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(42 1281)

Metran-150
Pressure Transmitters

Operation Manual

METRAN

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This Manual contains specifications, description of operating principle and design, as well as information required for proper operation of Metran-150 pressure transmitters: 150CD, 150CG, 150TG, 150TA models.

The specifications required for proper operation of 150CD, 150CG (1T-6T range codes), 150TG (0T-6T range codes), 150TA (0T-5T range codes) with HR7 code (HART 7 output and enhanced functionality) are given in Appendix M, which is a separate document.

Metran-150 transmitters manufactured for national economy purposes and exported transmitters are covered in this Manual.

Please note that continuous technical improvement of pressure transmitters may lead to inessential discrepancies in transmitter design, scheme and the contents of accompanying documentation.

Each manufactured transmitter has a unique QR code that allows to access information about this device.

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1 Description and Operation

1.1 Application

1.1.1 Metran-150 Pressure Transmitters (Transmitters) are designed to measure absolute, gage, differential and hydrostatic pressure. Transmitters ensure continuous conversion of pressure into dc analog and/or digital HART output.

Transmitters are designed to measure operating fluids: liquid, steam, and gas.

Transmitters are designed to operate in automatic process control systems in various industries, including food and beverage when coming into contact with food and drink water, as well as on board marine vessels, floating drilling rigs, and offshore fixed platforms.

Transmitters are available in various models and configurations, including design material that fit to various applications. It is the customer's sole responsibility to make a careful analysis of all process variables (such as chemical composition, temperature, pressure, abrasive materials, contaminants, etc.) when selecting a transmitter model, materials and components for a particular application. THE MANUFACTURER DOES NOT ANALYSE COMPATIBILITY OF THE SELECTED TRANSMITTER MATERIALS WITH THE PROCESS MEDIUM OR OTHER PROCESS VARIABLES.

Transmitters comply with the requirements of Technical Regulations of the Customs Union TP TC 020/2011.

Transmitters are designed for operation in non-explosive and explosive environments. Explosion-proof transmitters are available with the following protection types:

- Explosion-proof Enclosure (Exd);
- Intrinsically Safe Electrical Circuit (Exia);
- Explosion-proof Enclosure or Intrinsically Safe Electrical Circuit (Exd/Exia).

Explosion-proof transmitters are designed for installation and operation in hazardous areas and outdoor installations in compliance with GOST IEC 60079-14 and other documents regulating the use of electrical equipment in explosive environments.

Explosion-proof transmitters comply with the requirements of Technical Regulations of the Customs Union TP TC 012/2011.

Exd transmitters meet the requirements of GOST 31610.0, GOST IEC 60079-1 and are available with explosion-proof protection level and 1Ex db IIC T6…T5 Gb X explosion protection marking.

Transmitters with Intrinsically Safe Electrical Circuit protection type meet the requirements of GOST 31610.0, GOST 31610.11 and are available with extra explosion-proof protection level and 0Ex ia IIC T5 Ga X explosion protection marking.

Exd/Exia transmitters (KM code) meet requirements published for Exd and Exia versions depending on the protection type.

Transmitters designed for operation on board marine vessels, floating drilling rigs and offshore fixed platforms meet the requirements of the Rules of Classification and Construction of Marine Vessels, Part XV (RS Rules/C), Rules of Classification and Construction of Marine Vessels, Part XVII (with a distinguishing mark WINTERIZATION(–50)), Rules for Technical Supervision during Construction of Ships and Manufacture of Materials and Products for Ships, Part IV, Section 12 (RS Rules/TS), Rules for Classification, Construction and Equipment of Mobile Offshore Drilling Units and Fixed Offshore Platforms (MODU/FOP Rules), and Rules for Classification, Construction and Equipment of Floating Offshore Oil-and-Gas Production Units. Transmitters are manufactured and tested under the technical supervision of the Russian Maritime Register of Shipping (RS).

Transmitters designed for operation on board marine vessels, floating drilling rigs and offshore fixed platforms have MW1 option code.

Transmitters designed for operation on board marine vessels, floating drilling rigs and offshore fixed platforms with a distinguishing mark WINTERIZATION (–50) have MW2 option code.

1.1.2 Transmitters with HART protocol may transmit information on measured quantity in digital form through the two-wire communication line with DC 4-20 mA signal. Such digital signal can be received and processed by any device that supports HART protocol. Digital output is used to link the transmitter with a portable manually operated HART communicator or a personal computer via a standard serial port and an optional HART modem. In this regard may be performed as follows: reading of measured pressure, transmitter configuration, selection of its basic parameters, resetting of measurement ranges, zero trim and a number of other operations. HART protocol allows for two control devices in a system: a control system and a manually operated communicator.

Such devices have different addresses and therefore Metran-150 may recognize and execute commands for each of them.

Thus, two types of signals are transmitted through the two-wire connection – 4-20 mA analog signal and HART digital signal, which is superimposed on the analog output signal of the transmitter leaving it unaffected.

1.1.3 A model string should be specified in the order for the transmitter.

A model string of the transmitter should be compiled in accordance with Appendix A.

When referring to the transmitter in the documents developed for other products this transmitter can be used with, such documents shall include the following:

- Transmitter model string;
- Specifications: TU 4212-022-51453097-2006.

1.2 Specifications

1.2.1 Transmitter name and model, pressure range codes, maximum upper range value for the model P_{max}, minimum upper range value or measurement range for the model P_{min} are listed in Tables 1-3.

Maximum allowable operating gage pressure for differential and hydrostatic pressure transmitters is listed in Table 2.

The transmitters may be re-ranged to P_U within the limits of maximum range provided that $P_U \geq$ Pmin (Tables 1-3).

Transmitters are available with a standard configuration, unless C1 code is ordered.

The transmitter is set by default to Pmax in kPa or MPa (Tables 1-3), and the lower range value is equal to zero; by default, it is also set to linearly increasing dependence of the output signal and to low level of alarm output.

The transmitter may be set up as required by the customer for any measurement range within the limits specified for the model and for pressure units given in Appendix J3; do not specify C1 in order line.

When ordering C1 code, the transmitter is configured in accordance with the Configuration Data Sheet (Appendix B). If it is not technically feasible to set the transmitter to the requested range, it is set to the nearest possible measurement range.

1.2.2 Depending on the measured pressure, transmitters have the following models:

150TA – absolute pressure;
150TG, 150CG – gage pressure;
150CD – differential pressure.

1.2.3 The transmitters with M5 code are produced with LCD meters.

Transmitters with 0-5 mA output signal (B code) are available with M5 code only.

1.2.4 Maximum allowable reference accuracy (γ) of transmitters, which is expressed as a percentage of the measurement range, shall be better than the values listed in Table 4.

Transmitter's reference accuracy expressed as a percentage of the measurement range is numerically equal to the reference accuracy expressed as a percentage of the output turndown (for transmitters with a linear transfer function of measurable value). For transmitters with square root function, a reference accuracy is rated in percentage of URV. In that case, the reference accuracy expressed as a percentage of the output turndown is calculated by the formula given in Appendix 2 GOST 22520.

Table 1

Transmitter	Model	Range Code	Minimum Measurement Range or Upper Range Value, P_{min}		Maximum Upper Range Value, P_{max}		Overpressure [1], MPa
			kPa	MPa	kPa	MPa	
Gage Pressure Transmitter	150CG	0	0.025	-	0.63	-	4
		1	0.250	-	6.30	-	10
		2	1.250	-	63.00	-	25
		3	5.000	-	250.00	-	
		4	-	0.032	-	1.6	
		5	-	0.200	-	10.0	
		1T	0.125	-	6.30	-	10
		2T	0.400	-	40.00	-	16
		3T	2.500	-	250.00	-	
		4T	-	0.010	-	1.0	
		5T	-	0.030	-	3.0	
		6T	-	0.100	-	10.0	16

Notes

1 Lower range value is equal to zero.

2 150CG transmitters with range codes 0, 1, 2, 1T, 2T can be reset within the range from minus P_{max} up to P_{max}.

3 150CG transmitters with range codes 3, 4, 5 can be reset within the range from minus 97.85 kPa up to P_{max}, it being assumed that the atmospheric pressure is 101.3 kPa.

4 150CG transmitters with range codes 3T, 4T, 5T, 6T can be reset within the range from minus 100 kPa up to P_{max}.

---

[1] For transmitters with S1 code, overpressure value is determined by the lowest value of remote seal flange nominal pressure and overpressure for the transmitter.

Table 1a

Transmitter	Model	Range Code	Minimum Measurement Range or Upper Range Value, P_{min}		Maximum Upper Range Value, P_{max}		Overpressure [1], MPa
			kPa	MPa	kPa	MPa	
Gage Pressure Transmitter	150TG	1	3.2	-	160	-	4
		2	-	0.02	-	1	10
		3	-	0.12	-	6	10
		4	-	0.50	-	25	40
		5	-	16.00	-	60	100
		0T	4.0	-	40	-	1
		1T	3.2	-	250	-	4
		2T	-	0.01	-	1	6
		3T	-	0.03	-	3	15
		4T	-	0.10	-	10	20
		5T	-	0.40	-	40	60
		6T	-	0.60	-	60	100

Notes
1 Lower range value is equal to zero.
2 150TG transmitters with range code 0T can be reset within the range from minus P_{max} up to P_{max}.
3 150TG transmitters can be reset within the range from minus 100 kPa up to P_{max}.

[1] For transmitters with S1 code, overpressure value is determined by the lowest value of remote seal flange nominal pressure and overpressure for the transmitter.

Table 2

Transmitter	Model	Range Code	Minimum Measurement Range or Upper Range Value, P_{min}		Maximum Upper Range Value, P_{max}		Maximum Measurement Range	Maximum Allowable Operating Gage Pressure [1], MPa
			kPa	MPa	kPa	MPa		
Differential Pressure Transmitter	150CD	0	0.025	-	0.63	-	0 to 0.63 kPa	4
		1	0.250	-	6.30	-	0 to 6.30 kPa	10
		2	1.250	-	63.00	-	0 to 63.00 kPa	25; 40
		3	5.000	-	250.00	-	0 to 250.00 kPa	
		4	-	0.032	-	1.6	0 to 1.60 MPa	25
		5	-	0.200	-	10.0	0 to 10 MPa	
		1T	0.125	-	6.30	-	-6.30 to 6.30 kPa	10
		2T	0.400	-	40.00	-	-40.00 to 40.00 kPa	25
		3T	2.500	-	250.00	-	-250.00 to 250.00 kPa	
		4T	-	0.010	-	1.0	-1.00 to 1.00 MPa	
		5T	-	0.030	-	3.0	0 to 3.00 MPa	
		6T	-	0.100	-	10.0	0 to 10.00 MPa	

[1] For transmitters with S1, S2 codes, it is determined by the lowest value of remote seal flange nominal pressure and maximum allowable operating gage pressure for the transmitter.

Table 3

Transmitter	Model	Range Code	Minimum Measurement Range or Upper Range Value, P_{min}		Maximum Upper Range Value, P_{max}		Overpressure [1)], MPa
			kPa	MPa	kPa	MPa	
Absolute Pressure Transmitter	150TA	1	3.2	-	160	-	4
		2	-	0.02	-	1	10
		3	-	0.12	-	6	10
		4	-	0.50	-	25	40
		0T	8.0	-	40	-	1
		1T	5.0	-	250	-	4
		2T	-	0.01	-	1	6
		3T	-	0.03	-	3	15
		4T	-	0.10	-	10	20
		5T	-	0.40	-	40	60

Note
Lower range value is equal to absolute pressure zero.

[1)] For transmitters with S1 code, overpressure value is determined by the lowest value of remote seal flange nominal pressure and overpressure for the transmitter.

Table 4

Maximum Allowable Reference Accuracy for Transmitter Versions ±γ, %			
150CD/150CG			
Reference Accuracy Code			
Range Code	Standard	PA (±0.2%)	PC (±0.5%)
1	*2*	*7*	*8*
0	0.1 for $P_u \geq P_{max}/2$ $0.05P_{max}/P_u$ for $P_u < P_{max}/2$	0.2 for $P_u \geq P_{max}/2$ $0.1P_{max}/P_u$ for $P_u < P_{max}/2$	0.5 for $P_u \geq P_{max}/2$ $0.25P_{max}/P_u$ for $P_u < P_{max}/2$
1, 1T	0.1 for $P_u \geq P_{max}/15$ $0.025+0.005P_{max}/P_u$ for $P_u < P_{max}/15$	0.2 for $P_u \geq P_{max}/10$ $0.1+0.01P_{max}/P_u$ for $P_u < P_{max}/10$	0.5 for $P_u \geq P_{max}/10$ $0.25+0.025P_{max}/P_u$ for $P_u < P_{max}/10$
2-5, 2T-6T	0.075 for $P_u \geq P_{max}/10$ $0.025+0.005P_{max}/P_u$ for $P_u < P_{max}/10$	0.2 for $P_u \geq P_{max}/10$ $0.1+0.01P_{max}/P_u$ for $P_u < P_{max}/10$	0.5 for $P_u \geq P_{max}/10$ $0.25+0.025P_{max}/P_u$ for $P_u < P_{max}/10$

Table 4 (Continued)

Maximum Allowable Reference Accuracy for Transmitter Versions ±γ, %			
150TG/150TA			
Range Code	Standard	PA (±0.2%)	PC (±0.5%)
1	*2*	*3*	*4*
1, 1T	0.075 for $P_u \geq P_{max}/10$ $0.0075P_{max}/P_u$ for 150TG and $P_u < P_{max}/10$ $0.013P_{max}/P_u$ for 150TA and $P_u < P_{max}/10$	0.2 for $P_u \geq P_{max}/10$ $0.02P_{max}/P_u$ for 150TG and $P_u < P_{max}/10$ $0.025P_{max}/P_u$ for 150TA and $P_u < P_{max}/10$	0.5 for $P_u \geq P_{max}/10$ $0.05P_{max}/P_u$ for $P_u < P_{max}/10$
2-4, 2T-4T	0.075 for $P_u \geq P_{max}/10$ $0.0075P_{max}/P_u$ for $P_u < P_{max}/10$	0.2 for $P_u \geq P_{max}/10$ $0.02P_{max}/P_u$ for $P_u < P_{max}/10$	0.5 for $P_u \geq P_{max}/10$ $0.05P_{max}/P_u$ for $P_u < P_{max}/10$
5*)	0.075 for $P_u \geq P_{max}/5$	0.2 for $P_u \geq P_{max}/5$	0.5 for $P_u \geq P_{max}/5$
0T	0.075 for $P_u \geq P_{max}/5$ $0.06+0.012P_{max}/P_u$ for 150TG and $P_{max}/10 \leq P_u < P_{max}/5$	0.2 for $P_u \geq P_{max}/5$ $0.06+0.03P_{max}/P_u$ for 150TG and $P_{max}/10 \leq P_u < P_{max}/5$	0.5 for 150TG and $P_u \geq P_{max}/10$ 0.5 for 150TA and $P_u \geq P_{max}/5$
5T	0.075 for $P_u \geq P_{max}/5$ $0.015P_{max}/P_u$ for $P_u < P_{max}/5$	0.2 for $P_u \geq P_{max}/10$ $0.02P_{max}/P_u$ for $P_u < P_{max}/10$	0.5 for $P_u \geq P_{max}/10$ $0.05P_{max}/P_u$ for $P_u < P_{max}/10$
6T*)	0.075 for $P_u \geq P_{max}/5$ $0.015P_{max}/P_u$ for $P_{max}/50 \leq P_u < P_{max}/5$ $0.065P_{max}/P_u - 2.5$ for $P_u < P_{max}/50$	0.2 for $P_u \geq P_{max}/15$ $0.015P_{max}/P_u$ for $P_{max}/50 \leq P_u < P_{max}/15$ $0.065P_{max}/P_u - 2.5$ for $P_u < P_{max}/50$	0.5 for $P_u \geq P_{max}/35$ $0.015P_{max}/P_u$ for $P_{max}/50 \leq P_u < P_{max}/35$ $0.065P_{max}/P_u - 2.5$ for $P_u < P_{max}/50$

Notes

1 P_{max} – maximum upper range value given in Tables 1, 1a, 2, 3. P_u – upper value or measurement range the transmitter is set to.

2 Maximum permissible reference accuracy of transmitters verifiable in response to analog and digital output signals in compliance with HART protocol (for output code A) and analog output signal (for output code B).

3 For transmitters set to offset measurement range within 0 to P_{max} or within 0 to 100 kPa vacuum or 97.85 kPa (notes 2, 3 to Table 1), the reference accuracy is specified in 1.2.34.

*) for 150TG only.

1.2.5 Variation of output signal γ_{hys} is less than an absolute value of allowable reference accuracy $|\gamma|$, as indicated in paragraph 1.2.4.

1.2.6 All versions of Metran-150 transmitters have a linearly increasing or linearly decreasing, or proportional to the square root dependence of analog output signal on the input value (pressure).

The nominal static characteristic (standard curve) of the transmitter with a linearly increasing dependence of analog output signal on the input value is determined by the following formula:

$$I = I_l + \frac{I_u - I_l}{P_u - P_l} \cdot (P - P_l) \qquad (1)$$

Where I is the current value of output signal;

P is the value of measured quantity;

I_u and I_l are the upper and the lower limits of output signal and equal to:

$I_l=4$ *mA*, $I_u=20$ *mA* – for transmitters with 4-20 mA output;

$I_l=0$, $I_u=5$ *mA* – for transmitters with 0-5 mA output;

P_u is the upper range value;

P_l is lower range value for all transmitters (for standard conditions $P_l=0$)

The nominal static characteristic of the transmitter with a linearly decreasing dependence of analog output signal on the input value is determined by the following formula:

$$I = I_u - \frac{I_u - I_l}{P_u - P_l} \cdot (P - P_l) \qquad (2)$$

Where I, P, I_u, I_l, P_u and P_l are the same as in formula (1).

The nominal static characteristic of the transmitter with square root function is determined by the following formula:

$$I = I_l + (I_u - I_l) \cdot \sqrt{\frac{P}{P_u}}, \qquad (3)$$

Where P is the input value, i.e., differential pressure;

I, I_u, I_l and P_u are the same as in formula (1).

In this case, at the initial section of the curve at pressure value P≤0.8% of P_u, for piecewise linear function refer to Appendix C.

1.2.7 The value of analog output signal of transmitters corresponding to the lower limit value of the measured parameter is equal to:

0 and 4 mA – for transmitters with an increasing characteristic (1) and (3),
5 and 20 mA – for transmitters with a decreasing characteristic (2).

1.2.8 General industrial versions and explosion-proof versions with Explosion-proof Enclosure are powered from DC power supply with the voltage of:

12-42V – for 4-20 mA output signal;
22-42 V – for 0-5 mA output signal.

External wiring diagrams for transmitters are given in Appendix D.

The limits of permissible load resistance (resistance of devices and communication lines) depend on preset supply voltage of transmitters and should not overrun an operating area given in Appendix E.

1.2.9 Metran-150 explosion-proof transmitters with Intrinsically Safe Electrical Circuit protection type are powered from intrinsic safety barriers (units) having Intrinsically Safe Electrical Circuit protection type. In this case, maximum output voltage of barriers U0 does not exceed 24 V (except for transmitters with HR7 code), maximum output current I0 does not exceed 120 mA, and maximum output power P0 does not exceed 0.9 W.

Note. Power supply parameters of transmitters with HR7 code are given in Appendix M.

When using explosion-proof transmitters with Intrinsically Safe Electrical Circuit outside hazardous areas without preservation of explosion-proof properties, the transmitters are allowed to be powered from DC power supply with the voltage specified in 1.2.8.

1.2.10 Permissible load resistances of transmitters are listed in Table 5.

Table 5

Output, mA	Load Resistance	
	R_{min}, Ohm	R_{max}, Ohm
0-5	0	R_{max}≤100(U-10)
4-20	0* at U≤36 V R^*_{min}≥50(U-36) at U>36 V	R_{max}≤42(U-12)
Notes 1 When using explosion-proof transmitters with Intrinsically Safe Electrical Circuit in explosive environments, output resistance of intrinsic safety barriers (blocks) is selected from an operating area given in Figure E.1 when supply voltage is not higher than 24 V. When using HART channel, the intrinsic safety block should have minimum output resistance of at least 250 Ohms. 2 U is supply voltage, V. _____ *- For transmitters with HART signal R_{min} = 250 Ohms at a supply voltage from 18.5 V up to 41 V.		

1.2.11 Power consumption, not exceeding:

- 0.7 V·A – for transmitters with 0-5 mA output;
- 0.9 V·A – for transmitters with 4-20 mA output.

1.2.12 Transmitters are resistant to atmospheric pressure from 66 to 106.7 kPa (group R2, GOST R 52931).

1.2.13 Transmitters are resistant to ambient temperature within the operating range:

For models with range codes 0-5:

- –40 to 80 °C;
- –55 to 80 °C – for LT code;

For models with range codes 0T-6T:

- –40 to 85 °C;
- –55 to 85 °C – for LT code;
- –60 to 85 °C – for BR6 code.

Built-in LCD (M5 code) is immune to the ambient temperature ranging from –45 to 80 °C or 85 °C depending on the transmitter version.

Influence of ambient temperature lower than –45 °C does not cause LCD damage, but may cause illegible readings and decreased update rate.

In terms of immunity to ambient temperature changes, transmitters with MW1 code meet the requirements of 2.1.1, Part XV, RS Rules/C at a temperature up to 55 °C.

Transmitters with MW2 code are immune to the ambient temperature ranging from –50 to 55 °C.

1.2.14 Temperature effect caused by an ambient temperature change within the operating temperature range of –40 to 80 °C for transmitter models with range codes 0-5 and –40 to 85 °C for transmitter models with range codes 0T-6T (refer to 1.2.13) expressed as a percentage of the output turndown per 10 °C does not exceed γ_t values listed in Table 6-6a.

Within the operating temperature range of –60 to –40 °C, the temperature effect γ_t per 10 °C is 3 times more.

1.2.15 Transmitters are resistant to ambient relative humidity 100 % at 35 °C and lower with moisture condensation.

In terms of resistance to ambient relative humidity, transmitters with MW1, MW2 codes meet the requirements of 2.1.2, Part XV, RS Rules/C.

1.2.16 Degree of transmitter protection against dust and water complies with IP66/IP68 group in accordance with GOST 14254.

For transmitters with plug and socket connectors (SC, SC1, SC2, SC6, SC7 codes) degree of protection against dust and water complies with IP65 group in accordance with GOST 14254.

1.2.17 In terms of external mechanical impact resistance, transmitters correspond to:

- Vibration-proof version L3 as per GOST R 52931 for 150CD, 150CG models with range code 0;
- Vibration-proof version V2 as per GOST R 52931 for 150CD/CG models with range codes 1T–6T, 150TG, 150TA;
- Vibration-proof version V1 as per GOST R 52931 for 150CD, 150CG models with range codes 1-5.

Permissible vibration directions are shown in Appendix G.

Table 6

Transmitter Model	Range Code	Isolating Diaphragm Material	Temperature Effect per 10 °C, ± γ_t, %		
			Standard	PA Code	PC Code
1	*2*	*3*	*4*	*5*	*6*
150CD 150CG	0	SST	$0.15 + 0.09\frac{P_{max}}{P_u}$	$0.15 + 0.12\frac{P_{max}}{P_u}$	
	1	SST	$0.05 + 0.06\frac{P_{max}}{P_u}$	$0.05 + 0.08\frac{P_{max}}{P_u}$	
		C-276 alloy	$0.1 + 0.12\frac{P_{max}}{P_u}$	$0.15 + 0.18\frac{P_{max}}{P_u}$	
	2-5	SST	$0.02 + 0.03\frac{P_{max}}{P_u}$	$0.02 + 0.04\frac{P_{max}}{P_u}$	
		C-276 alloy	$0.02 + 0.05\frac{P_{max}}{P_u}$	$0.03 + 0.075\frac{P_{max}}{P_u}$	
		Tantalum	$0.1 + 0.12\frac{P_{max}}{P_u}$	$0.15 + 0.18\frac{P_{max}}{P_u}$	
150TG 150TA	1	SST C-276 alloy	$(0.02 + 0.03\frac{P_{max}}{P_u})$ for $P_u \geq \frac{P_{max}}{10}$ $(0.06 + 0.03\frac{P_{max}}{P_u})$ for $P_u < \frac{P_{max}}{10}$	$(0.02 + 0.05\frac{P_{max}}{P_u})$ for $P_u \geq \frac{P_{max}}{10}$ $(0.06 + 0.05\frac{P_{max}}{P_u})$ for $P_u < \frac{P_{max}}{10}$	
	2-4	SST C-276 alloy	$0.02 + 0.03\frac{P_{max}}{P_u}$	$0.02 + 0.04\frac{P_{max}}{P_u}$	
150TG	5	SST C-276 alloy	$0.05 + 0.05\frac{P_{max}}{P_u}$	$0.05 + 0.065\frac{P_{max}}{P_u}$	

Notes
1 P_{max} and P_u are the same as in the note to Table 4.

Table 6a

Temperature Effect per 10 °C, ± γ_t, %									
Range Code	Transmitter Model								
	150CG/150CD			150TG			150TA		
	Standard	Reference Accuracy Code		Standard	Reference Accuracy Code		Standard	Reference Accuracy Code	
		PA (±0.2%)	PC (±0.5%)		PA (±0.2%)	PC (±0.5%)		PA (±0.2%)	PC (±0.5%)
0T	–			$0.02+0.03P_{max}/P_u$	$0.02+0.05P_{max}/P_u$		$0.02+0.03P_{max}/P_u$	$0.02+0.05P_{max}/P_u$	
1T	Diaphragm: SST, SST+Au $0.05+0.06P_{max}/P_u$ Diaphragm: C-276 alloy $0.01+0.12P_{max}/P_u$	Diaphragm: SST, SST+Au $0.05+0.08P_{max}/P_u$ Diaphragm: C-276 alloy $0.15+0.18P_{max}/P_u$		$(0.02+0.03P_{max}/P_u)$ for $P_u \geq P_{max}/10$ $(0.06+0.03P_{max}/P_u)$ for $P_u < P_{max}/10$	$(0.02+0.05P_{max}/P_u)$ for $P_u \geq P_{max}/10$ $(0.06+0.05P_{max}/P_u)$ for $P_u < P_{max}/10$		$(0.02+0.03P_{max}/P_u)$ for $P_u \geq P_{max}/10$ $(0.06+0.03P_{max}/P_u)$ for $P_u < P_{max}/10$	$(0.02+0.05P_{max}/P_u)$ for $P_u \geq P_{max}/10$ $(0.06+0.05P_{max}/P_u)$ for $P_u < P_{max}/10$	
2T-4T	Diaphragm: SST, SST+Au $0.02+0.03P_{max}/P_u$ Diaphragm: C-276 alloy $0.02+0.05P_{max}/P_u$	Diaphragm: SST, SST+Au $0.02+0.04P_{max}/P_u$ Diaphragm: C-276 alloy $0.03+0.075P_{max}/P_u$		$0.02+0.03P_{max}/P_u$	$0.02+0.04P_{max}/P_u$		$0.02+0.03P_{max}/P_u$	$0.02+0.04P_{max}/P_u$	
5T				$0.05+0.05P_{max}/P_u$	$0.05+0.065P_{max}/P_u$		$0.05+0.05P_{max}/P_u$	$0.05+0.065P_{max}/P_u$	
6T				$0.05+0.05P_{max}/P_u$	$0.05+0.065P_{max}/P_u$		–		

Notes

1 P_{max} and P_u are the same as in the note to Table 4.

2 For transmitters with remote seals (S1, S2 codes) temperature effect is calculated separately for each version of the remote seal, taking into account specific application conditions.

1.2.18 Vibration effect (1.2.17) expressed as a percentage of the output turndown does not exceed γ_f values determined by the formulas:

- for 150TG, 150TA models

$$\gamma_f = \pm 0.1 \cdot \left(\frac{P_{\max}}{P_u} \right) \%, \quad (4)$$

where P_{max} and P_u are the same as in the note to Table 4;

- for other models

$$\gamma_f = \pm 0.25 \cdot \left(\frac{P_{\max}}{P_u} \right) \%, \quad (5)$$

where P_{max} and P_u are the same as in the note to Table 4.

1.2.19 Transmitters are designed to measure pressure and differential pressure of media, and wetted materials (Appendix A) are corrosion-resistant when they are in contact with such media.

1.2.20 Output ripple within the frequency range from 0.06 up to 5 Hz does not exceed $0.7|\gamma|$. For γ values, refer to paragraph 1.2.4.

Analog output ripple within the frequency range of 5 to 10^6 Hz does not exceed 1.5% of the output turndown for 0-5 mA output signal and 0.5% of the output turndown for 4-20 mA output signal.

Analog output ripple with the frequency over 10^6 Hz is not rated.

Output ripple is rated at load resistances:

- 1 kOhm for transmitters with 0-5 mA output signal;
- 250 Ohm – for transmitters with 4-20 mA output signal in the absence of communication with the transmitter via HART channel.

Note
The ripple is rated at a minimum time of measurement result averaging.

1.2.21 Analog output settling time (T_{settl}) at a stepped variation of a variable, which is 63.2% of measurement range (refer to Figure 1), is determined by the delay time (T_D), transient time (T_T).

Delay time (T_D):

does not exceed 90 ms, rating value $T_{D\ rated}$= 45 ms – for all models with range codes 0-5.

Transient time (T_T) does not exceed:

- 100 ms for 150CD, 150CG models range codes 2-5, 150TG, 150TA models range codes 1-5;
- 400 ms for 150CD, 150CG models range code 1;
- 900 ms for 150CD, 150CG models range code 0.

For transmitter models 150CD, 150CG with range codes 1T–6T, 150TG with range codes 0T–6T, 150TA with range codes 0T–5T, standard output settling time at a stepped variation of a variable, which is 63.2% of measurement range, does not exceed:

- 100 ms – 150TG with range codes 0T–6T, 150TA models with range codes 0T– 5T;
- 130 ms – 150CD, 150CG models with range codes 1T– 6T.

Notes

1 Dynamic characteristics of the transmitter are rated at (23 ± 5) °C and at minimum electronic damping of transmitter output. Electronic damping is characterized by averaging time of measurement results t_D (1.2.22).

2 Sinusoidal oscillations bandwidth of the transmitter variable at the level of 63.2% of output signal is from 0 to f and can be determined by empiric formulas:

$$f = \frac{1}{2\pi t_D}, \text{ Hz} \quad \text{at} \quad t_D > T_T, \text{ when} \quad f \leq 25 \text{ Hz} \qquad (6)$$

$$f = \frac{1}{2\pi T_T}, \text{ Hz} \quad \text{at} \quad t_D < T_T, \text{ when} \quad f \leq 25 \text{ Hz} \qquad (6a)$$

1.2.22 The transmitter has electronic output damping, which is characterized by averaging time of measurement results (t_D). The damping time increases the settling time of the transmitter smoothing variations in output readings caused by rapid input changes. The damping time is selected from the following values: 0.045; 0.5; 1.2; 2.5; 5; 10; 20; 40 s, and set by the user during configuration.

1.2.23 Transmitter turn-on time measured as the time from power-on to analog output settling with accuracy better than 5% of steady-state value does not exceed 2 s at minimum electronic damping of transmitter output signal.

1.2.24 Transmitter LCD in pressure measurement mode displays as follows:

a) value of measured pressure in digital form in preset units or expressed as a percentage of output turndown;

b) pressure units, mmHg, mmH2O, bar, kgf/cm^2, kgf/m^2, Pa, kPa, MPa; % of span;

c) diagnostic messages on faults, failures, and warnings in accordance with Table 7. Diagnostic messages, if any, are displayed in switching mode with the units. If there are two conditions, both messages are generated in turn, and the units are not displayed.

Table 7

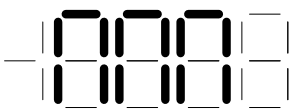
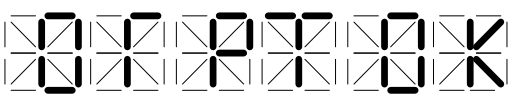
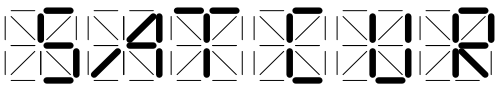
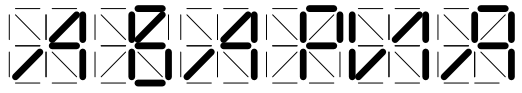
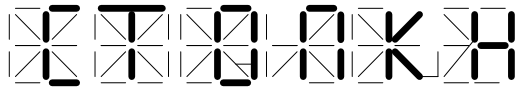
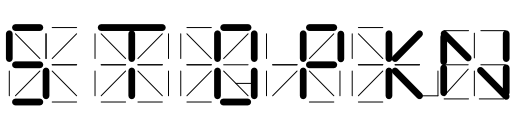
Symbols on DI (Russian / English)	Transmitter Operating Mode
	Display overflow due to incorrectly selected units
	Failure that does not affect the output parameters is detected in the transmitter. The transmitter generates error codes in accordance with Appendix J2.
	Output current is saturated (1.2.35)
	

Table 7 (Continued)

	Failure that affects the output parameters is detected in the transmitter. The transmitter generates error codes in accordance with Appendix J2. Fault current is set (1.2.25)
	One of the buttons is stuck in a depressed state or has been pressed for too long
	
Note. DI - display	

Messages on the transmitter's display are generated in Russian or English. Appropriate language is set by the user in response to a special HART command or using push-button switches in accordance with Setup Guide SPGK.5295.000.00 IN.

1.2.25 In normal operating mode, the transmitter continuously performs self-diagnostic routines. If self-diagnostic routines detect a failure, the transmitter drives its analog output to configured alarm in accordance with Table 8 and generates messages in accordance with Table 7.

Table 8

Output Signal, mA	Alarm Level	Alarm Value
4-20	Low	3.6 mA
	High	23 mA
0-5	Low	minus 0.1 mA
	High	5.75 mA

Notes
1 Output alarm values are set by the user.
2 Newly manufactured transmitters are available with low fault signal level.

Transmitters perform self-test to inspect the technical condition of:

- Microprocessor;
- Programmable storage device on ADC board (ADC - analog-digital converter);
- Reprogrammable microprocessor memory;
- ADC board connection;
- Transmitter operating mode;
- Sensor.

1.2.26 Variation of initial output value in differential and hydrostatic pressure transmitters caused by changes in operating gage pressure from zero to maximum permissible value and from maximum permissible value to zero (Table 2) and expressed as a percentage of the output turndown does not exceed γ_{op} values determined by the formula

$$\gamma_{op} = K_{op} \cdot P_{op} \cdot \frac{P_{max}}{P_u}, \qquad (7)$$

Where P_{max} and P_u are the same as in the note to Table 4;

P_{op} is the change in operating gage pressure, MPa;

K_{op} values are listed in Table 8a.

Table 8a

Transmitter Model	Range Code	Isolating Diaphragm Material	± K_{op}* %/1 MPa Values Depending on P_{op}	
			$P_{op} \leq 16$ MPa	$P_{op} > 16$ MPa
150CD	0	SST	0.700	–
150CD	1	SST	0.065	–
		C-276 alloy	0.140	–
150CD	1T	SST**	0.100	–
		C-276 alloy	0.140	–
150CD	2T	SST**	0.020	0.050
	2, 3, 3T	SST**	0.015	0.050
	2, 3, 2T, 3T	C-276 alloy	0.040	0.100
	2, 3	Tantalum	0.080	0.080
150CD	4 4T, 5T	SST**	0.025	0.075
		C-276 alloy	0.080	0.080
		Tantalum		
150CD	5 6T	SST**	0.015	0.075
		C-276 alloy	0.080	0.080
		Tantalum		
* For transmitters with PA, PC code, K_{op} values are 1.5 times more; ** including SST gold-plated.				

1.2.27 Gage and absolute pressure transmitters withstand overpressure and after the exposure their rated characteristics do not change. The overpressure value may be:

64 times greater than the upper range value for 150CG model with range code 0;
150 times greater than the upper range value for 150CG model with range code 1;
75 times greater than the upper range value for 150CG model with range code 2;
20 times greater than the upper range value for 150CG model with range code 3;
1.25 times greater than the upper range value for 150CG model with range codes 4, 5;
2.5 times greater than the upper range value, but no more than overpressure indicated in column 8 of Tables 1 and 3 for 150TG model with range codes 1-5, 150TA model with range codes 1-4.

Gage and absolute pressure transmitters withstand overpressure for 1 minute (as indicated in Tables 1, 1a and 3).

Note. For transmitters with S1, S2 codes, overpressure value is determined by the lowest value of remote seal flange nominal pressure and overpressure for the transmitter.

In some cases, overpressure may result in small changes of the rated transmitter characteristics. Following the exposure to overpressure, adjust an initial output signal value to exclude this effect.

1.2.28 150CD transmitters withstand overpressure from the positive chamber and after the exposure their rated characteristics do not change. The overpressure value may be:

64 times greater than the upper range value for range code 0;
150 times greater than the upper range value for range code 1;
75 times greater than the upper range value for range code 2;
20 times greater than the upper range value for range code 3;
1.25 times greater than the upper range value for range codes 4, 5.

150CD transmitters with range codes 0–5, 1T withstand overpressure from negative and positive chambers for 1 minute when exposed to unilateral pressure equal to the maximum allowable operating gage pressure (Table 2). 150CD transmitters with range codes 2T–5T withstand overpressure from negative and positive chambers for 1 minute when exposed to unilateral pressure equal to 16 MPa. 150CD transmitters with range code 6T withstand overpressure from the positive chamber for 1 minute when exposed to unilateral pressure equal to 16 MPa and from the negative chamber for 1 minute when exposed to unilateral pressure equal to 4 MPa.

Note. For transmitters with S1, S2 codes, unilateral pressure value is determined by the lowest value of remote seal flange nominal pressure and unilateral pressure for the transmitter.

In some cases, unilateral overload with operating gage pressure may result in small changes of the rated transmitter characteristics. Following the exposure to overpressure, adjust an initial output signal value to exclude this effect.

1.2.29 Mean time between failures (MTBF) of the transmitter considering maintenance regulated by this Operation Manual is 200,000 hours.

1.2.30 Average lifetime of transmitters, except for transmitters operated to measure corrosive media (their average lifetime depends on the corrosive media properties, operating conditions and materials employed – see Table A.1 and A.2), is at least:

– 20 years;

– 30 years – for ML option.

1.2.31 The weight of transmitters does not exceed the values listed in Table 9.

Table 9

Model	Weight *, kg, max	Note
150CD/CG	3.8 (5.1)	Without display
	4.0 (5.3)	With display
150 TG/TA	1.5 (2.8)	Without display
	1.7 (3.0)	With display
Note. Data in brackets are given for HS transmitters (stainless steel electronics module housing; available for transmitters with HR7 code only) _____ * Without mounting parts		

1.2.32 Installation and mounting dimensions of transmitters with installed mounting parts conform to those indicated in Appendix G.

1.2.33 Transmitters as per GOST 27.003 are products for continuous application, restorable and repairable items.

1.2.34 Transmitters enable an offset range setting with lower range value (zero offset) set to any value within an acceptable range of the transmitter (Tables 2, 3 and Note 2, 3 to Table 1) provided that: measurement range is greater than or equal to P_{min}, upper range value is less than or equal to P_{max} (where P_{max} is the maximum upper range value, P_{min} is the minimum measurement range (Tables 1-3)).

For 150CD/150CG with range codes 0–5, 150TG with range codes 1–5, 150TA with range codes 1–4, adjusted to offset measurement range with nonzero lower range value within the range from 0 to P_{max} or from 0 to 100 kPa vacuum or 97.85 kPa (Notes 2 and 3 to Table 1), the reference accuracy expressed as a percentage of the span is better than γ_{off} values determined by the formula:

$$\gamma_{off} = \gamma \cdot \frac{P_u}{P_u - P_l}, \qquad (8)$$

Where P_u is the upper range value;

P_l is a lower range value (Pl≠0*)*;

γ is the maximum allowable reference accuracy when set to P_u in accordance with Table 4.

1.2.35 Limit values (restriction levels) of the analog output signal are listed in Table 10.

Table 10

Output Signal, mA	Limits of Output Signal, mA	
	Lower	Upper
4-20	3.84±0.02	21.6±0.16
0-5	- 0.05±0.02	5.55±0.05

1.2.36 Transmitters have an external button to adjust an offset of transmitter characteristic (zero calibration) from the mounting position on the object or static pressure located on the electronics module housing.

1.2.37 Transmitters are protected against reverse polarity of supply voltage.

1.2.38 Transmitters have transient protection block for protection against unsteady processes in communication lines caused by lightning, welding, operation of powerful electrical equipment and starting mechanisms.

1.2.39 Transmitters with installed display (M5 code) are configured by built-in control tools.

1.2.40 Transmitters with A code of output signal are configured and controlled remotely using a control device supporting HART Revision 5.

1.2.41 All models of transmitters with range codes 0–5 are stable to EMI values given in Table 10b; performance criterion is A:

- as per GOST 32137 for transmitters with standard terminal block;
- as per GOST R IEC 61326–1 for transmitters with T0 terminal block.

All models of transmitters with range codes 0T–6T are stable to EMI values given in Table 10.1b; performance criterion is A as per GOST R IEC 61326–1.

In terms of EMI resistance, transmitters with MW1, MW2 codes meet the requirements of 2.1.8, Part XV, RS Rules/C.

Table 10b

Port	EMI		Electromagnetic Compatibility Standard	Value	
				Option Code	
				Standard	T0
Input – Output (signal/control)	Nano-second impulse interference		GOST 30804.4.4	2 kV	1 kV
Housing	Radio-frequency electromagnetic field within frequency band, MHz	80−1000	GOST IEC 61000-4-3	10 V/m	10 V/m
		800−960		30 V/m	–
		1400−2000		30 V/m	3 V/m
		2000−2700		–	1 V/m
Housing	Electrostatic discharges	Contact discharge	GOST 30804.4.2	8 kV	4 kV
		Air discharge		15 kV	8 kV
Input – Output (signal/control)	Conducted interference		GOST R 51317.4.6	10 V	3 V
Housing	Power frequency magnetic field	Long magnetic field	GOST R 50648	40 A/m	30 A/m
		Short-term magnetic field 3 seconds		600 A/m	–
Input – Output (signal/control)	Microsecond high-energy impulse interference applied under	wire-wire scheme	GOST R 51317.4.5	1 kV	–
		wire-ground scheme		2 kV	1 kV
Housing	Pulsed magnetic field		GOST R 50649	600 A/m	–
Housing	Evanescent oscillatory magnetic field		GOST R 50652	100 A/m	–
Note. During interference exposure, HF pulses level within frequency band over 5 kHz and output pulse height with duration of less than 100 ms are not rated.					

Table 10.1b

Port	EMI		Electromagnetic Compatibility Standard	Value	
				Terminal Block Option	
				Standard	T0
Input – Output (signal/control)	Nano-second impulse interference		GOST 30804.4.4	1 kV	
Housing	Radio-frequency electromagnetic field within frequency band, MHz	80–1000	GOST IEC 61000-4-3	10 V/m	
		1400–2000		3 V/m	
		2000–2700		1 V/m	
Housing	Electrostatic discharges	Contact discharge	GOST 30804.4.2	4 kV	
		Air discharge		8 kV	
Input – Output (signal/control)	Conducted interference		GOST R 51317.4.6	3 V	
Housing	Power frequency magnetic field	Long magnetic field	GOST R 50648	30 A/m	
Input – Output (signal/control)	Microsecond high-energy impulse interference applied under	wire-ground scheme	GOST R 51317.4.5	1 kV	
Note. During interference exposure, HF pulses level within frequency band over 5 kHz and output pulse height with duration of less than 100 ms are not rated.					

1.2.42 Additional transmitter error of all models with range codes 0-5 caused by exposure to electromagnetic interference (1.2.41) and expressed as a percentage of output turndown does not exceed the values given in Table 10c:

Table 10c

EMI	Additional Error	
	Terminal Block Option	
	Standard	T0
Radio frequency electromagnetic field (GOST IEC 61000-4-3)	±0.1 % of P_{max} for transmitters without built-in display	±1 % of P_{max}
	±0.4 % of P_{max} for transmitters with built-in display (M5 code)	
Other EMI are as stated in Table 10b.	±1 % of P_{max}	
Note. P_{max} is the same as in the note to Table 4		

Additional transmitter error of all models with range codes 0T–6T for standard and T0 terminal block options caused by exposure to electromagnetic interference (1.2.41) and expressed as a percentage of output turndown shall not exceed ±1 % of Pmax.

1.2.43 Transmitters of all models with range codes 0-5 meet noise emission rates specified in Table 10d.

Table 10d

Terminal Block Option	Electromagnetic Compatibility Standard	Frequency Band, MHz	Field Intensity, dB	Measuring Distance, m	Instrument Class
Standard	GOST 30805.22 (CISPR22)	30 – 230	40	10	A
		230 – 1000	47		
T0	GOST R 51318.11 (CISPR11)	30 – 230	40	3	B
		230-1000	47		

Transmitters of all models with range codes 0T–6T meet interference emission rates established for Class B in accordance with GOST R 51318.11 (CISPR11), i.e. field strength of 40 dB within the frequency range of 30–230 MHz and 47 dB within the frequency range of 230–1000 MHz at the distance of 3 m.

Transmitters with MW1, MW2 codes meet interference emission rates in accordance with 2.1.8, Part XV, RS Rules/C.

1.2.44 Standard terminal block of transmitters with range codes 0T–6T protects them from the effects of lightning and other transient overvoltages as per IEEE C62.41, category B, with the following parameters:

- ring wave: 6 kV maximum voltage, 100 kHz oscillation frequency, 0,5 μs rise time;

- combination wave: 6 kV maximum voltage, 1.2/50 μs voltage impulse and 3 kA maximum current, 8/20 μs current impulse.

1.2.45 Analog output signal recovery time for the transmitter with an accuracy of ±5% of the output signal turndown following supply voltage interruption for maximum 20 ms is less than 35 ms.

1.2.46 Transmitters are resistant to rain effects with an intensity of 5 mm/min in accordance with GOST 15150.

1.2.47 Transmitters retain functional performance after exposure to sunlight: integrated radiation flux density is 1,120 W/m^2, flux density of ultraviolet spectrum is 68 W/m^2 in accordance with GOST 15150.

1.2.48 Transmitters are corrosion-resistant to salt (sea) mist in accordance with GOST 15150.

1.2.49 Outer surfaces of transmitters are resistant to dynamic effects of dust in accordance with GOST 15150.

1.2.50 When explosion-proof transmitters are ordered with AR code, they are exposed to additional test for 360 hours.

1.2.51 For a transmitter with HART protocol signal, active component of the input impedance (resistance between power supply terminals) is not less than 100 kOhms, capacitive component of the input impedance is not more than 12,000 pF, capacitance between the transmitter housing and any power supply terminal is not more than 12,000 pF.

1.2.52 Following transmitter resetting to any measurement limits from P_{max} to P_{min} referred to in 1.2.1, the transmitter meets the requirements of this Operation Manual, and the reference accuracy and variation are better than those stipulated for the respective measurement limits (1.2.4, 1.2.5). Transmitter calibration after such resetting is not required.

1.2.53 Transmitters in shipping containers withstand vibration conforming to F3 Group in accordance with GOST R 52931 provided that vibration is applied in the direction marked on the containers with handling sign THIS SIDE UP.

1.2.54 Transmitters with SM code are earthquake resistant to 9 intensity degree on the MSK-64 scale provided that they are installed at a height of 70 m above the ground zero as per GOST 30546.1.

1.2.55 Seismic effect (1.2.54) expressed as a percentage of the measurement range does not exceed ±1 % of P_{max} (P_{max} is the same as in the note to Table 4).

1.2.56 Electrical insulation resistance between electrical circuits and transmitter housing at ambient temperature 15–35 °C and relative humidity up to 80% is equal to or exceeds the values given in Table 10f:

Table 10f

Terminal Block Option	Insulation Resistance, MOhm
–	5; 20 – at removed ground jumper of the terminal block
T0	20

For transmitters with MW1, MW2 codes, minimum insulation resistance at ambient temperature 15–35 °C and relative humidity 80 % complies with Table 3.1, Appendix 1, Section 12, Part IV, RS Rules/TS.

1.2.57 The specified lifetime of transmitters operated at hazardous facilities is 20 years provided that wetted materials are corrosion-resistant when in contact with fluids.

1.2.58 The specified shelf life of transmitters (except for transmitters with OR code) is 20 years.

Total shelf and operating time shall not exceed the specified lifetime.

1.2.59 Transmitter materials comply with GEST 79/82 for use in contact with chlorine.

1.2.60 Transmitters with MW1, MW2 codes are designed for all macroclimatic areas onshore and at sea, for unrestricted navigation vessels and for installation on open deck and in open spaces as well as any closed areas.

1.2.61 In terms of resistance to motions and long-term heel, transmitters with MW1, MW2 codes meet the requirements of 2.1.4, Part XV, RS Rules/C.

1.2.62 In terms of resistance to vibration occurring in any direction, transmitters with MW1, MW2 codes meet the requirements of 2.1.3, Part XV, RS Rules/C with the following parameters:

Frequency range 2 – 100 Hz;
Displacement amplitude ±1 mm where frequency range is 2 – 13.2 Hz;
Acceleration amplitude ±0.7 g where frequency range is 13.2 – 100 Hz.

Vibration effect shall not exceed ±0.1 % of P_{max} (P_{max} is the same as in the note to Table U.4).

1.2.63 Transmitters with MW1, MW2 codes are immune to the following shock load in any direction:

Acceleration amplitude ± 5g;
Shock pulse length 6 – 30 ms;
Number of shocks 20 in each direction;
Repetition frequency 40–80 shocks per minute.

Shock load does not trigger an alarm in accordance with 1.1.30 or a fault message. After the exposure, the transmitters meet 1.2.4 and 1.2.5 requirements.

1.2.64 In terms of resistance to supply voltage deviation from power rating, transmitters with MW1, MW2 codes meet the requirements of 2.1.6, Part XV, RS Rules/C.

Transmitters with MW1, MW2 codes do not affect operability of automation systems if power supply is interrupted as described in 2.1.6, Part XV, RS Rules/C.

1.2.65 Transmitters with MW1, MW2 codes are made of materials resistant to marine environment in accordance with 2.1.1, Part XV, RS Rules/C.

1.2.66 In terms of resistance to hoarfrost and dew, transmitters with MW1, MW2 codes meet the requirements of 3.13, Appendix 1, Section 12, Part IV, RS Rules/TS.

1.3 Design and Operation

1.3.1 The transmitter consists of a sensor and an electronics module.

The sensor consists of a measuring unit and analog-digital converter (ADC) board. Pressure is applied to the measuring unit chamber, which results in sensing element strain and electrical signal change.

The electronics module inverts an electrical signal into a corresponding output signal.

1.3.2 The diagram of 150CD, 150CG transmitters with range codes 0-5 is shown in Figure 2.

The measuring unit of transmitters consists of housing 1 and capacity cell 2. The capacity cell is mechanically, electrically and thermally insulated from the process medium and the atmosphere.

The measured pressure is transmitted through isolating diaphragms 3 and parting fluid 4 to center diaphragm 5 located in the center of the capacity cell.

Pressure deflects the center diaphragm. Deflection of the center diaphragm leads to the difference of capacitances between the center diaphragm and capacitor plates 6 located on both sides of the center diaphragm.

The difference between capacitances is measured by ADC and inverted by the electronics module into a corresponding output signal.

1.3.3 The diagram of 150TG, 150TA transmitters is shown in Figure 3.

The piezoresistive strain gage sensor on a silicon substrate is used in the measuring units of 150TG, 150TA models. The sensing element of the strain gage sensor is a silicon plate 1 with film strain gages (SOC structure).

Pressure is applied through the isolating diaphragm 2 and parting fluid 3 to the sensing element of the strain gage. Pressure impact is converted to the sensing element deflection causing a change in electrical resistance of its strain gages and bridge circuit imbalance. The electrical signal generated by bridge circuit imbalance is measured by ADC and transmitted to the electronics module.

The electronics module inverts this change into a corresponding output signal.

In 150TA model, a chamber above the sensing element is evacuated and sealed.

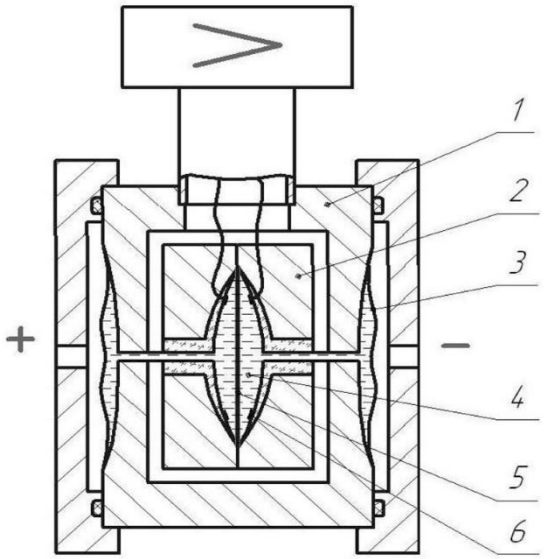


Figure 2. 150CD, 150CG Models with Range Codes 0–5

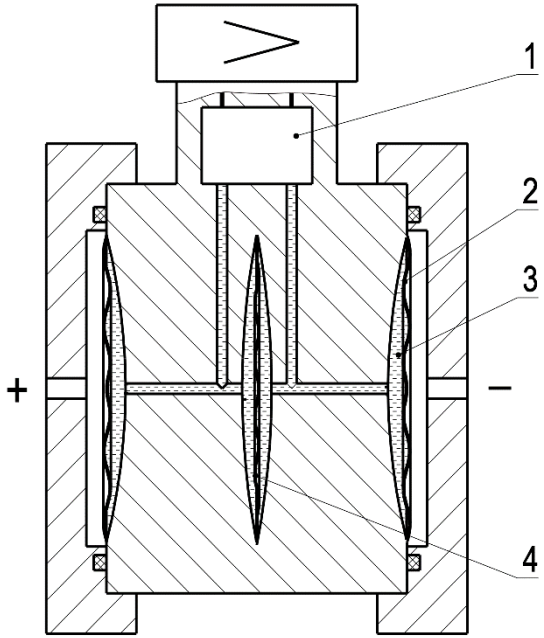


Figure 2a. 150CD, 150CG Models with Range Codes 1T–6T

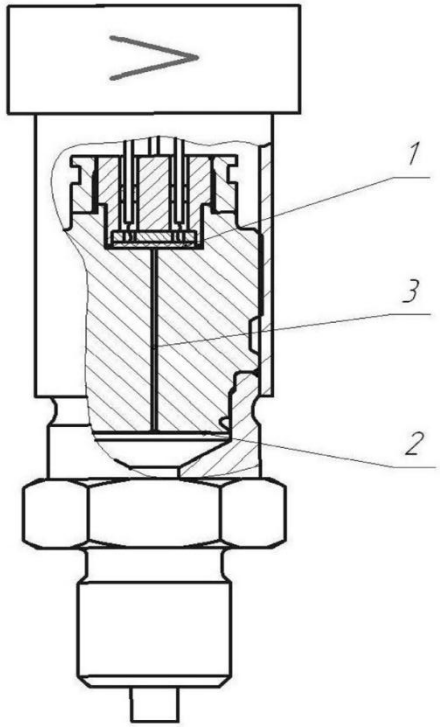


Figure 3. 150TG, 150TA Models

1.3.3a The diagram of 150CD, 150CG transmitters with range codes 1T–6T is shown in Figure 2a.

The piezoresistive strain gage sensor on a silicon substrate is used in the measuring units of 150CD, 150TA models with range codes 1T–6T. The sensing element of the strain gage sensor is a silicon plate with film strain gages (SOC structure).

The measuring unit of 150CD, 150CG models with range codes 1T–6T consists of isolating diaphragms 2. The cavity between the diaphragms is filled with parting fluid 3. The sensing element 1 is placed inside a closed cavity filled with parting fluid. The measuring unit has a protective diaphragm 4 against overpressure. Gage pressure (150CG) when supplied through the isolating diaphragm on the high pressure side and through the parting fluid is applied to the sensing element, the low-pressure chamber is vented to the atmosphere. Differential pressure (150CD) when supplied through the isolating diaphragm on the high pressure side and through the isolating diaphragm on the low pressure side and the parting fluid is applied to the sensing element.

Measured pressure impact is converted to the sensing element deflection causing a change in electrical resistance of its strain gages and bridge circuit imbalance. The electrical signal generated by bridge circuit imbalance is measured by ADC and transmitted to the electronics module.

The electronics module inverts this change into a corresponding output signal.

1.3.4 Functionally, the channel for measuring unit signal conversion (Figure 4) consists of analog-digital converter (ADC), ADC memory module, microcomputer with memory module, temperature sensor, digital-analog converter (DAC), voltage stabilizer, RFI filter, transient protection block, parameter adjustment and control unit, HART modem for transmitters with output code A. In addition, electronics modules include LCD (by customer's order - M5 code).

Structurally, the analog-digital converter and ADC memory module are located on ADC board being mounted in the sensor.

Other elements of the functional block diagram are located in the electronics module housing.

The electronics module (Figure 5) is located inside the housing 10. The housing is closed by covers 5 and 11 that are sealed with rubber rings 17. Covers of explosion-proof transmitters are locked by clips 13. Standard transmitter has a terminal block 6 with RFI filter installed for protection against high-energy pulse arising from man-made and natural interference in accordance with 1.2.41, 1.2.44. The terminal block has terminals for connection of cable cores. The electronics module includes screw 12 to connect the shield, if shielded cable is used, bolt 8 to ground the housing, external button 15 to adjust initial output signal value.

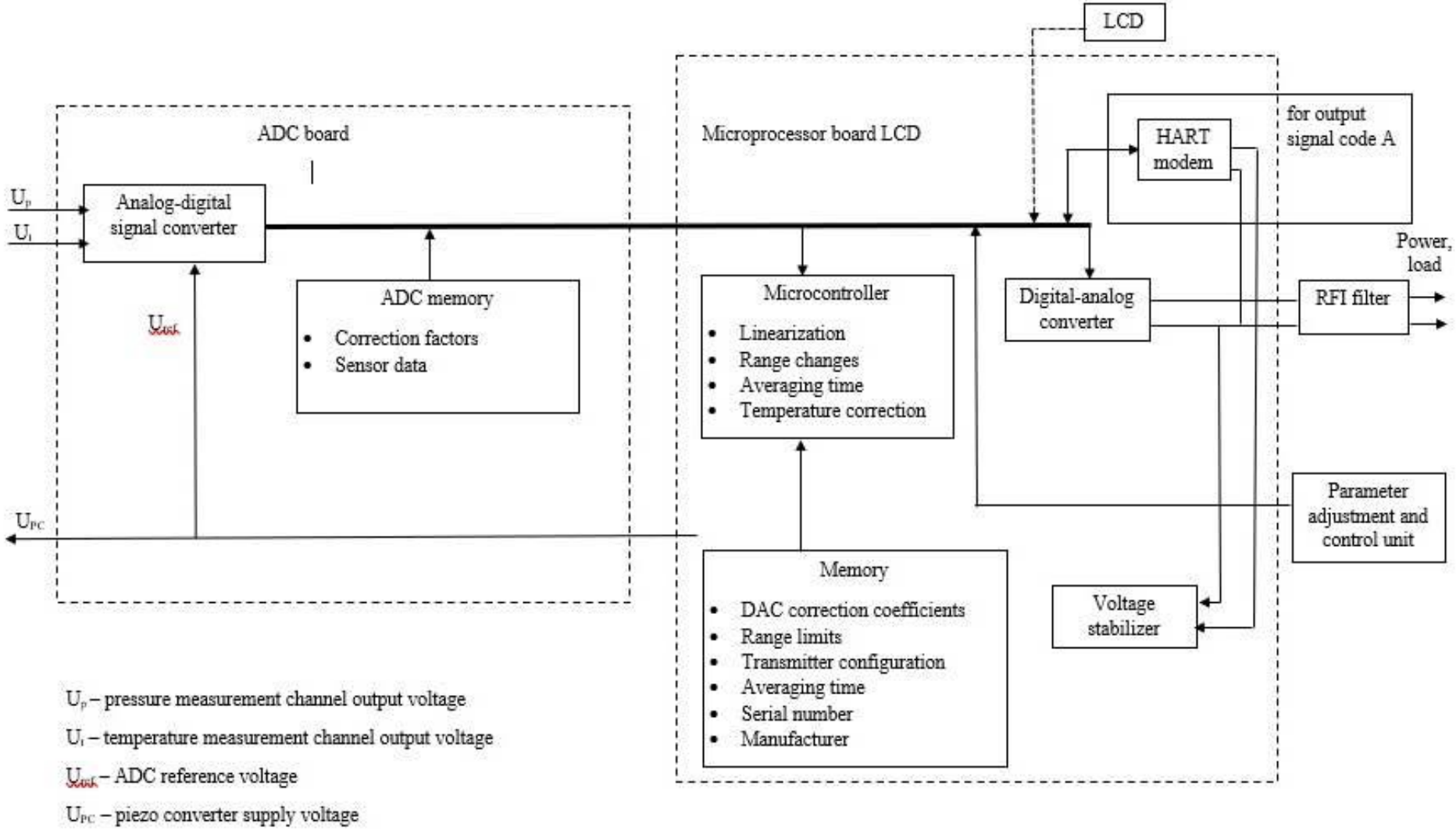


Figure 4. Flow Chart of Sensor Signal Channel

1.3.4.1 ADC board takes analog signals from the measuring unit in proportion to the input measurable value (pressure) (U_p) and temperature (U_t) and converts them into digital codes. Non-volatile memory is designed to store correction factors for sensor characteristics and other sensor data.

The microcomputer mounted on a microprocessor board 18 accepts digital signals from ADC together with the correction factors, corrects and linearizes the sensor characteristic, calculates the adjusted output value and transmits it to the digital-analog converter (DAC). The digital-analog converter inverts digital signal received from the microcomputer into the analog output signal. HART modem installed on a microprocessor board is designed to extract HART signal from 4-20 mA current loop and convert it into a standard digital signal, as well as for the reverse operation – converting the digital signal into HART signal and superimposing it on the analog signal.

The parameter adjustment and control unit is designed to change transmitter parameters. Adjustment elements are push-button switches (Figure 5) located under the cover.

LCD display with buttons is designed to configure the transmitter and control the measured variable.

Parameters and symbols for setting modes are displayed on the screen.

When ordering transmitters with J5 code, a plate for push-button switch ✳ (Figure 5) is installed in the electronics module to protect configuration parameters of the transmitter.

The transmitters with output code A may be configured via digital communication channel.

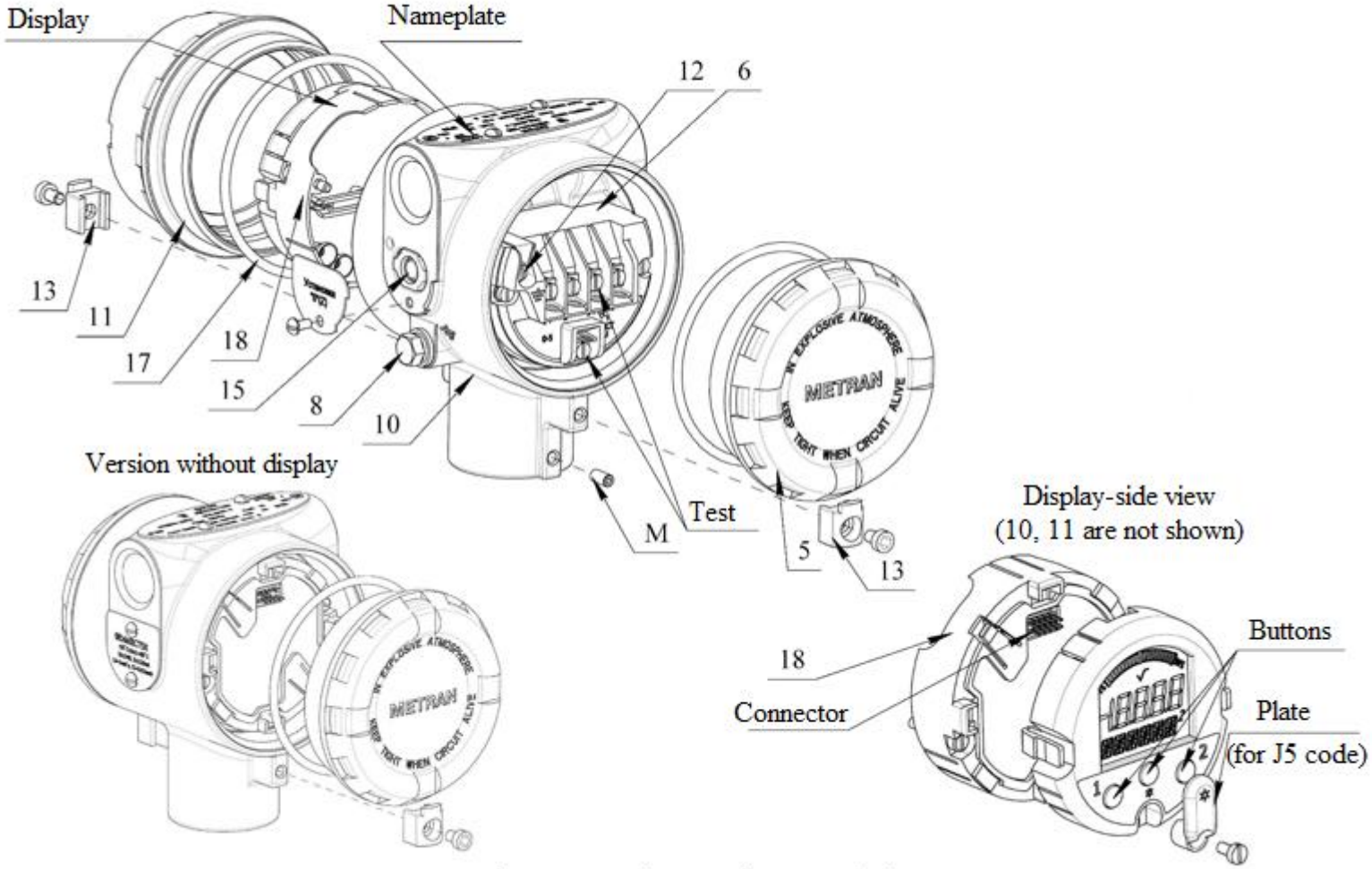


Figure 5. Electronics Module

The display may be installed in the electronics module housing and connected to the board of the microprocessor electronics module (M5 code). LCD display has three lines: graphic, matrix and digital 4.5-bit. Acceptable values displayed on the screen are from "-1999.9" to "1999.9", except for HR7 code. For code HR7, refer to M.1.2.26, Appendix M. When the transmitter is powered, all segments light up on the display, then they go out and the measured pressure is displayed.

Electrical circuit of the electronics module enables control of analog output signal without breaking a signal loop using a milliamperemeter connected to the terminals TEST “+” and “–”of the terminal block (Figure 5). Output signal test accuracy is better than minus 0.1% of output turndown.

1.4 Tagging and Sealing

1.4.1 The nameplate attached to the transmitter shall bear the following markings:

- Manufacturer's trademark;
- Pattern approval marking as per Order #2905;
- Transmitter name;
- Mark of Conformity for products in the market of Customs Union countries;
- Transmitter model string;
- Protection degree in accordance with GOST 14254;
- Range limit P_{max};
- Serial number of the transmitter under manufacturer's numbering system;
- Maximum allowable operating gage pressure, including the units for differential pressure transmitters and level gages;
- Year and month of manufacture;
- Supply voltage;
- Output signal, mA;
- Made in Russia marking.

1.4.2 The marking is made on a separate nameplate attached to the explosion-proof transmitter and includes:

- Special explosion protection mark in accordance with Appendix 2, Technical Regulations of the Customs Union TP TC 012/2011;
- Certificate No.;

a) for Exd transmitters (EM code):

- Explosion protection marking:
  1Ex db IIC T6…T5 Gb X
  T6 (–60°C≤t_a≤65°C), T5 (–60°C≤t_a≤80°C);

b) for Exia transmitters (IM code):

- Explosion protection marking:
  0Ex ia IIC T5 Ga X, –60°C≤t_a≤80°C,
  U_i≤24 V, I_i≤120 mA, P_i ≤ 0.9 W, L_i=70 µH, C_i=0.01 µF,

c) for Exd/Exia transmitters (KM code):

- Explosion protection marking:
  - ☐ 1Ex db IIC T6…T5 Gb X
    T6 (–60°C≤t_a≤65°C),
    T5 (–60°C≤t_a≤80°C);
  - ☐ 0Ex ia IIC T5 Ga X, –60°C≤t_a≤80°C
    U_i≤24 V, I_i≤120 mA, P_i ≤ 0.9 W,
    L_i=70 µH, C_i=0.01 µF

where U_i, I_i, and P_i are the maximum input voltage, current and power values respectively;

t_a is the ambient temperature range;

L_i and C_i are the maximum internal inductance and capacitance values respectively.

1.4.3 On the electronics module housing, next to the grounding clip there is a grounding sign.

+ and - signs on the sensor housing mark pressure supply points.

In 150CD transmitters, + sign corresponds to the supply point of measured pressure or greater of measured pressures, and - sign marks a chamber communicating with the static pressure or a chamber to supply the lower of measured pressures.

On the electronics module covers of transmitters with Explosion-proof Enclosure protection type there is a marking KEEP TIGHT WHEN CIRCUIT ALIVE.

For transmitters with S1, S2 codes, remote seal flange is marked with flange nominal pressure.

For transmitters with S1, S2 codes, an additional nameplate with remote seal / seals order line is attached to the transmitter.

There is a QR code on the electronics module housing, packaging and Technical Data Sheet. By scanning this code, the user may access electronic versions of transmitter documentation (PDF format): Technical Data Sheet, Operation Manual, certificates and other documents per order.

1.5 Packaging

1.5.1 Transmitters should be packaged in closed ventilated areas at an ambient temperature of 15 to 40 °C and relative humidity up to 80% provided that the environment is free of aggressive constituents.

1.5.2 Cable holes, fitting ports, flange holes, tapped holes should be closed by caps or plugs before packaging to protect the inner cavity from contamination and the thread from mechanical damage. Working cavities, plugs, fittings of oxygen transmitters should be degreased and cleaned before packaging.

1.5.3 Transmitters are packaged and preserved in accordance with GOST 9.014 (protection option VZ-10 or VZ-15). The maximum protection period without re-preservation is 2 years.

1.5.3.1 Preservation in accordance with VZ-10 protection option is provided by placing a transmitter wrapped in packing paper into a polyethylene casing with a desiccant (silica gel) followed by compression and sealing.

Relative humidity inside an isolated volume of a packing box is controlled through weight method. The maximum permissible silica gel watering prior to re-preservation should not exceed 26% of its mass.

The mass of dry silica gel when packaging should be indicated in the Technical Data Sheet.

1.5.3.2 Depending on the transmitter version, preservation in accordance with VZ-15 protection option is provided by one of the following methods:

- Wrapping a transmitter in several layers of inhibitor stretch film and then placing it into a polyethylene casing followed by compression and sealing;
- Placing a transmitter in inhibitor stretch film (in this case it shall be completely covered with film);
- Wrapping a transmitter together with a vapor capsule in packing paper and then placing them into a polyethylene casing followed by compression and sealing.

1.5.4 Mounting parts and mounting bracket supplied with each transmitter are placed in a polyethylene casing and packed in a consumer container – a cardboard box. Mounting kit parts of oxygen transmitters, which have been cleaned and degreased and which have not, are wrapped separately.

Transmitter and mounting parts are separated from each other and sealed in a box with sealing material.

The transmitter and mounting parts are packed in a box together with technical documentation (on top). Technical documentation is placed in a polyethylene bag.

Boxes are stacked in shipping containers – wood, plywood cases. Cases are lined with paper. Free space between boxes and cases is filled with cushioning material or gaskets.

When transmitters are transported in containers, shipping package of treble-lined corrugated paperboard may be used in accordance with GOST R 52901.

1.5.5 Mass of a transport package (plywood or fiberboard) with transmitters does not exceed 50 kg. Mass of a transport package (boarded as per GOST 2991) does not exceed 100 kg.

Mass of a transport package of treble-lined corrugated paperboard as per GOST R 52901 does not exceed 30 kg.

1.6 Provision of Explosion Protection

1.6.1 Explosion protection of transmitters with Explosion-proof Enclosure protection type (Exd, for EM and KM order codes).

1.6.1.1 Provision of explosion protection of Exd transmitters is obtained by placing their electrical parts in explosion-proof enclosure according to GOST IEC 60079-1, which has a high mechanical strength degree provided that the transmitter does not have a built-in display and a standard mechanical strength degree provided that the transmitter has it. Specified explosion protection type precludes the transfer of an explosion inside the transmitter to the surrounding explosive atmosphere.

1.6.1.2 Explosion-proof enclosure of explosion-proof transmitters and its fastening elements may withstand pressure tests inside an enclosure, equal to fourfold explosion pressure.

Explosion protection of an enclosure is provided by manufacturing of enclosure parts and their junction in compliance with the explosion protection parameters as per GOST IEC 60079-1, which are listed in Explosion Protection Drawing (Appendix H).

1.6.1.3 Explosion protection of an enclosure is provided by Explosion-proof Enclosure (d) protection type. Explosion Protection Drawing (Appendix H) illustrates mating of components to ensure “d” type explosion protection. This mating is marked with Ex sign including permissible explosion protection parameters.

Flameproof thread joints are locked with a bracket and a nut.

In flameproof thread joints there are at least 5 full continuous undamaged revolutions of engagement.

All current-carrying and grounding clips are protected from self-unfastening by spring washers and locknuts.

1.6.1.4 Maximum temperature of the outer surface considering ambient temperature should not exceed permissible values provided for the temperature class specified in the marking.

1.6.1.5 The nameplate attached to the transmitter housing bears explosion protection markings as per 1.4.2.

Close to the outer grounding clip, there is a relief grounding sign. On the removable covers, there is a warning sign: KEEP TIGHT WHEN CIRCUIT ALIVE.

X sign, which follows Ex marking of pressure transmitters with Explosion-Proof Enclosure protection type, means it is required to observe the following special conditions during operation:

- External electric circuits shall be connected to pressure transmitters through cable entries. Used Ex cable entries shall have valid certificates of conformity to CU TR 012/2011 for the relevant application and explosion protection type, as well as safety characteristics that do not adversely impact pressure transmitter safety parameters. Acceptable ambient temperature ranges (operating temperatures) of used Ex cable entries and cables shall correspond to acceptable ambient temperature range of pressure transmitters;

- Unused holes in pressure transmitter housings must be sealed with plugs having a certificate of conformity to CU TR 012/2011 for the relevant application and explosion protection type. Plugs shall have characteristics that do not adversely impact pressure transmitter safety parameters. Plugs must be protected from self-unfastening when installed into pressure transmitters;

- Explosion-proof connections of pressure transmitters are not subject to repair.

Transmitters with Explosion-proof Enclosure protection type are designed for operation in explosive areas (where explosive mixtures of gases and steam with air may be generated) of IIA, IIB, IIC category as per GOST 31610.20-1, Classes T1-T6.

- Transmitters with Explosion-proof Enclosure protection type are designed for operation at ambient and process temperatures of –60 to 65 °C (for T6 temperature class) and –60 to 80 °C (for T5 temperature class).

1.6.2 Explosion protection of transmitters with Intrinsically Safe Electrical Circuit protection type (Exia, for IM and KM order codes).

1.6.2.1 Explosion protection of transmitters with Exia protection type is ensured due to:

- Limitation of maximum input current (I_i=120 mA), maximum input voltage (U_i=24 V) and maximum input power (P_i=0.9 W) in electrical circuits of secondary instruments operating together with the transmitter up to intrinsically safe values;
- Compliance of transmitter design with GOST 31610.11;
- Power load on intrinsically safe circuit elements does not exceed 2/3 of their rated values;

- Internal capacitance and inductance of electrical circuit do not accumulate energy of gas mixtures hazardous under I category intrinsic safety.

Limitation of current and voltage in electrical circuits of transmitters up to intrinsically safe values is achieved by using them together with units/barriers having intrinsically safe electrical circuit of “ia” protection type for explosion-proof mixtures of IIC subgroup in accordance with GOST 31610.20-1, when voltage, current and power values of intrinsically safe electrical circuits do not exceed 24 V, 120 mA and 0.9 W respectively.

1.6.2.2 The transmitter bears explosion protection marking in accordance with 1.4.2.

X sign, which follows Ex marking of pressure transmitters with Intrinsically Safe Electrical Circuit protection type, means it is required to observe the following special conditions during operation:

- Pressure transmitters must be powered from intrinsic safety barriers (intrinsically safe power supplies) having a valid certificate of conformity to CU TR 012/2011;

- Total capacity and inductance of transmitter intrinsically safe circuits, connected intrinsically safe equipment and cables shall not exceed maximum values stated in intrinsic safety barrier or intrinsically safe power supply on the side of explosion hazard zone;

- Unused holes in pressure transmitter housings must be sealed with plugs having a certificate of conformity to CU TR 012/2011 for the relevant application and explosion protection type. Plugs shall have characteristics that do not adversely impact pressure transmitter safety parameters. Plugs must be protected from self-unfastening when installed into pressure transmitters;

- External electric circuits shall be connected to pressure transmitters through cable entries or the manufacturer’s plug and socket connector. Used Ex cable entries shall have valid certificates of conformity to CU TR 012/2011 for the relevant application and explosion protection type, as well as safety characteristics that do not adversely impact pressure transmitter safety parameters. Acceptable ambient temperature ranges (operating temperatures) of used Ex cable entries and cables shall correspond to acceptable ambient temperature range of pressure transmitters;

- Transmitters with Intrinsically Safe Electrical Circuit protection type are designed for operation at ambient and process temperatures of –60 to 80 °C (for T5 temperature class);

- For transmitters with standard terminal block, insulation strength test with RMS voltage of 500 VAC as per GOST 31610.11 is not carried out (protection is triggered), which must be taken into account;

Note. During manufacturing, the transmitters with Intrinsically Safe Electrical Circuit (IM code) or Intrinsically Safe Electrical Circuit / Explosion-proof Enclosure (KM code) protection type are subject to insulation strength test with RMS voltage of 500 VAC with no standard terminal block.

- Electronics module enclosure is made of aluminum alloy with a polyurethane paint finish which may constitute a potential electrostatic ignition risk; care should be taken to protect it from impact or abrasion that may cause sparking when located in Zone 0.

- Cable entry holes that are not used must be sealed with a metal plug certified to meet the requirements of Technical Regulations of the Customs Union TP TC 012/2011.

1.6.3 Exd/Exia transmitters (KM code) may be installed at customer's discretion considering requirements to the implemented protection type. The customer must provide an identification marking to comply with the selected transmitter Ex marking and ensure information integrity over the entire product life.

2 Operation

2.1 General Guidelines

2.1.1 Check container integrity upon receipt of a box with the transmitter. Take formal note in case of its damage.

2.1.2 In wintertime, boxes with transmitters should be unpacked in a heated room at least 12 hours after entering.

2.1.3 Check completeness in accordance with the Technical Data Sheet.

2.1.4 Date of commissioning, acceptance certificate number and date of its approval by the consumer's management should be indicated in the Technical Data Sheet.

Data concerning transmitter operation is recommended to be included in the Technical Data Sheet: maintenance records with an indication of faults and their causes, data on periodic monitoring of main technical characteristics during operation, data on transmitter calibration, etc.

The manufacturer is interested in obtaining technical information on the transmitter operation and malfunctions with a view to eliminate them in future.

All suggestions for improving transmitter design should be addressed to the manufacturer.

2.1.4a Before operation, remove shipping caps from:

- Dynamic and static cavities of transmitters;
- The cable hole and the plug connector of the electronics module.

2.1.5 After exposure to the maximum or minimum operating temperatures, it is recommended to perform zero calibration.

2.1.6 Transmitters can be used to measure liquid, gas or steam pressure.

When measuring liquid pressure, carefully fill the system with liquid.

2.1.6a Prevent the following in transmitter operation:

- Accumulation and freezing of condensate in process chambers and inside connecting tubes (when measuring gaseous medium parameters);

- Freezing, crystallization of the medium or individual components crystallizing out of it (when measuring liquid medium);
- Short-term overpressure (hydraulic shock, surge pressure) exceeding overpressure limits.

In such cases, the transmitter may fail due to damage or breakdown of its sensing element.

In the last case, pressure tap is recommended in the areas where medium flow rate is minimal, flow goes without turbulence, i.e. on the straight pipeline sections, at a maximum distance from the shut-off devices, knees, compensators and other hydraulic connections.

If surge pressure or hydraulic shock (water hammer) cannot be prevented, it is required to use pulsation dampeners or take other measures to prevent damage or break of the transmitter sensing element.

2.1.7 All operations on storage, transportation, calibration and commissioning of the transmitter with removed covers must comply with ESD protection requirements, namely:

- Use antistatic wrist straps during calibration and connection of transmitters;
- Workplaces for transmitter calibration should have electroconductive coating connected to the ground bus;
- All instruments and equipment used for calibration must be grounded;
- When connecting the transmitter on-site, primarily connect the ground and then feeding and measuring lines.

2.2 Safety Instructions

2.2.1 Transmitters are classified as Class 01 in accordance with GOST 12.2.007.0 by electric shock protection method.

The transmitter housing must be grounded in accordance with paragraph 2.4.7.

2.2.2 Explosion-proof transmitters should be operated in accordance with the requirements of Chapter 7.3 of Electrical Installation Code and other documents regulating the use of electrical equipment in explosive environments.

2.2.3 Do not use transmitters in systems with pressure exceeding maximum permissible limits specified in Tables 1-3 for each model.

Do not use 150CD transmitters with remote seal (S1, S2 codes) in systems where operating gage pressure may exceed the lowest value of remote seal nominal pressure (specified on the flange) and maximum allowable gage pressure of the transmitter (Table 2).

Do not use 150CG/150TG/150TA transmitters with remote seal (S1 code) in systems where pressure may exceed the lowest value of remote seal nominal pressure (specified on the flange) and maximum upper range value of the transmitter (Tables 1, 1a, 3).

2.2.4 Do not use transmitters that have modules filled with silicone fluid in processes where such fluid shall not be mixed with measured medium for safety reasons.

2.2.5 To connect transmitters to or to disconnect them from main pipes supplying measured fluid, first close the valve upstream. The transmitter should be disconnected when pressure in the transmitter is decreased down to atmospheric pressure.

2.2.6 Operation of transmitters is only permitted if safety instructions approved by management of the end user enterprise are available. Such instructions must consider specific application conditions in a particular process.

2.2.7 Operation of oxygen transmitters should be implemented in compliance with applicable industry-specific safety instructions.

2.2.8 Inner cavity of oxygen transmitters contacting with oxygen should be degreased before operation.

2.3 Provision of Explosion Protection during Installation

2.3.1 Explosion-proof transmitters may be installed in hazardous areas and outdoor installations in compliance with GOST IEC 60079-14 and other documents regulating the use of electrical equipment in explosive environments.

2.3.2 Follow the instructions in these documents during transmitter installation:

- Rules of Electrical Installation Code (Chapter 7.3);
- PTEEP rules (Chapter 3.4 Electrical Installations in Explosion-hazard Areas);
- GOST 31610.0;
- GOST IEC 60079-1;
- GOST 31610.11;
- GOST IEC 60079-14;
- This Manual and other local regulatory documents.

Transmitters may only be installed and operated by people who are familiar with this Manual and have appropriate training.

Prior to installation, the transmitter must be inspected. It is necessary to pay attention to explosion protection marking, warning labels, integrity both of explosion-proof enclosure housing (for transmitters with Explosion-proof Enclosure protection type) and module, availability of the grounding clip on the electronics module housing, the state of plug-in cable, availability of glands for cables and covers.

Cable termination and its connection should be performed at power off to avoid fuse triggering in intrinsic safety barrier (for transmitters with Intrinsically Safe Electrical Circuit protection type) at an accidental short-circuiting of connecting wires.

Upon completion of installation, electrical insulation resistance between joint electrical circuits and transmitter housing should be checked:

– not less than 5 MOhms for the transmitter with standard terminal block;
– not less than 20 MOhms for the transmitter with T0 terminal block,
and electrical resistance of the ground line should be less than 4 Ohms.

WARNING! FOR TRANSMITTERS WITH STANDARD TERMINAL BLOCK, INSULATION RESISTANCE SHOULD BE CHECKED UNDER DC VOLTAGE NOT EXCEEDING 50 V.

2.3.3 For transmitters with Explosion-proof Enclosure protection type, external electrical circuits should be connected through the cable entries properly certified to meet the requirements of GOST IEC 60079-1.

If only one cable entry is used to connect a transmitter with Explosion-proof Enclosure and Intrinsically Safe Electrical Circuit protection type, the unused entry should be closed with a metal plug supplied by the manufacturer. The plug must meet the requirements of GOST IEC 60079-1 and be certified to Technical Regulations of the Customs Union TP TC 012/2011.

2.3.4 During installation of transmitters with Explosion-proof Enclosure protection type, check the condition of explosion-proof surfaces of disassembled parts (scratches, cracks and dents are not permitted). Threaded parts should be screwed at full thread length and locked.

2.3.5 Cable termination to the gland entry, connection of cable cord to the terminal block 6 (Figure 5) should be made with a cover 5 removed in accordance with external wiring diagram (Appendix F, D). Cable shield (if shielded cable is used) should be attached to the housing with a screw 12 (Figure 5).

Following cable connection to the terminal block, install cover 5, lock it with a bracket 13 (Figure 5).

Covers should be screwed against stop to ensure proper sealing.

Communication line may be made of any type of cable with copper wires at least 0.35 mm^2 in cross section in accordance with Chapter 7.3 of Electrical Installation Code.

2.3.6 If there is an explosive mixture during installation of explosion-proof transmitters, transmitters should not be subject to friction or impacts that may cause sparking.

2.4 Installation Procedure

2.4.1 For dimensional drawings of transmitters, refer to Appendix G.

When selecting an installation site, the following factors should be considered:

- General industrial and oxygen versions of Metran-150 transmitters must not be installed in explosion-hazardous premises; explosion-proof transmitters may be installed in explosion-hazardous premises as per paragraph 2.3.1;
- Installation sites for transmitters should provide comfortable conditions for maintenance and dismantling.

For a better LCD view or easier access to two compartments of the electronics module (access to terminal block 6 and button switches), electronics module housing 10 (Figure 5) may be rotated relative to the sensor, which is installed as shown in Appendix G, at an angle **not exceeding 180°** in any direction. To do so, unscrew the adjusting screw M using S=2 mm hex-nut wrench and rotate the housing at ±180° (left or right) from its initial position. Tighten the screw M of the electronics module after rotation.

WARNING! ROTATION OF THE ELECTRONICS MODULE AT AN ANGLE GREATER THAN ± 180° MAY DISTURB ELECTRICAL CONNECTIONS BETWEEN THE SENSOR AND THE ELECTRONICS MODULE AND BREAKS CONDITIONS OF MANUFACTURER'S WARRANTY POLICY.

The display may be set at different angles in increments of 90º for easy reading. Install the display as follows: cramp two terminals, pull the display, turn it around and put in place. If the connector is still on the LCD after removing the display, it should be removed and installed in DAC board connector;

- Ambient air temperature and relative humidity should correspond to the values listed in paragraphs 1.2.13 and 1.2.15, M.1.2.38 and M.1.2.40, Appendix M;

- Vibration parameters should not exceed the values listed in paragraph 1.2.17, M.1.2.42, Appendix M;

- Magnetic field strength caused by external AC power sources with a frequency of 50 Hz should not exceed 400 A/m, caused by external DC power sources – 400 A/m;

- When transmitters are operated in subzero temperature range, the following should be excluded: accumulation and freezing of condensate in process chambers and inside connecting tubes (when measuring gaseous medium parameters);

- Freezing, crystallization of the medium or individual components crystallizing out of it (when measuring liquid medium).

2.4.2 Pressure measurement accuracy depends on proper installation of the transmitter and connecting tubes from pressure tap point to the transmitter. Connecting tubes should be laid along the shortest distance.

Pressure tap is recommended in the areas where medium flow rate is minimal, flow goes without turbulence, i.e. on the straight pipeline sections, at a maximum distance from the shut-off devices, knees, compensators and other hydraulic connections.

The process temperature in a working cavity of the transmitter shall not exceed permissible ambient temperature. As the working cavity of the transmitter has no fluid, the inlet temperature, as a rule, should not exceed 120 °C. To reduce process medium temperature at the inlet of working cavity, the transmitter should be installed on a connecting line with the recommended length of at least 3 m for 150CD transmitter, and at least 0.5 m for other transmitters. These lengths are approximate and depend on process temperature, diameter and material of the connecting line, and may be reduced.

Connecting lines should have one-way slope (at least 1:10) from pressure tap point towards the transmitter, if the process medium is gas, and downwards the transmitter, if the process medium is liquid. If it is not possible, settling vessels should be installed at the lowest points of the connecting line when pressure or differential pressure of gas is measured, and collecting gas mains should be installed at the highest points when pressure or differential pressure of liquid is measured.

It is recommended to mount settling vessels in front of the transmitter in other cases as well, especially when long connecting lines are used and when the transmitter is located below the pressure tap point.

If it is required to purge connecting lines, independent devices should be provided to exclude purging through the transmitter.

Needs for installation of devices to purge connecting lines at their short lengths (less than 1 m) and a filter to protect the transmitter from contamination with solid particles are determined by the engineer who designed specific application systems for the pressure transmitter.

A three-way tap or two valves are recommended to be installed in connecting lines from pressure tap point to disconnect the transmitter from the line and vent it to the atmosphere.

This will facilitate transmitter dismantling and periodic inspection of output signal setting relevant to the lower value of measured pressure.

In connecting lines from the orifice to the differential pressure transmitter it is recommended to install a valve on each line to vent the line to the atmosphere and a valve to turn off the transmitter.

Recommended connecting line diagrams for gas, steam and liquid flow measurement are shown in Figures 7, 8, and 9.

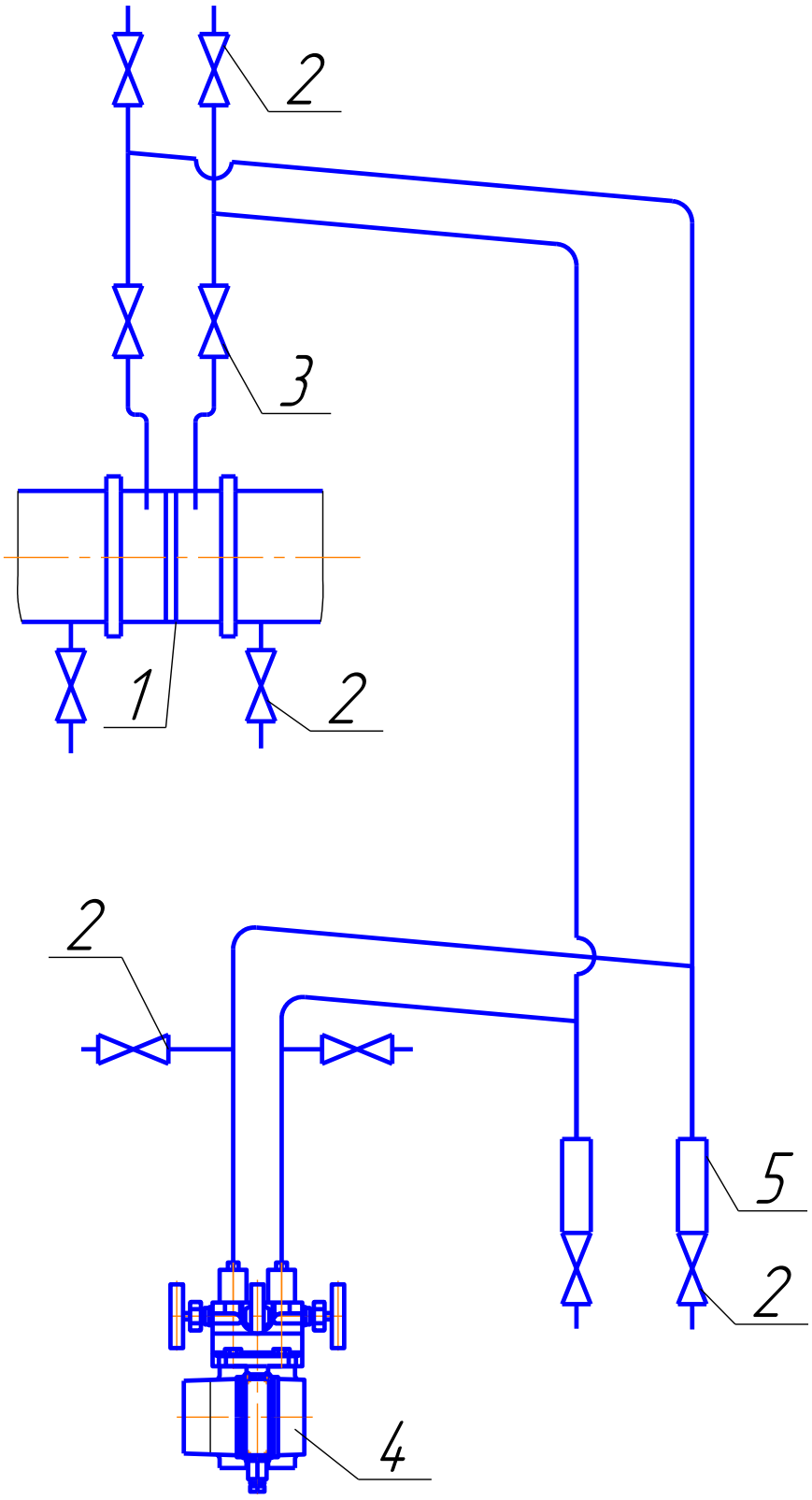


Figure 7. Connecting Line Diagram for Gas Flow Measurement
1 – Orifice; 2 – Blow-off valve;
3 – Valve; 4 – Transmitter; 5 – Settling vessel

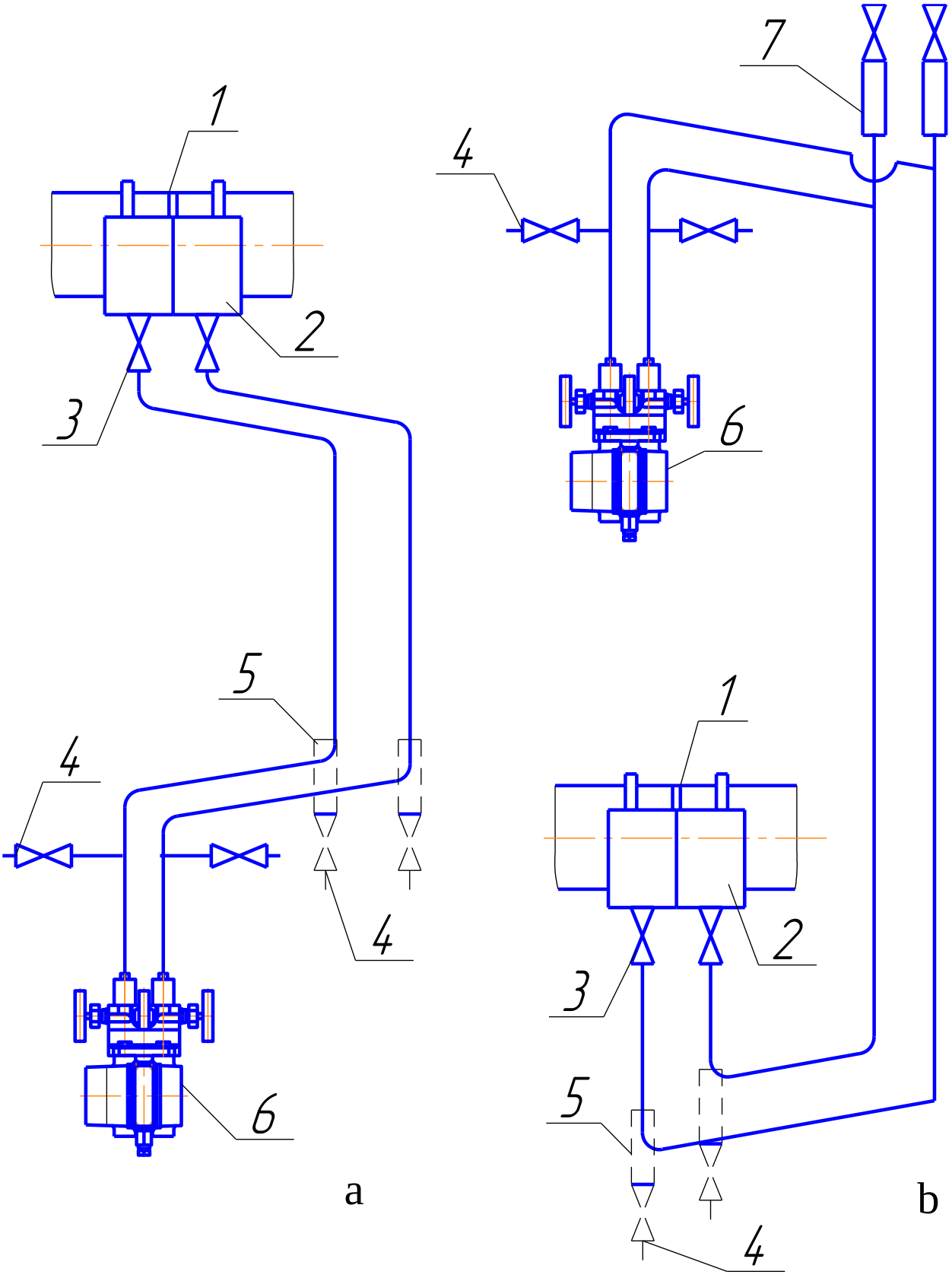


Figure 8. Connecting Line Diagram for Steam Flow Measurement
1 – Orifice; 2 – Leveling vessel; 3 – Valve;
4 – Blow-off valve; 5 – Settling vessel;
6 – Pressure transmitter; 7 – Collecting gas main.

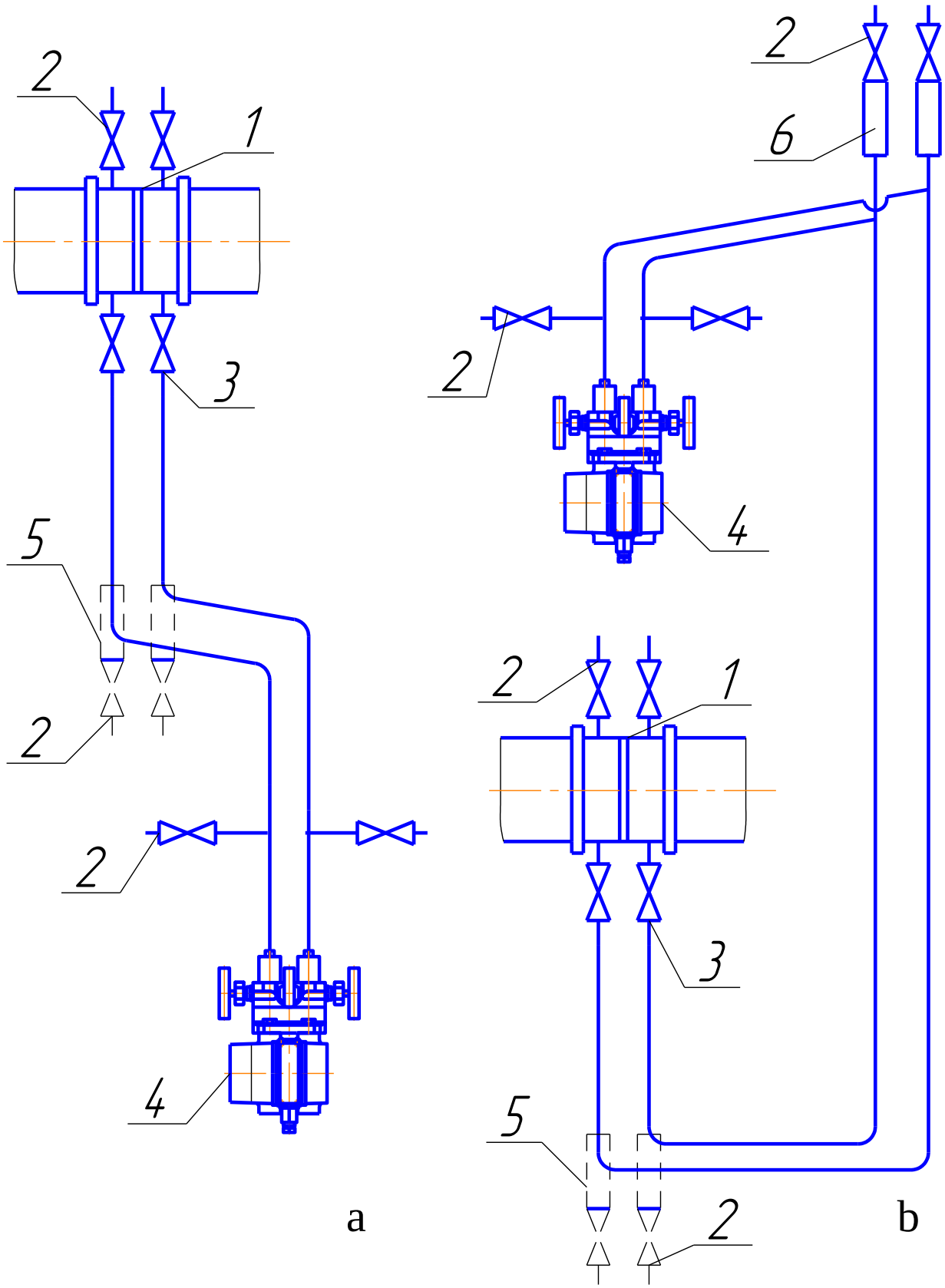


Figure 9. Connecting Line Diagram for Liquid Flow Measurement
1 – Orifice; 2 – Blow-off valve; 3 – Valve;
4 – Transmitter; 5 – Settling vessel; 6 – Collecting gas main.

Transmitters may be fitted with manifold by the customer's order.

Transmitters are supplied with installed manifold by the customer's order (S5 code when ordering the transmitter).

2.4.3 Transmitters may be pipe, wall or panel mounted using brackets. Brackets are supplied in accordance with the order. Installation of transmitters with brackets is shown in Appendix G.

2.4.4 Transmitters are attached to the connecting line using a nipple pre-welded to the tube or by mounting flange threaded in accordance with Appendix A for screwing on line tube ends (option by customer's order).

When installing 150TG/150TA transmitters, make sure the sensor is not damaged due to excessive torque value (Figure 10). Sensor housing rotation relative to the process connection fitting may damage electronics. The force may be applied only to the process connection fitting hexagon.

During installation and operation of 150TG transmitters with range codes 1-5, an environmental access should be provided between the sensor housing and the process connection fitting in Zone A (Figure 10).

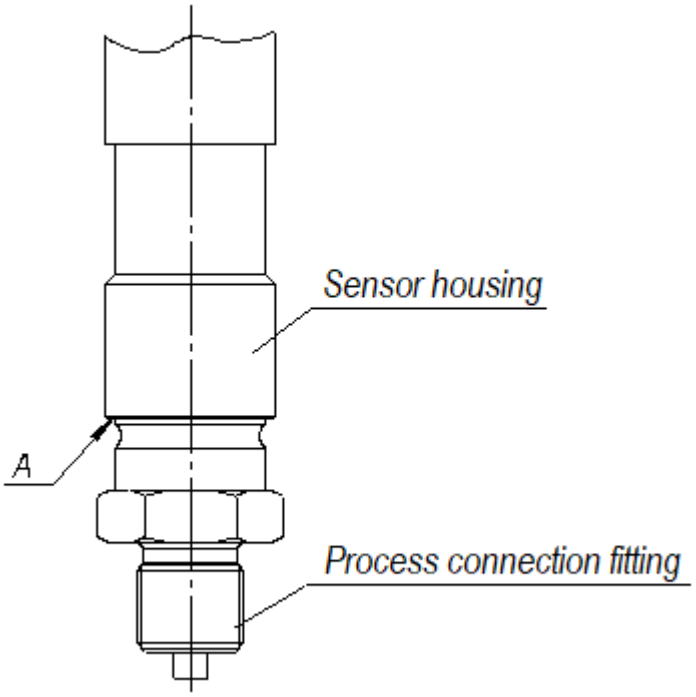


Figure 10

Sealant or lubricant accepted by the end user enterprise should be applied during process connection installation.

When sealing the joints by a metal gasket to improve the seal, it is recommended to apply

the following on M20 thread and metal gasket:

- Graphite or TSIATIM lubricant or material used at the consumer's enterprise for general industrial transmitters;
- PEF 130 liquid TU 6-02-1072 for oxygen transmitters.

Connecting lines before attaching to the transmitter should be thoroughly purged to minimize contamination of sensor chambers.

Before installing the oxygen transmitter, make sure that its Technical Data Sheet has 'Degreased' stamp. Connecting lines before attaching to the transmitter should be purged with clean compressed air or nitrogen. Air or nitrogen must be free of oils. During installation, it is required to prevent the ingress of fats and oils in transmitter cavities. Degrease the transmitter and connecting lines in the case of ingress.

Mounting parts making contact with oxygen should be degreased prior to installation.

2.4.6 Check the joints for leaks at maximum operating pressure after transmitter installation.

2.4.7 Always ground the transmitter housing in accordance with local or applicable industry-specific safety regulations. The most effective method to ground the transmitter housing is to provide direct connection to earth ground with minimal impedance.

2.4.8 Wires are connected through the cable entry holes. Cable entry holes must be sealed. Unused cable entries must be sealed with blanking plugs to prevent moisture penetration into the terminal block of the housing.

Note. If it is not possible, install the transmitter so that the electronics module housing is located at the bottom for drainage. Provide wire bending near the transmitter to avoid moisture ingress into the electronics module housing. Make sure the bending point is lower than the cable entry and the electronics module housing.

Remove the cover from terminal block during cable installation. Connect the wires to the terminals according to the diagrams included in Appendix D, F. Install the cover after connecting a wire.

Covers (5, 11 in Figure 5) should be screwed against stop to ensure proper sealing.

WARNING! FAILURE TO MEET 2.4.8 REQUIREMENTS ON ENSURING RELIABLE CONNECTION IN THE CABLE ENTRY AND RELIABLE CONNECTION OF THE COVER AND THE ELECTRONICS MODULE HOUSING DURING INSTALLATION MAY RESULT IN TRANSMITTER FAILURE DUE TO WATER OR MOISTURE INGRESS. IN SUCH CASES, THE MANUFACTURER SHALL NOT BE LIABLE FOR TRANSMITTER FAILURES.

Rubber-insulated control cables, polyethylene-insulated blocking and signaling cables are recommended to be used when laying the communication line during installation. Other cables with cord cross-section less than 1.50 mm^2 can be used. It is allowed to lay transmitter power supply and output signal wires together in one cable.

Note. Do not use polyethylene-insulated cables for installation of explosion-proof transmitters with Explosion-proof Enclosure protection type in explosion-hazard areas of all classes according to paragraph 7.3.102 of Electrical Installation Code.

The shielded cable with an insulating sheath is recommended to be used in the vicinity of communication lines of electric installations with a capacity exceeding 0.5 kW.

Insulated cores of a single cable may be used as signal loops and power circuits of the transmitter, with insulation resistance not less than 50 MOhms. Shielding of output signal loops from transmitter power circuits is not required.

For transmitters with digital HART signal, it is recommended to use shielded twisted pair of cables, the shield is grounded on the receiving side only (load resistance). The unshielded cable may be used, provided that electrical noise in the line will not adversely impact communication.

To ensure proper communication, use the wire with cross section of at least 0.2 mm^2, and its length shall not exceed 1,500 m.

2.4.9 Power supply for transmitters under operating conditions shall meet the following requirements:

- Insulation resistance not less than 20 MOhm;
- Withstand the test voltage of 1.5 kV when testing insulation strength;
- Output voltage ripple is less than 0.5% of nominal output voltage at harmonic frequency not exceeding 500 Hz;
- Power interruption is less than 20 ms.

Power supply for transmitters with digital HART signal under operating conditions shall meet the above requirements for insulation resistance and output voltage ripple at harmonic frequency up to 500 Hz, and have noise level of less than 2.2 mV rms within the frequency range from 500 Hz up to 10 kHz.

2.4.10 Multidrop mode of transmitters with digital HART signal (output signal code A).

The transmitter in multidrop mode operates only with digital output. Analog output is automatically set to 4 mA and does not depend on the input pressure. Pressure data can

be read via HART protocol. Up to 15 transmitters can be connected on a single pair of wires. The number of transmitters is determined by the length and quality of the line, as well as by the capacity of transmitter power supply. Each multidropped transmitter is identified by a unique address (1–15) and may be accessed via that address. The transmitter is set to address zero (0) in normal operation; if an address (1–15) is assigned, the transmitter automatically switches to multidrop mode and sets 4 mA output. The Field Communicator or PCS shall identify all transmitters connected to the line, and may communicate with each of them.

Multidrop mode setting is not recommended if intrinsic safety is required.

The transmitter is set to address zero (0) at the factory, which allows operation in the standard point-to-point manner. To activate multidrop communication, the transmitter poll address must be assigned a number from 1 to 15. This address change deactivates the 4–20 mA analog output, sending it to 4 mA. Failure signals in a multidropped transmitter are communicated through HART messages.

Note. In multidrop mode, the LCD will alternate the display between “ANALOG FIXED” and the set engineering units.

Wiring diagram for multidropped transmitters is given in Figure D.3.

2.4.11 When selecting external connection diagrams (Appendices D, F), the following should be considered:

- When power loops with two-wire communication line and 4-20 mA output are not galvanically isolated, the load of each transmitter is permitted to be grounded, but only from the power source side;

- When power channels are galvanically isolated, the following should be permitted:

1) Grounding of any single load end of each transmitter,

2) Connection between the loads of several transmitters provided that only one load output of each transmitter is combined.

- Expansion in the number of connected transmitters to a single power source is directly proportional to the increase of noise level in analog and HART signals.

The capacitor may be turned on in parallel to the load resistance, if additional decrease of output ripple level is required. In this case select the capacitor with a minimum capacity providing acceptable ripple level.

It is recommended to use capacitors with a leakage current not exceeding 5 μA for 4-20 mA signal and 1 μA for 0-5 mA signal at a constant voltage up to 20 V. For transmitters with HART output, installation of an additional capacity is not permitted.

2.4.12 When connecting a transmitter with standard terminal block to secondary equipment with no galvanic isolation and in the presence of considerable noise between the grounding of the transmitter housing and the grounding of the supply line (amplitude exceeding 60 V), transient protection circuits in the terminal block may be actuated, which will show as an accidental analog output burst or signal fade. If this is unacceptable for the user, it is recommended to remove the jumper, which connects standard terminal block (6 in Figure 5) with transient protection to the transmitter housing (10 in Figure 5), from the electronics module housing or order transmitters with T0 terminal block. When the jumper is removed, allowable voltage between the transmitter housing and any line is up to 150 V (for general industrial or explosion-proof transmitters with EM code) and up to 500 V (for explosion-proof transmitters with IM or KM codes).

When the jumper is removed in transmitters with standard terminal block, all requirements to electromagnetic interference listed in 1.2.41 are met. In this case, for transmitters with range codes 0–5, parameters of microsecond impulse interference as per GOST R 51317.4.5 in power supply lines when applying interference under "wire-ground" scheme and conducted interference as per GOST R 51317.4.6 in supply and communication lines correspond to the values for the version with T0 terminal block.

2.5 Startup Procedure

2.5.1 Before starting up the transmitter, make sure that installation and mounting comply with guidelines stated in 2.3, 2.4 hereof.

2.5.2 Power up the transmitter.

2.5.3 After 0.5 minutes following power-on, check and adjust output signal value corresponding to the lower range value, if necessary. Such adjustment should be made after supply and relief of the measured parameter making 80-100% of the upper range value.

WARNING! SPECIAL OPERATING CONDITIONS.

ZERO TRIM AND SETTING OF OUTPUT SIGNAL VALUE IN TRANSMITTERS WITH EXPLOSION-PROOF ENCLOSURE PROTECTION TYPE SHOULD BE MADE SUBJECT TO RULES FOR FIRE WORK EXECUTION WITHIN EXPLOSION-HAZARD AREAS OR BEYOND EXPLOSION-HAZARD AREA.

Note. In the event of explosive mixture, parameters of Exia explosion-proof transmitters may be configured and controlled within explosion-hazard area using a built-in display and push-button switches with no instrumentation.

Control of output signal values is performed according to Calibration/Verification Procedure.

2.5.4 When filling measurement chambers of differential pressure transmitters, it is necessary to ensure there are no gas slugs (when measuring differential pressure of liquid media) or liquid slugs (when measuring differential pressure of gas) in the transmitter chambers.

The transmitter chambers shall be filled with liquid after setting it into operating position. Liquid is supplied under low pressure (preferably by gravity) simultaneously in both chambers with drain valves open. Once the liquid begins to flow through the drain valves, they should be closed.

Drain valves screwed in plugs are located in sensor flanges to purge the transmitter chambers and drain condensate.

WARNING! AVOID PURGING THE CONNECTING LINES THROUGH THE TRANSMITTER.

2.6 Measurement, Configuration and Calibration

The transmitter with A output code (4-20 mA with HART) is configured through the digital channel using HART devices (HART Communicator, HART Modem, etc.) of revision 5 and higher and configuration programs or with the help of built-in LCD and with push-button switches located under the electronics module cover in accordance with Setup Guide SPGK.5295.000.00 IN.

The transmitter with B output code (0-5 mA) is configured with the help of built-in LCD and with push-button switches located under the electronics module cover in accordance with Setup Guide SPGK.5295.000.00 IN.

Zero Trim can be performed by an external button located on the electronics module housing. Zero Trim is completed with the external button when the transmitter is at zero pressure. The limits of permissible offset during Zero Trim of the transmitter depending on the set measurement range (dP) are listed in Table 11.

Table 11

Limits for Range	Offset Limits Permitted by Transmitter Program, % of Span
$0.25P_{max} \leq dP$	±10
$0.1P_{max} \leq dP < 0.25P_{max}$	±15
$dP < 0.1P_{max}$	±25
Note. P_{max} is the maximum upper range value of the model.	

Set limits for Zero Trim with the external button enable to compensate an effect of mounting position or eliminate static pressure effect on the output signal during operation of differential and hydrostatic pressure transmitters. For Zero Trim, press and hold the button for at least two seconds.

Zero Trim is performed with an accuracy of 0.8γ.

The transmitter must be within the limits specified in Table 11; if not, the program will reject to calibrate with Zero Trim function. The transmitter is to be reinstalled in such a position that provides permissible Zero Trim limits.

Note. During installation of 150CD, 150CG transmitters with range code 0, consider that transmitters are sensitive to the slope resulting in a significant zero offset.

2.6.1 Metran-150 Operation with Control Devices Supporting HART 5 or Higher Revision Protocol

Metran-150 is compatible with any HART device supporting HART 5 or higher, since it is fully compliant with HART protocol.

All HART protocol commands can be divided into 3 groups: universal, common-practice and transmitter-specific. Universal commands are supported by all HART-compatible devices; common-practice commands apply to a broad class of devices. Often standard HART protocol commands are not enough for full operation of the transmitter, so manufacturers have to develop some additional commands. In HART protocol, they are classified as transmitter-specific and may be accessed using third-party equipment with a special driver only. Metran-150 executes transmitter-specific commands: sensor

calibration, transmitter unique parameters reading, password entry, display output state reading, and display output state record. To access other transmitter commands, no special driver is required.

2.6.2 Operation with Communicator

Communicator communicates with the transmitter via HART protocol. This protocol uses frequency modulation principle. HART component does not affect the 4-20 mA signal, since the sine wave generating a digital signal has a small amplitude (±0.5 mA), and its average value equals zero.

Wiring diagram for connection of the communicator to the transmitter is shown in Appendix D.

A communicator can be connected to the transmitter at any point in the current loop: at the control panel, measuring stand or directly to the transmitter. In all cases to ensure successful communication, a resistance of at least 250 Ohms must be present between the Communicator loop connection and the power supply.

2.6.3 Setting of Basic Parameters for Transmitter Operation

2.6.3.1 Review of the transmitter factory configuration data is recommended prior to operation.

2.6.3.2 Transmitter configuration includes the following operations:

1) Transmitter output parameter setting:

- Set process variable units;
- Set output;

Assign to point 4(0) mA a pressure value greater than pressure value for the point 20(5) mA to obtain an inverted output characteristic for transmitters with software revision 2.1.

- Rerange;
- Damping;

2) Analog Output Trim

Analog Output Trim provides:

- Digital-to-Analog Zero Trim - this command allows you to adjust the initial DAC analog output (with an accurate reference meter) to match the rated value.

The DAC characterization curve is shifted in parallel, but its slope does not change when the trim is performed.

- Digital-to-Analog Slope Trim - this command allows you to adjust the upper DAC analog output (with an accurate reference meter) to match the rated value. DAC characterization curve slope is adjusted when the trim is performed;

3) Calibrate the sensor:

Sensor trim provides lower trim and upper trim.

A lower trim is to adjust the pressure reading to match the applied pressure. The transmitter characterization curve is shifted in parallel, but its slope does not change when the trim is performed.

An upper trim is to adjust the pressure reading to match the applied pressure. Slope of the characterization curve is adjusted when the upper trim is performed.

Sensor trim is always required to be started with lower trim. Upper trim shall provide slope correction based on lower trim.

For transmitters with software revision 2.1, pressure values the 4(0) and 20(5) mA points are set to must be within sensor calibration limits – upper trim and lower trim.

2.6.5 Configuring Transmitter Security

Changes can be prevented to the transmitter configuration data with the write protection by the following ways:

- Software protection of push-button switches. Protection mode is established in accordance with SPGK.5295.000.00 IN;
- Software protection by universal HART command.

All existing configuration modes of the transmitter are permitted when this mode is disabled. Review of transmitter configuration data, password entry to disable protection mode and zero trim by an external button to compensate mounting position or eliminate the effect of static pressure are permitted when protection mode is enabled.

2.7 Maintenance Check

Maintenance check of transmitters is performed upon receipt (incoming inspection), prior to on-site installation, as well as during operation (on-site or under laboratory conditions).

During on-site maintenance check of the transmitters, as a rule, an output signal corresponding to the lower range value (2.5.3) is checked and adjusted if necessary, leak check is performed by visual inspection of junction points, and functional test is performed by monitoring the change in output signal when measured parameter being changed.

Output signal (zero, range) should be adjusted in accordance with 2.5.3 and sections 2.6, M.2.6 of Appendix M during incoming inspection, prior to commissioning, during operation under laboratory conditions and when required.

Periodic in-service calibration should be performed in accordance with Calibration/Verification Procedure in terms established by the end user enterprise, depending on operating conditions and the required measurement accuracy. Calibration/verification interval shall not exceed the interval according to the information on instrument pattern approval in the Federal Information Fund on Assurance of Measurement Uniformity.

Metrological characteristics of the transmitter during calibration interval correspond to published values considering transmitter reliability factors and provided that the customer meets storage, transportation and operating requirements specified in this Manual.

3 Maintenance and Repair

3.1 Maintenance Procedures

3.1.1 Maintenance of transmitters means compliance with the operating, storage and transportation rules set forth in this Operation Manual and periodic verification, preventive maintenance inspection and repair work.

3.1.2 The transmitters may only be serviced by people who are familiar with this Manual and have appropriate training.

During operation of transmitters, follow instructions of this Manual, end-user instructions and other normative technical documents applicable to this branch of industry.

3.1.3 Maintenance of oxygen transmitters mainly includes periodic calibration and condensate drain from process chambers of the transmitter, if necessary, cleaning and degreasing of internal cavities, and maintenance check as well.

3.1.4 Claims for a transmitter with defects caused by violation of operation, transportation and storage requirements will not be satisfied.

3.1.5 During operation, check that the tubes of connecting lines and valves are not clogged and are sealed. Make sure there are no gas slugs (when measuring differential pressure of liquid media) or liquid slugs (when measuring differential pressure of gas) in tubes and valves. To this end, the tubes are recommended to be periodically purged, while avoiding transmitter overload; the frequency is established by the user subject to operating conditions.

Avoid purging and filling connecting lines with process fluid through the transmitter receiving cavities and drain valves. Use regular purging devices to purge and fill connecting lines.

During transmitter check in the laboratory after operation, remove liquid from the transmitter by air purging of transmitter cavities with drain valves open to ensure precise accuracy measurement.

Tighten all threaded connections (plug, fitting, mounting flange bolts) if module seal fails.

3.1.6 Routine inspections are carried out according to the procedure established by the end user site and includes the following checks:

- Enclosure integrity, lack of corrosion and other damages (for explosion-proof transmitters with Explosion-proof Enclosure protection type);
- Availability of all fasteners and their components,
- Availability of explosion protection marking and warning labels (for explosion-proof transmitters);
- Grounding state, grounding bolts should be tightened, they should contain no rust. They should be cleaned, if necessary;
- Check and, if necessary, zero trim the transmitter.

Operation of damaged and failed transmitters is strictly prohibited.

3.1.7 Periodic in-service calibration should be performed in accordance with Calibration/Verification Procedure in terms established by the end user enterprise, depending on operating conditions and the required measurement accuracy, but not less frequently than specified in the pattern description.

Metrological characteristics of the transmitter during calibration interval correspond to published values considering transmitter reliability factors and provided that the customer meets storage, transportation and operating requirements specified in this Manual.

3.1.8 During operation of explosion-proof transmitters, it is also recommended to comply with GOST IEC 60079-14, the section Provision of Explosion Protection during

Installation hereof, applicable Electrical Installation Code, chapter 3.4 Electrical Installations in Explosion-hazard Areas, and Operational Code for Electrical Installations (PTEEP).

At preventive inspections of explosion-proof transmitters, it is necessary to carry out visual inspection completely and the following actions:

- Open the electronics module cover after disconnecting the transmitter from the power source. Check explosion-proof surfaces (for explosion-proof transmitters with Explosion-proof Enclosure protection type). If explosion-proof surfaces are damaged, the transmitter should be repaired. Transmitters should be repaired at the factory;
- Having the cover removed, check that electrical contacts operate properly excluding heating and short circuit, check grounding resistance (4 Ohm maximum) and insulation resistance between the housing and interconnected cable outlets on the terminal block of the electronics module using a megohmmeter:

- 50 V DC maximum for transmitters with standard terminal block;
- 100 V DC for transmitters with T0 terminal block.

Insulation resistance shall comply with 1.2.56;

- Check input cable seal reliability;

Check terminal block state. It should not be chipped or otherwise damaged.

3.2 Troubleshooting

Table 12 provides troubleshooting information for most failures that arise during operation.

If you suspect a fault despite the absence of diagnostic messages on the display or HART communicator, perform described procedures to check operation of the hardware and process connections.

Table 12

Failure	Remedial Action
1	2
1 No output signal	Check voltage at terminals. Check power supply polarity. Check the state of the diode, which is parallel to the test terminal.
2 Unable to establish a connection between communicator and transmitter	Check loop resistance (250 ohms minimum). Check accuracy of transmitter address. Verify the output is between 4 and 20 mA or at saturation levels. Check DC supply voltage stability for the transmitter.
3 Output current is greater than 22 mA or less than 3.6 mA	Verify applied pressure. Check 4 and 20 mA range points in DAC calibration mode.
4 Transmitter does not respond to changes in applied pressure	Check measuring equipment. Check impulse piping or manifold for blockage. Check that applied pressure corresponds to the calibrated range.
5 Output is unstable, transmitter accuracy is less than the permissible value	Pressure feed line is leaky. Find and eliminate the leakage. Mounting flange or transmitter nipple is leaky. Replace O-ring. Sensor flange plug is leaky. Tighten the plugs.
6 Leakage	Leakage between the manifold and the transmitter or between the manifold and the mounting flange or nipple. Repeat the assembly or replace O-ring.

If operating errors are detected, the transmitter generates additional information (error codes) in accordance with Appendix J2.

3.2.1 Critical Failures

Critical failure that appears during operation means there is an external leakage in the transmitter. Critical failure may cause personal injury, environmental and property damage.

External leak may result from:

- Sealing gasket damage or leak in flanged connection;
- Diaphragm corrosion.

Potential human errors that result in an incident or accident:

- Incorrect installation of mounting flange sealing gaskets, incorrect selection of sealing gaskets;
- Incorrect installation or operation of manifolds;
- Applying the operating pressure that significantly exceeds the maximum permissible value;
- The material selected is not corrosion-resistant to the process.

3.2.2 Personnel Actions in the Event of Critical Failure, Incident or Accident

The transmitters with critical failures are not allowed for operation.

In case of an accident, stop applying the operating media to the failed transmitter, turn the power off. Dismantle the transmitter and replace it with the new one.

3.2.3 Critical State Criteria

Critical state criterion is part failure caused by corrosion, flow accelerated corrosion of materials, which is caused by operating fluid impact.

4 Storage and Transportation Rules

4.1 Transmitters may be stored both in transport containers up to 5 boxes piled (up to 4 boxes of treble-lined paperboard) and with/without inner packaging on the racks.

Storage conditions for transmitters in transport containers and with inner packaging shall comply with Class 3 in accordance with GOST 15150 at the ambient temperature of –60 to 60 °C.

Storage conditions of transmitters without packaging shall comply with Class 1 in accordance with GOST 15150.

Prior to the incoming inspection, do not remove polyethylene bag the transmitter is packaged in.

4.2 Transmitters in a package are transported by any mode of enclosed transport, including air transport in heated sealed compartments in accordance with the shipping rules applicable for each mode of transport.

Method of box stowage shall exclude any displacement of boxes in transport vehicles.

When handling and transporting, containers shall not be subject to sharp blows and atmospheric precipitation effect.

Dispatch type is small or low-tonnage during transportation of transmitters by railway transport.

4.3 The period of transmitter transportation in appropriate conditions shall not exceed 3 months.

4.4 Transportation conditions as to the impact of climatic factors should meet storage conditions 6 or 3 (for sea shipping under deck) in accordance with GOST 15150 at the ambient temperature of –60 to 60 °C.

5 Disposal Information

The transmitters are disposed in accordance with a local procedure.

Appendix A

Ordering Information

Table A.1. 150CD Differential Pressure Transmitter and 150CG Gage Pressure Transmitter

Model	Description			CD	CG
150CD	Differential Pressure Transmitter			•	–
150CG	Gage Pressure Transmitter			–	•
Mandatory Options					
Code	**Range [1]** **150CD**	**150CG**		**CD**	**CG**
0	0-0.63 kPa	(-0.63)-0.63 kPa		•	•
1	0-6.3 kPa	(-6.3)-6.3 kPa		•	•
1T	((-6.3)-6.3) kPa	((-6.3)-6.3) kPa		•	•
2	0-63 kPa	(-63)-63 kPa		•	•
2T	((-40)-40) kPa	((-40)-40) kPa		•	•
3	0-250 kPa	(-97.85) [2]-250 kPa		•	•
3T	((-250)-250) kPa	((-100)-250) kPa		•	•
4	0-1.6 MPa	(-97.85) [2] kPa-1.6 MPa		•	•
4T	((-1.0)-1.0) MPa	(-100) kPa-1.0 MPa		•	•
5	0-10 MPa	(-97.85) [2] kPa-10 MPa		•	•
5T	0-3.0 MPa	(-100) kPa-3.0 MPa		•	•
6T	0-10.0 MPa	(-100) kPa-10.0 MPa		•	•
Code	**Wetted Part Material**			**CD**	**CG**
	Flanges	**Drain Valves**	**Other Parts**		
2	316 SST	316 SST	316L SST	•	•
3	C-276 alloy (not available with range codes 0, 1T–6T)	316 SST	316L SST	•	•
6	316 SST	C-276 alloy	316L SST	•	•
Code	**Isolating Diaphragm Material**			**CD**	**CG**
2	316L SST			•	•
3	C-276 alloy (not available with range code 0)			•	•
5	Tantalum (not available with range codes 0 and 1, 1T–6T)			•	•
7	316L SST gold-plated (only for range codes 1T–6T)			•	•
Code	**O-ring Material**			**CD**	**CG**
1	Rubber NO-68-1			•	•
2	Glass-filled PTFE (only for range codes 1T–6T)			•	•
3	Fluorosilicone rubber (only for range codes 1T–6T)			•	•
4	Graphite-filled PTFE (only for range codes 1T–6T)			•	•
Code	**Fill Fluid**			**CD**	**CG**
1	Silicone			•	•
Code	**Fasteners**			**CD**	**CG**
L3	35ХГСА or 30ХГСА steel parts			•	•
L4	09Х16Н4Б or 14Х17Н2 steel parts			•	•
Code	**Output**			**CD**	**CG**
A	4-20 mA HART Output			•	•
B	0-5 mA (available only with M5 code, not available for transmitters with IM code)			•	•
Code	**HART Revision**			**CD**	**CG**
HR5	HART Revision 5 (not available with B output code)			•	•
Other Options					
Code	**Display and Interface**			**CD**	**CG**
M5 [3]	Built-in LCD			•	•
Code	**Application-Specific Certification**			**CD**	**CG**
IM	0Ex ia Intrinsic Safety			•	•
EM	1Ex db Explosion Safety			•	•
KM	1Ex db Explosion Safety or 0Ex ia Intrinsic Safety			•	•

Table A.1 (Continued)

Code	Integral Manifold			CD	CG
S5[4)]	Available with manifold installed			•	•
Code	**Diaphragm Seal Assembly**[9)]			**CD**	**CG**
S1	Assemble to one diaphragm seal (available only with isolating diaphragm code 2, wetted part material code 2, 6, O-ring material code 2, fill fluid code 1, fastener code L4; not available with mounting parts code D1–D8, DA for 150CG, with LT, BR6, MW2, RS codes)			•	•
S2	Assemble to two diaphragm seals (available only with isolating diaphragm code 2, wetted part material code 2, 6, O-ring material code 2, fill fluid code 1, fastener code L4; not available with mounting parts code D1–D8, DA, with LT, BR6, MW2, RS codes)			•	–
Code	**Mounting Parts** [5)]			**CD**	**CG**
D1	Stainless steel mounting flange with threaded hole K1/4″			•	•
D2	Stainless steel mounting flange with threaded hole K1/2″			•	•
D3	Stainless steel mounting flange with threaded hole ¼NPT			•	•
D4	Stainless steel mounting flange with threaded hole ½NPT			•	•
D5	Stainless steel mounting flange with nipple and coupling nut M20 x 1.5 for 14 mm outer pipe diameter (inner ∅10)			•	•
D6	Carbon steel mounting flange with nipple for 14 mm outer pipe diameter			•	•
D7	Stainless steel mounting flange with ¼NPT thread connector			•	•
D8	Stainless steel mounting flange with ½NPT thread connector			•	•
DA	Stainless steel mounting flange with nipple and coupling nut M20 x 1.5 for 14 mm outer pipe diameter (inner ∅8)			•	•
Code	**Nipple Material (for mounting part codes D5, D6, DA only)**			**CD**	**CG**
	Nipple Material	**Sealing Gasket Material (for D5, DA codes)**	**Nipple Coupling Nut Material (for D5, DA codes)**		
2	316L SST or 12X18H10T steel	12X18H10T steel	Stainless steel	•	•
4	Plated carbon steel	M3 copper	Plated carbon steel	•	•
5	09Г2С plated carbon steel (for D5, D6 codes only)	M3 copper	Plated carbon steel	•	•
Code	**Mounting Brackets**			**CD**	**CG**
B1	Mounting bracket to mount the transmitter on 50 mm outer diameter pipe (material – plated carbon steel)			•	•
B4	Mounting bracket to mount the transmitter on 50 mm outer diameter pipe (material – 12X18H10T steel)			•	•
Code	**Guaranteed Service Life**			**CD**	**CG**
WR5	Guaranteed service life is 5 years			•	•
Code	**Other Options**			**CD**	**CG**
Q4	Calibration Certificate			•	•
C1	Custom configuration (requires Configuration Data Sheet)			•	•
QZ	Remote seal system performance calculation report				
ST[12)]	Additional nameplate on a stainless steel wire (filled in as required by the customer)			•	•
SX[12)]	Additional nameplate on a stainless steel chain (filled in as required by the customer)			•	•
SC	Plug and socket connector: plug 2RMG14B4SH1E2B and socket 2RM14KPN4G1V1 (standard location according to Figure G.24, Appendix G) (not available with EM, KM codes)			•	•

Table A.1 (Continued)

SC1	Plug and socket connector DIN 43650 (standard location according to Figure G.24, Appendix G), (not available with EM, KM, MW1, MW2 codes)	•	•
SC2	Plug and socket connector: plug 2RM22B4SH3V1 and socket 2RM22KPN4G3V1 (standard location according to Figure G.24, Appendix G) (not available with EM, KM codes)	•	•
SC6	Plug and socket connector: plug 2RMG14B4SH1E2B (socket is not available) (standard location according to Figure G.24, Appendix G) (not available with EM, KM codes)	•	•
SC7	Plug and socket connector: plug 2RM22B4SH3V1 (socket is not available) (standard location according to Figure G.24, Appendix G) (not available with EM, KM codes)	•	•
KXX[8)]	Cable entry	•	•
D0[11)]	Stainless steel cable entry plug (not available with IM, EM, KM codes)	•	•
PA	Reference accuracy ±0.2 %	•	•
PC	Reference accuracy ±0.5 %	•	•
RH	Red electronics module housing	•	•
T0	Terminal block for industrial electromagnetic environment as per GOST R IEC 61326-1 (available for output code A only)	•	•
J5	Plate for configuration protection (available for M5 code)	•	•
LT	Low temperature version for ambient temperature from –55 °C (available only for codes: range 1T-6T; output A; O-ring 2, 3, 4; fastener L4)	•	•
BR6	Low temperature version for ambient temperature from –60 °C (available only for codes: range 1T–6T, output A, O-rings 2, 4, fastener L4)	•	•
ML	Average lifetime is 30 years	•	•
AR	Additional testing for 360 hours (available only for IM, EM, KM codes)	•	•
OR	For application at Gazprom Dobycha Orenburg sites (available with Q15 code only, without mounting parts)	•	•
AT	For application at Gazprom Dobycha Astrakhan sites (available with Q15 code only, without mounting parts)	•	•
OS	Alternative location of the plug and socket connector according to Figure G.24, Appendix G	•	•
RS[6)]	Alternative location of the drain valve according to Figure G.23, Appendix G	•	•
P1	Pressure test with a test report	•	•
Q8	Material traceability certificate consistent with EN 10204, 3.1B	•	•
Q76	Positive material identification certificate (available only with Q8)	•	•
Q15[10)]	Certificate of Conformance NACE MR0175/ISO 15156:2015, NACE MR0103/ISO 17945:2015 (available only for wetted part material and drain valve material code 6)	•	•
QM	Drawing up a Verification Certificate	•	•
QP	Drawing up a Verification Report	•	•
IG[7)]	INTERGAZCERT Certificate	•	•
SM	Seismic Certificate	•	•
MW1	Technical supervision of the Russian Maritime Register of Shipping (not available with LT, BR6 codes)	•	•
MW2	Technical supervision of the Russian Maritime Register of Shipping for use with a distinguishing mark WINTERIZATION(–50) (available only for isolating diaphragm material codes 2 and 7, O-ring codes 2, 4, fastener code L4, not available with LT, BR6 codes)	•	•

Table A.1 (Continued)

Notes

1 "–" – not available "●" – available.

2 The manifold (unless S5 code is specified) is available as a separate product in accordance with documents for the manifold.

[1)] The transmitter may be set up as required by the customer for any measurement range within the limits specified for the model; do not specify C1 in order line.

[2)] Atmospheric pressure of 101.3 kPa.

[3)] The transmitter with 4-20 mA signal and no built-in display shall be configured with HART communicator or HART modem and configuration programs.

[4)] The manifold is specified in a separate order line, ordering information shall comply with TU 3742-057-51453097-2009. When ordering the transmitter with S5 code, mounting parts are not specified in the transmitter model string. Mounting parts and bracket for manifold mounting are specified in the manifold order line.

[5)] O-ring material for mounting flanges D1, D2, D3, D4, D5, D7, D8, DA and nipple material for D6 code is rubber NO-68-1.

[6)] Not available with Metran 0104MT2 manifold TU 3742-057-51453097-2009.

[7)] The Technical Data Sheet includes Certificate number.

[8)] Cable entry order line is in accordance with Pressure Catalog.

[9)] To be specified with a separate order line in accordance with isolating diaphragm documentation.

[10)] Available only for mounting part codes D1, D2, D3, or D4, isolating diaphragm codes 2, 3, 7. When ordering option S5, the manifold should be ordered with Q15 code. When ordering options S1 or S2, remote seal should be ordered with Q15 or Q25 code.

[11)] If D0 code is not specified, the transmitter is supplied with a plastic cable entry plug (except for IM, EM, KM codes).

[12)] The size of the nameplate is 65×35 mm. Text parameters: text height 5 mm, GOST type A font, left alignment of the text.

Typical Model Number 150CD2 (0 – 40) kPa[1)] 2 2 1 1 L3 A HR5 M5 IM D5 2 B1 Q4 C1 K02 PA J5 LT ML IG

[1)] Pressure range with an engineering unit

Table A.2 150TG Gage Pressure Transmitters and 150TA Absolute Pressure Transmitters

Model	**Description**	
150TG	Gage Pressure Transmitter	
150TA	Absolute Pressure Transmitter	
Mandatory Options		
Code	**Range** [1]	
	150TG	**150TA**
0T	(-40)-40 kPa	0-40 kPa
1	(-100)-160 kPa	0-160 kPa
1T	(-100)-250 kPa	0-250 kPa
2, 2T	(-100) kPa-1 MPa	0-1 MPa
3T	(-100) kPa-3 MPa	0-3 MPa
3	(-100) kPa-6 MPa	0-6 MPa
4T	(-100) kPa-10 MPa	0-10 MPa
4	(-100) kPa-25 MPa	0-25 MPa
5T	(-100) kPa-40 MPa	0-40 MPa
5, 6T	(-100) kPa-60 MPa	–
Code	**Process Connection**	
2G	M20×1.5	
2B	½ NPT female thread	
2N	½ NPT male thread (available only for range codes 0T–6T)	
2C	G1/2 male thread (available only for range codes 0T–5T, not applicable with material code of parts in contact with the working environment, 4)	
Code	**Isolating Diaphragm Material**	**Wetted Part Material**
2	316L SST	316L SST
3	C-276 alloy (not available with range code 6T)	316L SST
4	C-276 alloy	C-276 alloy (for range codes 0T-6T)
7	316L SST gold-plated (only for range codes 0T-5T)	316L SST
Code	**Fill Fluid**	
1	Silicone	
Code	**Output**	
A	4-20 mA HART Output	
B	0-5 mA (available only with M5 code, not available for transmitters with IM code, not available for range codes 0T–6T)	
Code	**HART Revision**	
HR5	HART Revision 5 (not available with B output code)	
Other Options		
Code	**Display and Interface**	
M5[3]	Built-in LCD	
Code	**Application-Specific Certification**	
IM	0Ex ia Intrinsic Safety	
EM	1Ex db Explosion Safety	
KM	1Ex db Explosion Safety or 0Ex ia Intrinsic Safety	
Code	**Integral Manifold**	
S5[4]	Available with manifold installed	

Table A.2 (Continued)

Code	Diaphragm Seal Assembly[7)]		
S1	Assemble to one diaphragm seal (available only with process connection code 2B, isolating diaphragm material code 2, fill fluid code 1; not available with range code 6T, codes LT, BR6, MW2, mounting parts code 2A–2H, integral manifold code S5)		
Code	**Mounting Parts (for process connection code 2G only; not available for OR, AT codes)**		
2A	Adapters ¼FNPT		
2D	Adapters ¼MNPT		
2E	Adapters ½MNPT		
2F	Nipple for 14 mm outer pipe diameter (inner Ø10) with coupling nut M20×1.5		
2H	Nipple for 14 mm outer pipe diameter (inner Ø8) with coupling nut M20×1.5		
Code	**Nipple and Adapter Material**		
	Nipple, Adapter Material	**Sealing Gasket Material**	**Nipple Coupling Nut Material (only for 2F, 2H codes)**
2	12X18H10T or 316L SST	12X18H10T steel	Stainless steel
4	Plated carbon steel	M3 copper	Plated carbon steel
5	09Г2С plated carbon steel (for 2F code only)	M3 copper	Plated carbon steel
Code	**Mounting Brackets**		
B1	Mounting bracket to mount panel on 50 mm outer diameter pipe (material – plated carbon steel)		
B4	Mounting bracket to mount panel on 50 mm outer diameter pipe (material – 12X18H10T steel)		
Code	**Guaranteed Service Life**		
WR5	Guaranteed service life is 5 years		
Code	**Other Options**		
Q4	Calibration Certificate		
C1	Custom configuration (requires Configuration Data Sheet)		
QZ	Remote seal system performance calculation report		
ST[10)]	Additional nameplate on a stainless steel wire (filled in as required by the customer)		
SX[10)]	Additional nameplate on a stainless steel chain (filled in as required by the customer)		
SC	Plug and socket connector: plug 2RMG14B4SH1E2B and socket 2RM14KPN4G1V1 (not available with codes EM, KM, standard location according to Figure G.24, Appendix G)		
SC1	Plug and socket connector DIN 43650 (standard location according to Figure G.24, Appendix G, not available with EM, KM, MW1, MW2 codes)		
SC2	Plug and socket connector: plug 2RM22B4SH3V1 and socket 2RM22KPN4G3V1 (not available with EM, KM codes, standard location according to Figure G.24, Appendix G)		

Table A.2 (Continued)

SC6	Plug and socket connector: plug 2RMG14B4SH1E2B (socket is not available) (not available with EM, KM codes, standard location according to Figure G.24, Appendix G)
SC7	Plug and socket connector: plug 2RM22B4SH3V1 (socket is not available) (not available with EM, KM codes, standard location according to Figure G.24, Appendix G)
KXX[5)]	Cable entry
D0[9)]	Stainless steel cable entry plug (not available with IM, EM, KM codes)
PA	Reference accuracy ±0.2 %
PC	Reference accuracy ±0.5%
RH	Red electronics module housing
T0	Terminal block for industrial electromagnetic environment as per GOST R IEC 61326-1
J5	Plate for configuration protection (available for M5 code)
LT	Low temperature version for ambient temperature from –55 °C (available for output code A only)
BR6	Low temperature version for ambient temperature from –60 °C (available for range codes 0T–6T, output code A only)
ML	Average lifetime is 30 years (not available with OR, AT codes)
AR	Additional testing for 360 hours (available only for IM, EM, KM codes)
OR	For application at Gazprom Dobycha Orenburg sites (available with Q15 code only, without mounting parts, not available with range code 6T)
AT	For application at Gazprom Dobycha Astrakhan sites (available with Q15 code only, without mounting parts, not available with range code 6T)
OS	Alternative location of the plug and socket connector according to Figure G.24, Appendix G
P1	Pressure test with a test report
QM	Drawing up a Verification Certificate
QP	Drawing up a Verification Report
Q8	Material traceability certificate consistent with EN 10204, 3.1B
Q76	Positive material identification certificate (available only with Q8)
Q15[8)]	Certificate of Compliance to NACE MR0175/ISO 15156:2015, NACE MR0103/ISO 17945:2015 (not available with range code 6T, not available with mounting part codes 2A, 2D, 2E, 2F)
IG[6)]	INTERGAZCERT Certificate
SM	Seismic Certificate
MW1	Technical supervision of the Russian Maritime Register of Shipping (not available with LT, BR6 codes)
MW2	Technical supervision of the Russian Maritime Register of Shipping for use with a distinguishing mark WINTERIZATION(–50) (available for isolating diaphragm material codes 2 and 7, not available with LT, BR6 codes)

Table A.2 (Continued)

Note. The manifold (unless S5 code is specified) is available as a separate product.

_____

[1)] The transmitter may be set up as required by the customer for any measurement range within the limits specified for the model; do not specify C1 in order line.
[3)] HART device should be used for configuration, calibration, selection of operation mode for the transmitter with 4-20 mA signal and without built-in display.
[4)] The manifold is specified in a separate order line, ordering information shall comply with TU 3742-057-51453097-2009. When ordering the transmitter with S5 code, mounting parts are not specified in the transmitter model string. Mounting parts are specified in the manifold order line.
[5)] Cable entry order line is in accordance with Pressure Catalog.
[6)] The Technical Data Sheet includes Certificate number.
[7)] To be specified with a separate order line in accordance with isolating diaphragm documentation.
[8)] Not available with mounting part codes 2A, 2D, 2E, 2F. When ordering option S5, the manifold should be ordered with Q15 code. When ordering option S1, remote seal should be ordered with Q15 or Q25 code.
[9)] If D0 code is not specified, the transmitter is supplied with a plastic cable entry plug (except for IM, EM, KM codes).
[10)] The size of the nameplate is 65×35 mm. Text parameters: text height 5 mm, GOST type A font, left alignment of the text.

Typical Model Number 150TG3 (0 – 4) MPa[1)] 2G 2 1 A HR5 M5 IM 2F 2 B4 Q4 C1 K02 PA J5 LT ML IG

_____

[1)] Pressure range with an engineering unit.

APPENDIX B
(Mandatory)
Configuration Data Sheet (C1 code)

Configuration Data Sheet

Customer: _____ Sales Order No.: _____

Model No.: _____ Oder Item: _____

Tagging

Tag [5]: _____ (4 lines of 14 characters)

Software Tag [2]: |__|__|__|__|__|__|__|__| (8 characters)

Output Information

4 mA (0 mA) = _____ 0*[1]

20 mA (5 mA) = _____ P_{max}*[1]

Pressure Units = ☐ Pa
☐ bar
☐ MPa*
☐ kgf/cm^2
☐ kgf/m^2
☐ kPa*
☐ mmHg
☐ mmH_2O

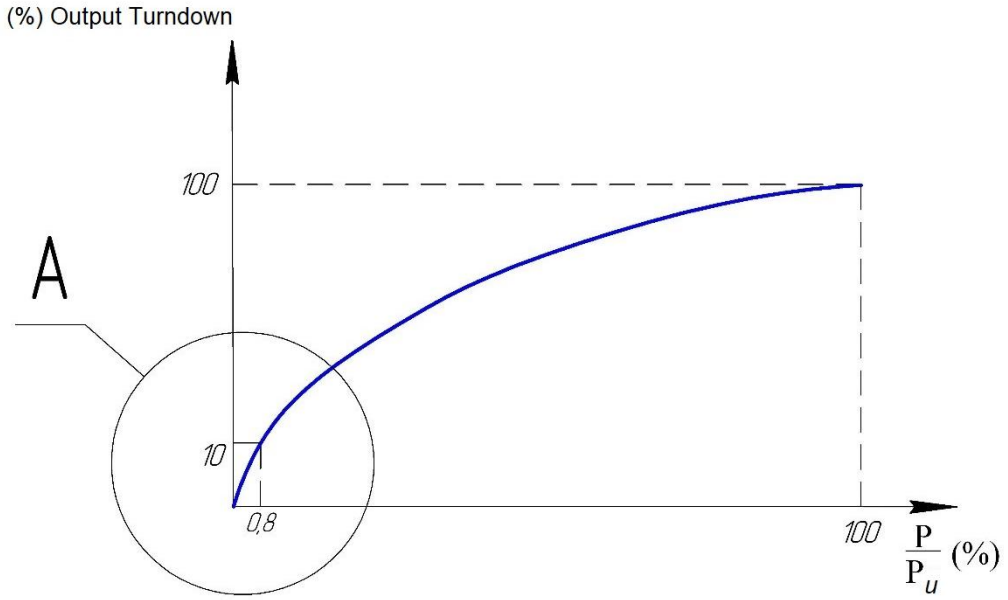
Output [1] = ☐ Linear* ☐ Square Root

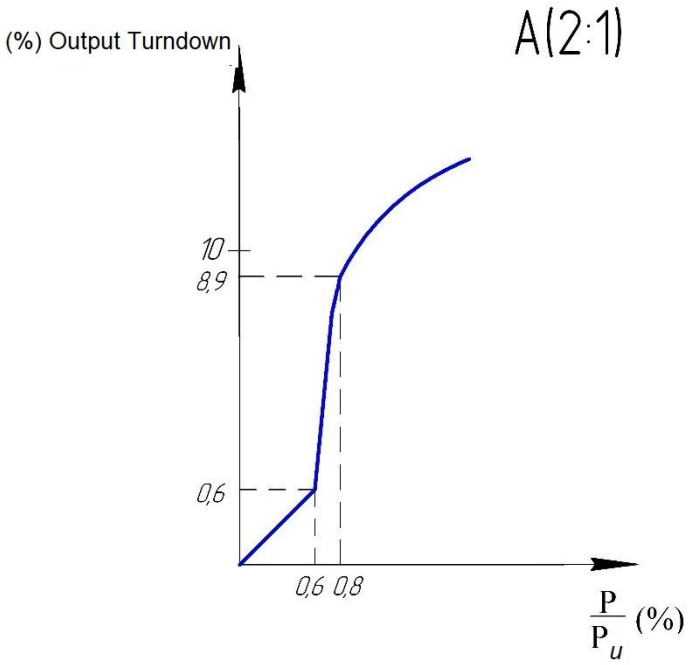
Damping [1] = ☐ 0.045 s ☐ 0.5 s* ☐ 1.2 s ☐ 2.5 s
☐ 5 s ☐ 10 s ☐ 20 s ☐ 40 s

Transmitter Information [1), 2)]
Descriptor: |__|__|__|__|__|__|__|__|__|__|__|__|__|__|__| (16 characters) Message |__|__|__|__|__|__|__|__|__|__|__|__|__|__|__|__|__|__|__|__|__|__|__|__|__|__|__|__|__|__|__|__| (32 characters) Date: ☐ ☐ / ☐ ☐/ ☐ ☐ Day Month Year
Alarm Levels [1)]
Alarm: ☐ High ☐ Low*
Security Information [1)]
Write Protect: ☐ OFF* ☐ ON
Signal Selection [1)]
☐ 4-20 mA with digital signal based on HART protocol * ☐ Multidrop Communication [3)] Transmitter Address [4)](1-15):_____

* Default
[1)] Requires C1 option code in order line of transmitter;
[2)] Set by HART protocol commands;
[3)] Fixed current is 4 mA;
[4)] Pressure transmitter default address equals 1, if multidrop mode is selected;
[5)] Only for ST option.

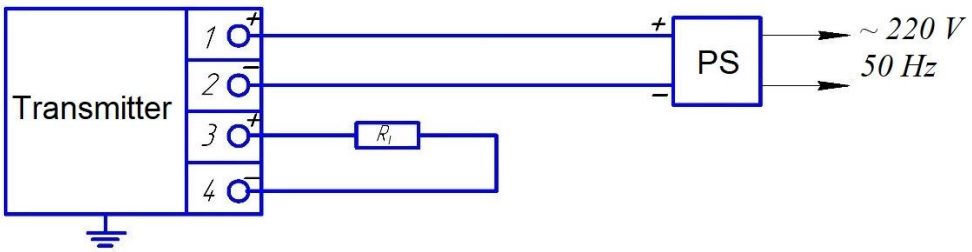
APPENDIX C
(Mandatory)
Square Root Function





APPENDIX D
(Mandatory)

External Wiring Diagrams



PS – Power Supply (e.g., Metran-602, Metran-604)
Rl – Load Resistance in accordance with paragraph 1.2.10

Figure D.1. 0-5 mA Output Signal
(four-wire communication line)

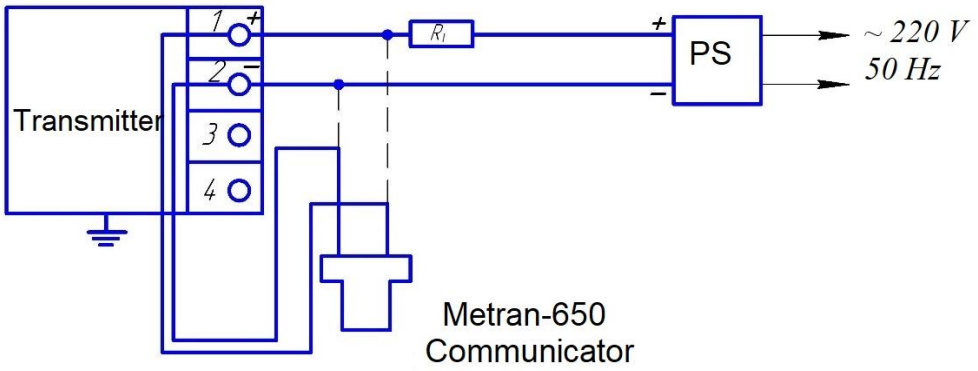
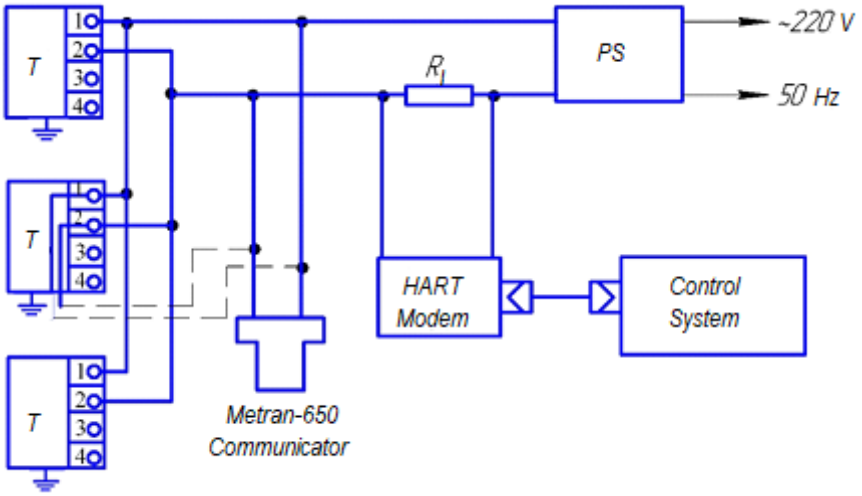


Figure D.2. 4-20 mA Output Signal
(two-wire communication line)

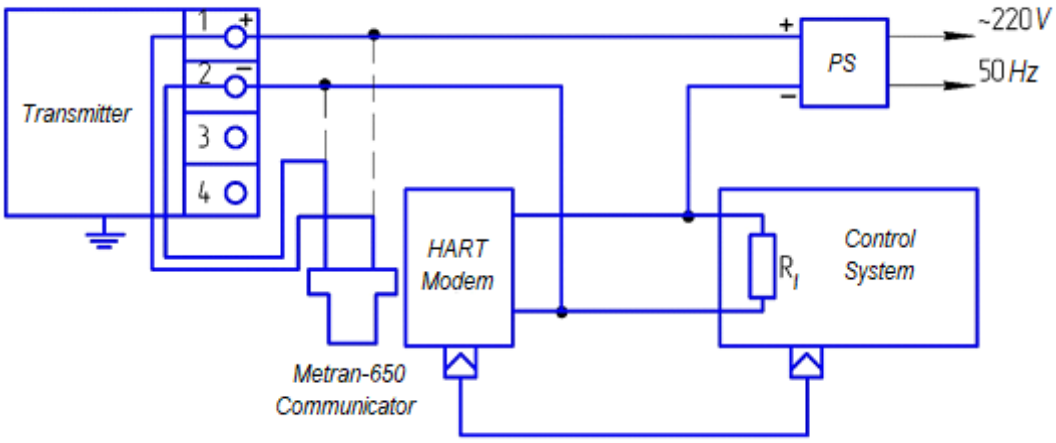


T - Transmitter

Notes

1. Communicator and HART modem may be connected to any point on the loop or terminals 1 and 2 of any transmitter.
2. Signal loop must have a resistance of not less than 250 Ohms.
3. Output current of power supply (PS) should not be less than the total useful current of all transmitters (4 mA per transmitter), useful current surge (maximum value) when engaged 25 mA per transmitter.

Figure D.3. Multidrop Operation Mode



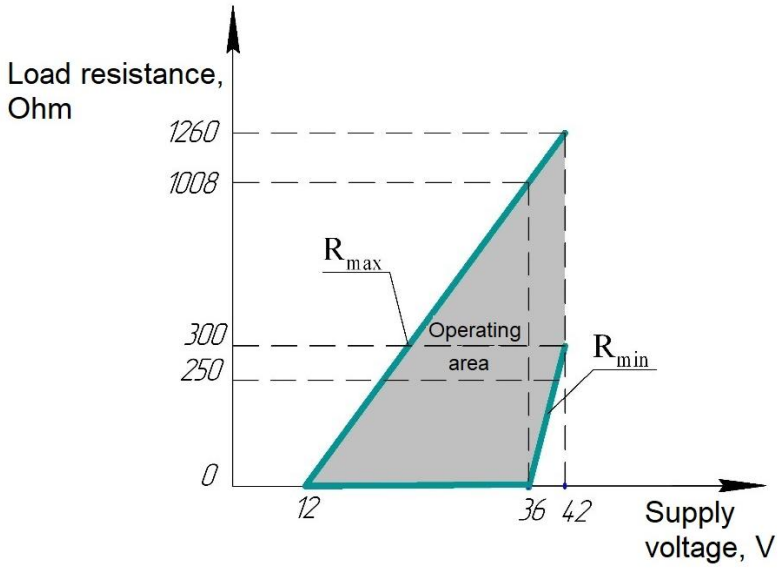
Notes

1. PS is the same as in Figure D.1.
2. Communicator and HART modem may be connected to any point on the loop.
3. Signal loop must have a resistance of not less than 250 Ohms for communication.
4. R_l is total resistance of all loads in control system.

Figure D.4. Variant of Wiring Diagram for Transmitter and HART Modem

APPENDIX E
(Mandatory)

Maximum Load Resistance vs. Supply Voltage



R_{min}= 250 Ohms for transmitters with HART signal

Figure E.1. 4-20 mA Output Signal

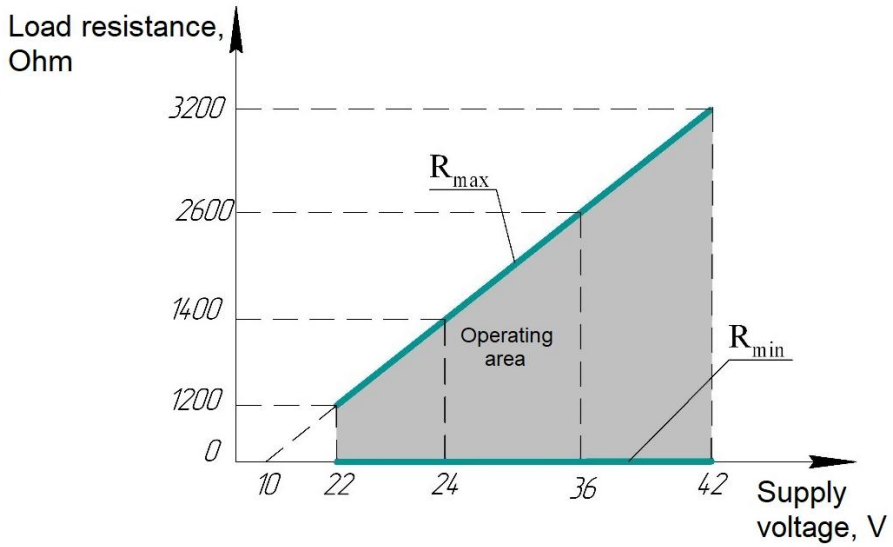
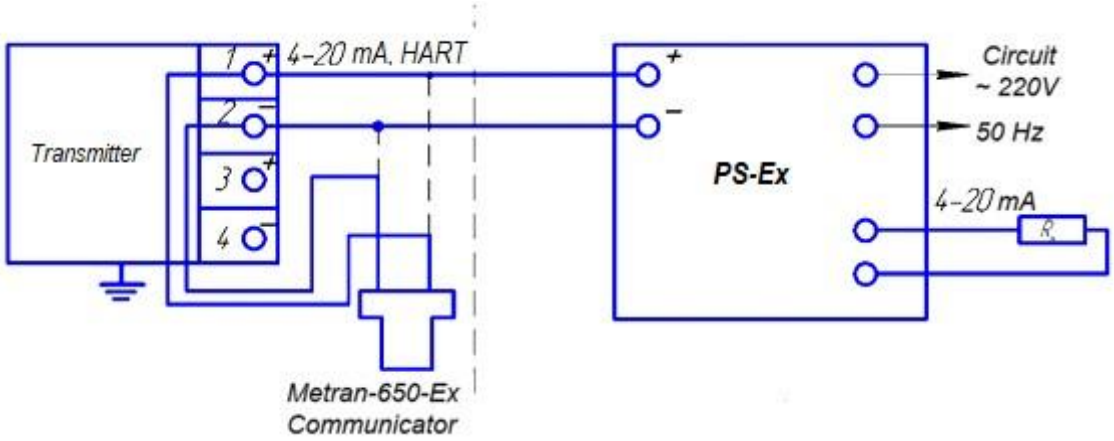


Figure E.2. 0-5 mA Output Signal

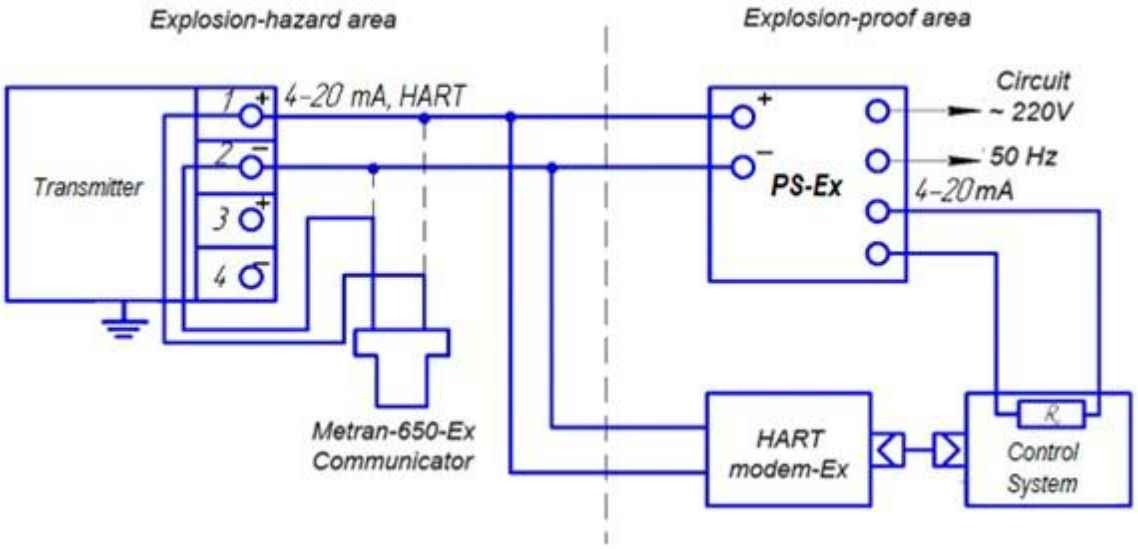
APPENDIX F
(Mandatory)

External Wiring Diagrams for Exia Transmitters



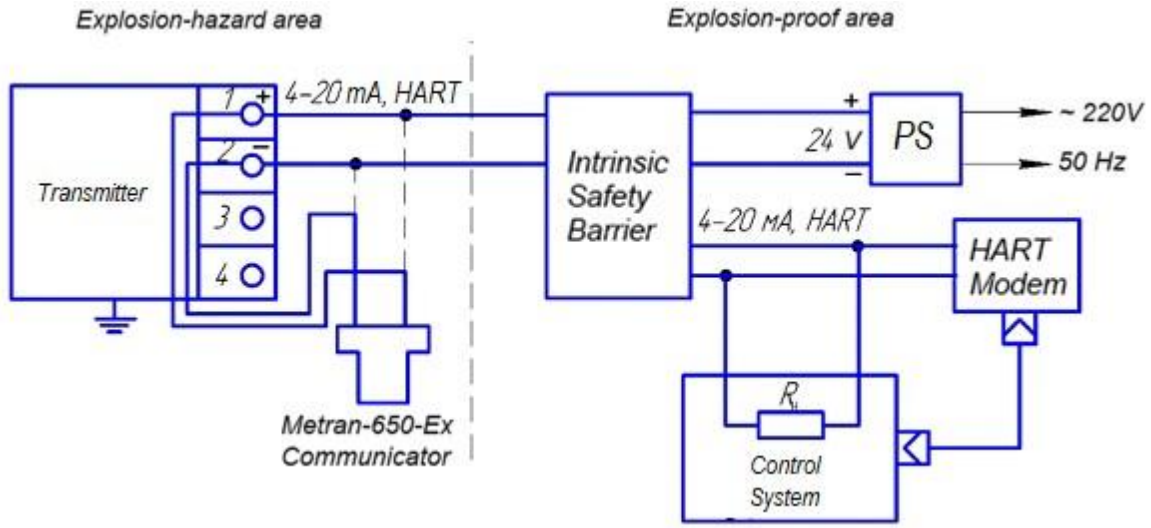
PS-Ex – Intrinsically Safe Power Supply (e.g., BPD-40-2k-Ex)
R_l is determined by PS-Ex parameters

Figure F.1. For Transmitters with Intrinsic Safety Block



Notes
1. PS-Ex is the same as in Figure F.1.
2. R_l is total resistance of all loads in control system.
3. Communicator and HART modem may be connected to any point on the loop, including explosion-hazard area.

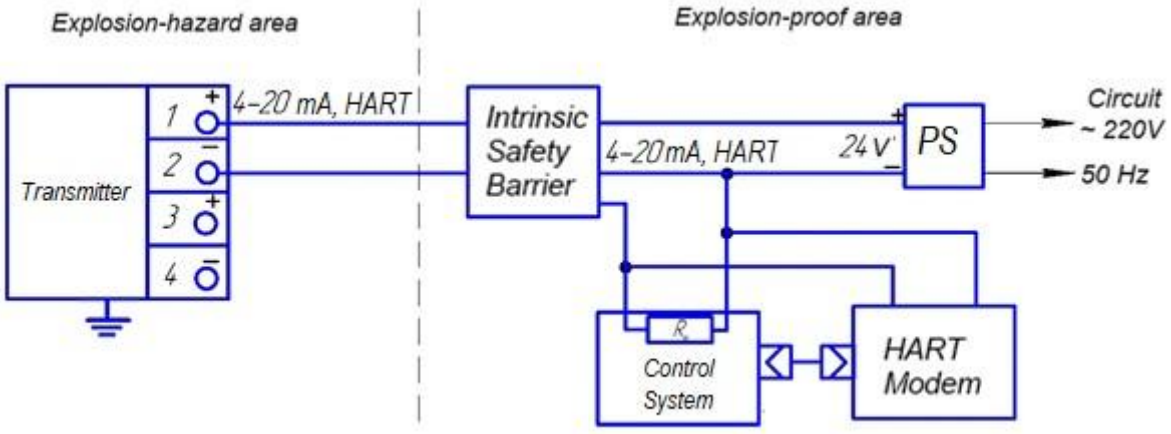
Figure F.2. Variant of Wiring Diagram for Transmitter with Intrinsically Safe Power Supply and HART Modem



Notes

1. PS – Power Supply (e.g., Metran-602, Metran-604)
2. R_l – total resistance of all loads in control system defined by barrier parameters, but not less than 250 Ohms.
3. Intrinsically Safe Barrier, e.g., D1010S, D1010D.

Figure F.3. Transmitter with Intrinsically Safe Barrier with Galvanic Isolation of Signal Loops and Power Circuits

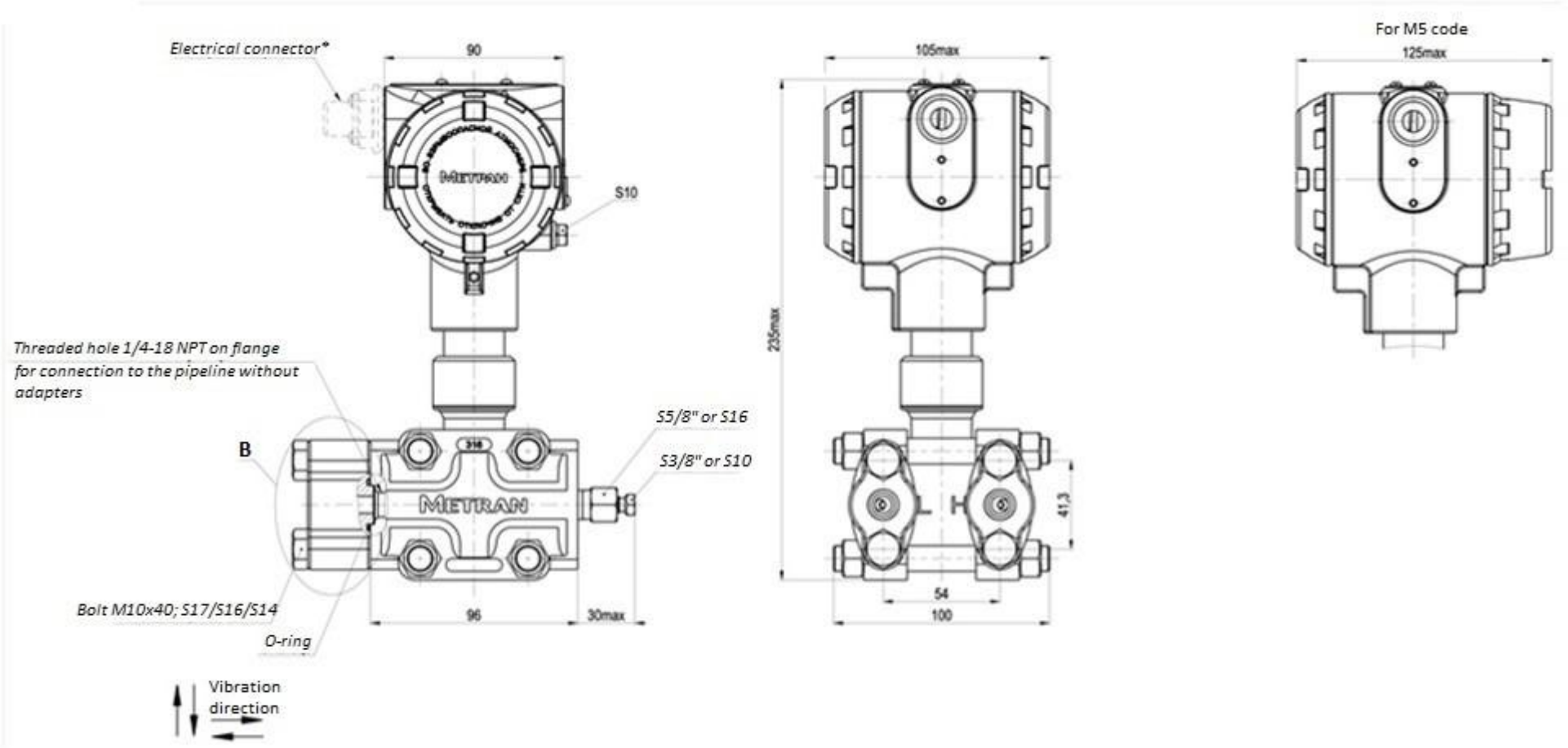


Notes

1. PS – Power Supply (e.g., Metran-602, Metran-604)
2. R_l – total resistance of all loads in control system defined by barrier parameters, but not less than 250 Ohms.
3. Intrinsically Safe Barrier, e.g., 9001/51.

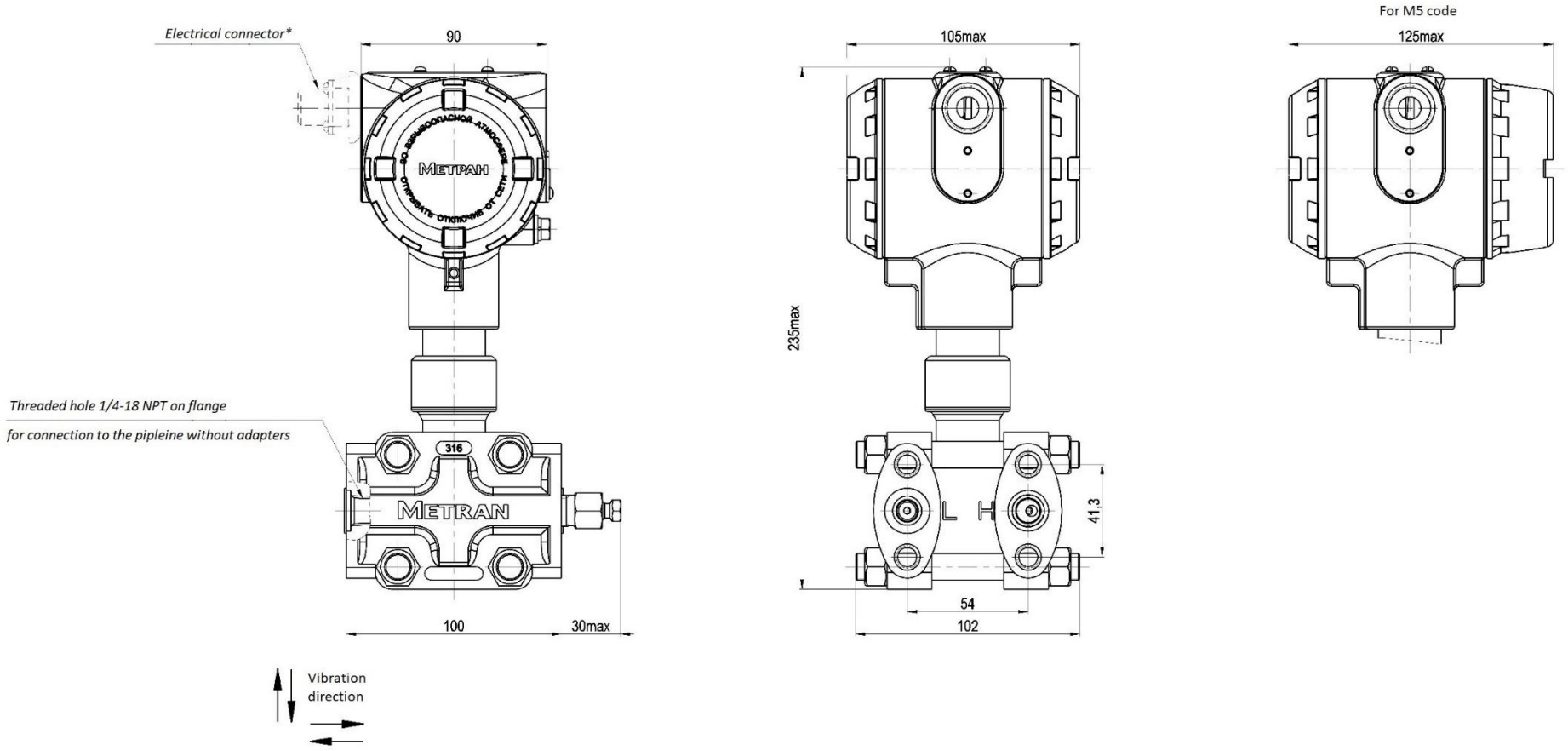
Figure F.4. Transmitter with Intrinsically Safe Barrier without Galvanic Isolation of Signal Loops and Power Circuits

APPENDIX G
(Reference)
Dimensional Drawings



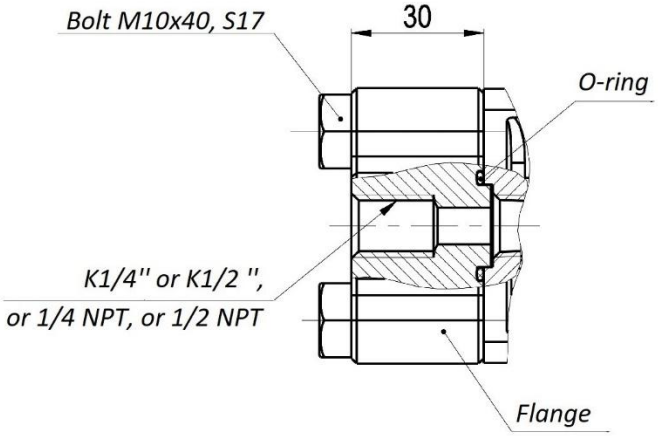
* Options of electrical connectors are shown in Appendix G1.
For mounting flange options (external element B), refer to Figure G.3.

Figure G.1. 150CD Transmitters with Range Codes 1T–6T

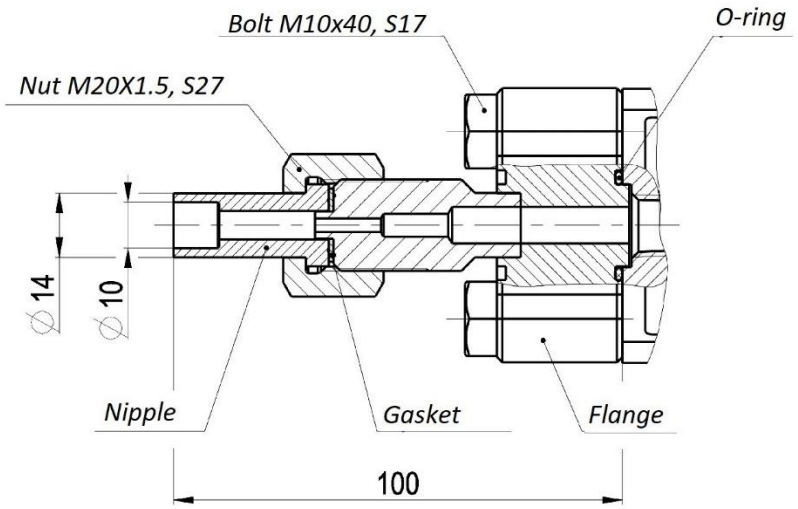


* Options of electrical connectors are shown in Appendix G1.

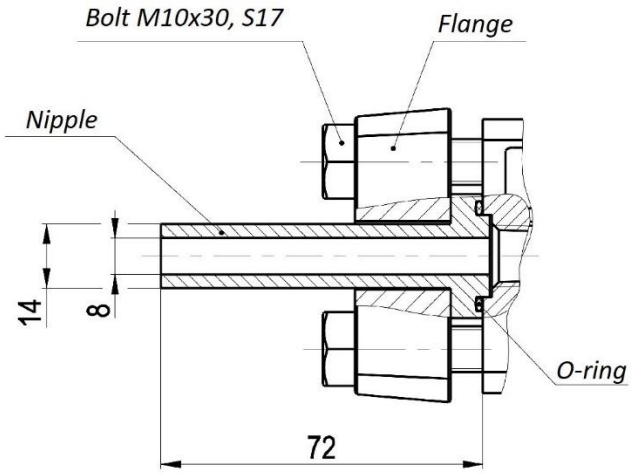
Figure G.2. 150CG Transmitters with Range Codes 1T–6T. Also refer to Figure G.1



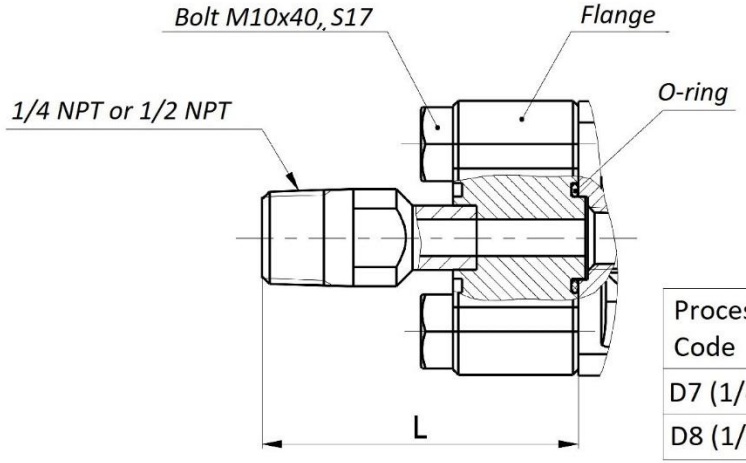
Mounting parts code D1-D4



Mounting parts code D5



Mounting parts code D6



Process Connection Code	L, mm
D7 (1/4 MNPT)	62.5
D8 (1/2 MNPT)	68.5

Mounting parts code D7-D8

Figure G.3. 150CD, 150CG Transmitters with Range Codes 1T–6T. Mounting Parts

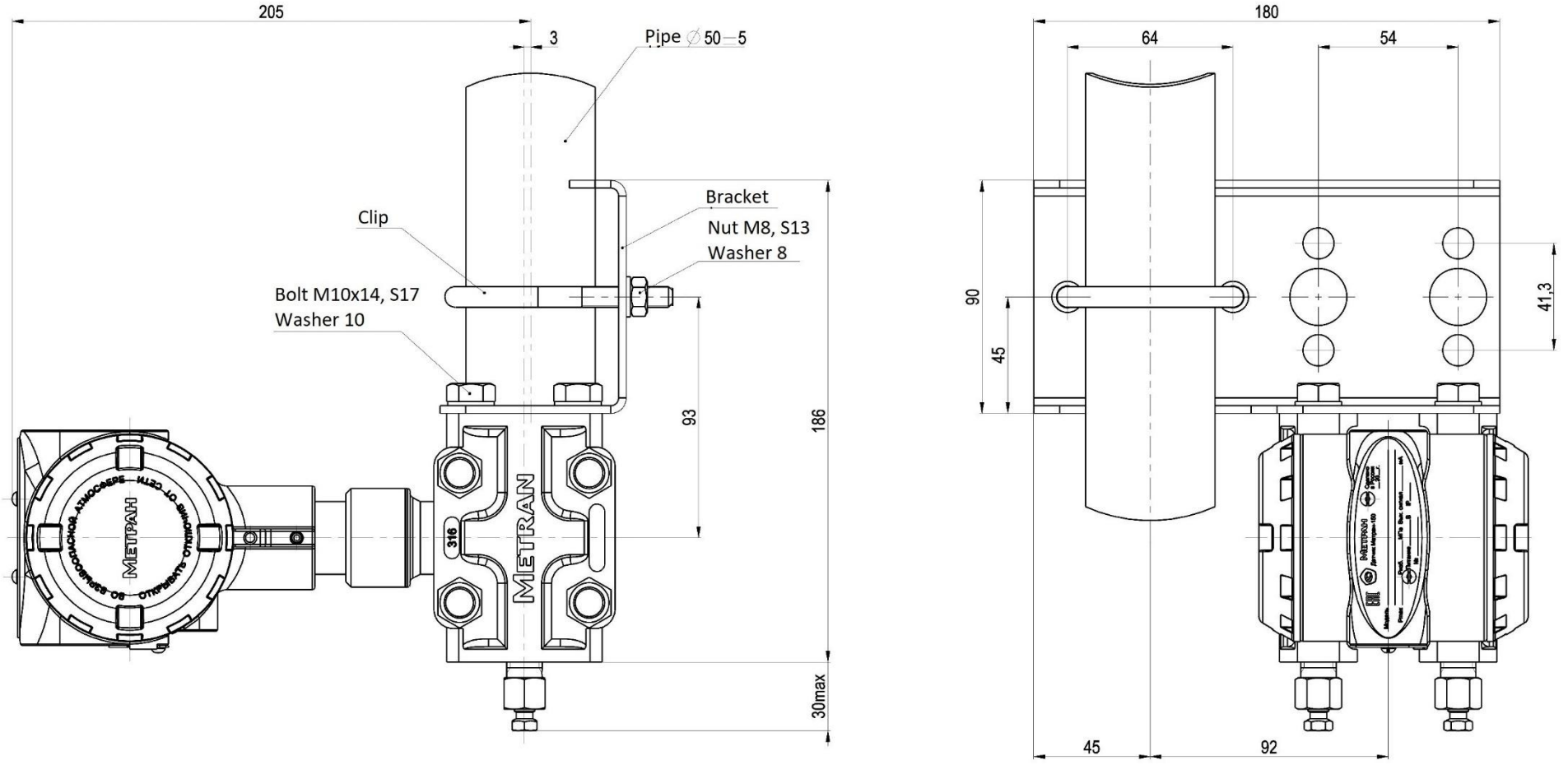
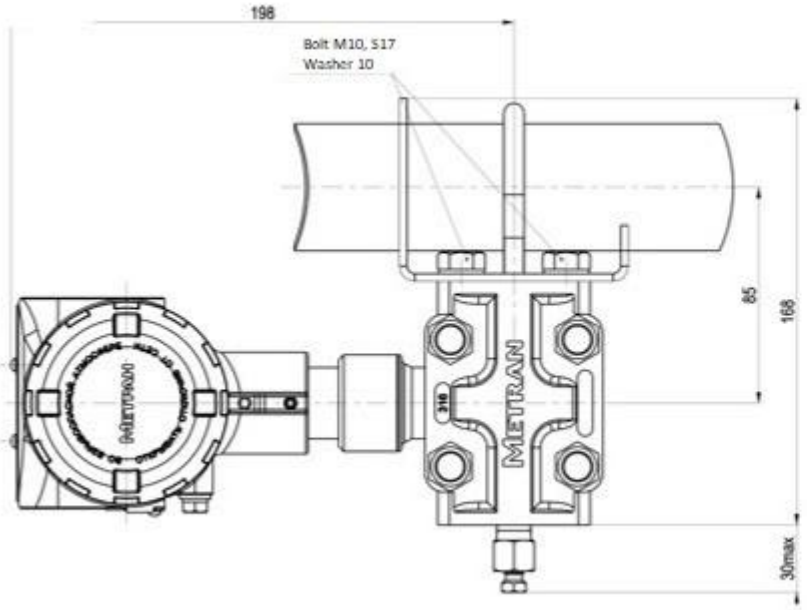


Figure G.4. 150CD, 150CG Transmitters with Range Codes 1T–6T and Mounting Bracket for Pipe or Panel Mount (B1 or B4 Code), Pipe Shown Vertically



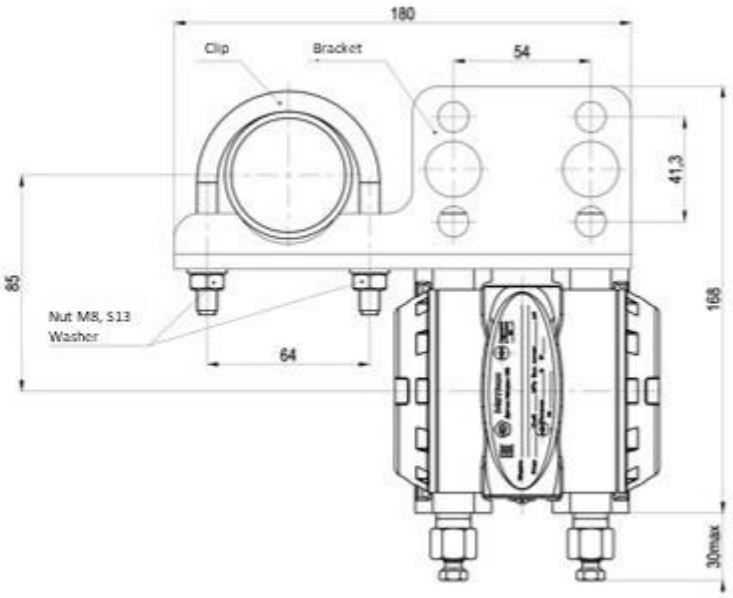


Figure G.5. 150CD, 150CG Transmitters with Range Codes 1T–6T and Mounting Bracket for Pipe or Panel Mount (B1 or B4 Code), Pipe Shown Horizontally

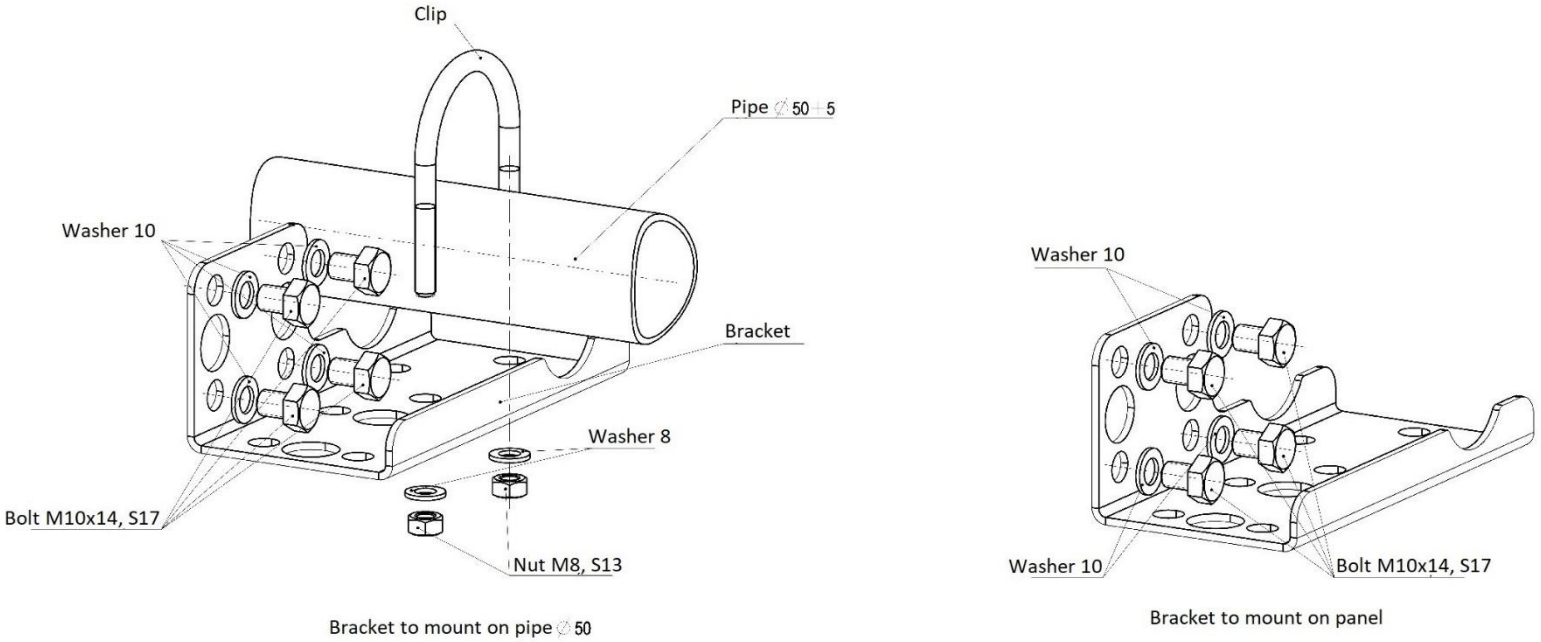


Figure G.6. Mounting Brackets for Pipe or Panel Mount (B1 or B4 Code) of 150CD, 150CG Transmitters with Range Codes 1T–6T

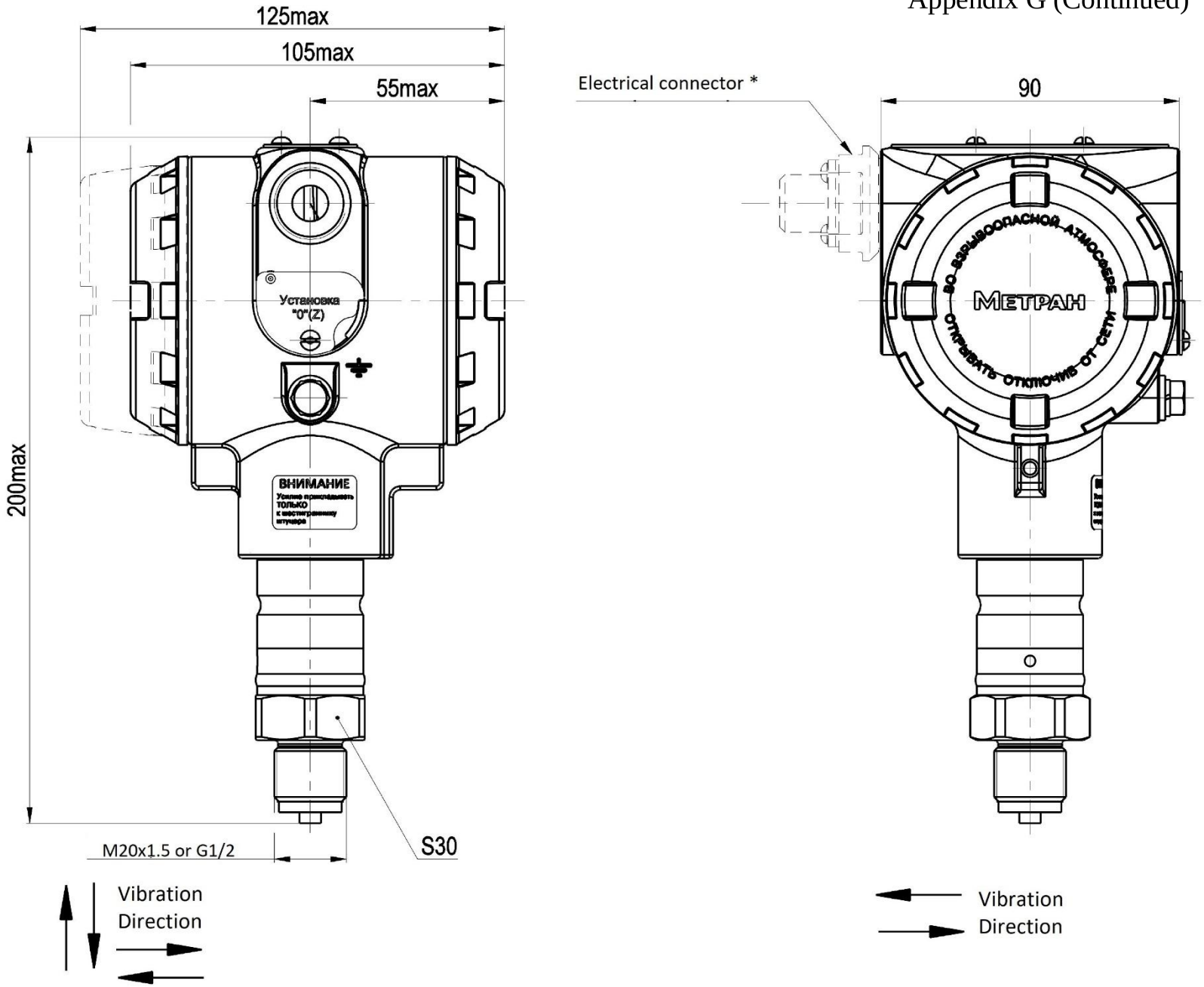


Figure G.7. 150TG (Range Codes 0T–6T), 150TA Transmitters (Range Codes 0T-5T) with Process Connection Codes 2G, 2C

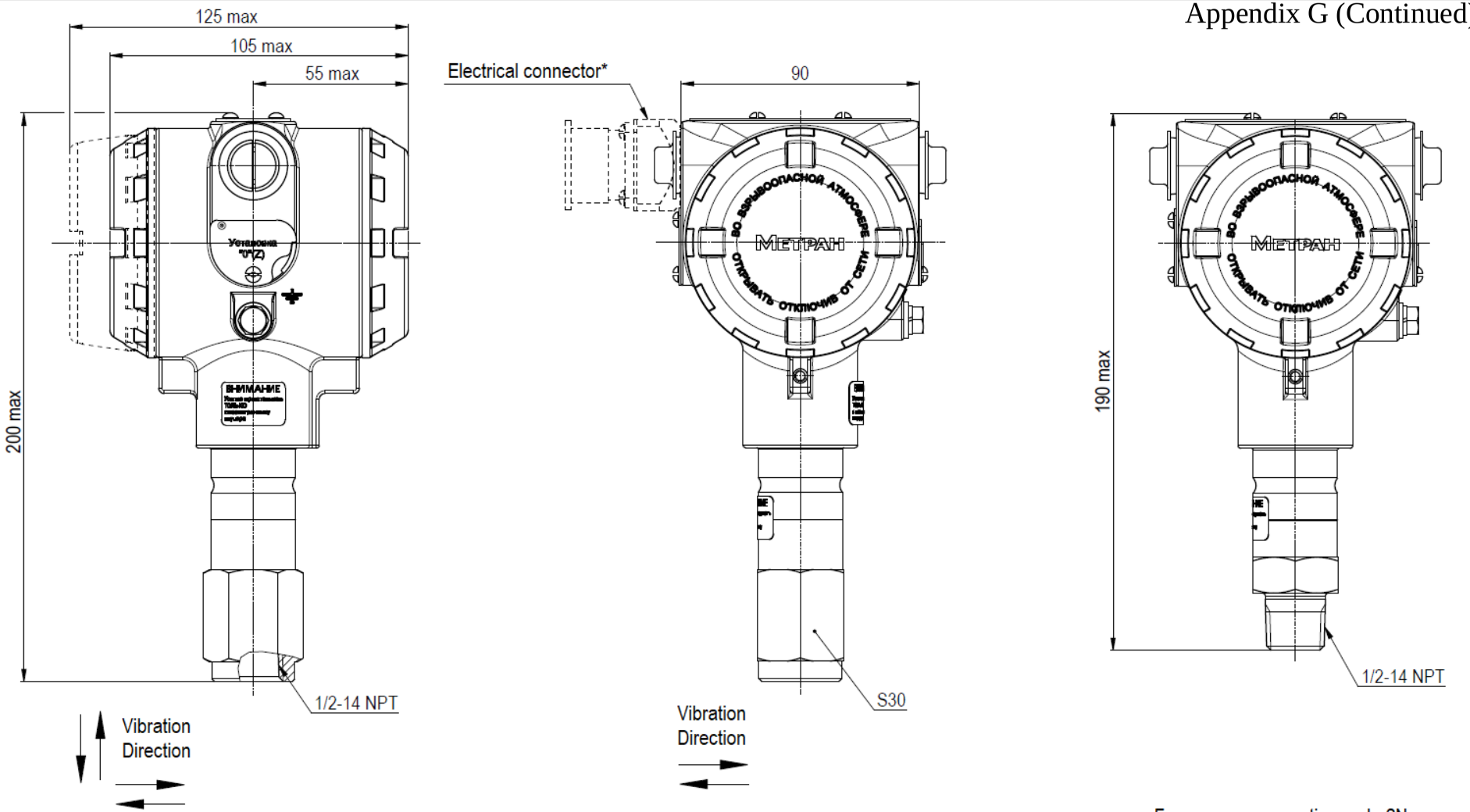


Figure G.8. 150TG (Range Codes 0T-6T), 150TA Transmitters (Range Codes 0T–5T) with Process Connection Codes 2B, 2N

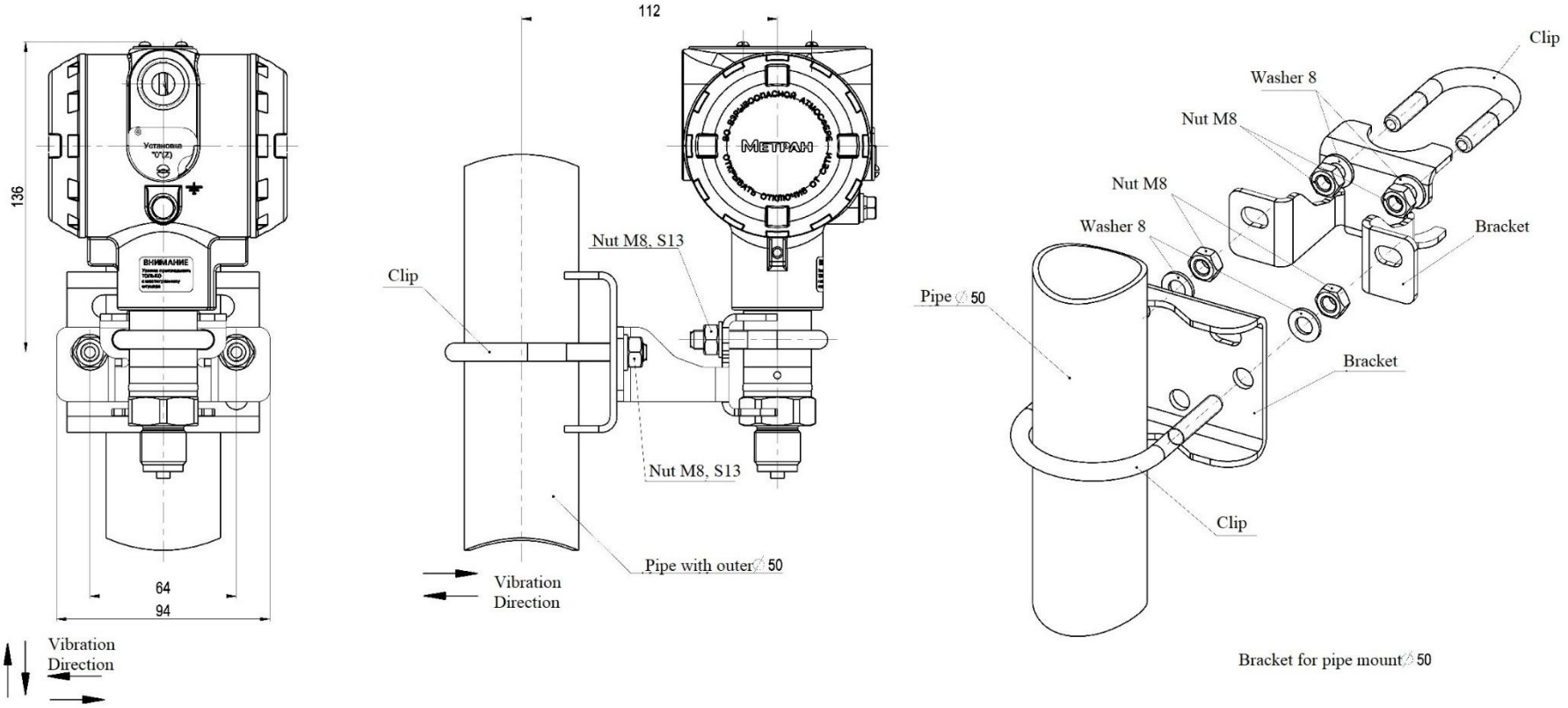


Figure G.9. 150TG (Range Codes 0T-6T), 150TA Transmitters (Range Codes 0T–5T) with Process Connection Code 2G and Mounting Bracket for Pipe Mount (B1 or B4 Code)

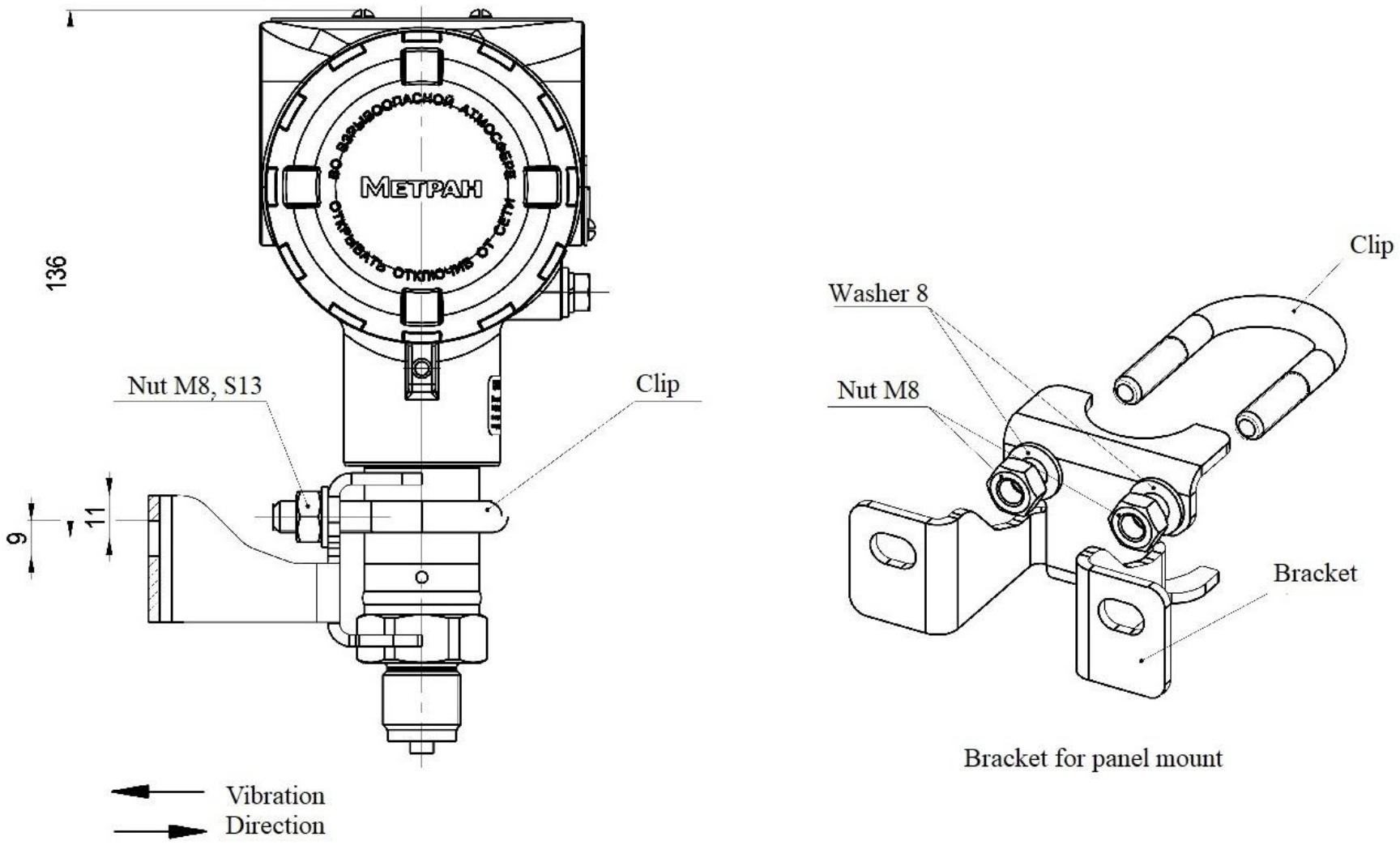
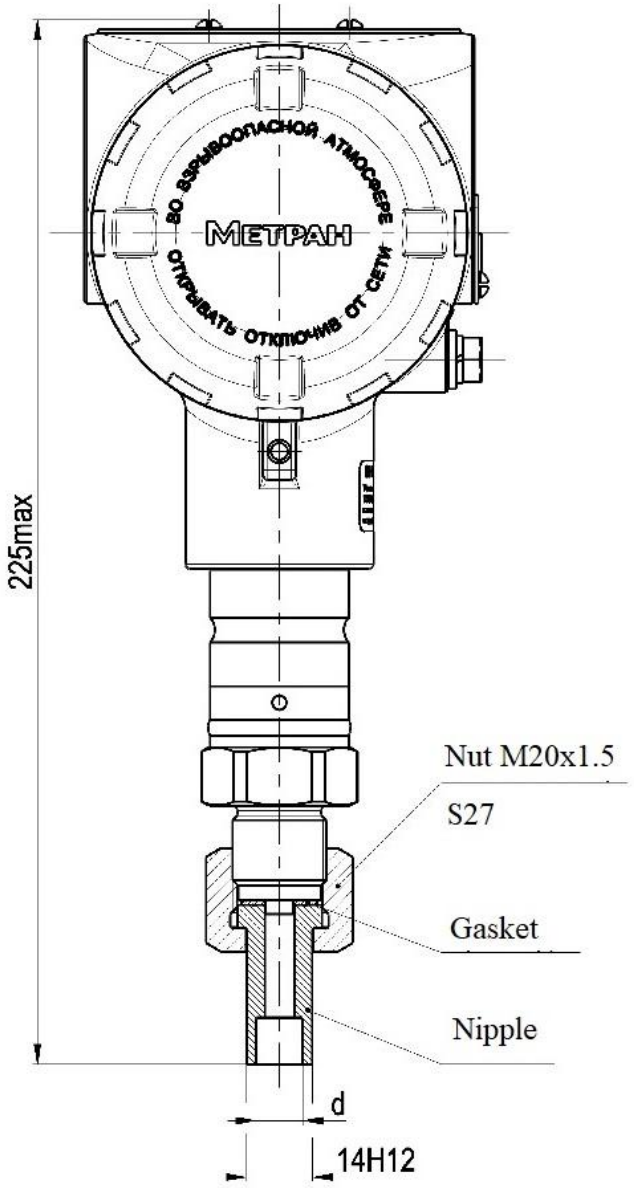
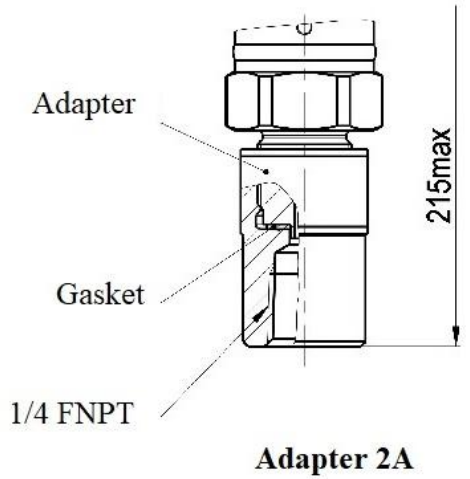


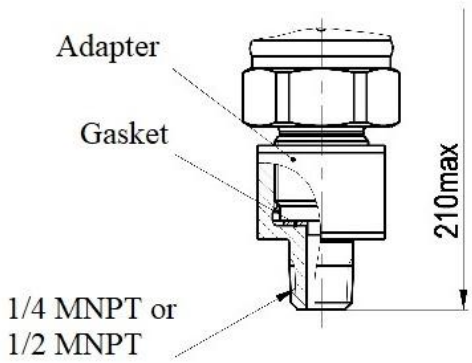
Figure G.10. 150TG (Range Codes 0T-6T), 150TA Transmitters (Range Codes 0T–5T) with Process Connection Code 2G and Mounting Bracket for Panel Mount (B1 or B4 Code)



Nipple for 2H or 2F code

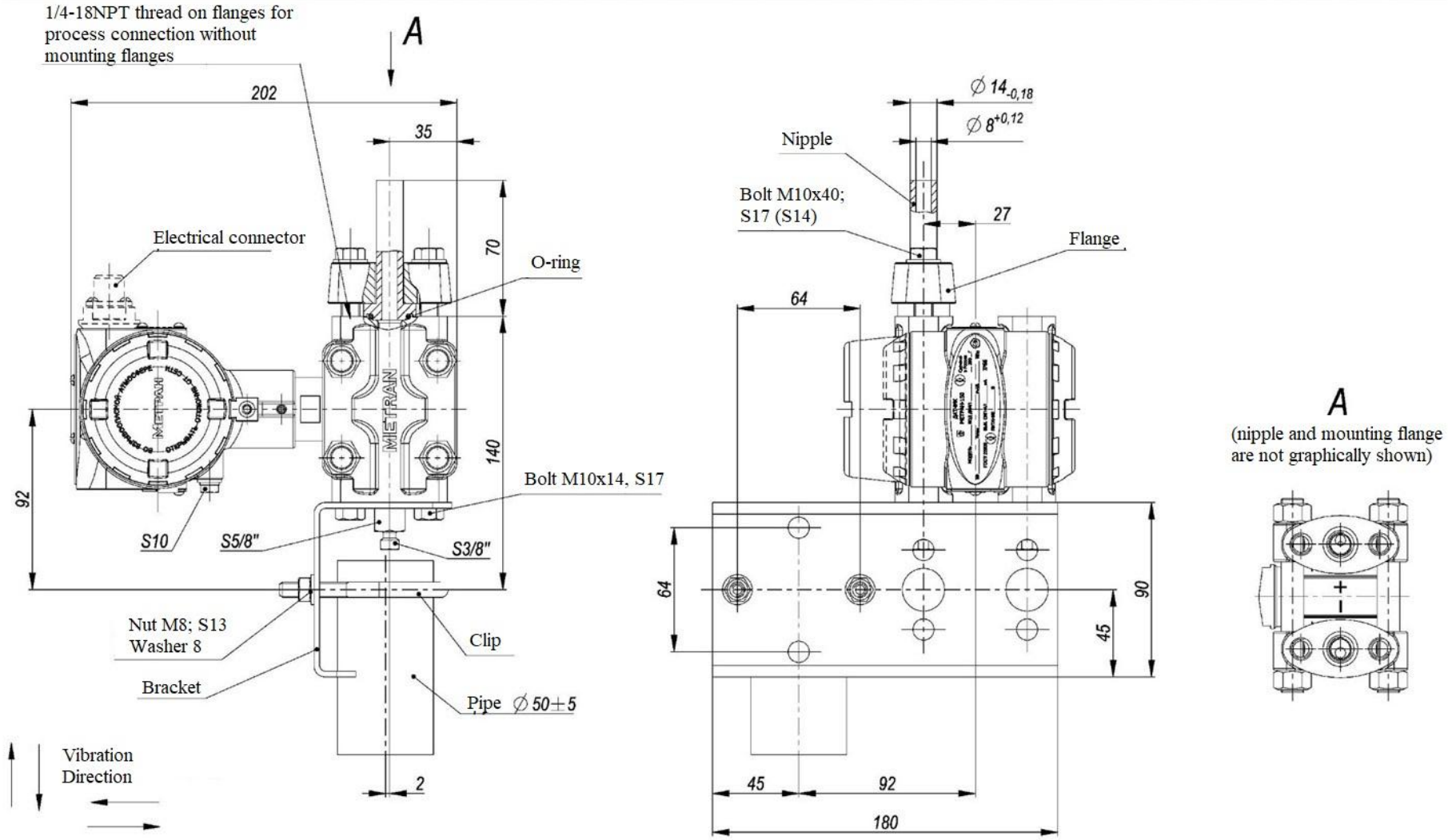


Adapter 2A



Adapter 2D or 2E

Figure G.11. 150TG (Range Codes 0T-6T),, 150TA Transmitters (Range Codes 0T–5T) with Process Connection Code 2G and Installed Nipple or Adapters (2A, 2B, 2E, 2F, 2H Codes)



Options of electrical connectors are shown in Appendix G1.

Figure G.12. 150CG Transmitters (Range Codes 0–5) with Installed Nipples (D6 Code) and Mounting Bracket for 2" Pipe Mount (B1 or B4 Code)

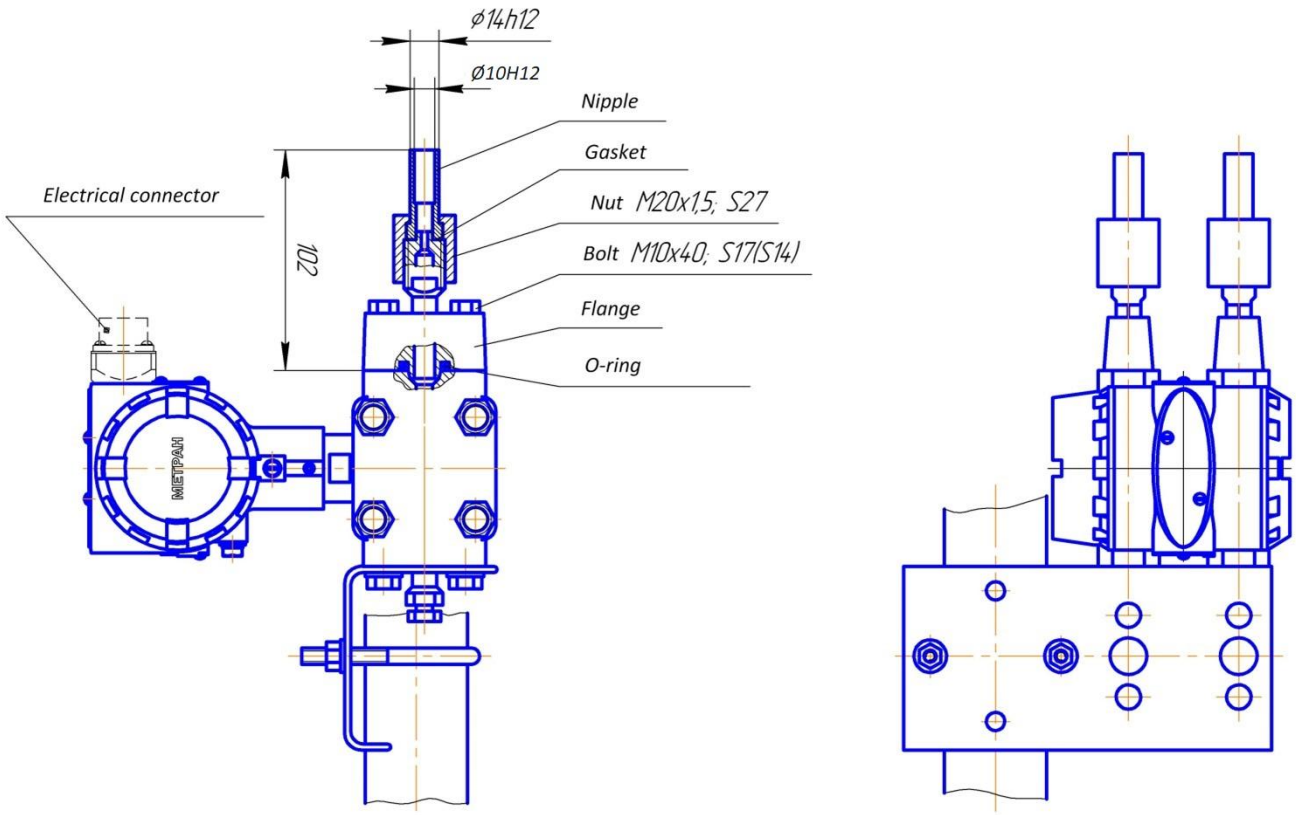


Figure G.13. 150CD Transmitters with Range Codes 0-5, Installed Nipples under Coupling Nuts M20x1.5 (D5 Code) and Mounting Bracket for 2" Pipe Mount (B1 or B4 Code).
Also refer to Figure G.12

Process Connection Code	L, mm
D7 (1/4 MNPT)	62.5
D8 (1/2 MNPT)	68.5

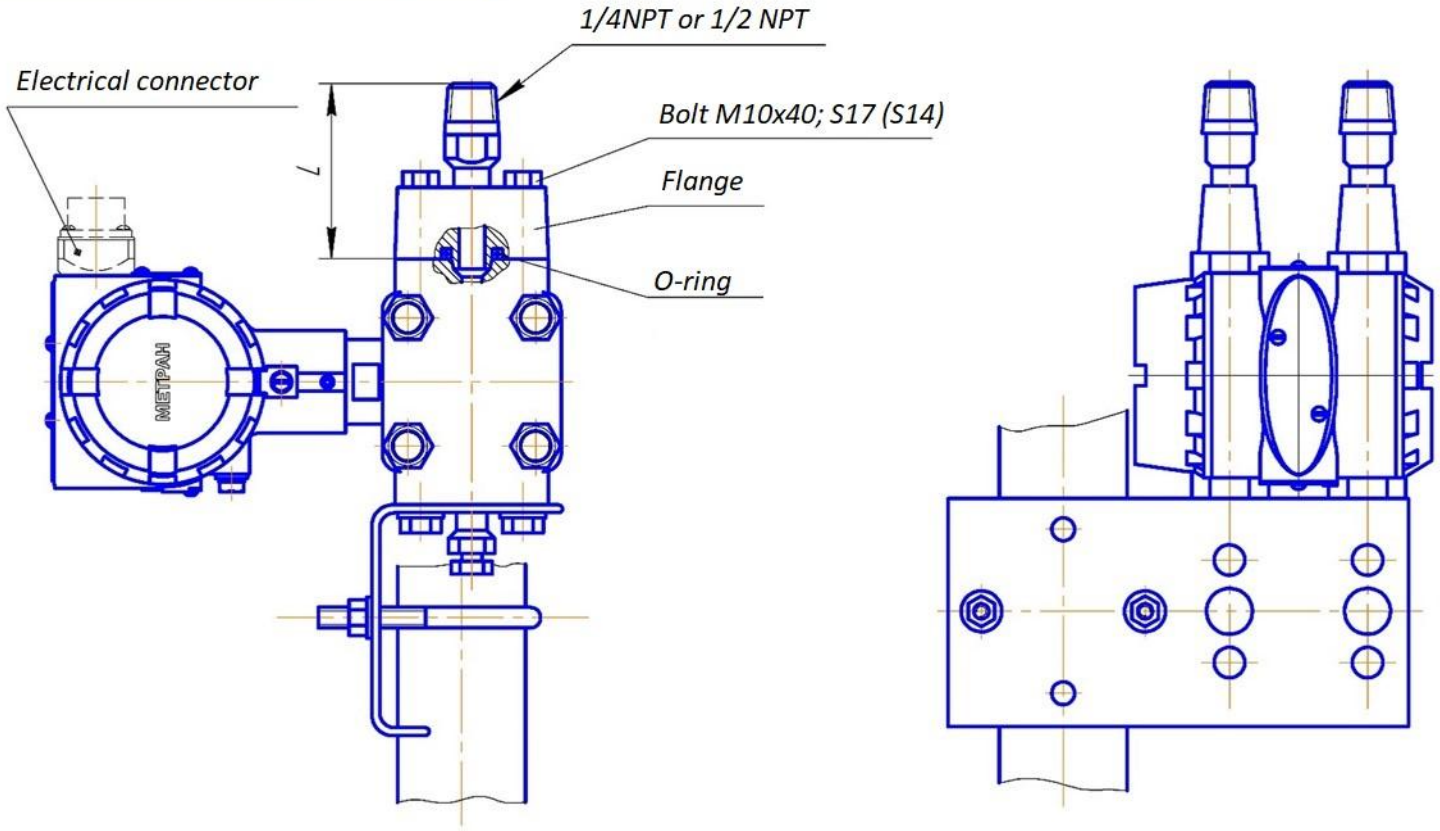


Figure G.14. 150CD Transmitters with Range Codes 0–5, Installed Mounting Flanges with 1/4 NPT Connector (D7 Code) or 1/2 NPT Connector (D8 Code) and Mounting Bracket for 2" Pipe Mount (B1 or B4 Code). Also refer to Figure G.12

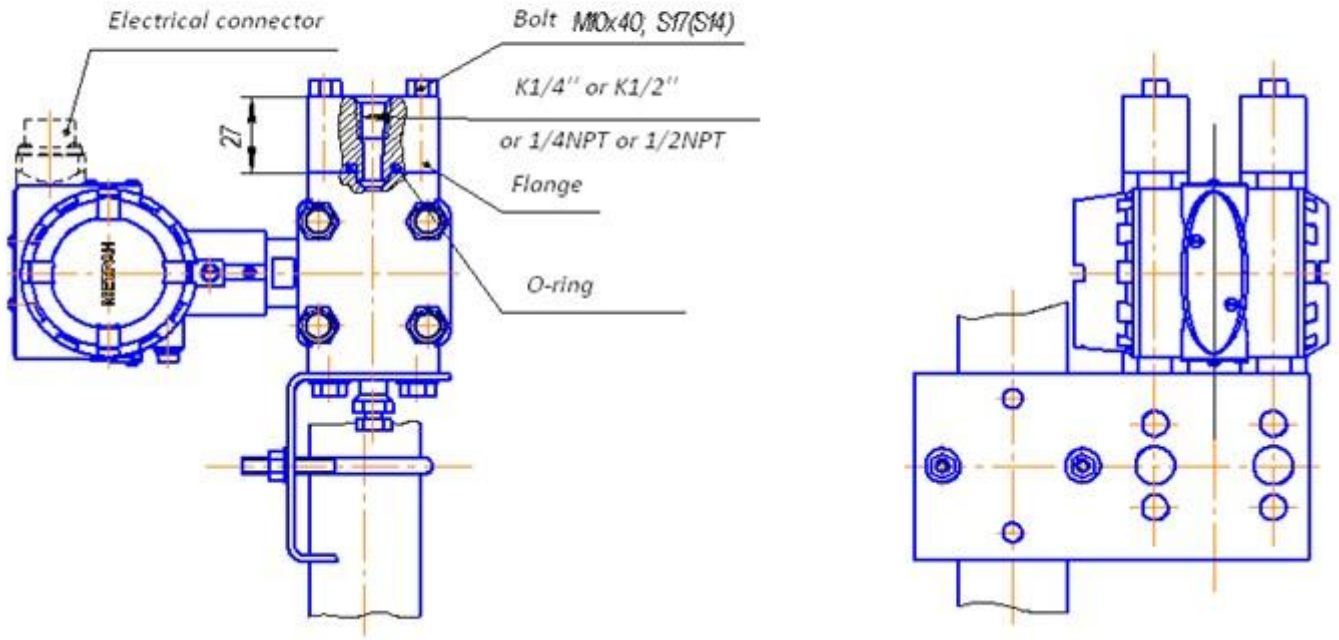
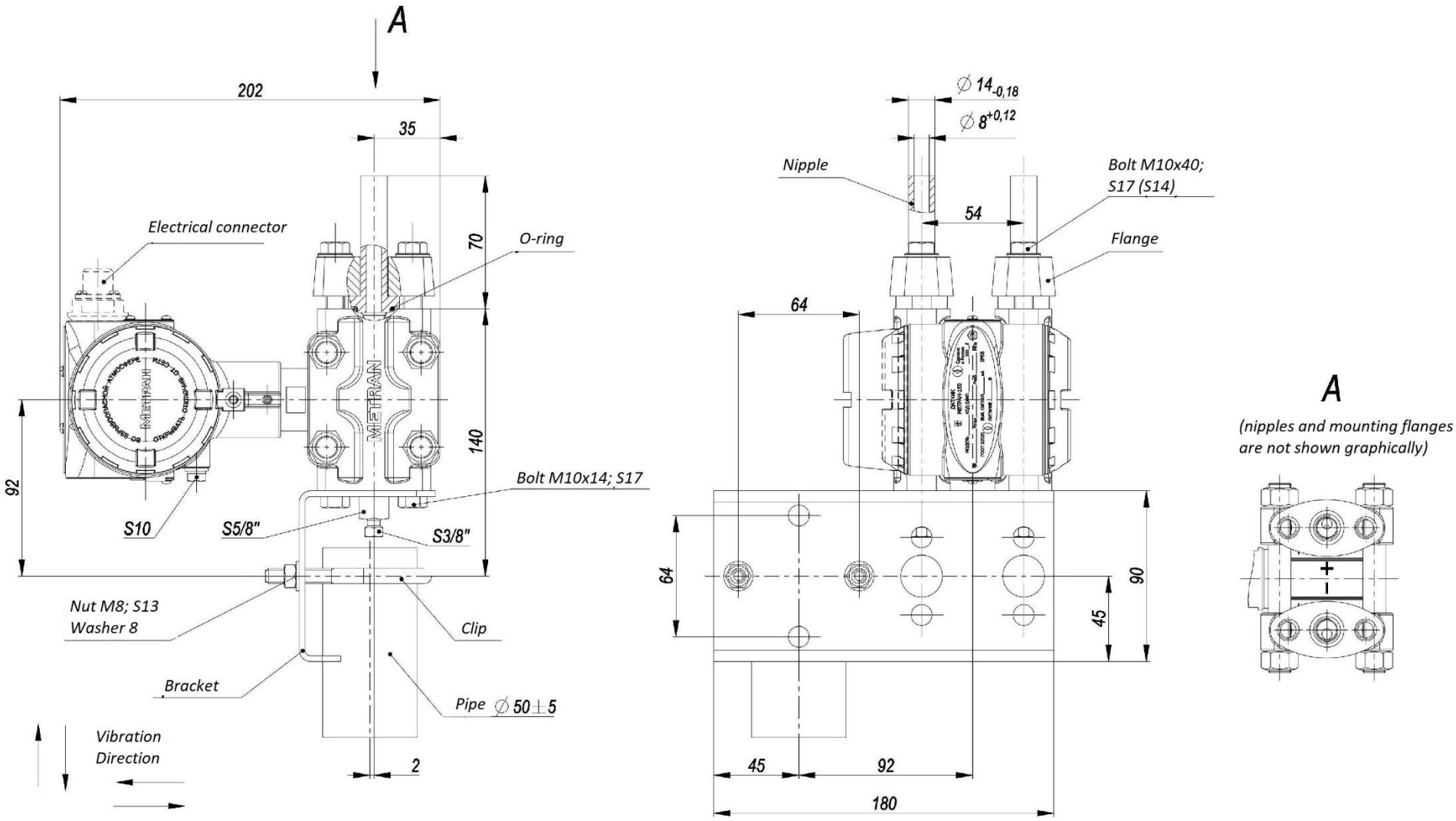


Figure G.15. 150CD Transmitters with Range Codes 0–5, Installed Mounting Flanges with Threaded Hole K1/4" (D1 Code), or K1/2" (D2 Code), or 1/4 NPT (D3 Code), or 1/2 NPT (D4 Code) and Mounting Bracket for 2" Pipe Mount (B1 or B4 Code). Also refer to Figure G.12



Options of electrical connectors are shown in Appendix G1

Figure G.16. 150CD Transmitters (Range Codes 0–5) with Installed Nipple (D6 Code) and Mounting Bracket for 2" Pipe Mount (B1 or B4 Code)

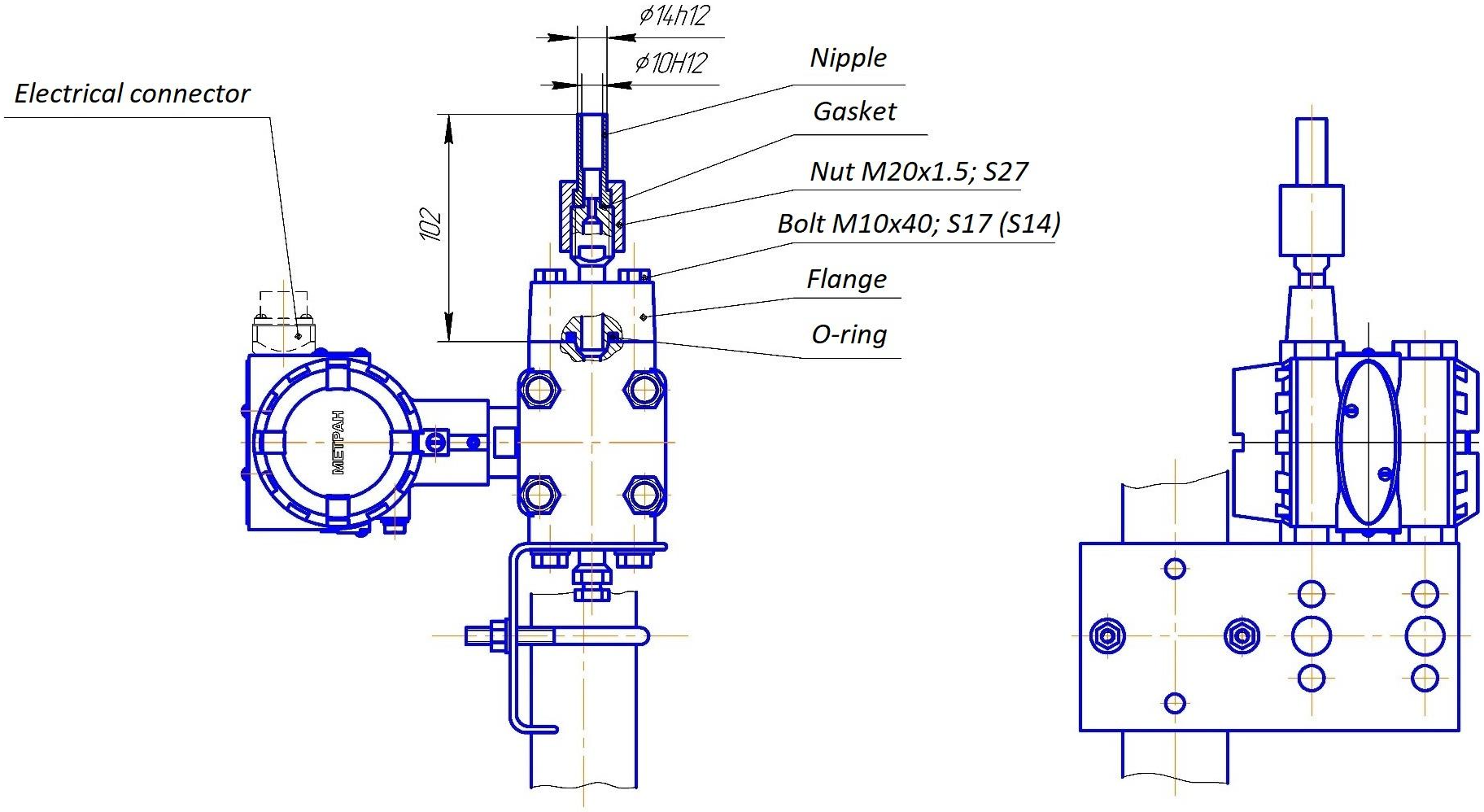


Figure G.17. 150CG Transmitters with Range Codes 0–5, Installed Nipple under Coupling Nuts M20x1.5 (D5 Code) and Mounting Bracket for 2" Pipe Mount (B1 or B4 Code).
Also refer to Figure G.16

Process Connection Code	L, mm
D7 (1/4 MNPT)	62.5
D8 (1/2 MNPT)	68.5

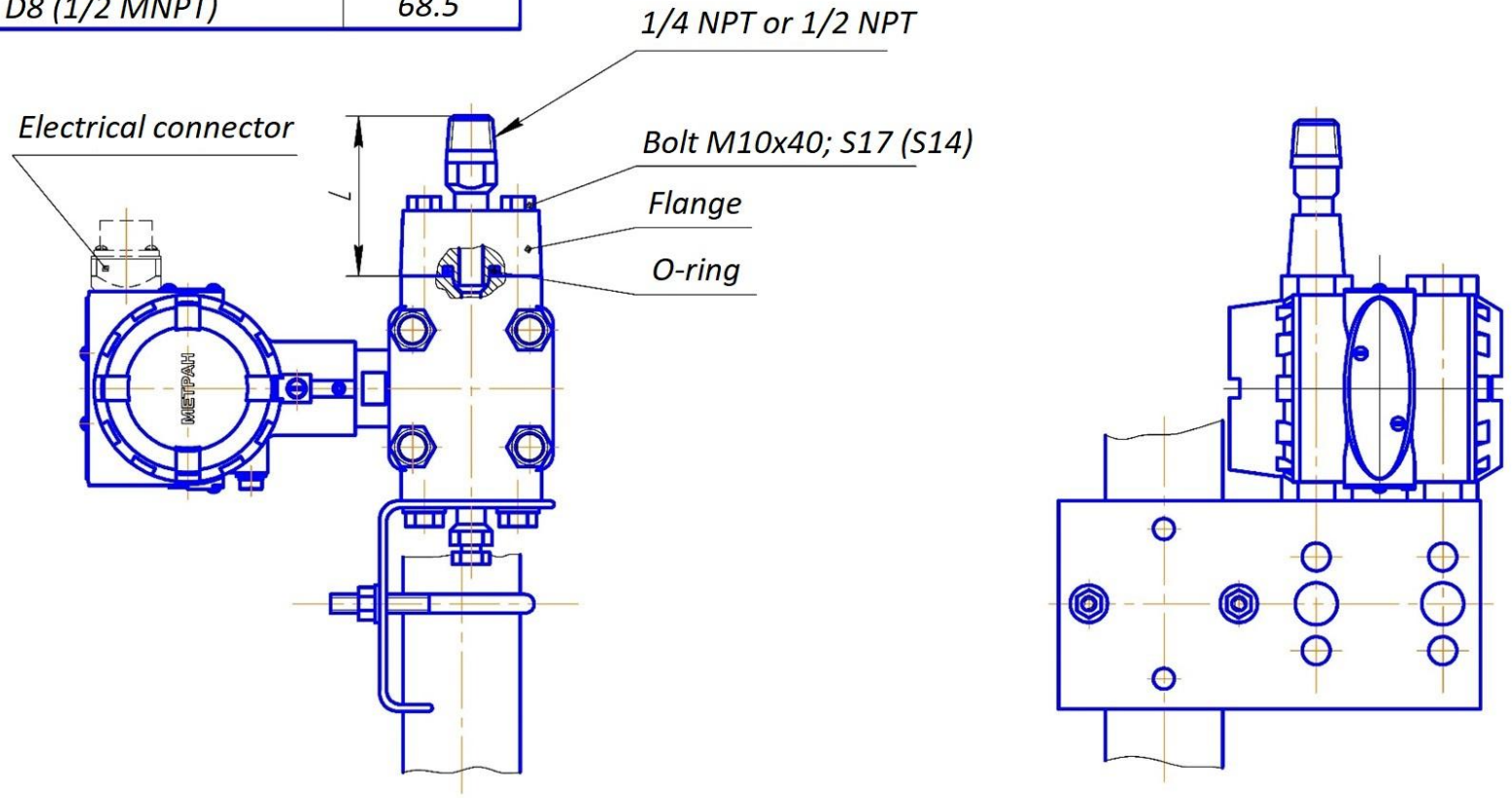


Figure G.18. 150CG Transmitters with Range Codes 0–5, Installed Mounting Flange with ¼NPT Thread Connector (D7 Code) or ½NPT Thread Connector (D8 Code) and Mounting Bracket for 2" Pipe Mount (B1 or B4 Code).
Also refer to Figure G.16

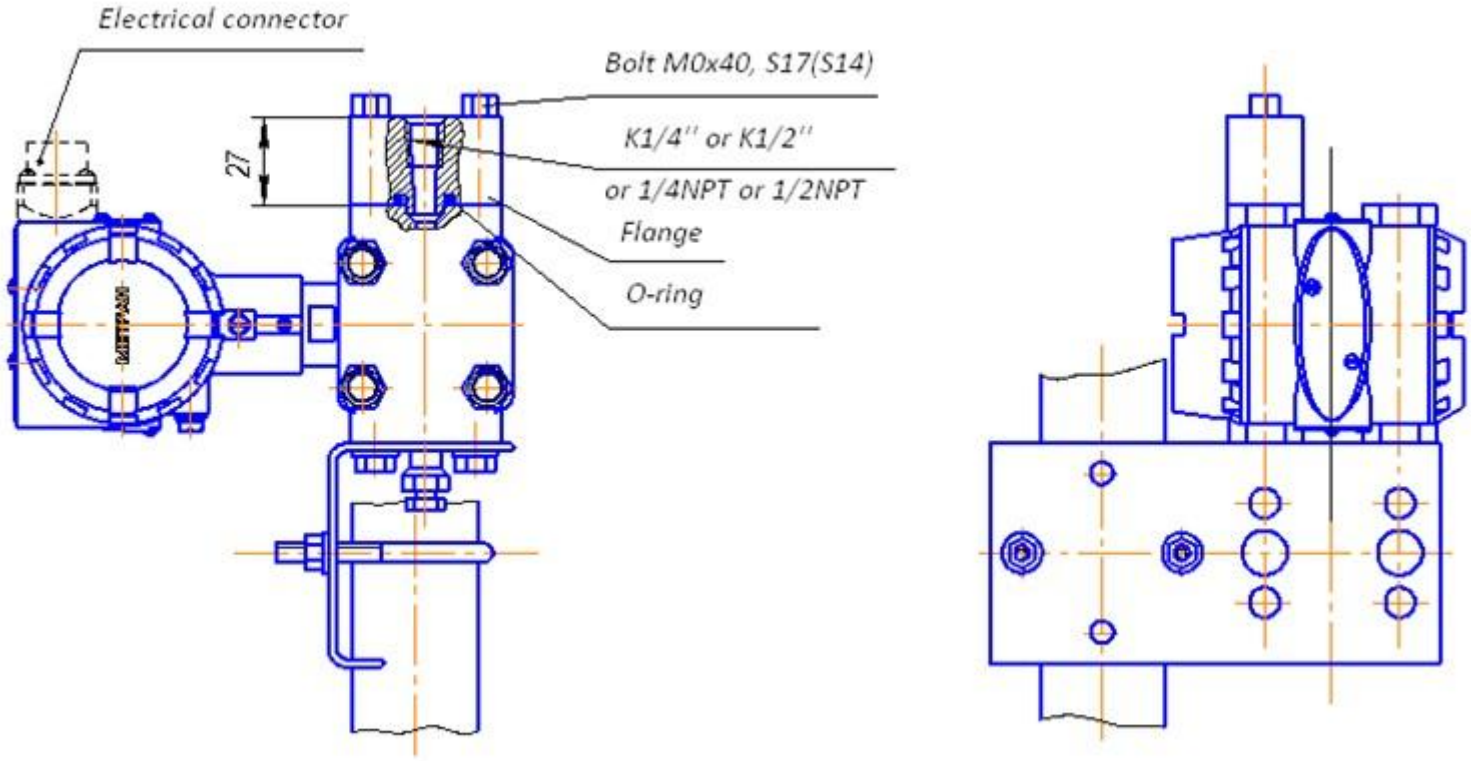
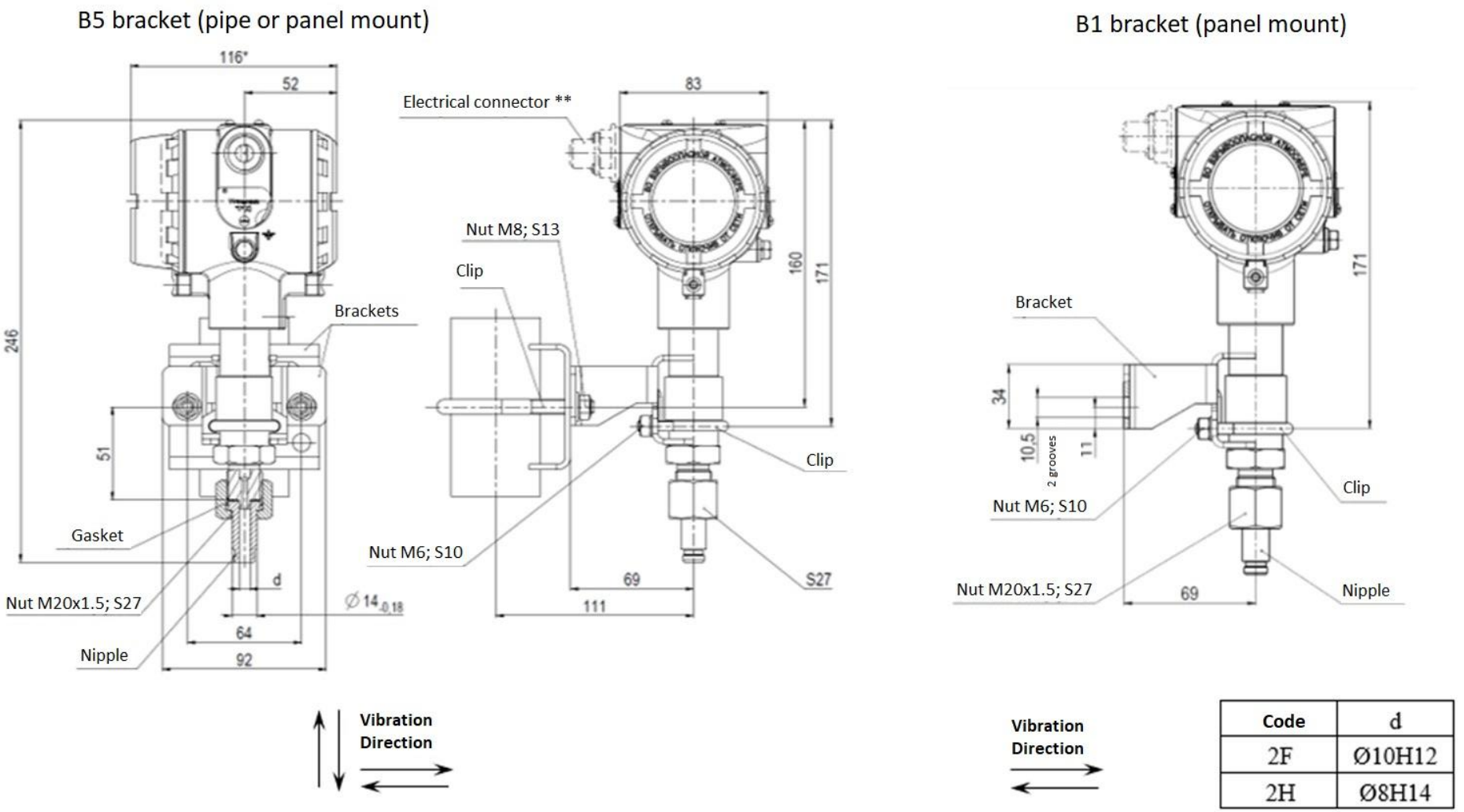


Figure G.19. 150CG Transmitters with Range Codes 0–5, Installed Mounting Flange with Threaded Hole K1/4" (D1 Code), or K1/2" (D2 Code), or 1/4 NPT (D3 Code), or 1/2 NPT (D4 Code) and Mounting Bracket for 2" Pipe Mount (B1 or B4 Code). Also refer to Figure G.16

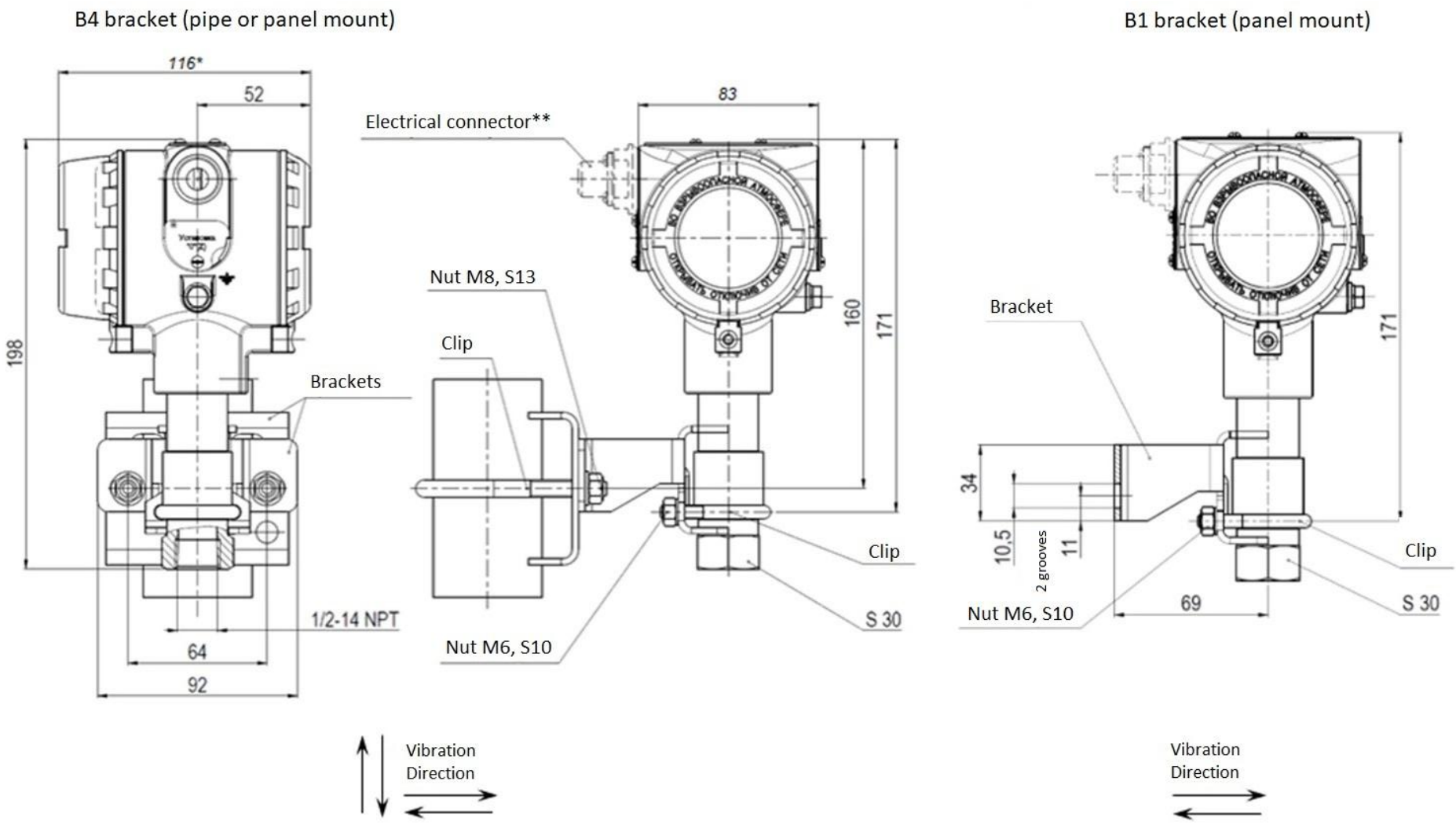


Code	d
2F	Ø10H12
2H	Ø8H14

*Dimension without LCD-meter is 105 mm. Dimensions are given for tightened covers

**Options of electrical connectors are shown in Appendix G1

Figure G.20. 150TG, 150TA Transmitters (Range Codes 1–5) with Installed Nipple (2F, 2H Codes) and Mounting Brackets for 2" Pipe or Panel Mount (B4 Code) or Panel Mount (B1 Code)



*Dimension without LCD-meter is 105 mm. Dimensions are given for tightened covers

**Options of electrical connectors are shown in Appendix G1

Figure G.21. 150TG, 150TA Transmitters (Range Codes 1–5) 1/2-14 FNPT Threaded (2B Code) and Mounting Brackets for 2" Pipe or Panel Mount (B4 Code) and Panel Mount (B1 Code)

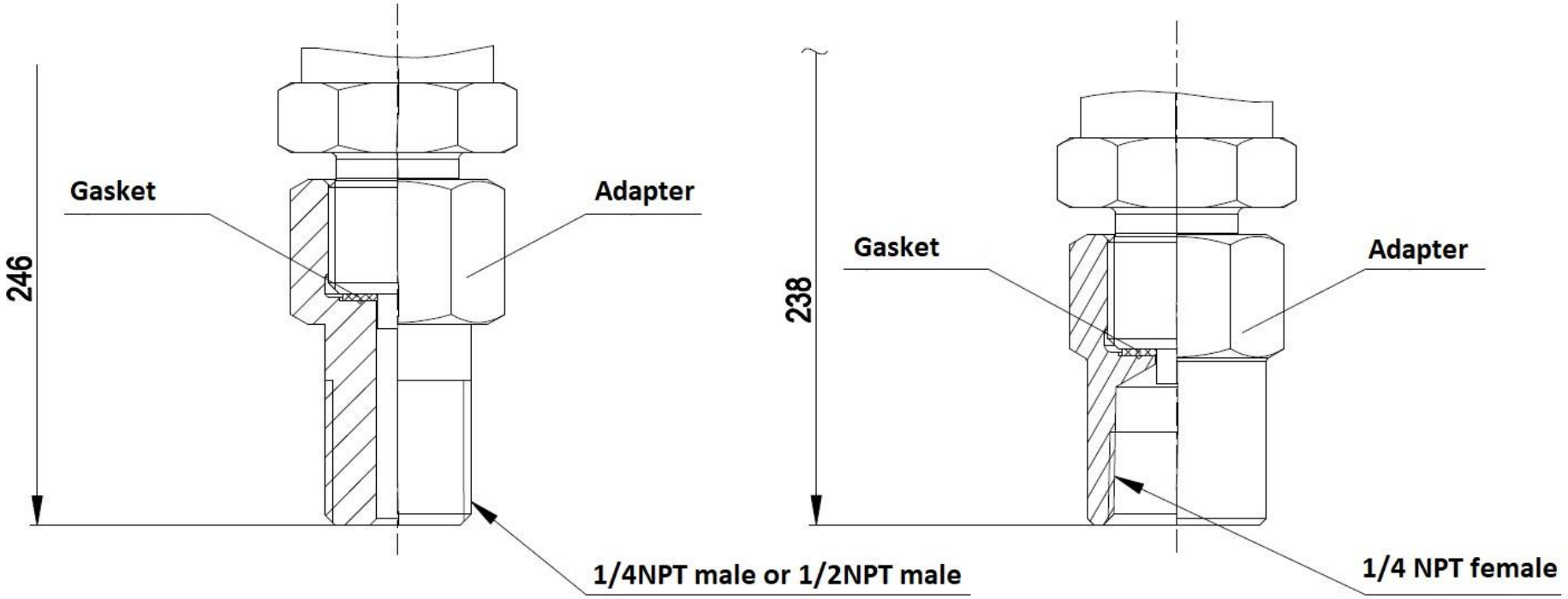


Figure G.22. 150TG, 150TA Transmitters with Range Codes 1–5. Installation of ¼ MNPT (Code 2D) or ½ MNPT (Code 2E) or ¼ FNPT (Code 2A) Mounting Adapters.
Also refer to Figure G.20

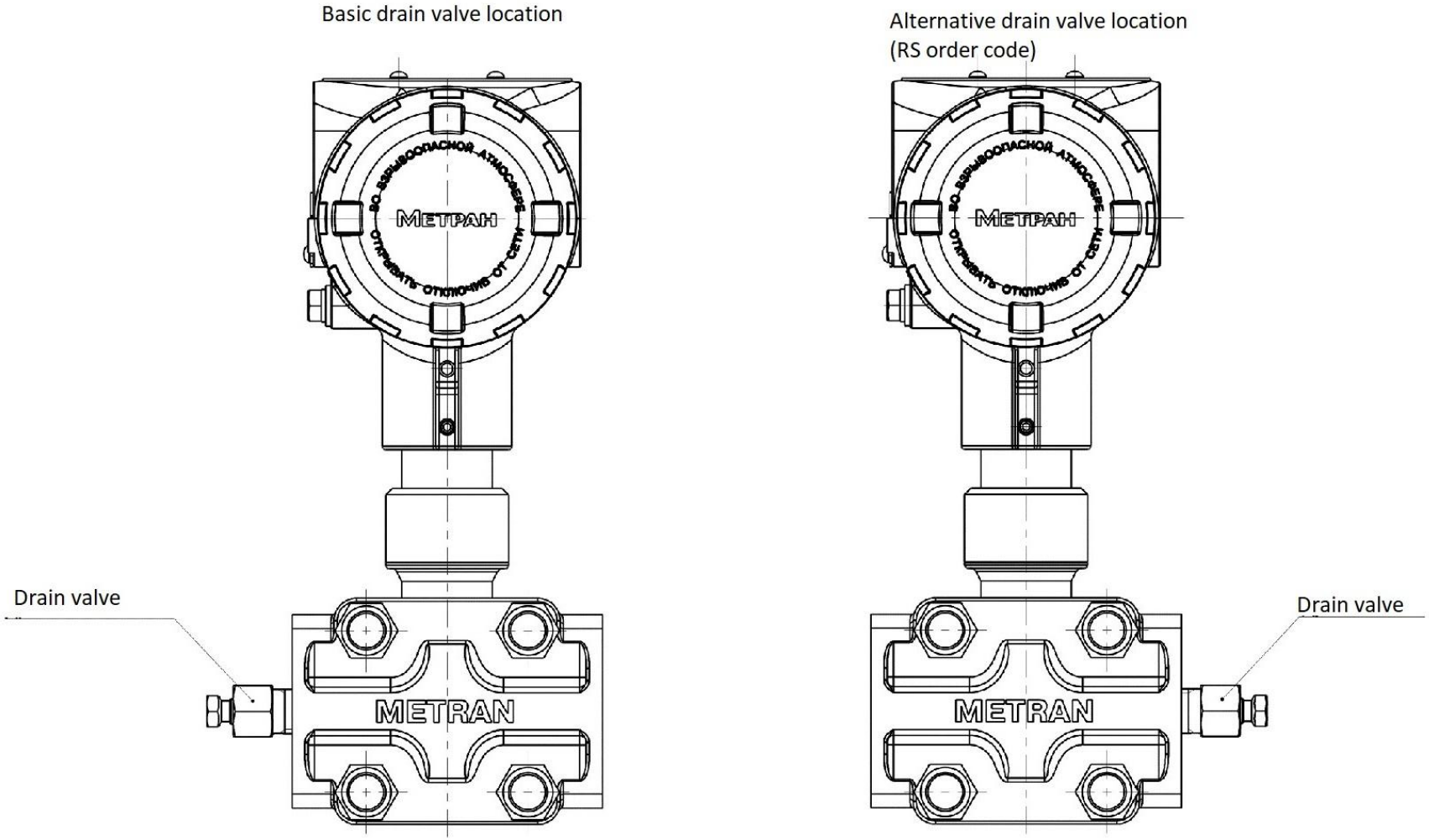
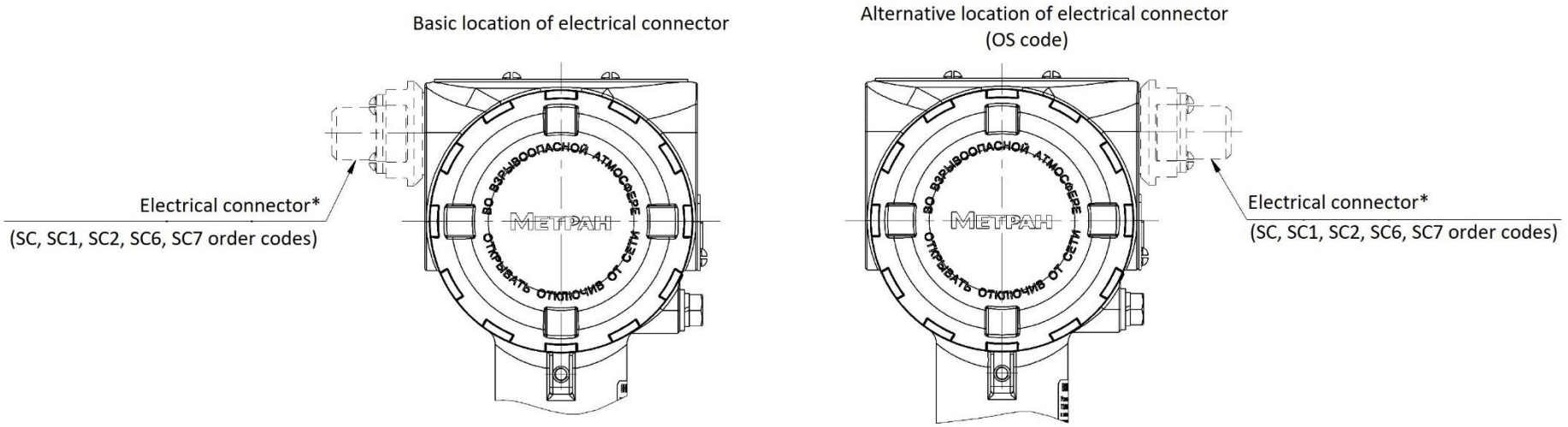


Figure G.23. 150CD, 150CG Transmitters. Options of Drain Valve Location



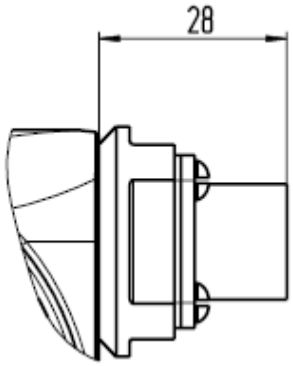
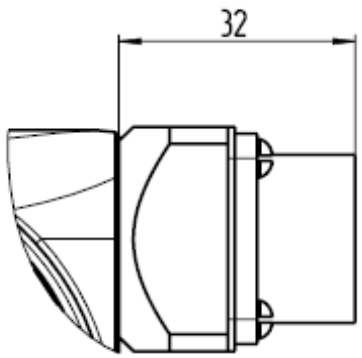
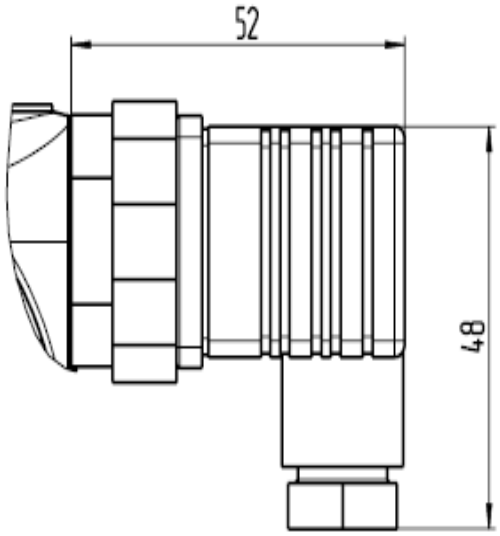
* Options of electrical connectors are shown in Table G1.1

Figure G.24. 150CD, 150CG, 150TA, 150TG Transmitters. Options of Connector Location

APPENDIX G1
(Reference)

Options of Electrical Connectors

Table G1.1. Overall Dimensions of Electrical Connectors

	Plug 2RMG14 (code SC, SC6)	Plug 2RM22 (code SC2, SC7)	Connector DIN 43650 (code SC1)
General View, Overall Dimensions			

APPENDIX J1
(Recommended)

Spare Parts

Table J1.1

Spare Part	Design Document ID	Transmitter Model					
		150CD	150CG	150TG/TA (M20x1.5)	150TG/TA (1/2 FNPT)	150TG/TA (G1/2)	150TG/TA (1/2 MNPT)
1	2	3	4	5	6	7	8
Spare Parts - Electronics Module							
Meter cover (for M5 code)	SPGK.5225.900.00-00	•	•	•	•	•	•
Red meter cover (for M5, RH codes)	SPGK.5225.900.00-54	•	•	•	•	•	•
Stainless steel meter cover (for M5, HS codes)*	SPGK.5225.900.00-60	•	•	•	•	•	•
Blank cover	SPGK.5225.900.00-01	•	•	•	•	•	•
Red blank cover (for RH code)	SPGK.5225.900.00-55	•	•	•	•	•	•
Blank stainless steel cover (for HS code)*	SPGK.5225.900.00-61	•	•	•	•	•	•
DAC module (4-20 mA, HART)	SPGK.5225.900.00-02	•	•	•	•	•	•
DAC module (4-20 mA, HART, for HR7 code)	SPGK.5225.900.00-57	•	•	•	•	•	•
LCD meter (for M5 code)	SPGK.5225.900.00-04	•	•	•	•	•	•
Meter jumper	SPGK.5225.900.00-05	•	•	•	•	•	•
Block (4-20 mA)	SPGK.5225.900.00-06	•	•	•	•	•	•
Block (4-20 mA, for T0 code)	SPGK.5225.900.00-07	•	•	•	•	•	•
Electronics module housing (4-20 mA)	SPGK.5225.900.00-09	•	•	•	•	•	•
Red electronics module housing (4-20 mA, for RH code)	SPGK.5225.900.00-56	•	•	•	•	•	•
Stainless steel electronics module housing (4-20 mA, for HS code)*	SPGK.5225.900.00-62	•	•	•	•	•	•
External ground screw (set, 1 pc., plated carbon steel)	SPGK.5225.900.00-11	•	•	•	•	•	•
External ground screw (set, 1 pc., stainless steel)	SPGK.5225.900.00-63	•	•	•	•	•	•
External zero trim (set, 1 pc.)	SPGK.5225.900.00-12	•	•	•	•	•	•

Table J1.1 (Continued)

1	2	3	4	5	6	7	8
Spare Parts - Electronics Module							
Lock clip for cover (set, 1 pc., for ex codes EM, KM)	SPGK.5225.900.00-13	•	•	•	•	•	•
Lock clip for cover (set, 1 pc., for ex codes EM and HS, KM and HS, EC, KC, TC)*	SPGK.5225.900.00-64	•	•	•	•	•	•
Cover plate on LCD * button for configuration protection (set, 1 pc.)	SPGK.5225.900.00-14	•	•	•	•	•	•
Plug 2RMG14B4SH1E2B assembly with connector (4-20 mA, for SC, SC6 codes)	SPGK.5225.900.00-58	•	•	•	•	•	•
Plug DIN 43650 assembly (4-20 mA, for SC1 code)	SPGK.5225.900.00-16	•	•	•	•	•	•
Plug 2RM22B4SH3V1 assembly with connector (4-20 mA, for SC2, SC7 codes)	SPGK.5225.900.00-59	•	•	•	•	•	•
Socket 2RM14KPN4G1V1 (for SC code)	SPGK.5285.900.00-41	•	•	•	•	•	•
Socket DIN 43650 (for SC1 code)	SPGK.5285.900.00-40	•	•	•	•	•	•
Socket 2RM22KPN4G3V1 (for SC2 code)	SPGK.5285.900.00-42	•	•	•	•	•	•
Nameplate (for ST/SX code)[1)]	SPGK.5285.900.00-39	•	•	•	•	•	•
Cover O-ring (set of 10 pcs.)	SPGK.5225.900.00-18	•	•	•	•	•	•
O-ring for connection of electronics module housing and pressure module (set of 5 pcs.)	SPGK.5225.900.00-19	•	•	•	•	•	•
Conduit entry plug (SST, set, 1 pc., for ex codes IM, EM, KM, IC*, EC*, KC*, TC*)	SPGK.5225.900.00-22	•	•	•	•	•	•
Conduit entry plug (plastic, set, 1 pc., except for ex codes IM, EM, KM, IC*, EC*, KC*, TC*)	SPGK.5225.900.00-23	•	•	•	•	•	•

Table J1.1 (Continued)

1	2	3	4	5	6	7	8
Spare Parts - Pressure Module							
Drain valve (set, 1 pc., SST)	SPGK.5285.900.00-22	•	•				
Mounting Parts							
Copper gasket for fitting-nipple connection M20x1.5 (set of 10 pcs., for mounting part codes D5, DA, 2A, 2D, 2E, 2F, 2H)	SPGK.5225.900.00-20	•	•	•			
SST gasket for fitting-nipple connection M20x1.5 (set of 10 pcs., for mounting part codes D5, DA, 2A, 2D, 2E, 2F, 2H)	SPGK.5225.900.00-21	•	•	•			
O-ring, NO-68-1 rubber (set of 10 pcs., for mounting part codes D1 – D8, DA)	SPGK.5225.900.00-24	•	•				
Bolt M10x40, plated carbon steel (set of 2 pcs., for mounting part codes D1 – D8, DA)	SPGK.5225.900.00-25	•	•				
Mounting parts (set, 1 pc., D1 code)	SPGK.5225.900.00-26	•	•				
Mounting parts (set, 1 pc., D2 code)	SPGK.5225.900.00-27	•	•				
Mounting parts (set, 1 pc., D3 code)	SPGK.5225.900.00-28	•	•				
Mounting parts (set, 1 pc., D4 code)	SPGK.5225.900.00-29	•	•				
Mounting parts (set, 1 pc., D5 code; SST nipple, nipple material code 2)	SPGK.5225.900.00-30	•	•				
Mounting parts (set, 1 pc., D5 code; CS nipple, nipple material code 4)	SPGK.5225.900.00-31	•	•				
Mounting parts (set, 1 pc., D5 code; 09Г2С steel nipple, nipple material code 5)	SPGK.5225.900.00-32	•	•				
Mounting parts (set, 1 pc., D6 code; SST nipple, nipple material code 2)	SPGK.5225.900.00-33	•	•				

Table J1.1 (Continued)

1	2	3	4	5	6	7	8
Mounting parts (set, 1 pc., D6 code; CS nipple, nipple material code 4)	SPGK.5225.900.00-34	•	•				
Mounting parts (set, 1 pc., D6 code; 09Г2С steel nipple, nipple material code 5)	SPGK.5225.900.00-35	•	•				
Mounting parts (set, 1 pc., D7 code)	SPGK.5225.900.00-36	•	•				
Mounting parts (set, 1 pc., D8 code)	SPGK.5225.900.00-37	•	•				
Mounting parts (set, 1 pc., DA code; SST nipple, nipple material code 2)	SPGK.5225.900.00-38	•	•				
Mounting parts (set, 1 pc., DA code; CS nipple, nipple material code 4)	SPGK.5225.900.00-39	•	•				
Mounting parts (set, 1 pc., 2A code, SST)	SPGK.5225.900.00-40			•			
Mounting parts (set, 1 pc., 2D code, SST)	SPGK.5225.900.00-41			•			
Mounting parts (set, 1 pc., 2E code, SST)	SPGK.5225.900.00-42			•			
Mounting parts (set, 1 pc., 2F code; SST nipple, nipple material code 2)	SPGK.5225.900.00-43			•			
Mounting parts (set, 1 pc., 2F code; CS nipple, nipple material code 4)	SPGK.5225.900.00-44			•			
Mounting parts (set, 1 pc., 2F code; 09Г2С steel nipple, nipple material code 5)	SPGK.5225.900.00-45			•			
Mounting parts (set, 1 pc., 2H code; SST nipple, nipple material code 2)	SPGK.5225.900.00-46			•			
Mounting parts (set, 1 pc., 2H code; CS nipple, nipple material code 4)	SPGK.5225.900.00-47			•			
Mounting Brackets							
Mounting bracket for 150CD, 150CG (set, 1 pc., for code B1, carbon steel)	SPGK.5225.900.00-48	•	•				

Table J1.1 (Continued)

1	2	3	4	5	6	7	8
Mounting bracket for 150CD, 150CG (set, 1 pc., for code B4, SST)	SPGK.5225.900.00-49	•	•				
Mounting bracket for 150TG, 150TA with range codes 1–5 (set, 1 pc., for code B1, carbon steel)	SPGK.5225.900.00-50			•	•		
Mounting bracket for 150TG, 150TA with range codes 1–5 (set, 1 pc., for code B4, SST)	SPGK.5225.900.00-51			•	•		
Mounting bracket for 150CD, 150CG (set, 1 pc., for code B4, SST)	SPGK.5225.900.00-49	•	•				
Mounting bracket for 150TG, 150TA with range codes 1–5 (set, 1 pc., for code B1, carbon steel)	SPGK.5225.900.00-50			•	•		
Mounting bracket for 150TG, 150TA with range codes 1–5 (set, 1 pc., for code B4, SST)	SPGK.5225.900.00-51			•	•		
Mounting bracket for 150TG, 150TA with range codes 0T–5T (set, 1 pc., for code B1, carbon steel)	SPGK.5225.900.00-52			•	•	•	•
Mounting bracket for 150TG, 150TA with range codes 0T–5T (set, 1 pc., for code B4, SST)	SPGK.5225.900.00-53			•	•	•	•
Pressure Modules[2)]							
Pressure module for codes 150CD1T 2 2 1 1 L3 (range 1T; wetted part material - 316 SST (flanges, drain valves), 316L SST (other parts); isolating diaphragm material – 316L SST; O-ring material – rubber NO-68-1; fill fluid – silicone; fastening part material – 35ХГСА or 30ХГСА steel)	SPGK.5225.902.00-00	•					

Table J1.1 (Continued)

1	2	3	4	5	6	7	8
Pressure module for codes 150CD1T 2 2 3 1 L4 (range 1T; wetted part material - 316 SST (flanges, drain valves), 316L SST (other parts); isolating diaphragm material – 316L SST; O-ring material – fluorosilicone rubber; fill fluid – silicone; fastening part material – 09Х16Н4Б or 14Х17Н2 steel)	SPGK.5225.902.00-01	•					
Pressure module for codes 150CD1T 6 2 1 1 L3 (range 1T; wetted part material - 316 SST (flanges), C-276 alloy (drain valves), 316L SST (other parts); isolating diaphragm material – 316L SST; O-ring material – rubber NO-68-1; fill fluid – silicone; fastening part material – 35ХГСА or 30ХГСА steel)	SPGK.5225.902.00-02	•					
Pressure module for codes 150CD2T 2 2 1 1 L3 (range 2T; wetted part material - 316 SST (flanges, drain valves), 316L SST (other parts); isolating diaphragm material – 316L SST; O-ring material – rubber NO-68-1; fill fluid – silicone; fastening part material – 35ХГСА or 30ХГСА steel)	SPGK.5225.902.00-03	•					
Pressure module for codes 150CD2T 2 2 3 1 L4 (range 2T; wetted part material - 316 SST (flanges, drain valves), 316L SST (other parts); isolating diaphragm material – 316L SST; O-ring material – fluorosilicone rubber; fill fluid – silicone; fastening part material – 09Х16Н4Б or 14Х17Н2 steel)	SPGK.5225.902.00-04	•					

Table J1.1 (Continued)

1	2	3	4	5	6	7	8
Pressure module for codes 150CD2T 6 2 1 1 L3 (range 2T; wetted part material - 316 SST (flanges), C-276 alloy (drain valves), 316L SST (other parts); isolating diaphragm material – 316L SST; O-ring material – rubber NO-68-1; fill fluid – silicone; fastening part material – 35ХГСА or 30ХГСА steel)	SPGK.5225.902.00-05	•					
Pressure module for codes 150CD3T 2 2 1 1 L3 (range 3T; wetted part material - 316 SST (flanges, drain valves), 316L SST (other parts); isolating diaphragm material – 316L SST; O-ring material – rubber NO-68-1; fill fluid – silicone; fastening part material – 35ХГСА or 30ХГСА steel)	SPGK.5225.902.00-06	•					
Pressure module for codes 150CD3T 2 2 3 1 L4 (range 3T; wetted part material - 316 SST (flanges, drain valves), 316L SST (other parts); isolating diaphragm material – 316L SST; O-ring material – fluorosilicone rubber; fill fluid – silicone; fastening part material – 09Х16Н4Б or 14Х17Н2 steel)	SPGK.5225.902.00-07	•					
Pressure module for codes 150CD3T 6 2 1 1 L3 (range 3T; wetted part material - 316 SST (flanges), C-276 alloy (drain valves), 316L SST (other parts); isolating diaphragm material – 316L SST; O-ring material – rubber NO-68-1; fill fluid – silicone; fastening part material – 35ХГСА or 30ХГСА steel)	SPGK.5225.902.00-08	•					

Table J1.1 (Continued)

1	2	3	4	5	6	7	8
Pressure module for codes 150CD4T 2 2 1 1 L3 (range 4T; wetted part material - 316 SST (flanges, drain valves), 316L SST (other parts); isolating diaphragm material – 316L SST; O-ring material – rubber NO-68-1; fill fluid – silicone; fastening part material – 35ХГСА or 30ХГСА steel)	SPGK.5225.902.00-09	•					
Pressure module for codes 150CD4T 2 2 3 1 L4 (range 4T; wetted part material - 316 SST (flanges, drain valves), 316L SST (other parts); isolating diaphragm material – 316L SST; O-ring material – fluorosilicone rubber; fill fluid – silicone; fastening part material – 09Х16Н4Б or 14Х17Н2 steel)	SPGK.5225.902.00-10	•					
Pressure module for codes 150CD4T 6 2 1 1 L3 (range 4T; wetted part material - 316 SST (flanges), C-276 alloy (drain valves), 316L SST (other parts); isolating diaphragm material – 316L SST; O-ring material – rubber NO-68-1; fill fluid – silicone; fastening part material – 35ХГСА or 30ХГСА steel)	SPGK.5225.902.00-11	•					
Pressure module for codes 150CD5T 2 2 1 1 L3 (range 5T; wetted part material - 316 SST (flanges, drain valves), 316L SST (other parts); isolating diaphragm material – 316L SST; O-ring material – rubber NO-68-1; fill fluid – silicone; fastening part material – 35ХГСА or 30ХГСА steel)	SPGK.5225.902.00-12	•					

Table J1.1 (Continued)

1	2	3	4	5	6	7	8
Pressure module for codes 150CD5T 2 2 3 1 L4 (range 5T; wetted part material - 316 SST (flanges, drain valves), 316L SST (other parts); isolating diaphragm material – 316L SST; O-ring material – fluorosilicone rubber; fill fluid – silicone; fastening part material – 09Х16Н4Б or 14Х17Н2 steel)	SPGK.5225.902.00-13	•					
Pressure module for codes 150CD5T 6 2 1 1 L3 (range 5T; wetted part material - 316 SST (flanges), C-276 alloy (drain valves), 316L SST (other parts); isolating diaphragm material – 316L SST; O-ring material – rubber NO-68-1; fill fluid – silicone; fastening part material – 35ХГСА or 30ХГСА steel)	SPGK.5225.902.00-14	•					
Pressure module for codes 150CD6T 2 2 1 1 L3 (range 6T; wetted part material - 316 SST (flanges, drain valves), 316L SST (other parts); isolating diaphragm material – 316L SST; O-ring material – rubber NO-68-1; fill fluid – silicone; fastening part material – 35ХГСА or 30ХГСА steel)	SPGK.5225.902.00-15	•					
Pressure module for codes 150CD6T 2 2 3 1 L4 (range 6T; wetted part material - 316 SST (flanges, drain valves), 316L SST (other parts); isolating diaphragm material – 316L SST; O-ring material – fluorosilicone rubber; fill fluid – silicone; fastening part material – 09Х16Н4Б or 14Х17Н2 steel)	SPGK.5225.902.00-16	•					

Table J1.1 (Continued)

1	2	3	4	5	6	7	8
Pressure module for codes 150CD6T 6 2 1 1 L3 (range 6T; wetted part material - 316 SST (flanges), C-276 alloy (drain valves), 316L SST (other parts); isolating diaphragm material – 316L SST; O-ring material – rubber NO-68-1; fill fluid – silicone; fastening part material – 35ХГСА or 30ХГСА steel)	SPGK.5225.902.00-17	•					
Pressure module for codes 150CG1T 2 2 1 1 L3 (range 1T; wetted part material - 316 SST (flanges, drain valves), 316L SST (other parts); isolating diaphragm material – 316L SST; O-ring material – rubber NO-68-1; fill fluid – silicone; fastening part material – 35ХГСА or 30ХГСА steel)	SPGK.5225.902.00-18		•				
Pressure module for codes 150CG1T 2 2 3 1 L4 (range 1T; wetted part material - 316 SST (flanges, drain valves), 316L SST (other parts); isolating diaphragm material – 316L SST; O-ring material – fluorosilicone rubber; fill fluid – silicone; fastening part material – 09Х16Н4Б or 14Х17Н2 steel)	SPGK.5225.902.00-19		•				
Pressure module for codes 150CG1T 6 2 1 1 L3 (range 1T; wetted part material - 316 SST (flanges), C-276 alloy (drain valves), 316L SST (other parts); isolating diaphragm material – 316L SST; O-ring material – rubber NO-68-1; fill fluid – silicone; fastening part material – 35ХГСА or 30ХГСА steel)	SPGK.5225.902.00-20		•				

Table J1.1 (Continued)

1	2	3	4	5	6	7	8
Pressure module for codes 150CG2T 2 2 1 1 L3 (range 2T; wetted part material - 316 SST (flanges, drain valves), 316L SST (other parts); isolating diaphragm material – 316L SST; O-ring material – rubber NO-68-1; fill fluid – silicone; fastening part material – 35ХГСА or 30ХГСА steel)	SPGK.5225.902.00-21		•				
Pressure module for codes 150CG2T 2 2 3 1 L4 (range 2T; wetted part material - 316 SST (flanges, drain valves), 316L SST (other parts); isolating diaphragm material – 316L SST; O-ring material – fluorosilicone rubber; fill fluid – silicone; fastening part material – 09Х16Н4Б or 14Х17Н2 steel)	SPGK.5225.902.00-22		•				
Pressure module for codes 150CG2T 6 2 1 1 L3 (range 2T; wetted part material - 316 SST (flanges), C-276 alloy (drain valves), 316L SST (other parts); isolating diaphragm material – 316L SST; O-ring material – rubber NO-68-1; fill fluid – silicone; fastening part material – 35ХГСА or 30ХГСА steel)	SPGK.5225.902.00-23		•				
Pressure module for codes 150CG3T 2 2 1 1 L3 (range 3T; wetted part material - 316 SST (flanges, drain valves), 316L SST (other parts); isolating diaphragm material – 316L SST; O-ring material – rubber NO-68-1; fill fluid – silicone; fastening part material – 35ХГСА or 30ХГСА steel)	SPGK.5225.902.00-24		•				

Table J1.1 (Continued)

1	2	3	4	5	6	7	8
Pressure module for codes 150CG3T 2 2 3 1 L4 (range 3T; wetted part material - 316 SST (flanges, drain valves), 316L SST (other parts); isolating diaphragm material – 316L SST; O-ring material – fluorosilicone rubber; fill fluid – silicone; fastening part material – 09Х16Н4Б or 14Х17Н2 steel)	SPGK.5225.902.00-25		•				
Pressure module for codes 150CG3T 6 2 1 1 L3 (range 3T; wetted part material - 316 SST (flanges), C-276 alloy (drain valves), 316L SST (other parts); isolating diaphragm material – 316L SST; O-ring material – rubber NO-68-1; fill fluid – silicone; fastening part material – 35ХГСА or 30ХГСА steel)	SPGK.5225.902.00-26		•				
Pressure module for codes 150CG4T 2 2 1 1 L3 (range 4T; wetted part material - 316 SST (flanges, drain valves), 316L SST (other parts); isolating diaphragm material – 316L SST; O-ring material – rubber NO-68-1; fill fluid – silicone; fastening part material – 35ХГСА or 30ХГСА steel)	SPGK.5225.902.00-27		•				
Pressure module for codes 150CG4T 2 2 3 1 L4 (range 4T; wetted part material - 316 SST (flanges, drain valves), 316L SST (other parts); isolating diaphragm material – 316L SST; O-ring material – fluorosilicone rubber; fill fluid – silicone; fastening part material – 09Х16Н4Б or 14Х17Н2 steel)	SPGK.5225.902.00-28		•				

Table J1.1 (Continued)

1	2	3	4	5	6	7	8
Pressure module for codes 150CG4T 6 2 1 1 L3 (range 4T; wetted part material - 316 SST (flanges), C-276 alloy (drain valves), 316L SST (other parts); isolating diaphragm material – 316L SST; O-ring material – rubber NO-68-1; fill fluid – silicone; fastening part material – 35ХГСА or 30ХГСА steel)	SPGK.5225.902.00-29		•				
Pressure module for codes 150CG5T 2 2 1 1 L3 (range 5T; wetted part material - 316 SST (flanges, drain valves), 316L SST (other parts); isolating diaphragm material – 316L SST; O-ring material – rubber NO-68-1; fill fluid – silicone; fastening part material – 35ХГСА or 30ХГСА steel)	SPGK.5225.902.00-30		•				
Pressure module for codes 150CG5T 2 2 3 1 L4 (range 5T; wetted part material - 316 SST (flanges, drain valves), 316L SST (other parts); isolating diaphragm material – 316L SST; O-ring material – fluorosilicone rubber; fill fluid – silicone; fastening part material – 09Х16Н4Б or 14Х17Н2 steel)	SPGK.5225.902.00-31		•				
Pressure module for codes 150CG5T 6 2 1 1 L3 (range 5T; wetted part material - 316 SST (flanges), C-276 alloy (drain valves), 316L SST (other parts); isolating diaphragm material – 316L SST; O-ring material – rubber NO-68-1; fill fluid – silicone; fastening part material – 35ХГСА or 30ХГСА steel)	SPGK.5225.902.00-32		•				

Table J1.1 (Continued)

1	2	3	4	5	6	7	8
Pressure module for codes 150CG6T 2 2 1 1 L3 (range 6T; wetted part material - 316 SST (flanges, drain valves), 316L SST (other parts); isolating diaphragm material – 316L SST; O-ring material – rubber NO-68-1; fill fluid – silicone; fastening part material – 35ХГСА or 30ХГСА steel)	SPGK.5225.902.00-33		•				
Pressure module for codes 150CG6T 2 2 3 1 L4 (range 6T; wetted part material - 316 SST (flanges, drain valves), 316L SST (other parts); isolating diaphragm material – 316L SST; O-ring material – fluorosilicone rubber; fill fluid – silicone; fastening part material – 09Х16Н4Б or 14Х17Н2 steel)	SPGK.5225.902.00-34		•				
Pressure module for codes 150CG6T 6 2 1 1 L3 (range 6T; wetted part material - 316 SST (flanges), C-276 alloy (drain valves), 316L SST (other parts); isolating diaphragm material – 316L SST; O-ring material – rubber NO-68-1; fill fluid – silicone; fastening part material – 35ХГСА or 30ХГСА steel)	SPGK.5225.902.00-35		•				
Pressure module for codes 150TG0T 2G 2 1 (range 0T; process connection – M20x1.5; isolating diaphragm material – 316L SST; wetted part material - 316L SST; fill fluid – silicone)	SPGK.5225.902.00-36			•			

Table J1.1 (Continued)

1	2	3	4	5	6	7	8
Pressure module for codes 150TG0T 2B 2 1 (range 0T; process connection – 1/2 FNPT; isolating diaphragm material – 316L SST; wetted part material – 316L SST; fill fluid – silicone)	SPGK.5225.902.00-37				•		
Pressure module for codes 150TG0T 2C 2 1 (range 0T; process connection – G1/2 male; isolating diaphragm material – 316L SST; wetted part material – 316L SST; fill fluid – silicone)	SPGK.5225.902.00-38					•	
Pressure module for codes 150TG0T 2N 2 1 (range 0T; process connection – 1/2 MNPT; isolating diaphragm material – 316L SST; wetted part material – 316L SST; fill fluid – silicone)	SPGK.5225.902.00-39						•
Pressure module for codes 150TG1T 2G 2 1 (range 1T; process connection – M20x1.5; isolating diaphragm material – 316L SST; wetted part material – 316L SST; fill fluid – silicone)	SPGK.5225.902.00-40			•			
Pressure module for codes 150TG1T 2B 2 1 (range 1T; process connection – 1/2 FNPT; isolating diaphragm material – 316L SST; wetted part material – 316L SST; fill fluid – silicone)	SPGK.5225.902.00-41				•		

Table J1.1 (Continued)

1	2	3	4	5	6	7	8
Pressure module for codes 150TG1T 2C 2 1 (range 1T; process connection – G1/2 male; isolating diaphragm material – 316L SST; wetted part material – 316L SST; fill fluid – silicone)	SPGK.5225.902.00-42					•	
Pressure module for codes 150TG1T 2N 2 1 (range 1T; process connection – 1/2 MNPT; isolating diaphragm material – 316L SST; wetted part material – 316L SST; fill fluid – silicone)	SPGK.5225.902.00-43						•
Pressure module for codes 150TG2T 2G 2 1 (range 2T; process connection – M20x1.5; isolating diaphragm material – 316L SST; wetted part material – 316L SST; fill fluid – silicone)	SPGK.5225.902.00-44			•			
Pressure module for codes 150TG2T 2B 2 1 (range 2T; process connection – 1/2 FNPT; isolating diaphragm material – 316L SST; wetted part material – 316L SST; fill fluid – silicone)	SPGK.5225.902.00-45				•		
Pressure module for codes 150TG2T 2C 2 1 (range 2T; process connection – G1/2 male; isolating diaphragm material – 316L SST; wetted part material – 316L SST; fill fluid – silicone)	SPGK.5225.902.00-46					•	

Table J1.1 (Continued)

1	2	3	4	5	6	7	8
Pressure module for codes 150TG2T 2N 2 1 (range 2T; process connection – 1/2 MNPT; isolating diaphragm material – 316L SST; wetted part material – 316L SST; fill fluid – silicone)	SPGK.5225.902.00-47						•
Pressure module for codes 150TG3T 2G 2 1 (range 3T; process connection – M20x1.5; isolating diaphragm material – 316L SST; wetted part material – 316L SST; fill fluid – silicone)	SPGK.5225.902.00-48			•			
Pressure module for codes 150TG3T 2B 2 1 (range 3T; process connection – 1/2 FNPT; isolating diaphragm material – 316L SST; wetted part material – 316L SST; fill fluid – silicone)	SPGK.5225.902.00-49				•		
Pressure module for codes 150TG3T 2C 2 1 (range 3T; process connection – G1/2 male; isolating diaphragm material – 316L SST; wetted part material – 316L SST; fill fluid – silicone)	SPGK.5225.902.00-50					•	
Pressure module for codes 150TG3T 2N 2 1 (range 3T; process connection – 1/2 MNPT; isolating diaphragm material – 316L SST; wetted part material – 316L SST; fill fluid – silicone)	SPGK.5225.902.00-51						•

Table J1.1 (Continued)

1	2	3	4	5	6	7	8
Pressure module for codes 150TG4T 2G 2 1 (range 4T; process connection – M20x1.5; isolating diaphragm material – 316L SST; wetted part material – 316L SST; fill fluid – silicone)	SPGK.5225.902.00-52			•			
Pressure module for codes 150TG4T 2B 2 1 (range 4T; process connection – 1/2 FNPT; isolating diaphragm material – 316L SST; wetted part material – 316L SST; fill fluid – silicone)	SPGK.5225.902.00-53				•		
Pressure module for codes 150TG4T 2C 2 1 (range 4T; process connection – G1/2 male; isolating diaphragm material – 316L SST; wetted part material – 316L SST; fill fluid – silicone)	SPGK.5225.902.00-54					•	
Pressure module for codes 150TG4T 2N 2 1 (range 4T; process connection – 1/2 MNPT; isolating diaphragm material – 316L SST; wetted part material – 316L SST; fill fluid – silicone)	SPGK.5225.902.00-55						•
Pressure module for codes 150TG5T 2G 2 1 (range 5T; process connection – M20x1.5; isolating diaphragm material – 316L SST; wetted part material – 316L SST; fill fluid – silicone)	SPGK.5225.902.00-56			•			

Table J1.1 (Continued)

1	2	3	4	5	6	7	8
Pressure module for codes 150TG5T 2B 2 1 (range 5T; process connection – 1/2 FNPT; isolating diaphragm material – 316L SST; wetted part material – 316L SST; fill fluid – silicone)	SPGK.5225.902.00-57				•		
Pressure module for codes 150TG5T 2C 2 1 (range 5T; process connection – G1/2 male; isolating diaphragm material – 316L SST; wetted part material – 316L SST; fill fluid – silicone)	SPGK.5225.902.00-58					•	
Pressure module for codes 150TG5T 2N 2 1 (range 5T; process connection – 1/2 MNPT; isolating diaphragm material – 316L SST; wetted part material – 316L SST; fill fluid – silicone)	SPGK.5225.902.00-59						•
Pressure module for codes 150TA0T 2G 2 1 (range 0T; process connection – M20x1.5; isolating diaphragm material – 316L SST; wetted part material – 316L SST; fill fluid – silicone)	SPGK.5225.902.00-60			•			
Pressure module for codes 150TA0T 2B 2 1 (range 0T; process connection – 1/2 FNPT; isolating diaphragm material – 316L SST; wetted part material – 316L SST; fill fluid – silicone)	SPGK.5225.902.00-61				•		

Table J1.1 (Continued)

1	2	3	4	5	6	7	8
Pressure module for codes 150TA0T 2C 2 1 (range 0T; process connection – G1/2 male; isolating diaphragm material – 316L SST; wetted part material – 316L SST; fill fluid – silicone)	SPGK.5225.902.00-62					•	
Pressure module for codes 150TA0T 2N 2 1 (range 0T; process connection – 1/2 MNPT; isolating diaphragm material – 316L SST; wetted part material – 316L SST; fill fluid – silicone)	SPGK.5225.902.00-63						•
Pressure module for codes 150TA1T 2G 2 1 (range 1T; process connection – M20x1.5; isolating diaphragm material – 316L SST; wetted part material – 316L SST; fill fluid – silicone)	SPGK.5225.902.00-64			•			
Pressure module for codes 150TA1T 2B 2 1 (range 1T; process connection – 1/2 FNPT; isolating diaphragm material – 316L SST; wetted part material – 316L SST; fill fluid – silicone)	SPGK.5225.902.00-65				•		
Pressure module for codes 150TA1T 2C 2 1 (range 1T; process connection – G1/2 male; isolating diaphragm material – 316L SST; wetted part material – 316L SST; fill fluid – silicone)	SPGK.5225.902.00-66					•	

Table J1.1 (Continued)

1	2	3	4	5	6	7	8
Pressure module for codes 150TA1T 2N 2 1 (range 1T; process connection – 1/2 MNPT; isolating diaphragm material – 316L SST; wetted part material – 316L SST; fill fluid – silicone)	SPGK.5225.902.00-67						•
Pressure module for codes 150TA2T 2G 2 1 (range 2T; process connection – M20x1.5; isolating diaphragm material – 316L SST; wetted part material – 316L SST; fill fluid – silicone)	SPGK.5225.902.00-68			•			
Pressure module for codes 150TA2T 2B 2 1 (range 2T; process connection – 1/2 FNPT; isolating diaphragm material – 316L SST; wetted part material – 316L SST; fill fluid – silicone)	SPGK.5225.902.00-69				•		
Pressure module for codes 150TA2T 2C 2 1 (range 2T; process connection – G1/2 male; isolating diaphragm material – 316L SST; wetted part material – 316L SST; fill fluid – silicone)	SPGK.5225.902.00-70					•	
Pressure module for codes 150TA2T 2N 2 1 (range 2T; process connection – 1/2 MNPT; isolating diaphragm material – 316L SST; wetted part material – 316L SST; fill fluid – silicone)	SPGK.5225.902.00-71						•

Table J1.1 (Continued)

1	2	3	4	5	6	7	8
Pressure module for codes 150TA3T 2G 2 1 (range 3T; process connection – M20x1.5; isolating diaphragm material – 316L SST; wetted part material – 316L SST; fill fluid – silicone)	SPGK.5225.902.00-72			•			
Pressure module for codes 150TA3T 2B 2 1 (range 3T; process connection – 1/2 FNPT; isolating diaphragm material – 316L SST; wetted part material – 316L SST; fill fluid – silicone)	SPGK.5225.902.00-73				•		
Pressure module for codes 150TA3T 2C 2 1 (range 3T; process connection – G1/2 male; isolating diaphragm material – 316L SST; wetted part material – 316L SST; fill fluid – silicone)	SPGK.5225.902.00-74					•	
Pressure module for codes 150TA3T 2N 2 1 (range 3T; process connection – 1/2 MNPT; isolating diaphragm material – 316L SST; wetted part material – 316L SST; fill fluid – silicone)	SPGK.5225.902.00-75						•
Pressure module for codes 150TA4T 2G 2 1 (range 4T; process connection – M20x1.5; isolating diaphragm material – 316L SST; wetted part material – 316L SST; fill fluid – silicone)	SPGK.5225.902.00-76			•			

Table J1.1 (Continued)

1	2	3	4	5	6	7	8
Pressure module for codes 150TA4T 2B 2 1 (range 4T; process connection – 1/2 FNPT; isolating diaphragm material – 316L SST; wetted part material – 316L SST; fill fluid – silicone)	SPGK.5225.902.00-77				•		
Pressure module for codes 150TA4T 2C 2 1 (range 4T; process connection – G1/2 male; isolating diaphragm material – 316L SST; wetted part material – 316L SST; fill fluid – silicone)	SPGK.5225.902.00-78					•	
Pressure module for codes 150TA4T 2N 2 1 (range 4T; process connection – 1/2 MNPT; isolating diaphragm material – 316L SST; wetted part material – 316L SST; fill fluid – silicone)	SPGK.5225.902.00-79						•
Pressure module for codes 150TA5T 2G 2 1 (range 5T; process connection – M20x1.5; isolating diaphragm material – 316L SST; wetted part material – 316L SST; fill fluid – silicone)	SPGK.5225.902.00-80			•			
Pressure module for codes 150TA5T 2B 2 1 (range 5T; process connection – 1/2 FNPT; isolating diaphragm material – 316L SST; wetted part material – 316L SST; fill fluid – silicone)	SPGK.5225.902.00-81				•		

Table J1.1 (Continued)

1	2	3	4	5	6	7	8
Pressure module for codes 150TA5T 2C 2 1 (range 5T; process connection – G1/2 male; isolating diaphragm material – 316L SST; wetted part material – 316L SST; fill fluid – silicone)	SPGK.5225.902.00-82					•	
Pressure module for codes 150TA5T 2N 2 1 (range 5T; process connection – 1/2 MNPT; isolating diaphragm material – 316L SST; wetted part material – 316L SST; fill fluid – silicone)	SPGK.5225.902.00-83						•

* Only for transmitters with HR7 code

[1)] Nameplate for ST/SX code is supplied blank or may be filled in on special request (information to be filled in must be specified).

[2)] The modules that are not specified in this table are available on special request.

Appendix J2
(Mandatory)
Error Codes

Table J2.1

Error Code	Error Description	Communicator Display	Recommended Action	Transmitter Operating Mode
1	2	3	4	5
1	No data from ADC during transmitter operation	ADC board failure	Restart the transmitter. The error cannot be fixed by a user when recurrent	Analog output fault signal is set, character line of a display reads FAILURE
2	Standby time from EEPROM ADC exceeds 100 ms	ADC board failure		
3	Standby time from EEPROM DAC exceeds 100 ms	DAC board failure		
4	No data from ADC at power on	ADC board failure		
5	Program memory checksum error	DAC board failure	The error cannot be fixed by a user	Error code is not displayed. Readable only via HART protocol.
6	ALU processor operation error	DAC board failure		Analog output fault signal is set, character line of a display reads FAILURE
7	RAM data storage error	DAC board failure	The error cannot be fixed by a user	This error does not affect an output signal of the transmitter, character line of a display reads WARNING.
8	Technological mode is activated in the transmitter	Unknown error	Error can be recovered via HART	Error code is not displayed. Readable only via HART protocol.
9	Erroneous temperature code	DAC board failure	The error cannot be fixed by a user.	Analog output fault signal is set, character line of a display reads FAILURE
10	Incorrectly calculated temperature coefficients	DAC board failure		
11	Incorrectly calculated limiting values of ADC codes in pressure and temperature channels	ADC board failure		Analog output fault signal is set, character line of a display reads FAILURE

Table J2.1 (continued)

1	2	3	4	5
12	Out of ADC code limiting values in pressure channel	Measured pressure is greater than 1.15 P_{max} or measured pressure is less than (P_L-0.15 P_{max}) Sensor failure	Eliminate pressure overload for error recovery. Restart the transmitter. The error cannot be fixed by a user when recurrent.	Analog output fault signal is set, character line of a display reads FAILURE
13	Wrong pin-code	DAC board failure	The error can be fixed by rerecording parameters by HART or with buttons.	These errors do not affect an output signal of the transmitter, character line of a display reads WARNING
14	Wrong variable display mode	DAC board failure		
15	Wrong message language	DAC board failure		
16	Out of ADC code limiting values in temperature channel	ADC board failure	Restart the transmitter. The error cannot be fixed by a user when recurrent.	Analog output fault signal is set, character line of a display reads FAILURE
17	Wrong units	DAC board failure	The error can be fixed by rerecording parameters by HART or with buttons.	
18	Supply voltage is less than 5V	DAC board failure	The error cannot be fixed by a user.	
19	Supply voltage is less than 3V			
20	Supply voltage is less than 2.5V			
21	Comparator triggering			
22	Button 1 is stuck	LCD board failure	The error cannot be fixed by a user.	Error code is not displayed. Readable only via HART protocol. These errors do not affect an output signal of the transmitter, character line of a display reads KEYLOCK.
23	Button 2 is stuck			
24	Button 3 is stuck			
25	Identification number misreading	DAC board failure		Error code is not displayed. Readable only via HART protocol.

Table J2.1 (continued)

1	2	3	4	5
26	Misreading of short address, number of preambles, control byte	DAC board failure	The error cannot be fixed by a user.	Analog output fault signal is set, character line of a display reads FAILURE
27	TAG misreading	DAC board failure	The error can be fixed by rerecording parameters by HART.	Error code is not displayed. Readable only via HART protocol.
28	Message misreading			
29	Date, descriptor misreading			
30	Misreading of alarm level, transfer function, distributor code	Misreading of alarm level for conversion function, distributor	The error cannot be fixed by a user.	Analog output fault signal is set, character line of a display reads FAILURE
31	Final assembly number misreading	DAC board failure		Error code is not displayed. Readable only via HART protocol.
32	Wrong DAC board identification	Unknown error	The error cannot be fixed by a user.	Analog output fault signal is set, character line of a display reads FAILURE
33	Upper range limit misreading	Upper range limit misreading	The error can be fixed by rerecording parameters by HART or with buttons.	
34	Lower range limit misreading	Lower range limit misreading		
35	ADC configuration byte misreading	ADC board failure	Restart the transmitter. The error cannot be fixed by a user when recurrent.	
36	Sensor data misreading	ADC board failure		
37	ADC data misreading	ADC board failure		
38	Technical data misreading	ADC board failure	The error cannot be fixed by a user.	Error code is not displayed. Readable only via HART protocol.

Table J2.1 (continued)

1	2	3	4	5
40	ADC thermal correction coefficient misreading	ADC board failure	The error cannot be fixed by a user.	Analog output fault signal is set, character line of a display reads FAILURE
41	DAC zero misreading	DAC board failure		
42	DAC slope misreading	DAC board failure		
43	DAC thermal correction coefficient misreading	DAC board failure		
44	ADC zero misreading	DAC board failure		
45	ADC slope misreading	DAC board failure		
46	Misreading of units, damping time, write-protection flag	DAC board failure	The error cannot be fixed by a user.	These errors do not affect an output signal of the transmitter, character line of a display reads WARNING
47	Control byte misreading	Control byte misreading		Error code is not displayed. Readable only via HART protocol.
48	Sensor identification number misreading	ADC board failure	The error cannot be fixed by a user.	Analog output fault signal is set, character line of a display reads FAILURE
49	Unit misreading	DAC board failure	The error can be fixed by rerecording parameters by HART or with buttons.	This error does not affect an output signal of the transmitter, character line of a display reads WARNING
50	Damping time misreading	DAC board failure		Error code is not displayed. Readable only via HART protocol.
51	Write-protection flag misreading	DAC board failure		
52	Short address misreading	Short address misreading	The error can be fixed by rerecording parameters by HART or with buttons.	Analog output fault signal is set, character line of a display reads FAILURE

Table J2.1 (continued)

1	2	3	4	5
53	Control byte misreading	DAC board failure	The error cannot be fixed by a user.	Error code is not displayed. Readable only via HART protocol.
54	Preamble number misreading	DAC board failure	The error can be fixed by rerecording parameters by HART.	
55	Unable to remove DAC EEPROM write protection	DAC board failure	The error cannot be fixed by a user.	Analog output fault signal is set, character line of a display reads FAILURE
56	Unable to remove ADC EEPROM write protection	ADC board failure		
57	Alarm level misreading	Alarm level misreading	The error can be fixed by rerecording parameters by HART or with buttons.	
58	Transfer function misreading	Conversion function misreading		
59	Distributor label misreading	DAC board failure	The error can be fixed by rerecording parameters by HART.	Error code is not displayed. Readable only via HART protocol.
62	Current saturation	Pressure is outside the set range	The error can be fixed by changing configuration parameters by HART or with buttons.	Error code is not displayed. Character line of a display reads LMTCRNT
63	Out of temperature limits	Temperature is outside the operating range	The error cannot be fixed by a user, if temperature does not match operating conditions	This error does not affect an output signal of the transmitter, character line of a display reads WARNING
64	Sensor user data misreading	ADC board failure	The error cannot be fixed by a user	Analog output fault signal is set, character line of a display reads FAILURE

Notes

1. P_{max} is the maximum upper range value, P_l is lower range value
2. Following error recovery, reset the transmitter (turn the power off and on again)

APPENDIX J3
(Reference)

Pressure Conversion Factors

Table J3.1. Pressure Conversion Factors

International Unit Symbol	kPa
kPa	1
Pa	10^{-3}
MPa	10^{3}
kgf/cm^2	$0.98066136 \cdot 10^{2}$
kgf/m^2	$0.98066136 \cdot 10^{-2}$
mmH_2O	$0.98066136 \cdot 10^{-2}$
mmHg	0.133322
bar	10^{2}

APPENDIX K
(Reference)
List of Reference Documents

Document ID	Number of Section, Subsection, Paragraph with Reference
1	*2*
GOST 9.014-78	1.5.3
GOST 12.2.007.0-75	2.2.1
GOST 27.003-2016	1.2.33
GOST 2991-85	1.5.5
GOST 13954-74	Appendix A, Appendix G
GOST 14254-2015	1.2.16, 1.4.1
GOST 15150-69	1.2.46, 1.2.47, 1.2.48, 1.2.49, 4.1, 4.4
GOST 22520-85	1.2.4
GOST 30804.4.2-2013	1.2.41
GOST 30804.4.3-2013	1.2.41, 1.2.42
GOST 30804.4.4-2013	1.2.41
GOST 30805.22-2013	1.2.43
GOST 31610.0-2019 (IEC 60079-0:2017)	1.1.1, 1.4.2, 2.3.2
GOST 31610.11-2014 (IEC 60079-11:2011)	1.1.1, 1.4.2, 1.6.2, 2.3.2
GOST 31610.19-2014	3.1.3
GOST 31610.20-1-2020 (ISO/IEC 80079-20-1:2017)	1.6.1
GOST 32137-2013	1.2.40a, 1.2.41,
GOST R 50648-94	1.2.41
GOST R 50649-94	
GOST R 50652-94	
GOST R 51317.4.5-99	
GOST R 51317.4.6-99	
GOST R 51318.11-2006	1.2.43
GOST R 52931-2008	1.2.12, 1.2.17
GOST IEC 60079-1-2013	1.1.1, 1.6.1, 1.6.2, 2.3.2, 2.3.3
GOST IEC 60079-14-2013	1.1.1, 1.2.9, 1.6.6
GOST IEC 61000-4-3-2016	1.2.41, 1.2.42
GOST R IEC 61326-1-2014	1.2.40a, 1.2.41, Appendix A
OST 26-04-312	1.5.2
OST 92-0948-74	Appendix H
TU 4212-022-51453097-2006 Metran-150 Pressure Transmitters. Performance Specifications	1.1.3

1	*2*
PUE Electrical Installation Code	1.1.1, 2.2.2, 2.3.1, 2.3.2, 2.3.5, 2.4.8, 3.1.8
PTEEP Operational Code for Electrical Installations	2.3.2, 3.1.8
The Order of the Ministry of Industry and Trade of the Russian Federation #2095 dated 28 August 2020 On Approval of Procedure for Pattern Approval Tests of Standard Samples or Measuring Instruments, Pattern Approval Procedure for Standard Samples or Measuring Instruments, Procedure for Introduction of Changes in Data, Procedure of Pattern Approval Certification for Standard Samples or Measuring Instruments, Form of Pattern Approval Certificate for Standard Samples or Measuring Instruments, Requirements for Approval Marks of Standard Samples or Measuring Instruments and Marking Procedure	1.4.1
Technical Regulations of the Customs Union (CU TR) 012/2011 Safety of Equipment Designed for Operation in Explosive Environments	1.1.1, 1.4.2, 1.6.1, 1.6.2
Technical Regulations of the Customs Union (CU TR) 020/2011 On Electromagnetic Compatibility of Technical Equipment	1.1.1
Rules of Classification and Construction of Marine Vessels, Part XV	1.1.1, 1.2.13, 1.2.15, 1.2.41, 1.2.44, 1.2.61, 1.2.62, 1.2.64, 1.2.65
Rules of Classification and Construction of Marine Vessels, Part XVII	1.1.1
Rules for Technical Supervision during Construction of Ships and Manufacture of Materials and Products for Ships, Part IV	1.1.1, 1.2.56, 1.2.66
Rules for Classification, Construction and Equipment of Mobile Offshore Drilling Units and Fixed Offshore Platforms	1.1.1
Rules for Classification, Construction and Equipment of Floating Offshore Oil-and-Gas Production Units	1.1.1
IEEE C62.41-1991	1.2.44