

ISO 16911-1:2013-03 (E)

Stationary source emissions - Manual and automatic determination of velocity and volume flow rate in ducts - Part 1: Manual reference method

Contents		Page
Foreword		v
Introduction		vi
1	Scope	1
2	Normative references	1
3	Terms and definitions	1
4	Symbols and abbreviated terms	3
4.1	Symbols	3
4.2	Abbreviated terms	7
5	Principle	7
5.1	General	7
5.2	Principle of flow velocity determination at a point in the duct	8
5.3	Principle of measurement of volume flow rate	8
6	Selection of monitoring approach	10
6.1	Monitoring objective	10
6.2	Choice of technique to determine point flow velocity	11
6.3	Choice of technique for volume flow rate and average flow determination	12
7	Measuring equipment	12
7.1	General	12
7.2	Measurement of duct area	13
8	Performance characteristics and requirements	13
9	Measurement procedure	14
9.1	Site survey before testing	14
9.2	Determination of sampling plane and number of measurement points	14
9.3	Checks before sampling	14
9.4	Quality control	16
9.5	Measurement of flow at locations within the measurement plane	16
9.6	Post-measurement quality control	17
10	Calculation of results	17
10.1	General	17
10.2	Measurement of velocity	17
10.3	Determination of the mean velocity	18
10.4	Correction of average velocity for wall effects	18
10.5	Calculation of the volume flow rate from the average velocity	18
10.6	Conversion of results to standard conditions	19
11	Establishment of the uncertainty of results	20
12	Evaluation of the method	20
Annex A (normative) Measurement of velocity using differential pressure based techniques		22

Annex B (normative) Vane anemometer	34
Annex C (normative) Tracer gas dilution method determination of volume flow rate and average velocity	40
Annex D (normative) Transit time tracer gas method determination of average velocity	46
Annex E (normative) Calculation of flue gas volume flow rate from energy consumption	53
Annex F (informative) Example of uncertainty budget established for velocity and volume flow rate measurements by Pitot tube	61
Annex G (informative) Description of validation studies	72
Annex H (informative) Differential pressure measurement	79
Annex I (informative) The use of time of flight measurement instruments based on modulated laser light	82
Annex J (informative) Relationship between this International Standard and the essential requirements of EU Directives	83
Bibliography	84