# DUCTWORK AIRTIGHTNESS REQUIREMENTS IN PORTUGAL

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## ABSTRACT

Portugal introduced, for the first time, in the 2006 Building Regulations, a requirement on the airtightness of the ductwork in new HVAC installations. A test is required during commissioning. Data on compliance is however still quite scarce to conclude how effective this requirement is in practice.

## KEYWORDS

Duct airtightness; HVAC regulations.

## INTRODUCTION

As part of the transposition of the EU Directive 2002/91/EC, on the Energy performance of Buildings (EPBD) [1], new regulations were adopted in Portugal and came into force in 2006. Requirements for new HVAC systems [2] included for the first time a set of mandatory tests that must be carried out during commissioning, before the building receives its use permit. The aim of the tests is to demonstrate that the installation is functioning as designed, in operational terms, but also meeting the minimum energy efficiency and indoor air quality (IAQ) targets set in the legislation.

Proof of the results of these tests, consisting of a detailed report, must be handed to the Qualified Expert (QE) who will issue the Energy Performance Certificate (EPC) for the building, who may ask for further tests if he/she is not satisfied with the report or just for confirmation (random check). Often, the QE is present while the commissioning tests take place. The EPC is required by the local authorities before issuing the building's use permit.

Tests on the ventilation system include:

- Airflow delivered to each room in accordance with design parameters;
- Overall cleanliness of the whole ductwork and other components, such as air handling units and fans;
- Airtightness of the ductwork.

To pass the test on airtightness, ductwork leakage may not exceed 1.5 l/s.m$^2$ under a static pressure of 400 Pa. Airtightness tests should be carried out using the following procedure:

- A 10% random sample of the ductwork is selected and tested. If the measured leakage is below 1.5 l/s.m$^2$, no further testing is required;
- If the first test is not satisfactory, a second test is performed, after the contractor takes corrective measures, again on the initially tested ducts plus an additional randomly selected 20% of the ductwork. If these tests are satisfactory, no further testing is required.

- If the previous test is still unsuccessful, the contractor must take additional corrective measures and the final test(s) must cover the whole ductwork until the required airtightness is met.

## MOTIVATION

Up until 2006, there was no check on the quality of the ductwork (most often, building owners did not require the check simply to avoid its cost), and its performance was in general quite poor (high leakage, cheap materials), resulting in significant losses, with consequences in terms of the energy efficiency of the whole installation (more air circulated and treated to compensate for the leakage). Moreover, it was often impossible to meet the minimum fresh air rates in many spaces, resulting in degraded IAQ levels. The new regulation aims at ensuring minimum levels of IAQ and improved energy efficiency during operation of the building, by adopting a life-cycle perspective and moving away from the up-to-then prevailing strategy of lowest possible first cost.

## THE NEW REGULATIONS IN ACTION

The new regulations apply to buildings larger than 1000 $m^2$ that begun their licensing procedure after 2006. Taking into account design and construction, this cycle usually takes, for large buildings, at least 3-4 years before completion. Therefore, there are not yet much data on the success of the new regulations. The first large buildings that had to comply with these new regulations only finished the construction phase late in 2009 and during 2010.

However, there is proof that the market adapted to the regulations. The share of pre-fabricated round ductwork with quality seals between ductwork components increased significantly (from <5% in 2006 to 30% in 2010). For rectangular ducts, the technology evolved to achieve better seals along duct sections and at unions between two consecutive sections, namely at the corners, representing now 20% of the market (extraction ducts carrying air that is not recirculated, e.g., from toilets and wet-zones, are still usually low-quality ducts). Welded and screwed joists disappeared since then. In parallel, “a dozen” specialized companies now offer duct leakage testing services in the market (there were none in 2006).

Although only few EPCs have been issued for large new non-residential buildings so far, there is anecdotal evidence that the required commissioning tests (not just ductwork leakage) resulted, in most cases, in significant delays to the construction phase, with the corresponding negative backlash.

## CONCLUSION

It is too early to say if the new regulations have been successful (the number of completed new HVAC installations falling under the new requirements is still rather small) and there are no data regarding the actual performance of the few buildings constructed with the new requirements. But ductwork technology evolved, with better quality components now much more used, and ductwork leakage testing, as well as ductwork cleaning, are now new niche markets that appeared since the new regulations entered into force.

## REFERENCES

[1] Directive 2002/91/EC, on the Energy performance of Buildings (EPBD), EU Official Journal, 16 December 2002

[2] RSECE – Regulation on HVAC systems for energy efficiency in buildings, Portuguese Law 79/2006, Portugal Official Journal, April 6, 2006.