

LGP

BALANCED FLOW METER (MULTI-HOLE
ORIFICE FLOW METER)

Operation Manual



Preface

Thank you for choosing the products of Dandong Top Electronics Instrument (Group) Co., Ltd.

This operation manual provides you with important information about installation, connection and commissioning as well as maintenance, troubleshooting and storage. Please read it carefully before installation and commissioning and save it as an integral part of the product near the instrument for reading at any time.

This manual can be downloaded from www.ddtop.com.

If you do not follow this manual, the protection provided by this instrument may be damaged.

Trademarks, Copyrights and Restrictions Instructions

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Dandong Top Electronics Instrument (Group) Co., Ltd guarantees that all products will be free from defects in materials and manufacturing processes within one year from the date of leaving the factory.

During the warranty period, if the product is returned due to quality problems, and the claim is determined to fall within the scope of the warranty after inspection by the manufacturer, Dandong Top Electronics Instrument (Group) Co., Ltd is responsible for repairing or replacing it for the buyer (or owner) free of charge.

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Dandong Top Electronics Instrument (Group) Co., Ltd has passed the ISO9001 quality system certification. The entire production process is strictly implemented in accordance with the scope of the quality system, providing the strongest guarantee for the quality of products and services.

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1 Safety Tips

For safety reasons, it is expressly prohibited to modify or change the product without authorization. Repair or replacement is only allowed to use the accessories specified by the manufacturer.

1.1 An explosion may cause death or serious injury.

When installing the device in an explosive environment, be sure to comply with applicable local, national, and international standards, codes, and regulations. Ensure that the equipment is installed in accordance with intrinsically safe or non-flammable site operating procedures.

1.2 Process leaks can cause serious injury or death.

If the process seal is damaged, the medium may leak at the connection.

1.3 Failure to follow the safety installation guidelines may result in death or serious injury.

The operations described in this manual need to be completed by professionals who have received professional training and obtained corresponding qualifications or special end-users.

2 Product Description

2.1 Product Structure-Figure 1

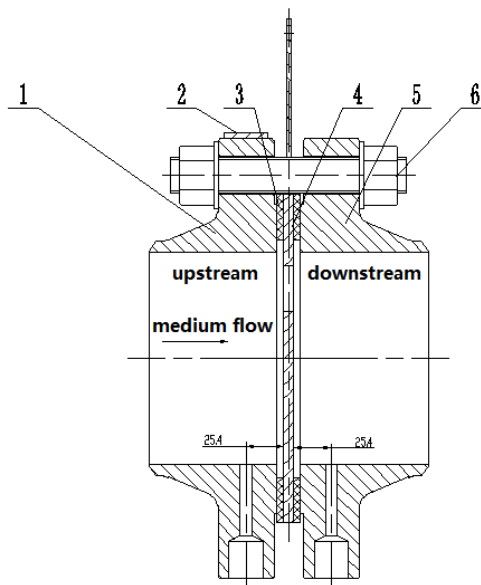


Figure 1-Structure F

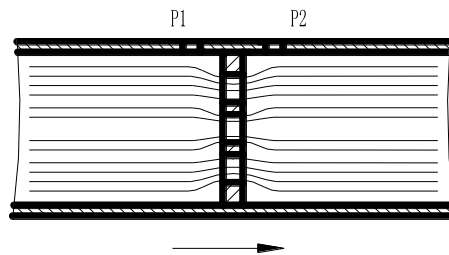
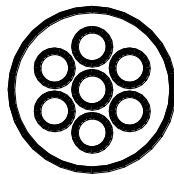
- 1 . Upstream Tapping Flange
- 2 . Nameplate, Rivet
- 3 . Metal Graphite Wound Gasket
- 4 . Balanced Orifice Plate Components
- 5 . Downstream Tapping Flange
- 6 . Bolt Nut Gasket Fastener

2.2 Operating Principle-Figure 2

The working principle of the LGP balanced flow meter is the same as that of the orifice plate. It is also based on the energy conservation law of Bernoulli equation. When the fluid passes through the function hole of the disc, the fluid will be balanced and adjusted, the vortex will be minimized, and an ideal flow field will be formed. The device obtains a stable differential pressure signal.

Basic Calculation Formula:

$$q_m = \frac{C}{\sqrt{1-\beta^4}} \varepsilon \frac{\pi}{4} d^2 \sqrt{2\Delta p \rho_1}$$



In this formula:

- q_m —Actual measured flow, kg/s;
- C — (BFM) Outflow coefficient;
- ε —BFM Gas expansion coefficient;
- Δp —Measured differential pressure value, Pa;
- ρ_1 —Fluid density kg/m³
- d —BFM Equivalent orifice diameter, m;
- β —BFM Equivalent diameter ratio, it is the ratio of the equivalent orifice diameter to the pipe inner diameter.

$$q_v = \frac{q_m}{\rho}$$

The volume flow is calculated as follows:

In this formula:

ρ —Fluid density under temperature and pressure when measuring volume flow, kg/m^3

q_v —Volume flow, m^3/s π

2.3 ackage

Please send packaging waste to a special recycling agency.

2.4 Lifting Transportation

Please use qualified lifting equipment and lifting straps, and pay attention to safety.

2.5 Storage

Storage temperature $-20^{\circ}\text{C}\sim 40^{\circ}\text{C}$; storage humidity $\leq 20\%$.

3 Product Application

3.1 Product Features

3.1.1 High Measurement Accuracy

Because the LGP balanced flow meter has a symmetrical porous structure, it can balance the flow field, reduce eddy current, vibration and signal noise, and greatly improve the stability of the flow field.

3.1.2 Low Requirements for Straight Pipe Sections

The LGP balanced flow meter can balance the flow field, stabilize the adjustment, and restore the pressure twice faster than the traditional orifice flow element, which greatly reduces the requirements for straight pipe sections. In most cases, straight pipe sections can be as small as $0.5D \sim 2D$, and a large number of straight pipe sections can be saved by using LGP balanced flow meter.

3.1.3 Low Permanent Pressure Loss

LGP balanced flow meter's porous and symmetrical balance design reduces the formation of vortex and turbulent friction, and reduces the loss of kinetic energy. Under the same measurement conditions without reducing the differential pressure, it can be reduced to $1/2$ compared to the traditional flow element. , $1/3$ permanent pressure loss.

3.1.4 Wide Range Ratio

Compared with the traditional flow element, the LGP balanced flow meter greatly improves the measurement range ratio.

3.1.5 Wide Range of Applications

The working temperature and pressure of LGP balanced flow meter depend on the material and grade of the pipe and flange, and it is suitable for high temperature and high pressure working conditions. LGP balanced flow meter can measure gas-liquid two-phase, slurry, and even solid particles. The balanced flow meter is completely symmetrical, so it can measure bidirectional flow.

3.2 Main Parameters

Accuracy: ± 0.5

Repeatability: ± 0.2

Range Ratio: 10: 1

Operating Pressure: 0~ 42MPa

Temperature: $-196^{\circ}\text{C} \leq T \leq 650^{\circ}\text{C}$

Straight Pipe Section Requirements: Front 3~4D Back 2D

Instrument Caliber: DN25~DN600

Reynolds Number Range: $500 \sim 1 \times 10^7$

3.3 Application Scope

3.3.1 Conditions Requiring High Flow Measurement Accuracy and Range

The porous LGP balanced flow meter is calibrated with real flow to make the sensor accuracy reach 0.50%. At the same time, its conventional measurement range ratio is 10:1.

3.3.2 Vapor Flow Measurement

For the condensed water in the vapor flow, it will condense in front of the standard orifice, which will affect the accuracy of measurement. When the machine is turned on and off, the pressure of vapor will produce water hammer on the condensed water, which will seriously impact the standard orifice deformed. Because the LGP balanced flow meter has holes around it, the condensed water will flow through the lower hole to avoid condensate, water hammer, and bending deformation.

3.3.3 Flow Rate of Low Temperature Fluid

Under this condition, when the medium flows through the orifice, the gasification phenomenon is so serious that it cannot be measured normally. The LGP balanced flow meter ensures stability and measurement accuracy due to its low pressure loss.

3.3.4 Working Condition of Gas Volume Liquid

Large-diameter orifice flow meters used to measure the flow of compressed air and other gases, the orifice often has water, which affects the accuracy of the measurement. The common method to solve the water accumulation in front of the throttling part is to install the flow element on the vertical process pipe, or use a round orifice plate or an eccentric orifice plate. The LGP balanced flow meter can fundamentally solve the problem of water accumulation in front of the throttle because of its porous structure, and because this is its inherent feature, it does not need to be specially

made.

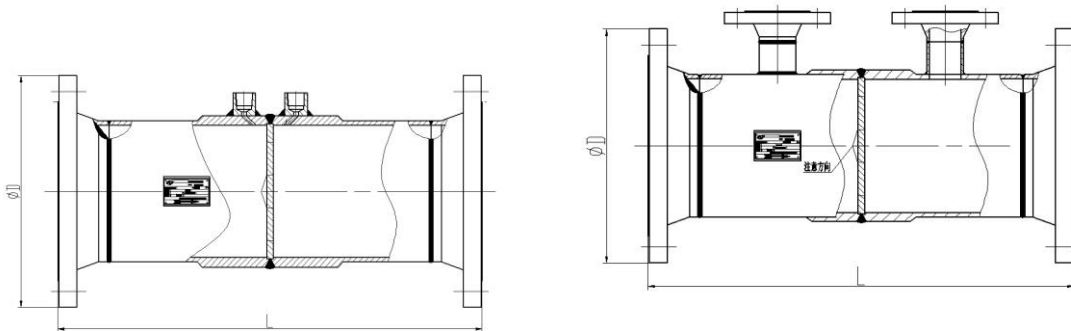
3.3.5 Liquid Impurity Conditions

When the impurity content in the fluid is high, the standard flow element is easy to be inaccurate due to solid deposits and wear on sharp edges, and the porous LGP balanced flow meter can eliminate the deposition of circular objects due to its porous characteristics; because of its balance (without sharp edge) can solve the phenomenon of sharp edge wear. The problem of impurities in the liquid is better solved.

3.3.6 Two-way Measurement Conditions

The upstream and downstream of the LGP balanced flow meter are completely symmetrical, and there is no downstream oblique angle of the standard orifice, so it can be used as a bidirectional fluid measurement, which completely solves the problem of bidirectional fluid measurement under special working conditions.

4 Schematic Diagram of Pipeline Size-Figure 2



Pipeline Type (Nozzle Tap) G

Pipeline Type (Double Flange Tap) S

Figure 2

Note: D/L size is subject to our design standard

If special size is required when ordering, the actual size shall prevail.

5 Unpacking and Inspection

5. Precautions for Unpacking Inspection

5.1.1 Check whether the product nameplate (Figure 3) is consistent with the supply list information.




| | | | | | | |
|--|--|---|------------------|-------------------|-------------|---|
|  | |  | | Flow Meter | | |
| | | | | 15F107-21 | | |
| Pipe Inner Diameter, Throttle Aperture | | mm | Nominal Pressure | MPa | Temperature | ℃ |
| Scale Flow | | Tag No. | | | | |
| Upper Limit of Differential Pressure | | KPa | Factory Date/No. | | | |
| Body Material | | Flange Standard | | | | |
| Dandong Top Electronics Instrument (Group) Co., Ltd | | | | | | |
|  | | | | | | |

Figure 3

5.1. Check the quantity and material of each part against the packing list.

5.2 Check Content

5.2.1 Check whether the appearance of the instrument is defective or damaged.

5.2.2 If the LGP balanced flow meter and its accessories are packaged separately, please confirm that the quantity and specifications are correct before unpacking.

6 Installation

6.1 Installation Tools

6.1.1 Suitable for wrenches, flange gaskets and flange bolts of process connections.

6.1.2 Welding equipment

6.2 Installation Technical Requirements

6.2.1 The basic structure of LGP balanced flow meter F considers the flow direction of the medium when installing—Figure 4.

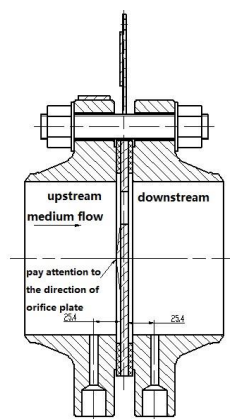
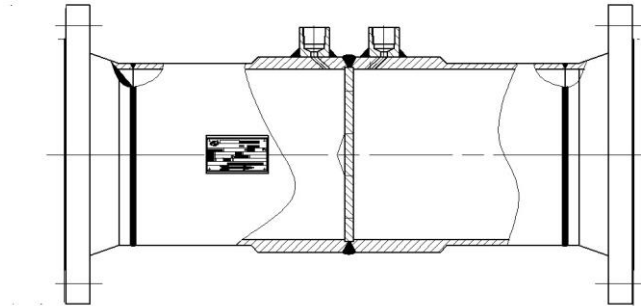


Figure 4 Basic Structure F

* For adjusting the flow meter, the tapered head is the upstream side.

* If it is a balanced flow meter, there is no direction requirement, and the handle is usually the upper side.

6.2.2 Consider the flow direction of the medium when installing the LGP balanced flow meter in pipeline-Figure 5





| | | | | | |
|--|-----------------|----------------------|------------------|-------------------|-------------|
|  | | <input type="text"/> | | Flow Meter | |
| | | | | 15F107-21 | |
| Pipe Inner Diameter, Throttle Aperture | | m.m | Nominal Pressure | MPa | Temperature |
| Scale Flow | | Tag No. | | | |
| Upper Limit of Differential Pressure | | KPa | Factory Date/No. | | |
| Body Material | Flange Standard | | | | |
| Dandong Top Electronics Instrument (Group) Co., Ltd | | | | | |
|  | | | | | |

Figure 5 Pipeline Structure G/S

* For adjusting the flow meter, the tapered head is the upstream side.

* If it is a balanced flow meter , and there is no direction requirement, assemble according to the arrow information on the nameplate.

6.2.3 When the LGP balanced flow meter is installed on a horizontal pipeline, the pressure tap should be within 45° of the horizontal centerline of the pipeline. When installed on a vertical pipeline, the different elevations of the pressure tap will produce additional pressure heads, which should change after the transmitter is installed, it can be solved by resetting the zero.

6.2.4 When the LGP balanced flow meter measures fluids with high viscosity, easy to crystallize, coking or containing solid particles, the tapping place should be self-tracing or additional heating

and an isolation container should be provided.

6.2.5 The upstream and downstream of the LGP balanced flow meter should have a certain length of straight pipe section without resistance.

6.2.6 Requirements of Front and Back Straight Pipe Section:

| Choke | Upstream | Downstream |
|----------------------|----------|------------|
| 1 Elbow | 3D | 2D |
| 2 Elbows | 4D | 2D |
| Tee Joint Head | 3D | 2D |
| Full Open Gate Valve | 4D | 2D |
| Full Open Ball Valve | 3D | 2D |
| Reducer | 3D | 2D |
| Divergent Tube | 3D | 2D |

7 Fault Analysis and Troubleshooting

| Failure Phenomenon | Reason | Method |
|--|---|---|
| 1. Differential pressure transmitter indicates no change | 1. Stop valve is not opened | Open the stop valve |
| | 2. Differential pressure pipeline is blocked | Unblock the differential pressure pipeline |
| | 3. Differential pressure transmitter failure | Check differential pressure transmitter |
| 2. The indication value of the differential pressure transmitter obviously deviates from the indication value of gauge | 1. The installation direction of flow element is wrong | Reinstall the flow element |
| | 2. Differential pressure transmitter failure | Check differential pressure transmitter |
| | 3. The working condition parameters of the measured medium are inconsistent with those used when designing the flow element | Correct according to the relevant formula, it is necessary to recalculate the differential pressure value |
| | 4. The length of the straight pipe before and after the flow element is not enough | Adjust the length of straight pipe |
| | 5. The inner diameter of the straight pipe section is out of tolerance | Measure the inner diameter of straight pipe section and recalculate the maximum flow |
| | 6. Throttle aperture tolerance | Measure the orifice aperture, recalculate the maximum flow |

| | | |
|--|--|---|
| | 7. Flow element is deformed | Replace flow element |
| | 8. There are attachments on flow element | Clean and replace flow element |
| | 9. Tap location is incorrect | Reinstall in the correct way |
| | 10. Condensate liquid level in the condenser is inconsistent | Adjust the condensate level to make the height consistent |
| 3. Differential pressure transmitter has no indication | 1. Power is not turned on | Turn on the power |
| | 2. The stop valve is not open | Open the stop valve |
| | 3. Differential pressure transmitter failure | Check differential pressure transmitter |
| 4. Medium leakage at the flow element | 1. Insufficient clamping force of connector | Refasten the connection |
| | 2. Sealing gasket failure | Replace sealing gasket |
| | 3. Material is corroded | Replace corroded parts |

8 Maintenance

After the flow element is put into use, in order to ensure its measurement accuracy and reliability, it must be maintained.

8.1 Regularly clean the tapping signal pipeline and the differential pressure transmitter to remove all debris, and check and adjust the zero point of the differential pressure transmitter at the same time.

8.2 If the indicated value of the differential pressure transmitter is found to be significantly different from the measured value, a comprehensive inspection and adjustment should be carried out, and the metrological verification should be carried out if necessary.

8.3 The differential pressure transmitter shall be subject to periodic measurement verification according to the measurement verification period.

9 Disassemble

9.1 Warning

Before disassembling, pay attention to dangerous process conditions, such as pressure, high temperature, corrosive or toxic media in the container, etc.

9.2 Waste Disposal

Please follow the current regulations in each region for waste disposal.

10 Product Certificate

Product Certificate

| Certificate | Certification No. | Scope and Description |
|--|-------------------|-----------------------|
| Approval of Measuring Instrument Form Approval Certification | 15F207-21 | |

