



**NSAI**  
Standards

Irish Standard  
I.S. EN ISO 16960:2014

Natural gas - Determination of sulfur compounds - Determination of total sulfur by oxidative microcoulometry method (ISO 16960:2014)

## I.S. EN ISO 16960:2014

*Incorporating amendments/corrigenda/National Annexes issued since publication:*

The National Standards Authority of Ireland (NSAI) produces the following categories of formal documents:

I.S. xxx: Irish Standard — national specification based on the consensus of an expert panel and subject to public consultation.

S.R. xxx: Standard Recommendation — recommendation based on the consensus of an expert panel and subject to public consultation.

SWiFT xxx: A rapidly developed recommendatory document based on the consensus of the participants of an NSAI workshop.

*This document replaces/revises/consolidates the NSAI adoption of the document(s) indicated on the CEN/CENELEC cover/Foreword and the following National document(s):*

*NOTE: The date of any NSAI previous adoption may not match the date of its original CEN/CENELEC document.*

*This document is based on:*

EN ISO 16960:2014

*Published:*

2014-10-15

*This document was published under the authority of the NSAI and comes into effect on:*

2014-11-01

ICS number:

75.060

NOTE: If blank see CEN/CENELEC cover page

NSAI  
1 Swift Square,  
Northwood, Santry  
Dublin 9

T +353 1 807 3800  
F +353 1 807 3838  
E standards@nsai.ie  
W NSAI.ie

Sales:  
T +353 1 857 6730  
F +353 1 857 6729  
W standards.ie

Údarás um Chaighdeáin Náisiúnta na hÉireann

EUROPEAN STANDARD

EN ISO 16960

NORME EUROPÉENNE

EUROPÄISCHE NORM

October 2014

ICS 75.060

English Version

Natural gas - Determination of sulfur compounds - Determination  
of total sulfur by oxidative microcoulometry method (ISO  
16960:2014)

Gaz naturel - Détermination des composés soufrés -  
Détermination de la teneur totale en soufre par  
microcoulométrie oxydante (ISO 16960:2014)

Erdgas - Bestimmung von Schwefelverbindungen -  
Bestimmung des Schwefelgehalts mittels oxidativem  
mikrocoulometrischen Verfahren (ISO 16960:2014)

This European Standard was approved by CEN on 24 August 2014.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and United Kingdom.



EUROPEAN COMMITTEE FOR STANDARDIZATION  
COMITÉ EUROPÉEN DE NORMALISATION  
EUROPÄISCHES KOMITEE FÜR NORMUNG

CEN-CENELEC Management Centre: Avenue Marnix 17, B-1000 Brussels

**Contents**

Page

**Foreword.....3**

## **Foreword**

This document (EN ISO 16960:2014) has been prepared by Technical Committee ISO/TC 193 "Natural gas".

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 April 2015, and conflicting national standards shall be withdrawn at the latest by April 2015.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

According to the CEN-CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

### **Endorsement notice**

The text of ISO 16960:2014 has been approved by CEN as EN ISO 16960:2014 without any modification.

This page is intentionally left blank

**INTERNATIONAL  
STANDARD**

**ISO  
16960**

First edition  
2014-10-01

---

---

**Natural gas — Determination of sulfur  
compounds — Determination of total  
sulfur by oxidative microcoulometry  
method**

*Gaz naturel — Détermination des composés soufrés — Détermination  
de la teneur totale en soufre par microcoulométrie oxydante*



Reference number  
ISO 16960:2014(E)

© ISO 2014

**ISO 16960:2014(E)**



**COPYRIGHT PROTECTED DOCUMENT**

© ISO 2014

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



# Contents

	Page
<b>Foreword</b> .....	<b>iv</b>
<b>Introduction</b> .....	<b>v</b>
<b>1 Scope</b> .....	<b>1</b>
<b>2 Normative references</b> .....	<b>1</b>
<b>3 Test principle</b> .....	<b>1</b>
<b>4 Reagents</b> .....	<b>1</b>
<b>5 Apparatus</b> .....	<b>2</b>
5.1 Converter .....	2
5.2 Titration cell .....	2
5.3 Microcoulometer .....	2
5.4 Flow controller .....	2
5.5 Electromagnetic agitator .....	2
5.6 Medical syringe .....	2
5.7 Volumetric flask .....	2
<b>6 Test preparation</b> .....	<b>2</b>
6.1 Preparation of electrolyte .....	2
6.2 Reference sample .....	2
6.3 Apparatus installation .....	3
6.4 Preparation of instrument .....	3
6.5 Check and adjustment of the instrument .....	3
6.6 Determination of recovery factor of sulfur .....	3
<b>7 Test procedure</b> .....	<b>4</b>
7.1 Sampling .....	4
7.2 Sample injection and measurement .....	4
<b>8 Calculation</b> .....	<b>4</b>
8.1 Volume conversion .....	4
8.2 Calculation of total sulfur mass concentration in the gas sample .....	5
<b>9 Precision</b> .....	<b>6</b>
9.1 General .....	6
9.2 Repeatability .....	6
<b>Bibliography</b> .....	<b>7</b>

## ISO 16960:2014(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. 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 193, *Natural gas*, Subcommittee SC 1, *Analysis of natural gas*.

## **Introduction**

Three methods for determination of sulfur compounds in natural gas already exist as International Standards:

- ISO 6326-3, Natural gas — Determination of sulfur compounds — Part 3: Determination of hydrogen sulfide, mercaptan sulfur and carbonyl sulfide sulfur by potentiometry;
- ISO 6326-5, Natural gas — Determination of sulfur compounds — Part 5: Lingener combustion method;
- ISO 19739, Natural gas — Determination of sulfur compounds using gas chromatography.



# Natural gas — Determination of sulfur compounds — Determination of total sulfur by oxidative microcoulometry method

**WARNING** — The use of this International Standard can involve hazardous material, operations, and equipment. This International Standard does not purport to address all of the safety problems associated with its use. It is the responsibility of the user of this International Standard to establish appropriate safety and health practices and to determine the applicability of regulatory limitations prior to use.

## 1 Scope

This International Standard specifies a method for the determination of total sulfur in the range from 1 mg/m<sup>3</sup> to 200 mg/m<sup>3</sup> in pipeline natural gas by oxidative microcoulometry. Natural gas with sulfur contents above 200 mg/m<sup>3</sup> can be analysed after dilution with a suitable sulfur-free solvent.

## 2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 3696, *Water for analytical laboratory use — Specification and test methods*

ISO 6142, *Gas analysis — Preparation of calibration gas mixtures — Gravimetric method*

ISO 6144, *Gas analysis — Preparation of calibration gas mixtures — Static volumetric method*

ISO 6146, *Gas analysis — Preparation of calibration gas mixtures — Manometric method*

ISO 10715, *Natural gas — Sampling guidelines*

## 3 Test principle

A gas sample containing sulfur is mixed with oxygen in a quartz furnace tube in order to convert the sulfur compounds to sulfur dioxide by oxidative pyrolysis. The obtained sulfur dioxide enters the titration cell along with carrier gas and reacts with iodine contained therein. The consumed iodine is complemented by the electrolysis of potassium iodide. In accordance with Faraday's law of electrolysis, the sulfur concentration in the gas sample can be calculated from the consumed electric quantity by electrolysis and corrected by comparison to a reference standard sample.

## 4 Reagents

**4.1 Test water**, conforming to the requirements of Grade 3 of ISO 3696,

**4.2 Glacial acetic acid**, analytical purity.

**4.3 Potassium iodide**, analytical purity.

**4.4 Oxygen**, minimum purity 99,99 % (by volume fraction), maximum volume fraction of sulfur containing gases 0,01 % (by volume fraction).

This is a free preview. Purchase the entire publication at the link below:

[Product Page](#)

- 
- [Looking for additional Standards? Visit Intertek Inform Infostore](#)
  - [Learn about LexConnect, All Jurisdictions, Standards referenced in Australian legislation](#)
-