Flow Measurement for Domestic Ventilation Fans

Tests on 15l/s fans

Final Report 57015/4

Carried out for
BSRIA Ltd

By Mark Roper

7 February 2013

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Carried out for:

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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 15l/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 and January 2013.

2 TEST ITEMS

The fans tested were all axial units with fan diameters of approximately 100mm, designed to give flows in excess of 15 l/s. They were from four different market leading manufacturers.

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

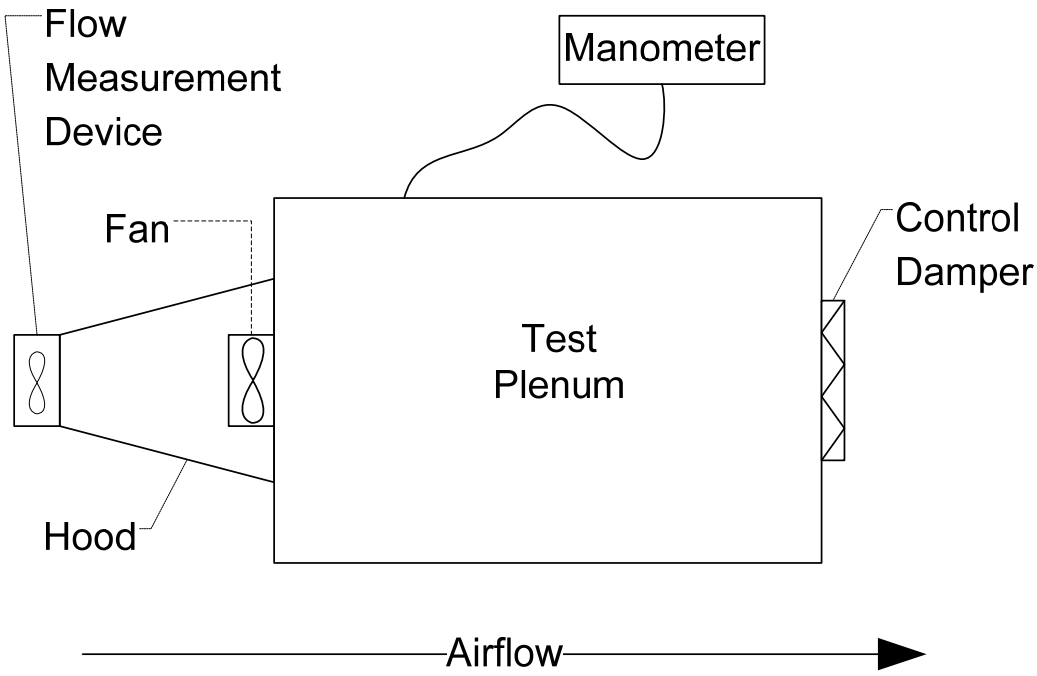


Table 2 Instrumentation

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.

Figure 2 Testo Anemometer vs DIFF Results

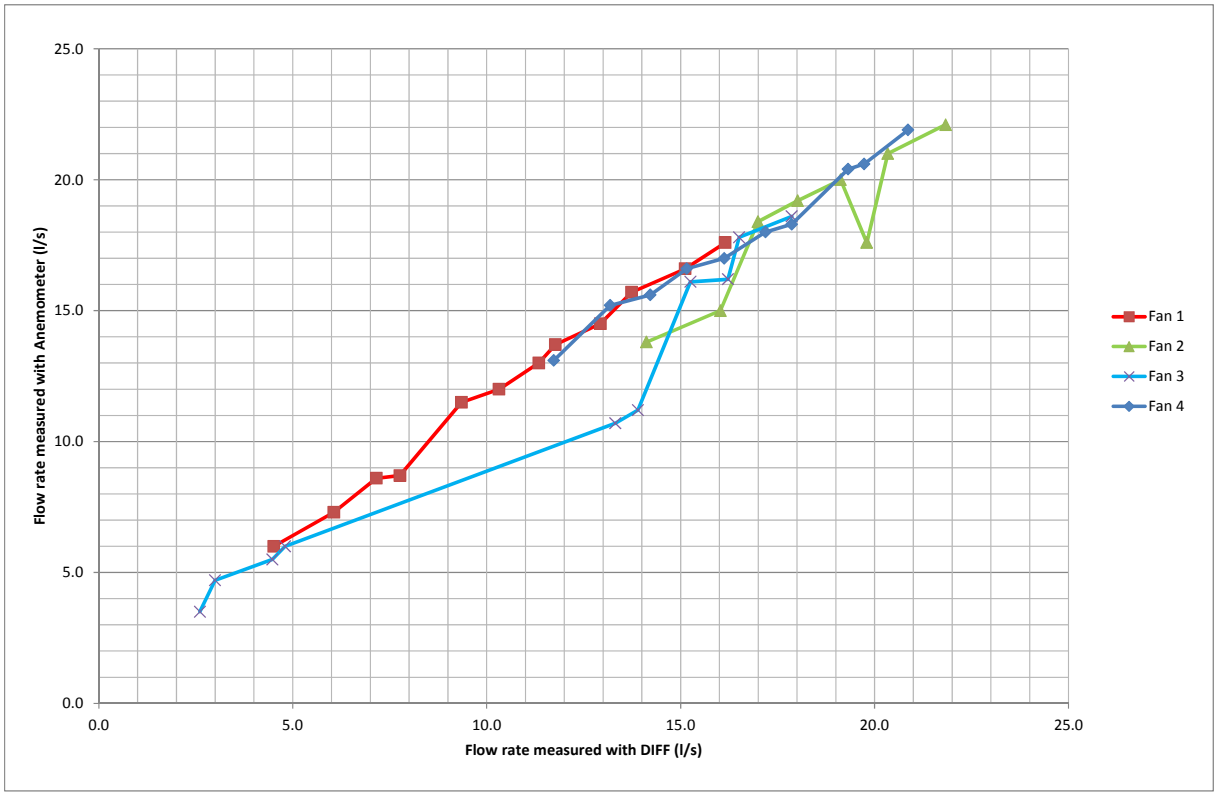
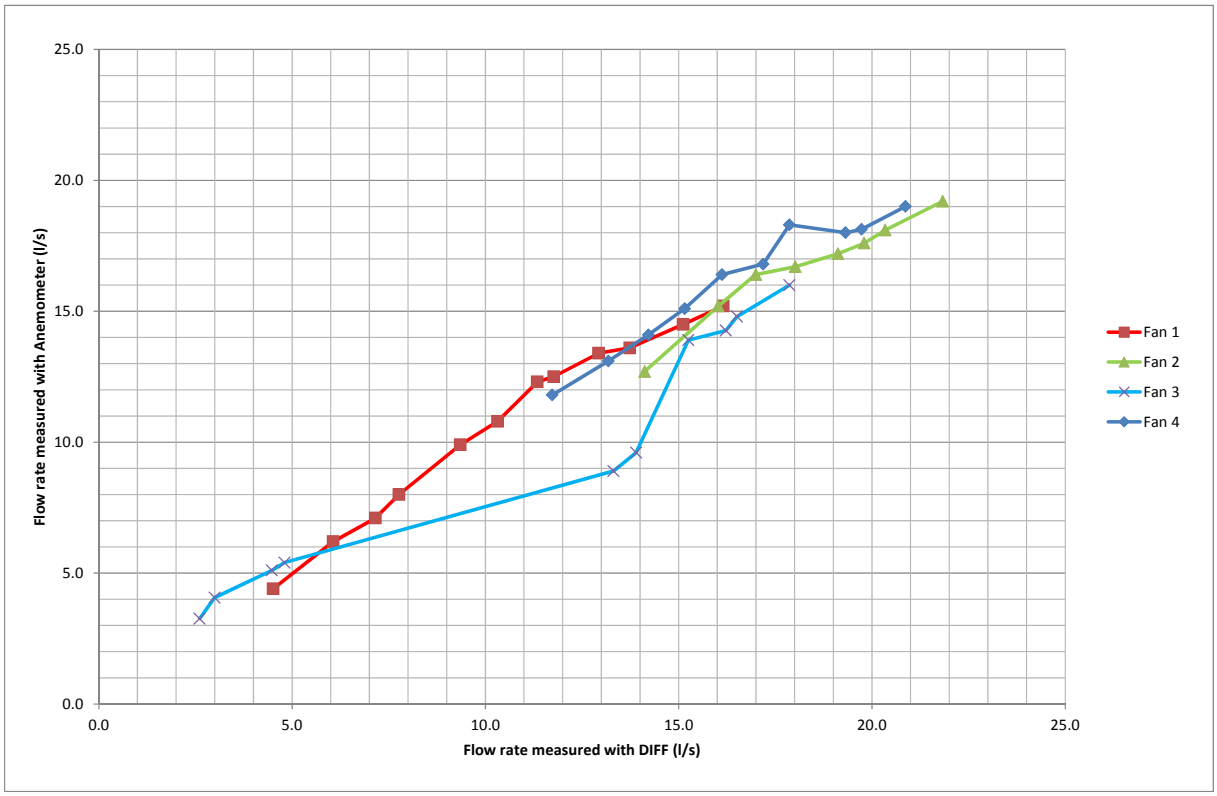


Figure 3 TSI Anemometer vs DIFF Results



5 CONCLUSIONS

For flows indicated by the powered flow hood as 15 l/s, anemometer (with hood kit) flows were in the region 15.0-13.0 l/s for the TSI unit and 16.6-14.4 l/s for the Testo unit[1].

Overall, the influence of the anemometer and flow hood on fan performance is of much smaller magnitude than when tested with 60 l/s fans (See BSRIA Report 57015/2). Given the lower flow rates, the resistance of the anemometers and hoods is less significant. However, the influence of the anemometer varies from fan to fan, the Testo differs from Diff results by up to +11% and -5% and the TSI differs from Diff results by up to +0% and -15%.

This means that a single common correction factor would not be suitable for each anemometer, for use with all fans. From these results, it would appear that a correction factor would be feasible for certain fan and anemometer/hood combinations, for example Fan 1 and Fan 4. The plot for fan 3 suggests that it enters the stall region just below 15l/s, so that a reliable correction for values below 15 l/s would be difficult.

These results are based on a single installation type – further trials would be recommended before attempting to produce suitable correction factors.

[1] Note: It is unlikely that the actual flow rates with the Testo Anemometer are higher than those recorded by the DIFF. Calibration of the anemometer would be likely to give lower flow results in all cases. This is not investigated further in this report, because the aim of the testing was to discover whether the anemometer influence was comparable across all fans, and whether a reliable correction factor could be established. Calibration would not significantly affect the comparison of the magnitude of the effects.