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Measurement of fluid flow by means of pressure differential devices inserted in circular cross-section conduits running full —

Part 6:
Wedge meters

Mesure de débit des fluides au moyen d'appareils déprimogènes insérés dans des conduites en charge de section circulaire —

Partie 6: Débitmètres à coin

Reference number
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ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Fax: +41 22 749 09 47
Email: copyright@iso.org
Website: www.iso.org

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation on the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see the following URL: www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 30, *Measurement of fluid flow in closed conduits*, Subcommittee SC 2, *Pressure differential devices*.

A list of all the parts in the ISO 5167 series can be found on the ISO website.

Introduction

ISO 5167, divided into six parts, covers the geometry and method of use (installation and operating conditions) of orifice plates, nozzles, Venturi tubes, cone and wedge meters when they are inserted in a conduit running full to determine the flow rate of the fluid flow in the conduit. It also gives necessary information for calculating the flow rate and its associated uncertainty.

ISO 5167 is applicable only to pressure differential devices in which the flow remains subsonic throughout the measuring section and where the fluid can be considered as single-phase, but it is not applicable to the measurement of pulsating flow. Furthermore, each of these devices can only be used within specified limits of pipe size and Reynolds number.

ISO 5167 deals with devices for which direct calibration experiments have been made, sufficient in number, spread and quality to enable coherent systems of application to be based on their results and coefficients to be given with certain predictable limits of uncertainty. However, for wedge meters calibrated in accordance with Clause 7, a wider range of pipe size, β and Reynolds number can be considered.

The devices introduced into the pipe are called 'primary devices'. The term primary device also includes the pressure tappings. All other instruments or devices required for the measurement are known as 'secondary devices'. ISO 5167 covers primary devices; secondary devices[1)] are mentioned only occasionally.

ISO 5167 is divided into the following six parts.

a) Part 1 gives general terms and definitions, symbols, principles and requirements as well as methods of measurement and uncertainty that are to be used in conjunction with Part 2 to Part 6 of ISO 5167.

b) Part 2 specifies requirements for orifice plates, which can be used with corner pressure tappings, D and $D/2$ pressure tappings[2)] , and flange pressure tappings.

c) Part 3 specifies requirements for ISA 1932 nozzles[3)], long radius nozzles and Venturi nozzles, which differ in shape and in the position of the pressure tappings.

d) Part 4 specifies requirements for classical Venturi tubes[4)].

e) Part 5 specifies requirements for cone meters, and includes a section on calibration.

f) Part 6 specifies requirements for wedge meters, and includes a section on calibration.

NOTE This document is complementary to ISO 5167-1:2003, ISO 5167-2:2003, ISO 5167-3:2003, ISO 5167-4:2003 and ISO 5167-5:2015.

1) See ISO 2186[1] and also ISO/TR 9464[4].

2) Orifice plates with 'vena contracta' pressure tappings are not considered in ISO 5167.

3) ISA is the abbreviation for the International Federation of the National Standardizing Associations, which was succeeded by ISO in 1946.

4) In the USA the classical Venturi tube is sometimes called the Herschel Venturi tube.

Measurement of fluid flow by means of pressure differential devices inserted in circular cross-section conduits running full —

Part 6:
Wedge meters

1 Scope

This document specifies the geometry and method of use (installation and operating conditions) of wedge meters when they are inserted in a conduit running full to determine the flow rate of the fluid flowing in the conduit.

NOTE 1 As the uncertainty of an uncalibrated wedge meter can be too large for a particular application, it could be deemed essential to calibrate the flow meter according to Clause 7.

This document gives requirements for calibration which, if applied, are for use over the calibrated Reynolds number range. Clause 7 could also be useful guidance for calibration of meters of similar design but which fall outside the scope of this document.

It also provides background information for calculating the flow rate and is applicable in conjunction with the requirements given in ISO 5167-1.

This document is applicable only to wedge meters in which the flow remains subsonic throughout the measuring section and where the fluid can be considered as single-phase. Uncalibrated wedge meters can only be used within specified limits of pipe size, roughness, beta (or wedge ratio) and Reynolds number. It is not applicable to the measurement of pulsating flow. It does not cover the use of uncalibrated wedge meters in pipes whose internal diameter is less than 50 mm or more than 600 mm, or where the pipe Reynolds numbers are below 1×10^4.

NOTE 2 A wedge meter has a primary element which consists of a wedge-shaped restriction of a specific geometry. Alternative designs of wedge meters are available; however, at the time of writing there is insufficient data to fully characterize these devices, and therefore these meters are calibrated in accordance with Clause 7.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 4006, *Measurement of fluid flow in closed conduits — Vocabulary and symbols*

ISO 5167-1, *Measurement of fluid flow by means of pressure differential devices inserted in circular cross-section conduits running full — Part 1: General principles and requirements*

ISO 5168, *Measurement of fluid flow — Procedures for the evaluation of uncertainties*

ISO/IEC 17025, *General requirements for the competence of testing and calibration laboratories*

ISO/IEC Guide 98-3, *Uncertainty of measurement — Part 3: Guide to the expression of uncertainty in measurement (GUM:1995)*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 4006, ISO 5167-1 and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at http://www.electropedia.org/

3.1
wedge gap
h
maximum gap between the apex of the wedge element and the pipe wall, in the plane perpendicular to the pipe axis

Note 1 to entry: See Figure 1.

3.2
wedge ratio
ratio of the wedge gap to the meter inlet diameter, *D*

Note 1 to entry: See ISO 4006:1991, Clause 2, for the meter inlet diameter, *D*.

3.3
wedge throat area
A_t
minimum cross-sectional open area of the wedge meter

4 Principles of the method of measurement and computation

The principle of the method of measurement is based on the installation of the wedge meter into a pipeline in which a fluid is running full. Flow through a wedge meter produces a differential pressure between the upstream and downstream tappings.

The mass flow rate can be determined by the following formulae:

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

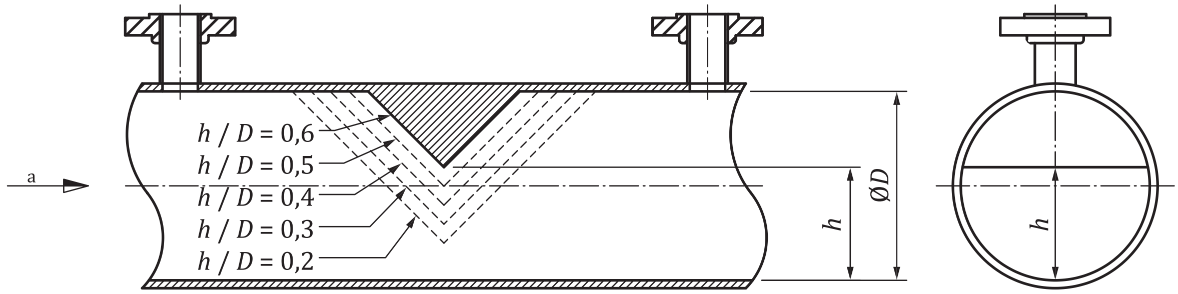
and

$$\beta = \sqrt{\frac{4A_t}{\pi D^2}} \tag{2}$$

A larger β corresponds to a larger wedge gap height, h (see Figure 1), and therefore a larger throat area A_t. The value of β can be calculated using Formula (3):

$$\beta = \sqrt{\frac{1}{\pi}\left[\arccos\left(1-\frac{2h}{D}\right) - 2\left(1-\frac{2h}{D}\right)\times\sqrt{\frac{h}{D}-\left(\frac{h}{D}\right)^2}\right]} \tag{3}$$

NOTE For example, h/D = 0,5 does not correspond to β = 0,5, but to $\beta = \sqrt{0,5} \approx 0,707$. β = 0,5 corresponds to $h/D \approx 0,298$.



Key

a Flow.

Figure 1 — Wedge meter showing different values of wedge ratio

The uncertainty limits can be calculated using the procedure given in ISO 5167-1:2003, Clause 8.

Similarly, the value of the volume flow rate can be calculated since

$$q_V = \frac{q_m}{\rho} \tag{4}$$

where ρ is the fluid density at the temperature and pressure for which the volume is stated.

Computation of the flow rate, which is a purely arithmetic process, is performed by replacing the different items on the right-hand side of Formula (1) by their numerical values. Formula (5) (or the computed values in Table A.1) gives wedge meter expansibility factors (ε). The values in Table A.1 are not intended for precise interpolation. Extrapolation is not permitted. However, for a meter calibrated according to Clause 7, the coefficient of discharge, C, is generally related to the Reynolds number, Re, which is itself related to q_m, and has to be obtained by iteration (see ISO 5167-1:2003, Annex A, for guidance regarding the choice of iteration procedure and initial estimates).

The wedge gap, h, and the pipe diameter, D, mentioned in Formula (3) are the values of the lengths at working conditions. Measurements taken at any other conditions should be corrected for any possible expansion or contraction of the primary device and the pipe due to the values of the temperature and pressure of the fluid during the measurement.

As the wedge meter flow rate calculation is particularly sensitive to the pipe diameter and wedge gap values used, the user shall ensure that these are correctly entered into the flow computation calculations. The measured internal diameter shall be used rather than a nominal value.

It is necessary to know the density and the viscosity of the fluid at working conditions. In the case of a compressible fluid, it is also necessary to know the isentropic exponent of the fluid at working conditions.

NOTE The turndown of all differential pressure flow meters is dependent upon the differential pressure range. Typically a 10:1 turndown in flow rate (equivalent to 100:1 turndown in differential pressure) can be achieved.

5 Wedge meters

5.1 Field of application

Uncalibrated wedge meters can be used in pipes with diameters between 50 mm and 600 mm and with $0{,}377 \le \beta \le 0{,}791$ (wedge ratio $0{,}2 \le h/D \le 0{,}6$). Wedge meters with $\beta > 0{,}791$ ($h/D > 0{,}6$) or $\beta < 0{,}377$ ($h/D < 0{,}2$) are not normally manufactured.

There are limits to the roughness which are addressed in 5.2.3, 5.2.7, and 6.3.2. There are limits to the Reynolds number which are addressed in 5.5.2.

5.2 General shape

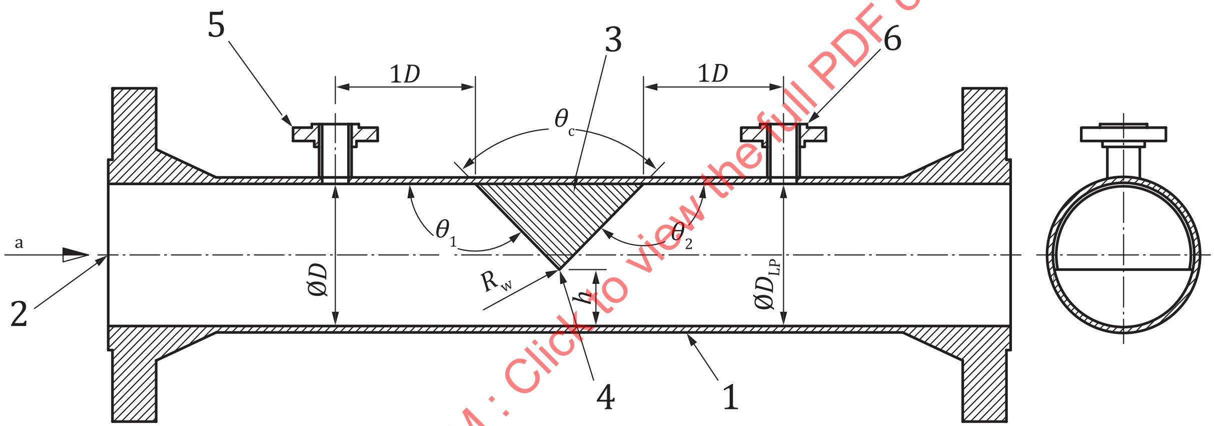
5.2.1 The wedge meter as shown in Figure 2 comprises (listed in the direction of flow) an entrance cylinder, an upstream pressure tapping, a pipe section including the wedge element, a downstream pressure tapping, and an exit cylinder. The form of the pressure tappings is described in 5.4.

5.2.2 The diameter D shall be measured at the plane of the upstream tapping. The number of measurements shall be a minimum of four equally spaced around the pipe internal circumference. The arithmetic mean value of these measurements shall be taken as the value of D in the calculations.

The minimum entrance cylinder length shall be 0,5D. The minimum exit cylinder length shall be 0,5D.

Diameters shall also be measured in planes other than the plane of the upstream pressure tapping.

No diameter along the wedge meter shall differ by more than 0,4 % from the value of the mean diameter. This requirement is satisfied when the difference in the length of any of the measured diameters complies with the said requirement with respect to the mean of the measured diameters.



Key

1 meter body
2 meter body centreline
3 wedge element
4 wedge apex
5 high pressure tapping
6 low pressure tapping
a Flow.

Figure 2 — Geometric profile of wedge meter

5.2.3 The internal surface of the pipe section from the planes of the upstream and downstream tappings shall be clean and smooth, and the roughness criterion, Ra, should be as small as possible and shall be less than $10^{-3}D$.

5.2.4 The wedge plane angle, θ_c, shall be 90° ± 2° at all points of intersection along the span of the wedge apex. The span of the wedge apex shall be perpendicular to the centreline of the tappings and also to the centreline of the wedge meter.

5.2.5 The radius of curvature of the wedge apex, R_w, as shown in Figure 3, shall be less than or equal to 1 mm along the span of the wedge apex.

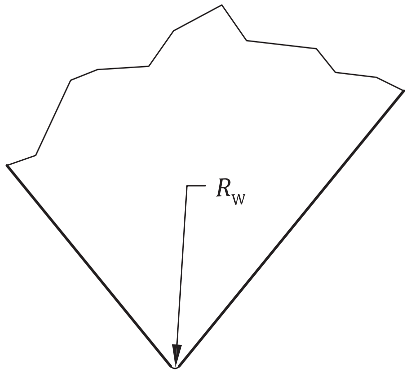


Figure 3 — Radius of curvature, R_w, at the wedge apex

5.2.6 The upstream external angle, θ_1, and downstream external angle, θ_2, of the wedge shall be measured and shall both be equal to 135° ± 2°.

5.2.7 The wedge surface shall be clean and smooth, and the roughness criterion, *Ra*, shall be as small as possible and shall always be less than $10^{-3}D$.

5.2.8 Where the wedge is attached to the meter body by welding, the manufacturer should take care to minimize the size of the weld beads within the limits required for structural integrity.

5.2.9 Where the wedge is attached to the meter body by welding, the manufacturer shall ensure there is no intrusion of the weld into the design throat area.

5.3 Material and manufacture

5.3.1 The wedge meter may be manufactured from any material and using any construction technique, provided that the wedge meter is in accordance with the foregoing description and will remain so during use.

5.3.2 Hollow wedge element designs shall include a pressure equalization system to ensure the structural stability of the wedge under rapid pressure changes.

5.4 Pressure tappings

5.4.1 The upstream tapping shall be made either in the form of a pipe wall pressure tapping or a large bore branch tapping. It is recommended that the tappings be as small as compatible with the fluid (for example, with its viscosity and contaminants).

The large bore tapping design may be considered to be more applicable for slurry, corrosive fluids, or fluids which require diaphragm seals.

5.4.2 The centreline of the tappings shall be perpendicular to and pass through the centreline of the meter body (see Figure 2). The centreline of the tappings shall also be perpendicular to the line of the wedge apex ±2°. The tappings shall be located on the same side of the meter body as the wedge element.

5.4.3 The centreline of the tappings shall be located $1D \pm 0{,}02D$ from the nearest edge of the wedge element.

5.4.4 The diameter of pipe wall pressure tappings shall be between 4 mm and 10 mm.

5.4.5 The diameter of large bore branch tappings shall be between 25 mm and 75 mm, and moreover shall never be greater than D.

5.4.6 At the point of break-through, the hole of the pressure tapping shall be circular. The edges shall be flush with the pipe wall and free from burrs. The radius shall not exceed one-tenth of the diameter of the pressure tapping.

5.4.7 Each pressure tapping should be cylindrical over its length.

5.4.8 Conformity of the pressure tapping with the two foregoing requirements is assessed by visual inspection.

5.5 Discharge coefficient, C

5.5.1 Limits of use

A simultaneous use of extreme values for D, β and Re_D shall be avoided as otherwise the uncertainties given in 5.7 might increase.

For installations outside the limits defined in 5.5.2 for D, β and Re_D, it is necessary to determine the discharge coefficient for each meter by calibration in accordance with Clause 7 over its entire Reynolds number range of operation.

The effects of Re_D, Ra/D and β on C are not yet sufficiently known for it to be possible to give reliable values of C outside the limits defined in this document.

Refer to Annex B for information regarding the traditional Kd^2 parameter, which is geometrically related to the discharge coefficient, C.

5.5.2 Discharge coefficient of the wedge meter

Wedge meters can only be used in accordance with this document when:

$$50 \text{ mm} \leq D \leq 600 \text{ mm}$$

$$0,377 \leq \beta \leq 0,791 \; (0,2 \leq h/D \leq 0,6)$$

$$1 \times 10^4 \leq Re_D \leq 9 \times 10^6$$

Under these conditions the value of the discharge coefficient C for an uncalibrated meter is:

$$C = 0,77 - 0,09\beta$$

5.6 Expansibility [expansion] factor, ε

As no data or equation for the expansibility [expansion] factor has been generated for the wedge meter, the theoretical isentropic expansibility [expansion] equation is applied, given in Formula (5).

$$\varepsilon = \sqrt{\left(\frac{\kappa\tau^{2/\kappa}}{\kappa-1}\right)\left(\frac{1-\beta^4}{1-\beta^4\tau^{2/\kappa}}\right)\left(\frac{1-\tau^{(\kappa-1)/\kappa}}{1-\tau}\right)} \quad (5)$$

This formula is generally applied to wedge meters for gases and vapours for which the isentropic exponent is known.

However, the formula is only applicable if $p_2/p_1 \geq 0{,}75$.

Values of the expansibility [expansion] factor for a range of isentropic exponents, pressure ratios and β (and wedge ratios) are given for convenience in Table A.1.

5.7 Uncertainty of the discharge coefficient, C

The uncertainty of an uncalibrated wedge meter is relatively high when compared with orifice, nozzles and Venturi tube differential pressure devices. However, if a flow calibration is carried out as per Clause 7, the uncertainty in discharge coefficient is comparable to that of these other devices. Therefore, for applications requiring higher accuracy, it is recommended that every wedge meter is calibrated over the full operational range of Reynolds number as specified in Clause 7.

The relative uncertainty of the discharge coefficient as given in 5.5.2 is equal to 4 %, expressed at a 95 % confidence interval.

For a given flowrate, the uncertainty of the discharge coefficient and that of the predicted differential pressure are directly linked. Consequently, care shall be taken with determining β such that the maximum differential pressure does not exceed the upper range limit of the transmitter.

5.8 Uncertainty of the expansibility [expansion] factor, ε

From available data, the absolute uncertainty of ε is estimated (expressed at a 95 % confidence interval) to be:

$$\frac{1-\tau}{3} \quad (6)$$

5.9 Pressure loss

The pressure loss, $\Delta\varpi$, for the wedge meter described in this document is approximately related to the differential pressure, Δp, by Formula (7):

$$\Delta\varpi = (1{,}09 - 0{,}79\beta)\Delta p \quad (7)$$

This pressure loss is the difference in static pressure between the pressure measured at the upstream tapping and that measured on the downstream side of the wedge meter, where the static pressure recovery by expansion of the jet may be considered as just completed (approximately 5D downstream of the centreline of the downstream tapping).

NOTE When comparing the permanent pressure loss of a wedge meter with alternative differential pressure meter designs, it is important to compare meter designs that are sized to provide a similar range of differential pressure, rather than comparing the different meter designs with the same value of β.

6 Installation requirements

6.1 General

General installation requirements for pressure differential devices are contained in ISO 5167-1:2003, Clause 7, and shall be followed in conjunction with the additional specific installation requirements for wedge meters given in this clause. The general requirements for flow conditions at the primary device are given in ISO 5167-1:2003, 7.3. The requirements for use of a flow conditioner are given in ISO 5167-1:2003, 7.4; however, flow conditioners are generally not used with wedge meters.

6.2 Minimum upstream and downstream straight lengths for installations between various fittings and the wedge meter

The designer of the metering system should make reasonable efforts to minimize flow disturbances.

The effect of the disturbance is relative to the meter's performance with no disturber installed.

Upstream straight lengths shall be measured from the downstream end of the curved portion of the nearest (or only) bend or the downstream end of the curved or conical portion of a reducer or expander to the plane of the centreline of the upstream tapping of the wedge meter.

Downstream straight lengths shall be measured from the plane of the centreline of the downstream tapping of the wedge meter to the upstream end of the curved portion of the nearest (or only) bend or the upstream end of the curved or conical portion of a reducer or expander. Fittings at least $6D$ downstream of the wedge meter introduce no additional errors.

These data were collected with a 100 mm NB wedge meter with β = 0,707 (h/D = 0,5), but given the absence of other data they are assumed to be applicable for $0{,}377 \le \beta \le 0{,}791$ (wedge ratio $0{,}2 \le h/D \le 0{,}6$). The lengths given in Table 1 are sufficient to avoid shifts in discharge coefficient greater than 0,5 %.

Table 1 — Recommended upstream straight lengths for flow disturbers

Single 90° bend	$7D$
Three 90° bends with parallel exit and outlet	$22D$
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	$15D$
Pipe tee – straight run	$7D$
Pipe tee – used as elbow or tee	$8D$

Fully open, full-bore, isolation valves introduce no additional errors.

6.3 Additional specific installation requirements for wedge meters

6.3.1 Circularity and cylindricality of pipes upstream and downstream of the wedge meter

6.3.1.1 Over the required upstream length from Table 1, measured from the plane of the centreline of the upstream pressure tapping, the pipe shall be cylindrical. The pipe upstream of the entrance cylinder is said to be cylindrical when no diameter in any plane differs by more than 2 % from D. The number of measurements in a plane shall be equal to a minimum of four. At least one axial plane shall be examined in addition to the plane of the upstream tapping.

6.3.1.2 Over a downstream length of at least $6D$ measured from the plane of the centreline of the downstream tapping, the pipe shall be cylindrical. The pipe downstream of the exit cylinder is said to be cylindrical when no diameter in any plane differs by more than 2 % from D. The number of measurements in a plane shall be equal to a minimum of four. At least one axial plane shall be examined in addition to the plane of the downstream tapping.

6.3.1.3 The mean diameter of upstream pipe where it joins the entrance cylinder shall be within 1 % of the wedge meter diameter *D*, as defined in 5.2.2.

6.3.2 Roughness of the upstream and downstream pipe

The upstream and downstream pipe roughness criterion, *Ra*, shall be less than $10^{-3}D$ over the required upstream lengths and 6*D* downstream.

6.3.3 Positioning of a thermowell

If a thermowell is installed, it is recommended that it be located downstream of the wedge. Its location shall be between 4*D* and 14*D* downstream of the plane of the downstream tapping. Refer to 5.9 and ISO 5167-1:2003, 5.4.4.1 for guidance on calculating the temperature correction to an upstream tapping.

6.3.4 Bidirectional wedge meters

Wedge meters can be used for bidirectional applications; however, consideration shall be given to the location of the tappings and the position of the thermowell(s). Furthermore, any calibration is only valid for the direction of flow during the calibration (see 7.4).

7 Flow calibration of wedge meters

7.1 General

For users of wedge meters of the geometry described in this standard that require a lower discharge coefficient uncertainty than that stated in 5.7, or for users of devices where the geometry differs from that described in this standard, the wedge meter shall be calibrated.

The purpose of a flow calibration is to determine the discharge coefficient of an individual wedge meter and its associated uncertainty.

Where the geometry of the wedge meter differs from that described in this standard, the expansibility equation given in Formula (5) shall not be used unless verified. In such a case the manufacturer of the wedge meter shall provide an appropriate equation for the expansibility [expansion] factor.

Calibrated meters shall only be used over the calibrated Reynolds number range.

7.2 Test facility

The wedge meter shall be calibrated at a facility operating in accordance with ISO/IEC 17025.

7.3 Meter installation

The wedge meter should be installed with a long straight inlet run, with a minimum of 10*D* of upstream straight length of the same nominal pipe diameter immediately preceding the wedge meter. Similarly, the wedge meter should have a minimum of two diameters of downstream straight length of the same nominal pipe diameter immediately after the wedge meter.

The orientation of the wedge meter is irrelevant.

If the wedge meter in operation will be installed in pipe work that significantly differs from the installation guidelines in this document, the operational pipe design should be replicated at the calibration facility in order to reduce the uncertainty of the wedge meter in its installation.

7.4 Design of the test programme

The wedge meter should be calibrated, as a minimum, over the entire Reynolds number range the meter is expected to see in operational service. The test facility can calibrate the wedge meter using liquid or gas, or both liquid and gas in separate tests to cover the required Reynolds number range.

The calibration data of a wedge meter are not transferrable to another wedge meter. If the meter has multiple sets of tappings, each set shall be calibrated as if it were a separate meter. Bidirectional meters shall be calibrated in both directions. Extrapolation of the calibration shall not be permitted.

A minimum of six test points shall be taken approximately evenly spread across the Reynolds number range, with a minimum of three data points taken for each test point to demonstrate the repeatability of the data.

7.5 Reporting the calibration results

The calibration test report shall provide both tabulated and graphical results of the differential pressure, Reynolds number and discharge coefficient values.

The discharge coefficient versus Reynolds number relationship determined in the calibration process shall be implemented according to the user's requirements. If this relationship is not constant within the user's tolerance then a non-constant mathematical expression should be used which will require an iterative solution. As stated in 7.4, the user shall not extrapolate this mathematical expression.

7.6 Uncertainty analysis of the calibration

7.6.1 General

All uncertainties calculated as part of this flow calibration shall be stated to a 95 % confidence level.

7.6.2 Uncertainty of the test facility

The uncertainty of the instrumentation used by the test facility shall be calculated and recorded for each test point of the flow calibration. The uncertainty in the flow measurement shall be computed from these data utilizing a method detailed in either ISO 5168 or ISO/IEC Guide 98-3. Both the chosen method and the results shall be recorded in the calibration report.

Where both liquid and gas tests are separately used to cover the Reynolds number range, the uncertainties of each test facility for the relevant test points shall be clearly detailed in the calibration report.

7.6.3 Uncertainty of the wedge meter

The calibration procedure and the calculated uncertainty of the wedge meter under test shall be recorded in the calibration report. As so few measurements are taken at each Reynolds number, an appropriate statistical methodology shall be used.