ASME MFC-16–2014
(Revision of ASME MFC-16–2007)

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Measurement of Liquid Flow in Closed Conduits With Electromagnetic Flowmeters

AN AMERICAN NATIONAL STANDARD

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Two Park Avenue • New York, NY • 10016 USA

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The American Society of Mechanical Engineers
Two Park Avenue, New York, NY 10016-5990

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FOREWORD

This Standard was prepared by Subcommittee 16 of the ASME Committee on the Measurement of Liquid Flow in Closed Conduits. The chair of the subcommittee is indebted to the many individuals who contributed to this document.

Electromagnetic flowmeters were introduced to the process industries in the mid 1950s. They quickly became accepted flowmeters for difficult applications. Subsequent improvements in technology and reductions in cost have transformed these flowmeters into one of the leading contenders for general use in water-based and other electrically conducting liquid applications.

Due to differences in design of the various electromagnetic flowmeters in the marketplace, this Standard cannot address detailed performance limitations in specific applications. It covers issues that are common to all meters, including application considerations.

The flow industry has been changing from the use of the names "primary" and "secondary" to "sensor" and "transmitter." Previous editions of ASME MFC-16 did use primary and secondary in their figures and text. This new edition uses the sensor and transmitter terminology.

Suggestions for improvement of this Standard will be welcomed. They should be sent to The American Society of Mechanical Engineers; Attn: Secretary, MFC Standards Committee; Two Park Avenue; New York, NY 10016-5990.

This revision was approved an an American National Standard on January 28, 2014.

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Measurement of Fluid Flow in Closed Conduits

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Secretary, MFC Standards Committee
The American Society of Mechanical Engineers
Two Park Avenue
New York, NY 10016-5990
http://go.asme.org/Inquiry

Proposing Revisions. Revisions are made periodically to the Standard to incorporate changes that appear necessary or desirable, as demonstrated by the experience gained from the application of the Standard. Approved revisions will be published periodically.

The Committee welcomes proposals for revisions to this Standard. Such proposals should be as specific as possible, citing the paragraph number(s), the proposed wording, and a detailed description of the reasons for the proposal, including any pertinent documentation.

Proposing a Case. Cases may be issued for the purpose of providing alternative rules when justified, to permit early implementation of an approved revision when the need is urgent, or to provide rules not covered by existing provisions. Cases are effective immediately upon ASME approval and shall be posted on the ASME Committee Web page.

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Interpretations. Upon request, the MFC Committee will render an interpretation of any requirement of the Standard. Interpretations can only be rendered in response to a written request sent to the Secretary of the MFC Standards Committee at go.asme.org/Inquiry.

The request for interpretation should be clear and unambiguous. It is further recommended that the inquirer submit his/her request in the following format:

Subject:	Cite the applicable paragraph number(s) and the topic of the inquiry.
Edition:	Cite the applicable edition of the Standard for which the interpretation is being requested.
Question:	Phrase the question as a request for an interpretation of a specific requirement suitable for general understanding and use, not as a request for an approval of a proprietary design or situation. The inquirer may also include any plans or drawings that are necessary to explain the question; however, they should not contain proprietary names or information.

Requests that are not in this format may be rewritten in the appropriate format by the Committee prior to being answered, which may inadvertently change the intent of the original request.

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MEASUREMENT OF LIQUID FLOW IN CLOSED CONDUITS WITH ELECTROMAGNETIC FLOWMETERS

1 SCOPE

This Standard is applicable to industrial electromagnetic flowmeters and their application in the measurement of liquid flow. The electromagnetic flowmeters covered by this Standard utilize an alternating electrical current (AC) or pulsed direct-current (pulsed-DC) to generate a magnetic field in electrically conductive and electrically homogeneous liquids or slurries flowing in a completely filled, closed conduit.

This Standard does not cover the following:

- insertion-type electromagnetic flowmeters
- electromagnetic flowmeters used in surgical, therapeutic, or other health and medical applications
- applications of industrial flowmeters involving nonconductive liquids
- highly conductive liquids (e.g., liquid metals)

2 REFERENCES

The following document forms a part of this Standard to the extent specified herein. The latest edition shall apply.

ISO 13359, Measurement of conductive liquid flow in closed conduits — Flanged electromagnetic flowmeters — Overall length

Publisher: International Organization for Standardization (ISO) Central Secretariat, 1, ch. de la Voie-Creuse, Case postale 56, CH-1211, Genève 20, Switzerland/Suisse

3 DEFINITIONS AND SYMBOLS

3.1 Definitions

accuracy of measurement: closeness of the agreement between the result of a measurement and a true value of the measurand.

NOTE: Accuracy is a qualitative concept; for the quantitative concept, see *uncertainty*.

calibration: the experimental determination of the relationship between the quantity being measured and the device that measures it, usually by comparison with a standard, then (typically) correcting the output of that device to bring it to the desired value, within a specified tolerance, for a particular value of the input.

flowmeter sensor: includes the flow tube, process connections, electromagnetic coils, and electrodes. Flowmeter sensor is also known by other names, e.g., flowmeter sensor device, sensor device, and sensor.

flowmeter transmitter: includes the electronic transmitter, measurement of the emf_v, and, in most cases, the power for the electromagnet coils of the flowmeter sensor.

meter factor: the number determined by liquid calibration that enables the output flow signal to be related to the volumetric flow rate under defined reference conditions; often expressed as the reciprocal of mean *K*-factor.

uncertainty (of measurement): parameter, associated with the result of a measurement, that characterizes the dispersion of the values that could reasonably be attributed to the measurand.

verification: provision of objective evidence that a given item fulfills requirements.

EXAMPLE: Use of independent flow calibration to confirm that performance properties and/or legal requirements of a measuring system are met.

3.2 Symbols

See Table 3.2-1.

4 THEORY AND MEASUREMENT TECHNIQUE

Industrial electromagnetic flowmeters are composed of the following basic components (see Fig. 4-1):

(a) a nonmagnetic tube with a nonconductive inner surface

(b) a magnetic field passing through the tube and perpendicular to the axis of the tube at the center of the flow tube

(c) a minimum of two electrodes on opposite sides of the tube in a cross-sectional plane passing through the center of the flow tube, the straight line between these two electrodes being perpendicular to the magnetic field at the center of the flow tube

4.1 Flow-Related Electromotive Force

Faraday's law of induction applied to this physical configuration predicts the generation of an electromotive force (a voltage) between the electrodes when a