Physikalisch-Technische Bundesanstalt

Braunschweig und Berlin

Bericht

Report

Ausgestellt für: *Issued to:*	SICK Engineering GmbH Bergener Ring 27 01458 Ottendorf-Okrilla Deutschland
Bezug: *In accordance with:*	International Recommendation OIML R 137-1&2 Gas meters, International Organisation of Legal Metrology
Geräteart: *Type of Instrument:*	Ultraschallgaszähler *Ultrasonic Gas Meter*
Typbezeichnung: *Type designation*	FLOWSIC600
Kennwerte: *Characteristics:*	Destined for the measurement of : gas volume Accuracy class : class 0.5 Environment classes : M2/E2/H3 Ambient and gas temperature range : -40 °C / +70 °C Intended location : open
Prüfbescheinigungs-Nr. *Examination certificate number*	EC Type-examination certificate DE-08-MI002-PTB005 Revision 5
Anzahl der Seiten: *Number of pages:*	12
Geschäftszeichen: *Reference No.:*	PTB-1.42-4069855

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Im Auftrag:
By order:

Dr. Roland Schmidt

Braunschweig, 2014-05-28

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PHYSIKALISCH-TECHNISCHE BUNDESANSTALT 41

1 General information

1.1 General information concerning the Notified Body responsible

Name:	Physikalisch-Technische Bundesanstalt
Address:	Bundesallee 100
	D-38116 Braunschweig
	Germany

This report is the 1st revision of the report with the Reference No. 4067630, dated 2014-01-30.

The only change is the following:

- The list of gas meters which are suitable for OIML class 0.5 has been amended by those with the following nominal diameters: DN350, DN450, DN550, DN650, DN750, DN800, and DN850.

1.2 List of laboratories involved

No.	Laboratory
1	Physikalisch-Technische Bundesanstalt, Bereich Gasmessgeräte Bundesallee 100, D-38116 Braunschweig, Germany http://www.ptb.de/en/org/1/14/142/_index.htm
2	Pigsar, c/o Ruhrgas AG Haltener Str. 125, D-46284 Dorsten, Germany http://www.pigsar.de
3	SLG Prüf- und Zertifizierungs GmbH Burgstädter Straße 20, D-09232 Hartmannsdorf, Germany http://www.slg.de.com/en/index.shtml
4	E.ON Ruhrgas AG, Gas Measurement Competence Centre Gladbecker Straße 404, D-45326 Essen, Germany www.eon-ruhrgas.com
5	SICK Engineering GmbH Bergener Ring 27, D-01458 Ottendorf-Okrilla, Germany www.sick.com
6	Gaz de France, Direction de la Recherche Pôle Métrologie et Matériels de Réseaux, 1, chemin de Villeneuve F-94140 Alfortville, France http://www.gazdefrance.com/EN/D/1002/research-and-development.html
7	TransCanada Calibrations Ltd. P.O Box 654 Arnould Road, Ile des Chenes, Manitoba, R0A 0T0 http://www.tccalibrations.com/
8	Colorado Engineering Experiment Station Inc. 54043 County Rd. 37, Nunn, Colo. 80648, U.S.A. http://www.ceesi.com/

1.3 List of meters submitted

No.	Manufacturers Serial Number, Specification
1.	No. 05480000, NPS03 ANSI CL600, 4-path
2.	No. 02328813, NPS08 ANSI CL600 4-path
3.	No. 03218754, NPS12 ANSI CL600 4-path
4.	No. 04068704, NPS12 ANSI CL600 4-path
5.	No. 03288720, NPS04 ANSI CL600, 4-path
6.	No. 07168739, NPS30 ANSI CL600, 4-path
7.	No. 04408794, NPS24 ANSI CL600, 4-path
8.	No. 04288715, NPS16 ANSI CL600, 4-path
9.	No. 03218755, NPS12 ANSI CL600, 4-path
10.	No. 03118716, NPS06, ANSI CL600, 4-path
11.	No. 04068702, NPS04, ANSI CL600, 4-path
12.	No. 07118707, NPS03, ANSI CL600, 4-path
13.	No. 07118708, NPS03, ANSI CL600, 4-path
14.	No. 07178835, NPS10, ANSI CL600, 4-path

1.4 Test severity levels / classification

- Temperature: -40 ℃ to +70 ℃
- Humidity: H3 (see chapter 3)
- IP Classification: IP66 / IP67
- Mechanical: M2 (see chapter 3)
- Electromagnetic: E2 (see chapter 3)
- MPE 1% for $Q_{min} \leq Q < Q_t$ and 0,5% for $Q_t \leq Q \leq Q_{max}$

1.5 Measuring ranges

The following conditions have to be respected:

- a flow straightener as described in the MID type examination certificate (document 18) is used during the high pressure tests as well as during application
- there is a straight pipe of at least 2D upstream of the flow straightener
- there is a straight pipe of at least 8D between the flow straightener and the gas meter with an inner diameter corresponding to that of the gas meter (max. deviation 1 %)
- there is a straight pipe of at least 3D downstream of the gas meter with an inner diameter corresponding to that of the gas meter (max. deviation 1 %).
- the meter has to be tested with the gas pressure which is expected during application

- testing and adjustment of the meter is carried out in accordance to the requirements of OIML R 137 class 0.5 (polynomial adjustment) and according to document E110242.
- during operation, it is compulsive to use the same flow straightener and the same pipes as during the calibration of the meter. The orientations shall be unchanged.

The flow rate ranges which are suitable for class 0.5 are given in the following table:

Nennweite *nominal pipe size*	Q_{min} [m³/h]	Q_t [m³/h]	Q_{max} [m³/h]
3" (DN80)	20	40	400
4" (DN100)	25	65	650
6" (DN150)	32	160	1600
8" (DN200)	50	250	2500
10" (DN250)	60	400	4000
12" (DN300)	65	650	6500
14“ (DN350)	100	830	8300
16" (DN400)	120	1000	10000
18“ (DN450)	160	1400	14000
20" (DN500)	200	1600	16000
22“ (DN550)	240	2100	21000
24" (DN600)	320	2500	25000
26“ (DN650)	330	3000	30000
28" (DN700)	400	4000	40000
30“ (DN750)	450	4400	45000
32“ (DN800)	510	5100	51000
34“ (DN850)	580	5800	58000
36" (DN900)	650	6500	65000

Higher values of Q_{min} and lower values for Q_{max} are admissible, provided that $Q_{min} \leq 0.05\ Q_{max}$. The operating gauge pressure during application shall not be below 4 bar. A test with pressure $p_{e,test}$ allows using the meter in pressure range 0.5 $p_{e,test}$ to 2.0 $p_{e,test}$. The requirements described in the type examination certificate DE-08-MI002-PTB005 continue to be valid as far as they are not limited by the statements above.

1.6 List of documents

The documents listed in the type examination certificate DE-08-MI002-PTB005 are valid. In addition, the following document concerning testing and adjustment is valid:

	Document no.	Description	Pages	Issued
	E110242	Flow Test Instructions - Ultrasonic Gas Flow Meter FLOWSIC600 OIML R137 – 1&2	11	2014-01-29

2 Overview of the Performed Tests with the Conclusion (Passed/Failed)

Clause R 137-2	Performance tests	Clause R137-1	Complies with R137-1		
			pass	fail	N/A
12.6.1	Error of indication	5.3	x		
	WME	5.4	x		
	Cyclic volume	6.4.2			x
	Determination of the value of the pulse generator	6.4.3	x		
12.6.2	Reproducibility	5.6	x		
12.6.3	Repeatability	5.7	x		
12.6.4	Orientation	5.13.1			x
12.6.5	Flow direction	5.13.2	x		
12.6.6	Working pressure	5.8	x		
12.6.7	Temperature	5.9	x		
12.6.7.1	Flow tests with equal gas and ambient temperatures	5.9			
12.6.7.2	Flow tests with unequal gas and ambient temperatures	5.9			
12.6.8	Flow disturbance	5.13.3			
	- single 90° bend		x		
	- double out-of-plane bend		x		
	- expander		x		
	- reducer		x		
	- diameter step				x
	- half pipe area plate		x		
12.6.9	Durability	5.10	x		
12.6.10	Drive shaft (torque)	5.13.4			x
12.6.11	Overload flow	5.11			x
12.6.12	Different gases	5.13.5	x		
12.6.13	Vibration and shocks	5.12	x		
12.6.14	Interchangeable components	5.13.6	x		

Clause R 137-2	Performance tests	Clause R137-1	Complies with R137-1		
			pass	fail	N/A
12.6.15	Electronics				
A.4.1.1	Dry heat	5.13.7	x		
A.4.1.2	Cold	5.13.7	x		
A.4.2.1	Damp heat, steady state (non condensing)	5.13.7	x		
A.4.2.2	Damp heat, cyclic (condensing)	5.13.7	x		
A.5.1	Vibration (random)	5.13.7	x		
A.5.2	Mechanical shock	5.13.7	x		
A.6.1.1	Radio frequency immunity (radiated)	5.13.7	x		
A.6.1.2	Radio frequency immunity (conducted)	5.13.7	x		
A.6.2	Electrostatic discharge	5.13.7	x		
A.6.3	Bursts on signal and control lines	5.13.7	x		
A.6.4	Surges on signal and control lines	5.13.7	x		
A.7.1	DC mains voltage variation	5.13.7	x		
A.7.2	AC mains voltage variation	5.13.7			x
A.7.3	AC mains voltage dips and short interruptions	5.13.7			x
A.7.4	DC mains voltage dips, short interruptions and voltage variations	5.13.7	x		
A.7.5	Bursts on mains	5.13.7	x		
A.7.6	Surges on mains	5.13.7	x		
A.7.7	Ripple on DC mains power	5.13.7	x		
A.8	Low voltage of internal battery	5.13.7			x
12.6.16	Influences from ancillary devices	5.13.8			x

Due to the measuring principle (time difference measurement) and the scalability of this measurement to different meter sizes of the ultrasonic flow meter, the MPE was applied to the gas velocity for the performance test of the electronis (12.6.15) and the mechanical performance tests (12.6.13).

During all environment tests, the meter was blocked in order to achieve zero flow. The smallest meter size (NPS3, DN80) requiring the best accuracy in signal travel time measurement was used as test specimen. The result of the flow rate measurement (this is the deviation from zero flow) was compared to 1 % of Q_{min}.

3 Climatic, mechanical and electromagnetic environments

3.1 Overview

The meter is intended to be used in an environment classified according to the document OIML D11 (2013) “General requirements measuring instruments – Environmental conditions“ and OIML R137 (2012) “Gas meters, Part 1: Metrological and technical requirements” as follows:

Climatic environment:
“Instruments or parts of instruments used in open locations with average climatic conditions, thus excluding polar and desert environments”

- lower temperature limit: -40 ℃
- upper temperature limit: +70 ℃
- humidity: H3 (OIML D11)
- dust and water: IP65 / IP67 (EN 60529:1991+A1:2006)

Mechanical environment:
“Locations with significant or high levels of vibration and shock, e.g. transmitted from machines and passing vehicles in the vicinity or adjacent to heavy machines, conveyor belts, etc”

- classification: M2 (OIML D11)

Electromagnetic environment:
“Instruments used in locations with electromagnetic disturbances corresponding to those likely to be found in industrial buildings”

- classification: E2 (OIML D11)

3.2 Test results

For a reference to all test reports see appendix A.

A Results

A.1 Error (R 137-2 clause 12.6.1)

Document	Name	Pages	Date
E_33953_00.pdf	Niederdruckmessung PTB Braunschweig	20	2003-09-16
E_33955_00.pdf	Evaluation du compteur à ultrasons TotalSonic 9000 de la société ABB Process Industrie	54	2004-10-15
E_33917_00.pdf	Uncertainty Analysis	47	2007-08-09
E_19561_00_A.pdf	MTBF Calculation	2	2007-11-19

A.2 Reproducibility (R 137-2 clause 12.6.2)

Document	Name	Pages	Date
E_33953_00.pdf	Niederdruckmessung PTB Braunschweig	20	2003-09-16
E_33955_00.pdf	Evaluation du compteur à ultrasons TotalSonic 9000 de la société ABB Process Industrie	54	2004-10-15

A.3 Repeatability (R 137-2 clause 12.6.3)

Document	Name	Pages	Date
E_33955_00.pdf	Evaluation du compteur à ultrasons TotalSonic 9000 de la société ABB Process Industrie	54	2004-10-15

A.4 Flow direction (R 137-2 clause 12.6.5)

Document	Name	Pages	Date
E_33953_00.pdf	Niederdruckmessung PTB Braunschweig	20	2003-09-16

A.5 Working pressure (R 137-2 clause 12.6.6)

Document	Name	Pages	Date
E_33953_00.pdf	Niederdruckmessung PTB Braunschweig	20	2003-09-16
E_34125_00.pdf	Prüfschein PIGSAR HD-Kennlinien Eichschein-Nr. 1976/2003	4	2003-01-21
E_34125_00.pdf	Prüfschein PIGSAR HD-Kennlinien Eichschein-Nr. 1981/2003	4	2003-01-21

A.6 Temperature (R 137-2 clause 12.6.7)

Document	Name	Pages	Date
E_32641_00.pdf	Test report environmental testing 1274-05-EG-06-PB005	25	2006-08-30
E_33942_00.pdf	Test report – Sensorkennlinie (Druck, Temperatur)	26	2007-06-19

A.7 Flow disturbance (R 137-2 clause 12.6.8)

Document	Name	Pages	Date
E101229_00.pdf	Flow Disturbance Tests	3	2013-12-16

A.8 Durability (R 137-2 clause 12.6.9)

Document	Name	Pages	Date
E_39923_00_A.pdf	Langzeittest FL600	12	2004-11-29

A.9 Different gases (R 137-2 clause 12.6.12)

Document	Name	Pages	Date
E_33953_00.pdf	Niederdruckmessung PTB Braun-schweig	20	2003-09-16

A.10 Vibrations and shocks (R 137-2 clause 12.6.13)

Document	Name	Pages	Date
E_93862_00.pdf	Test report – Environmental tests 6029-09-AA-09-PB001	8	2009-10-20

A.11 Interchangeable components (R 137-2 clause 12.6.14)

Document	Name	Pages	Date
E109280_00.pdf	CEESI – Calibration results	1	2007-11-06

A.12 Electronics (R 137-2 clause 12.6.15)

A.12.1 Dry heat (R 137-2 clause A.4.1.1)

Document	Name	Pages	Date
E_32641_00.pdf	Test report environmental testing 1274-05-EG-06-PB005	25	2006-08-30

A.12.2 Cold (R 137-2 clause A.4.1.2)

Document	Name	Pages	Date
E_32641_00.pdf	Test report environmental testing 1274-05-EG-06-PB005	25	2006-08-30

A.12.3 Damp heat, steady-state (R 137-2 clause A.4.2.1)

Document	Name	Pages	Date
E_32641_00.pdf	Test report environmental testing 1274-05-EG-06-PB005	25	2006-08-30

A.12.4 Damp heat, cyclic (R 137-2 clause A.4.2.2)

Document	Name	Pages	Date
E_32641_00.pdf	Test report environmental testing 1274-05-EG-06-PB005	25	2006-08-30

A.12.5 Vibration (R 137-2 clause A.5.1)

Document	Name	Pages	Date
E_93862_00.pdf	Test report – Environmental tests 6029-09-AA-09-PB001	8	2009-10-20

A.12.6 Mechanical shock (R 137-2 clause A.5.2)

Document	Name	Pages	Date
E_93862_00.pdf	Test report – Environmental tests 6029-09-AA-09-PB001	8	2009-10-20

A.12.7 Radio frequency immunity (R 137-2 clause A.6.1.1)

Document	Name	Pages	Date
E109364_00.pdf	Test report – EMC test 1274-05-EE-13-PB004	16	2013-12-18

A.12.8 Radio frequency immunity (R 137-2 clause A.6.1.2)

Document	Name	Pages	Date
E_33915_00.pdf	Test report – EMC test 1274-05-EE-06-PB003	49	2006-01-23

A.12.9 Electrostatic discharge (R 137-2 clause A.6.2)

Document	Name	Pages	Date
E_33915_00.pdf	Test report – EMC test 1274-05-EE-06-PB003	49	2006-01-23

A.12.10 Bursts on signal and control lines (R 137-2 clause A.6.3)

Document	Name	Pages	Date
E_33915_00.pdf	Test report – EMC test 1274-05-EE-06-PB003	49	2006-01-23

A.12.11 Surges on signal and control lines (R 137-2 clause A.6.4)

Document	Name	Pages	Date
E_33915_00.pdf	Test report – EMC test 1274-05-EE-06-PB003	49	2006-01-23

A.12.12 DC mains voltage variation (R 137-2 clause A.7.1)

Document	Name	Pages	Date
E_33915_00.pdf	Test report – EMC test 1274-05-EE-06-PB003	49	2006-01-23

A.12.13 DC mains voltage dips (R 137-2 clause A.7.4)

Document	Name	Pages	Date
E_33915_00.pdf	Test report – EMC test 1274-05-EE-06-PB003	49	2006-01-23

A.12.14 Bursts on mains (R 137-2 clause A.7.5)

Document	Name	Pages	Date
E_33915_00.pdf	Test report – EMC test 1274-05-EE-06-PB003	49	2006-01-23

A.12.15 Surges on mains (R 137-2 clause A.7.6)

Document	Name	Pages	Date
E_33915_00.pdf	Test report – EMC test 1274-05-EE-06-PB003	49	2006-01-23

A.12.16 Ripples on DC mains power (R 137-2 clause A.7.7)

Document	Name	Pages	Date
E_33915_00.pdf	Test report – EMC test 1274-05-EE-06-PB003	49	2006-01-23

Die Physikalisch-Technische Bundesanstalt (PTB) in Braunschweig und Berlin ist das nationale Metrologieinstitut und die technische Oberbehörde der Bundesrepublik Deutschland für das Messwesen und Teile der Sicherheitstechnik. Die PTB gehört zum Dienstbereich des Bundesministeriums für Wirtschaft und Technologie. Sie erfüllt die Anforderungen an Kalibrier- und Prüflaboratorien auf der Grundlage der DIN EN ISO/IEC 17025.

Zentrale Aufgabe der PTB ist es, die gesetzlichen Einheiten in Übereinstimmung mit dem Internationalen Einheitensystem (SI) darzustellen, zu bewahren und – insbesondere im Rahmen des gesetzlichen und industriellen Messwesens – weiterzugeben. Die PTB steht damit an oberster Stelle der metrologischen Hierarchie in Deutschland. Kalibrierscheine der PTB dokumentieren die Rückführung des Kalibriergegenstandes auf nationale Normale.

Zur Sicherstellung der weltweiten Einheitlichkeit der Maße arbeitet die PTB mit anderen nationalen metrologischen Instituten auf regionaler europäischer Ebene in EURAMET und auf internationaler Ebene im Rahmen der Meterkonvention zusammen. Das Ziel wird durch einen intensiven Austausch von Forschungsergebnissen und durch umfangreiche internationale Vergleichsmessungen erreicht.

The Physikalisch-Technische Bundesanstalt *(PTB) in Braunschweig and Berlin is the National Metrology Institute and the highest technical authority of the Federal Republic of Germany for the field of metrology and certain sectors of safety engineering. The PTB comes under the auspices of the Federal Ministry of Economics and Technology. It meets the requirements for calibration and testing laboratories as defined in the EN ISO/IEC 17025.*

It is fundamental task of the PTB to realize and maintain the legal units in compliance with the International System of Units (SI) and to disseminate them, above all within the framework of legal and industrial metrology. The PTB thus is on top of the metrological hierarchy in Germany. Calibration certificates issued by it document that the object calibrated is traceable to national standards.

To ensure worldwide coherence of measures, the PTB cooperates with other national metrology institutes within EURAMET on the regional European level and on the international level within the framework of the Metre Convention. The aim is achieved by an intensive exchange of results of research work carried out and by comprehensive international comparison measurements.