J. Phys. E: Sci. Instrum., Vol. 17, 1984. Printed in Great Britain

An optoelectronic device for the measurement of air tightness of buildings

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Received 10 February 1984, in final form 7 June 1984

In 1982 Siitonen developed a method of measuring the local air tightness of sections of buildings using a device called a collector chamber (CC). This measurement is of interest because it can indicate building faults.

This design note describes an improved method which also uses a CC (figure 1(*a*)). The principle of the Siitonen method is to measure the pressure difference between the outside of the building and CC (Δp) when the pressure difference between CC and the room ($\Delta p'$) is zero. When this occurs, the leakage flowrate $\dot{V}$ is measured by a flowmeter from which the tightness parameter can be obtained. However on windy days or when doors and lifts are operated $\Delta p'$ is fluctuating rapidly and it is difficult to adjust and maintain $\Delta p' = 0$ and to measure Δp and $\dot{V}$ simultaneously.

In order to overcome this problem, the authors have developed a system incorporating a null detector of $\Delta p'$. This detector is more sensitive than that used by Siitonen (1982). Furthermore, the system automatically measures Δp whenever $\Delta p'$ is zero in spite of the fact that the external or internal conditions affecting the building are continually altering both Δp and $\Delta p'$.

The sensitive detector (figure 1(*b*)) is constructed from a thin reflecting diaphragm built into CC which senses the differential pressure between CC and the room. A laser beam is reflected from the diaphragm to a diode array (DA) and the angle of the reflected beam is dependent upon the movement of the diaphragm which in turn is dependent upon $\Delta p'$. The detector is set up so that when $\Delta p' = 0$ the reflected beam is incident on DA and the output from DA commands a microcomputer (MC) to sample the micromanometer (MM) measuring Δp and store the value in its memory. The value of V, the flow rate, can also be stored at the same instant when $\Delta p' = 0$.

As an alternative to the microprocessor the sensor for measuring the condition $\Delta p' = 0$ can be used with an amplifier, trigger and camera to photograph the micromanometer measuring Δp and the flowmeter measuring $\dot{V}$.

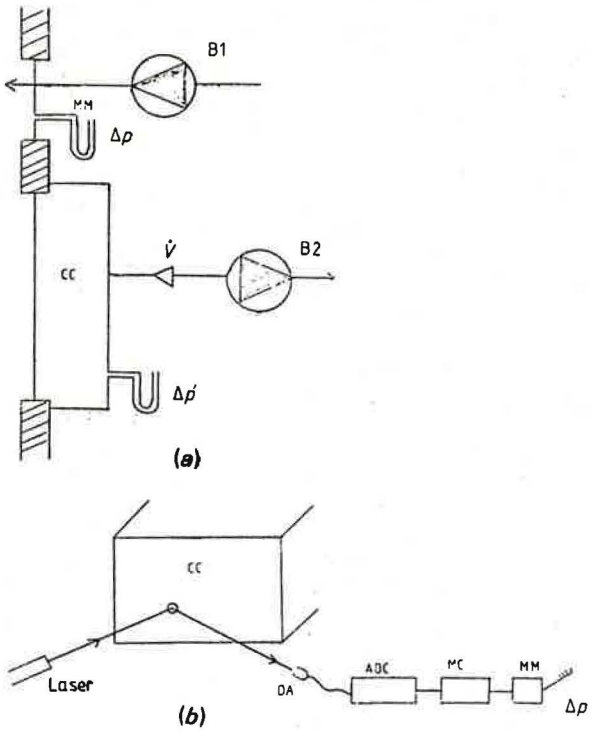

Figure 1. (*a*) The measurement of the local tightness of a window. The blower B1 affects an under pressure inside the room and at the same time the blower B2 will suck air through the collector chamber. The CC is placed by taping on the object. The flowrate $\dot{V}$ is measured by a flowmeter. Usually $\dot{V}$ stays approximately constant during the measurement due to the high internal resistance of the measurement circuit. (*b*) The optoelectronic null detector. ADC is the analogue–digital converter.

Reference

Siitonen V 1982 Measurement of local air tightness in buildings *Technical Research Centre of Finland, Research Notes No 125*

0022-3735/84/100837 + 01 $02.25