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موضوع: استاندارد کنتورهای گاز نوع دیافراگمی

با سلام و احترام

به استناد مصوبه کارگروه سامانه اندازه گیری هوشمند گاز و همچنین مصوبه مورخ ۲۷/۰۹/۹۶ شورای استاندارد در خصوص موضوع فوق الذکر مقرر گردید:

- ۱- آخرین نسخه استاندارد IGS-M-IN-101(4) مبنای عملکرد قرار گیرد.
- ۲- ارائه ی نتایج آزمون های نوعی (type test) طبق استاندارد فوق الذکر، برای کنتورهای G6 و G10 از تاریخ ۹۷/۰۷/۰۱ و برای کنتورهای با ظرفیت (G Rate) بالاتر از ابتدای سال ۹۸ الزامی خواهد بود.

با احترام

سعید پاک سرشت

مدیر پژوهش و فناوری



شرکت ملی گاز ایران

مدیریت پژوهش و فناوری

امور تدوین استانداردها

IGS

مشخصات فنی خرید

کنتورهای گاز نوع دیافراگمی

Gas Meters Diaphragm Type



تاریخ: ۱۳۹۴/۱۱/۲۶
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مدیر محترم پژوهش و فناوری

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رئیس محترم امور فناوری اطلاعات و ارتباطات

باسلام،

به استحضار می‌رساند در جلسه ۱۶۶۹ مورخ ۱۳۹۴/۱۱/۱۸ هیأت مدیره، نامه شماره گ/دب/۰ ۱۶۱۳۹۴/۱۰/۹ مورخ ۹۴/۱۱/۷ مدیر پژوهش و فناوری درمورد تصویب نهایی استاندارد تحت عناوین " مشخصات فنی کنتورهای گاز نوع دیافراگمی " به شماره استاندارد IGS-M-IN-101(4) و دستورالعمل بازرسی کنتورهای گاز نوع دیافراگمی به شماره استاندارد IGS-I-IN-101(0) مطرح و مورد تصویب قرار گرفت .
این مصوبه در حکم مصوبه مجمع عمومی شرکت‌های تابعه محسوب و برای کلیه شرکت‌های تابعه لازم الاجرا می‌باشد و ابلاغ مصوبه شماره گ/دب/۰ ۳۵۳ - ۱۷۵۶۷ مورخ ۹۴/۱۰/۱۴ کان لم یکن می‌گردد .

ناصر آنگون

دبیر هیأت مدیره

رونوشت: مدیر عامل محترم شرکت ملی گاز ایران و تائب رئیس هیأت مدیره

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Table of contents

<u>Title</u>	<u>Pages</u>
1. Scope	2
2. Normative References.....	2
3. Definitions.....	2
4. Requirements.....	4
5. Inspection and Test.....	12
6. Painting.....	35
7. Marking.....	36
8. Documentation.....	36
9. Packing and Packaging.....	37
10. Guarantee.....	37
11. Data sheet.....	38

1. Scope

This specification covers the minimum requirements for design, material, fabrication, painting, marking, testing, inspection, packing and packaging of diaphragm type gas meters, used to measure volume of natural gas for domestic and commercial consumers.

2. Normative references

Throughout this standard specification the following standards and codes are referred to. The editions of these standards and codes that are in effect at the time of publication of this standard specification are a part of this standard specification. The applicability of changes in standards and codes that occur after the date of this standard specification shall be mutually agreed upon by the purchaser and supplier and/or manufacturer.

1. ANSI B1.1: Unified inch screw threads (UN and UNR thread form)
2. ANSI B16.5 Pipe Flanges and flanged fitting NPS ½ through NPS 24 m.IS
3. ASTM B85 : Standard specification for Aluminum alloy die casting
4. ASTM B117:Practice for operating salt spray(fog) apparatus
5. ASTM D 09 (2014): Standard Practices for preparation of Aluminum and Aluminum – alloy surface for painting.
6. EN 549:Rubber material for seal and diaphragm for gas appliances and gas equipments
7. EN 1359:Diaphragm gas meter
8. IGS-M-CH-033: Specification for Iranian natural gas quality
9. IGS-M-IN-101(3) : Specification for diaphragm gas meter
10. ISO 228-1:Pipe threads pressure-tight joints are not made on the threads
11. ISO 1817:Determination of the effect of liquids
12. ISO 3574 :Cold-reduced carbon steel of commercial drawing qualities
13. ISO 12944 : Paints and varnish – corrosion of steel structures by protective paint system

3. Definitions

For the purposes of this document, the following terms and definitions apply.

3.1 Actual flow rates

Flow rate at the gas pressure and gas temperature conditions prevailing in the gas distribution line in which the meter is fitted, at the meter inlet

3.2 Working pressure

Difference between the pressure of the gas at the inlet of the meter and the atmospheric pressure

3.3 Maximum working pressures (P_{max})

Upper limit of the working pressure for which the meter has been designed, as declared by the manufacturer and marked on the meter data plate

3.4 Pressure absorption

Difference between the pressures measured at the inlet and outlet connections of the meter whilst the meter is operating

3.5 Error of indication, E

Value which shows the relationship in percentage terms of the difference between the volume indicated by the meter and the volume which has actually passed through the meter, to the latter volume

Note 1 to entry: Error of indication, as a percentage, is calculated using the equation

$$E=100(V_i-V_c)/V_c$$

Where

V_i is the indicated volume

V_c is the volume which has actually passed through the meter.

3.6 Maximum permissible errors – initial (MPE)

Those errors of indication which are permitted when first determining the accuracy of a meter, prior to any other tests being carried out

3.7 Maximum permissible errors - endurance

Those errors of indication which are permitted during and on completion of the endurance test

3.8 Cyclic volume (V)

Volume of gas corresponding to the working cycle of the gas meter

Note 1 to entry: This means that all the moving components, except for the indicating device and the intermediate transmissions, resume for the first time the position they occupied at the beginning of the cycle.

3.9 Meter error curve

Plot of average error of indication against actual flow rate

3.10 Volume flow rate (Q)

Actual volume of gas passing through the diaphragm gas meter

3.11 Minimum flow rate ($Q_{\min}$)

Lowest flow rate at which the gas meter provides indications that satisfy the requirements regarding MPE

3.12 Transitional flow rate (Q_t)

Flow rate occurring between the maximum and minimum flow rates at which the flow rate range is divided into two zones, the 'upper zone' and the 'lower zone', each zone having a characteristic MPE

3.13 Overload flow rate

Highest flow rate at which the meter operates for a short period of time without deteriorating.

3.14 Maximum flow rate ($Q_{\max}$)

Highest flow rate at which the gas meter provides indications that satisfy the requirements regarding MPE

3.15 Routine test

Conformity test made on each individual items during or after manufacture.

3.16 Type test

Conformity test made on one or more items respective of the Production

3.17 Lot

Part or all of a consignment that may comprise part of all of or more than one batch

4. Requirements

4.1 Service and design conditions

This specification is primarily based on EN1359. Special or additional requirements are specified as followings:

4.1.1 The natural gas specification is in accordance with IGS-M-CH-033.

4.1.2 The Ambient temperature range is -29°C to +60°C.

4.1.3 Normal Inlet Pressure is 18 mbar.

4.1.4 The meter shall have easy moving part without stresses over operation duration.

4.1.5 The meter shall be constructed from quality materials in a workmanlike manner.

4.1.6 The meter designation (G-rate), $Q_{\max}$, $Q_{\min}$, Q_t values of maximum flow rates values of the upper limits of the minimum flow rates shall be one of those given in Table 1.

Designation	$Q_{\max}$ m ³ /h	Upper limits of $Q_{\min}$ m ³ /h	Q_t m ³ /h
G 2.5	4	0,025	0,4
G4	6	0,04	0,6
G6	10	0,06	1,0
G10	16	0,1	1,6
G16	25	0,16	2,5
G25	40	0,25	4,0
G40	65	0,4	6,5
G65	100	0,65	10,0
G100	160	1	16,0

Table1-Designation and flow values

4.1.7 The maximum working pressure of the meter shall not be less than 100 mbar.

4.1.8 All meters shall be capable of meeting the requirements for a minimum ambient temperature range of -29 °C to +60 °C

4.1.9 The gas temperature range shall be within the -10°C to $+55^{\circ}\text{C}$.

4.1.10 The meter shall be suitable for installation in open locations (outdoor without any protection) with condensing humidity.

4.1.11 The gas meter error shall be adjusted as close as possible to zero. The individual errors of indication of the meter shall be within the initial permissible error limits specified in Table 2 (When tested by the method (a)).

Flow rate m^3/h	Maximum permissible errors	
	Initial	Endurance
$Q_{\min} \leq Q < 0,1 Q_{\max}$	$\pm 3\%$	$\pm 6\%$
$0,1 Q_{\max} \leq Q \leq Q_{\max}$	$\pm 1,5\%$	$\pm 3\%$

Table 2-Error Limits

4.1.12 The meter error shall be adjusted as close to zero as the adjustment and maximum permissible errors allow, without favoring any party.

4.1.13 Measuring stability of meter shall be such that the errors of indication found at each of the specified test flow rates from $0,1 Q_{\max}$ to $Q_{\max}$, shall not differ by more than 0,6 %.

4.1.14 After exposure the meter to an overload flow rate of $1,2 Q_{\max}$ the error of indication shall remain within the maximum permissible error - initial limits specified in Table 2.

4.1.15 The error of indication of meter after aging test shall be within the maximum permissible errors - endurance, given in Table 2.

4.1.16 The error of indication of meter after humidity test shall remain within the maximum permissible error- initial limits specified in Table 2

4.1.17 The average pressure absorption of a meter, over a measuring cycle, with a flow of air with a density of $1,2 \text{ kg}/\text{m}^3$, at a flow rate equal to $Q_{\max}$, shall not exceed the values given in Table 3.

Designation	$Q_{\max} \text{ m}^3/\text{h}$	Maximum permissible pressure absorption (mbar)	
		Initial	Post endurance
G 2,5 to G10	4 to 16 inclusive	2	2,2
G16 to G40	25 to 65 inclusive	3	3,3
G65 and G100	100 and 160	4	4,4

Table 3- Pressure absorption

4.1.18 The starting flow rate shall not be greater than those specified in Table 4.

Destination	$Q_{\max}$ m ³ /h	Maximum starting flow rate dm ³ /h
G2,5 , G4	4 and 6	5
G6	10	8
G10,G16	16 and 25	13
G25	40	20
G40,G65	65 and 100	32
G100	160	50

Table 4- Starting flow rates

4.1.19 The cyclic volume of any meter shall not be less than the cyclic volume given in table 5 and shall be indicated on the index plate.

The measured value at base condition shall be within $\pm 5\%$ of the indicated value.

Designation	$Q_{\max}$ (m ³ /h)	Cycling Volume (dm ³)
G 2.5	4	1.2
G 4	6	2
G 6	10	3.5
G10	16	6
G 16	25	10
G 25	40	18
G 40	65	30
G 65	100	55
G 100	160	100

Table 5-Cycling Volume

4.1.20 No lubricants shall be required during the life of the meter.

4.1.21 The meter shall be 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 by visual inspection.

4.1.22 The meter shall be leak tight under normal operating conditions

4.1.23 The meter shall be resistance to internal pressure of 1.5 times the maximum working pressure or 350mbar, whichever is the greater.

Any residual deformation of the unpressurized meter case shall not exceed 0,75 % of the linear dimension over which it is measured. After the test, the meter case shall remain leak tight.

4.1.24 Mechanical means for sealing shall be provided for the gas containing components of the meter case where the failure of any seals and/or adhesives can cause external leakage, e.g. at the junction of the top and bottom case of the meter.

4.1.25 The meter shall have two pipe connections.

4.1.26 The connections of meters from G2.5 to G25 inclusive shall be top mounted.

4.1.27 The connections of meters from G2.5 to G25 inclusive shall be male straight threaded according to ISO 228/1.

4.1.28 The connections of meters from G40 to G100 inclusive shall be top or side mounted such that specified in data sheet.

4.1.29 The connections of meters from G40 to G100 inclusive shall be flange type.

4.1.30 Meter flanges shall be raised face, serrated finish according to ANSI B16.5 to match welding neck flanges ANSI class 150.

4.1.31 Provision shall be made in the design for sealing the meter inlet and outlet connections.

4.1.32 The centerlines of top connections shall be within 1° of vertical, with respect to the horizontal plane of the meter.

4.1.33 The centerlines of side connections shall be within 1° of horizontal, with respect to the vertical plane of the meter.

4.1.34 The meter connections sizes shall be as specified in table 6.

Designation	Q _{max} (m ³ /h)	Size(in)
G 2.5	4	1 1/4
G 4	6	
G 6	10	
G10	16	2
G 16	25	
G 25	40	
G 40	65	3
G 65	100	
G 100	160	4

Table 6- Connection sizes

4.1.35 The distance between the centerlines/face to face of the connections, measured at the free end of the connections, shall be within ±0,5 mm of the nominal distance between centerlines/face to face or within ±0,25 % of the nominal distance between centerlines/face to face whichever is the greater.

4.1.36 The centerlines and face to face shall be within 1° of being parallel.

4.1.37 The free ends of the connections shall be level within 2 mm, or within 1 % of the nominal distance between the centerlines or face to face of the connections, whichever is the greater.

4.1.38 The meter connections shall be subjected to the appropriate torque specified in Table 7 and shall then conform to the following:

- external leak tightness;
- any residual rotational deformation of the meter connection shall not exceed 2°.

Nominal connection diameter		Torque value N.m	Bending moment N.m
Inches	DN		
1	25	110	40
1 1/4	32	110	40
2	50	170	60
3	80	170	60
4	100	170	60

Table 7-Torque and bending moment

4.1.39 The meter shall confirm error of indication test method (c) and an error of indication check at Q_{min} shall be carried out. Then meter shall be subjected to the bending moment given in Table 7. During and after the test, the meter shall remain leak tight.

After the test:

- The residual deformation of the connections shall not exceed 5°.
- The meter shall be retested in accordance with the error of indication test method(c), plus an error of indication check at Q_{min} . The errors of indication shall be within the allowed endurance maximum permissible error limit given in Table 2.

4.1.40 The meter shall remain leak tight and its error of indication shall be within the initial permissible limits given in Table 2, before and after being subjected to the vibration.

4.1.41 The meter shall remain leak tight after being subjected to impact.

4.1.42 The meter shall withstand the handling required during its transport and installation. Before testing the meter shall conform to the following:

- a) Error of indication, 4.1.11;
- b) Pressure absorption, 4.1.17;
- c) External leak tightness, 4.1.22.

After undergoing the mishandling test, the meter shall conform to the following requirements:

- i) Its errors of indication are within the allowed endurance maximum permissible error limit (method(C));
- ii) The post endurance maximum permissible value for average pressure absorption.

iii) It is still leak tight

4.1.43 Before and after testing in -29°C and -60°C according to storage temperature range test, the meter shall be within the initial permissible error limits

4.1.44 The meter shall be equipped with the magnetic index drive.

4.1.45 The torque transmission of the magnetic drive unit shall be at least three times that required to drive the index when all of the index digits are in motion (i.e. all the nines to all the zeros) and when measured after the index has been operated to record an equivalent volume of gas to that passing through the meter during the entirety of the endurance test.

NOTE Additional devices, such as reed switches, are considered to be part of the index.

4.1.46 Meters shall be fitted with a device to prevent the registration of reverse flow. This device shall not allow the registration of more than 50 cyclic volumes when subjected to reverse flow.

4.1.47 Samples of the meter shall conform to the durability requirement according to test section.

4.1.48 Over the gas temperature range between the flow rates of $Q_{\min}$ and $Q_{\max}$, the errors of indication of meters shall be within the maximum permissible initial limits given in Table 2.

4.1.49 Over the ambient temperature range, between the flow rates of $Q_{\min}$ and $Q_{\max}$, the errors of indication of meters shall remain within the maximum permissible endurance limits given in Table 2 throughout the expected life of the meter.

4.1.50 Meters shall be fitted with a metrologically controlled mechanical index.

4.1.51 The index shall be easily readable without the use of tools.

4.1.52 The index shall operate satisfactorily for the normal life of the meter under normal conditions of use.

4.1.53 The index shall be non-resettable.

4.1.54 The index shall be non-volatile.

4.1.55 The index shall be protected with a metrological seal. Provision shall be made in the design the indicating device from unauthorized interference.

4.1.56 An index shall have at least a sufficient number of numerals to ensure that the volume passed during 8 000 hr a flow rate of $Q_{\max}$ does not return all of the numerals to their original positions.

4.1.57 The numerals shall indicate in cubic meters, decimal multiples or sub-multiples of a cubic meter.

4.1.58 The symbol m^3 shall be marked on the index plate/display close to the number wheels of the index.

4.1.59 The numerals indicating the sub-multiples of the cubic meter shall be clearly distinguishable from the other numerals (i.e. by red color) and they shall be separated from the other numerals by a clearly marked decimal sign.

4.1.60 The minimum height of the numerals for the metrological data shall be 4 mm and the minimum width shall be 2.4 mm.

4.1.61 Indexes shall be designed in such a way that testing of the meters can be carried out with sufficient accuracy in a reasonable time, and the resolution of the index shall be such as to conform to Table 8.

Designation	$Q_{\max}$ m ³ /h	Numbering every dm ³	Maximum scale interval of a mechanical index dm ³
G2,5-G6	4 to 10 inclusive	1	0.2
G10-G65	16 to 100 inclusive	10	2
G100	160	100	20

Table 8 — Resolution of meter index

4.1.62 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 of -29 °C to 60 °C.

4.1.63 A complete revolution of an index 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.

4.1.64 The index shall be remain legible after humidity test.

4.1.65 No sealant, grease or adhesive shall be used for sealing purpose on valve covers, grids, diaphragm and pan assembly.

4.1.66 All screws, bolts and nuts shall conform to ANSI B1.1.

4.2 Materials

4.2.1 All components of meter shall be suitable for pressure, temperature and other operating conditions.

4.2.2 The meter case shall be made from carbon steel according to ISO 3574 (ST 14) or die cast aluminum according to ASTM B85.

4.2.3 The external surface of the meter case which is in direct contact with the ambient air and the internal surface of the meter case which is in direct contact with the gas shall be of sufficient thickness to meet the requirements of this standard.