SLOVENSKI STANDARD
SIST EN ISO 8316:1998

01-avgust-1998

Measurement of liquid flow in closed conduits - Method by collection of the liquid in a volumetric tank

Measurement of liquid flow in closed conduits - Method by collection of the liquid in a volumetric tank (ISO 8316:1987)

Durchflußmessung von Flüssigkeiten in geschlossenen Leitungen - Verfahren der Volumenbestimmung mit einem Meßbehälter (ISO 8316:1987)

Mesure de débit des liquides dans les conduites fermées - Méthode par jaugeage d'un réservoir volumétrique (ISO 8316:1987)

Ta slovenski standard je istoveten z: **EN ISO 8316:1995**

ICS:

17.120.10 Pretok v zaprtih vodih Flow in closed conduits

SIST EN ISO 8316:1998 **en**

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN ISO 8316

September 1995

ICS 17.120.10

Descriptors: liquid flow, pipe flow, flow measurements, volume measurements, tanks containers, gauging, flow rate, flowmeters, error analysis

English version

Measurement of liquid flow in closed conduits - Method by collection of the liquid in a volumetric tank (ISO 8316:1987)

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CEN

European Committee for Standardization
Comité Européen de Normalisation
Europäisches Komitee für Normung

Central Secretariat: rue de Stassart,36 B-1050 Brussels

Foreword

This European Standard was taken over by CEN from the work of ISO/TC 30 "Measurementof fluid flow in closed conduits" of the International Standards Organization (ISO).

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by March 1996 , and conflicting national standards shall be withdrawn at the latest by March 1996.

According to the CEN/CENELEC Internal Regulations, the following countries are bound to implement this European Standard: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, United Kingdom.

Endorsement notice

The text of the International Standard ISO 8316:1987 was approved by CEN as a European Standard without any modification.

NOTE: Normative references to International publications are listed in annex ZA (normative).

Annex ZA (normative)
Normative references to international publications with their relevant European publications

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies (including amendments).

Publication	Year	Title	EN	Year
ISO 4006	1991	Measurement of fluid flow in closed conduits - Vocabulary and symbols	EN 24006	1993
ISO 4185	1980	Measurement of liquid flow on closed conduits - Weighing method	EN 24185	1993

INTERNATIONAL STANDARD

ISO 8316

First edition
1987-10-01

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION
ORGANISATION INTERNATIONALE DE NORMALISATION
МЕЖДУНАРОДНАЯ ОРГАНИЗАЦИЯ ПО СТАНДАРТИЗАЦИИ

Measurement of liquid flow in closed conduits — Method by collection of the liquid in a volumetric tank

Mesure de débit des liquides dans les conduites fermées — Méthode par jaugeage d'un réservoir volumétrique

Reference number
ISO 8316 : 1987 (E)

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.

Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council. They are approved in accordance with ISO procedures requiring at least 75 % approval by the member bodies voting.

International Standard ISO 8316 was prepared by Technical Committee ISO/TC 30, *Measurement of fluid flow in closed conduits*.

Users should note that all International Standards undergo revision from time to time and that any reference made herein to any other International Standard implies its latest edition, unless otherwise stated.

Printed in Switzerland

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Measurement of liquid flow in closed conduits — Method by collection of the liquid in a volumetric tank

1 Scope and field of application

This International Standard specifies methods for the measurement of liquid flow in closed conduits by determining the volume of liquid collected in a volumetric tank in a known time interval. It deals in particular with the measuring apparatus, the procedure, the method for calculating the flow-rate and the assessment of uncertainties associated with the measurements.

The method described may be applied to any liquid provided that

a) its vapour pressure is sufficiently low to ensure that any escape of liquid by vaporization from the volumetric tank does not affect the required measurement accuracy;

b) its viscosity is sufficiently low so as not to alter or delay unduly the measurement of the level in the volumetric tank;

c) it is non-toxic and non-corrosive.

Theoretically, there is no limit to the application of this method, but, for practical reasons, this method of measurement is normally used for flow-rates less than approximately 1,5 m^3/s and is used on the whole in fixed laboratory installations only. However, there is a variation of this method which uses a natural or artificial storage pond as a volumetric tank, but this application is not dealt with in this International Standard.

Owing to its high potential accuracy, this method is often used as a primary method for calibrating other methods or devices for volume flow-rate measurement or for mass flow-rate measurement; for the latter method or device, it is necessary to know the density of the liquid accurately.

If the installation for flow-rate measurement by the volumetric method is used for purposes of legal metrology, it shall be certified and registered by the national metrology service. Such installations are then subject to periodic inspection at stated intervals. If a national metrology service does not exist, a certified record of the basic measurement standards (length, time and temperature), and error analysis in accordance with this International Standard and ISO 5168, shall also constitute certification for legal metrology purposes.

Annex A forms an integral part of this International Standard. Annexes B to E, however, are given for information only.

2 References

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

ISO 4185, *Measurement of liquid flow in closed conduits — Weighing method.*

ISO 4373, *Measurement of liquid flow in open channels — Water level measuring devices.*

ISO 5168, *Measurement of fluid flow — Estimation of uncertainty of a flow-rate measurement.*

3 Symbols and definitions

3.1 Symbols (see also ISO 4006)

Table 1

Symbol	Quantity	Dimensions	SI unit
e_R	Random uncertainty, in absolute terms	*	*
E_R	Random uncertainty, as a percentage	—	—
e_S	Systematic uncertainty, in absolute terms	*	*
E_S	Systematic uncertainty, as a percentage	—	—
q_m	Mass flow-rate	MT^{-1}	kg/s
q_V	Volume flow-rate	L^3T^{-1}	m^3/s
t	Filling time of the tank	T	s
V	Discharged or measured volume	L^3	m^3
z	Liquid level in the tank	L	m
ϱ	Density	ML^{-3}	kg/m^3

* The dimensions and units are those of the quantities in question.

3.2 Definitions

For the purposes of this International Standard, the definitions given in ISO 4006 apply. Only terms which are used with a particular meaning or the meaning of which might be usefully restated are defined below. The definitions of some of the terms concerned with error analysis are given in ISO 5168.

3.2.1 static gauging: A method by which the net volume of liquid collected is deduced from measurements of liquid levels (i.e. gaugings), made respectively before and after the liquid has been diverted for a measured time interval into the gauging tank, to determine the volume contained in the tank.

3.2.2 dynamic gauging: A method by which the net volume of liquid collected is deduced from gaugings made while liquid flow is being delivered into the gauging tank. (A diverter is not required with this method.)

3.2.3 diverter: A device which diverts the flow either to the gauging tank or to its by-pass without changing the flow-rate during the measurement interval.

3.2.4 flow stabilizer: A device inserted into the measuring system, ensuring a stable flow-rate in the conduit being supplied with liquid; for example, a constant level head tank, the level of liquid in which is controlled by a weir of adequate length.

4 Principle

4.1 Statement of the principle

4.1.1 Static gauging method

The principle of the flow-rate measurement method by volumetric static gauging (see figure 1 for a schematic diagram of a typical installation) is

— to determine the initial volume of liquid contained in the tank;

— to divert the flow into the volumetric tank, until it is considered to contain a sufficient quantity to attain the desired accuracy, by operation of a diverter which actuates a timer to measure the filling time;

— to determine the final volume of liquid contained in the tank. The volume contained at the initial and at the final times is obtained by reading the liquid levels in the tank and by reference to a preliminary calibration which gives the level-volume relationship.

The flow-rate is then derived from the volume of liquid collected and the filling time as explained in clause 7.

One variation of this method uses two tanks which are successively filled (see 6.3). A further variation, given in annex D, uses a valve instead of a diverter mechanism to start and stop the flow into a volumetric tank.

Care shall be taken when using a valve instead of a diverter that the flow-rate does not change when the valve is operated.

4.1.2 Dynamic gauging method

The principle of the flow-rate measurement method by volumetric dynamic gauging (see figure 2 for a schematic diagram of a typical installation) is

— to let liquid collect in the tank to a predetermined initial level (and thus volume), at which time the timer is started;

— to stop the timer when a second predetermined final level (and thus volume) is reached and then to drain the liquid collected.

The flow-rate is then derived as explained in clause 7.

4.1.3 Comparison of instantaneous and mean flow-rates

It should be emphasized that only the mean value of flow-rate for the filling period is given by the volumetric method. Instantaneous values of flow-rate as obtained on another instrument or meter in the flow circuit may be compared with the mean flow-rate only if the flow is kept stable during the measurement interval, by a flow-stabilizing device, or if the instantaneous values are properly time-averaged during the whole filling period.

4.2 Accuracy of the method

4.2.1 Overall uncertainty in the volumetric measurement

The volumetric method gives a measurement of flow-rate which, in principle, requires only level and time measurements. After the weighing method, the static gauging method in a volumetric tank may be considered as one of the most accurate of all flow-rate measuring methods, particularly if the precautions given in 4.2.2 are taken. For this reason, it is often used as a standard or calibration method. When the installation is carefully constructed, maintained and used, an uncertainty of ± 0,1 % to ± 0,2 % (with 95 % confidence limits) may be achieved.

4.2.2 Requirements for accurate measurements

The volumetric method gives an accurate measurement of flow-rate provided that

a) there is no leak in the flow circuit and there is no unmeasured leakage flow across the diverter;

b) the conduit is running full at the measuring section and there is no vapour or air-lock between the measuring section and the volumetric tank;