PRODUCTION SURVEILLANCE CERTIFICATE
NO. 1450-MID-006

Instytut Nafty i Gazu – Państwowy Instytut Badawczy (INiG-PIB) being a notified body for directive 2014/32/EU hereby certifies that the quality system of the manufacturer:

APATOR METRIX S.A.
83-110 TCZEW, UL. GRUNWALDZKA 14

within the scope of EU type examination certificates indicated on 2nd page.

have been approved and is subject to surveillance carried out by the Instytut Nafty i Gazu – Państwowy Instytut Badawczy in accordance with the requirements of directive 2014/32/EU on the harmonisation of the laws of the Member States to the making available on the market of measuring instruments (module D- conformity to type based on quality assurance of the production process)

at the same time INiG-PIB hereby gives the authorisation to a/m company to use its identifying number **1450** and to put it behind the CE mark on the products covered by this surveillance within the period of validity of this certificate.

Hereby Production Surveillance Certificate has been issued on **22nd October 2024** and remains valid until **9th February 2030** as long as the approved quality system in the manufacturing place is not significantly modified and unless this certificate is not suspended, withdrawn, invalidated or limited by the notified body which issued it.

This Production Surveillance Certificate is no longer valid for certificate that expired.

Certification Office Manager
Magdalena Swat

Instytut Nafty i Gazu * Państwowy Instytut Badawczy * 4

Director of Instytut Nafty i Gazu - Państwowy Instytut Badawczy
Jacek Jaworski

Kraków, 22-10-2024

43rd issue, replaces 42nd issue of 09-10-2024

INSTYTUT NAFTY I GAZU – Państwowy Instytut Badawczy
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PCA Polskie Centrum Akredytacji – Certyfikacja Wyrobów AC 010

The list of Type Examination Certificates covered by Production Surveillance Certificate No. 1450-MID-006

No.	No.	Type of gas meter
1	PL-MI002-1450CL0001 12th issue of 11-04-2024 valid until 09-02-2030	UG (G1,6; G2,5; G4; G6; G40; G65)
2	T10382 6th issue of 17-05-2022 valid until 09-09-2031	UG T; UG T HybridSmart
3	PL-MI002-1450CN0007 6th issue of 29-10-2022 valid until 28-10-2032	UG G4
4	PL-MI002-1450CP0014 10th issue of 22-10-2024 valid until 29-09-2034	UG G10, UG G16, UG G25
5	PL-MI002-1450CQ0002 4th issue of 27-02-2023 valid until 09-06-2025	HybridSmart UG (G1,6; G2,5; G4)
6	PL-MI002-1450CQ0004 5th issue of 27-02-2023 valid until 16-12-2025	2UG G4; 2UG G6
7	PL-MI002-1450CT0009 9th issue of 29-05-2023 valid until 01-03-2028	iSmart UG (G1,6; G2,5; G4) iSmart 2UG (G4; G6) iSmart UG (G10; G16; G25)
8	PL-MI002-1450DO0001 5th issue of 09-10-2024 valid until 12-01-2033	iSmart2 UG (G1,6; G2,5; G4; G6)

Kraków, 22-10-2024

Certification
Office Manager
Magdalena Swat

43rd issue, replaces 42nd issue of 09-10-2024

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Nr Certyfikatu
NC-0164

CERTYFIKAT

Przyznany Organizacji:

APATOR METRIX S.A.

ul. Grunwaldzka 14
83-110 Tczew

Biuro Certyfikacji Systemów Zarządzania Polskiego Rejestru Statków S.A., al. gen. Józefa Hallera 126, 80-416 Gdańsk, zaświadcza, że Zintegrowany System Zarządzania obejmujący System Zarządzania Jakością, System Zarządzania Środowiskowego, System Zarządzania Bezpieczeństwem i Higieną Pracy oraz System Zarządzania Bezpieczeństwem Informacji wyżej wymienionej Organizacji został oceniony i stwierdzono jego zgodność z wymaganiami:

ISO 9001:2015
ISO 14001:2015
ISO 45001:2018
ISO/IEC 27001:2013

Zakres certyfikacji:

PROJEKTOWANIE I PRODUKCJA GAZOMIERZY I WYROBÓW DLA GAZOWNICTWA

W OBSZARZE ISMS CERTYFIKAT OBOWIĄZUJE ŁĄCZNIE Z DEKLARACJĄ STOSOWANIA ED.05 Z DNIA 20.07.2021

Pierwsze wydanie Certyfikatu:	**21.08.2014**
Certyfikat ISO 9001, ISO 45001, ISO 14001 jest ważny do:	**20.08.2026**
Certyfikat ISO 27001 jest ważny do:	**31.10.2025**

Gdańsk, 21.08.2023

AC 014

Dyrektor Pionu Certyfikacji
Dariusz Denis

Certificate No.
NC-0164

CERTIFICATE

Issued for:

APATOR METRIX S.A.

ul. Grunwaldzka 14
83-110 Tczew

Management Systems Certification Bureau of Polski Rejestr Statków S.A., al. gen. Józefa Hallera 126, 80-416 Gdańsk, certifies that the Integrated Management System including Quality Management System, Environmental Management System, Occupational Health and Safety Management System and Information Security Management System of the above Organization has been assessed and found to be in accordance with the requirements of:

ISO 9001:2015
ISO 14001:2015
ISO 45001:2018
ISO/IEC 27001:2013

Scope of certification:

DESIGN AND MANUFACTURE OF GAS METERS AND PRODUCTS FOR GAS ENGINEERING INDUSTRY

FOR ISMS RANGE THE CERTIFICATE IS VALID TOGETHER WITH DECLARATION ON USE ED.05 OF 20.07.2021

Certificate first issue:	**21.08.2014**
The Certificate ISO 9001, ISO 45001, ISO 14001 is valid until:	**20.08.2026**
The Certificate ISO 27001 is valid until:	**31.10.2025**

Gdańsk, 21.08.2023

AC 014

Certification Division Director
Dariusz Denis

EU-type examination certificate

Number **T10382** revision 7
Project number 3744075

Issued by

NMi Certin B.V.,
designated and notified by the Netherlands to perform tasks with respect to conformity assessment procedures mentioned in article 17 of Directive 2014/32/EU, after having established that the measuring instrument meets the applicable requirements of Directive 2014/32/EU, to:

Manufacturer

Apator Metrix S.A.
Grunwaldzka 14
83-110 Tczew
Poland

Measuring instrument **Diaphragm gas meter**

Type	:	UG T UG T HybridSmart
Manufacturer's mark or name	:	Apator Metrix S.A.
Destined for the measurement of	:	Gas volume
Accuracy class	:	Class 1,5
Environment classes	:	M1 / E1
Ambient temperature range	:	- 25 °C / +55 °C
Gas temperature range	:	- 25 °C / +40 °C
Location	:	Closed/Open

Further properties are described in the annexes:
- Description T10382 revision 7;
- Documentation folder T10382-6.

Valid until 9 September 2031

Initially issued 9 September 2011

Remark This revision replaces the earlier versions, including its documentation folder.

Issuing Authority **NMi Certin B.V., Notified Body number 0122**
11 March 2024

Certification Board

NMi Certin B.V.
Thijsseweg 11
2629 JA Delft
The Netherlands
T +31 88 636 2332
certin@nmi.nl
www.nmi.nl

Description

1 General information about the gas meter

All properties of the gas meter, whether mentioned or not, shall not be in conflict with the legislation.

The meter is executed as follows:
- A gas meter with a mechanical register, indicating the volume at base conditions only, conform paragraph 2.1 of ANNEX IV (MI-002).

1.1 Essential parts

Description	Documentation	Remarks
Construction - 1,15 dm^3 - 1,2 dm^3 - 1,9 dm^3	 10382/6-01 10382/6-01 10382/6-01	
Diaphragm - 1,15 dm^3 and 1,2 dm^3 - 1,9 dm^3	 10382/6-02 10382/6-03	Material 401615P or 401617P, manufacturer EFFBE. Material 0P3NV/205, manufacturer SMI (type CSQ3).
Valve and valve seat - valve - valve seat	 10382/6-04 10382/6-05	Material Delgra 90 and Delgra 100, manufacturer Elchi. Slider rods material brass or plastic (PBT). Coupling sleeve material brass or stainless steel.
Temperature compensation - 1,15 dm^3 - 1,2 dm^3 - 1,9 dm^3 - 2,0 dm^3	 10382/6-07 10382/6-08 10382/6-09 10382/7-01 and 10382/7-02	

1.2 Essential characteristics

1.2.1 Approved meter types : UG T and UG T HybridSmart

G-value	Maximum Q_{max} [m^3/h]	Minimum Q_{min} [m^3/h]	Minimum Q_t [m^3/h]	Cyclic Volume [dm^3]
4	6	0,040	0,6	1,15 or 1,20 or 1,90 or 2,0
2,5	4	0,025	0,4	1,15 or 1,20 or 1,90
1,6	2,5	0,016	0,25	

If higher values are chosen for Q_{min} and/or lower values for Q_{max}, it has to be taken into ccount that $Q_{max} / Q_{min} \geq 150$. For Q_t it has to be taken in account that the minimum value is not lower than the minimum value as indicated in the table above and that $Q_t \leq 0,1\ Q_{max}$.

1.2.2 maximum p_{max} Steel housing : 0,5 bar
Aluminium housing : 2 bar

1.2.3 Indicated converted volume (optional)
The volume is converted through the following formula;

$$V_b = V_a * \frac{T_b}{T}$$

With T_b and T in Kelvin.

1.3 Essential shapes

1.3.1 The nameplate is bearing at least, good legible, the following information:
- CE marking including the supplementary metrological marking (M + last 2 digits of the year in which the instrument has been put into use);
- Notified Body identification number, following the supplementary metrological marking;
- type examination certificate no. T10382;
- manufacturer's name, registered trade name or registered trade mark;
- manufacturer's postal address;
- serial number of the meter and year of manufacture;
- Q_{max}, Q_t and Q_{min};
- cyclic volume;
- maximum working pressure p_{max};
- ambient temperature range;
- gas temperature range;
- accuracy class;
- base temperature (t_b);
- specific centre temperature (t_{sp});
- resistance to high temperatures, marked with a 'T' (optional);

The following may be stated on either the nameplate or in the user manual:
- mechanical environment class;
- electromagnetic environment class.

Examples of the markings are shown in document no. 10382/6-10 and 10382/7-03.

1.3.2 Sealing: see chapter 2.

1.4 Conditional parts

1.4.1 Housing The gas meter has a housing, which has sufficient tensile strength.
The cover is made of steel sheet, the lower and upper case are connected with each other by a clamp or the cover is made of aluminium alloy, the lower and upper case are connected with each other by screws. Examples of the different housing combinations are stated on drawings no. 10382/6-11, 10382/6-12 and 10382/6-13.
The counter case is also connected to the upper case by screws. Examples of the bottom housing are depicted on drawings no. 10382/6-14, 10382/6-15, 10382/6-16, 10382/6-17, 10382/6-18 and 10382/6-19.
Examples of the top housings are depicted in drawings no. 10382/6-20, 10382/6-21, 10382/6-22, 10382/6-23, 10382/6-24, 10382/6-25 and 10382/6-26.

1.4.2 Transmission
The transmission between the measuring part and the register is executed via a fixed mechanical coupling.

1.4.3 Register
The indication takes place in m3, by at least 5 drums before the comma and 3 drums after the comma. In drawings no. 10382/6-27 (UG T) and 10382/6-28 (UG T HybridSmart) examples of the counters are presented.
The counter is adjustable via an adjusting wheel, see drawing no. 10382/6-29, 10382/6-30, 10382/6-31 and 10382/4-09.

1.4.4 Shut-off valve (optional)
The meter can be equipped with a shut-off valve which is mounted in the outlet of the meter. A drawing of the valve can be found in document number 10382/6-06.

1.5 Conditional shapes

1.5.1 Connection
The meter is executed with a double pipe connection. The diameter of the connections is at least 20 mm. The distance between the middle of the in- and outlet connection is 250 mm maximally.

The diameter of the single pipe connection is at least DN25.

1.6 Non-essential parts

1.6.1 Reverse stop for preventing registration in reversed flow direction

1.6.2 Pulse generator

1.6.3 Hybrid Smart (optional)
External encoder type "GWFcoder" connected to the output shaft on the mechanical index. See document 10382/6-28.

1.6.4 Radio module (HybridSmart only).

2 Seals

The following items of the meter are sealed:

- The entrance to the measuring part is sealed with one or more seals.
- The entrance to the register is sealed with one or more seals.

See drawing no. 10382/6-33 for an example of the sealing.

Inspection Certificate No :
Протокол испытаний № :

Order No/ Номер заказа:	
Customer/ Заказчик:	
Type/Size of the gas meter / Типоразмер счетчика газа:	UG T G4
Nominal cyclic volume/ Циклический объем:	Vc = 1,2 dm3
Minimum flow rate/ Минимальный расход:	Qmin = 0,04 m3/h
Maximum flow rate/ Максимальный расход:	Qmax = 6 m3/h
Year of manufacture/ Дата изготовления:	2025
Sample size/ Количество испытываемых счетчиков:	60
Test date/ Дата поверки:	2025-02-25
Maximum permission error/ Максимальная погрешность показаний:	Qmin / 0,2Qmax / Qmax : ±3,5% / ±2% / ±2%
Date/ Дата:	2025-03-06

UG G4T		APATOR METRIX S.A.		
Item/№:	No, of gas meter/Серийный номер счетчика газа:	Measurement errors [%]/Погрешность показаний [%]:		
		Qmax	0,2Qmax	Qmin
1	25MUGTG4 11006233754	-0.46	0.56	-1.32
2	25MUGTG4 11006233755	-0.58	0.47	-1.35
3	25MUGTG4 11006233756	-0.43	0.50	-1.76
4	25MUGTG4 11006233757	-0.49	0.50	-1.80
5	25MUGTG4 11006233758	-0.41	0.46	0.33
6	25MUGTG4 11006233759	-0.56	0.64	-0.32
7	25MUGTG4 11006233760	-0.74	0.70	-0.90
8	25MUGTG4 11006233761	-0.50	0.57	-1.27
9	25MUGTG4 11006233762	-0.82	0.82	-0.82
10	25MUGTG4 11006233763	-0.58	0.54	-1.84
11	25MUGTG4 11006233764	-0.30	0.19	-1.65
12	25MUGTG4 11006233765	-0.50	0.46	-1.30
13	25MUGTG4 11006233766	-0.63	0.67	-1.37
14	25MUGTG4 11006233767	-0.41	0.44	-1.23
15	25MUGTG4 11006233768	-0.60	0.75	-0.83
16	25MUGTG4 11006233769	-0.45	0.35	-1.40
17	25MUGTG4 11006233770	-0.28	0.33	-1.33
18	25MUGTG4 11006233771	-0.05	0.02	-0.91
19	25MUGTG4 11006233772	-0.14	0.12	-2.38
20	25MUGTG4 11006233773	-0.47	0.44	-1.78
21	25MUGTG4 11006233774	-0.69	0.77	-0.52
22	25MUGTG4 11006233775	-0.64	0.57	-0.62
23	25MUGTG4 11006233776	-0.50	0.52	-0.99
24	25MUGTG4 11006233777	-0.30	0.35	-1.26
25	25MUGTG4 11006233778	-0.31	0.38	-1.83
26	25MUGTG4 11006233779	-0.84	0.94	-0.55
27	25MUGTG4 11006233780	-0.74	0.72	-2.53
28	25MUGTG4 11006233781	-0.79	0.68	-1.49
29	25MUGTG4 11006233782	-0.70	0.70	-0.76
30	25MUGTG4 11006233783	-0.16	0.40	-1.13

31	25MUGTG4 11006233784	-0.58	0.45	-0.65
32	25MUGTG4 11006233785	-0.40	0.37	-1.31
33	25MUGTG4 11006233786	-0.14	0.26	-0.54
34	25MUGTG4 11006233787	-0.42	0.28	-0.64
35	25MUGTG4 11006233788	-0.85	0.61	-1.01
36	25MUGTG4 11006233789	-0.51	0.47	-2.86
37	25MUGTG4 11006233790	-0.40	0.57	-1.32
38	25MUGTG4 11006233791	-0.12	0.23	-2.08
39	25MUGTG4 11006233792	-0.48	0.62	-0.20
40	25MUGTG4 11006233793	-0.89	0.73	-1.04
41	25MUGTG4 11006233794	-0.35	0.44	-1.72
42	25MUGTG4 11006233795	-0.80	0.73	-1.35
43	25MUGTG4 11006233796	-0.69	0.69	-2.92
44	25MUGTG4 11006233797	-0.44	0.43	-0.81
45	25MUGTG4 11006233798	0.08	-0.08	-2.26
46	25MUGTG4 11006233799	-0.33	0.32	-1.56
47	25MUGTG4 11006233800	-0.62	0.49	-0.92
48	25MUGTG4 11006233801	-0.16	0.23	-0.59
49	25MUGTG4 11006233802	-0.58	0.51	-1.87
50	25MUGTG4 11006233803	-0.07	0.11	-1.86
51	25MUGTG4 11006233804	-0.23	0.04	-1.66
52	25MUGTG4 11006233805	-0.65	0.71	-1.70
53	25MUGTG4 11006233806	-0.40	0.45	-0.91
54	25MUGTG4 11006233807	-0.57	0.55	-0.29
55	25MUGTG4 11006233808	-0.72	0.60	0.09
56	25MUGTG4 11006233809	-0.39	0.51	-0.16
57	25MUGTG4 11006233810	-0.46	0.45	-0.98
58	25MUGTG4 11006233811	-0.38	0.37	-1.39
59	25MUGTG4 11006233812	-0.97	1.00	-0.02
60	25MUGTG4 11006233813	-0.19	0.20	-0.82

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tel. centr. 58-53-09-200; fax 58-53-09-300
NIP 593-010-00-81 REGON 190558973
PKD 2651Z KRS: 0000046259 (11)

Instructions for installation and operation

Residential diaphragm gas meters

UG & UGT (G1.6, G2.5, G4), 2UG G6

APATOR METRIX

Table of contents

1. Application

The residential gas meters UG (standard version) and UG T (with mechanical temperature compensation) are designed acc. to the European Standard EN1359 to measure the consumption of gas in households and at other consumers, where the maximum consumption of all gas appliances does not exceed 2.5 m³/h in case of gas meter UG G1.6, 4 m³/h in case of gas meter UG G2.5, 6 m³/h in case of gas meter UG G4 and 10 m³/h in case of gas meter 2UG G6 of the air (density 1,2 kg/m³). They are suitable to measure the consumption of natural gas, synthetic gases and their mixtures. They can optionally be equipped with low frequency pulse transmitter type NI-3 manufactured by APATOR METRIX.

2. Technical data

	UG / UGT G1,6	**UG / UGT G2,5**	**UG / UGT G4**	**UG G4**	**UGT G4**	**2UG G6**
Cycle volume	1,2 dm^3	1,2 dm^3	1,2 dm^3	2,2 dm^3	2,0 dm^3	2,2 dm^3
Nominal flowrate Q_n	1,6 m³/h	2,5 m³/h	4 m³/h	4 m³/h	4 m³/h	6 m³/h
Minimal flowrate Q_{min} *)	0,016 m³/h	0,016 m³/h lub 0,025 m³/h	0,016 m³/h lub 0,025 m³/h lub 0,04 m³/h	0,04 m³/h	0,04 m³/h	0,06 m³/h
Maximum flowrate Q_{max}	2,5 m³/h	4 m³/h	6 m³/h	6 m³/h	6 m³/h	10 m³/h
Transitional flowrate Q_t	0,25 m³/h	0,4 m³/h	0,6 m³/h	0,6 m³/h	0,6 m³/h	1 m³/h
Overload flowrate Q_r	3 m³/h	4,8 m³/h	7,2 m³/h	7,2 m³/h	7,2 m³/h	12 m³/h

Cyclic volume – V (measured at 20°C)

UG 1,2 dm³; 2,2 dm³
UG T 1,2 dm³, 2,0 dm³
2UG 2,2 dm³

Allowable indication errors limits during initial verification: UG / UG T

- Q_{min} to 0,1Q_{max} – E ±3%
- 0,1Q_{max} to Q_{max} – E ±1,5%

Ambient temperature range - t_m -25÷55ºC
Gas temperature range - t_g -25÷55ºC

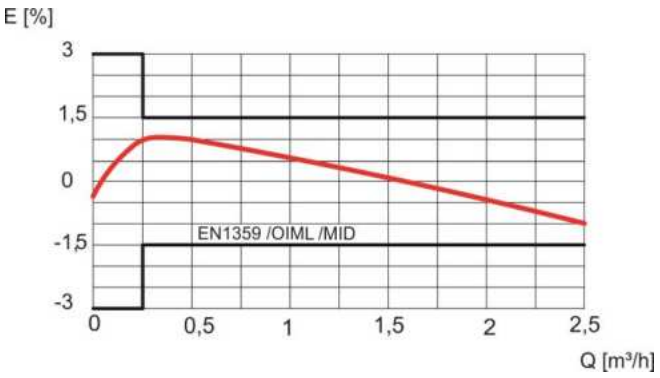
UG T - TC correction range

Maximum working pressure P_{max} 50 kPa (0,5 bar)
Max. pressure drop Δp at Q_{max} ≤200 Pa (2 mbar)
Index measuring range 99999,999 m³
Pulse value (pulse is optional): 0,01m3

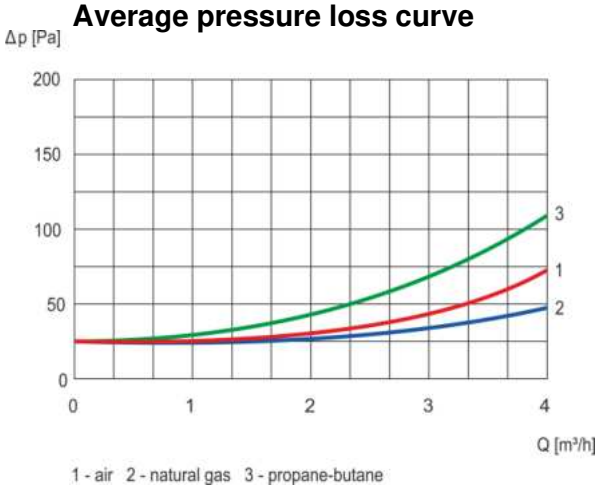
Distance between connection bosses:	0 mm; 100 mm; 110 mm; 130 mm; 6”(152,4 mm); 160 mm; 220 mm; 250 mm
Weight	~1,9 kg to 3,2 kg
Family of gases	Gaseous fuels: family 1,2 & 3 acc. to EN 437 for all gas meters and 100% hydrogen (H_2) for UG G4
Electromagnetic are classified into classes	E1
Mechanical are classified into classes	M1
Class of gas meter	1,5
Explosive group	IIB
Possible connection standards:	ISO, British Standard, NPT, NPR and others.

UG G1,6

Average error curve for air



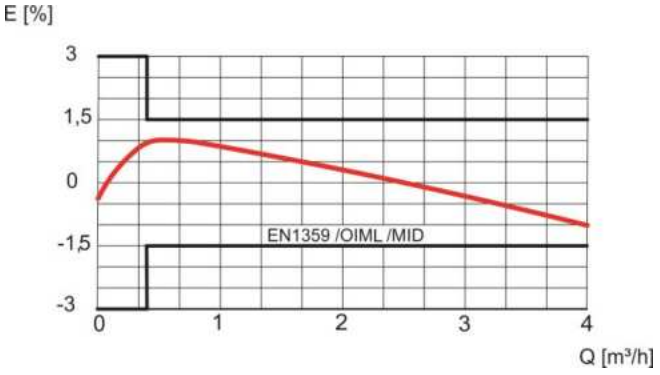
Average pressure loss curve



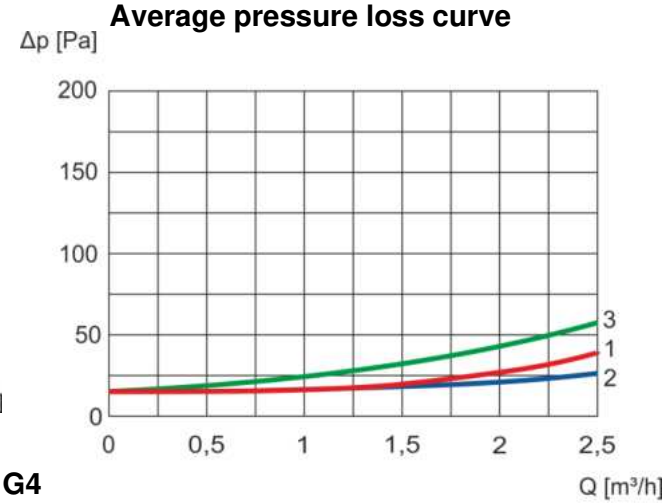
1 - air 2 - natural gas 3 - propane-butane

UG G2,5

Average error curve for air



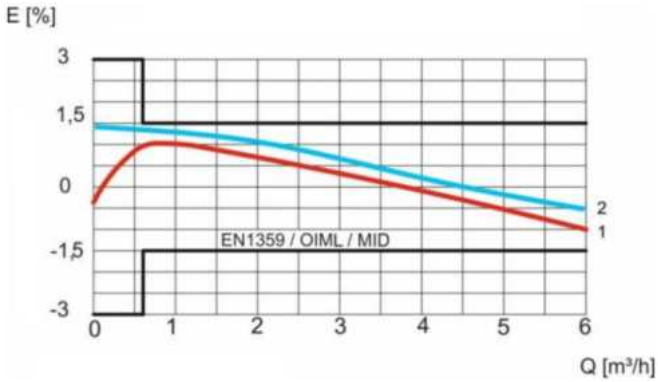
Average pressure loss curve



1 - air 2 - natural gas 3 - propane-butane

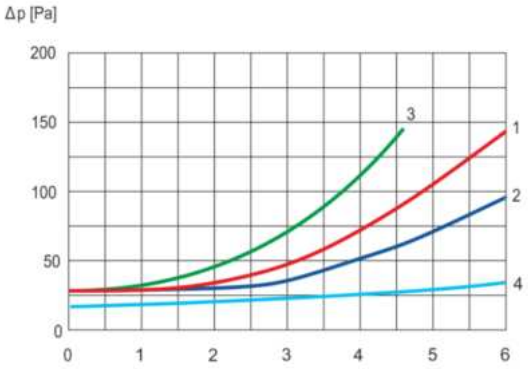
UG G4

Average error curve for air



1 – air 2 – hydrogen

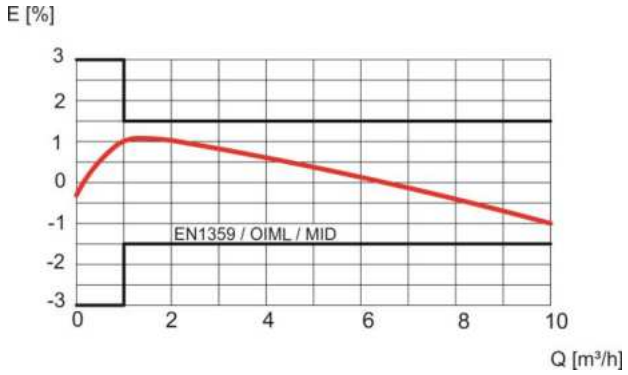
Average pressure loss curve



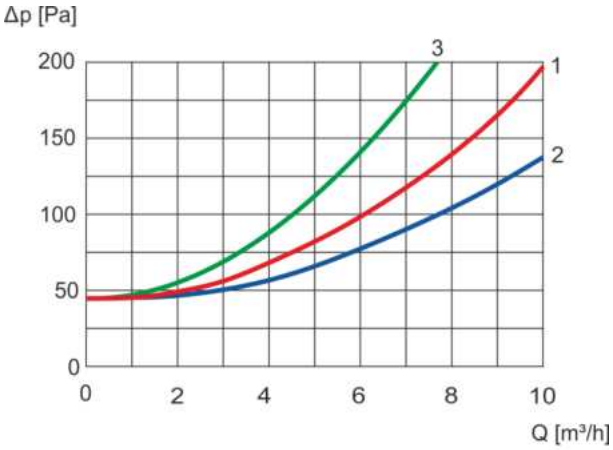
1 – air 2 – natural gas 3 – propane-butane 4 - hydrogen

2UG G6

Average error curve for air

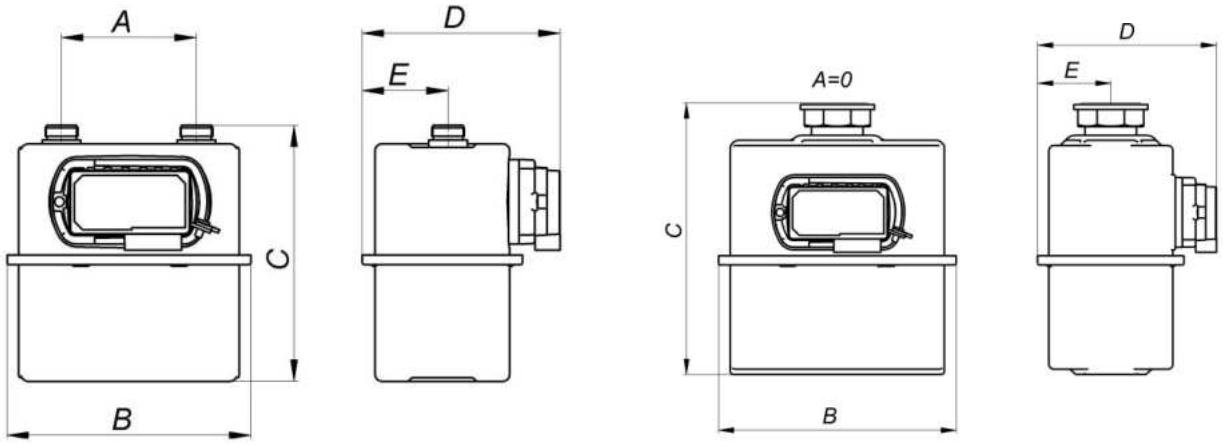


Average pressure loss curve



1 - air 2 - natural gas 3 - propane-butane

3. Dimensions



UG / UGT V=1,2dm³

A [mm]	**B** [mm]		**C** [mm]		**D** [mm]		**E** [mm]		**Weight** [kg]
	Steel casing	Alu casing*	Steel casing	Alu casing*	Steel casing	Alu casing*	Steel casing	Alu casing*	
000	199	-	227	-	163	-	66	-	~2,0
100	199	210	212	210	163	175	66	74	~1,9
110	199	210	212	210	163	175	66	74	~1,9
130	199	-	212	-	163	-	66	-	~1,9
152,4	235	-	263	-	177	-	73	-	~2,8
160	235	-	241	-	177	-	77	-	~2,8
220	283	-	222	-	177	-	73	-	~2,6
250	328	-	222	-	177	-	73	-	~3,2

*) Aluminium casing

UG V=2,2dm³, UG T V=2,0dm³ and 2UG G6 V=2,2dm³

A [mm]	**B** [mm]	**C** [mm]	**D** [mm]	**E** [mm]	**Weight** [kg]
	Steel casing	Steel casing	Steel casing	Steel casing	
000	235	254	178	72	~2,8
130	235	241	178	72	~2,6
152,4	235	262	178	72	~2,9
160	235	241	178	77	~3,0
220	327	235	178	72	~3,0
250	327	224	178	72	~3,0

4. Construction of the gas meter

The gas meter consists of three basic units:

- measuring unit
- gas meter casing
- index

4.1 Measuring unit

It contains two measuring chambers including diaphragm, distributing duct and control mechanism including valves and sliders, rocking levers, connecting rods, crank and crankshaft. The measuring unit is equipped with a device to prevent the registration of reverse flow acc. to the norm EN1359.

4.2 Gas meter casing

It consists two subassemblies, i.e. top casing and bottom casing. These units are joint hermetically by means of a casing hoop (band). The following parts belong to the top casing: magnetic drive with internal and external magnet subassembly and a driving pinion.

4.3 Index

It is connected to the top casing with screws and is protected from outside by the index housing, which can be locked by a lead seal or the index blockade. The index design allows connecting a Pulse Transmitter NI-3 or Telemetry Module Unismart at any time of the gas meter operation without damaging the seal.

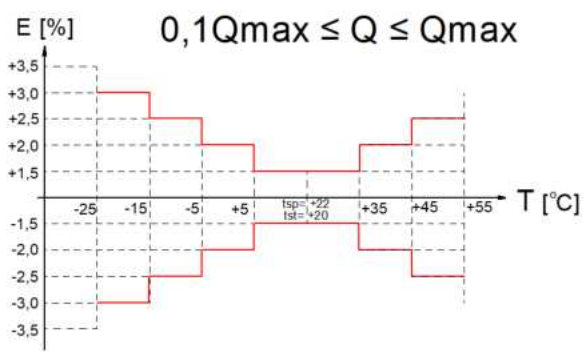
5. Operating principals

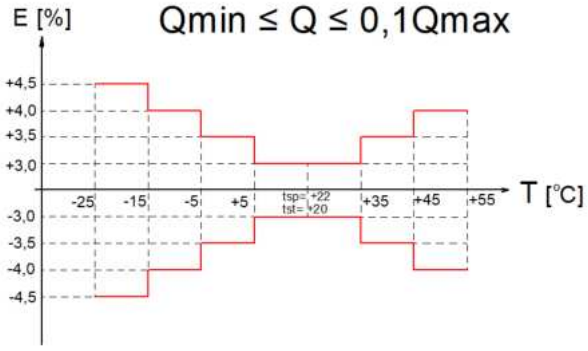
The highly precise instrument – gas meter – measures the volume of gas that moves through it. Gas entering the meter flows through the holes of the distribution duct and causes a diaphragm to move, allowing gas into a chamber. The movement of the diaphragms causes a rotary reversible movements of the connected shafts. The rocking levers are fastened on the shafts. The rocking levers are connected throughout the connecting rods to the crank shaft. The rotary movement of the crank shaft is transferred to the slider and through the transmission and magnetic drive to the index driving pinion.

As the cycle continues, the gas is moved from the chamber into the gas line that feeds home's gas appliances. The meter records the number of times the chamber is filled and emptied.

6. Mechanical temperature compensation

Gas meters UG G1.6 up to UG G4 can be equipped with mechanical temperature compensation (bimetal).





Gas is a substance subject to thermal expansion, which means that depending on temperature, it increases or decreases its volume. Consequently, what changes is the measuring accuracy of a gas meter with relation to its energy content. In other words when gas with some energy content, volume and temperature is already in pipes and is heated, then the index unit is to show a bigger consumption after flow, whereas when gas is cooled, the gas meter will indicate a lower consumption. It is a very important issue as a temperature change of 3˚C corresponds to a volume change of approximately 1%. Such considerable temperature changes are likely to occur especially to meters placed on the outside of a building. Consequently the meter works at various temperatures depending on the season.

A gas meter with temperature compensation provides a solution to this problem as it uses and undergoes thermal expansion as well. A temperature compensation mechanism installed in the measuring unit is adjusted in such a way so that it changes the cyclic volume of the measuring unit exactly like gas undergoing expansion due to temperature changes. Elements responsible for compensation installed in the meter allow a radial shift of the diaphragm, which results in moving the curve of typical error up or down in relation to the zero line.

Thus the gas meter converts the measured value of gas volume into its value at fiducial temperature – irrespective of measuring temperature.

7. Initial verification (sealing)

The gas meters under obligation are subject of initial verification. The sealing is carried out by authorized staff. The proof of initial verification is the stamp in the right-down corner of the index window or on a traditional seal. Sealing is invalid in case of gas meter damage or if the indication error exceeds the permissible error settled by appropriate regulations.

8. Conformity assessment

Gas meters are required to comply with the 2014/32 / EU (MID) conformity assessment. Proof of conformity assessment is stamped by the manufacturer. The deadline for reporting to the next metrological control is the separate national regulations. The conformity assessment will be invalidated if the meter is faulty.

8.1 Declaration of conformity

CE	**CE - DECLARATION OF CONFIRMITY**

- **PN-EN 1359:2017** (UG / UGT G1,6; UG / UGT G2,5; UG / UGT G4 V=1,2dm³, UGT G4 V=2,0dm³, UG G4 V=2,2dm³; 2UG G6 V=2,2dm³)
- **PN-EN:2004** [EN1359:1998] (2UG G6 V=2,2dm³)
- **PN-EN ISO 80079-36:2016-7 (ISO/IEC 80079)**
- **OIMIL R 137 1&2:2012** (Only applies to UG G1,6; UGG2,5; UG G4 V=1, 2dm³ gas-meters in version UG-FP &UG FL outside the scope of OIMIL)
- **Directive MID (2014/32/EC)**

9. Storage and transportation

9.1 Storage

The gas meters should be stored in a dry room, free from dust and highly corrosive chemical vapors. During storage, the gas meter connectors should be protected with plugs. Security measures should not be removed from the moment of verification until the gas meter is connected to the gas installation. Gas meters stored in unit packaging can be placed on top of each other in accordance with handling signs, provided that they are protected against tipping over and falling. The room temperature should be between -25°C and +60°C, and the relative humidity should not exceed 75%. The storage period should not be longer than 12 months from the date of delivery or 6 months for gas meters with mechanical thermocorrection. This is due to the resistance of certain materials (such as gaskets or membranes), which can degrade in contact with air.

9.2 Conditions for the receipt of gas meters

1. Receipt of gas meters at the customer's premises should be performed in accordance with DVGW Gas Information Nr. 14 in accordance with point 3.3 (within 14 days from the receipt of the goods by the customer). The reception representations will follow this period - error messages "in operation" from EN1359 table 2.
2. The stabilization before the temperature measurement was to be checked at the same time and in the same quality, ie 20ºC +/- 1ºC for the period of every 4 hours.
3. Temperature during thickness measurement 20ºC +/- 1ºC. Change during the measurement to 1ºC
4. Measurement doses (minimum) (according to the PTB Testing Manual, Volume 29, p. 6.3.2.1, Table 8)
5. When making a gas meter, in order to obtain a measurement of the measurement point, you are limited to the control for which, for this measurement, you can use the other side, as well, (Three measurements required for the confidence level for the measurement at 95%). Successor to the gas meter readings.

9.3 Transportation

The gas meters should be transported in unit packages placed on covered means of transport in accordance with the handling signs on the packaging. During transport, the gas meters should be secured against overturning and shifting. Transport of individual gas meters to the place of installation should be carried out together with unit packages or in a way that prevents damage.

10. Installation of gas meter

The gas meter can be installed in the installation or externally in the air in the gas box combined with the current supplement in your country.

The gas installation should be made in such a way that it is possible to connect the gas meter without stresses. There should be a marker on the pipe supplying gas to the gas meter that enables the gas to be shut off. The gas flow direction is indicated by an arrow on the top of the gas meter. The gas meter should be connected to the installation with the use of nuts (nuts in the case of a single-king gas meter), first tightening them by hand and then with a torque wrench to connect to the installation of the connection to obtain a stub pipe.

Torque values are shown in Table 1.

Nominalna średnica króćca przyłączeniowego		Wartość momentu skręcającego - max
Nominal connection diamater		Torque value - max
cale / inch	DN	[Nm]
½	15	50
¾	20	80
1	25	110
1 ¼	32	110
1 ½	40	140
2	50	170
2 ½	65	170
3	80	170
4	100	170
5	125	170

Table 1. Torque values

After installation, the top surface of the gas meter should be in a horizontal position. The gas meter should be started up with a slow increase in gas pressure, not exceeding its permissible Pmax value. Otherwise the gas meter may be damaged. If the gas meter has an integrated valve, this valve must be opened during the leak test.

It is recommended to use the gaskets recommended by the manufacturer. In the case of gas meters with a declaration of heat resistance, gaskets tested for resistance to high temperature must be used. Seals may only be used once.

11. Using gas meters

The gas meters do not require any maintenance. The gas meter should be protected against mechanical and chemical damage. All activities performed on the gas meter or in its vicinity should be performed with the use of chemical agents that do not cause corrosion of the gas meter components.

Periodic checking of the gas installation with the gas meter is carried out in accordance with the requirements of the law. The manufacturer recommends carrying out technical inspections by trained personnel at least once a year - during the inspection, pay attention to signs of corrosion, attempts to break into the counter, tightness, disturbing noises, etc. If there are any signs of red corrosion, the gas meter should be removed from the mains.

Due to the possibility of unintentional electrification of the gas meter housing covered with epoxy-polyester powder paint, for periodic cleaning of the external surfaces of the gas meter, e.g. to remove a layer of dust, use a damp cloth or fabric made of antistatic material.

The gas meter should be used in accordance with the parameters presented on the rating plate and the guidelines for validation and warranty validity, and in accordance with the internal legal regulations in force in a given country.

When removing the gas meter for secondary verification or disposal, the gas meter should be flushed with an inert gas (e.g. nitrogen) before transport, and then the connectors should be protected against external contamination.

12. Reparation

In the event of damage to the gas meter, it must be repaired at the manufacturer's or in a plant having an appropriate permit to repair gas meters. The manufacturer provides training in the field of gas meter repairs. After the repair, the index plate should be permanently marked with a marking consisting of: the index specifying the plant performing the repair and the year of repair. The repaired gas meter is subject to error checking and re-verification. The errors in gas meters readings and the validity of the verification are specified in the relevant regulations.

Service address:
APATOR METRIX S.A.
ul. Grunwaldzka 14
83-110 Tczew

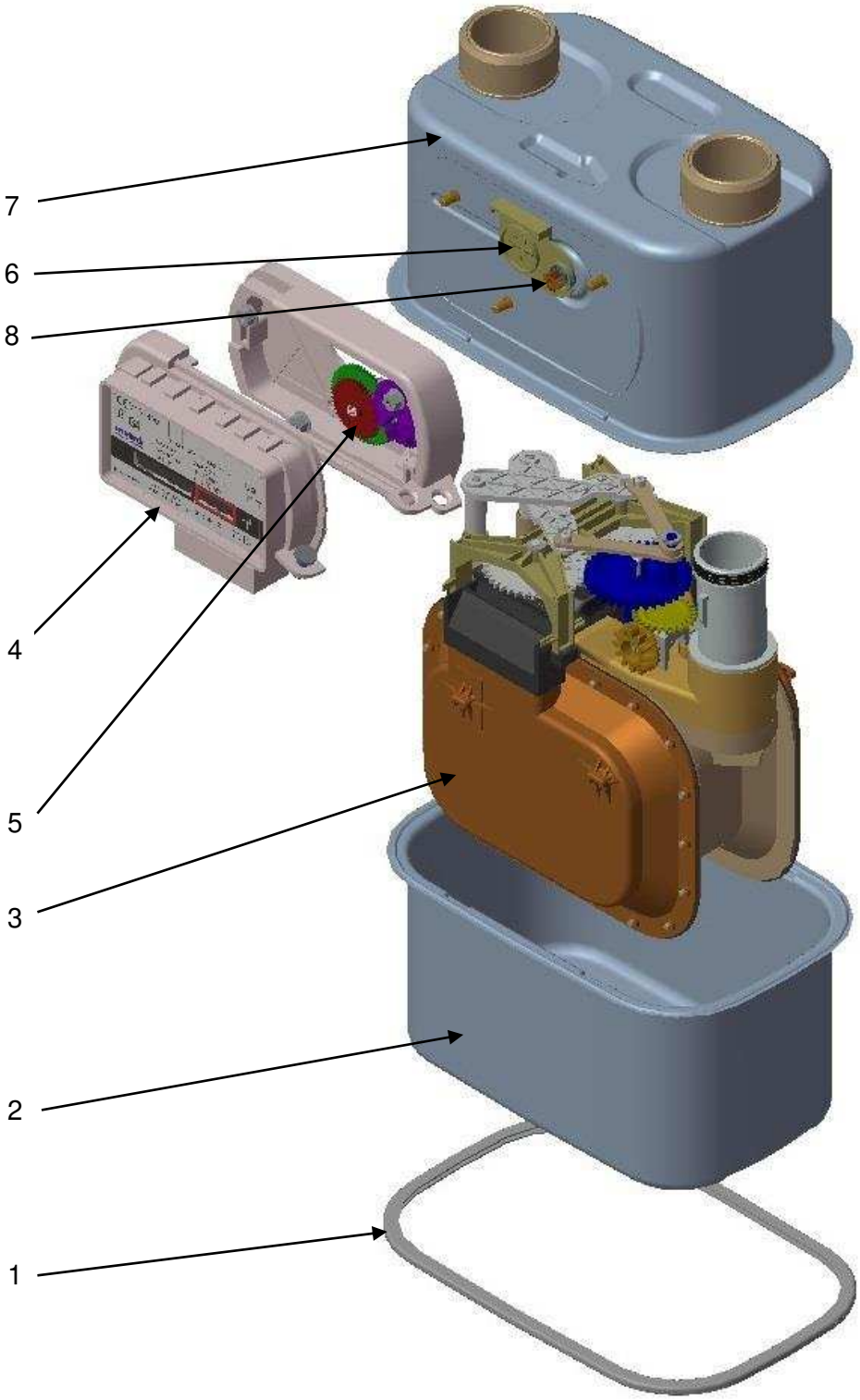
13. Handling with worn-out gas meters

Dispose of the used gas meter in accordance with the applicable local environmental protection regulations. A used meter should be handed over to a licensed recipient of waste. After disassembly, most of the materials from which the product is made can be recycled. Detailed information on the recycling of individual materials from which the gas meter is made can be obtained from the manufacturer.

Dispose of used packaging in accordance with the applicable local environmental protection regulations. The packaging is made of corrugated cardboard and plastic components that can be recycled

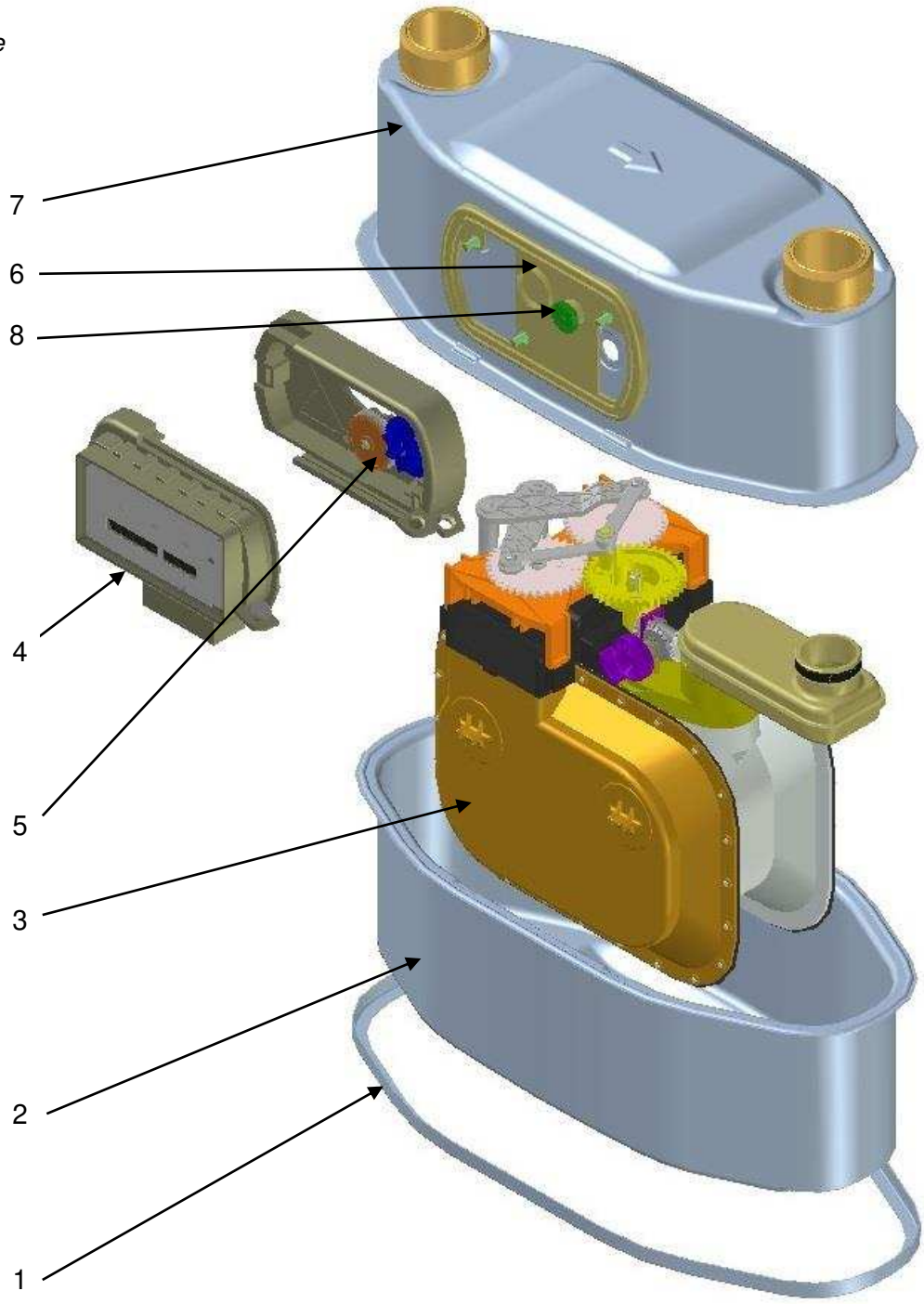
14. Parts of the UG gas meter

1) *Band*
2) *Bottom casing*
3) *Measuring unit*
4) *Index*
5) *Gears*
6) *Sealing insert*
7) *Top casing*
8) *Wheel drive*



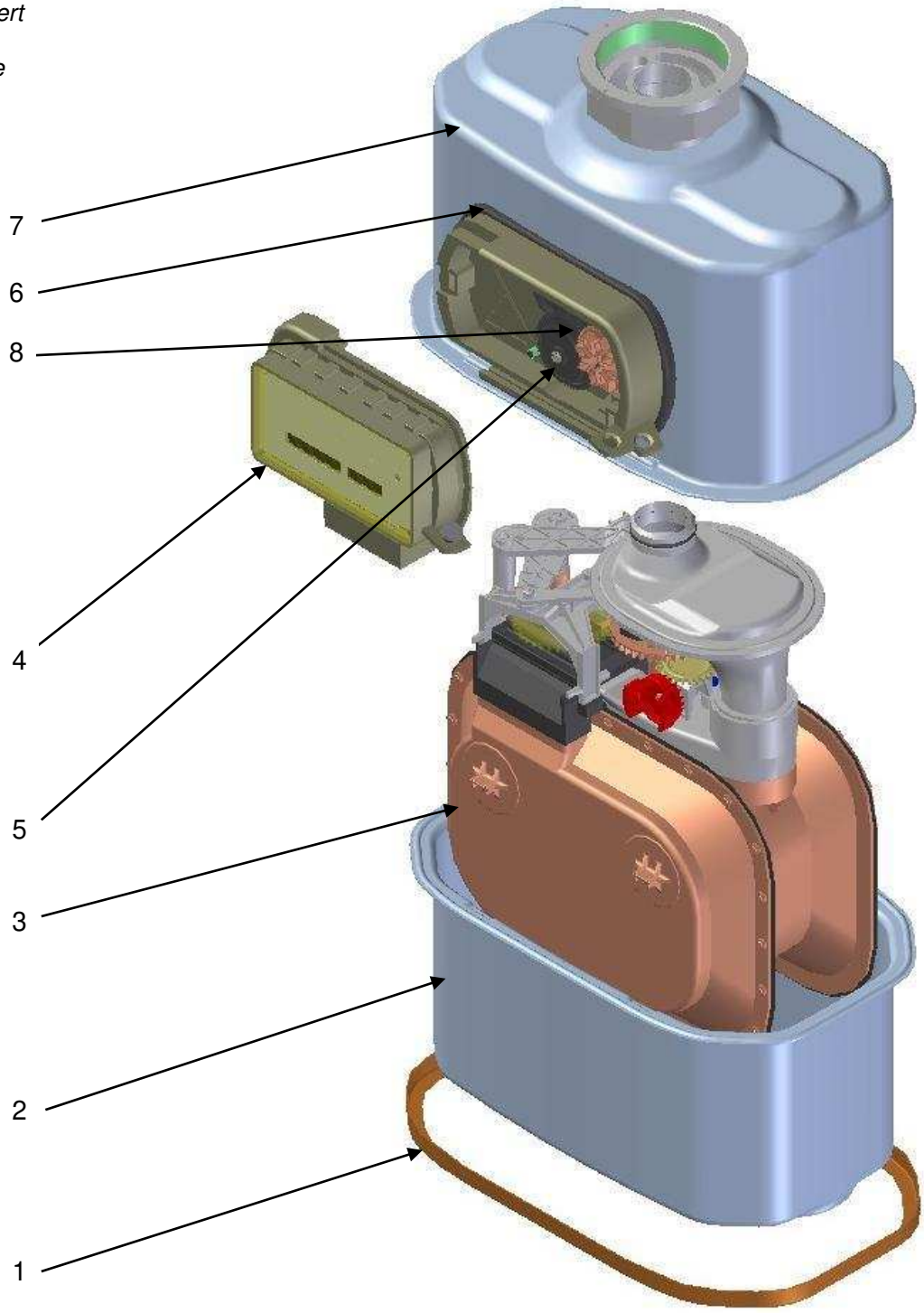
15. Parts of the 2UG gas meter

1) *Band*
2) *Bottom casing*
3) *Measuring unit*
4) *Index*
5) *Gears*
6) *Sealing insert*
7) *Top casing*
8) *Wheel drive*



16. Parts of the UGT gas meter (bimetal)

1) *Band*
2) *Bottom casing*
3) *Measuring unit*
4) *Index*
5) *Gears*
6) *Sealing insert*
7) *Top casing*
8) *Wheel drive*



Apator Metrix S.A.
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83-110 Tczew, Poland
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e-mail metrix@apator.com

www.apator.com

Type evaluation report

Issued by	:	NMi Certin B.V., accredited by the national accreditation body (RvA), based on the ISO/IEC 17020, with identification number I122 and the ISO/IEC 17025, with identification number L029, RvA is signatory member of both the Multi-Lateral Agreement of the European cooperation for Accreditation (EA) and the Mutual Recognition Arrangement of the International Laboratory Accreditation Cooperation (ILAC). The evaluation results are reported under I122. The test results, including interpretations, are reported under L029.
Applicant	:	Apator Metrix S.A. Grunwaldzka 14 83-110 Tczew Poland
Measuring instrument	:	A **diaphragm gas meter** Manufacturer : Apator Metrix S.A. Type : UG T
Test specifications	:	- EN 1359:2017 "Diaphragm gas meters"
Testing period	:	October 2020 up to and including March 2021
Result	:	The meter fulfils the class 1,5 requirements of the EN 1359:2017 for all performed tests, as reported on the following pages. Based on the compliance with the EN 1359:2017 documents NMi presumes conformity with the Measuring Instrument Directive (MID).
Issue date	:	11 March 2021

Performed by:

M.M. Nazim
Approval Expert

Reviewed by:

S. van Reek
Approval Expert

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ilac-MRA
INSPECTION RvA I 122
TESTING RvA L 029

Traceability : The measurements have been executed using standards for which the traceability to (inter)national standards has been demonstrated towards the RvA.

Uncertainty : The reported uncertainty is based on a standard uncertainty multiplied by a coverage factor k=2, which provides a confidence level of approximately 95%.
The total uncertainty of the measurements of the error of indication is:

$Q \geq 400\ dm^3/h$: 0,3%
$Q < 400\ dm^3/h$: 0,6%

Annexes : The complete report consists of the following annexes:

annex 1	:	performed tests
annex 2	:	characteristics of the tested gas meters
annex 3	:	checklist of general requirements
annex 4	:	test data

Remarks : The test data as presented in the annex 4 of this report is performed under RvA accreditation with reference number L029, in which conformity to ISO/IEC 17025 has been demonstrated.
The data as presented in the annexes 1, 2 and 3 is performed under RvA accreditation with reference number I122.

The UG T meter is identical to the previous tested meter. For the tests which are not performed, as indicated in annex 1, a reference can be made to the previous investigations with the UG T meter, as presented in the report numbers NMi-10200983-01, NMi-12200033-01 and NMi-13200414-01 granted by NMi.

Annex 1: Performed tests

In the following tables the performed tests are indicated with the accompanying results, as well as the page number of the appertaining annex where the results are presented.

Clause EN 1359	Performance test	Complies with EN 1359:2017				Details on page of Annex 4
		pass	fail	N/A	not performed	
B.2.1 a)	Errors of indication at reference temperature	X				1
5.2	Pressure absorption				X*	-
5.3	Starting flow rate				X*	-
5.4	Metrological stability				X*	-
5.5	Overload flow rate				X*	-
5.6	Environment and humidity				X*	-
5.7	Influences of other devices				X*	-
5.8	Cyclic volume				X*	-
6.3.3	External leak tightness	X				5
6.3.4	Resistance to internal pressure				X*	-
6.3.5	Meter case sealing				X*	-
6.3.6	Connections				X*	-
6.3.7	Resistance to vibration				X*	-
6.3.8	Resistance to impact				X*	-
6.3.9	Resistance to mishandling				X*	-
6.4	Corrosion tests	X***				-
6.5	Resistance to storage temperature range				X*	-
6.6.1	Pressure measuring point				X*	-
6.6.2	Insulating feet				X*	-
6.6.3	Magnetic drive index				X*	-
6.6.4	Devices to prevent the registration of reverse flow				X*	-
6.6.5	Devices to prevent reverse flow				X*	-
6.6.6	Resistance to high ambient temperature				X*	-
7.1.2	Durability			X**		-
7.1.3	Meter error at declared gas temperature limits			X**		-
7.1.4	Errors of indication subject to declared ambient temperature limits			X**		-
7.2	Index				X*	-
7.3.3	Toluene/iso-octane vapour				X*	-
7.3.4	Water vapour				X*	-
7.3.5	Ageing test				X*	-
8.3.1	Marking, requirements				X*	-
8.3.2	Marking, ultraviolet exposure test				X*	-
8.3.3	Marking, indelibility test				X*	-
8.3.4	Marking, adhesion				X*	-
B.2.1	Errors of indication at declared gas temperature range	X				6
B.2.2	Errors of indication at declared ambient temperature limits	X				11
B.2.3	Error of indication where the gas and ambient temperatures are not equal	X				12
B.2.4	Durability	X				13
C.1	Humidity			X		-
C.2	Wheatering			X		-

Remark: The measurements are performed at a reference temperature of 21±2 °C, unless an other temperature is stated.

*) The UG T meter is identical to the previous tested meter. For the tests which are not performed, as indicated in annex 1, a reference can be made to the previous investigations with the UG T meter, as presented in the report numbers NMi-10200983-01, NMi-12200033-01 and NMi-13200414-01 granted by NMi.

**) The meter is temperature compensated, therefor the tests B2.1 till B2.4 applies.

***) Test performed by a third party.

Annex 2: Characteristics of the tested gas meters

Manufacturer:	Apator Metrix S.A.
Model:	UG T
V [dm^3]:	1,15
p_{max} [bar]:	0,5
Upper ambient temperature [°C]:	55
Lower ambient temperature [°C]:	-25
Base temperature [°C]:	15
t_{sp} [°C]:	22
Connections:	1 1/4"
Version (single / double pipe):	double

Sample number	Model	Serial number	Year of fabrication	Q_{max} [m^3/h]	Q_{min} [m^3/h]	Q_t [m^3/h]
1	20MUGTG4	03110913	2020	6	0,6	0,04
2	20MUGTG4	03110914	2020	6	0,6	0,04
3	20MUGTG4	03110915	2020	6	0,6	0,04
4	20MUGTG4	03110916	2020	6	0,6	0,04
5	20MUGTG4	03110917	2020	6	0,6	0,04
6	20MUGTG4	03110918	2020	6	0,6	0,04
7	20MUGTG4	03110919	2020	6	0,6	0,04
8	20MUGTG4	03110920	2020	6	0,6	0,04
9	20MUGTG4	03110921	2020	6	0,6	0,04
10	20MUGTG4	03110922	2020	6	0,6	0,04
11	20MUGTG4	03110923	2020	6	0,6	0,04
12	20MUGTG4	03110924	2020	6	0,6	0,04

The measurements for the following meters have been theoretically adjusted:
Sample 7 by -0,6%, sample 8 by -1,1%, sample 9 by -1,0%, sample 10 by -0,6% and sample 12 by -1,0%.

Photograph:

Annex 3: Checklist of general requirements

General requirements standard EN 1359:

article	requirement	passed (yes/no)	not applicable
4.1	The flowrange corresponds with the values as stated in table 1.	yes	
4.2	The maximum working pressure is declared and marked on the index.	yes	
4.3	The minimum ambient and gas temperature is -10 °C to +40 °C and the minimum storage temperature is -20 °C to +60 °C.	yes	
4.5	The meter is designed to be installed upright	yes	
6.1	No additional lubricants shall be required during the life of the meter	yes	
	The meter connections shall be fitted with suitable non-sealing plugs or covers to prevent the entry of foreign matter during transit and storage.	yes	
6.2.1	The meter is constructed in such a way that any mechanical interference capable of affecting the measuring accuracy results in permanently visible damage to the meter or the verification or protection marks.	yes	
6.2.2	The meter with electronics is conform the requirements of EN 16314:2013, 4.1.2		n.a.
6.6.8	The additional functionalities are conform the requirements of EN 16314:2013		n.a.
7.2	The electronic index is conform to the requirements of EN 16314:2013, Annex C.		n.a.
	The index has sufficient numerals to ensure that the volume passed during 8000 h at Qmax does not return all of the numerals to their original positions.	yes	
	The numerals shall indicate in cubic meters or decimal multiples or sub-multiples of a cubic metre. The symbol m3 shall be marked on the index plate / display.	yes	
	In cases in which the last numeral indicates in decimal multiples of a cubic metre, the index plate shall be marked with fixed zero's or the indication x10, x100 etc.	yes	
	The minimum height of the numerals shall be 4 mm and the minimum width shall be 2,4 mm.	yes	
	The resolution of the index meets the requirements of table 8.	yes	
	Is the index executed such that testing of the meters can be carried out with sufficient accuracy in a reasonable time.	yes	
	For a mechanical index, a complete revolution of a drum shall, during the last tenth of its travel, I.e. from 9 to 0, cause the advance of the next higher drum by one unit.	yes	
	For an electronic index, the maximum resolution shall be achieved without any special equipment or software. The internal resolution shall be equivalent or more accurate than the increment of the teest element.		n.a.
	It shall be possible to read the index clearly and correctly within an angle of 15° from normal to the window within the ambient temperature range.	yes	
7.3.2	Rubber/elastomeric components with the exception of the diapohragms shall be deemed acceptable if they conform to EN 549 or the requirements of 7.3.1.	yes	

General requirements standard EN 1359 (continued):

article	requirement	passed (yes/no)	not applicable
8.1	The meter is marked with the stated markings. - type approval mark and number - identification mark or name of the manufacturer - serial number of the meter - year of manufacture - maximum and minimum flow rates - maximum working pressure - nominal volume of the cyclic volume - number and date of this standard i.e. EN 1359:2017 - ambient temperature range and gas temperature range - accuracy class - if applcable, base and specified centre temperature - if suitable for high ambient temperature, 'T' - if suitable for open locations, 'H3'	yes	
8.2	Two-pipe meters shall be clearly and permanently marked with the direction of the flow by means of an arrow between the connections.	yes	

Annex 4: Test data

Test: B.2.1a) Errors of indication at reference temperature

The errors of indication of the meters are measured under reference conditions at several flow rates, by performing 6 accuracy curves.

Before performing the accuracy tests the meters have been running in at a flow rate of 6 m³/h and passing a volume of 1 m³.

Results: The tests are performed with air.

Sample no. 1												
Flow rate	Errors [%]						average error	limits	result	maximum difference	limits	result
[m^3/h]	1	2	3	4	5	6	[%]	[%]	+/-	[%]	[%]	+/-
Qmax	-1,59	-1,51	-1,56	-1,59	-1,52	-1,40	-1,5	2	+	0,19	0,6	+
0,7 Qmax	-0,25	-0,24	-0,24	-0,19	-0,23	-0,20	-0,2	2	+	0,06	0,6	+
0,4 Qmax	0,32	0,30	0,30	0,36	0,32	0,30	0,3	2	+	0,07	0,6	+
0,2 Qmax	0,80	0,81	0,79	0,80	0,76	0,75	0,8	2	+	0,06	0,6	+
0,1 Qmax	1,11	1,12	1,12	1,14	1,06	1,05	1,1	2	+	0,09	0,6	+
3 Qmin	0,65	0,79	0,56	0,56	0,74	0,58	0,6	3,5	+			
Qmin	0,82	0,61	0,60	0,64	0,56	0,57	0,6	3,5	+			

Sample no. 2												
Flow rate	Errors [%]						average error	limits	result	maximum difference	limits	result
[m^3/h]	1	2	3	4	5	6	[%]	[%]	+/-	[%]	[%]	+/-
Qmax	-1,54	-1,41	-1,44	-1,49	-1,42	-1,30	-1,4	2	+	0,24	0,6	+
0,7 Qmax	-0,30	-0,23	-0,17	-0,12	-0,15	-0,13	-0,2	2	+	0,18	0,6	+
0,4 Qmax	0,45	0,45	0,41	0,40	0,42	0,36	0,4	2	+	0,09	0,6	+
0,2 Qmax	0,94	0,95	0,90	0,85	0,81	0,77	0,9	2	+	0,18	0,6	+
0,1 Qmax	1,24	1,25	1,20	1,20	1,14	1,07	1,2	2	+	0,18	0,6	+
3 Qmin	0,81	1,05	1,03	0,95	1,17	0,99	1,0	3,5	+			
Qmin	1,05	1,05	1,11	1,23	0,98	0,93	1,1	3,5	+			

Sample no. 3												
Flow rate	Errors [%]						average error	limits	result	maximum difference	limits	result
[m^3/h]	1	2	3	4	5	6	[%]	[%]	+/-	[%]	[%]	+/-
Qmax	-0,98	-0,67	-0,73	-0,74	-0,69	-0,69	-0,7	2	+	0,30	0,6	+
0,7 Qmax	-0,26	-0,21	-0,27	-0,22	-0,14	-0,17	-0,2	2	+	0,13	0,6	+
0,4 Qmax	0,13	0,16	0,17	0,17	0,19	0,17	0,2	2	+	0,05	0,6	+
0,2 Qmax	0,46	0,47	0,50	0,35	0,48	0,46	0,5	2	+	0,14	0,6	+
0,1 Qmax	0,50	0,50	0,58	0,47	0,47	0,44	0,5	2	+	0,15	0,6	+
3 Qmin	0,29	0,25	0,25	0,15	0,09	0,22	0,2	3,5	+			
Qmin	0,56	0,65	0,29	0,19	0,45	0,57	0,4	3,5	+			

When the errors between Qt and Qmax all have the same sign, they shall not exceed 1,3% for class 1,5: yes

Sample no. 4												
Flow rate	Errors [%]						average error	limits	result	maximum difference	limits	result
[m^3/h]	1	2	3	4	5	6	[%]	[%]	+/-	[%]	[%]	+/-
Qmax	-1,05	-0,70	-0,80	-0,77	-0,78	-0,78	-0,8	2	+	0,36	0,6	+
0,7 Qmax	-0,33	-0,29	-0,38	-0,40	-0,22	-0,24	-0,3	2	+	0,18	0,6	+
0,4 Qmax	0,15	0,16	0,14	0,14	0,14	0,12	0,1	2	+	0,04	0,6	+
0,2 Qmax	0,68	0,71	0,69	0,71	0,63	0,67	0,7	2	+	0,07	0,6	+
0,1 Qmax	1,13	1,03	1,10	1,00	1,00	1,05	1,1	2	+	0,13	0,6	+
3 Qmin	0,75	0,69	0,49	0,63	0,48	0,57	0,6	3,5	+			
Qmin	0,61	0,75	0,51	0,49	0,82	0,52	0,6	3,5	+			

Sample no. 5												
Flow rate	Errors [%]						average error	limits	result	maximum difference	limits	result
[m^3/h]	1	2	3	4	5	6	[%]	[%]	+/-	[%]	[%]	+/-
Qmax	-0,65	-0,30	-0,40	-0,38	-0,37	-0,43	-0,4	2	+	0,36	0,6	+
0,7 Qmax	0,01	0,06	0,01	0,05	0,13	0,11	0,1	2	+	0,12	0,6	+
0,4 Qmax	0,02	0,04	0,04	0,06	0,06	0,07	0,0	2	+	0,05	0,6	+
0,2 Qmax	0,75	0,80	0,77	0,78	0,79	0,75	0,8	2	+	0,05	0,6	+
0,1 Qmax	1,04	1,07	1,03	1,05	1,01	0,98	1,0	2	+	0,08	0,6	+
3 Qmin	0,86	0,90	0,83	0,79	0,82	0,80	0,8	3,5	+			
Qmin	0,80	0,79	0,68	0,68	0,64	0,74	0,7	3,5	+			

Sample no. 6												
Flow rate	Errors [%]						average error	limits	result	maximum difference	limits	result
[m^3/h]	1	2	3	4	5	6	[%]	[%]	+/-	[%]	[%]	+/-
Qmax	-0,73	-0,32	-0,40	-0,39	-0,39	-0,49	-0,5	2	+	0,41	0,6	+
0,7 Qmax	-0,06	-0,01	-0,05	-0,01	0,05	0,03	0,0	2	+	0,11	0,6	+
0,4 Qmax	0,44	0,48	0,47	0,48	0,41	0,46	0,5	2	+	0,07	0,6	+
0,2 Qmax	0,89	0,94	0,87	0,89	0,84	0,84	0,9	2	+	0,10	0,6	+
0,1 Qmax	0,83	0,84	0,86	0,88	0,73	0,70	0,8	2	+	0,18	0,6	+
3 Qmin	0,44	0,47	0,44	0,31	0,29	0,38	0,4	3,5	+			
Qmin	0,82	0,58	0,29	0,23	0,44	0,45	0,5	3,5	+			

Sample no. 9												
Flow rate	Errors [%]						average error	limits	result	maximum difference	limits	result
[m^3/h]	1	2	3	4	5	6	[%]	[%]	+/-	[%]	[%]	+/-
Qmax	-0,89	-0,86	-0,78	-0,76	-0,69	-0,75	-0,8	2	+	0,21	0,6	+
0,7 Qmax	-0,18	-0,12	-0,06	-0,06	-0,07	-0,08	-0,1	2	+	0,13	0,6	+
0,4 Qmax	0,49	0,60	0,66	0,65	0,64	0,63	0,6	2	+	0,17	0,6	+
0,2 Qmax	0,93	1,06	1,08	1,11	1,12	1,11	1,1	2	+	0,19	0,6	+
0,1 Qmax	1,17	1,23	1,28	1,30	1,34	1,33	1,3	2	+	0,16	0,6	+
3 Qmin	1,22	1,28	1,31	1,29	1,37	1,45	1,3	3,5	+			
Qmin	0,96	1,05	1,08	0,99	1,21	1,21	1,1	3,5	+			

Sample no. 11												
Flow rate	Errors [%]						average error	limits	result	maximum difference	limits	result
[m^3/h]	1	2	3	4	5	6	[%]	[%]	+/-	[%]	[%]	+/-
Qmax	-1,20	-0,98	-0,85	-0,85	-0,74	-0,71	-0,9	2	+	0,50	0,6	+
0,7 Qmax	-0,44	-0,37	-0,22	-0,21	-0,15	-0,12	-0,3	2	+	0,32	0,6	+
0,4 Qmax	0,50	0,49	0,64	0,55	0,51	0,56	0,5	2	+	0,15	0,6	+
0,2 Qmax	0,88	0,95	1,03	1,16	1,17	1,16	1,1	2	+	0,29	0,6	+
0,1 Qmax	1,01	0,94	1,07	1,20	1,18	1,09	1,1	2	+	0,26	0,6	+
3 Qmin	0,59	0,91	1,23	1,07	1,01	1,25	1,0	3,5	+			
Qmin	0,56	1,12	1,33	0,92	1,39	1,31	1,1	3,5	+			

Sample no. 10												
Flow rate	Errors [%]						average error	limits	result	maximum difference	limits	result
[m^3/h]	1	2	3	4	5	6	[%]	[%]	+/-	[%]	[%]	+/-
Qmax	-0,73	-0,72	-0,63	-0,63	-0,68	-0,69	-0,7	2	+	0,10	0,6	+
0,7 Qmax	-0,14	-0,01	0,07	0,04	0,15	0,09	0,0	2	+	0,28	0,6	+
0,4 Qmax	0,33	0,46	0,47	0,45	0,39	0,39	0,4	2	+	0,14	0,6	+
0,2 Qmax	0,24	0,53	0,53	0,52	0,56	0,56	0,5	2	+	0,32	0,6	+
0,1 Qmax	0,63	0,71	0,79	0,81	0,79	0,82	0,8	2	+	0,19	0,6	+
3 Qmin	0,49	0,34	0,78	0,68	0,47	0,61	0,6	3,5	+			
Qmin	0,36	0,54	0,25	0,26	0,57	0,32	0,4	3,5	+			

Sample no. 7												
Flow rate	Errors [%]						average error	limits	result	maximum difference	limits	result
[m^3/h]	1	2	3	4	5	6	[%]	[%]	+/-	[%]	[%]	+/-
Qmax	-1,25	-1,33	-1,17	-1,17	-1,14	-1,07	-1,2	2	+	0,26	0,6	+
0,7 Qmax	-0,52	-0,41	-0,32	-0,33	-0,28	-0,26	-0,4	2	+	0,27	0,6	+
0,4 Qmax	-0,28	-0,19	-0,15	-0,09	-0,08	-0,07	-0,1	2	+	0,21	0,6	+
0,2 Qmax	0,35	0,43	0,44	0,46	0,47	0,41	0,4	2	+	0,11	0,6	+
0,1 Qmax	0,54	0,65	0,75	0,72	0,71	0,68	0,7	2	+	0,21	0,6	+
3 Qmin	0,68	0,78	0,65	0,99	0,96	0,98	0,8	3,5	+			
Qmin	1,05	0,72	0,90	0,97	0,81	0,96	0,9	3,5	+			

Sample no. 8												
Flow rate	Errors [%]						average error	limits	result	maximum difference	limits	result
[m^3/h]	1	2	3	4	5	6	[%]	[%]	+/-	[%]	[%]	+/-
Qmax	-1,59	-1,41	-1,35	-1,30	-1,27	-1,27	-1,4	2	+	0,32	0,6	+
0,7 Qmax	-0,65	-0,57	-0,55	-0,47	-0,45	-0,41	-0,5	2	+	0,25	0,6	+
0,4 Qmax	0,29	0,35	0,33	0,37	0,39	0,27	0,3	2	+	0,12	0,6	+
0,2 Qmax	0,60	0,62	0,57	0,67	0,73	0,58	0,6	2	+	0,16	0,6	+
0,1 Qmax	0,60	0,63	0,68	0,78	0,81	0,81	0,7	2	+	0,21	0,6	+
3 Qmin	1,14	1,24	1,30	1,37	1,41	1,25	1,3	3,5	+			
Qmin	1,56	1,57	1,48	1,48	1,66	1,50	1,5	3,5	+			

Sample no. 12												
Flow rate [m^3/h]	Errors [%] 1	2	3	4	5	6	average error [%]	limits [%]	result +/-	maximum difference [%]	limits [%]	result +/-
Qmax	-1,44	-1,75	-1,97	-1,64	-1,64	-1,66	-1,7	2	+	0,53	0,6	+
0,7 Qmax	-0,53	-0,90	-0,99	-0,56	-0,63	-0,58	-0,7	2	+	0,46	0,6	+
0,4 Qmax	0,54	0,37	0,50	0,64	0,56	0,57	0,5	2	+	0,27	0,6	+
0,2 Qmax	1,21	1,06	1,09	1,30	1,25	1,24	1,2	2	+	0,24	0,6	+
0,1 Qmax	1,58	1,47	1,40	1,68	1,57	1,50	1,5	2	+	0,27	0,6	+
3 Qmin	1,51	1,58	1,72	1,75	1,74	1,70	1,7	3,5	+			
Qmin	1,58	1,64	1,64	1,61	1,52	1,71	1,6	3,5	+			

Test: 6.3.3 External leak tightness

The meters under test are pressurized with air to the pressures as stated below, at normal ambient temperature. After the meter is being pressurized, and after a short stabilizing period, the gauge pressure in the closed meter has been registered to determine any possible leakage.

The test is performed with sample no. 1.

Applied pressures	-	25	mbar
	-	750	mbar
	-	25	mbar

Results: No leakage is observed.

Test: B.2.1 Errors of indication at declared gas temperature range

The errors of indication of the meters are measured at several different operating temperatures, at different flow rates.

The tests are performed with air.

Results: **Test at reference conditions: 22 °C**

Sample no. 7						
Flow rate [m3/h]	Errors [%] 1	2	3	average error [%]	limits [%]	result +/-
Qmax	-1,33	-1,17	-1,17	-1,22	2	+
0,4 Qmax	-0,19	-0,15	-0,09	-0,14	2	+
0,1 Qmax	0,65	0,75	0,72	0,71	2	+
Qmin	0,72	0,90	0,97	0,86	3,5	+

Sample no. 8						
Flow rate [m3/h]	Errors [%] 1	2	3	average error [%]	limits [%]	result +/-
Qmax	-1,41	-1,35	-1,30	-1,35	2	+
0,4 Qmax	0,35	0,33	0,37	0,35	2	+
0,1 Qmax	0,63	0,68	0,78	0,69	2	+
Qmin	1,57	1,48	1,48	1,51	3,5	+

Sample no. 12						
Flow rate [m3/h]	Errors [%] 1	2	3	average error [%]	limits [%]	result +/-
Qmax	-1,75	-1,97	-1,64	-1,79	2	+
0,4 Qmax	0,37	0,50	0,64	0,51	2	+
0,1 Qmax	1,47	1,40	1,68	1,52	2	+
Qmin	1,64	1,64	1,61	1,63	3,5	+

Results: **Test at minimum gas temperature: -25 °C**

Sample no. 7						
Flow rate [m3/h]	Errors [%] 1	2	3	average error [%]	limits [%]	result +/-
Qmax	2,10	1,61	1,62	1,78	4	+
0,4 Qmax	0,63	0,79	0,65	0,69	4	+
0,1 Qmax	0,62	-0,01	0,31	0,31	4	+
Qmin	-2,64	-2,76	-2,73	-2,71	5,5	+

Sample no. 8						
Flow rate [m3/h]	Errors [%] 1	2	3	average error [%]	limits [%]	result +/-
Qmax	-0,45	-1,19	-1,59	-1,08	4	+
0,4 Qmax	-0,33	-0,37	-0,23	-0,31	4	+
0,1 Qmax	-0,93	-0,90	-0,84	-0,89	4	+
Qmin	-3,38	-3,53	-3,63	-3,51	5,5	+

Sample no. 12						
Flow rate [m3/h]	Errors [%] 1	2	3	average error [%]	limits [%]	result +/-
Qmax	0,81	0,77	0,73	0,77	4	+
0,4 Qmax	0,48	0,78	-0,83	0,14	4	+
0,1 Qmax	1,59	1,62	0,41	1,21	4	+
Qmin	-1,15	-2,26	-1,56	-1,66	5,5	+

Results: **Test at maximum gas temperature: 40 °C**

Sample no. 7						
Flow rate [m3/h]	Errors [%] 1	2	3	average error [%]	limits [%]	result +/-
Qmax	0,98	0,75	0,84	0,86	2,5	+
0,4 Qmax	1,52	1,44	1,41	1,45	2,5	+
0,1 Qmax	2,18	2,04	2,02	2,08	2,5	+
Qmin	2,57	2,19	2,00	2,25	4	+

Sample no. 8						
Flow rate [m3/h]	Errors [%] 1	2	3	average error [%]	limits [%]	result +/-
Qmax	0,24	0,20	0,14	0,20	2,5	+
0,4 Qmax	1,04	0,96	0,96	0,98	2,5	+
0,1 Qmax	1,67	1,59	1,48	1,58	2,5	+
Qmin	1,60	1,46	1,12	1,39	4	+

Sample no. 12						
Flow rate [m3/h]	Errors [%] 1	2	3	average error [%]	limits [%]	result +/-
Qmax	0,07	-0,14	-0,08	-0,05	2,5	+
0,4 Qmax	0,93	0,93	0,86	0,91	2,5	+
0,1 Qmax	1,45	1,33	1,21	1,33	2,5	+
Qmin	1,56	1,48	1,38	1,47	4	+

Results: **Test at reference conditions: 22 °C**

Sample no. 7						
Flow rate [m3/h]	Errors [%] 1	2	3	average error [%]	limits [%]	result +/-
Qmax	-1,32	-1,26	-1,25	-1,28	2	+
0,4 Qmax	-0,16	-0,11	-0,09	-0,12	2	+
0,1 Qmax	0,43	0,45	0,46	0,45	2	+
Qmin	0,25	0,45	0,30	0,33	3,5	+

Sample no. 8						
Flow rate [m3/h]	Errors [%] 1	2	3	average error [%]	limits [%]	result +/-
Qmax	-1,64	-1,65	-1,63	-1,64	2	+
0,4 Qmax	0,21	0,22	0,23	0,22	2	+
0,1 Qmax	0,54	0,57	0,56	0,56	2	+
Qmin	1,07	1,03	0,92	1,01	3,5	+

Sample no. 12						
Flow rate [m3/h]	Errors [%] 1	2	3	average error [%]	limits [%]	result +/-
Qmax	-1,72	-1,73	-1,72	-1,72	2	+
0,4 Qmax	0,56	0,66	0,64	0,62	2	+
0,1 Qmax	1,32	1,40	1,39	1,37	2	+
Qmin	1,48	1,52	1,53	1,51	3,5	+

Results: **Overview**

Sample no. 7					
Flow rate [m3/h]	Average errors [%]				result + / -
	22 °C	-25 °C	40 °C	22 °C	
Qmax	-1,22	1,78	0,86	-1,28	+
0,4 Qmax	-0,14	0,69	1,45	-0,12	+
0,1 Qmax	0,71	0,31	2,08	0,45	+
Qmin	0,86	-2,71	2,25	0,33	+

Sample no. 8					
Flow rate [m3/h]	Average errors [%]				result + / -
	22 °C	-25 °C	40 °C	22 °C	
Qmax	-1,35	-1,08	0,20	-1,64	+
0,4 Qmax	0,35	-0,31	0,98	0,22	+
0,1 Qmax	0,69	-0,89	1,58	0,56	+
Qmin	1,51	-3,51	1,39	1,01	+

Sample no. 12					
Flow rate [m3/h]	Average errors [%]				result + / -
	22 °C	-25 °C	40 °C	22 °C	
Qmax	-1,79	0,77	-0,05	-1,72	+
0,4 Qmax	0,51	0,14	0,91	0,62	+
0,1 Qmax	1,52	1,21	1,33	1,37	+
Qmin	1,63	-1,66	1,47	1,51	+

Test: B.2.2 Errors of indication at declared ambient temperature limits

The meter is exposed to the maximum and minimum ambient temperatures while running at Q_{max}. Before and after that the accuracy of the meter is examined.

Results: Before applying the exposure to the ambient temperatures range:

Sample no. 10						
Flow rate [m3/h]	Errors [%] 1	2	3	average error [%]	limits [%]	result +/-
Qmax	-1,55	-1,56	-1,57	-1,56	2	+
0,4 Qmax	0,10	0,07	-0,05	0,04	2	+
0,1 Qmax	-0,32	-0,10	-0,22	-0,21	2	+
Qmin	0,49	0,07	-0,20	0,12	3,5	+

After applying the exposure to the ambient temperatures range:

Sample no. 10						
Flow rate [m3/h]	Errors [%] 1	2	3	average error [%]	limits [%]	result +/-
Qmax	-1,11	-1,10	-1,02	-1,08	4	+
0,4 Qmax	-0,08	0,10	0,22	0,08	4	+
0,1 Qmax	0,55	0,59	0,71	0,62	4	+
Qmin	-0,19	-0,25	-0,32	-0,25	7	+

Test: B.2.3 Error of indication where the gas and ambient temperatures are not equal

The errors of indication of the meter is measured using air with a temperature of t_m + 20 °C while the meter body is at t_m.

$t_{ambient:}$ 21 °C
$t_{gas:}$ 41 °C

Results:

Sample no. 9			
Flow rate [m3/h]	measured errors [%]	limits	result
Qmax	-0,79	2,5	+
0,4 Qmax	0,37	2,5	+
0,1 Qmax	-0,40	2,5	+

$t_{ambient:}$ 21 °C
$t_{gas:}$ 1 °C

Sample no. 9			
Flow rate [m3/h]	measured errors [%]	limits	result
Qmax	-0,11	2,5	+
0,4 Qmax	0,21	2,5	+
0,1 Qmax	0,69	2,5	+

Test: B.2.4 Durability

The meters are exposed to a durability test under the conditons as stated below.
Before and after the durability test the error of indicaton is measured with air. Beside that the meters are also investigated after 25.000, 150.000 and 300.000 cycles.

Test medium : air
Duration : 450.000 cycles

Sample number	initial [m^3]	meter reading [m^3] after:			
		25k	150k	300k	450k
7	42	522	2823	5136	7603
8	43	533	2830	5186	7562
12	41	523	2857	5216	7497

Results: General results:

Sample no. 7							
Flow rate [m^3/h]	Mean error before durability test at 22 °C [%]	at -25 °C [%]	at 40 °C [%]	Mean error after durability test at 22 °C [%]	at -25 °C [%]	at 40 °C [%]	Result +/-
Qmax	-1,2	1,9	0,9	-1,7	0,3	0,6	+
0,7 Qmax	-0,3			-1,2			+
0,4 Qmax	-0,1	0,7	1,5	-0,7	-0,3	1,1	+
0,2 Qmax	0,5			-0,2			+
0,1 Qmax	0,7	0,3	2,1	0,0	0,0	1,8	+
3 Qmin	0,9			-0,2			+
Qmin	0,9	-2,7	2,4	-0,5	-2,9	1,5	+

Sample no. 8							
Flow rate [m^3/h]	Mean error before durability test at 22 °C [%]	at -25 °C [%]	at 40 °C [%]	Mean error after durability test at 22 °C [%]	at -25 °C [%]	at 40 °C [%]	Result +/-
Qmax	-1,3	-0,8	0,2	-2,0	0,0	-0,1	+
0,7 Qmax	-0,4			-1,2			+
0,4 Qmax	0,3	-0,4	1,0	-0,5	-0,9	0,8	+
0,2 Qmax	0,7			-0,2			+
0,1 Qmax	0,8	-0,9	1,6	0,3	-1,5	1,0	+
3 Qmin	1,3			0,4			+
Qmin	1,5	-3,5	1,5	0,2	-4,1	0,7	+

Sample no. 12							
Flow rate [m^3/h]	Mean error before durability test at 22 °C [%]	at -25 °C [%]	at 40 °C [%]	Mean error after durability test at 22 °C [%]	at -25 °C [%]	at 40 °C [%]	Result +/-
Qmax	-1,6	0,8	0,0	-1,2	5,2	0,0	+
0,7 Qmax	-0,6			-0,6			+
0,4 Qmax	0,6	0,6	0,9	0,5	3,6	1,3	+
0,2 Qmax	1,3			1,1			+
0,1 Qmax	1,6	1,6	1,4	1,3	3,5	1,8	+
3 Qmin	1,7			1,4			+
Qmin	1,6	-1,7	1,5	1,2	2,1	1,3	+

Results: Detailed results

Sample no. 7												
Temperature	Flow rate	Mean error before	Mean error after 25k	150k	300k	450k	Limit	Result	Shift	Limit	Result
[°C]	[m^3/h]	[%]	[%]	[%]	[%]	[%]	[%]	[+/-]	[%]	[%]	[+/-]
22 °C	Qmax	-1,2	-0,8	-1,2	-1,0	-1,7	4	+	0,5	2	+
	0,7 Qmax	-0,3	-0,1	-0,9	-0,6	-1,2	4	+	0,9	2	+
	0,4 Qmax	-0,1	-0,1	-0,5	-0,6	-0,7	4	+	0,6	2	+
	0,2 Qmax	0,5	0,4	0,1	-0,1	-0,2	4	+	0,6	2	+
	0,1 Qmax	0,7	0,6	0,3	-0,1	0,0	4	+	0,8	2	+
	3 Qmin	0,9	-	0,3	-0,3	-0,2	7	+			
	Qmin	0,9	0,5	0,3	-0,6	-0,5	7	+			
-25 °C	Qmax	1,9	2,5	2,4	2,6	0,3	8	+			
	0,4 Qmax	0,7	0,9	2,0	0,8	-0,3	8	+			
	0,1 Qmax	0,3	1,0	0,8	0,2	0,0	8	+			
	Qmin	-2,7	-1,8	-2,8	-3,2	-2,9	11	+			
40 °C	Qmax	0,9	1,3	0,9	1,1	0,6	5	+			
	0,4 Qmax	1,5	1,7	1,2	1,3	1,1	5	+			
	0,1 Qmax	2,1	2,3	1,9	1,8	1,8	5	+			
	Qmin	2,4	2,5	2,1	1,5	1,5	8	+			

Sample no. 8												
Temperature	Flow rate	Mean error before	Mean error after 25k	150k	300k	450k	Limit	Result	Shift	Limit	Result
[°C]	[m^3/h]	[%]	[%]	[%]	[%]	[%]	[%]	[+/-]	[%]	[%]	[+/-]
22 °C	Qmax	-1,3	-0,7	-1,3	-1,5	-2,0	4	+	0,7	2	+
	0,7 Qmax	-0,4	-0,2	-0,8	-1,0	-1,2	4	+	0,7	2	+
	0,4 Qmax	0,3	0,4	-0,1	-0,3	-0,5	4	+	0,8	2	+
	0,2 Qmax	0,7	0,6	0,2	0,1	-0,2	4	+	0,9	2	+
	0,1 Qmax	0,8	0,7	0,5	0,2	0,3	4	+	0,6	2	+
	3 Qmin	1,3	-	0,7	0,7	0,4	7	+			
	Qmin	1,5	1,1	1,0	0,6	0,2	7	+			
-25 °C	Qmax	-0,8	1,6	0,9	1,2	0,0	8	+			
	0,4 Qmax	-0,4	-0,1	-0,3	-0,3	-0,9	8	+			
	0,1 Qmax	-0,9	-1,0	-0,4	-1,0	-1,5	8	+			
	Qmin	-3,5	-3,1	-3,5	-4,1	-4,1	11	+			
40 °C	Qmax	0,2	1,2	0,7	0,6	-0,1	5	+			
	0,4 Qmax	1,0	1,8	1,4	1,1	0,8	5	+			
	0,1 Qmax	1,6	2,2	1,5	1,4	1,0	5	+			
	Qmin	1,5	2,0	1,5	1,3	0,7	8	+			

Sample no. 12											
Temperature	Flow rate	Mean error before	Mean error after 25k	150k	300k	450k	Limit	Result	Shift	Limit	Result
[°C]	[m³/h]	[%]	[%]	[%]	[%]	[%]	[%]	[+/-]	[%]	[%]	[+/-]
22 °C	Qmax	-1,6	-1,3	-1,2	-1,3	-1,2	4	+	0,5	2	+
	0,7 Qmax	-0,6	-0,3	0,2	0,0	-0,6	4	+	0,8	2	+
	0,4 Qmax	0,6	0,6	0,8	0,7	0,5	4	+	0,2	2	+
	0,2 Qmax	1,3	1,1	1,1	1,1	1,1	4	+	0,2	2	+
	0,1 Qmax	1,6	1,3	1,4	1,1	1,3	4	+	0,5	2	+
	3 Qmin	1,7	-	1,6	1,4	1,4	7	+			
	Qmin	1,6	1,5	1,7	1,1	1,2	7	+			
-25 °C	Qmax	0,8	3,1	5,2	5,4	5,2	8	+			
	0,4 Qmax	0,6	2,2	4,1	3,9	3,6	8	+			
	0,1 Qmax	1,6	2,9	3,9	3,5	3,5	8	+			
	Qmin	-1,7	-1,6	2,9	-3,2	2,1	11	+			
40 °C	Qmax	0,0	0,7	0,3	0,5	0,0	5	+			
	0,4 Qmax	0,9	1,8	1,6	1,6	1,3	5	+			
	0,1 Qmax	1,4	2,2	2,0	1,9	1,8	5	+			
	Qmin	1,5	2,2	1,7	1,6	1,3	8	+			

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