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Standards and documents applied:

EN 1434-1:2015;
EN 1434-2:2015;
EN 1434-3:2015;
EN 1434-4:2015;
EN 1434-5:2015;
WELMEC 7.2 – Software guide (Issue 6).

The measuring instrument must correspond with the following specifications:

1 Design of the instrument

1.1 Construction

Ultrasonic flow sensor for heat meter INVONIC F designed for measuring of volume of the heat-conveying liquid in heating system and conversion it into electrical pulse signal. It is used in conjunction with the type approved heating energy calculator.

The flow sensor consists of the brass measuring section with built-in ultrasonic transducers and electronics unit, which can be mounted either directly on the measuring section or separately. For flow sensors having relative diameters from DN65 to DN100 measuring section can be made from either brass (cast) or steel (welded construction). The measuring section is inseparably connected with the electronic unit via 1,2 m length screened cable (2,5 m or 5 m – optional). For welded construction measuring sections two cables are used.

The flow sensor is powered by 3,6 V DC lithium battery either remote 12 V to 42 V DC or 12 V to 36 V AC or 3,6 V \pm 0,2 V DC power source.

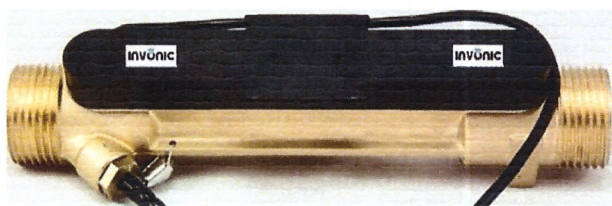


Fig.1. Flow sensor INVONIC F (measuring section and electronic unit)



Fig.2. Electronics unit of the flow sensor

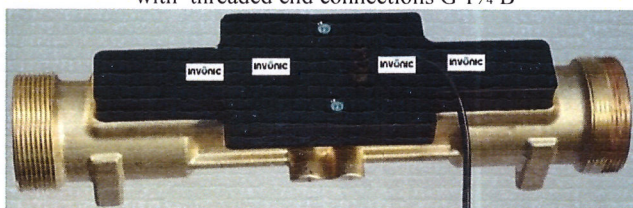
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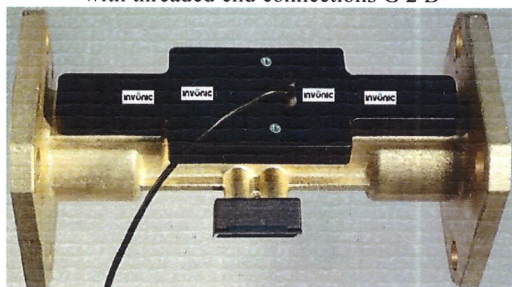
a) Measuring section of the flow sensor $q_p = 0,6/1,0/1,5/2,5 \text{ m}^3/\text{h}$ with threaded end connections G $\frac{3}{4}$ B or G 1 B



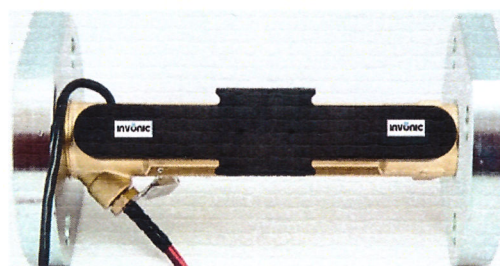
c) Measuring section of the flow sensor $q_p = 3,5/6 \text{ m}^3/\text{h}$ with threaded end connections G $1 \frac{1}{4}$ B



e) Measuring section of the flow sensor $q_p = 10 \text{ m}^3/\text{h}$ with threaded end connections G 2 B



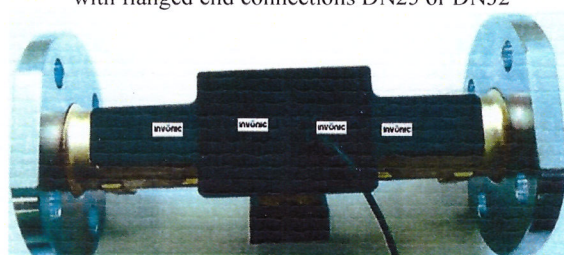
g) Measuring section of the flow sensor $q_p = 15 \text{ m}^3/\text{h}$ with flanged end connections DN50



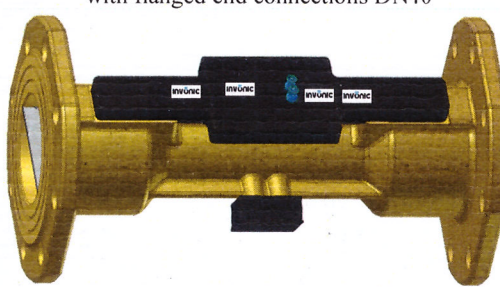
b) Measuring section of the flow sensor $q_p = 0,6/1,0/1,5/2,5 \text{ m}^3/\text{h}$ with flanged end connections DN20



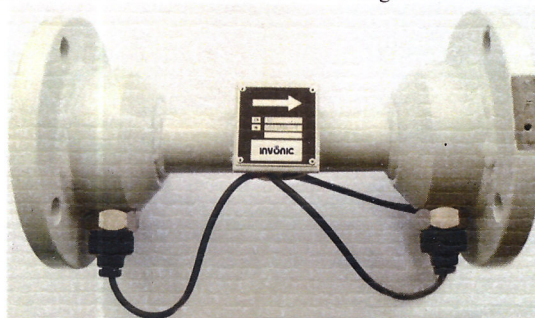
d) Measuring section of the flow sensor $q_p = 3,5/6 \text{ m}^3/\text{h}$ with flanged end connections DN25 or DN32



f) Measuring section of the flow sensor $q_p = 10 \text{ m}^3/\text{h}$ with flanged end connections DN40



h) Measuring section of the flow sensor $q_p = 25/40/60 \text{ m}^3/\text{h}$ with flanged end connections (DN65/DN80/DN100), brass body



i) Measuring section of the flow sensor $q_p = 25/40/60 \text{ m}^3/\text{h}$ with flanged end connections (DN65/DN80/DN100), steel body

Fig.3. Measuring section of the flow sensor INVONIC F

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Structure of type number of the flow sensor INVONIC F

		□	□	□	□	-	□	□	□	□	□	
Ratio of the flow rates q_p/q_i :		Code										
100		F										
250*		G										
Destination of the flow sensor; protection class of electronic unit; protection class of measuring section; heat-conveying liquid; nominal pressure PN		Code										
Heating system; IP65; IP65; water; PN16		1										
Heating/cooling system; IP65; IP67; water; PN16		2										
Heating system; IP65; IP65; water; PN25		3										
Heating/cooling system; IP65; IP67; water; PN25		4										
Flow sensor (nominal flow-rate q_p , overall length, connection type and size):		Code										
0,6 m³/h, 110 mm, thread, DN15/G ¾		A										
0,6 m³/h, 190 mm, thread, DN20/G 1		B										
0,6 m³/h, 190 mm, flange, DN20		C										
1 m³/h, 110 mm, thread, DN15/G ¾		D										
1 m³/h, 190 mm, thread, DN20/G 1		E										
1 m³/h, 190 mm, flange, DN20		F										
1,5 m³/h, 110 mm, thread, DN15/G ¾		G										
1,5 m³/h, 165 mm, thread, DN15/G ¾		H										
1,5 m³/h, 130 mm, thread, DN20/G 1		I										
1,5 m³/h, 190 mm, thread, DN20/G 1		J										
1,5 m³/h, 190 mm, flange, DN20		K										
2,5 m³/h, 130 mm, thread, DN20/G 1		L										
2,5 m³/h, 190 mm, thread, DN20/G 1		M										
2,5 m³/h, 190 mm, flange, DN20		N										
3,5 m³/h, 260 mm, thread, DN25/G 1¼		O										
3,5 m³/h, 260 mm, flange, DN25		P										
3,5 m³/h, 260 mm, flange, DN32		Q										
6 m³/h, 260 mm, thread, DN25/G 1¼		R										
6 m³/h, 260 mm, flange, DN25		S										
6 m³/h, 260 mm, flange, DN32		T										
10 m³/h, 300 mm, thread, DN40/G2		U										
10 m³/h, 300 mm, flange, DN40		V										
15 m³/h, 270 mm, flange, DN50		W										
25 m³/h, 300 mm, flange, DN65		X										
40 m³/h, 300 mm, flange, DN80		Y										
60 m³/h, 360 mm, flange, DN100		Z										
40 m³/h, 350 mm, flange, DN80		1										
60 m³/h, 350 mm, flange, DN100		2										
Power supply:		Code										
Battery (battery not included)		0										
Battery (1 × AA Li-SOC12 battery, 3,6 V 2,7 Ah)		1										
Battery (2 × AA Li-SOC12 battery, 3,6 V 2,7 Ah)		2										
External 24 V AC/DC power supply + battery (3,6 V 2,7 Ah)		3										
External 24 V AC/DC power supply + 230 V power adapter + battery (3,6 V 2,7 Ah)		4										
External 3,6 V ± 0,2 V DC power supply		5										
Communication module:		Code										
None		A										
Communication module with calculator		B										



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Structure of type number of the flow sensor INVONIC F (continue)

Pulse value:	Code
1 litre/pulse	13
10 litre/pulse	12
100 litre/pulse	11
$N \times 10^{-M}$ litre/pulse ($N = 1...9$ ir $M = 1...6$)	NM

Cable length between flow measuring section and electronic unit:	Code
1,2 m	A
2,5 m	B
5,0 m	C

Length of pulse cable:	Code
None	0
1 m	1
2 m	2
3 m	3
4 m	4
5 m	5
6 m	6
7 m	7
8 m	8
9 m	9
10 m	A

Configuration profile:	Code
Standard profile	A

Note: * - with the exceptions of flow sensors $q_p = 0,6 \text{ m}^3/\text{h}$; $q_p = 1,0 \text{ m}^3/\text{h}$; $q_p = 1,5 (130 \text{ mm}) \text{ m}^3/\text{h}$; $q_p = 3,5 \text{ m}^3/\text{h}$.

1.2 Sensor

Ultrasonic flow sensor.

1.3 Measurement value processing

Volume measurement is made by means of bi-directional ultrasonic technique according to the transit time method. Measured volume of heat-conveying liquid is converted into the pulses quantity that is transferred in output pulse terminal.

1.4 Indication of the measurement results

None.

Output pulse signal (litre/pulse) is transferred to the connected heat meter calculator.

1.5 Optional equipment and functions subject to MID requirements

None.

1.6 Technical documentation

Ultrasonic flow sensor INVONIC F. Technical description, installation and user instructions, 10-05-2018.

Other reference documents on which basis this certificate is issued, are stored in a file Nr.LEI-12-MP-078.18.

1.7 Integrated equipment and functions not subject to MID

The flow sensor electronics unit can be equipped with a wired data communication module for transmitting information about the status of the flow sensor – the operating status (error) code and flow rate of the heat-conveying liquid.

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Main technical data of the data communication module:

- data transmission protocol : M-Bus;
- output type : OneWire/open collector.

The flow sensor can be used also as a sub-assembly for cooling meter under rated operating conditions, listed in section 2.1.

2 Technical data

2.1 Rated operating conditions

2.1.1 Measurand

Quantity of a heat-conveying liquid passed through the flow sensor is transferred in the form of volume pulses (litre/pulse).

2.1.2 Measurement range

The technical data of the flow sensor are presented in table 1.

Table 1

End connections	Flow-rate, m ³ /h			Overall length, mm
	Permanent q_p	Maximum q_s	Minimum q_i	
G ¾	0,6	1,2	0,006	110
G 1 or DN20	0,6	1,2	0,006	190
G ¾	1,0	2,0	0,010	110
G 1 or DN20	1,0	2,0	0,01	190
G ¾	1,5	3,0	0,006	110; 165
G 1 or DN20	1,5	3,0	0,006	190
G ¾	1,5	3,0	0,015	110; 165
G 1 or DN20	1,5	3,0	0,015	190
G 1	1,5	3,0	0,015	130
G 1	2,5	5,0	0,01	130
G 1 or DN20	2,5	5,0	0,01	190
G 1	2,5	5,0	0,025	130
G 1 or DN20	2,5	5,0	0,025	190
G 1¼ either DN25 or DN32	3,5	7,0	0,035	260
G 1¼ either DN25 or DN32	6,0	12,0	0,024	260
G 1¼ either DN25 or DN32	6,0	12,0	0,06	260
G 2 or DN40	10,0	20,0	0,04	300
G 2 or DN40	10,0	20,0	0,10	300
DN50	15,0	30,0	0,06	270
DN50	15,0	30,0	0,15	270
DN65	25,0	50,0	0,10	300
DN65	25,0	50,0	0,25	300
DN80	40,0	80,0	0,16	300; 350
DN80	40,0	80,0	0,40	300; 350
DN100	60,0	120,0	0,24	350; 360
DN100	60,0	120,0	0,60	350; 360

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Temperature limits of heat conveying liquid :

- when electronics unit is mounted directly on the measuring section : Θ_q : 5 °C to 90 °C;
- when electronics unit is mounted separately : Θ_q : 5 °C to 130 °C.

2.1.3 Accuracy class

Accuracy class: 2 according to EN 1434-1.

2.1.4 Environmental conditions / Influence quantities

Ambient temperature	:	5 °C to 55 °C;
Humidity level	:	condensing;
Installations	:	indoor;
Mechanical environment	:	class M1;
Electromagnetic environment	:	class E2.

2.1.5 Maximum admissible working pressure

The nominal pressure/maximum admissible working pressure (PN/PS) of flow sensor is 16 bar or 25 bar.

2.1.6 Mounting position of the flow sensor of the heat meter

Flow sensor can be mounted either horizontally or vertically.

3 Interfaces and compatibility conditions

Pulse output. Class of pulse output device - OD according to EN 1434-2.

The minimum admissible pulse values are specified in table 2:

Table 2

Permanent flow-rate q_p , m ³ /h	0,6/1,0/1,5	2,5	3,5	6/10/15	25	40	60
Pulse value, litre/pulse	0,01	0,02	0,05	0,1	0,2	0,5	1

4 Requirements on production, putting into use and utilization

4.1 Requirements on production

At the end of the manufacturing and adjustment process the flow sensors shall be tested according to the requirements of the EN 1434-5. Errors of the flow sensors shall not exceed the maximum permissible errors, described in Annex VI (MI-004) of Directive 2014/32/EU.

The flow sensor can be tested with cold water (25 ± 5) °C.

4.2 Requirements on putting into use

The flow sensor must be installed in accordance with the requirements of document listed in section 1.6.

For flow sensors with nominal diameter DN65 to DN100 necessary straight pipelines lengths are: upstream $\geq 5 \times DN$, downstream $\geq 3 \times DN$. For flow sensors of other sizes the straight pipelines installation in upstream and downstream the sensor are not necessary.

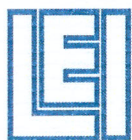
4.3 Requirements for consistent utilization

No special requirements identified.

5 Control of the measuring process after tasks of the instrument in use

5.1 Documentation of the procedure

None.



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5.2 Special equipment or software

No special requirements identified.

5.3 Identification of hardware and software

Identification of hardware:

- see Fig.1, Fig.2, Fig.3 and Fig. 4 of this appendix.

Identification of software: version number of the software is **1.00**. This number shall be marked on the label of flow sensor (SW:1.00).

5.4 Calibration-adjustment procedure

Flow sensor errors determination test shall be carried out when TEST mode is activated as described in section 7 of the document noted in section 1.6 of the present appendix. Two middle contacts in the terminal block under cover of the electronics unit have to be closed using the jumper (Fig. 4).

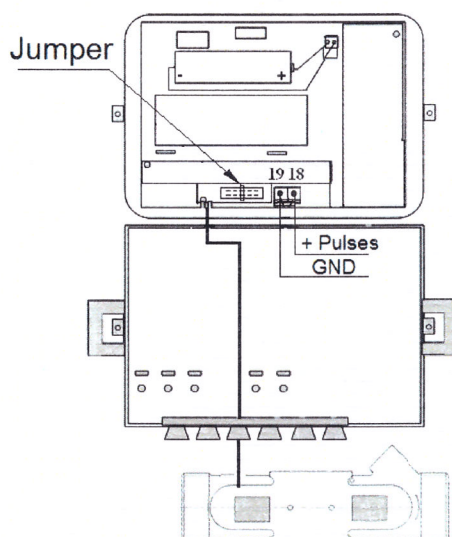


Fig. 4. Activation of the TEST mode

The flow sensor measurement error should be evaluated at the control flow rates specified in the section 6.2 of the EN 1434-5. Pulse output of the flow sensor is used (terminals 18 and 19).

The volume pulse value in TEST mode is presented in table 3.

Table 3

Permanent flow-rate q_p , of the flow sensor , m ³ /h	Volume pulse value in TEST mode, litre/pulse
0,6/1,0	0,002
1,5	0,004
2,5	0,005
3,5/6	0,02
10/15/25	0,05
40/60	0,2

6 Security measures

6.1 Sealing

The following sealing of the electronics unit is provided:

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- manufacturer adhesive seal - sticker on the access to the adjustment activation jumper (Fig.5, pos.1) and on the fixer of the cover protecting electronics wiring plate (Fig.5, pos.2);
- after installation the case and cover of the electronics unit (Fig.5, pos.3) are sealed with two hanged seals of heat supplier.

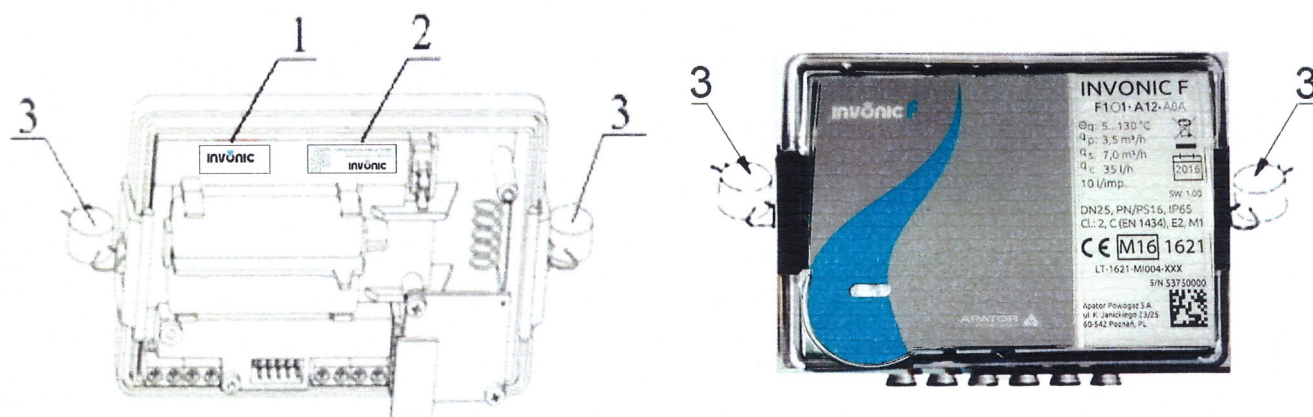


Fig.5. Sealing of the electronics unit of the flow sensor

The following measuring section sealing is provided:

- manufacturer's adhesive seal - sticker on the bolts of the cover (Fig.6, Fig.7, Fig.8);
- manufacturer's hanged seals on ultrasonic transducers for flow sensors with steel body (Fig. 9).

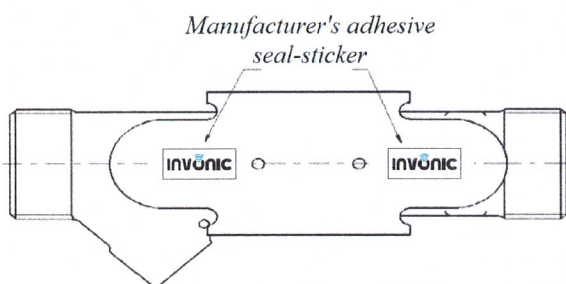


Fig. 6. Sealing of measuring section of the flow sensor $q_p = 0,6/1,0/1,5/2,5 \text{ m}^3/\text{h}$

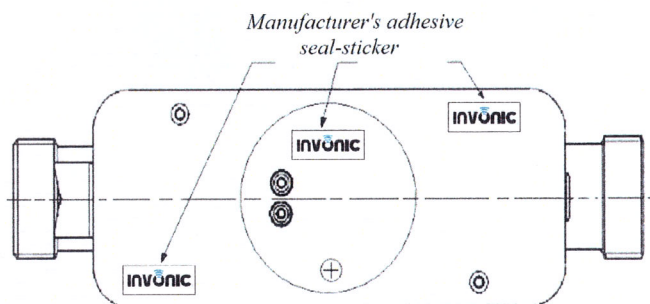


Fig. 7. Sealing of measuring section of the flow sensor $q_p = 3,5/6,0 \text{ m}^3/\text{h}$

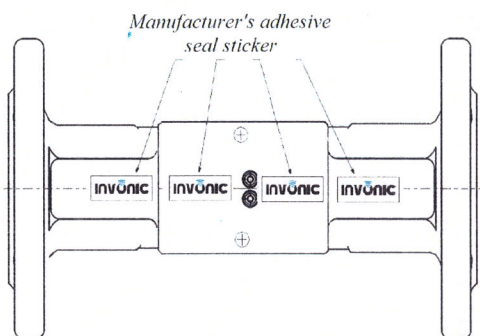


Fig. 8. Sealing of measuring section of the flow sensor $q_p = 10/15/25/40/60 \text{ m}^3/\text{h}$ (brass body)

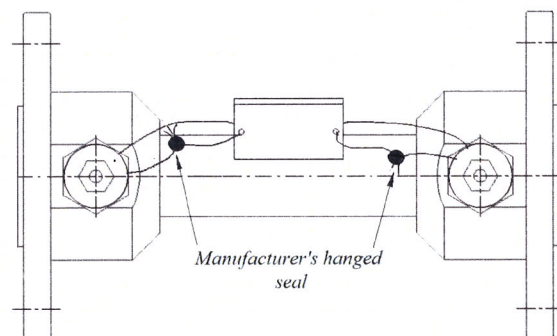
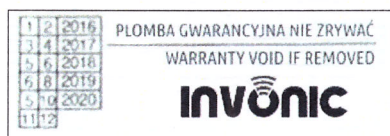


Fig. 9. Sealing of measuring section of the flow sensor $q_p = 25/40/60 \text{ m}^3/\text{h}$ (steel body)

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a) Manufacturer's adhesive seal-sticker



b) Manufacturer's adhesive warranty seal sticker



c) Manufacturer's hanged seal

Fig.10. Manufacturer's protective seals

7 Marking and inscriptions

7.1 Information to be borne by and to accompany the measuring instrument

At least the following information shall appear on the casing of the electronics unit and his label:

- EC-type examination certificate number (LT-1621-MI004-031 rev. 1);
- manufacturer's mark or name;
- type designation and type number;
- year of manufacture and serial number;
- limits of heat conveying liquid temperature;
- meter factor (pulse value of volume);
- limits of flow-rate: maximum q_s , permanent q_p and minimum q_i ;
- the nominal pressure/maximum admissible working pressure (PN/PS);
- accuracy class;
- voltage level for external power supply;
- climatic class;
- electromagnetic class;
- mechanical class;
- software version number.

Additional metal label is attached to the flow sensor DN65/DN80/DN100 steel measuring section. On the label is the following information:

- nominal diameter DN of the measuring section;
- serial number;
- year of manufacture;
- manufacturer's mark or name;
- arrow to indicate the direction of the flow.

Arrow to indicate the direction of the flow shall appear on flow sensor brass body.

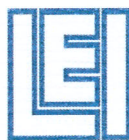
7.2 Conformity marking

In addition, the label of electronic unit of the flow sensor should contain the following marking:

- „CE” marking;
- metrology marking, consisting of the capital letter „M” and the last two digits of the year of its affixing, surrounded by a rectangle;
- identification number of the notified body, which carried out the conformity assessment.

8 List of the drawings attached to the certificate.

Drawings are not added.



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9 Certificate history

Issue	Date and reference №	Description																																	
LT-1621-MI004-031	10-04-2017, No. LEI-12-MP-055.17	Type examination certificate first issued																																	
LT-1621-MI004-031 Revision 1	23-08-2018, No. LEI-12-MP-078.18	1.Type number of the flow sensor has been changed.																																	
		2. Measuring section of the flow sensor has been supplemented with the following modifications:																																	
		<table><tr><th rowspan="2">End connections</th><th colspan="3">Fow-rate, m³/h</th><th rowspan="2">Overall length, mm</th></tr><tr><th>Permanent q_p</th><th>Maximum q_s</th><th>Minimum q_i</th></tr><tr><td>DN65</td><td>25</td><td>50</td><td>0,10</td><td>300</td></tr><tr><td>DN80</td><td>40</td><td>80</td><td>0,16</td><td>300; 350</td></tr><tr><td>DN80</td><td>40</td><td>80</td><td>0,40</td><td>300</td></tr><tr><td>DN100</td><td>60</td><td>120</td><td>0,24</td><td>350; 360</td></tr><tr><td>DN100</td><td>60</td><td>120</td><td>0,60</td><td>360</td></tr></table>	End connections	Fow-rate, m³/h			Overall length, mm	Permanent q_p	Maximum q_s	Minimum q_i	DN65	25	50	0,10	300	DN80	40	80	0,16	300; 350	DN80	40	80	0,40	300	DN100	60	120	0,24	350; 360	DN100	60	120	0,60	360
		End connections		Fow-rate, m³/h				Overall length, mm																											
			Permanent q_p	Maximum q_s	Minimum q_i																														
DN65	25	50	0,10	300																															
DN80	40	80	0,16	300; 350																															
DN80	40	80	0,40	300																															
DN100	60	120	0,24	350; 360																															
DN100	60	120	0,60	360																															
3. The flow sensor is supplemented (optional) with the wired data communication module.																																			
4. The technical description, issued 12-2016, has been replaced by the technical description, issued 10-05-2018.																																			

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