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IGS

Iranian Gas Standards

امور تدوین استانداردها

Standardization Division

مشخصات فنی خرید

Multipath Ultrasonic Transit-Time Gas Flow Meter

کنترل گاز نوع اولتراسونیک

APPROVED

FOREWORD

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Iranian Gas Standards (**IGS**) are prepared , reviewed and ammended by technical standard committees within NIGC Standardization Div. and submitted to the **NIGC's "STANDARDS COUNCIL"** for approval .

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5- "**SHOULD**" : is used where a provision is advised only.

6- "**MAY**" : is used where a provision is completely discretionary.

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موضوع: ابلاغ مصوبات استانداردها

با سلام،

باستحضار میرساند در جلسه هزار و دویست و پنجاه و سه مورخ ۸۵/۸/۲۱ هیئت مدیره محترم استانداردهای زیر به تصویب رسیده است که بدینوسیله جهت اعلام به واحدهای ذیربط در آن شرکت / منطقه / مدیریت ابلاغ می گردد.

- ۱- مشخصات فنی مواد مصرفی ژئوتکستایل به شماره (IGS-M-PL-025-1)
 - ۲- دستورالعمل رنگ آمیزی تأسیسات صنعت گاز با رنگهای مختلف به شماره (IGS-O-CH-042)
 - ۳- اصلاحیه استاندارد پوشش سه لایه پلی اتیلن خطوط لوله به شماره (IGS-M-TP-010 1&2)
 - ۴- پیشنهاد مشخصات فنی کنتور گاز نوع اولتراسونیک به شماره (IGS-M-IN-104 (DRAFT))
 - ۵- پوشش پلی یورتیان برای تعویض پوشش خطوط لوله به شماره (IGS-M-TP-020-1)
- در مورد ردیف ۴، مشخصات فنی کنتور گاز از نوع اولتراسونیک لازم است نکات زیر را که در جلسه هیئت مدیره محترم مطرح گردید به استفاده کنندگان از استاندارد یاد شده ابلاغ فرمائید.
- ۱- بعلت عدم وجود استاندارد مصوب بین المللی در مورد کنتورهای اولتراسونیک با توضیحاتی که در این مورد به استحضار هیئت مدیره محترم رسید موافقت فرمودند که این استاندارد استثنائاً بصورت پیشنهادی (DRAFT) تصویب و ابلاغ گردد.

تاریخ :

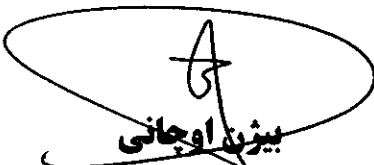
شماره :

پیوست :

۲- با توجه به اینکه خرید پراکنده و متنوع این کنتورها بلحاظ انتقال دانش فنی و عدم وجود سیستم کالیبراسیون در کشور مشکلاتی را به دنبال خواهد داشت لذا لازم است قبل از هر گونه سفارش گذاری با مدیریت محترم گازرسانی هماهنگی های لازم انجام شود .

۳- با توجه به قیمت بالای کنتورهای فوق در مقایسه با سایر انواع موجود بخصوص در ظرفیتهای پائین، لذا فعلاً برای ظرفیت های بالاتر از یکصد هزار متر مکعب در ساعت برای کاربرد در اندازه گیری گاز ورودی به خطوط انتقال و یا ایستگاههای ورودی شهرها، صنایع بزرگ و نیروگاهها مورد استفاده قرار گیرند .

۴- بلحاظ اثرات نامطلوب عواملی نظیر صدا ، وضعیت قرار گرفتن کنتور در لوله کشی ایستگاه و غیره در دقت اندازه گیری ، ملاحظات طراحی مهندسی خاص کاربرد این نوع کنتورها رعایت گردد .
متن کامل استانداردهای فوق الذکر جهت استفاده در سایت اطلاع رسانی امور تدوین استانداردها به آدرس (igs.nigc.ir) قرار داده شده است.



امیر اوچانی
رئیس امور تدوین استانداردها

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1 SCOPE

This specification together with the appendices there to covers the minimum requirements for design, material, fabrication, testing, inspection, painting, marking, packing and packaging of "Multi path ultrasonic transit – time flow meter for 6" and larger in diameter, used for the measurement of natural gas refer to IGS-CH-033.

Multi path ultrasonic meters have at least two independent pairs of measuring transducers (acoustic path).

Typically applications include measuring the flow of large volumes of gas through production facilities, transmission pipelines, storage facilities, distribution systems and large end-use customer meter sets.

It is not applicable to clamp-on/externally mounted meters.

For specific requirements see data sheet (normative appendix). In case of any exception to the specification, it shall be clearly stated on the technical quotation submitted by suppliers.

2 REFERENCES

Throughout this standard specification the following standards, codes and reports are referred to. The editions of these standards and codes that are in effect at the time of publication of this standard specification (2006) shall, to the extent specified herein, form 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.

AGA REPORT NO.9: 2003

Measurement of gas by multi path ultrasonic meters.

BS ISO/TR: 12765:1998

Measurement of fluid in closed conduits—methods using transit–time ultrasonic flow meters.

BS7965:2000

The selection, installation, operation and calibration of diagonal path transit time ultrasonic flow meter for industrial gas applications.

ISO/CD/17089 part 1 (ISO TC 30/SC 5 N169 Date: 2005-04-05)

Measurement of fluid flow in closed conduits ultrasonic meters for gas; meters for custody transfer and allocation measurement.

3 DEFINITIONS

3.1 Ultrasonic flow meter (USM)

Flow meter which generates ultrasonic signals and receives them again after they have been influenced by the flow in such a way that the observed result can be used as a measure of the flow rate.

An ultrasonic flow rate normally consists of the ultrasonic transducers and equipment which evaluates the flow rate measurement from the emitted and received ultrasonic signals and converts these signals to a standard output signal proportional to the flow rate.

3.2 Ultrasonic transducer

Element that converts acoustic energy into electrical signals and/or vice versa. Ultrasonic transducers used in transit-time flow meters usually work as both transmitter and receiver.

3.3 Acoustic path

Path traveled by an acoustic wave between a pair of ultrasonic transducers.

3.4 Ultrasonic pulse

Signal generated by finite-duration electrical excitation of an ultrasonic transducer.

3.5 Continuous-wave ultrasound

Signal generated by continuous electrical excitation of an ultrasonic transducer.

3.6 Transit time (t)

Time needed by an ultrasonic pulse to traverse the acoustic path.

3.7 Transit-time difference (Δt)

Difference between the transit times of the ultrasonic signals propagated upstream and downstream.

3.8 Transit-time difference method (time of flight method)

Method of flow rate measurement in which the average fluid velocity along the acoustic path ($\bar{V}$) is determined from the transit-time difference of two ultrasonic signals, one traveling upstream and one downstream over the same distance in the flowing fluid.

3.9 Velocity of sound (C)

Velocity of acoustic signals in the fluid at rest.

3.10 Average fluid velocity along the acoustic path ($\bar{V}$)

Fluid velocity in the plane which is formed by the acoustic path and the direction of flow.

3.11 Mean axial fluid velocity ($\bar{V}_A$)

Ratio of the volume flow rate (the integral over a cross-section of the meter tube of the axial components of the local fluid velocities) to the area of the measurement cross-section.

3.12 Inclination angle (θ)

Angle between the axes of the ultrasonic transducers and a line parallel to the axis of the conduit.

3.13 Interrogation length (L)

Length of that part of the acoustic path, in fluid at rest, inside the conduit (see figure 1).

3.14 Interrogation distance (d)

Projection of the interrogation length on the line parallel to the axis of the conduit or of the flow (see figure1).

3.15 Path length (L_p)

Length of acoustic path, in fluid at rest, from the faces of both transducer (see figure 1).

3.16 Meter tube

Specially fabricated section of conduit containing the ultrasonic transducers and conforming in all respects to the specification of the standard.

3.17 Clamp-on arrangement

Arrangement by which the transducers are attached to the outside wall of the conduit in which the flow rate is to be measured.

3.18 Multi-path method

Method of flow rate measurement in which the average fluid velocity over a number of different paths is determined.

3.19 Flow rate

Volume per unit of time at metering conditions.

3.20 Flow rate integrator

Device for volume measurement by time-integration of volume flow rate.

3.21 Indication

The flow rate indicated by the meter.

3.22 Working range

Range of flow rates of gas limited by the maximum flow rate $q_{\max}$ and the minimum flow rate $q_{\min}$, for which the meter error lies within specified limits.

3.23 Metering pressure

Absolute gas pressure in a meter at flowing conditions to which the indicated volume of gas is related.

3.24 Metering conditions

Conditions, prevailing at the point of measurement, e.g. gas composition, temperature and pressure.

3.25 Base conditions

Conditions to which the measured volume of the gas is converted, e.g. base temperature and base pressure.

3.26 SPU

Signal processing unit, the portion of the multi path ultrasonic meter that is made up of the electronic microprocessor system.

3.27 Auditor

Representative of the operator or other interested party that audits operation of multi path ultrasonic meter.

3.28 Designer

Company that designs and constructs metering facilities and purchases multi path ultrasonic meters.

3.29 Manufacturer

Company that designs, manufactures, sells and delivers multi path ultrasonic meters.

3.30 Operator

Company that operates multi path ultrasonic meters and performs normal maintenance.

3.31 Inspector

Representative of the designer who visits the manufacturer's facilities for quality assurance purposes.

3.32 Bi-directional

The inherent capability of measuring flow in either direction with equal accuracy by the ultrasonic meters.

3.33 Deviation

The difference between the actual volume flow rate (e.g., flow rates in engineering units of acf/h) measured by the meter under test and the actual volume flow rate measured by a reference meter. Correction shall be made for the differences in flowing gas pressure, temperature and compressibility between the two meters. The deviation is also measured as a difference between the mass flow rate through the meter under test and the mass flow rate through the reference meter. Typically, three or more test runs are averaged to establish the deviation at each nominal flow rate. These test runs can be used to determine the repeatability as defined below.

3.34 Error

The observed deviation of a meter calculated as: percent error = $[(\text{Test meter reading} - \text{reference meter reading}) \div (\text{Reference meter reading})] \times 100$.

3.35 Maximum Error

The allowable error limit within the specified operational range of the meter, as mentioned in item 4.1.41.

3.36 Maximum peak-to-peak error

The largest allowable difference between the upper-most error point and the lower-most error point as mentioned in section 4.1.40 and 4.1.41. This applies to all error values in the flow rate range between q_t and $q_{\max}$.

3.37 $q_{\max}$

The maximum gas flow rate through the USM that can be measured within the error limits, as mentioned in section 4.1.41.

3.38 q_t

The transition gas flow rate below which the expanded error limit is applicable and where $q_t \leq 0.1q_{\max}$ as mentioned in 4.1.41.

3.39 $q_{\min}$

The minimum gas flow rate through the USM that can be measured within the expanded error limits, as mentioned 4.1.41.

3.40 q_i

The actual measured gas flow rate passing through a USM under a specific set of test conditions.

3.41 Reference Meter

A meter or measurement device of proven flow measurement accuracy.

3.42 Repeatability

The closeness of agreement among a number of consecutive measurements of the output of the test meter for the same reference flow rate under the same operating condition, approaching from the same direction, for full scale traverses. The repeatability shall correspond to the 95% confidence interval of the deviation based on the assumption of a normal distribution. See section 4.1.40.

3.43 Resolution

The smallest step by which the change of the flow velocity is indicated by the meter. See section 4.1.40.

3.44 Velocity sampling interval

The time interval between two succeeding gas velocity measurements by the full set of transducers or acoustic paths. Typically, between 0.05 and 0.5 seconds, depending on meter size. See section 4.1.40.

3.45 Zero-flow reading

The maximum allowable flow-velocity reading when the gas is at rest; i.e., both the axial and the non-axial velocity components are essentially zero. See section 4.1.40.

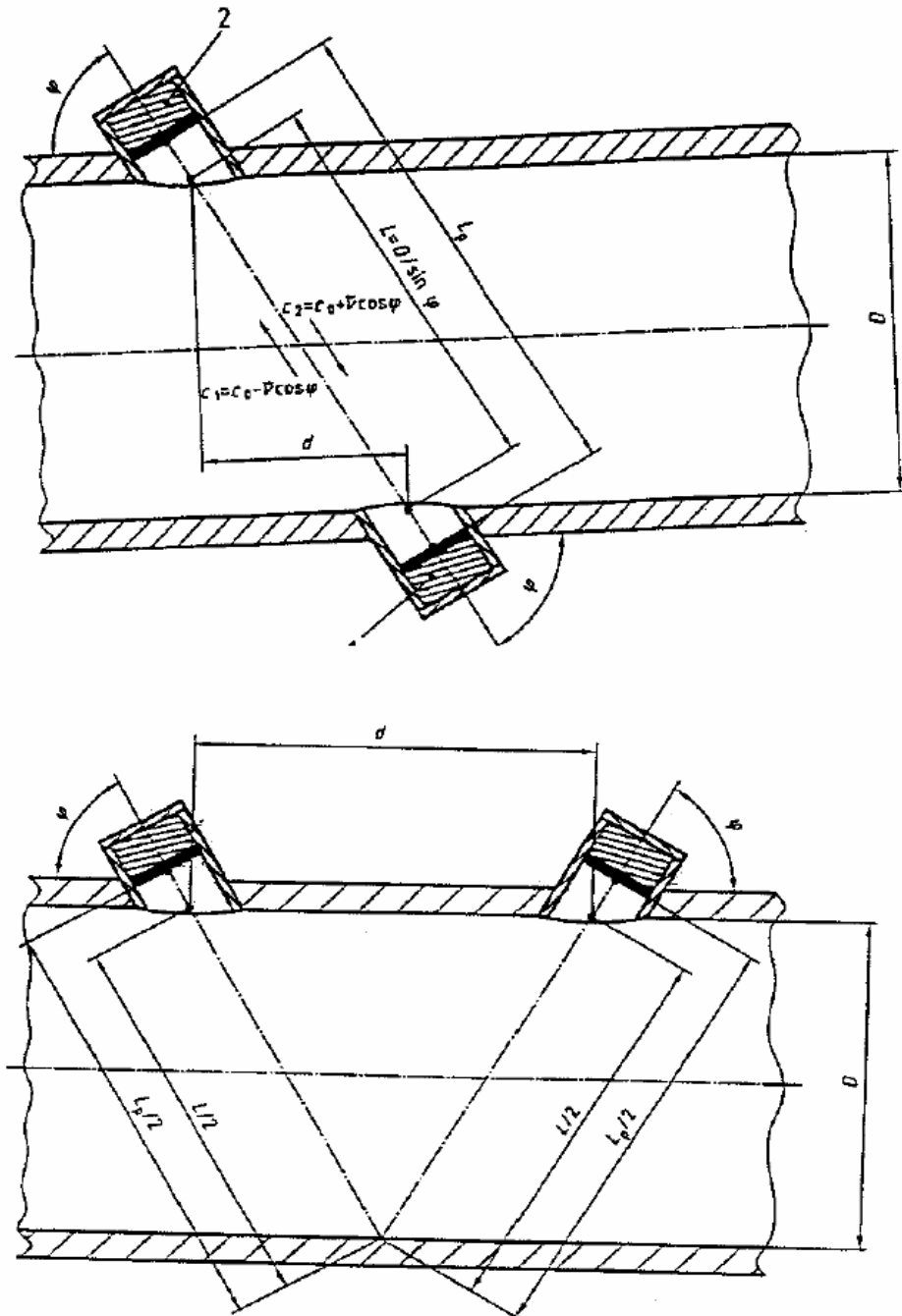


Figure 1

4 REQUIREMENTS

4-1 Design and service conditions

The USM shall be constructed of quality materials in a workmanlike manner in order to attain gas tightness, stability of performance and sustained accurate metering over a period of time and over the range of operating conditions with minimum of maintenance, when metering natural gas.

Such meter shall have the general characteristic listed below:

- 4.1.1** The USM shall be tamper proof, gas tight and capable to sustain accuracy under the whole range of service conditions.
- 4.1.2** The operating ambient air temperature range should be at a minimum -29° to 60°C (-20°F to 140°F). This ambient temperature range applies to the meter body with and without gas flow, field-mounted electronics and ultrasonic transducers, cabling, etc.
- 4.1.3** The USM should operate over a flowing gas temperature range of -25 ° to 55° C (13 ° to 131°F).
- 4.1.4** The manufacturer shall state the flowing gas and ambient air temperature specifications for the multi path ultrasonic meter, if they differ from the above.
- 4.1.5** Ultrasonic transducers used in USM require a minimum gas density (a function of pressure) to ensure acoustic coupling of the sound pulses to and from the gas, therefore, the manufacturer shall consider the expected minimum operating pressure as well as the maximum operating pressure which are specified by the designer.
- 4.1.6** Standard volume measured at 1.01325 BARA (14.696 PSIA) and 15.56°C (60°F).
- 4.1.7** The USM shall, as a minimum requirement, operate with any of the "normal range" natural gas composition mixtures specified in (IGS-CH-033(0):2004). This includes relative densities between 0.554 (pure methane) and 0.87.
- 4.1.8** For each meter design and size, the minimum, transition and maximum gas flow rate ($q_{\min}$, q_t and $q_{\max}$) passing through the USM should be specified by the manufacturer.
- 4.1.9** The manufacturer should figure the SPU parameters for USM if bi-directional measurement is required by the designer.