

DIN EN 12405-1:2006-04 (E)

Gas meters - Conversion devices - Part 1: Volume conversion

Contents		Page
Foreword		8
1	Scope	9
2	Normative references	9
3	Terms, definitions and symbols	11
3.1	Terms and definitions	11
3.2	Symbols	14
4	Principle of measurement	16
4.1	Conversion as a function of temperature	16
4.2	Conversion as a function of pressure and temperature	16
4.3	Conversion as a function of pressure, temperature and deviation from the ideal gas law	17
4.4	Correction of the volume at measurement conditions	17
5	Rated operating conditions	18
5.1	Specified field of measurement	18
5.1.1	Specified measurement range for gas pressure	18
5.1.2	Specified measurement range for gas temperature	18
5.1.3	Gas characteristics	18
5.2	Environmental class	18
5.2.1	Ambient temperature range	18
5.2.2	Humidity range	19
5.3	Power supply	19
6	Construction requirements	19
6.1	General	19
6.2	Casings	20
6.3	Indications	20
6.3.1	General	20
6.3.2	Electronic indicating device	22
6.4	Inputs for volume conversion	22
6.5	Battery powered conversion device	22
6.6	Security devices and alarms	23
7	Installation requirements	24
7.1	General	24
7.2	Temperature transducer	24
7.3	Pressure transducer	24
8	Performance	24
8.1	Reference conditions	24
8.2	Rated operating conditions	25
8.3	Maximum permissible errors	25
8.3.1	General	25
8.3.2	Error of conversion	26
8.3.3	Specific errors for a gas-volume conversion device, type 2	26
8.4	Conditions of matching the constituent elements of a conversion device type 2	26
8.5	Influence factors	27
8.6	Disturbances	27
8.7	Durability	27

9	Tests of conformity	27
9.1	Verification of the construction requirements	27
9.2	Verification of the performance requirements	27
9.2.1	Test conditions	27
9.2.3	Samples of gas volume conversion device type 1 required for testing	28
9.2.4	Samples of gas volume conversion devices type 2 required for testing	30
9.3	Test report	30
10	Marking	30
Annex A (normative) Type test		32
A.1	General conditions	32
A.1.1	General	32
A.1.2	Additional conditions specific to gas volume conversion devices type 1	32
A.1.3	Additional conditions specific to gas-volume conversion devices type 2	32
A.1.4	Test procedures	33
A.1.5	Verification of the construction requirements	34
A.2	Accuracy tests under reference conditions	34
A.2.1	Objective	34
A.2.2	Reference to documents	35
A.2.3	Procedure	35
A.2.4	Acceptance criteria	35
A.3	Effect of ambient temperature	35
A.3.1	Objective	35
A.3.2	Reference to documents	35
A.3.3	Procedure	35
A.3.4	Acceptance criteria	35
A.4	Effect of damp heat, steady state test	35
A.4.1	Objective	35
A.4.2	Reference to documents	35
A.4.3	Procedure	36
A.4.4	Acceptance criteria	36
A.5	Effect of damp heat, cyclic test	36
A.5.1	Objective	36
A.5.2	Reference to documents	36
A.5.3	Procedure	36
A.5.4	Acceptance criteria	37
A.6	Electrical power variation	37
A.6.1	Objective	37
A.6.2	Reference to documents	37
A.6.3	Procedure	37
A.6.4	Acceptance criteria	37
A.7	Short time power reductions	38
A.7.1	Objective	38
A.7.2	Reference to documents	38
A.7.3	Procedure	38
A.7.4	Acceptance criteria	38
A.8	Electrical bursts	38
A.8.1	Objective	38
A.8.2	Reference to documents	38
A.8.3	Procedure	38
A.8.4	Acceptance criteria	38
A.9	Electromagnetic susceptibility	39
A.9.1	Objective	39
A.9.2	Reference to documents	39
A.9.3	Procedure	39
A.9.4	Acceptance criteria	39
A.10	Electrostatic discharges	39
A.10.1	Objective	39
A.10.2	Reference to documents	39

A.10.3	Procedure	39
A.10.4	Acceptance criteria	40
A.11	Overload of pressure (only for type 1 and pressure transducers)	40
A.11.1	Objective	40
A.11.2	Reference to documents	40
A.11.3	Procedure	40
A.11.4	Acceptance criteria	40
A.12	Effect of vibrations	40
A.12.1	Objective	40
A.12.2	Reference to documents	40
A.12.3	Procedure	41
A.12.4	Acceptance criteria	41
A.13	Effect of shocks	41
A.13.1	Objective	41
A.13.2	Reference to documents	41
A.13.3	Procedure	41
A.13.4	Acceptance criteria	41
A.14	Overload of pressure (mechanical)	41
A.14.1	Objective	41
A.14.2	Reference to documents	42
A.14.3	Procedure	42
A.14.4	Acceptance criteria	42
A.15	Durability	42
A.15.1	Objective	42
A.15.2	Reference to documents	42
A.15.3	Procedure	42
A.15.4	Acceptance criteria	43
A.16	Alarms operation	43
A.16.1	Objective	43
A.16.2	Reference to documents	43
A.16.3	Procedure	43
A.16.4	Acceptance criteria	43
Annex B (normative) Pressure transducers		44
B.1	Scope	44
B.2	Rated operating conditions	44
B.2.1	Specified measurement range for pressure	44
B.2.2	Environmental class	44
B.2.3	Power supply	44
B.3	Construction requirements	44
B.3.1	General	44
B.3.2	Casings	44
B.3.3	Indications	44
B.4	Performances	45
B.4.1	Reference conditions	45
B.4.2	Rated operating conditions	45
B.4.3	Maximum permissible errors	45
B.4.4	Influence factors	45
B.4.5	Disturbances	45
B.4.6	Durability	45
B.5	Tests of conformity	46
B.5.1	Test conditions	46
B.5.2	Tests	46
B.5.3	Sample of pressure transducers required for testing	46
B.6	Marking	46
Annex C (normative) Platinum resistance thermometer sensors		47
C.1	Scope	47
C.2	Operating rated conditions	47
C.2.1	Specified measurement range for temperature	47

C.2.2	Environmental class	47
C.3	Construction requirements	47
C.4	Performances	47
C.5	Marking	48
C.5.1	Required markings	48
C.5.2	Verification mark	48
C.6	Metrological verifications	48
C.6.1	Type approval	48
C.6.2	Initial verification	49
C.7	Verification procedure	49
C.7.1	Visual inspection	49
C.7.2	Type testing (type approval)	49
C.7.3	Samples of PRT required for testing	49
C.7.4	Initial verification	49
Annex D (normative) Temperature transducers		51
D.1	Scope	51
D.2	Rated operating conditions	51
D.2.1	Specified measurement range for temperature	51
D.2.2	Environmental class	51
D.2.3	Power supply	51
D.3	Construction requirements	51
D.3.1	General	51
D.3.2	Casings	51
D.3.3	Indications	51
D.4	Performances	52
D.4.1	Reference conditions	52
D.4.2	Rated operating conditions	52
D.4.3	Maximum permissible errors	52
D.4.4	Influence factors	52
D.4.5	Disturbances	52
D.4.6	Durability	52
D.5	Tests of conformity	53
D.5.1	Test conditions	53
D.5.2	Tests	53
D.5.3	Sample of temperature transducers required for testing	53
D.6	Marking	53
Annex E (informative) Model type test report for conversion devices		54
E.1	General	54
E.1.1	General remarks	54
E.1.2	Number of pages	54
E.1.3	Laboratory's identification	54
E.1.4	Applicant	54
E.1.5	Identification of device(s) submitted for testing	54
E.2	Accuracy tests under reference conditions	55
E.2.1	Ambient temperature during the test	55
E.2.2	Test equipment used	55
E.2.3	Test results	55
E.3	Ambient temperature	56
E.3.1	Effect of dry heat	56
E.3.2	Effect of cold	57
E.4	Effect of damp heat, steady state test	59
E.4.1	Ambient temperature during the test	59
E.4.2	Test equipment used	59
E.4.3	Test results	59
E.5	Effect of damp heat, cyclic test	60
E.5.1	Ambient temperature during the test	60
E.5.2	Test equipment used	60
E.5.3	Test results	61

E.6	Electrical power variation	62
E.6.1	AC power supply	62
E.6.2	DC power supply or battery supply	64
E.7	Short time power reductions	65
E.7.1	Test equipment used	65
E.7.2	Test results	65
E.8	Electrical bursts	66
E.8.1	Test equipment used	66
E.8.2	Test results	66
E.9	Electromagnetic immunity	68
E.9.1	Test equipment used	68
E.9.2	Test results	68
E.10	Electrostatic discharges	68
E.10.1	Test equipment used	68
E.10.2	Test results	69
E.11	Effect of an overload of static pressure	69
E.11.1	Ambient temperature during the test	69
E.11.2	Test equipment used	69
E.11.3	Test results	70
E.12	Effect of vibrations	71
E.12.1	Ambient temperature during the test	71
E.12.2	Test equipment used	71
E.12.3	Test results	71
E.13	Effect of shocks	72
E.13.1	Ambient temperature during the test	72
E.13.2	Test equipment used	72
E.13.3	Test results	72
E.14	Mechanical resistance to overload of static pressure	73
E.14.1	Ambient temperature during the test	73
E.14.2	Test equipment used	73
E.14.3	Test results	73
E.15	Durability	73
E.15.1	Ambient temperature during the test	73
E.15.2	Test equipment used	73
E.15.3	Test equipment used	74
Annex F (informative) Model type test report for associated transducers		77
F.1	General	77
F.1.1	General remarks	77
F.1.2	Number of pages	77
F.1.3	Laboratory's identification	77
F.1.4	Applicant	77
F.1.5	Identification of device(s) submitted for testing	77
F.2	Accuracy tests under reference conditions	78
F.2.1	Ambient temperature during the test	78
F.2.2	Test equipment used	78
F.2.3	Test results	78
F.3	Ambient temperature	78
F.3.1	Effect of dry heat	78
F.3.2	Effect of cold	79
F.4	Effect of damp heat, steady state test	80
F.4.1	Ambient temperature during the test	80
F.4.2	Test equipment used	80
F.4.3	Test results	80
F.5	Effect of damp heat, cyclic test	81
F.5.1	Ambient temperature during the test	81
F.5.2	Test equipment used	81
F.5.3	Test results	82
F.6	Electrical power variation	82
F.6.1	AC power supply	82
F.6.2	DC power supply or battery supply	84

F.7	Short time power reductions	84
F.7.1	Ambient temperature during the test	84
F.7.2	Test equipment used	84
F.7.3	Test results	85
F.8	Electrical bursts	85
F.8.1	Ambient temperature during the test	85
F.8.2	Test equipment used	85
F.8.3	Test results	85
F.9	Electromagnetic immunity	86
F.9.1	Ambient temperature during the test	86
F.9.2	Test equipment used	86
F.9.3	Test results	87
F.10	Electrostatic discharges	87
F.10.1	Ambient temperature during the test	87
F.10.2	Test equipment used	87
F.10.3	Test results	88
F.11	Effect of an overload of static pressure	88
F.11.1	Ambient temperature during the test	88
F.11.2	Test equipment used	88
F.11.3	Test results	89
F.12	Effect of vibrations	90
F.12.1	Ambient temperature during the test	90
F.12.2	Test equipment used	90
F.12.3	Test results	90
F.13	Effect of shocks	90
F.13.1	Ambient temperature during the test	90
F.13.2	Test equipment used	90
F.13.3	Test results	91
F.14	Mechanical resistance to overload of static pressure	91
F.14.1	Ambient temperature during the test	91
F.14.2	Test equipment used	91
F.14.3	Test results	91
F.15	Durability	92
F.15.1	Ambient temperature during the test	92
F.15.2	Test equipment used	92
F.15.3	Test results	92
Bibliography		94