	Technical Specification for Verification and Inspection of Diaphragm Gas Meters	S/N	CNMV 31
		Rev.	5

1. This Technical Specification is developed pursuant to the stipulations in Paragraph 2 of Articles 14 and Paragraph 2 of Articles 16 in the Weights and Measures Act.

2. The date of promulgation, document number, date of enforcement and content of amendment are listed as follows:

Rev.	Date of Promulgation	Document No. (Ching-Piao-Szu-Tsu)	Date of Enforcement	Content of Amendment
1	Jun. 2, .2003	No. 09240005160	Jul. 1, 2003	
2	May 1, 2006	No. 09540001570	Jul. 1, 2007	Revised according to related OIML requirements.
3	Nov. 18, 2010	No. 09940005810	Jan. 1, 2011	1. When implements re-verification against meters that passed initial verification prior to subject to type approval, meters shall be sampled and tested for their errors at flow rate point 3 $Q_{min.}$ as required against meters that has been subject to type approval. 2. For the verified flow rate between 0.1 Q_{max} and Q_{max} and when the symbols "±" are the same, the stipulations regarding the errors are revised.
4	Sep. 2, 2014	No. 10340007390	Sep. 2, 2014	1. For gas meters with Q_{max} more than 16 m^3/h that are not subject to type approval, the test for errors at flow rate 3 Q_{min} is no longer conducted. 2. For gas meters with Q_{max} equal to or less than 16 m^3/h that passed initial verification before the implement of type approval, the test for errors at flow rate 3 Q_{min} is maintained. For gas meters with Q_{max} more than 16 m^3/h, the test for errors at flow rate 3 Q_{min} is no longer conducted with reference to those procedures for gas meters that are not subject to type approval.
5	○.○, 2017	No. ○○○	July 1,2018	1. For effective management, year of manufacture and history of repair are added as mandatory marking items. 2. To regulate the external airtight test in accordance with the claimed maximum working pressure of gas meters, the leakage rate of external airtight and the submitted documents required for verification are revised. 3. For effective use of verification resources, the determination of pass or fail for errors at flow rate 3 Q_{min} is revised.

				4. In consideration of the material of seal may change with the progress of technology and the requirement of environmental protection, the material of seal is widened and no longer limited to lead.

3. This specification is formulated with reference to the following international specifications and National Standards of the Republic of China (CNS)：

OIML R6	General provisions for gas volume meters	（1989（E））
OIML R31	Diaphragm gas meters	（1995（E））
CNS 14741	Microcomputer diaphragm gas meters for natural gas	（2003（(E)）
OIML R137-1&2	Gas meters	（2012（E））

Date of Promulgation	Bureau of Standards, Metrology and	Date of Enforcement
○.○, 2017	Inspection, Ministry of Economic Affairs	July 1, 2018

1. Scope: This technical specifications applies to diaphragm gas meters (hereinafter referred to as "gas meters") subject to verification and inspection, that are the gas volume meters in which the gas flow is measured by means of measuring chambers with deformable thin walls, including the gas meters with a built-in temperature conversion device.

2. Definition

2.1 Flow rate (Q)

- Quotient of the actual quantity of gas passing through the gas meter and the time taken for this quantity to pass through the gas meter.

2.2 Maximum flow rate (Q_{max})

- Highest flow rate at which a gas meter is required to operate within the limits of its maximum permissible error.

2.3 Minimum flow rate (Q_{min})

- Lowest flow rate at which a gas meter is required to operate within the limits of its maximum permissible error.

2.4 Flow rate range

- The range of the flow rate of gas that is limited by the maximum flow rate Q_{max} and the minimum flow rate Q_{min}.

2.5 Maximum permissible error

- The extreme value of the error that is permitted by the legal requirements.

2.6 Maximum working pressure (P_{max})

- Maximum internal pressure that a gas meter can withstand, within the limits of its maximum permissible error, without deterioration of its metrological performance.

2.7 Minimum working pressure (P_{min})

- Minimum internal pressure that a gas meter can withstand, within the limits of its maximum permissible error, without deterioration of its metrological performance.

2.8 Working pressure range (P_m)

- The range that is between the maximum working pressure and the minimum working pressure.

2.9 Working temperature range (t_m)

- The temperature range that is allowed when a gas meter works within the maximum permissible error.

2.10 Pressure loss

- The pressure difference between the inlet and the outlet of a gas meter when gas is flowing.

2.11 Value of a given air volume quantity

- The specified air volume that has been passing through the gas meter under test to ensure correct error of the meter.

2.12 Cyclic volume of a gas volume meter

- The volume of gas corresponding to the working cycle of the gas volume meter, i.e. to all the movements of the moving components which, except for the indicating device and the intermediate transmissions, resume for the first time the position they occupied at the beginning of the cycle.

2.13 Built-in temperature conversion device

- A device which converts the volume measured at the metering conditions to the volume at base conditions.

2.14 Pressure absorption

- The difference between the pressures at the inlet and outlet of the gas volume meter while the gas is flowing. Using air under ambient pressure and ambient temperature as the medium, the average pressure loss in one measurement cycle at flow rate Q_{max} is taken as the total pressure absorption.

3. Constitution

3.1 Gas meterS shall be clearly marked with the following items on easy scrutiny spot:

(1) Model and serial number.

(2) Name of measured gas.

(3) Flow rate range: mark the maximum flow rate and the minimum flow rate as Table 1, in cubic meters per hour (m^3/h).

(4) The nominal diameter (inside diameter of inlet and outlet, in mm)

(5) Cyclic volume: V = …m^3 (or dm^3).

(6) Directions of gas inlet and outlet.

(7) Manufacturer's name or trademark.

(8) Working pressure range: P_m =... - ... kPa (or Pa).

(9) Maximum permissible pressure difference between inlet and outlet: ΔP_{max}=...kPa (or Pa).

(10) Working temperature range: t_m= … - … ℃

(11) Type approval number.

(12) Year of manufacture.

(13) History of repair: including manufacturer's trademark and year of repair.

(14) For a gas meter with a built-in temperature conversion device, the base temperature and the range of convertible temperature shall be marked.

For meters applied for re-verification, the aforementioned Items 8 to 14 do not apply to meters not subject to type approval or meters which passed initial verification prior to type approval has come into force.

For meters applied for re-verification, the aforementioned Item 12 regarding the marking for year of manufacture does not apply to meters which pass initial verification before June 30, 2018.

3.2 The indicating device of a gas meter must be provided with scale marks which stand out in contrast to the scale (i.e. the silver lines).

3.3 The upper limit of the maximum flow rate and the corresponding minimum flow rate for a gas meter are given in Table 1.

Table 1

Q_{max} m^3/h	Upper limit of Q_{min} m^3/h
1	0.016
1.6	0.016
2.5	0.016
4	0.025
6	0.040
10	0.060
16	0.100
25	0.160
40	0.250
65	0.400
100	0.650
160	1.000
250	1.600
400	2.500
650	4.000
1000	6.500

4. Verification, inspection and maximum permissible errors

4.1 The traceability of verification and inspection equipments is required.

4.2 Prior to verification or inspection, gas meters shall be placed at least 12 hours in the place in which the verification is implemented.

4.3 External airtight test of gas meters

4.3.1 For gas maters with maximum working pressure not greater than 10 kPa: block the outlet of gas meters; conduct the test with air pressure of 10 kPa, and hold for 3 minutes; the leakage rate shall be less than 67 Pa / min.

4.3.2 For gas maters with maximum working pressure greater than 10 kPa: block the outlet of gas meters; conduct the test with maximum working pressure, and hold for 3 minutes; the leakage rate shall be less than 2%.

4.3.3 When applying for verification to the dedicated weights and measures authority or conducting self-verification, the applicants or the measuring instrument enterprises entitled to conduct self-verification shall submit or prepare quality report/certificate, complied with the requirements of Section 4.3.1 or 4.3.2 and issued by testing labs accredited by accreditation bodies of ILAC MRA, original manufacturers of said gas meters or enterprises holding business license of measuring instrument repairer, and relevant supporting documents in accordance with the quantity of gas meters to be tested. If necessary, the dedicated weights and measures authority should check the external airtight of these gas meters.

4.4 Pressure absorption test

The total pressure absorption of gas meters, averaged over a measuring cycle, with a flow with ambient condition, at flow rate as Q_{max}, shall not exceed the values given in Table 2.

Table 2

Maximum Flow rate m^3/h	Maximum permissible average value for total pressure absorption (including safety detection control unit) Verification Pa	Maximum permissible average value for total pressure absorption (including safety detection control unit) Inspection Pa
1 to 10 (inclusive)	200 (242)	220 (242)
16 to 65 (inclusive)	300 (330)	330 (363)
100 to 1000 (inclusive)	400 (440)	440 (484)

4.5 When implementing error test of gas meters for verification and inspection, the procedure shall be conducted at specified flow rates and minimum volumes for verification and inspection listed in Table 3. The difference between the real flow rate and the flow rate listed in Table 3 shall not be greater than 5%.

For gas meters subject to type approval, the error test shall be conducted at flow rate Q_{max} and 0.2 Q_{max} one by one. Besides, 5% of the gas meters applied for verification shall be sampled and tested for error at flow rate 3 Q_{min}. If the number of meters applied for verification is less than 100, it is counted as 100. In case any of the samples failed the test, the original samples should be re-tested. If any of them failed the test again, the whole batch of gas meters applied for verification shall be rejected.

For gas meters with Q_{max} greater than 16 m^3/h that are not subject to type approval, all meters shall be verified one by one for error test at flow rates Q_{max} and 0.2 Q_{max}.

For gas meters with Q_{max} not greater than 16 m^3/h that passed initial verification before the implement of type approval, all meters shall be conducted error test one by one at flow rate Q_{max} and 0.2 Q_{max} when apply for re-verification. Besides, 5% of the gas meters applied for verification shall be sampled and tested for error at flow rate 3 Q_{min}. If the number of meters applied for verification is less than 100, it is counted as 100. In case any of the samples failed the test, the original samples could be re-tested. If any of them failed the test again, the whole batch of gas meters applied for verification shall be rejected. For gas meters with Q_{max} greater than 16 m^3/h that passed initial verification before the implement of type approval, all meters shall be conducted error test one by one at flow rate Q_{max} and 0.2 Q_{max} when apply for re-verification.

Table 3

Maximum Flowrate (m^3/h)	Verification and inspection flowrate m^3/h			Minimum volume for verification and inspection dm^3		
	Q_{max}	0.2 Q_{max}	3 Q_{min}	Q_{max}	0.2 Q_{max}	3 Q_{min}
1	1	0.20	0.048	50	20	10
1.6	1.6	0.32	0.048	50	20	10
2.5	2.5	0.50	0.048	50	30	10
4	4	0.80	0.075	70	50	20
6	6	1.20	0.120	120	70	30
10	10	2.00	0.180	200	100	50
16	16	3.20	0.30	500	300	100

25	25	5.00	0.48	800	400	200
40	40	8.00	0.75	1200	600	300
65	65	13.00	1.20	2000	1000	500
100	100	20.00	1.95	4000	2000	1000
160	160	32.00	.300	8000	4000	2000
250	250	50.00	4.80	12000	6000	3000
400	400	80.00	7.50	20000	10000	5000
650	650	130.00	12.0	32000	16000	8000
1000	1000	200.00	19.5	60000	30000	15000

4.6 The error of gas meter shall be expressed by percentage; i.e., the ratio of the deviation between the indicated value of air volume flowing through the gas meter and the standard value from the standard meter divided by the standard value from the standard meter. If the gas meter does not equip a temperature conversion device, the reference conditions of the standard value of standard meters shall be the absolute pressure at the inlet and the temperature at outlet of the gas meter. If the gas meter equips a temperature conversion device, the reference conditions of the standard value for a standard meter shall be the absolute pressure at inlet and basic temperature of the gas meter.

$$\text{Error (\%)} = \frac{(\text{Indicated value} - \text{standard value})}{(\text{standard value})} \text{X}\,100\,(\%)$$

(1) When a wet gas meter is used as calibrator, the standard value V_s is defined as follows.

$(V_s) = V_{WG} \times CF(Q) \times C_T \times C_P$

V_{WG}：Volume of wet gas meter

CF(Q)：Correction function of instrument error of the wet gas meter

C_T：Temperature correction quantity between calibrator and gas meter

C_p：Pressure correction quantity between calibrator and gas meter

(2) When sonic nozzle is used as calibrator, the standard value V_s is defined as follows.

$$(V_s) = \frac{C_d \times A^* \times C^* \times P_0 \times t}{\sqrt{\overline{R}T_o/M} \times \rho(T_m, P_m)}$$

C_d：Discharge coefficient of sonic nozzle

A^*：Cross-section area at throat

C^*：Critical flow function of sonic nozzle

P_0：Stagnation pressure at the upstream of sonic nozzle

T_0：Stagnation temperature at the upstream of sonic nozzle

t： Collection time for verification

$\overline{R}$ ：Universal gas constant

M：Molecular mass of air

$\rho(T_m, P_m)$：Air density under T_m and P_m, in which T_m and P_m respectively stand for the temperature and pressure of the meter under testy

4.7 Maximum permissible errors for verification and inspection of gas meters

With the air under room temperature and normal pressure as the medium, the maximum permissible errors for verification and inspection shall conform to the stipulations given in Table 4. On verification of a meter the absolute value of each meter error shall not exceed 1 % at flow rates between 0.1 Q_{max} and Q_{max} where these errors are all of the same sign.

Table 4

Flow rate (m^3/h)	Maximum permissible errors	
	Verification	Inspection
$Q_{min} \leqq Q < 0.1\ Q_{max}$	±3%	-6%,+3%
$0.1Q_{max} \leqq Q \leqq Q_{max}$	±1.5%	±3%

4.8 The period of validity of verification is 10 years, from the day of a verification compliance mark affixed to the gas meter to the first day of the following month of the next 10 years.

5. Verification compliance marks

5.1 The verification compliance mark shall be attached with metal wire and seal at the opening of the shell on the body of a gas meter. The duration of validity of verification shall also mark at easy scrutiny spot on the front of the meter.