

# Airtightness of buildings in the Middle East



## Introduction

On May 15, 2018, Buildingdoctor, a corporate member of EmiratesGBC, delivered a Technical Workshop which discussed the importance of air-tightness and its implementation in buildings in the Middle East. The workshop was facilitated by Rob Dam, who elaborated on the regulations for air-tightness in the UAE, the energy saving potential, and the solutions that can be adopted to improve the energy efficiency and thermal comfort of existing buildings.

## The importance of air-tightness

According to the International Energy Agency (IEA), the UAE was listed as fifth in terms of CO<sub>2</sub> emissions per capita, with 40% of the yearly electric loads coming from HVAC equipment, and up to 60% of emissions occurring during the summer. While attention is usually given to the installation of the most efficient HVAC systems and thermal insulation in buildings, there is little focus given to the unintended loss of air from these buildings.

### What is air-leakage?

Air-leakage is the unintended loss of conditioned air through the building envelope. Air leakage is not to be confused with ventilation, which is controlled airflow in and out of the building naturally through windows or mechanically through the building's HVAC systems. Air leakage is unwanted and can take place not only through gaps, cracks and seams but also through materials due to their air permeability characteristics.

### Why do air-leakage tests?

Air-leakage tests are used to identify the points of leakage within the building and aid in rectification of the issue. This is important as [studies](#) have shown that a 30-40% reduction of the amount of leakages roughly leads to a 10% reduction on the overall energy costs. Another [study](#) by the U.S. Department of Energy's (DOE) Windows and Building Envelope Research and Development: Roadmap for

Emerging Technologies also indicates that improving airtightness is among the most cost-effective strategies to decrease energy loads due to the building envelope. This conclusion is based on the fact that air leakage (i.e., infiltration and exfiltration) is responsible for about 6% of the total energy used by commercial buildings in the U.S. (~15% of primary energy consumption in commercial buildings). Figure 1 shows that common areas of air-leakage is from the floors, walls and ceilings.

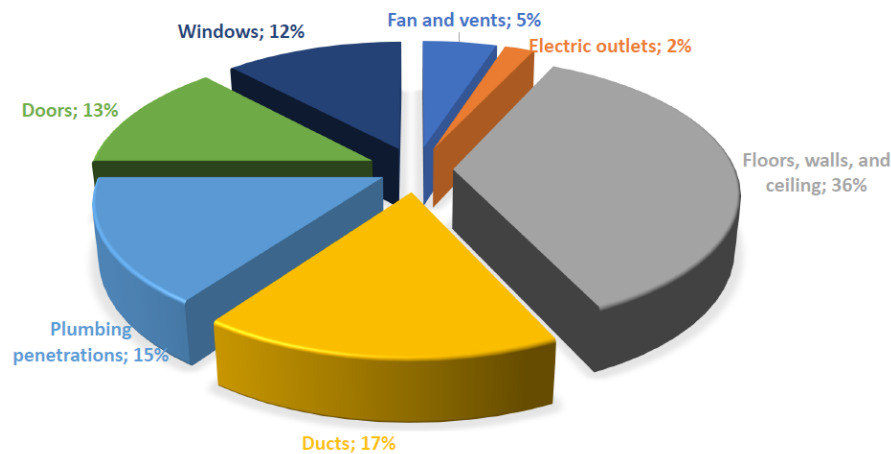


Figure 1 Common points of air-leakages in a building.

Locating air-leakages is also important as this can often result in the intrusion of humid air into the building. This is undesirable as condensation of the humid air allows growth of moulds in the building, which can be quite difficult to fix without major renovation efforts and costs. This also has a major impact on the indoor-air quality of the building and can pose a serious risk to the occupants.

### Air-tightness regulations in the UAE

An examination of Figure 2 shows the allowed air rates for buildings under the applicable regulations in the UAE. Overall the regulations are not very strict and therefore design teams are often not very much concerned with the air-tightness of the buildings, unless it has been specified by the client. This leads to the common situations whereby the air-tightness test is done near the end of the project, making it difficult to rectify. This has more serious consequences, as quick short-term solutions are often used to pass the test.

Regulation	Etidama	Dubai- Green Building Regulations	Trakhees (EHS)	Masdar
Applicability	Abu Dhabi	Dubai	Ports customs and Freezone corporations	Masdar free zone
Standard	Not specified	ATTMA or CIBSE TM23 or similar	Thermography- Mandatory Airtightness test- Voluntary- CIBSI TM23	-
Requirement	3,64l/s/m2 @75Pa or 2.0l/s/m2 @75Pa (Mandatory requirement under RE-R1: Minimum energy performance. No credit points are awarded)	10m3/h/m2 @50Pa (For buildings with a cooling load of 1MW or greater)	10m3/hr/m2 @ 50 Pa.	5m3/h/m2 @50Pa

Figure 2 Air-tightness regulations in the UAE

### Common issues

Some of the common issues seen in the UAE are shown in Figures 3 and 4. Figure 3 shows the service riser that is left open at the top whereas Figure 4 shows a hole that was made for the service penetration but is left completely open even after project completion. Other common issues include missing brush strips and poorly aligned balcony doors and windows. It is important to note that while the windows, walls components, etc. have been laboratory tested and are air-tight, the points of connections between the different components is where most often there is air-leakage i.e. the corners and intersections.



Figure 3 Service Risers

### Solutions

While it is important to design with air-tightness from the very beginning, it is equally as important to have the contractors and sub-contractors brought in early so that they too can verify the design and give their inputs if something is unfeasible.

Retrofit measures for new and existing buildings include:

- Performing air-tightness test to locate the hidden leak paths.

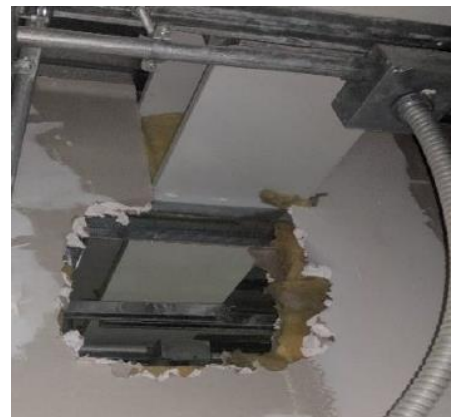


Figure 4 Service penetration

- Checking the alignment of door and windows. Install gaskets or brushes where required.
- Checking for robust seals at service entry points.
- Using good quality material for sealing crack joints, etc. The effects of heat and the harsh conditions on the material should also be considered.
- Sealing shafts and service risers from the top and bottom.

## Conclusion

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Through the Green Economy for Sustainable Development national initiative, the UAE has set out clear objectives for a future sustainable economy. Under the Dubai Demand Side Management Strategies, it is important to reduce energy demand and increase energy efficiency to support the ambitious strategies in place. It is also critical to keep the conditioned air inside the building and keep air-leakages to a minimum. Stringent allowable air-rates incorporated into building regulation is essential for ensuring everyone involved in the construction chain considers air-tightness from the very beginning. Another way to bring attention to the air-tightness of the building is to have well-defined contracts which outline the liabilities to increase the accountability for ensuring air-tightness specifications are met. The contracts should also highlight which party is responsible for repairs and maintenance of the envelope.