DIN EN ISO 16911-2:2013-06 (E)

Stationary source emissions - Manual and automatic determination of velo city and volume flow rate in ducts - Part 2: Automated measuring systems (ISO 16911-2:2013)

Contents

Page

Foreword 4

Introduction 5

1 Scope 6

2 Normative references 6

3 Terms and definitions 6

4 Symbols and abbreviations 9
4.1 Symbols 9
4.2 Abbreviations 10

5 Principle 11
5.1 General 11
5.2 Importance of minimizing systematic errors 11
5.3 Relationship to EN 14181 12

6 Type testing, quality assurance level 1 data 12
6.1 Introduction 12
6.2 Performance criteria 13
6.3 Flow reference material or procedure 13
6.4 Quality assurance level 1 calculation 14
6.5 Velocity check points and quality assurance level 3 14

7 Selection of automated measuring system location 15
7.1 General 15
7.2 Selection based upon pre-investigation 15
7.3 Selection based upon a predictable flow profile 15
7.4 Qualifying the automated measuring system calibration through a type 2 quality assurance level 2 procedure 16
7.5 Ports and working platforms 16

8 Pre-investigation of flow profile 16
8.1 General 16
8.2 Pre-investigation by measurement 17
8.3 Pre-investigation by computational fluid dynamics (CFD) 18
8.4 Automated measuring system selection guide 19
8.5 Quality assurance level 2 requirements 19

9 Calibration and validation of the automated measuring system (quality assurance level 2 and annual surveillance test) 19
9.1 Selection of calibration method 19
9.2 Selection of calibration method, if calculation methods are used 20
9.3 Calibration procedure 20
9.4 Functional tests 20
9.5 Parallel measurements with a standard reference method 20
9.6 Wall effects 21
9.7 Automated measuring system flow calibration procedure with transit time tracer 22
9.8 Data evaluation 22

9.9 Calibration function of the automated measuring system and its validity 22
9.10 Calculation of variability 23
9.11 Test of variability and annual surveillance test of validity of the calibration function 23
9.12 Test of R 23
9.13 Quality assurance level 2 and annual surveillance test report 23

10 Commissioning documentation 24

11 On-going quality assurance during operation (quality assurance level 3) 24

12 Assessment of uncertainty in volume flow rate 24

Annex A (informative) Example of calculation of the calibration function (data from tests in Copenhagen and Wilhelmshaven) 25

Annex B (informative) Flow profile characteristics 37

Annex C (informative) Determination of measuring points and/or paths 42

Annex D (normative) Treatment of a polynomial calibration function 46

Annex E (normative) Values of kv(N) and t0,95(N - 1) 47

Annex F (informative) Example of a pre-investigation measurement 48

Annex G (informative) Computational fluid dynamics issues 55

Annex H (informative) The use of time of flight measurement instruments based on modulated laser light 59

Annex I (informative) Relationship between this International Standard and the essential requirements of EU Directives 60

Bibliography 61