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Liquid flow measurement in open channels — Rotating element current-meters

Mesure de débit des liquides dans les canaux découverts — Moulinets à élément rotatif

Reference number
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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

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 2537 was prepared by Technical Committee ISO/TC 113, *Measurement of liquid flow in open channels.*

This third edition cancels and replaces the second edition (ISO 2537 : 1985), of which it constitutes a technical revision.

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.

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Liquid flow measurement in open channels — Rotating element current-meters

1 Scope and field of application

This International Standard specifies the operational requirements, construction, calibration, and maintenance of rotating element devices for the measurement of flow velocities in open channels. This International Standard does not define the form of the signal produced by the equipment or the signal receiving equipment.

For the use of these devices, refer to ISO 748.

2 References

ISO 748, *Liquid flow measurement in open channels — Velocity-area method.*

ISO 772, *Liquid flow measurement in open channels — Vocabulary and symbols.*

ISO 3454, *Liquid flow measurement in open channels — Direct depth sounding and suspension equipment.*

ISO 3455, *Liquid flow measurement in open channels — Calibration of rotating-element current-meters in straight open tanks.*

3 Definitions

For the purposes of this International Standard, the definitions given in ISO 772 apply.

4 Principle of operation

4.1 Proportionality

The rotating element of a current-meter is driven by the fluid at an angular velocity which is proportional to the local velocity of the fluid at the point of immersion when that velocity exceeds a critical value.

4.2 Positioning

The axis of the rotating element may be at right angles or it may be parallel to the direction of flow.

4.3 Types of current-meter

4.3.1 Cup-type current-meters

Cups or curved vanes attached at equal intervals around the perimeter of a hub comprise an assembly which will rotate when placed in a fluid flow. It is usual to mount the rotor with the axis vertical.

4.3.2 Propeller-type current-meters

An assembly consisting of a number of straight, angled vanes attached at equal intervals around the perimeter of a hub, or two or more helical screw blades formed around a hub that will rotate about a horizontal axis when placed in a fluid flow.

4.4 Flow velocity

The velocity of the fluid is determined by counting the number of revolutions of the rotor during a specified time interval or by observing the time required by the rotor to turn a given number of revolutions and consulting the meter calibration table or rating equation. The velocity of fluid movement may be determined from the sensing of signals emitted (such as electrical pulses) through the rotation of the rotor. The velocity may be determined from a direct reading of the speed of rotation of the rotating element by means of equipment designed for this purpose.

5 Operational requirements

5.1 Positioning

The equipment should maintain alignment with the flow in such a way that the rotating element responds to flow movement as intended. If a pivoted suspension is incorporated within the current-meter, it should permit freedom in the vertical plane to ensure correct alignment with the liquid flow. Alignment in the horizontal plane may be affected by the correct choice of suspension equipment (see ISO 3454).

Current-meters of conventional construction are intended to operate in a horizontal or near-horizontal position. Current-meters designed to operate in other positions are not covered by this International Standard.

5.2 Resistance to flow

The current-meter shall offer minimum resistance to the force of the flow.

5.3 Relationship of rotor movement and stream velocity

The rotating element of the current-meter shall be such that, when driven by the fluid, it rotates at an angular velocity which has a known relation to the velocity of the flow within the calibrated velocity range stated by the manufacturer or rating laboratory.

The meter shall respond rapidly and consistently to changes in velocity; the manufacturer shall state the expected response rates.

5.4 Limits of use

5.4.1 Various liquids

The current-meter shall be used only in liquids with properties similar to those in which the meter was calibrated. If the liquid properties are significantly different, the meter shall be recalibrated in a liquid with properties similar to that in which the meter is to be used.

Unless otherwise indicated, the current-meter shall be capable of being used in waters containing suspended sediment and in saline waters.

5.4.2 Cup-type current-meters

Vertical components of velocity may cause rotation of a hollow-cup-type current-meter. When there is considerable turbulence in a stream or where there are otherwise significant vertical components of velocity, hollow-cup-type meters may over-register. Usually the over-registration will be small unless large vertical components of velocity relative to the horizontal components are encountered.

6 Construction features

6.1 General

6.1.1 Cup-type current-meters

A cup-type current-meter shall generally consist of

a) a rotor revolving about a vertical shaft;

b) a hub assembly;

c) bearings;

d) a main frame or yoke;

e) a chamber containing the signal generation mechanism;

f) tail fins;

g) a means of attaching the instrument to the suspension equipment.

6.1.2 Propeller-type current-meters

A propeller-type current-meter shall consist of

a) a rotor that is either a propeller revolving about a fixed axis or a revolving set composed of the propeller and axis;

b) two bearings;

c) a device giving a signal indicating movement of the rotor;

d) a streamlined body;

e) a means of attaching the instrument to the suspension equipment.

A means of providing directional control to the meter in the current will generally be provided. This may be either a part of the suspension equipment or an integral part of the meter.

6.2 Rotor

6.2.1 Cup-type current-meters

The rotor will generally be constructed of six hollow or solid conical cups, fixed in the same horizontal plane at equally spaced intervals (equal angles) to a frame mounted on a vertical shaft. This assembly shall be retained in the yoke by means of the upper shaft bearing and a lower pointed bearing consisting of a central pivot and a bearing cup.

6.2.2 Propeller-type current-meters

The current-meter may be provided with a single propeller or with several interchangeable propellers each having a different pitch and/or diameter. Each propeller shall consist of two or more vanes or helical screw blades that generally rotate about a horizontal axis. The propellers should be made from a material which will not allow them to be easily distorted.

6.3 Bearings

The resisting torque of the bearings shall be as small as possible and shall be constant during use. Bearings shall be lubricated as stated by the manufacturer. Provision shall be made to ensure that silt and water do not enter the bearings except as required for water-lubricated bearings.

6.4 Means of counting rotor revolutions

6.4.1 Signals

The revolutions of the rotor shall, by means of mechanical contacts or by means of magnetic, optical or other devices, generate a clear and positive signal at all velocities within the effective range of the meter. If electrical connections are used, they should be appropriately waterproofed.

Manufacturers should stipulate the maximum conductivity of water in which the meter can be used.