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**Refrigerated hydrocarbon  
fluids — Dynamic measurement —  
Requirements and guidelines for  
the calibration and installation of  
flowmeters used for liquefied natural  
gas (LNG) and other refrigerated  
hydrocarbon fluids**

*Hydrocarbures liquides réfrigérés — Mesurage dynamique —  
Exigences et lignes directrices pour l'étalonnage et l'installation  
de débitmètres utilisés pour le gaz naturel liquéfié (GNL) et autres  
hydrocarbures liquides réfrigérés*



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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](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 of 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 [www.iso.org/iso/foreword.html](http://www.iso.org/iso/foreword.html).

This document was prepared by Technical Committee ISO/TC 28, *Petroleum and related products, fuels and lubricants from natural or synthetic sources*.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at [www.iso.org/members.html](http://www.iso.org/members.html).

## Introduction

Reliable, accurate and commonly agreed measurement methods are a first requirement for the trade of goods. In the LNG distribution chain, there is a commonly agreed measurement practice, as described in various International Standards and in the GIIGNL *Custody transfer handbook*<sup>[10]</sup>. The LNG industry is committed to improve measurement accuracy to reduce financial risks and to optimize mass and energy balances throughout the LNG measurement chain. Dynamic measurement technologies have the potential to reduce measurement uncertainty. As an extension of the traditional distribution chain for LNG, a new market of professional consumers for LNG is developing related to transport fuel and metrological infrastructure. In this respect, the availability of the following tools for dynamic flow measurement is essential:

- primary standards for the determination of the amount of an LNG substance and calibration of working standards;
- LNG test and calibration facilities (for volume and mass flow) for the calibration of equipment for custody transfer, allocation or process control under operational conditions;
- stable meters for the determination of volume and mass flow under cryogenic conditions;
- guidelines for the selection and installation of cryogenic flowmeters;
- guidelines for zeroing and adjusting cryogenic flowmeters, including tips and traps;
- guidelines for the further dissemination of traceability by (master meter) calibration techniques, including correction methods for parasitic metrological effects;
- guidelines for the calibration of volume and mass flowmeters with alternative fluids such as water.

This document provides designers of metering stations and end-users with a set of valuable guidelines to enable a better performance of liquid flowmeters under cryogenic operating conditions. The document focuses on LNG as a medium, however, it is assumed that much of the information is also directly applicable to other cryogenic fluids.

# Refrigerated hydrocarbon fluids — Dynamic measurement — Requirements and guidelines for the calibration and installation of flowmeters used for liquefied natural gas (LNG) and other refrigerated hydrocarbon fluids

## 1 Scope

This document specifies the metrological and technical requirements for flowmeters intended to be used for the dynamic measurement of liquefied natural gas (LNG) and other refrigerated hydrocarbon fluids. For LNG static volume measurement used in custody transfer, see ISO 10976.

This document sets the best practice for the proper selection and installation of flowmeters in cryogenic applications and identifies the specific issues that can affect the performance of the flowmeter in use.

Moreover, it offers a calibration guideline for laboratory and on-site conditions (mass or volume) by either using LNG or other reference fluids. The choice of calibration fluid will depend on the capabilities of the available flow calibration facilities and the ability to achieve the required overall measurement uncertainty demanded by the intended application.

This document is applicable, but is not limited, to the use of Coriolis and ultrasonic flowmeters for dynamic measurements of LNG.

In principle, LNG and other refrigerated liquid hydrocarbons are considered in this document. Recommendations in this document are based on the available test results with LNG. These results are probably applicable to other cryogenic fluids.

## 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 10790, *Measurement of fluid flow in closed conduits — Guidance to the selection, installation and use of Coriolis flowmeters (mass flow, density and volume flow measurements)*

ISO 12242, *Measurement of fluid flow in closed conduits — Ultrasonic transit-time meters for liquid*

## 3 Terms, definitions and abbreviated terms

### 3.1 Terms and definitions

For the purposes of this document, the following terms and definitions 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/>