PREN16211 DRAFT STANDARD – MEASUREMENT OF AIR FLOW RATES ON SITE, 2014

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ABSTRACT

The preliminary Standard prEN16211 deals with methods, including method uncertainties for measuring air flow rates on site. It has its background in the Nordic countries, where these guidelines have been used for decades. PrEN16211 include an alternative method for flow measurement in a duct compared to EN 12599. An average flow can be obtained from just a few measurement points when a straight duct is used and some simple flow conditions are met.

KEYWORDS

Air flow measurement method, k-factor, ventilation

1 INTRODUCTION

In the Nordic countries, Denmark, Finland, Norway and Sweden there has been a long tradition and need to install, balance and test ventilation systems in buildings. Due to climate, energy tight houses has been built and there has developed a tradition of controlled air exchange. A Nordic guide of how to measure was developed by today retired professor Anders Svensson. This work is widely used in revised editions of guidelines ”Methods of measuring air flow in ventilation installations”, in swedish ”Metoder för mätning av luftflöden i ventilationsinstallationer” His work has is now transferred into a proposed European standard. PrEN16211.

2 MEASURING METHODS IN PREN 16211 AND EN12599:2012

PrEN 16211 “Measuring of air flows on site – methods”, including 41 pages, covers air flow rates measuring methods and their uncertainties.
EN 12599 “Test procedures and measurement methods to hand over air conditioning and ventilation systems.” including 85 pages covers what to check, the extent of check and measurements, what to measure, (Electric current, air flow, air temperature, filter pressure drop, ductwork leakage, humidity, sound, air velocity) and special agreed measurements, uncertainty and test reports.
Below follows the different measuring methods in the two standards.

2.1 Method: Air flow in duct cross section

Figure 1

prEN 16211 requires 4 to 8 measurement points are selected according to a table. It requires also that the velocity in any point is less than 1,4 times the velocity in the center, that no back flow occure and that the cross-section is in a straight duct at least 5...6D_h downstream from a disturbance, such as a bend. The unceratainty of this measurement is : 10% (instrument=5%, method 8%) with 95% confidens level. The method stipulates that the flow is multiplied with 0,89 for diameters lower and equal to 160mm. The calculated air flow is density compensated.

EN 12999 divides the the cross-section equal area annular rings. An uncertainty calculations is made depending of number of measurement points and distance from disturbance. For circular ducts a multiple of four points is choosen. For a measurement uncertainty of 10%, nine points (but will be 12 points – since a multiple of four points is used) are required for a disturbance minimum 6D_h upstream. In section 2.4.2 there are rules regarding minimum air velocity in relation to the diameter of the Pitot static tubes. There is also a formula for reducing the flow depending of the area of the probe in the air stream. For a 9mm probe in a duct with diameter 100 mm the reduction factor is 94%.

The difference between prEN 16211 and EN12599 could lead to difference result and could be investigated by using other measurement methods, such as pressure drop over orifice plates in laboratory conditions. For circular ducts, the reduction factors for prEN 16211 has been recommended by “Slutrapport, Nordtest Prosj. 1463-99 from Norges Byggforskningsinstitut Rev 2001.05.23.”

2.2 Other Methods in booth EN 12599 and prEN16211

Pressure drop method. The air flow is calculated from a pressure drop over a valve or throttle device. The k-factor is supplied by the supplier of the valve and is multiplied by the square root of the measured differential pressure. Instead of square root another exponent could be used.

Figure 2

The bag method uses a bag with a calibrated volume. The flow is the Volume of the bag diveded by the time it takes to fill it. Two persons are normally needed. The picture does not

show the stop watch and a differential pressure meter.

Figure 3

Flow funnel methods. Large uncertainties can occur due to pressure drop and leakage. There are compensations methods for the pressure drop. Two point measurement with calculation of the unrestricted flow and the zero-pressure drop measurement with an built-in fan in the flow funnel. By measuring the pressure drop over the funnel there is a formula in prEN 16211 to use for compensation.

Figure 4

The tracer gas method inserts tracer gas in the air flow and calculates the flow. Important is that a good mixing take place.

Figure 5

The effective area method is only in EN 12599. The air velocity is measured at the air terminal, which works like a nozzle. The air velocity is multiplied with an effective area given by the manufacturor of the air terminal.

2.3 Uncertainty of measurement

Booth standards stipulates the measurement uncertainty to be stated with a probability coverage of approximately 95%. prEN 16211 calls this the expanded measurement uncertainty, being twice the standard measurement uncertainty. prEN 16211 divides the standrad measurement uncertainty into standard instrument uncertainty, standard method uncertainty and standard reading uncertainty.

2.4 Density compensation

PrEN 16211 stipulates that real or standard air flow rate should can be choosen. A formula how to convert between them is presented. EN 12599 stipulates that for fan measurements air flow should be presented with an air density of 1,2 kg/m3.

3 CONCLUSIONS

Air flow measurement on site are widely used according to prEN 16211 and EN 12599. prEN 16211 methods and uncertainty calculations are used in the Nordic countries including the duct flow measurement. prEN16211 is only dealing with measurements of air flow rates on site, which makes it easy to follow and use and also to edit if future needs arise. By approving prEN 16211 as an European standard, the daily work of measurement technicians will be standardised.

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