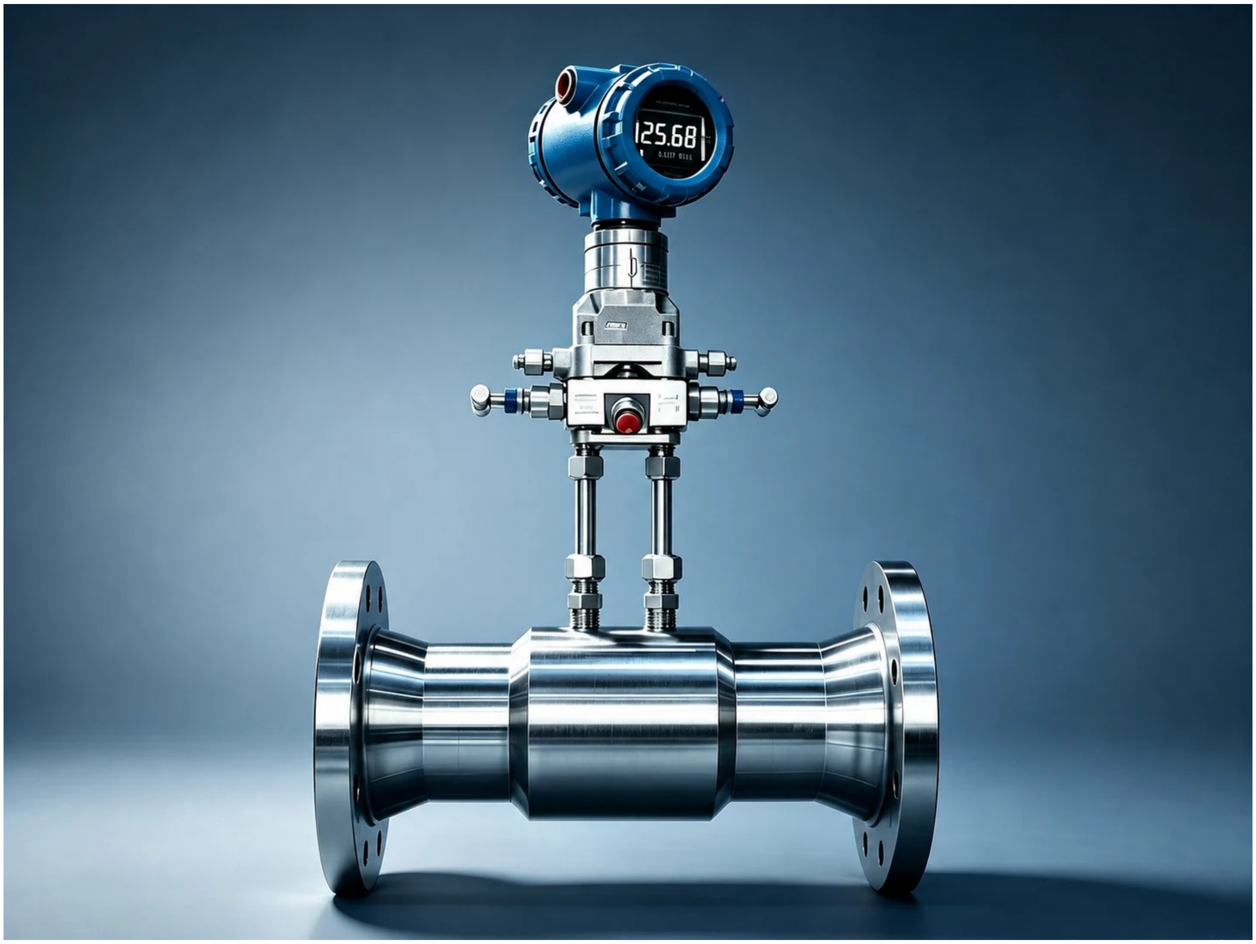
PRODUCT & SELECTION GUIDE

Balanced Flow Meters

Pipeline • Wafer • Replaceable-Core



Application-specific multi-hole differential-pressure measurement

Engineering position
Final geometry, transmitter range, straight-run requirement and performance are confirmed against verified process data and, where required, flow calibration.

Manufacturer	Jinan Shizhong Automation Instruments Co., Ltd.
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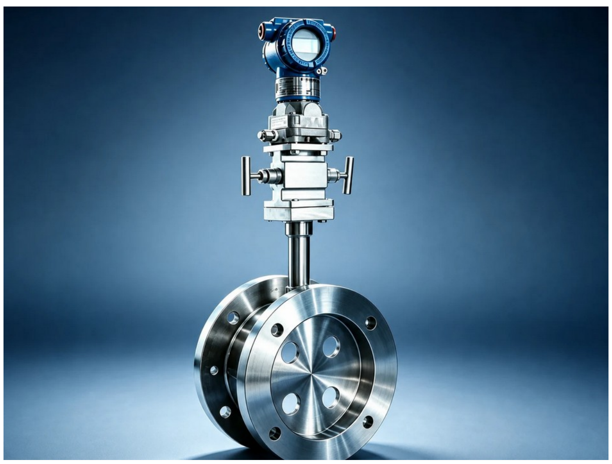
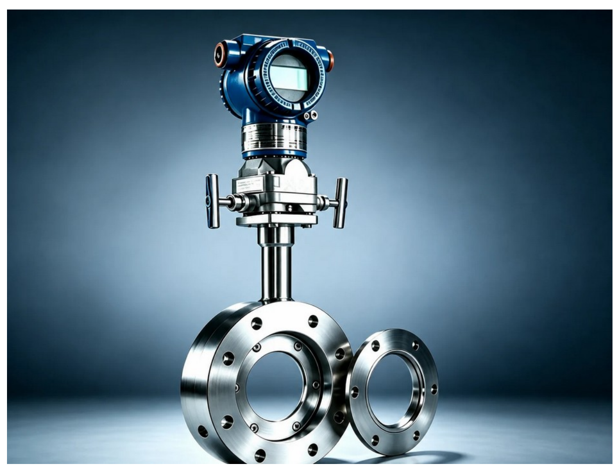
1. Product overview

Shizhong balanced flow meters use a project-specific multi-hole primary element to generate differential pressure while redistributing the velocity profile. The range includes pipeline, wafer and replaceable-core constructions for new installations, compact skid packages and maintainability-focused duties.

Configuration	Best fit	Key review
Pipeline type	New-build meter runs and factory-controlled alignment	Pipe bore, welding, pressure boundary and installation length
Wafer type	Compact skids and retrofit locations	Centering, gasket intrusion, face-to-face space and service access
Replaceable core	Inspection, maintenance or future re-ranging	Isolation, element identity, sealing, coefficient and configuration control





Standards statement

The meter follows the general differential-pressure principles of ISO 5167-1:2022. A project-specific multi-hole element is not an ISO 5167-2 standard concentric orifice plate; its coefficient and installation basis must match the selected design.

2. Measurement principle and range

Flow through the multi-hole element accelerates and produces a measurable pressure difference. The mass-flow relationship follows the differential-pressure form:

$$q_m = (C\cdot\varepsilon / \sqrt{(1 - \beta^4)}) \cdot A_o \cdot \sqrt{(2\cdot\Delta p\cdot\rho_1)}$$

Symbol	Meaning
C	Discharge coefficient for the selected geometry and tapping arrangement
ε	Expansibility factor; essential for gases and steam
β	Equivalent beta ratio based on total open area
A_o	Total effective open area of the multi-hole element
Δp	Differential pressure between defined upstream and downstream taps
ρ_1	Upstream fluid density at operating conditions

Why minimum flow matters

Because $q \propto \sqrt{\Delta p}$, differential pressure collapses rapidly at low flow.

Turndown	Minimum flow	Minimum Δp as % of full-scale Δp
10:1	10.00%	1.000%
15:1	6.67%	0.444%
20:1	5.00%	0.250%
30:1	3.33%	0.111%

Selection rule

A 10:1 turndown is typical. Wider ranges require verification of minimum DP, zero stability, Reynolds-number effects, process pulsation and single- versus dual-range transmitter architecture.

3. Mechanical and transmitter configurations

Direct-mounted assembly

- Reduces external impulse tubing, fittings and potential leak paths.
- Provides compact factory integration of primary element, manifold and DP transmitter.
- Requires review of process temperature, vibration, access and drainage/venting.

Remote transmitter

- Preferred for high-temperature steam, severe vibration, corrosive locations or easier service access.
- Impulse lines should be symmetric, correctly sloped and protected against gas pockets, liquid pockets or unequal condensate heads.

Replaceable-core controls

1. Isolate, depressurize, drain and apply the site work-permit procedure.
2. Confirm the replacement element serial number, material, flow direction and coefficient record.
3. Inspect the locating and sealing surfaces; install with controlled alignment and bolt torque.
4. Update the transmitter range, flow calculation, nameplate and asset history when geometry changes.
5. Perform leakage, zero and loop checks before return to service.

Important

Replaceability lowers lifecycle replacement cost; it does not permit uncontrolled interchange of elements or online removal under pressure.

4. Sizing and selection workflow

Step	Action
1	Define fluid, phase, composition, contamination and corrosivity.
2	Confirm minimum, normal and maximum flow with the correct mass/actual/standard reference.
3	Record minimum, normal and maximum pressure and temperature.
4	Confirm pipe OD, actual ID, schedule, material, flange standard and pressure class.
5	Map filters, regulators, control valves, elbows, tees and reducers with distances in pipe diameters.
6	Define allowable permanent pressure loss and the preferred maximum differential pressure.
7	Set the accuracy, turndown, reporting and calibration requirements.
8	Select pipeline, wafer or replaceable-core construction and direct or remote transmitter mounting.
9	Calculate beta, Reynolds range, expansibility, DP range and permanent pressure loss.
10	Issue an approved datasheet, drawing, calculation and calibration basis.

Situation	Preferred direction
New pipework; alignment control is important	Pipeline-type assembly
Existing skid/cabinet; axial space is limited	Wafer-type assembly
Future inspection or re-ranging is expected	Replaceable-core assembly
High-temperature steam	Remote transmitter with condensate arrangement
Wide flow range	Minimum-DP check; consider dual range
Severe upstream disturbance	Piping-layout review and, if required, calibration

5. Installation and commissioning

Mechanical checks

- Verify flow direction, centerline, flange parallelism and meter orientation.
- Keep gaskets, weld penetration and foreign material out of the flow path and tap passages.
- Use the designed centering feature for wafer units.
- Locate control valves downstream where practicable; review any upstream regulator or partially open valve.
- Provide sufficient access for manifold operation, drain/vent service and replaceable-core removal.

Impulse-system checks

Service	Typical arrangement principle
Dry gas	Transmitter commonly above taps; avoid liquid pockets and provide low-point drainage where needed.
Liquid	Transmitter commonly below taps; avoid gas pockets and provide venting.
Steam	Use equal-height condensate pots/legs and symmetric impulse lines; protect the transmitter from temperature.
Wet or condensable gas	Use symmetric drainage and prevent one-sided liquid accumulation.

Commissioning sequence

Step	Action
1	Check the nameplate, element identity, drawing, range and process data.
2	Leak-test the pressure boundary and impulse system.
3	Vent liquid systems or drain gas systems as required.
4	Equalize the DP transmitter and verify zero.
5	Open the manifold slowly in the approved sequence.
6	Verify DP, static pressure, temperature, density basis and flow units.
7	Record a stable baseline at minimum, normal and maximum practical load.

6. Application case: compact natural-gas metering retrofit

A Shanghai pressure-regulating cabinet required added flow measurement between an existing filter and regulator without a major change to the cabinet envelope. The available face-to-face distance was 107 mm.

Parameter	Case record
Meter concept	Wafer-type balanced flow meter
Line size	DN65/50
Pressure class	PN16
Location	Between filter and pressure regulator
Face-to-face envelope	107 mm
Reference calibration range	12.00–180.00 m^3/h

Engineering lessons

- Compact construction must still preserve centering, gasket clearance, transmitter access and safe manifold operation.
- The filter and regulator are significant disturbances; straight-run and calibration assumptions must be reviewed together.
- At 10:1 turndown, minimum DP is only 1% of full scale, so low-flow stability is a core design issue.
- Air calibration can validate meter behavior, but natural-gas conversion still depends on the correct operating density, composition and compressibility model.

Traceable calibration evidence

A representative SEGD-65-2.5 differential-pressure flow meter (serial SER230606-01) was calibrated on 14 July 2023 at the National Steam Flowrate Measurement Station. The certificate records seven flow points from 12.12 to 172.73 m^3/h and point-specific relative expanded calibration uncertainty of 0.34%–0.38% (k=2).

Correct interpretation

The 0.34%–0.38% values are calibration-result uncertainty, not total meter accuracy. The approved product accuracy must also consider indication error, repeatability, process conditions, installation, transmitter performance and property compensation.

7. Performance, calibration and uncertainty

A balanced flow-meter system is a measurement chain. A credible uncertainty statement separates the primary element, sensors, fluid properties, installation and calibration.

Contribution	Typical review
Primary element	Discharge coefficient, open area, hole geometry, thickness, roughness and thermal expansion
DP transmitter	Range, zero, static-pressure effect, ambient effect, stability and square-root processing
Pressure / temperature	Sensor accuracy, installation response and calibration traceability
Fluid properties	Density, viscosity, compressibility, isentropic exponent and composition
Installation	Velocity profile, swirl, straight run, centering, tap condition and impulse-line head
Calibration	Facility uncertainty, range coverage, Reynolds similarity, curve fit and extrapolation

Public performance language

- Accuracy: project-specific; stated on the approved datasheet and calibration basis.
- Turndown: 10:1 typical; wider ranges require minimum-DP review.
- Straight run: installation dependent; submit the piping layout for engineering review.
- Permanent pressure loss: calculated for the selected geometry and operating range.
- Discharge coefficient: geometry-specific; flow calibration recommended.

Do not generalize

Do not publish 0D/0D, a universal ±0.5% accuracy, a universal 30:1 turndown or a fixed 50% pressure-loss reduction unless a defined product configuration and evidence package support the statement.

8. Enquiry and selection datasheet

Complete all applicable fields. Use actual values rather than nominal labels whenever available.

Project field	Customer data
Project / tag / quantity	
Fluid, phase and composition	
Min / normal / max flow and basis	
Min / normal / max pressure (gauge/absolute)	
Min / normal / max temperature	
Density / viscosity / Z / κ	
DN, OD, actual ID, schedule and material	
Flange standard, class and facing	
Available upstream / downstream straight run	
Upstream disturbances and distances	
Allowable permanent pressure loss	
Required accuracy and turndown	
Pipeline / wafer / replaceable-core preference	
Direct or remote transmitter	
Power / output / protocol	
Ambient / IP / hazardous area	
Calibration and documentation requirement	

9. Final engineering checklist

- Fluid basis and standard conditions are unambiguous.
- Pipe internal diameter and pressure class are verified.
- Minimum-flow differential pressure is above the usable threshold.
- The upstream disturbance and straight-run arrangement are accepted.
- The selected construction fits the available envelope and maintenance plan.
- Materials, pressure boundary, welding and NDT requirements are specified.
- DP, pressure and temperature ranges match the approved calculation.
- The calibration basis covers the required flow/Reynolds range.
- The uncertainty statement is not confused with facility calibration uncertainty.
- Drawings, coefficients, ranges, serial numbers and configuration are under document control.

Engineering review

Send the completed enquiry sheet and piping arrangement to info@shizhongflow.com. Shizhong will confirm the primary-element geometry, DP range, installation, materials, calibration scope and project-specific performance.

Contact

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Product page	https://www.shizhongflow.com/products/balanced-flow-meters

This guide provides engineering selection information and does not replace the approved project datasheet, calculation, drawing, calibration certificate or contractual specification.