

ENGINEERING REFERENCE | 2026 EDITION

# Wedge Flow Meter Selection Guide

ISO 5167-6 engineering basis, RFQ data, installation and calibration planning



## Purpose

Use this guide to decide whether a standard-coefficient or individually calibrated wedge meter is appropriate. Final selection is governed by the approved project data sheet, drawings and calibration certificate.

Jinan Shizhong Automation Instruments Co., Ltd.

[www.shizhongflow.com](http://www.shizhongflow.com) | [info@shizhongflow.com](mailto:info@shizhongflow.com) | +86 188 0531 6689

## 1. Measurement Basis and Scope

A wedge meter creates differential pressure across a defined wedge restriction. The open segment-shaped passage can reduce accumulation risk in viscous, contaminated or solids-bearing single-phase service, while retaining the familiar differential-pressure measurement chain.

### ISO 5167-6 uncalibrated envelope

| Parameter                          | ISO 5167-6:2022 basis                                      |
|------------------------------------|------------------------------------------------------------|
| Pipe internal diameter D           | 50–600 mm                                                  |
| Relative opening h/D               | 0.2–0.6                                                    |
| Equivalent beta ratio $\beta$      | 0.377–0.791                                                |
| Pipe Reynolds number $Re_D$        | $1 \times 10^4$ to $9 \times 10^6$                         |
| Discharge coefficient              | $C = 0.77 - 0.09\beta$                                     |
| Relative expanded uncertainty of C | 4% at $k = 2$                                              |
| Gas/vapor pressure ratio           | $p_2/p_1 \geq 0.75$ for the Part 6 expansibility treatment |

Source: ISO 5167-1:2022 and ISO 5167-6:2022. Verify the purchased standard for full geometry, notes and conditions.

#### Critical distinction

The 4% value is the expanded uncertainty assigned to the uncalibrated discharge coefficient C—not the total installed flow-system accuracy.

### Standard boundary

- Full circular conduit and full pipe.
- Single-phase, subsonic and non-pulsating flow.
- Standard geometry, pressure taps, roughness and straight runs.
- Known fluid properties and Reynolds number inside the stated range.

## 2. Geometry and Flow Equations

### Equivalent beta ratio

For  $x = h/D$ , ISO 5167-6 defines the equivalent beta ratio from the circular-segment open area:

#### $\beta$ relation

$$\beta = \sqrt{\{[\arccos(1 - 2x) - 2(1 - 2x)\sqrt{x - x^2}] / \pi\}}$$

Do not replace this relation with  $\beta = h/D$  or  $\beta = \sqrt{h/D}$ .

### Key geometry controls

| Feature                             | Requirement                                                 |
|-------------------------------------|-------------------------------------------------------------|
| Wedge plane angle                   | $90^\circ \pm 2^\circ$                                      |
| Upstream/downstream external angles | $135^\circ \pm 2^\circ$                                     |
| Apex radius                         | $\leq 1 \text{ mm}$                                         |
| Entrance and exit cylinders         | Each at least 0.5D                                          |
| Body diameter variation             | Within 0.4% of mean D                                       |
| Internal roughness                  | $Ra < 10^{-3}D$                                             |
| Pressure-tap position               | Same side as wedge; $1D \pm 0.02D$ from nearest wedge point |
| Wall / large-bore taps              | 4–10 mm / 25–75 mm and no larger than D                     |

### Pressure-loss estimate

#### ISO relation

Permanent pressure loss may be estimated as  $\Delta\omega = (1.09 - 0.79\beta)\Delta p$ . Use this as a primary-element estimate, not as a complete piping pressure-drop calculation.

### 3. Engineering Selection Workflow

1. Confirm the fluid phase and whether the pipe remains full at all operating points.
2. Define minimum, normal and maximum flow on a consistent mass or actual-volume basis.
3. Collect operating/design pressure and temperature, density, viscosity and gas properties.
4. Calculate  $Re_D$  across the complete flow range and determine whether the standard coefficient applies.
5. Select  $D$ ,  $h/D$  and  $\beta$ ; calculate differential pressure, velocity and permanent loss.
6. Select body, wedge, flange, tapping, valve, gasket and fastener materials.
7. Select wall taps, large-bore taps, diaphragm seals, flushing or heat tracing.
8. Check the actual upstream/downstream disturbances and available straight run.
9. Define DP transmitter range, static pressure, output, protocol, protection and hazardous-area requirements.
10. Decide whether individual wet calibration, witness testing or project-specific uncertainty analysis is required.

#### Rangeability check

Because flow is proportional to the square root of differential pressure, 10:1 flow range requires approximately 100:1 differential-pressure range; 30:1 requires approximately 900:1. Zero stability, static-pressure effects, ambient temperature, impulse-line head, process noise and calibration must all be included.

**Published product position**

10:1 typical system rangeability; up to 30:1 with dual-range DP measurement, subject to process and calibration review.

## 4. RFQ Data Checklist

| Data group                                                                                                                                                                                                                                                       | Required information                                                                                   |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------|
| Fluid                                                                                                                                                                                                                                                            | Name, composition, phase, corrosiveness, solids/gas content, particle size, fouling or crystallization |
| Flow                                                                                                                                                                                                                                                             | Minimum / normal / maximum, units, mass or actual/standard volume basis                                |
| Operating                                                                                                                                                                                                                                                        | Minimum / normal / maximum pressure and temperature                                                    |
| Design                                                                                                                                                                                                                                                           | Design pressure and temperature, piping class and governing code                                       |
| Properties                                                                                                                                                                                                                                                       | Density, dynamic viscosity; for gas: molecular weight, Z and isentropic exponent                       |
| Pipe                                                                                                                                                                                                                                                             | Nominal size, actual internal diameter, wall thickness and material                                    |
| Connection                                                                                                                                                                                                                                                       | Flange standard, rating, facing or welded-end details                                                  |
| Installation                                                                                                                                                                                                                                                     | Orientation, available straight runs and disturbance sketch/isometric                                  |
| Instrument                                                                                                                                                                                                                                                       | DP range, static pressure, output/protocol, hazardous area, IP rating                                  |
| Documents                                                                                                                                                                                                                                                        | Calibration points, witness, NDE, MTR, pressure test, language and data format                         |
| <b>Do not quote from pipe size alone</b><br>A reliable wedge selection needs the complete flow range, density, viscosity, pressure, temperature and installation layout. A nominal DN/PN request is not enough to establish $\beta$ , $\Delta p$ or uncertainty. |                                                                                                        |

## 5. Configuration Selection



*Remote-mounted arrangement — final construction follows approved drawings.*

| Service condition               | Preferred configuration                      | Engineering focus                                    |
|---------------------------------|----------------------------------------------|------------------------------------------------------|
| General single-phase service    | Integrated valve manifold and DP transmitter | Temperature, vibration and maintenance access        |
| High temperature / vibration    | Remote-mounted transmitter                   | Equal impulse paths, support and condensate handling |
| Slurry / solids / plugging risk | Large-bore taps or diaphragm seals           | Flushing, deposition and diaphragm wear              |
| Viscous / solidifying           | Jacketed or insulated body                   | Uniform heat input and maintainable viscosity        |
| Corrosive                       | Alloy, lining or diaphragm seal              | Compatibility, welding and inspection                |
| Abrasive                        | Wear-resistant material or hard facing       | Apex geometry and service-life plan                  |
| Frequent inspection             | Removable wedge element                      | Repeatable positioning and sealing                   |

## 6. Installation Requirements

### Minimum upstream straight runs

| Nearest upstream disturbance                 | Minimum straight run |
|----------------------------------------------|----------------------|
| Single 90° bend                              | 7D                   |
| Three 90° bends under the listed orientation | 22D                  |
| Two 90° bends in the same plane              | 21D                  |
| Concentric expander D/2 to D                 | 7D                   |
| Concentric reducer 3D/2 to D                 | 7D                   |
| Partially closed valve                       | 15D                  |
| Tee, straight-through                        | 7D                   |
| Tee used as an elbow/combining junction      | 8D                   |

*Downstream fittings at least 6D away introduce no additional error under the Part 6 table basis. A thermowell should be located 4D–14D downstream. Always verify orientation notes and compound disturbances in the standard.*

### Impulse-line principles

- Liquid: keep both sides liquid-filled and avoid trapped gas.
- Gas: avoid liquid pockets and provide controlled draining if needed.
- Steam: use symmetrical condensate pots/legs and equal impulse lines.
- Dirty service: consider large-bore taps, diaphragm seals and controlled flushing.
- Remote seals: match capillary length, fill fluid and environmental exposure.

## 7. Calibration and Uncertainty

### When individual calibration is required

- A lower uncertainty than the uncalibrated coefficient can support.
- $D$ ,  $\beta$ ,  $h/D$ ,  $ReD$  or geometry lies outside the standard envelope.
- Alternative pressure taps, linings, hard facing or non-standard internals are used.
- Low- $Re$ , bidirectional or special-service performance must be established.

### Calibration controls

| Control           | Requirement                                                        |
|-------------------|--------------------------------------------------------------------|
| Coverage          | Whole intended $ReD$ range; no unsupported extrapolation           |
| Transferability   | Results apply only to the calibrated meter                         |
| Pressure taps     | Each tap pair calibrated separately                                |
| Bidirectional use | Each flow direction calibrated                                     |
| Recommended run   | 10D upstream and 2D downstream during calibration                  |
| Report            | $\Delta p$ , $ReD$ , $C$ , uncertainty and the fitted relationship |

### Total measurement uncertainty

The installed result combines the primary-element coefficient with DP measurement, dimensions, density/temperature/pressure compensation, static head, installation effects, zero drift and data acquisition. State the required total uncertainty before final design and calibration.



## 8. Inspection, Commissioning and Maintenance

### Factory documentation

- Approved data sheet and outline drawing; serial-number traceability.
- Material certificates; dimensional inspection of D, h, angles, apex and tap locations.
- Welding/NDE, pressure and leak tests as ordered.
- DP transmitter configuration/calibration and wet-flow certificate if ordered.

### Commissioning

1. Verify flow arrow, line size, rating, materials, orientation and straight run.
2. Confirm valves and impulse lines are clean, symmetric and leak-free.
3. Check zero at equal pressure without exposing one side to unsafe overpressure.
4. Introduce process gradually; confirm square-root, density and compensation settings.
5. Record zero, DP, pressure, temperature, valve positions and process condition as the baseline.

### Maintenance triggers

- Persistent zero shift or elevated DP noise.
- Blocked taps, trapped gas/liquid, leakage or seal damage.
- Wedge wear, corrosion, deposits or dimensional change.
- Any modification to wedge, taps, lining, body or calibration basis.

## 9. RFQ Worksheet and Contact

| Field                                                                                                                                                                                                                                                                                                               | Customer entry |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|
| Fluid / composition / phase                                                                                                                                                                                                                                                                                         |                |
| Minimum / normal / maximum flow                                                                                                                                                                                                                                                                                     |                |
| Operating & design P/T                                                                                                                                                                                                                                                                                              |                |
| Density / viscosity / gas properties                                                                                                                                                                                                                                                                                |                |
| Solids, particle size, corrosion                                                                                                                                                                                                                                                                                    |                |
| Pipe OD / ID / wall / material                                                                                                                                                                                                                                                                                      |                |
| Connection / rating / facing                                                                                                                                                                                                                                                                                        |                |
| Available straight runs / disturbances                                                                                                                                                                                                                                                                              |                |
| Allowable pressure loss                                                                                                                                                                                                                                                                                             |                |
| DP transmitter / output / hazardous area                                                                                                                                                                                                                                                                            |                |
| Accuracy / calibration / witness                                                                                                                                                                                                                                                                                    |                |
| Documents / inspection / quantity                                                                                                                                                                                                                                                                                   |                |
| <b>Send the completed data</b><br>Email <a href="mailto:info@shizhongflow.com">info@shizhongflow.com</a> or use the Request Quote form at <a href="https://www.shizhongflow.com/contact">https://www.shizhongflow.com/contact</a> .<br>Attach the piping isometric or a marked-up process sketch whenever possible. |                |

### References

- ISO 5167-1:2022 — General principles and requirements.
- ISO 5167-6:2022 — Wedge meters.
- GB/T 2624.6—2024 — Chinese national adoption for wedge meters.

*This guide is an engineering aid, not a substitute for the purchased standards, approved project specifications or individual calibration certificate.*