

This is a preview of "ISO 10790:2015". [Click here to purchase the full version from the ANSI store.](#)

Third edition  
2015-04-01

---

---

## **Measurement of fluid flow in closed conduits — Guidance to the selection, installation and use of Coriolis flowmeters (mass flow, density and volume flow measurements)**

*Mesure de débit des fluides dans les conduites fermées — Lignes directrices pour la sélection, l'installation et l'utilisation des mesureurs à effet Coriolis (mesurages de débit-masse, masse volumique et débit-volume)*



Reference number  
ISO 10790:2015(E)

© ISO 2015

This is a preview of "ISO 10790:2015". [Click here to purchase the full version from the ANSI store.](#)



**COPYRIGHT PROTECTED DOCUMENT**

© ISO 2015

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized otherwise in any form or by any means, electronic or mechanical, including photocopying, or posting on the internet or an intranet, without prior written permission. Permission can be requested from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office  
Case postale 56 • CH-1211 Geneva 20  
Tel. + 41 22 749 01 11  
Fax + 41 22 749 09 47  
E-mail [copyright@iso.org](mailto:copyright@iso.org)  
Web [www.iso.org](http://www.iso.org)

Published in Switzerland

This is a preview of "ISO 10790:2015". [Click here to purchase the full version from the ANSI store.](#)

## Contents

	Page
<b>Foreword</b> .....	<b>v</b>
<b>Introduction</b> .....	<b>vi</b>
<b>1 Scope</b> .....	<b>1</b>
<b>2 Normative references</b> .....	<b>1</b>
<b>3 Terms and definitions</b> .....	<b>1</b>
3.1 Definitions specific to this Coriolis flowmeter standard.....	1
3.2 Definitions from VIM, ISO/IEC Guide 99 (JCGM:2012).....	3
3.3 Symbols.....	4
3.4 Abbreviations.....	5
<b>4 Coriolis flowmeter selection criteria</b> .....	<b>5</b>
4.1 General.....	5
4.2 Physical installation.....	5
4.2.1 General.....	5
4.2.2 Installation criteria.....	6
4.2.3 Full-pipe requirement for liquids.....	6
4.2.4 Orientation.....	6
4.2.5 Flow conditions and straight length requirements.....	6
4.2.6 Valves.....	6
4.2.7 Cleaning.....	6
4.2.8 Hydraulic and mechanical vibrations.....	7
4.2.9 Pipe stress and torsion.....	7
4.2.10 Crosstalk between sensors.....	7
4.3 Effects due to process conditions and fluid properties.....	7
4.3.1 General.....	7
4.3.2 Application and fluid properties.....	7
4.3.3 Multiphase flow.....	8
4.3.4 Influence of process fluid.....	8
4.3.5 Temperature effects.....	8
4.3.6 Pressure effects.....	9
4.3.7 Pulsating flow effects.....	9
4.3.8 Viscosity effects.....	9
4.3.9 Flashing and/or cavitation.....	9
4.4 Pressure loss.....	9
4.5 Safety.....	9
4.5.1 General.....	9
4.5.2 Hydrostatic pressure test.....	9
4.5.3 Mechanical stress.....	10
4.5.4 Erosion.....	10
4.5.5 Corrosion.....	10
4.5.6 Housing design.....	10
4.5.7 Cleaning.....	10
4.6 Transmitter (secondary device).....	10
4.7 Diagnostics.....	11
<b>5 Inspection and compliance</b> .....	<b>11</b>
<b>6 Mass flow measurement</b> .....	<b>12</b>
6.1 Apparatus.....	12
6.1.1 Principle of operation.....	12
6.1.2 Coriolis sensor.....	14
6.1.3 Coriolis transmitter.....	15
6.2 Mass flow measurement.....	15
6.3 Factors affecting mass flow measurement.....	17
6.3.1 Density and viscosity.....	17

6.3.2	Multiphase flow .....	17
6.3.3	Temperature .....	18
6.3.4	Pressure .....	18
6.3.5	Installation .....	18
6.4	Zero adjustment .....	18
6.5	Calibration of mass flow measurement .....	18
<b>7</b>	<b>Density measurement .....</b>	<b>19</b>
7.1	General .....	19
7.2	Principle of operation .....	20
7.3	Specific gravity of fluids .....	21
7.4	Density measurement uncertainty .....	21
7.5	Factors affecting density measurement .....	21
7.5.1	Temperature .....	21
7.5.2	Pressure .....	22
7.5.3	Multiphase (Two phase) .....	22
7.5.4	Flow effect .....	22
7.5.5	Corrosion and erosion .....	22
7.5.6	Coatings .....	22
7.5.7	Installation .....	22
7.6	Density calibration and adjustment .....	22
7.6.1	General .....	22
7.6.2	Manufacturer's density calibration .....	22
7.6.3	Field density calibration and adjustment .....	23
<b>8</b>	<b>Volume flow measurement at metering conditions .....</b>	<b>23</b>
8.1	General .....	23
8.2	Volume calculation .....	23
8.3	Gas as a process fluid .....	24
8.4	Volume measurement uncertainty .....	24
8.5	Special influences .....	24
8.5.1	General .....	24
8.5.2	Empty pipe effect .....	24
8.5.3	Multiphase fluids .....	24
8.6	Factory calibration .....	24
8.6.1	Mass flow and density .....	24
8.7	Volume check .....	25
<b>Annex A (informative) Calibration techniques .....</b>		<b>26</b>
<b>Annex B (informative) Safety guidelines for the selection of Coriolis flowmeters .....</b>		<b>29</b>
<b>Annex C (informative) Considerations for multi-component liquid systems .....</b>		<b>31</b>
<b>Annex D (informative) Miscible liquids containing chemically non-interacting components .....</b>		<b>34</b>
<b>Bibliography .....</b>		<b>37</b>

This is a preview of "ISO 10790:2015". [Click here to purchase the full version from the ANSI store.](#)

## 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](http://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](http://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 meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT), see the following URL: [Foreword — Supplementary information](#).

The committee responsible for this document is ISO/TC 30, *Measurement of fluid flow in closed conduits*, Subcommittee SC 5, *Velocity and mass methods*.

This third edition cancels and replaces the second edition (ISO 10790:1999), which has been technically revised. It also incorporates the Amendment ISO 10790:1999/Amd 1:2003.

## Introduction

This International Standard has been prepared as a guide for those concerned with the selection, testing, inspection, operation, and calibration of Coriolis flowmeters (Coriolis flowmeter assemblies). A list of related International Standards is in the Bibliography.

This International Standard provides the following:

- a) description of the Coriolis operating principle;
- b) guideline to expected performance characteristics of Coriolis flowmeters;
- c) description of calibration, verification, and checking procedures;
- d) description of potential error sources;
- e) common set of terminology, symbols, definitions, and specifications.

The next paragraphs contain an explanation of when to use the measurement terminology, uncertainty, and accuracy.

The VIM definition (see [3.2](#)) of accuracy: closeness of agreement between a measured quantity value and a “true quantity value” of a measurand. Per the VIM, accuracy is a quality and should not be given a numerical value.

To understand the preceding paragraph, one needs to understand that a “true quantity value” does not exist. The best that can be done is to determine the measured quantity value with measurement instrumentation calibrated with a very good but imperfect reference. Therefore, the measurement is an estimate. Uncertainty is used to define these measurement estimates (see [3.2.2](#)).

Many Coriolis manufacturers use accuracy and zero stability as part of their published performance specifications. The manufacturer’s accuracy specification includes repeatability, hysteresis, and linearity but can also include other items that might be different for each manufacturer.

This International Standard will use uncertainty to quantify the results of a flow measurement system. This International Standard will only use accuracy when it is very clear that it is referring to or using all or part of the manufacturers published specifications.