Flow Measurement for Domestic Ventilation Fans

Final Report 57015/2

Carried out for
BSRIA Ltd

By Mark Roper

16 January 2013

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Contract: **Final Report 57015/2**

Date: **16 January 2013**

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1 INTRODUCTION

This report covers work carried out to investigate the use of various site measurement instruments to measure the flow performance of a number of typical small domestic ventilation fans, intended to provide ventilation rates to meet the 60l/s Building Regulations requirements. This work is intended to assess the magnitude of the influence of the typical flow measurement devices (vane anemometers) and consider whether a correction factor method can be successfully applied when assessing flow rates on site.

Almost all flow measurement devices present some resistance to the flow being measured, thus reducing the flow. Depending on the device, and the flow being measured, this change may be negligible or it may be a significant proportion of the measured figure. Efforts may be made to overcome this. In some cases, by the use of a 'correction factor' to attempt to correct the measured flow back to the value that would be expected without the flow measurement device. An alternative solution is to use another fan to compensate for the measurement system resistance, so that the original flow is maintained. This is the principle used by the powered flow hood, referred to later in this report.

Testing was carried out in the BSRIA Laboratory during December 2012.

2 TEST ITEMS

The fans tested were all axial units with fan diameters of approximately 150mm, designed to give flows in excess of 60 l/s. They were from five different market leaders whose sales represent more than 60% of the marketplace.

Two 100mm vane anemometers were supplied by BSRIA Instrument Solutions, as detailed in Table 1. These are believed to be the most widely used models. These were used "out of the box" with no calibration, with the supplied hood kits and stated correction factors.

Table 1 Vane anemometers

Manufacturer	Model	Serial Number
Testo	417	02422534
TSI	LCA301	0254230

3 METHODOLOGY

A schematic of the test rig may be found in Figure 1. Each fan was mounted on the test plenum, initially with the control damper fully open. The pressure within the plenum was then measured. The flow rate was then measured using the powered flow hood, and the plenum pressure again recorded, to assess if there was any significant difference in plenum pressure. The powered flow hood was then removed and each anemometer and hood was then placed in turn over the fan under test, and the average of three flow measurements recorded for each anemometer, along with the static pressure within the test plenum. The control damper was then closed slightly, and the process repeated, so that flows could be measured with a range of resistances on the fan. Details of the instrumentation may be found in Table 2.

Figure 1 Test Rig Schematic

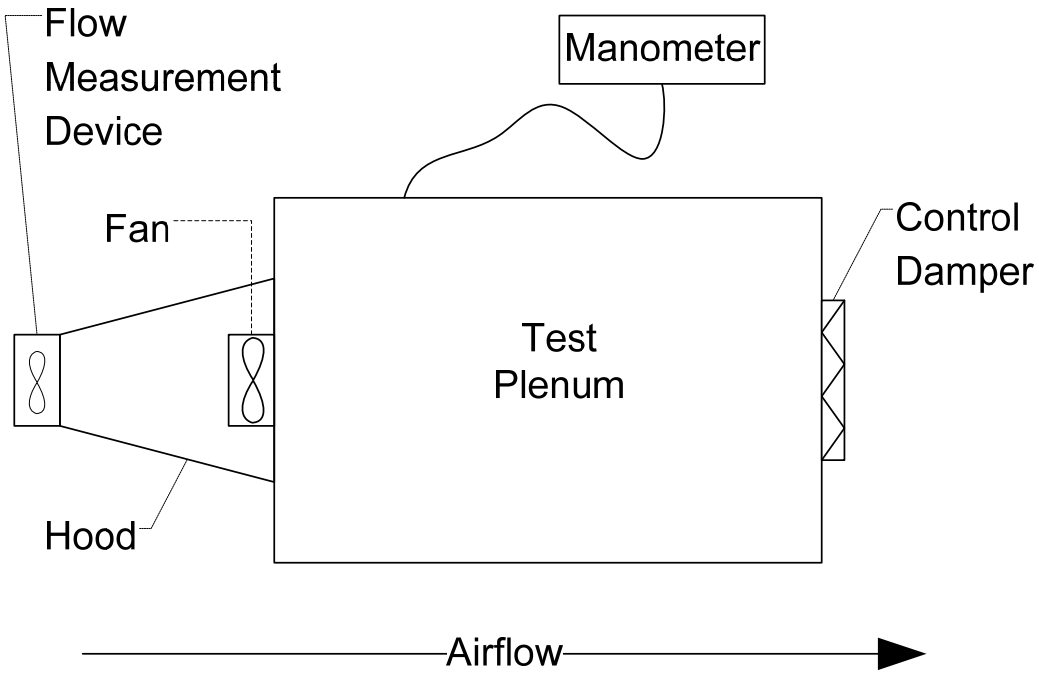


Table 2 Instrumentation

Instrument	Identifier	Calibration Date
Powered Flow Hood - Observator Instruments DIFF	Serial No: DIF00302	28 November 2012
Autozeroing Micromanometer TT470S	BSRIA ID: ZZ/MAN/15	24 July 2012

The manufacturer's stated accuracy for the DIFF is ±3% of reading, ±1m3/h.

4 RESULTS

Tables of the recorded flow rate data for each fan may be found in appendix A. Manufacturer's names and designations have been removed from this data.

A summary of the results using the Testo 417 is shown in Figure 2, with a summary of the TSI LCA301 testing shown in Figure 3. For each fan, the Anemometer volume flow vs. the powered flow hood volume has been plotted. Fan 2 was not tested with the TSI LCA301, as the supplied hood did not physically fit over the fan.

Figure 2 Testo Anemometer vs DIFF Results

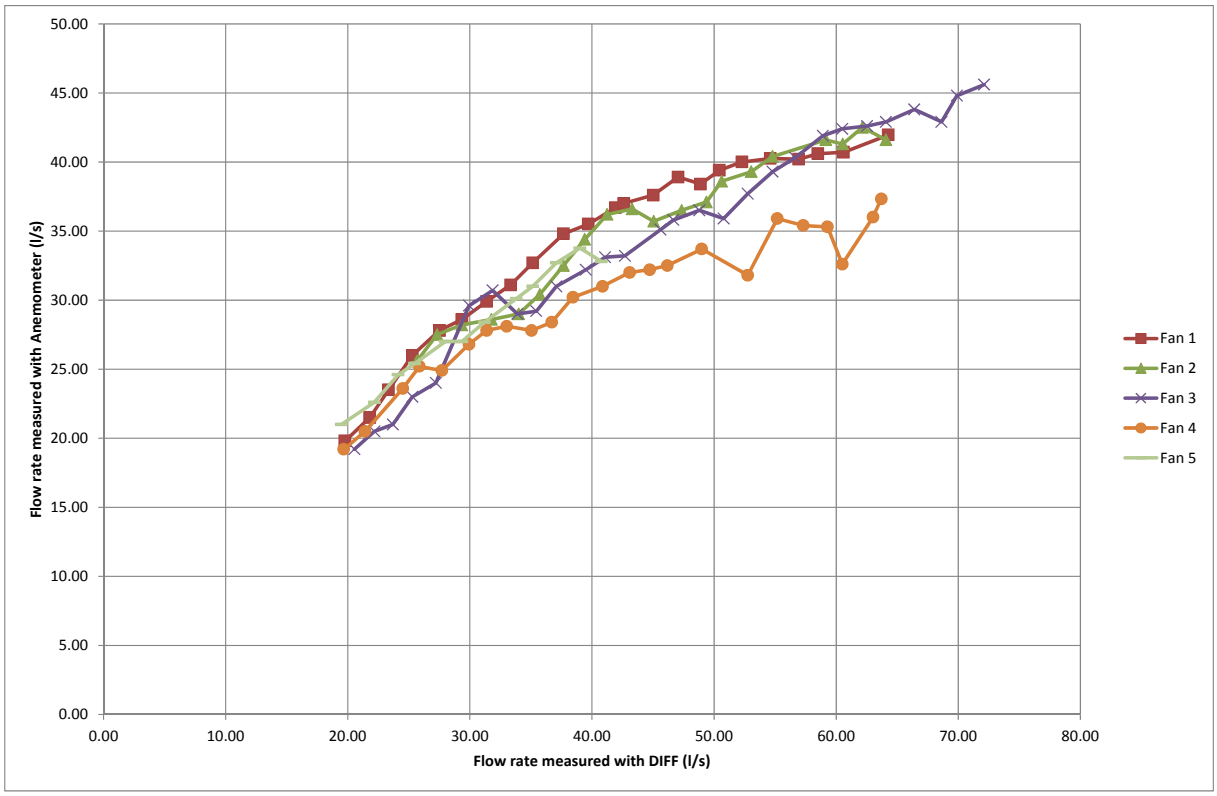
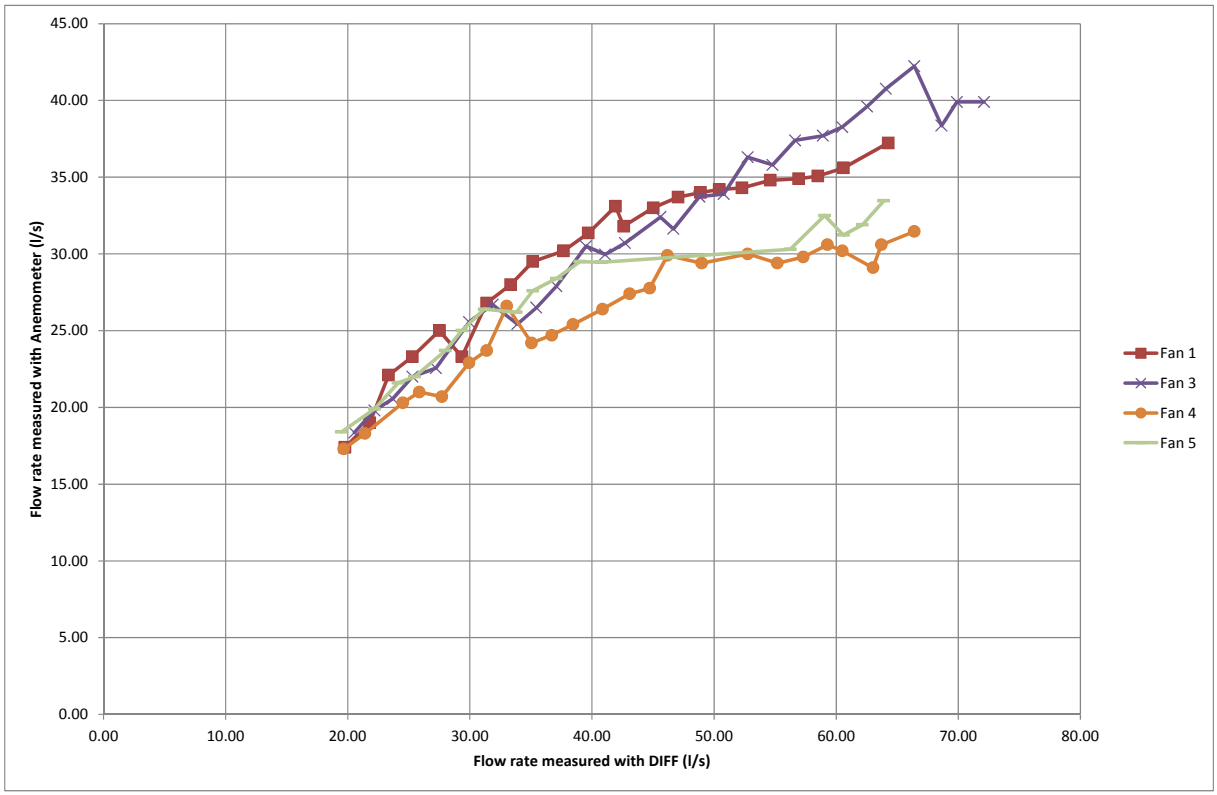


Figure 3 TSI Anemometer vs DIFF Results



5 CONCLUSIONS

It can be seen that the use of the vane anemometers has a very significant effect on the fan flow, especially at the upper end of the fan performance curve, when there is relatively little flow resistance in the system. For flows indicated by the powered flow hood as 60 l/s, anemometer (with hood kit) flows were in the region 30-37 l/s for the TSI unit and 33-42 l/s for the Testo unit.

The influence of the anemometer varies from fan to fan, meaning that a single common correction factor will not be satisfactory.

For each individual set of fan data, it can be seen that in most cases, the plot is not smooth. It is thought this is because the resistance of the anemometers and hoods is such that the fans are pushed into the stall region of operation, where flow is unstable. Any correction factor based on operating in this region would be an approximation prone to significant error.