



**ГБ05**

**DOMESTIC GAS METERS**  
**СГБ G4 СИГНАЛ (SGB G4 SIGNAL),**  
**СГБ G2,5СИГНАЛ (SGB G2.5 SIGNAL),**  
**СГБ G4-1 СИГНАЛ (SGB G4-1 SIGNAL),**  
**СГБ G2,5-1СИГНАЛ (SGB G2.5-1 SIGNAL),**

**OPERATION MANUAL**

**SIaMI.407274–287RE**  
**(СЯМИ.407274–287РЭ)**

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The operation manual includes design description, technical specifications, operating principle, mounting and service procedure, test certificate, packing certificate, manufacturer warranty and other information necessary for correct mount and operation of СГБ G4 СИГНАЛ, СГБ G2,5 СИГНАЛ, СГБ G4-1 СИГНАЛ, СГБ G2,5-1 СИГНАЛ domestic gas meters (hereinafter “meters”).

Meters are produced by LLC ЕРО “Signal” (ООО ЭПО “Сигнал”), Russia and meet GOST R 50818-95 requirements and TU 4213-054-51416204-01 technical specifications.

## **1 DESCRIPTION AND OPERATION**

### **1.1 Designation**

Meters are designed to measure gas volume and for commercial recording of gas consumption.

Meter climatic category is УХЛ (UKhL “moderately cold climate”), placement category is 2.1, according to GOST 15150–69. Meters are designed to operate at ambient temperature from 40 up to 60°C.

Meters belong to several categories:

a) depending on inlet choke position – left, right;

b) depending on chokes position:

1) vertical position of chokes - СГБ G4 СИГНАЛ and СГБ G2,5СИГНАЛ;

2) horizontal position of chokes - СГБ G4-1 СИГНАЛ and СГБ G2,5-1 СИГНАЛ;

c) depending on choke thread:

1) M33x1,5; G1¼; G¾; - СГБ G4 СИГНАЛ and СГБ G2,5СИГНАЛ;

2) M33x1,5 - СГБ G4-1 СИГНАЛ and СГБ G2,5-1 СИГНАЛ.

Example of identification note at the time of order:

СГБ G4 СИГНАЛ meter (left, thread G1¼) TU 4213-054-51416204-01 (vertical choke position, inlet choke positioned to the left in respect of meter front side, choke thread type G1¼).

СГБ G4 СИГНАЛ meter (right, thread G1¼) TU 4213-054-51416204-01 (vertical choke position, inlet choke positioned to the right in respect of meter front side, choke thread type G1¼).

СГБ G4-1 СИГНАЛ meter (left, thread M33x1,5) TU 4213-054-51416204-01 (horizontal choke position, inlet choke positioned to the left, choke thread type M33x1,5);

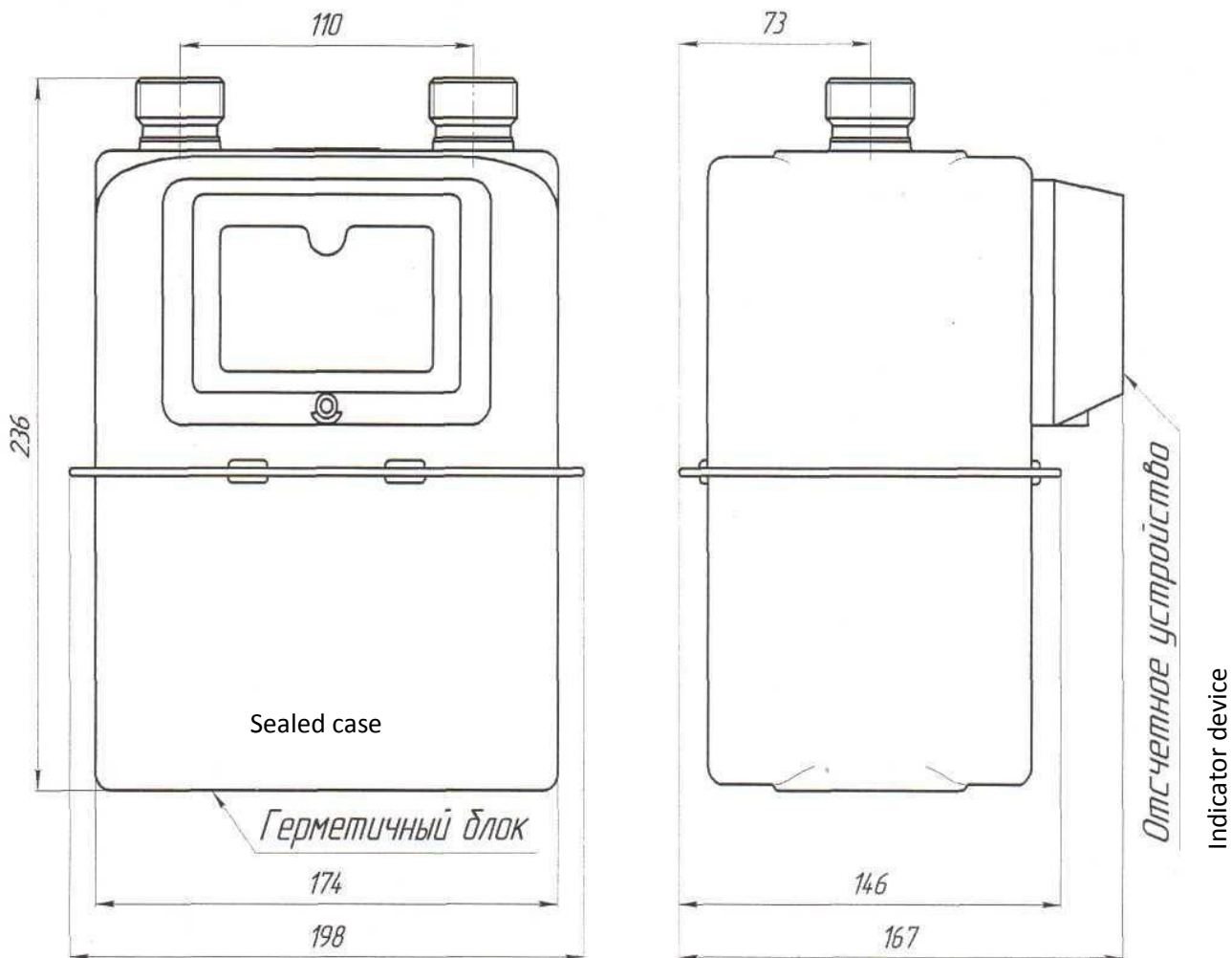
СГБ G4-1 СИГНАЛ meter (right, thread M33x1,5) TU 4213-054-51416204-01 (horizontal choke position, inlet choke positioned to the right, choke thread type M33x1,5).

### **1.2 Technical specifications**

Technical specifications, general quantities and characteristic can be found in table 1.

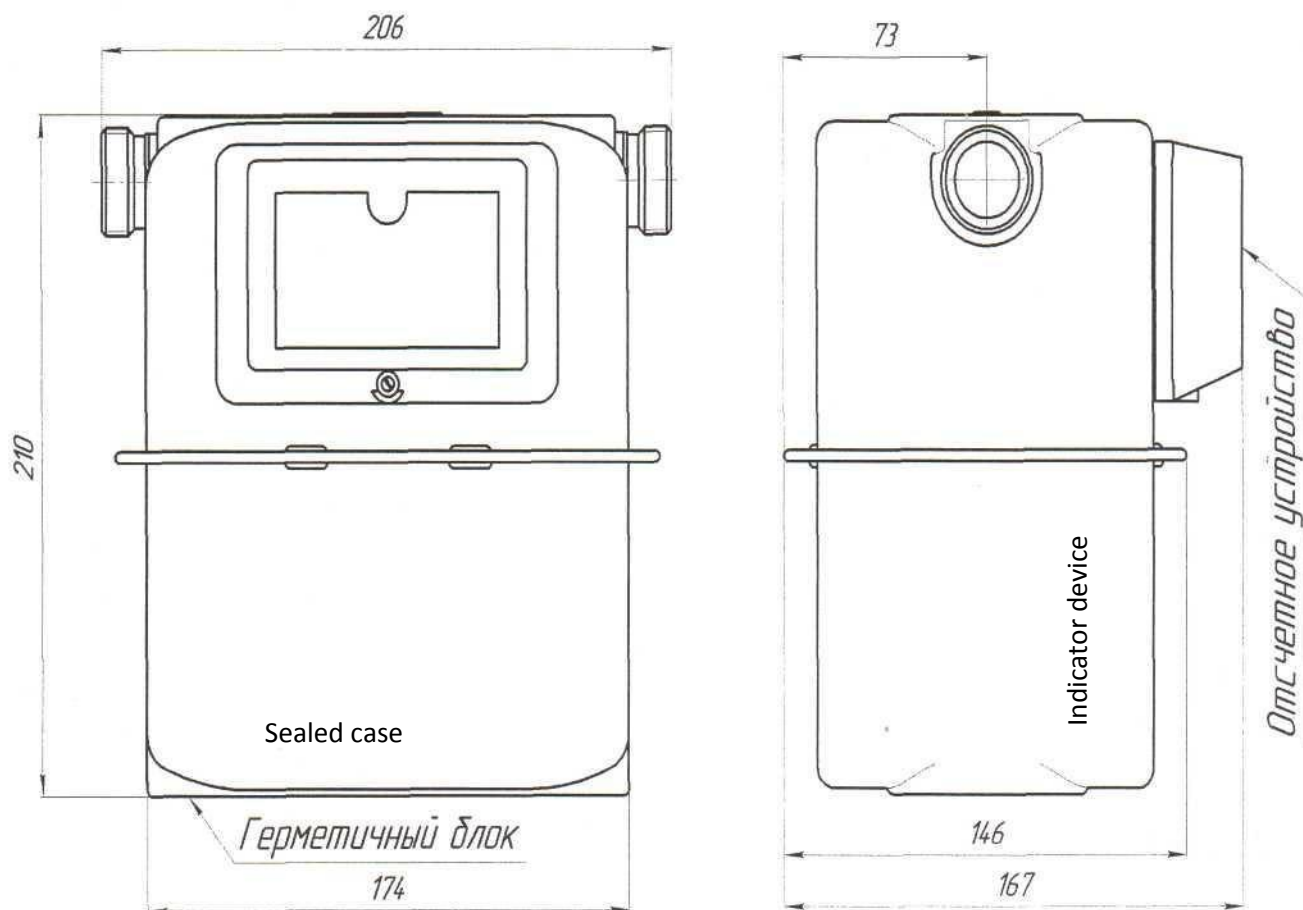
Table 1

Parameter name	Parameter value for meters			
	СГБ G4 СИГНАЛ	СГБ G2,5 СИГНАЛ	СГБ G4-1 СИГНАЛ	СГБ G2,5-1 СИГНАЛ
1 Test condition	Natural gas according to GOST 5542-87, liquefied gas according to GOST 20448-90			
2 Maximum flow, $Q_{max}, m^3/h$	6	4	6	4
3 Rated flow, $Q_{rated}, m^3/h$	4	2,5	4	2,5
4 Minimum flow, $Q_{min}, m^3/h$	0,04	0,025	0,04	0,025
5 Operation pressure, kPa, (kgf/cm <sup>2</sup> )	10(0,10)			
6 Maximum pressure, kPa, (kgf/cm <sup>2</sup> )	50(0,51)			
7 Pressure loss at maximum flow, Pa (mm water column.), not exceeding	200(20)			
8 Process temperature, °C	from minus 40 to plus 60			
9 Margin of permissible primary relative measurement error within flow range, %, %, not exceeding:				
- when produced and after repair works:				
from $Q_{min}$ to $0,1Q_{rated}$ .	±3			
from $0,1Q_{rated}$ to $Q_{max}$	±1,5			
- in operation:				
from $Q_{min}$ to $0,1Q_{rated}$	±5			
from $0,1Q_{rated}$ to $Q_{max}$	±3			
10 Complementary error, caused by test gas temperature deviation from standard temperature, as compared to permissible at temperature change by 1 °C, %, not exceeding	0,45			
11 Threshold of sensitivity, $m^3/h$ , not exceeding	0,008	0,005	0,008	0,005
12 Cyclic volume, dm <sup>3</sup>	1,2			
13 Indicator device capacity, m <sup>3</sup>	99999,999			
14 Roller graduation mark, m <sup>3</sup> (dm <sup>3</sup> )	0,0002(0,2)			
15 Overall dimensions, mm, height, length, width (without mounting parts), not exceeding:	236x198x167		210x206x167	
16 Mounting dimensions – choke thread	M33x1,5 or G1¼, or G¾		M33x1,5	
- choke spacing, mm	110			
17 Weight without mounting parts, kg, not exceeding:	2,1			
18 Operation conditions:				
- ambient temperature, °C	from 40 to plus 60			
- air relative humidity, %	от 30 до 80			
- atmospheric pressure, kPa (mm Hg column)	от 84 до 106,7 (от 630 до 800)			
19 Service life, years, not less	20			



Choke thread – M33 × 1,5 or G1/4, or G3/4

**Fig. 1** – Domestic gas meter СГБ G4 СИГНАЛ or СГБ G2,5 СИГНАЛ



Choke thread – M33 × 1,5

**Fig. 2** – Domestic gas meter  
 СГБ G4-1 СИГНАЛ or СГБ G2,5-1 СИГНАЛ

### 1.3 Meter configuration

Meter exterior view is presented in Fig. 1 – СГБ G4 СИГНАЛ or СГБ G2,5 СИГНАЛ and Fig. 2 - СГБ G4-1 СИГНАЛ or СГБ G2,5-1 СИГНАЛ.

Meter includes two assembly blocks:

- 1) sealed case;
- 2) indicator device.

#### 1.3.1 Sealed case includes:

- 1) two measuring bellows with traveling membranes and lever system;
- 2) crank mechanism;
- 3) distributing gear.

1.3.2 Pressure seal is positioned on the front side of the sealed case and transfers motion from the crank mechanism to the indicator device. Screen is placed in the inlet choke of the sealed case and excludes ingress of solid particles onto distributing gear, performing filtrating function.

1.3.3 Indicator device (adding machine) is of roller type, mechanical, with eight digits, includes:

- 1) body;
- 2) train of gears transferring motion from pressure seal to rollers;
- 3) eight rollers;
- 4) nameplate;
- 5) cap.

### 1.4 Operating principle

When extensive pressure is applied, gas fills interspace beneath meter top cap through inlet choke and travels to measuring bellows through distributing gear.

Pressure difference appears on separating membrane which causes membrane travel. One of the chambers divided by the membrane is filled with gas; meanwhile gas is blown out of the other chamber through distributing gear to outlet choke.

Membrane travel is transformed with the help of crank mechanism into reciprocal motion of slide damper of the distributing gear and rotational motion of indicator device which records quantity of blown out test volume.

Meter design allows repair of all elements by certified enterprises or manufacturer.

### 1.5 Completeness

Meter package contents correspond to the mentioned in table 2

Table 2

Designation	Name	Quantity	Serial number	Notes
СГБ G4СИГНАЛ   СГБ G2,5СИГНАЛ (left or right, thread M33x1,5 or G <sup>3</sup> / <sub>4</sub> , or G 1 <sup>1</sup> / <sub>4</sub> ) ТУ4213-054-51416204-01	Domestic gas meter	1		
СЯМИ.407274-287РЭ	Operation manual	1		
СЯМИ.407274-287РЭ	Operation manual with annex A and B	1		on demand
СЯМИ.407274-144 Д2 (МК-СГБ-М33x1,5-Ду20) or СЯМИ.407274-287 Д2 (МК-СГБ-G <sup>3</sup> / <sub>4</sub> -Ду15), or СЯМИ.407274-287 Д4 (МК-СГБ-G1 <sup>1</sup> / <sub>4</sub> -Ду20)	Installation kit to mount meter on pipe	1		on demand
287-01-26	Seal	1		on demand
СЯМИ 407 274-287УЧ	Packing	1		

Table 2 continued

Designation	Name	Quantity	Serial number	Notes
СГБ G4-1СИГНАЛ   СГБ G2,5-1СИГНАЛ (left or right, thread M33x1,5) ТУ4213-054-51416204-01	Domestic gas meter	1		
СЯМИ.407274-287РЭ	meter	1		
СЯМИ.407274-287РЭ	Operation manual with annex A and B	1		on demand
СЯМИ.407274-144 Д2(МК-СГБ-М33x1,5- Ду20)	Installation kit to mount meter on a pipeline	1		on demand
287-01-26	Seal	1		on demand
СЯМИ 407 274-287УЧ	Packing	1		



## 1.6 Tagging and sealing

### 1.6.1 Tagging

1.6.1.1 Meter tag is placed on the nameplate and label of the indicator device.

Sealed case has an arrow pointing at gas flow direction.

1.6.1.2 Transport package possesses indicator designation and handling marks.

### 1.6.2 Sealing.

1.6.2.1 Meter possesses stamp impression by the verification officer in the seal cup of the indicator device.

In order to eliminate access to the screw, securing indicator device cap, seal 287-01-26 (from delivery set) is supposed to be placed to indicator device cup.

1.6.2.2 Transport package is sealed.

1.6.2.3 Packing is sealed with splice tape and labeled.

## 1.7 Packing

1.7.1 Meter is placed into shipping box out of corrugated board.

1.7.2 Operation manual is put into polybag and placed into shipping box.

1.7.3 Packed meters are placed into transport package.

## **2 SUITABLE APPLICATION**

### 2.1 Meter preparation for use

#### 2.1.1 Safety precautions during meter preparation for use

2.1.1.1 Installation, commissioning, technical servicing and meter verification is performed by an organization which possesses certificate for mentioned scope of work.

2.1.1.2 Review present operation manual prior to using the meter.

2.1.1.3 All works on mounting and dismounting are to be performed with no gas in the pipeline.

#### 2.1.2 Scope and sequence of meter external examination

2.1.2.1 Open the box and verify delivery completeness according to the operation manual.

2.1.2.2 Verify stamp impression by the verification officer. Meter without stamp impression by the verification officer cannot be installed.

#### 2.1.3 Regulations and procedure of meter installation

2.1.3.1 Position on the gas pipeline is to be selected to prevent the meter from hits, process vibration, atmospheric precipitation and mechanical effects.

2.1.3.2 It is recommended to provide fastening at the spot of meter connection according to SNIP (Construction rules and regulations).

2.1.3.3 Gas pipeline shall not have any declines towards the meter in order to exclude condensate inside of the meter.

2.1.3.4 Gas pipeline is to be purged and tested for leaks and strength by means of simulator pipe.

2.1.3.5 IT IS PROHIBITED to mount the meter on a pipeline by means of gas welding and at spots exposed to corrosion and high temperatures.

2.1.3.6 Meter is mounted vertically so that arrow direction on a sealed case corresponds to gas flow direction; to be connected to gas pipeline voltage-free.

2.1.3.7 Check leak tightness of meter body and pipeline connections with the meter.

2.1.3.8 Ensure steady, jam-and flick-free operation of the indicator device.

2.1.3.9 When mounted and function tested, make up certificate for meter installation, leave a note about commissioning in the paragraph 6.3 of the present manual; meter is sealed.

## 2.2 Meter application

2.2.1 Service of the meter is allowed only to a person familiar with the present operation manual.

2.2.2 Performance monitoring is to be conducted regarding indicator device performance.

With gas appliances in function, indicator device shall work steadily, without flicks and jams.

2.2.3 When performing works on meter operation, requirements “Safety rules in gas industry” approved by Gostekhnadzor (State Technical Supervision Body) are to be met.

2.2.4 Meter operation shall be performed according to “Fire safety rules in Russian Federation” PPB01-03 (ППБ01-03).

2.2.5 Should gas smell appear in premises, gas supply is to be immediately cut off, aerate the room and call for maintenance service. It is forbidden to light matches, smoke, use open fire, turn on/off electric appliances before trouble is removed!

2.2.6 When performing calculation between consumer and gas supplier, gas meter reading is to be adjusted with standard conditions as per conventional procedure MI 2721-2007 (МИ 2721-2007) applying correction index in regards to actual location of the meter (outside, unheated premises, heated premises).

### **3 STORAGE**

3.1 Packaged gas meters are to be stored according to 2 storage conditions as per GOST 15150-69 (ГОСТ15150-69).

### **4 CONVEYANCE**

4.1 Packaged meters can be conveyed by all means of transport, following paragraph 4.2 and the next requirements:

- 1) ambient temperature from minus 50 to +70 °C;
- 2) jolting with acceleration not exceeding  $98\text{m/s}^2$ ;
- 3) relative humidity not exceeding 98 % at 35 °C.

4.2 Method of stowage and fastening at transporting equipment shall exclude shifting.

4.3 Boxes shall not be exposed to hits and atmospheric precipitation during handling operations and shipment.

### **5 RECYCLING**

5.1 When exceeding lifetime, meters are of no harm for people life, environment and do not require special preparation to be recycled.

### **6 MANUFACTURER WARRANTY**

6.1 Manufacturer secures meter compliance with TU 4213-054-51416204-01 requirements, when conditions for conveyance, storage, mounting and operation are observed. Warranty period – 48 months as from the date of production.

Manufacturer address: 413119, Engels, Saratov oblast, LLC EPO “Signal” (ООО ЭПО “Сигнал”).

6.2 When in service, meter is verified according to GOST 8.324-2002 (ГОСТ8.324-2002).

Verification interval 10 years.

Verification date	Verification results	Inspecting authority		
		Name	Last name and signature of the verification officer	Verification mark

6.3 Meter malfunction during warranty period, proved by the certificate issued by the executive official of gas service with indication of malfunction, is recovered free of charge, however, manufacturer has a right to refuse with free warranty repair in case of nonobservance of terms of warranty.

Meter warranty does not cover the following cases:

- a) mechanical defects caused by conveyance;
- b) when stamp of meter verification mark is broken;
- c) when operation conditions are violated;
- d) damage caused by nature, fire, social factors. Warranty is valid only with properly filled warranty card indicating meter number, date of sale and distinct seller stamp.

Serial number and meter tagging should correspond with those stated in the warranty card.

**WARNING!** Meter is protected from counterfeiting by the ID card № \_\_\_\_\_ . Card, attached to the meter, and label with number are to be preserved during warranty period.

Date of commissioning \_\_\_\_\_ 201 \_\_\_\_\_

Representative of operating organization \_\_\_\_\_ L.S.

(personal signature)

Address of operating organization \_\_\_\_\_ tel. \_\_\_\_\_

**Counterfoil №**

For warranty repair  
(technical service)

(article name)

Lead mechanic of the shop(service center)

(Last name, personal signature)

**WARRANTY CARD BLANK**

LLC EPO "Signal", Engels,413119  
(manufacturer name and address)

**CARD№**

for warranty repair \_\_\_\_\_

(technical servicing) \_\_\_\_\_ (article)

\_\_\_\_\_ produced \_\_\_\_\_

(production date)

Serial№ \_\_\_\_\_

Sold by \_\_\_\_\_

(store name)

«\_\_» \_\_\_\_\_ 201\_\_.

Store stamp \_\_\_\_\_

(personal signature)

Owner and address \_\_\_\_\_

(personal signature)

Performed work to repair malfunction: \_\_\_\_\_

Mechanic shop/service center

(personal signature)

Owner \_\_\_\_\_

(personal signature)

**Approve**

Shop (service center)manager \_\_\_\_\_

(name of repair facility)

Shop stamp (service center)«\_\_» \_\_\_\_\_ 201\_\_

(personal signature)

Notes

**Cut here**



## 7 PACKING CERTIFICATE

Domestic gas meter СГБ G \_\_\_\_\_ СИГНАЛ  
(designation)

Packed \_\_\_\_\_  
LLC EPO "Signal"  
(manufacturer name or code)

in accordance with requirements, provided by the present technical documentation

\_\_\_\_\_ position \_\_\_\_\_ personal signature \_\_\_\_\_ printed name

\_\_\_\_\_  
year, month, date

## 8 TEST CERTIFICATE

Domestic gas meter СГБ G \_\_\_\_\_ СИГНАЛ \_\_\_\_\_  
(designation) (serial number)

produced and approved according to mandatory requirements of the present technical documentation and qualified as ready for operation.

Head of QCD (Quality Control Department)

L.S. \_\_\_\_\_  
personal signature printed name

\_\_\_\_\_  
year, month, date

Shop representative \_\_\_\_\_  
personal signature

Verification Officer

L.S. \_\_\_\_\_  
personal signature

\_\_\_\_\_  
year, month, date

## 9 REFERENCE REGULATORY DOCUMENTS

Indexing of the referred document	Number of section number, subsection, point, item, enumeration, annex of the operation manual, where reference if provided
<p>GOST8.324-2002 State system for traceability of measurements Gas meters Verification procedure.</p>	6.2
<p>GOST5542-87 Combustible natural gasses for industrial and domestic use. Technical regulation.</p>	1.2
<p>GOST15150-69 Machines, instruments and other industrial products. Categories for different climatic regions.</p>	1.1;3.1
<p>GOST20448-90 Hydrocarbonic liquefied power gases for domestic use. Technical regulation.</p>	1.2
<p>MI2721-2007 State system for traceability of measurements Quantity (volume) of gas.</p>	2.2.6
<p>Typical procedures for performing measurements with membrane gas meters without temperature compensation.</p>	2.2.6
<p>PPB01-03 “Fire safety rules in Russian Federation”</p>	2.2.4



**Annex A**  
**(mandatory)**

**State System for Traceability of Measurements**

**Domestic gas meters**  
**СГБ G4 СИГНАЛ, СГБ G2,5 СИГНАЛ,**  
**СГБ G4-1 СИГНАЛ, СГБ G2,5-1СИГНАЛ,**  
**СГК G4 СИГНАЛ, СГК G2,5СИГНАЛ**

**Verification procedure**

Present verification procedure applies to domestic gas meters СГБ G4 СИГНАЛ, СГБ G2,5 СИГНАЛ, СГБG4-1 СИГНАЛ,

СГБ G2,5-1 СИГНАЛ, СГК G4 СИГНАЛ, СГК G2,5 СИГНАЛ (hereinafter “meters”) and puts in place their primary verification. Verification interval 10 years.

## 1 VERIFICATION STAGES

1.1 Stages mentioned in table 1 are performed during verification.

Table 1

Stage name	Paragraph number of the present procedure	Perform during primary verification
1 External examination	6.1	Yes
2 Test run	6.2	Yes
3 Estimation of meter’s primary relative error	6.3	Yes

1.2 Stage execution at paragraph 6.2 of the present procedure shall be performed simultaneously with execution of paragraph 6.3.

## 2.1 VERIFYING INSTRUMENTS

2.1 Verifying instruments can be found in table 2

Table 2

Paragraph number of the present procedure	Name and type of primary or auxiliary verifying instrument; designation of normative document, regulating technical requirements and (or) metrological and primary technical characteristics of the verifying instrument.
1	2
6.2,6.3	У-659 (U-659) calibration setup for domestic gas meters with error not exceeding $\pm 0,5\%$ flow range from 0,016 to 10 m <sup>3</sup> /h, TU4213-027-07508919-97 (ТУ4213-027-07508919-97); АРМ П СГБ-1 (АРМ Р СГБ-1) calibration setup with error not exceeding 0,4 %, flow range from 0,016 to 10 m <sup>3</sup> /h, СИaMI.408863-522ТУ(СЯМИ.408863-522ТУ);

Table 2 continued

1	2
	ВИТ-2 (VIT-2) type psychometric humidity indicator, humidity measurement range from 20 to 90 %; temperature measurement range from 15 to 40 °C, thermometer scale division value 0,2°C TU25-11.1645-84(TY25-11.1645-84); M67 aneroid barometer, measurement range from 79990 to 105320 Pa (from 600 to 790 mm Hg column), with error not exceeding $\pm 106$ Pa (0,8 mm Hg column.) TU 2504-1797-75(TY2504-1797-75).

2.2 Shall different verifying instruments be used, their characteristics should match those mentioned in paragraph 2.1 and should pass testing by metrological service facilities according to verification intervals.

### 3 SAFETY REQUIREMENTS

3.1 During gas meter verification safety requirements are to be met in accordance with “Safety rules for the operation of consumer electric installations” and “Rules of technical operation of consumer electric installations” and safety conditions, mentioned in operation documentation for the meter and verifying instruments.

3.2 Meter shall be verified only by party certified to perform verifying operations, experienced at verifying measurement instruments for gas flow and volume, experienced with operating PC and instructed about safety rules in accordance with the established practice

### 4 VERIFICATION CONDITIONS

4.1 The following conditions shall be followed during verification:

- verifying environment - air;
- ambient temperature and temperature of verifying environment – from plus 17 to plus 23°C;
- relative air humidity — from 30 to 80%;
- atmospheric pressure - from 84 to 106 kPa (from 630 to 800 mm Hg clm);
- difference of process temperature in calibration setup, tested meter and environment does not exceed 1 °C (the requirement is automatically met when following paragraph 4.2 of the present procedure).

4.2 Meters and verifying instruments shall be held in premises, where verification is conducted, not less than 1 hour prior to use.

## **5 PREPARATION FOR VERIFICATION**

5.1 У-659 and АРМ II СГБ-1 setups are prepared for operation in accordance with part 2 of СЯМИ 408863-238 РЭ operation manual and СЯМИ.408863-522 РЭ relatively.

5.2 Preparation of different verifying instruments is conducted according to the attached operation documentation.

## **6 VERIFICATION AND PROCESSING OF MEASUREMENTS RESULTS**

### 6.1 External examination

When conducting meter external examination, carrying-out of the following requirements shall be verified:

- availability of preliminary test record;
- completeness meets requirements of the operation manual;
- properly filled out operation manual;
- no mechanical damage of the meter which hinder its operation;
- legibility of legend and notation on the meter.

Meter is considered to pass verification when it meets the abovementioned requirements.

### 6.2 Testing

Meter testing is conducted by blowing air at the flow of  $Q_{\max}$ , to ensure values change at the indicator device of the meter.

### 6.3 Estimation of primary relative error of the meter

Estimation of primary relative error of the meter is conducted via АРМ II СГБ-1 or У-659 calibration setup at flow of  $Q_{\max}$ ,  $Q_{\text{rated}}$  and  $Q_{\min}$ . One measurement is conducted at every flow value and shall not exceed permissible relative error.

6.3.1 Estimation of primary relative error of the meter with the help of АРМ II СГБ-1 calibration setup.

Process temperature value, at site of the test, shall be measured with thermometer, atmospheric pressure value define with aneroid barometer, cycle time of the meter measurement device shall be defined by PC timer, pressure loss value of the indicator corresponds to average values, defined with combined pressure-and-vacuum gage:

- 200 Pa – at flow  $6 \text{ m}^3/\text{h}$ ;
- 120 Pa – at flow  $4 \text{ m}^3/\text{h}$ ;
- 90 Pa – at flow  $2,5 \text{ m}^3/\text{h}$ ;

30 Pa – at flow 0,04 m<sup>3</sup>/h and 0,025m<sup>3</sup>/h.

6.3.1.1 Install data reading device on the meter (with indicator device cap off) to download data from the indicator device, run “СГБ.exe” (“SGB.exe”) program, setup number is entered automatically.

6.3.1.2 Enter the following data in the dialog mode:

1) process temperature, where verification is conducted, in °C, (temperature may be entered automatically);

2) atmospheric pressure value in Pa;

3) meter type;

4) meter serial number;

5) number of gearing ratio of changeable gear wheel pairs;

6) flow number.

Input of each variable shall be followed by pressing “Enter” key.

6.3.1.3 Open micronozzle valve of the setup, corresponding to the tested flow, press “Enter”, monitor will display relative error. Close valve of the setup.

6.3.1.4 Press “Space” key. Repeat stages 6.3.1.2.6)... 6.3.1.3 for every verified flow.

6.3.1.5 Press “5” key of the PC keyboard to receive printed record copy.

6.3.1.6 Upon completion of meter operation, with setup valves closed, remove data reading device and disconnect the meter from the setup.

6.3.1.7 Estimation of primary relative error at flows  $Q_{max}$ ,  $Q_{rated}$ ,  $0,1Q_{rated}$ ,  $Q_{min}$  is performed according to the formula:

$$\mathcal{D} = \left( \frac{V_{meter}}{V_{setup}} - 1 \right) \cdot 100, \quad (1)$$

with

$V_{meter}$  – cyclic volume of the meter, volume passed through the meter at one operation cycle of the mechanical mechanism, m<sup>3</sup>;

$V_{setup}$  – volume passed through the micronozzle during one operation cycle of the meter’s measuring mechanism, m<sup>3</sup>.

$$V_{setup} = \frac{K \cdot \sqrt{T} \cdot \tau}{1000} \cdot \left( 1 - \frac{P_{meter}}{P_{atm}} \right), \quad (2)$$

with

$K$  – micronozzle calibration factor (according to micronozzle calibration record), dm<sup>3</sup> / (c · K<sup>1/2</sup>);

$T = (273,15 + t)$  – process temperature, K;

$t$  – process temperature, °C;

$\tau$  – time of operation cycle of meter measuring mechanism, s;

1000 – conversion coefficient  $V_{\text{setup}} \text{ m}^3$ ;

$\Delta P_{\text{meter}}$  – meter pressure loss at verifying flow, Pa;

$P_{\text{atm}}$  – atmospheric pressure at verification site, Pa.

Meter cyclic volume ( $V_{\text{meter}}$ ), estimate by formula:

$$V_{\text{meter}} = u \cdot 10^{-2} = 0,4 \frac{Z_1}{Z_2} \cdot 10^{-2}, \quad (3)$$

with

$u$  – gearing ratio of indicator device reducing gear;

0,4 – gearing ratio of fixed gear-wheels of indicator device reducing gear;

$Z_1/Z_2$  – gearing ratio of changeable gear- wheel pairs with gear teeth number  $Z_1$  and  $Z_2$ .

$10^{-2}$  – volume, passing through the meter during one turn of the indicator device roller least order,  $\text{m}^3$ .

Meter cyclic volume is demonstrated in Table 3.

Table 3

Number of gear ratio	1	2	3	4	5
$Z_1/Z_2$	11/43	11/42	11/41	11/40	12/43
$V_{\text{meter}, \text{m}^3}$	$1,0233 \cdot 10^{-3}$	$1,0476 \cdot 10^{-3}$	$1,0732 \cdot 10^{-3}$	$1,1000 \cdot 10^{-3}$	$1,1163 \cdot 10^{-3}$

Number of gear ratio	6	7	8	9	10
$Z_1/Z_2$	11/39	12/42	11/38	12/41	11/37
$V_{\text{meter}, \text{m}^3}$	$1,1282 \cdot 10^{-3}$	$1,1429 \cdot 10^{-3}$	$1,1579 \cdot 10^{-3}$	$1,1707 \cdot 10^{-3}$	$1,1892 \cdot 10^{-3}$

Number of gear ratio	11	12	13	14	15
$Z_1/Z_2$	12/40	11/36	12/39	12/38	12/37
$V_{\text{meter}, \text{m}^3}$	$1,2000 \cdot 10^{-3}$	$1,2222 \cdot 10^{-3}$	$1,2308 \cdot 10^{-3}$	$1,2632 \cdot 10^{-3}$	$1,2973 \cdot 10^{-3}$

Number of gear ratio	16
$Z_1/Z_2$	12/36
$V_{\text{meter}, \text{m}^3}$	$1,3333 \cdot 10^{-3}$

Note – Gear marking:

$Z_1$  - 11 teeth – black colour;

$Z_1$  - 12 teeth – white colour;

$Z_2$  – number of teeth indicated on the butt.

Meter is considered suitable for operation if primary relative error does not exceed:

$\pm 1,5\%$  at flow  $Q_{\max.}, Q_{\text{rated.}}$ ;

$\pm 3\%$  at flow  $Q_{\text{мин.}}$ .

6.3.2 Estimation of primary relative error of the meter with Y-659 calibration setup.

6.3.2.1 Open setup valve at the required flow.

6.3.2.2 Take readings of the indicator device.

Switch stopwatch on and off when zero mark of the indicator device least order passes graduation line.

6.5.2.3 Flow volumes through the meter according to the table 4.

Table 4

Meter designation	СГБ G4 СИГНАЛ, СГБ G4-1 СИГНАЛ, СГК G4СИГНАЛ			СГБ G2,5 СИГНАЛ, СГБ G2,5-1 СИГНАЛ, СГК G2,5СИГНАЛ		
Flow, $Q, \text{m}^3/\text{h}$	6	4	0,04	4	2,5	0,025
Volume passing through the meter, $V_{\text{meter}}, \text{m}^3$	$200 \cdot 10^{-3}$	$160 \cdot 10^{-3}$	$10 \cdot 10^{-3}$	$160 \cdot 10^{-3}$	$100 \cdot 10^{-3}$	$10 \cdot 10^{-3}$

6.5.2.4 Process temperature value during verification shall be estimated according to thermometer reading, atmospheric pressure value shall be estimated according to aneroid barometer reading, meter pressure loss value shall be defined according to combined pressure-and-vacuum gage, time frame of flow of the specified air volume through the meter shall be defined by stopwatch reading.

6.5.2.5 Estimate primary relative meter error for every flow value in percent by formula:

$$\delta = \left( \frac{V_{\text{meter}}}{V_{\text{setup}}} - 1 \right) \cdot 100, \quad (4)$$

with

$V_{\text{meter}}$  – volume shown by the meter indicator device,  $\text{m}^3$ ;

$V_{\text{setup}}$  – volume, set by the micronozzle during stopwatch operation,  $\text{m}^3$ .

$$V_{rated} = \frac{K \cdot \sqrt{T} \cdot \tau}{1000} \cdot \left( 1 - \frac{P_{meter}}{P_{atm}} \right), \quad (5)$$

with

$K$  – calibration factor of the setup micronozzle (as per micronozzle calibration record)  $\text{dm}^3/(\text{c} \cdot \text{K}^{1/2})$ ;

$T = (273,15 + t)$  – process temperature, K;

$t$  – process temperature,  $^{\circ}\text{C}$ ;

$1000 - V_{rated}$  to  $\text{m}^3$  conversion coefficient;

$\tau$  – time frame of flow of the set air volume through the meter, s;

$P_{meter}$  – meter pressure loss at verifying flow, Pa;

$P_{atm}$  – atmospheric pressure at verification site, Pa.

Meters are accepted to operation if primary relative error value does not exceed:

$\pm 1,5$  % at flow  $Q_{max}$ ,  $Q_{rated}$  and  $0,1 Q_{rated}$ ;

$\pm 3$  % at flow  $Q_{min.}$ ;

6.3.2.6 Verification results shall be entered to the record (annex B).

## 7 PRESENTATION OF THE VERIFICATION RESULTS

7.1 Verification results shall be printed out by APM II CГБ-1 setup or entered to the verification record (annex B).

7.2 Having received positive verification results, according to PR 50.2.007-2001 (IIP 50.2.007-2001) the meter receives a seal in the indicator device sealing cup; verification mark shall be stamped and verification officer signs in section 8 of the operation manual.

7.3 Having received negative verification results, meter is not admitted to operation, note about its unworthiness is put in the record and unworthiness report shall be issued, according to PR 50.2.006-94 (IIP 50.2.006-94).



**Annex B**  
(recommended)

RECORD № \_\_\_\_\_ d/d« \_\_\_\_\_ » \_\_\_\_\_

Gas meter CF \_\_\_\_\_ G \_\_\_\_\_ СИГНАЛ№ \_\_\_\_\_

Setup № \_\_\_\_\_

Process temperature \_\_\_\_\_ °C

Atmospheric pressure \_\_\_\_\_ Pa

Air flow during verification, m <sup>3</sup> /h	Pressure loss, $\Delta P_{\text{meter}}$ , Pa	Time frame of flow of the set air volume through the meter, $\tau$ , s	Air volume set by setup micronozzle, $V_{\text{setup}}$ , m <sup>3</sup>	Air volume passed through the meter, $V_{\text{meter}}$ , m <sup>3</sup>	Relative error of the meter, $\delta$ , %
$Q_{\text{mzx}}$ .					
$Q_{\text{rated}}$ .					
$Q_{\text{min}}$ .					

Permissible primary relative error shall not exceed:

±1,5 % at flow  $Q_{\text{max}}$  and  $Q_{\text{rated}}$ ,

±3 % at flow  $Q_{\text{min}}$ .

Pressure loss at  $Q_{\text{max}}$  corresponds to technical regulations.

Leaktightness corresponds to technical regulations.

Physical configuration, fitting dimension, marking, completeness correspond to technical regulations.

Gas meter accepted (not accepted)  
(delete as applicable)

Executing Officer \_\_\_\_\_  
(signature)

Quality Control Representative \_\_\_\_\_  
(signature)

Verification Officer \_\_\_\_\_  
(signature)