Recover at least 30% of the generator plant capacity.

**Reference code / standard:** -

**Building types:** As mentioned above

**Climate zones:** All

### 1.9. Insulation on Pipes & Ducts

**A. Duct Insulation.** All supply and return ducts installed as part of an HVAC air distribution system shall be *thermally insulated* in accordance with table 1.8



**B. Piping Insulation.** All Pipes installed as part of a cooling, heating or service hot water distribution system, shall be *thermally insulated* in accordance with table 1.9

**Reference code / standard:** Extract from ASHRAE standard 90.1 2007

**Building types:** All buildings,

**Climate zones:** All

### 1.10. Energy Metering

#### A. Electric Power meters

For buildings with multiple tenancy, each tenant shall have its own electric Power Meter.



#### B. Other energy meters

For buildings supplied with central chilled water, central heating water, central VRV or central gas, and where energy is delivered individually to multiple tenants, energy meters shall be fitted to measure and record energy consumption.

**Reference code / standard:** -

**Building types:** Buildings with Multiple Tenants

**Climate zones:** All

### 1.11. Solar Energy

#### A. Thermal Solar Water Heating System

For all single family houses, a solar water heating system shall be installed to provide at least seventy percent (70%) of the yearly domestic hot water requirements.



#### B. Excessive external lighting

Where the external lighting power density exceeds that specified in Section 1.4 “Artificial Lighting”, any additional lighting load shall be powered entirely through renewable electricity sources such as photovoltaic systems.



**Reference code / standard: -**

**Building types: All**

**Climate zones: All**

## 2. Water Use Efficiency

### 2.1 Efficient Sanitary Fixtures

All buildings shall install sanitary fixtures complying with all of the following:

1. Criteria detailed in Table 2.1.
2. Automatic shut off faucets shall be installed in all public facilities.
3. Specialty Fixtures installed as a component of a specialized application (Hospital, Laboratory, Eye Shower, ...) are exempt from the above requirements.



**Reference code / standard: -**

**Building types: All**

**Climate zones: All**

## 2.2. Condensate Drain Recovery

All projects with a total cooling load equal to or greater than seven hundred (700) kW cooling (200 tons refrigeration), shall have a condensate recovery installation.

Such installation shall be required to recover at least 80% of the total condensate.

Condensate water could be used for irrigation of plants not intended for human consumption, toilet flushing, make-up water for *cooling towers*, or other suitable onsite purposes.

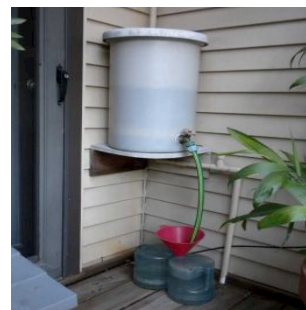
The water should not be used for human consumption as it may contain *heavy metals* from contact with the cooling coils and other *HVAC* equipment.

Condensate water being corrosive to most metals especially steel and iron, installation of the recovery system should be made of non-metallic or corrosion resistant materials.

**Reference code / standard: -**

**Building types:** Buildings having more than 700kW (200 tons refrigeration) total capacity of air-conditioning equipment.

**Climate zones:** Zones 1 and 2



## 2.3. Efficient Irrigation

For all buildings, irrigation systems for the exterior landscaping and eventually for *vegetated roofs* shall be controlled by a qualifying controller that uses moisture sensors to adjust irrigation schedules and to shut-off the system after reaching a predetermined amount of moisture in the soil.



Exterior landscaping shall be irrigated using high-efficiency irrigation methods *drip* subsoil water delivery systems or micro sprinklers where water is delivered at low pressure through buried pipes and sub-pipes, which in turn distribute

water to the soil from a network of perforated tubes or emitters or micro sprinklers.

All irrigation systems shall incorporate, at any point where they connect to a *potable water* supply, backflow prevention (anti-pollution) devices.

**Reference code / standard:** -

**Building types:** All

**Climate zones:** All

## 2.4. Rainwater Harvesting

All single family houses shall implement a rain water harvesting system. The average rain fall in Lebanon is considered to be 800 mm/m<sup>2</sup>/year.

Rain water shall be collected from at least 25% of the roofs and external non accessible terraced areas. Storage of the rain water shall be done in dedicated rain water tank. The minimum net capacity of the storage tank shall be calculated as follows:

Minimum Net Volume (m<sup>3</sup>) = 0.25 (Minimum percentage of Terraces & Roof) x Area of roofs and Terraces (m<sup>2</sup>) x 0.8m/m<sup>2</sup>/year (Rainfall) x 0.6 (Factor of Evaporation, 1st rain, wastage, etc...)

The rain water collection system shall be capable of discharging the first rain fall into the storm water network or of ensuring a free discharge, to prevent the accumulation of dirt in the rain water tank. The collected rain water shall be used for the purpose of irrigation, and / or general service cleaning.

If the collected rain water is used for toilet flushing, then the size of the water tank could be reduced by 75%. In this case, the water closet fixture shall have a dedicated supply water network.

**Reference code / standard:** -

**Building types:** Single Family Houses

**Climate zones:** All





### 3. Indoor Environmental Quality

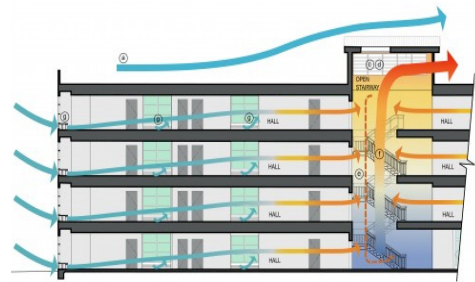
#### 3.1. Ventilation

All building *ventilation* systems (mechanical or natural) shall comply with the requirements detailed below:

##### Natural ventilation

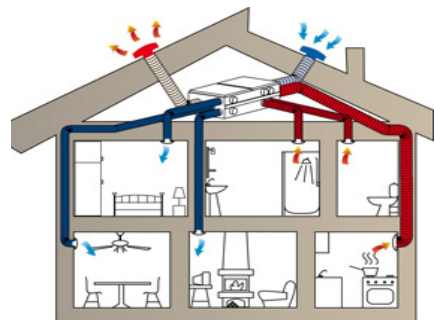
All naturally ventilated regularly occupied rooms shall comply with the following:

- The *openable net area* in each regularly occupied room / floor plate is minimum 4% of the gross internal floor area of that room/floor plate.
- For room/floor plates between 7m-15m depth, the *openable net area* shall be on opposite sides and evenly distributed across the area to promote adequate cross-ventilation.
- For rooms with depth higher than 15m, calculations or modeling should be carried out in order to demonstrate that the ventilation strategy can provide adequate cross flow of air to maintain the required thermal comfort conditions and ventilation rates. Where interior spaces without direct openings to the outdoors are ventilated through adjoining rooms, the opening between rooms shall be permanently unobstructed and have a free area of not less than 8% of the area of the interior room nor less than 2.3 m<sup>2</sup>.



##### Mechanical ventilation

- All mechanically ventilated areas shall comply with the values listed in the tables presented in the appendix, extracted from ASHRAE 62.1-2010 Standard for:
- Air intake minimum separation distance (Table 3.1)
- Minimum ventilation rates in breathing zone (Table 3.2)



- Minimum exhaust rates (Table 3.3)

*Parking ventilation* shall be in accordance with the regulations referred to within the Lebanese Public Safety Decree 7964.

**Reference code / standard:** ASHRAE 62.1 – 2010 Lebanese Public Safety Decree 7964 for parking spaces.

**Building types:** All

**Climate zones:** All

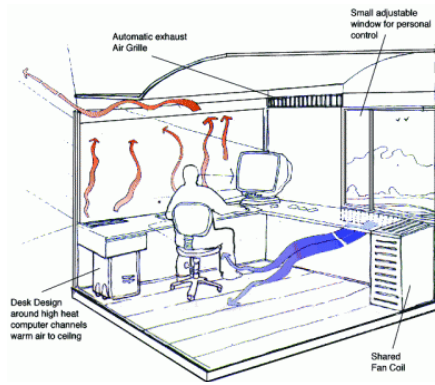
### 3.2. Thermal Comfort

All buildings having cooling and/or heating systems shall be designed in order to meet the temperature and relative humidity ranges as set in Table 3.4, in all regularly occupied spaces,

**Reference code / standard:-**

**Building types:** All

**Climate zones:** All



### 3.3. VOC Emissions – Paints & Coatings

All buildings shall use low *Volatile Organic Compound (VOC)* emission paints & coatings for all internal painted surfaces, complying with one of the following standards:

- Green Seal GS-11
- EN 13300:2001
- EU Directive 2004/42/CE21

**Reference code / standard:** Green Seal GS-11, EN 13300 :2001, EU Directive 2004/42/CE21

**Building types:** All

**Climate zones:** All





### 3.4. Daylighting

All buildings shall comply with the Lebanese Construction Law for the purpose of introducing sufficient natural *daylighting* (Article 7 of the Construction Law in Lebanon 646 / 2004).

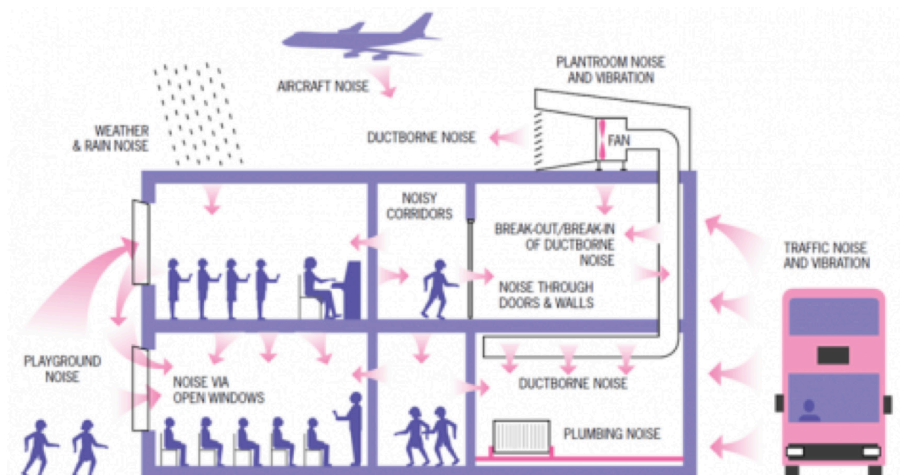
**Reference code / standard:** Lebanese Construction Law

**Building types:** All

**Climate zones:** All



### 3.5. Acoustic Performance



All buildings shall comply with the Lebanese Official Gazette 1269/1996 Appendix. Once the Lebanese national standard for acoustic performance is issued, it shall supersede the Lebanese Official Gazette 1269/1996 Appendix

**Reference code / standard:** Same reference as above

**Building types:** All

**Climate zones:** All

## 4. Environmental impact

### 4.1. Impact of Construction Works

All buildings shall comply with all the items listed below throughout the whole Construction Phase:

#### a) Construction Waste

Dumping of construction waste into neighboring property or general waste skips, as well as burning it, shall not be permitted. Such waste shall be either sent to recycling, donated, used for other construction purposes (such as backfilling), or hauled to authorized landfills.



#### b) Water Pollution

Dumping of construction waste, or liquids and petroleum and chemical liquids, into water streams or neighboring roads shall not be permitted.



#### c) Dust pollution:

Dust-producing site activities shall be sprayed with water to minimize air pollution.

#### d) Scaffolding

Scaffolding shall be covered by a protective net to prevent the danger from falling materials and reduce dust pollution.



#### e) Vehicle pollution

Vehicle wheels shall be sprayed in order to be cleaned from dust and debris before exiting the site, to prevent pollution to nearby roads.



#### f) Working schedule

Site operations shall take place during the hours permitted by the local municipality or regulations to prevent noise disturbance to the neighborhood.

#### g) Asbestos

The use of asbestos in the building, on site, or during construction, shall be strictly forbidden.

#### Reference code / standard:

**Building types:** All

**Climate zones:** All

### 4.2. Landscape



In the absence of specific local requirements for landscape, all plots shall have 25% of their Landscape Area vegetated / planted.

In case the full exploitation of the site area is allowed (i.e. there is no Landscaped Area), an area equivalent to 10% of the site area shall be vegetated. This includes *vegetated roofs*, green walls, and planters, or a combination of those.

It is strongly recommended to plant native or adaptive species since they are cheaper, require less maintenance and less water for irrigation.

**Reference code / standard:-**

**Building types:** All

**Climate zones:** All

#### 4.3. Heat Island Effect

##### LANDSCAPE AREA:



In addition to compliance with item 4.2 above, all buildings shall have another 25% of their Landscape Area either:

- Vegetated/planted OR
- Covered with high *SRI* materials ( $SRI \geq 29$ ) OR
- Shaded by high *SRI* materials ( $SRI \geq 29$ ) OR
- Shaded by solar panels OR
- A combination of any of the above

##### ROOF:

All buildings shall have 50% of their non-technical roof area either:

- Vegetated/planted OR
- Covered with high *SRI* materials ( $SRI \geq 78$ ) OR
- Shaded with high *SRI* materials ( $SRI \geq 78$ ) OR

- Shaded by solar panels or / a combination of any of the above
- In case the building has a sloped roof above 25 degrees,  $SRI \geq 29$  shall be permitted

Note that red brick tiles, required by local regulations, are considered complying with the above requirement.

**Reference code / standard:-**

**Building types:** All

**Climate zones:** All

#### 4.4. Night Time Light Pollution



For all buildings, exterior lighting shall comply with the following:

- All exterior *light fixtures*, shall be aimed towards the downward horizontal plane or shielded to prevent the lighting of the night sky.
- Emergency lighting, Civil Aviation safety lighting and / or signage lighting shall be exempted from the above mentioned requirement.

**Reference code / standard:-**

**Building types:** All

**Climate zones:** All



#### 4.5. Operational Waste

All buildings shall provide at least three containers or bins dedicated for recyclable waste. The containers shall be located in a communal area (internal or external) within the project boundaries.

The containers shall be exclusively designated for, at a minimum:

1. Paper and cardboard
2. Co-mingled waste: metal, and glass
3. Plastic

Note that these containers shall be separate from any other bins used for general refuse waste.

The size of the provided storage space shall comply with the following:

##### **Residential:**

The total volume of *recycling* bins shall be calculated as 50L per bedroom provided in the building

##### **Non-Residential:**

- At least 2m<sup>2</sup> of total *recycling* storage area per 1,000m<sup>2</sup> of net used floor area excluding parking area shall be provided.

##### **Mixed-Use:**

The above requirements shall be applied in proportion to the building usage.

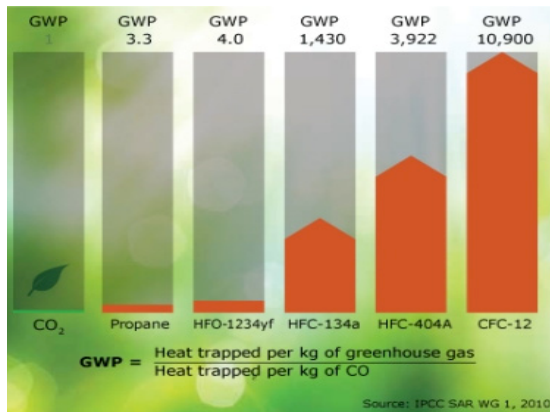
##### **Reference code / standard:-**

**Building types:** All

**Climate zones:** All



## 4.6. Refrigerant Impact



All buildings using *refrigerants* in their systems shall select a *refrigerant* with zero *Ozone Depleting Potential (ODP)*.

**Reference code / standard:-**

**Building types:** All

**Climate zones:** All





## C. Definitions



## C. Definitions

Terms that are not defined shall have their ordinary accepted meaning within the context in which they are used.

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

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

**ASHRAE** American Society of Heating, Refrigerating and Air-Conditioning Engineers.

**Building envelope** The exterior elements of a building which form a barrier between the internal and exterior spaces. For an air conditioned building, the building envelope is defined as the elements of a building that separate conditioned spaces from the exterior.

**Building metering** The use of meters to track the use of utilities (such as water and electricity) per building unit.

**Building occupants (also building users)** Persons using the building. Full-time occupants use the building for at least 8 hours most days. Part-time occupants use the building for less than 8 hours most days. Transient occupants, such as visitors, customers, students, use the building at irregular times.

**Condensation** The process through which a gas or vapour changes to liquid form. Also defined as the water which is produced in this process.

### Construction and demolition waste

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

**Control systems** Controls that allow users to change/adjust the level of lighting and air conditioning in a space.

**Control zone (HVAC)** A space (or group of spaces) with heating or cooling requirements that is sufficiently similar so that desired conditions (e.g. temperature) can be maintained throughout by using a single controller. The zone may be part of a larger space, an individual office or a small dwelling.

**Cooling Degree Day** Cooling degree days are a measure of how much (in degrees), and for how long (in days), the outside air temperature is above a certain level. The unit is used in estimating the energy needs for cooling a building.

**Cooling tower** Heat removal devices used to transfer process waste heat to the atmosphere. Cooling towers may either use the evaporation of water or rely solely on air to cool the working fluid. Common applications include removing heat from the water used to cool refrigeration chillers.

**Daylighting** The use of natural light from the sun or sky to provide illumination in interior spaces.

**DX** Direct expansion.

**Grade A Building** As per the criteria set by the Lebanese safety regulations 7964.

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

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

**Exhaust air** Air removed from a building space and discharged to the outside of the building through a mechanical or natural ventilation system.

**Fan systems** A system of fans used to supply to, or exhaust air from, a building space

**Glazed Elements** All areas in the building envelope that let in light, including windows, plastic panels, clerestories, skylights, doors that are more than one half glass, and glass block walls.

**Glazing area** The area of glazed elements in the exterior walls of a building.

**Heating Degree Day** Heating degree days are a measure of how much (in degrees), and for how long (in days), the outside air temperature is below a certain level. The unit is used in estimating the energy needs for heating a building.

**Heat Island Effect (HIE)** Heat Island Effect occurs when warmer temperatures are experienced in urban/developed areas compared to adjacent undeveloped areas due to solar energy retention on constructed surfaces. Some of the surfaces that contribute to the Heat Island Effect are paved streets, sidewalks, parking lots and buildings.

**Heating, ventilation, and air conditioning(HVAC) system**

The equipment, distribution systems, and terminals that provide either individually or collectively, the processes of heating, ventilating, or air conditioning to a building or a portion of a building.

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

**HVAC** Heating, Ventilation and Air conditioning.

**Hydraulic elevator** An elevator operated using liquid pressure.

**Landscape Area** The difference between the site area and the Building Footprint area.

**Light fixture** The component of a luminaire that houses the lamp(s), positions the lamp, shields it from view, and distributes the light. The fixture also provides for connection to the power supply, which may require the use of ballast.

**Lighting Power Density (LPD)** The maximum lighting power per unit area.

**Mechanical system** Those systems within a building which include components of mechanical plant or machinery. These systems include, but are not limited to, the HVAC system of a building.

**Natural ventilation (passive ventilation)** Ventilation provided by thermal, wind or diffusion effects through windows, doors, or other openings in the building.

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

**ODP** Ozone Depleting Potential

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

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

**Potable water** Water that is suitable for human consumption.

**Heat/temp.** Radiant heat may be present if there are heat sources in an environment. Examples of radiant heat sources include: the sun, fire, ovens, driers, hot surfaces and machinery, etc.

**Recycling** Processing used materials into new products in order to prevent the waste of potentially useful materials, reduce the consumption of fresh raw materials, reduce energy usage, reduce air pollution and water pollution by reducing the need for “conventional” waste disposal.

**Reflectivity (solar reflectance)** Reflectivity measures how well a material reflects back solar radiation.

**Refrigerants** Working fluids of refrigeration cycles, which absorb heat at low temperatures and reject heat at higher temperatures.

**Regular occupied spaces** Refer to areas typically occupied for 30 consecutive minutes or more (i.e. living areas, bedrooms, offices, kitchens, dining rooms, working areas etc.)

**Solar Reflectance** The SRI is an index that combines reflectivity and emissivity,

**Index (SRI)** Measuring a material's ability to reject solar heat. SRI is defined so that a standard black (reflectance 0.05 and emittance 0.90) is 0 and a standard white (reflectance 0.80 and emittance 0.90) is 100. Materials with higher SRI absorb less heat and can reduce the heat island effect.

**Thermal comfort** A condition experienced by building occupants who are satisfied with the thermal environment.

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

**Vegetated roof** A vegetated roof consists of vegetation and soil or a growing medium, planted over a waterproofing membrane on rooftops. Vegetated roofs may also include additional layers, such as a root barrier and drainage and irrigation systems. The use of vegetated roofs may have different purposes, from energy savings to storm water management and aesthetics benefits.

**Ventilation** The process of supplying air to or removing air from a space in order to control air contaminant levels, humidity, or temperature within the space.

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





## D. Appendices



## D. Appendices

### 1.Tables

#### ENERGY

**Table 1.1: Unitary and Applied Heat Pumps – Minimum Efficiency Requirements**

Reference ASHRAE 90.1 2007 Table 6.8.1

Unitary and Applied Heat Pumps – Minimum Efficiency Requirements Reference ASHRAE 90.1 2007 Table 6.8.1				
Equipment type	Size category	Subcategory	Minimum efficiency COP	Test procedure
Air conditioners, air cooled – cooling mode	<19 kW	Split system or Single package	2.93	ARI 210/240
	>19 kW <40 KW		2.90	ARI 340/360
	>40 KW <70 kW		2.66	
	>70 kW		2.58	

**Table 1.2: Water chilling packages – Minimum Efficiency Requirements (Part 1)**

Reference ASHRAE 90.1 2007 Table 6.8.1

Water chilling packages – Minimum Efficiency Requirements Reference ASHRAE 90.1 2007 Table 6.8.1				
Equipment type	Size category	IPLV	Minimum efficiency COP	Test procedure
Air cooled – cooling mode	All capacities	3.05	2.8	ARI 550/590
Water cooled reciprocating	All capacities	5.05	4.2	

**COP = Coefficient of Performance**

**IPLV = Integrated Part-load value for equipment with load modulation**

**Table 1.3: Water chilling packages –  
Minimum Efficiency Requirements (Part 2)**

**Reference ASHRAE 90.1 2007 Table 6.8.1**

<b>Water chilling packages – Minimum Efficiency Requirements</b> Reference ASHRAE 90.1 2007 Table 6.8.1				
<b>Equipment type</b>	<b>Size category</b>	<b>IPLV</b>	<b>Minimum efficiency COP</b>	<b>Test procedure</b>
Water cooled – rotary screw or scroll	<528 KW	5.2	4.45	ARI 550/590
	>528KW <1055 KW	5.6	4.9	
	>1055 KW	6.15	5.5	
Water cooled – centrifugal	<528 KW	5.25	5	ARI 550/590
	>528KW <1055 KW	5.90	5.55	
	>1055 KW	6.40	6.1	

**COP = Coefficient of Performance**

**IPLV = Integrated Part-load value for equipment with load modulation**

**Table 1.4: Boiler efficiency**

**Reference RT 2005 - Art. 26**

<b>Nominal Boiler Capacity</b> (Reference RT 2005 art26)	<b>P<sub>n</sub> &lt; 400 KW</b>	<b>P<sub>n</sub> &gt; 400 KW</b>
Efficiency PCI at full load and 70 °C average water temperature inside the boiler	$88.5 + 1.5 \log P_n$	92.4
Efficiency PCI at 30% load and 40 °C average water temperature inside the boiler	$88.5 + 1.5 \log P_n$	92.4

**PCI = Pouvoir Calorifique Inferieure = Lower Heating Value**

**Table 1.5: Maximum energy losses KWh per 24h  
for electric waters heaters**

**Reference RT 2005 – Art. 58**

<b>maximum energy losses KWh per 24h</b> (Reference RT 2005 – art58)	<b>Electric heater</b>
<b>Volume &lt; 70 L</b>	$0,147\ 4 + 0,071\ 9\ V^{2/3}$
<b>Horizontal      Volume &gt; 70 L</b>	$0,939 + 0,010\ 4\ V$
<b>Vertical          Volume &gt; 70 L</b>	$0,224 + 0,066\ 3\ V^{2/3}$

**Table 1.6 Lighting Power Densities for building (Interior)**

**Reference RT 2005 Art. 32 and ASHRAE 90.1-2007 Table 9.5.1**

<b>Building Type</b>	<b>Maximum average Watts per square meter (W/m<sup>2</sup>) across total building area</b>
Commercial/Public: Offices, Hotels, Resorts, Restaurants	12
Educational Facilities	13
Manufacturing Facility	14
Retail Outlets, Shopping Malls , Workshop	16
Warehouses	9
Residential	10

Lighting Power Densities for building types not listed in the above Table should be no greater than those values given in ASHRAE 90.1-2007 Table 9.5.1. or in the French regulation RT 2005 article 32.

**Table 1.7 Lighting Power Densities for building (Exterior)**

**Reference ASHRAE 90.1-2007 Table 9.4.5 2005**

<b>Building Area</b>	<b>Maximum Watts per square meter or linear meter</b>
Uncovered parking lots and drives	1.6 W/m <sup>2</sup>
Walkways less than 3 meters wide	3.3 W/linear meter
Walkways 3 meters wide or greater	2.2 W/m <sup>2</sup>
Outdoor Stairways	10.8 W/m <sup>2</sup>
Main entries	98 W/linear meter of door width
Other doors	66 W/linear meter of door width
Building Facades	2.2 W/m <sup>2</sup> for each illuminated wall or surface or 16.4 W/linear meter for each illuminated wall or surface length
Entrances and gatehouse inspection stations at guarded facilities	13.5 W/m <sup>2</sup>

Lighting Power Densities for exterior areas not listed in the above Table should be no greater than those values given in ASHRAE 90.1-2007 Table 9.4.5 or French regulation RT 2005.

**Table 1.8: Minimum Duct Insulation R-Valuea, Combined Heating and Cooling Supply Ducts and Return Ducts**

**Reference ASHRAE 90.1 2007 Table 6.8.2**

<b>Climate Zone</b>	<b>Exterior</b>	<b>Unconditioned Space<sup>b</sup></b>	<b>Indirectly Conditioned Space<sup>c</sup></b>	<b>Buried</b>
1 & 2	R-1.06	R-0.62	none	R-0.62
3 & 4	R-1.41	R-0.62	none	R-0.62

**a.** Insulation R-values, measured in m<sup>2</sup> K/W, are for the insulation as installed and do not include film resistance. The required minimum thickness does not consider water vapor transmission and possible surface condensation. Where exterior walls are used as plenum walls, wall insulation shall be required by the most restrictive condition of Section 6.4.4.2 or Section 5 of the ASHRAE standards. Insulation resistance measured on a horizontal plane in accordance with ASTM C518 at a mean temperature of 23.9oC at the installed thickness.

**b.** Includes crawlspaces, both ventilated and nonventilated.

**c.** Includes return air plenums with or without exposed roofs above.

**Table 1.9 Minimum Pipe Insulation Thickness**

Reference ASHRAE 90.1 2007 Table 6.8.3

**TABLE 6.8.3 Minimum Pipe Insulation Thickness<sup>a</sup>**

Fluid Design Operating Temp. Range (°C)	Insulation Conductivity		Nominal Pipe or Tube Size (in.)				
	Conductivity (W/m·K)	Mean Rating Temp. °C	<25	25 to <40	40 to <100	100 to <200	≥200
<b>Heating Systems (Steam, Steam Condensate, and Hot Water)<sup>b,c</sup></b>							
>177	0.046–0.049	121	6.4	7.6	7.6	10.2	10.2
122–177	0.042–0.046	93	3.8	6.4	7.6	7.6	7.6
94–121	0.039–0.043	66	3.8	3.8	5.1	5.1	5.1
61–93	0.036–0.042	52	2.5	2.5	2.5	3.8	3.8
41–60	0.032–0.040	38	1.3	1.3	2.5	2.5	2.5
<b>Domestic and Service Hot-Water Systems</b>							
41+	0.032–0.040	38	1.3	1.3	2.5	2.5	2.5
<b>Cooling Systems (Chilled Water, Brine, and Refrigerant)<sup>d</sup></b>							
4–16	0.032–0.040	38	1.3	1.3	2.5	2.5	2.5
<4	0.032–0.040	38	1.3	2.5	2.5	2.5	3.8

<sup>a</sup> For insulation outside the stated conductivity range, the minimum thickness ( $T$ ) shall be determined as follows:

$$T = r \{ (1 + tr)^{k/k} - 1 \}$$

where  $T$  = minimum insulation thickness (cm),  $r$  = actual outside radius of pipe (cm),  $t$  = insulation thickness listed in this table for applicable fluid temperature and pipe size,  $K$  = conductivity of alternate material at mean rating temperature indicated for the applicable fluid temperature (W/m·K); and  $k$  = the upper value of the conductivity range listed in this table for the applicable fluid temperature.

<sup>b</sup> These thicknesses are based on energy efficiency considerations only. Additional insulation is sometimes required relative to safety issues/surface temperature.

<sup>c</sup> Piping insulation is not required between the control valve and coil on run-outs when the control valve is located within 1.2 m of the coil and the pipe size is 25 mm or less.

<sup>d</sup> These thicknesses are based on energy efficiency considerations only. Issues such as water vapor permeability or surface condensation sometimes require vapor retarders or additional insulation.



## Water

**Table 2.1: Sanitary fixtures requirements**  
Adapted from LEED and BREEAM

Fixture type	Maximum Flow Rate	Applicable to
Toilets	Dual Flush 3Lit / 6Lit	all toilets in building
Hand Wash Faucets	6 Lit / Min	2/3 of faucets in building
Showerheads	9 Lit / Min	2/3 of showerheads in building
Kitchen Sinks	9 Lit / Min	all kitchen sinks in building
Urinals	1 Lit / Flush or waterless	all urinals in building

## IEQ

**Table 3.1: Air Intake Minimum Separation Distance**

Reference ASHRAE Standard 62.1-2010 - Table 5-1

**Table 5A – Air Intake Minimum Separation Distance**

This is a reproduction of Table 5-1 from Standard 62.1-2010

OBJECT	MINIMUM DISTANCE	
	ft	m
Class 2 air exhaust/relief outlet (Note 1)	10	3
Class 3 air exhaust/relief outlet (Note 1)	15	5
Class 4 exhaust/relief outlet (Note 2)	30	10
Plumbing vents terminating less than 3 ft (1 m) above the level of the outdoor intake	10	3
Plumbing vents terminating at least 3 ft (1 m) above the level of the outdoor intake	3	1
Vents, chimneys and flues from combustion appliances and equipment (Note 3)	15	5
Garage entry, automobile loading area, or drive-in queue	15	5
Truck loading area or dock, bus parking/idling area	25	7.5
Driveway, street or parking place	5	1.5
Thoroughfare with high traffic volume	25	7.5
Roof, landscaped grade, or other surface directly below intake (Note 7)	1	0.30
Garbage storage/pick-up area, dumpsters	15	5
Cooling tower intake or basin	15	5
Cooling tower exhaust	25	7.5

*Selected notes to the table (see standard for all notes):*

*Note 1 of the table clarifies that this separation requirement applies only when the outlet is from a different system than the intake. This is because 5.15, Air Classification and Recirculation, allows Class 2 and 3 air to be recirculated within the space of origin.*

*Note 2 exempts laboratory fume hood exhaust air outlets from this clearance requirement provided that they comply with separation criteria in NFPA 45, Standard on Fire Protection for Laboratories Using Chemicals and ANSI/AIHA Z9.5 Standard for Laboratory Ventilation.*

*Note 3 allows for shorter separation distances are permitted when determined in accordance with other codes related to combustion equipment. For more information, the designer can generally consult the manufacturer of the combustion equipment, who should be well versed in the ratings and approvals of their products.*

IEQ = Indoor Environmental Quality

**Table 3.2: Minimum ventilation rates in breathing zone**

**Reference ASHRAE Standard 62.1-2010, Ventilation for Acceptable Indoor Air Quality**

Occupancy Category	People Outdoor Air Rate		Area Outdoor Air Rate		Notes	Default Values		Air Class	
	$R_p$		$R_a$			Occupant Density (see Note 4)	Combined Outdoor Air Rate (see Note 5)		
	cfm/person	L/s·person	cfm/ft <sup>2</sup>	L/s·m <sup>2</sup>		#/1000 ft <sup>2</sup> or #/100 m <sup>2</sup>	cfm/person L/s·person		
Correctional Facilities									
Cell	5	2.5	0.12	0.6		25	10	4.9	2
Dayroom	5	2.5	0.06	0.3		30	7	3.5	1
Guard stations	5	2.5	0.06	0.3		15	9	4.5	1
Booking/waiting	7.5	3.8	0.06	0.3		50	9	4.4	2
Educational Facilities									
Daycare (through age 4)	10	5	0.18	0.9		25	17	8.6	2
Daycare sickroom	10	5	0.18	0.9		25	17	8.6	3
Classrooms (ages 5–8)	10	5	0.12	0.6		25	15	7.4	1
Classrooms (age 9 plus)	10	5	0.12	0.6		35	13	6.7	1
Lecture classroom	7.5	3.8	0.06	0.3		65	8	4.3	1
Lecture hall (fixed seats)	7.5	3.8	0.06	0.3		150	8	4.0	1
Art classroom	10	5	0.18	0.9		20	19	9.5	2
Science laboratories	10	5	0.18	0.9		25	17	8.6	2
University/college laboratories	10	5	0.18	0.9		25	17	8.6	2
Wood/metal shop	10	5	0.18	0.9		20	19	9.5	2
Computer lab	10	5	0.12	0.6		25	15	7.4	1
Media center	10	5	0.12	0.6	A	25	15	7.4	1
Music/theater/dance	10	5	0.06	0.3		35	12	5.9	1
Multi-use assembly	7.5	3.8	0.06	0.3		100	8	4.1	1
Food and Beverage Service									
Restaurant dining rooms	7.5	3.8	0.18	0.9		70	10	5.1	2
Cafeteria/fast-food dining	7.5	3.8	0.18	0.9		100	9	4.7	2
Bars, cocktail lounges	7.5	3.8	0.18	0.9		100	9	4.7	2
Kitchen (cooking)	7.5	3.8	0.12	0.6		20	14	7.0	2

### General

Break rooms	5	2.5	0.06	0.3		25	7	3.5	1
Coffee stations	5	2.5	0.06	0.3		20	8	4	1
Conference/meeting	5	2.5	0.06	0.3		50	6	3.1	1
Corridors	—	—	0.06	0.3		—			1
Occupiable storage rooms for liquids or gels	5	2.5	0.12	0.6	B	2	65	32.5	2

### Hotels, Motels, Resorts, Dormitories

Bedroom/living room	5	2.5	0.06	0.3		10	11	5.5	1
Barracks sleeping areas	5	2.5	0.06	0.3		20	8	4.0	1
Laundry rooms, central	5	2.5	0.12	0.6		10	17	8.5	2
Laundry rooms within dwelling units	5	2.5	0.12	0.6		10	17	8.5	1
Lobbies/prefunction	7.5	3.8	0.06	0.3		30	10	4.8	1
Multipurpose assembly	5	2.5	0.06	0.3		120	6	2.8	1

## Reference ASHRAE Standard 62.1-2010, Ventilation for Acceptable Indoor Air Quality

**TABLE 6-1 MINIMUM VENTILATION RATES IN BREATHING ZONE** (Continued)  
(This table is not valid in isolation; it must be used in conjunction with the accompanying notes.)

Occupancy Category	People Outdoor Air Rate		Area Outdoor Air Rate		Notes	Default Values			Air Class
	$R_p$		$R_a$			Occupant Density (see Note 4)	Combined Outdoor Air Rate (see Note 5)		
	cfm/person	L/s-person	cfm/ft <sup>2</sup>	L/s-m <sup>2</sup>		#/1000 ft <sup>2</sup> or #/100 m <sup>2</sup>	cfm/person	L/s-person	
Office Buildings									
Breakrooms	5	2.5	0.12	0.6		50	7	3.5	1
Main entry lobbies	5	2.5	0.06	0.3		10	11	5.5	1
Occupiable storage rooms for dry materials	5	2.5	0.06	0.3		2	35	17.5	1
Office space	5	2.5	0.06	0.3		5	17	8.5	1
Reception areas	5	2.5	0.06	0.3		30	7	3.5	1
Telephone/data entry	5	2.5	0.06	0.3		60	6	3.0	1
Miscellaneous Spaces									
Bank vaults/safe deposit	5	2.5	0.06	0.3		5	17	8.5	2
Banks or bank lobbies	7.5	3.8	0.06	0.3		15	12	6.0	1
Computer (not printing)	5	2.5	0.06	0.3		4	20	10.0	1
General manufacturing (excludes heavy industrial and processes using chemicals)	10	5.0	0.18	0.9		7	36	18	3
Pharmacy (prep. area)	5	2.5	0.18	0.9		10	23	11.5	2
Photo studios	5	2.5	0.12	0.6		10	17	8.5	1
Shipping/receiving	10	5	0.12	0.6	B	2	70	35	2
Sorting, packing, light assembly	7.5	3.8	0.12	0.6		7	25	12.5	2
Telephone closets	—	—	0.00	0.0		—			1
Transportation waiting	7.5	3.8	0.06	0.3		100	8	4.1	1
Warehouses	10	5	0.06	0.3	B	—			2
Public Assembly Spaces									
Auditorium seating area	5	2.5	0.06	0.3		150	5	2.7	1
Places of religious worship	5	2.5	0.06	0.3		120	6	2.8	1
Courtrooms	5	2.5	0.06	0.3		70	6	2.9	1
Legislative chambers	5	2.5	0.06	0.3		50	6	3.1	1
Libraries	5	2.5	0.12	0.6		10	17	8.5	1
Lobbies	5	2.5	0.06	0.3		150	5	2.7	1
Museums (children's)	7.5	3.8	0.12	0.6		40	11	5.3	1
Museums/galleries	7.5	3.8	0.06	0.3		40	9	4.6	1
Residential									
Dwelling unit	5	2.5	0.06	0.3	F,G	F			1
Common corridors	—	—	0.06	0.3					1
Retail									
Sales (except as below)	7.5	3.8	0.12	0.6		15	16	7.8	2
Mall common areas	7.5	3.8	0.06	0.3		40	9	4.6	1
Barbershop	7.5	3.8	0.06	0.3		25	10	5.0	2

## Reference ASHRAE Standard 62.1-2010, Ventilation for Acceptable Indoor Air Quality

**TABLE 6-1 MINIMUM VENTILATION RATES IN BREATHING ZONE (Continued)**  
(This table is not valid in isolation; it must be used in conjunction with the accompanying notes.)

Occupancy Category	People Outdoor Air Rate $R_p$		Area Outdoor Air Rate $R_a$		Notes	Default Values			Air Class
						Occupant Density (see Note 4)	Combined Outdoor Air Rate (see Note 5)		
	cfm/person	L/s-person	cfm/ft <sup>2</sup>	L/s-m <sup>2</sup>		#/1000 ft <sup>2</sup> or #/100 m <sup>2</sup>	cfm/person	L/s-person	
Beauty and nail salons	20	10	0.12	0.6		25	25	12.4	2
Pet shops (animal areas)	7.5	3.8	0.18	0.9		10	26	12.8	2
Supermarket	7.5	3.8	0.06	0.3		8	15	7.6	1
Coin-operated laundries	7.5	3.8	0.12	0.6		20	14	7.0	2
Sports and Entertainment									
Sports arena (play area)	—	—	0.30	1.5	E	—			1
Gym, stadium (play area)	—	—	0.30	1.5		30			2
Spectator areas	7.5	3.8	0.06	0.3		150	8	4.0	1
Swimming (pool & deck)	—	—	0.48	2.4	C	—			2
Disco/dance floors	20	10	0.06	0.3		100	21	10.3	2
Health club/aerobics room	20	10	0.06	0.3		40	22	10.8	2
Health club/weight rooms	20	10	0.06	0.3		10	26	13.0	2
Bowling alley (seating)	10	5	0.12	0.6		40	13	6.5	1
Gambling casinos	7.5	3.8	0.18	0.9		120	9	4.6	1
Game arcades	7.5	3.8	0.18	0.9		20	17	8.3	1
Stages, studios	10	5	0.06	0.3	D	70	11	5.4	1

### GENERAL NOTES FOR TABLE 6-1

- 1 **Related requirements:** The rates in this table are based on all other applicable requirements of this standard being met.
- 2 **Environmental Tobacco Smoke:** This table applies to ETS-free areas. Refer to Section 5.17 for requirements for buildings containing ETS areas and ETS-free areas.
- 3 **Air density:** Volumetric airflow rates are based on an air density of 0.075 lb<sub>a</sub>/ft<sup>3</sup> (1.2 kg<sub>a</sub>/m<sup>3</sup>), which corresponds to dry air at a barometric pressure of 1 atm (101.3 kPa) and an air temperature of 70°F (21°C). Rates may be adjusted for actual density but such adjustment is not required for compliance with this standard.
- 4 **Default occupant density:** The default occupant density shall be used when actual occupant density is not known.
- 5 **Default combined outdoor air rate (per person):** This rate is based on the default occupant density.
- 6 **Unlisted occupancies:** If the occupancy category for a proposed space or zone is not listed, the requirements for the listed occupancy category that is most similar in terms of occupant density, activities and building construction shall be used.

### ITEM-SPECIFIC NOTES FOR TABLE 6-1

- A For high school and college libraries, use values shown for Public Assembly Spaces—Libraries.
- B Rate may not be sufficient when stored materials include those having potentially harmful emissions.
- C Rate does not allow for humidity control. Additional ventilation or dehumidification may be required to remove moisture. "Deck area" refers to the area surrounding the pool that would be expected to be wetted during normal pool use, i.e., when the pool is occupied. Deck area that is not expected to be wetted shall be designated as a space type (for example, "spectator area").
- D Rate does not include special exhaust for stage effects, e.g., dry ice vapors, smoke.
- E When combustion equipment is intended to be used on the playing surface, additional dilution ventilation and/or source control shall be provided.
- F Default occupancy for dwelling units shall be two persons for studio and one-bedroom units, with one additional person for each additional bedroom.
- G Air from one residential dwelling shall not be recirculated or transferred to any other space outside of that dwelling.

**Table 3.3: Minimum Exhaust Rates**

**Reference ASHRAE Standard 62.1-2010, Ventilation for Acceptable  
Indoor Air Quality**

**TABLE 6-4 Minimum Exhaust Rates**

Occupancy Category	Exhaust Rate, cfm/unit	Exhaust Rate, cfm/ft <sup>2</sup>	Notes	Exhaust Rate, L/s-unit	Exhaust Rate, L/s-m <sup>2</sup>	Air Class
Arenas	—	0.50	B	—	—	1
Art classrooms	—	0.70		—	3.5	2
Auto repair rooms	—	1.50	A	—	7.5	2
Barber shops	—	0.50		—	2.5	2
Beauty and nail salons	—	0.60		—	3.0	2
Cells with toilet	—	1.00		—	5.0	2
Copy, printing rooms	—	0.50		—	2.5	2
Darkrooms	—	1.00		—	5.0	2
Educational science laboratories	—	1.00		—	5.0	2
Janitor closets, trash rooms, recycling	—	1.00		—	5.0	3
Kitchenettes	—	0.30		—	1.5	2
Kitchens—commercial	—	0.70		—	3.5	2
Locker/dressing rooms	—	0.25		—	1.25	2
Locker rooms	—	0.50		—	2.5	2
Paint spray booths	—	—	F	—	—	4
Parking garages	—	0.75	C	—	3.7	2
Pet shops (animal areas)	—	0.90		—	4.5	2
Refrigerating machinery rooms	—	—	F	—	—	3
Residential kitchens	50/100	—	G	25/50	—	2
Soiled laundry storage rooms	—	1.00	F	—	5.0	3
Storage rooms, chemical	—	1.50	F	—	7.5	4
Toilets—private	25/50	—	E	12.5/25	—	2
Toilets—public	50/70	—	D	25/35	—	2
Woodwork shop/classrooms	—	0.50		—	2.5	2

A Stands where engines are run shall have exhaust systems that directly connect to the engine exhaust and prevent escape of fumes.

B When combustion equipment is intended to be used on the playing surface additional dilution ventilation and/or source control shall be provided.

C Exhaust not required if two or more sides comprise walls that are at least 50% open to the outside.

D Rate is per water closet and/or urinal. Provide the higher rate where periods of heavy use are expected to occur, e.g., toilets in theatres, schools, and sports facilities. The lower rate may be used otherwise.

E Rate is for a toilet room intended to be occupied by one person at a time. For continuous system operation during normal hours of use, the lower rate may be used. Otherwise use the higher rate.

F See other applicable standards for exhaust rate.

G For continuous system operation, the lower rate may be used. Otherwise use the higher rate.

**Table 3.4: Acceptable thermal comfort conditions  
in regularly occupied spaces**

**Reference ASHRAE Handbook 2007 - HVAC applications**

		Lower Limit	Upper Limit
COOLING	Dry bulb Temperature	23°C	26°C
	Relative Humidity	40%	60%
HEATING	Dry bulb Temperature	18°C	22°C
	Relative Humidity	30%	60%

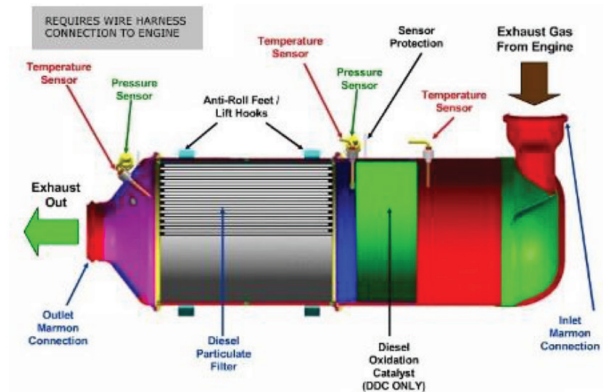
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- City of Geneva  
Wastewater Treatment Facility



3- In case the project is connected to a municipal sewage network, then a grey water treatment plant could be mandatory with effluent used for irrigation or toilet flushing.

4- A Soot Filter with catalytic converter for the generator exhaust chimney.



5- Outside compensator for heating systems.

6- The use of thermal solar panels for the production of domestic hot water or space heating.

7- The use of photo voltaic panels to produce part of the electrical load.

8- A complete waste management plan.

9- In case these projects aim for LEED or BREEAM certification, the minimum accepted is LEED Silver and BREEAM Good.

10- These projects shall comply with the Green Building Criteria items 1 to 4.



## E. References



## E. References

1. Ashrae 2007-90.1 is available at: <http://archive.org/details/gov.law.ashrae.90.1.2007>
2. RT 2005 is available at:  
<http://www.legifrance.gouv.fr/affichTexte.do?cidTexte=JORFTEXT000000427149>
3. TSBL 2005 available for free download at:  
[http://www.lcecp.org.lb/uploads/policies/Thermal\\_Standard\\_2005.pdf](http://www.lcecp.org.lb/uploads/policies/Thermal_Standard_2005.pdf)



F. Summary Table of Green Buildings  
Criteria in Lebanon

## F. Summary Table of Green Buildings Criteria in Lebanon

Building Types	Energy																
	Building Envelope	Air conditioners	Fuel Boilers	Service Water Heating	Elevators and Escalators	VVVF Lifts	Artificial Lighting	Occupancy / Motion Sensors	Electronic Ballasts	Control System	Thermostatic Valves	Energy Recovery (Air)	Energy Recovery (Generators)	Insulation on Pipes & Ducts	Energy Metering	Thermal Solar Water Heating System	PV Panels for Excessive external lighting
<b>Residential buildings</b>																	
Residential Units	√	√	√	√	√	√1	√	√	√	√	√	√2	-	√	-	-	√5
Independent Houses	√	√	√	√	-	-	√	√	√	√	√	√2	-	√	-	√	√5
Secondary housing	√	√	√	√	√	√1	√	√	√	√	√	√2	-	√	-	-	√5
Students' dormitories	√	√	√	√	√	√1	√	√	√	√	√	√2	-	√	√4	-	√5
<b>Non Residential Buildings</b>																	
Hospitality and hotel buildings	√	√	√	√	√	√1	√	√	√	√	√	√2	√3	√	√4	-	√5
Hospitals and health care centers	√	√	√	√	√	√1	√	√	√	√	√	√2	√3	√	-	-	√5
Commercial Centers and shops	√	√	√	√	√	√1	√	√	√	√	√	√2	-	√	√4	-	√5
Educational institutions	√	√	√	√	√	√1	√	√	√	√	√	√2	√3	√	-	-	√5
Indoor sports fields and complexes	√	√	√	√	√	√1	√	√	√	√	√	√2	-	√	-	-	√5
<b>Other Building Types</b>																	
Factories and laboratories	√	√	√	√	√	√1	√	√	√	√	-	√2	√3	√	-	-	√5
Warehouses	√	√	√	√	√	√1	√	√	√	√	-	√2	-	√	-	-	√5
Furnished Apartments	√	√	√	√	√	√1	√	√	√	√	√	√2	√3	√	√4	-	√5
Offices and various services	√	√	√	√	√	√1	√	√	√	√	√	√2	-	√	√4	-	√5
Parking	√	√	-	-	√	√1	√	√	√	√	-	-	-	√	-	-	√5
Theaters, restaurants, night clubs	√	√	√	√	√	√1	√	√	√	√	√	√2	-	√	√4	-	√5
Multipurpose buildings	√	√	√	√	√	√1	√	√	√	√	√	√2	√3	√	√4	-	√5
Projects with significant environmental impact	√	√	√	√	√	√	√	√	√	√	√	√2	√3	√	√4	√	√

- 1- VVVF for 4 floors' buildings or more and Soft Start for 3 floors' buildings or less
- 2- In buildings with more than 200 Tons of cooling
- 3- Hotels with more than 100 rooms  
Industrial Establishment larger than 600 m<sup>2</sup>  
Schools larger than 1500 m<sup>2</sup>
- 4- Only for multi-tenant buildings
- 5- In the event that the density of the external lighting exceeds the permissible amount.
- 6- When cooling is greater than 200 Tons in Zone 1 & 2



