

ISO 16911-2:2013-03 (E)

Stationary source emissions - Manual and automatic determination of velocity and volume flow rate in ducts - Part 2: Automated measuring systems

Contents		Page
Foreword		v
Introduction		vi
1	Scope	1
2	Normative references	1
3	Terms and definitions	1
4	Symbols and abbreviations	4
4.1	Symbols	4
4.2	Abbreviations	5
5	Principle	6
5.1	General	6
5.2	Importance of minimizing systematic errors	6
5.3	Relationship to EN 14181	7
6	Type testing, quality assurance level 1 data	7
6.1	Introduction	7
6.2	Performance criteria	8
6.3	Flow reference material or procedure	8
6.4	Quality assurance level 1 calculation	9
6.5	Velocity check points and quality assurance level 3	9
7	Selection of automated measuring system location	10
7.1	General	10
7.2	Selection based upon pre-investigation	10
7.3	Selection based upon a predictable flow profile	10
7.4	Qualifying the automated measuring system calibration through a type 2 quality assurance level 2 procedure	11
7.5	Ports and working platforms	11
8	Pre-investigation of flow profile	11
8.1	General	11
8.2	Pre-investigation by measurement	12
8.3	Pre-investigation by computational fluid dynamics (CFD)	13
8.4	Automated measuring system selection guide	14
8.5	Quality assurance level 2 requirements	14
9	Calibration and validation of the automated measuring system (quality assurance level 2 and annual surveillance test)	14
9.1	Selection of calibration method	14
9.2	Selection of calibration method, if calculation methods are used	15
9.3	Calibration procedure	15
9.4	Functional tests	15
9.5	Parallel measurements with a standard reference method	15
9.6	Wall effects	16
9.7	Automated measuring system flow calibration procedure with transit time tracer	17
9.8	Data evaluation	17

9.9	Calibration function of the automated measuring system and its validity	17
9.10	Calculation of variability	18
9.11	Test of variability and annual surveillance test of validity of the calibration function	18
9.12	Test of R2	18
9.13	Quality assurance level 2 and annual surveillance test report	18
10	Commissioning documentation	19
11	On-going quality assurance during operation (quality assurance level 3)	19
12	Assessment of uncertainty in volume flow rate	19
Annex A (informative)	Example of calculation of the calibration function (data from tests in Copenhagen and Wilhelmshaven)	20
Annex B (informative)	Flow profile characteristics	32
Annex C (informative)	Determination of measuring points and/or paths	37
Annex D (normative)	Treatment of a polynomial calibration function	41
Annex E (normative)	Values of $k_v(N)$ and $t_{0,95}(N - 1)$	42
Annex F (informative)	Example of a pre-investigation measurement	43
Annex G (informative)	Computational fluid dynamics issues	50
Annex H (informative)	The use of time of flight measurement instruments based on modulated laser light	54
Annex I (informative)	Relationship between this International Standard and the essential requirements of EU Directives	55
Bibliography	56