Duct leakage testing in Portugal, a consulting engineer view and experience

Carlos Pires Eurico Lisboa

BLC navitas, Lda, Rua dos Fornos, 21, 2.ºE, 2770-066 Paço de Arcos, Portugal

1 INTRODUCTION

Duct leakage airflow in existing ductwork can reach values of over 20% of the design air handling unit (AHU) airflow, undermining efficiency and effectiveness of HVAC systems. We have measured, in an existing building where ductwork was installed 20 years before, with no special care on duct leakage and tight building construction schedules, operational duct leakage rates between 10% and 40% of the AHUs airflows.

In an average office building, annual fan energy consumption is of the same magnitude of annual chiller energy consumption, minimising leakage has a significant impact on building energy consumption.

Duct leakage testing gives knowledge of the magnitude of duct leakage airflow and, consequently, increasing awareness of the problem, will support the shift to installations with tighter ductwork.

2 SHARED EXPERIENCE AS A PRACTITIONER

In Portugal leakage testing of ductwork systems is mandatory by law since 2006, although this legal requirement is seldom complied with. This situation originates, in our view, on the lack of awareness of the magnitude of the problem by practitioners and all those involved in the building construction process. Another cause relates do lack of knowledge and experience on the duct leakage test procedures, together with lack of adequate testing equipment, that leads to the misconception that the test is complex and costly.

In Portugal, by law (5), ductwork must have a leakage rate of less than 1,5 l/s/m^2, when tested at a pressure of 400Pa. This requirement is less demanding than class A, according to the European standard (1). The Portuguese law does not refer to the European standards on duct air leakage.

From our consulting practice experience, in design and commissioning building construction works, a class B ductwork can easily be achieved in ductworks of circular cross section if adequate installation procedures are met and adequate duct joining accessories are applied. The test itself takes around 10 minutes to perform, after correctly preparing the duct sample to test.

To achieve the required performance, we stress the importance to guarantee adequate dimension tolerances in the straight duct sections, ie, avoiding ovalization due to incorrect handling of ducts, namely transport or storage of straight duct sections in the horizontal position, stacked or not, without adequate rigid circular end caps. When rigid end caps are not used, to prevent ovalization, straight ducts must be transported and stored in the vertical position.

Duct leakage testing must be done systematically during the construction process and this task must be previewed in the construction works planning. We recommend that the first part of the installed ductwork be immediately tested to identify and correct possible inadequate

installation procedures that, otherwise, would be repeated in subsequent parts of the ductwork.

When using 3D BIM models of the ductwork, with adequate level od detail, prefabrication of ductwork can be done, increasing quality of the finished job and decreasing installation time. Using this method, in a recent job, the tested samples reached, on average, leakage class C, and, in one of the last duct samples even reached class D.

3 CONCLUSIONS

Duct leakage can be relevant, undermining efficiency and effectiveness of HVAC systems. Duct leakage testing is a simple procedure and should be systematically done preventing leaky duct systems.

The use of BIM procedures, and duct prefabrication, increases the final quality of ductwork systems and should be strongly promoted.

Ductwork should be built to comply, at least, to leakage class B, according to EN-12237. Legal requirements should be updated and merely state a minimum leakage class, according to the European standard.

KEYWORDS

Duct, leakage, hvac, testing

ACKNOWLEDGEMENTS

Not applicable.

REFERENCES

(1) EN-12237:2003 – Ventilation for buildings – Ductwork – Strenght and leakage of circular sheet metal ducts

(2) EN-1507:2006 – Ventilation for buildings – Sheet metal air ducts with rectangular section - Requirements for strength and leakage

(3) Decreto-Lei 118/2013, de 20 de agosto. Sistema de certificação energética de edifícios (SCE).

(4) Decreto-Lei 28/2016, de 23 de junho. Quarta alteração ao Decreto-Lei 118/2013, de 20 de agosto.

(5) Despacho (extrato) – 15793-G/2013. Ensaio e receção provisória de instalações. Plano de manutenção.