AS/NZS 60079.29.3:2016
IEC 60079-29-3, Ed. 1.0 (2014)

AS/NZS 60079.29.3:2016

Australian/New Zealand Standard™

Explosive atmospheres

Part 29.3: Gas detectors—Guidance on functional safety of fixed gas detection systems

This Joint Australian/New Zealand Standard was prepared by Joint Technical Committee EL-014, Equipment for Explosive Atmospheres. It was approved on behalf of the Council of Standards Australia on 15 July 2016 and by the New Zealand Standards Approval Board on 17 August 2016.
This Standard was published on 30 September 2016.

The following are represented on Committee EL-014:

Auckland Regional Chamber of Commerce
Australian Chamber of Commerce and Industry
Australian Industry Group
Australian Institute of Petroleum
Australian Pipeline Industry Association
Aviation and Marine Engineers Association
Bureau of Steel Manufacturers of Australia
Department of Natural Resources and Mines, Qld
Department of Trade and Investment, NSW
Electrical Compliance Testing Association
Electrical Contractors Association of New Zealand
Electrical Regulatory Authorities Council
Engineers Australia
Institute of Electrical Inspectors
Institute of Instrumentation, Control and Automation Australia
Institution of Professional Engineers New Zealand
Mining Electrical and Mining Mechanical Engineering Society
Ministry of Business, Innovation and Employment, New Zealand
University of Newcastle
WorkCover New South Wales

Keeping Standards up-to-date

Standards are living documents which reflect progress in science, technology and systems. To maintain their currency, all Standards are periodically reviewed, and new editions are published. Between editions, amendments may be issued. Standards may also be withdrawn. It is important that readers assure themselves they are using a current Standard, which should include any amendments which may have been published since the Standard was purchased.

Detailed information about joint Australian/New Zealand Standards can be found by visiting the Standards Web Shop at www.saiglobal.com or Standards New Zealand web site at www.standards.govt.nz and looking up the relevant Standard in the on-line catalogue.

For more frequent listings or notification of revisions, amendments and withdrawals, Standards Australia and Standards New Zealand offer a number of update options. For information about these services, users should contact their respective national Standards organization.

We also welcome suggestions for improvement in our Standards, and especially encourage readers to notify us immediately of any apparent inaccuracies or ambiguities. Please address your comments to the Chief Executive of Standards Australia or the New Zealand Standards Executive at the address shown on the back cover.

This Standard was issued in draft form for comment as DR AS/NZS 60079.29.3:2015.

Australian/New Zealand Standard™

Explosive atmospheres

Part 29.3: Gas detectors—Guidance on functional safety of fixed gas detection systems

First published as AS/NZS 60079.29.3:2016.

Jointly published by SAI Global Limited under licence from Standards Australia Limited, GPO Box 476, Sydney, NSW 2001 and by Standards New Zealand, PO Box 1473, Wellington 6011.

ISBN 978 1 76035 564 7

PREFACE

This Standard was prepared by the Joint Standards Australia/Standards New Zealand Committee EL-014, Equipment for Explosive Atmospheres.

The objective of this Standard is to provide guidance on the design and implementation of fixed gas detection systems when used in safety-related applications. The status of this Standard as guide only is reinforced since the ultimate reliability of a gas detection system to perform an intended safety function may depend on a number of factors that are beyond the scope of this Standard.

This Standard is identical with, and has been reproduced from, IEC 60079-29-3, Ed. 1.0 (2014), *Explosive atmospheres*, Part 29-3: *Gas detectors—Guidance on functional safety of fixed gas detection systems*.

As this Standard is reproduced from an International Standard, the following applies:

(a) In the source text 'this International Standard' should read 'this Australian/New Zealand Standard'.

(b) A full point substitutes for a comma when referring to a decimal marker.

References to International Standards should be replaced by references to Australian or Australian/New Zealand Standards, as follows:

Reference to International Standard		*Australian/New Zealand Standard*	
IEC		AS/NZS	
60079	Explosive atmospheres	60079	Explosive atmospheres
60079-29-1	Part 29-1: Gas detectors—Performance requirements of detectors for flammable gases	60079.29.1	Part 29.1: Gas detectors—Performance requirements of detectors for flammable gases
60079-29-2	Part 29-2: Gas detectors—Selection, installation, use and maintenance of detectors for flammable gases and oxygen	60079.29.2	Part 29.2: Gas detectors—Selection, installation, use and maintenance of detectors for flammable gases and oxygen
60079-29-4	Part 29-4: Gas detectors—Performance requirements of open path detectors for flammable gases	60079.29.4	Part 29.4: Gas detectors—Performance requirements of open path detectors for flammable gases
		AS	
61508	Functional safety of electrical/electronic/programmable electronic safety-related systems (series)	61508	Functional safety of electrical/electronic/programmable electronic safety-related systems (series)
61508-1	Part 1: General requirements	61508.1	Part 1: General requirements
61508-2	Part 2: Requirements for electrical/electronic/programmable electronic safety-related systems	61508.2	Part 2: Requirements for electrical/electronic/programmable electronic safety-related systems
61508-3	Part 3: Software requirements	61508.3	Part 3: Software requirements

This Standard is to be used in conjunction with the following Standards:

(i) AS/NZS 60079.0, *Explosive atmospheres*, Part 0: *Equipment—General requirements*.

(ii) AS/NZS 60079.29.1, *Explosive atmospheres*, Part 29.1: *Gas detectors—Performance requirements of detectors for flammable gases*.

(iii) AS/NZS 60079.29.2, *Explosive atmospheres*, Part 29.2: *Gas detectors—Selection, installation, use and maintenance of detectors for flammable gases and oxygen*.

(iv) AS/NZS 60079.29.4, *Explosive atmospheres*, Part 29.4: *Gas detectors—Performance requirements of open path detectors for flammable gases*.

The term ‘informative’ has been used in this Standard to define the application of the annex to which it applies. An ‘informative’ annex is only for information and guidance.

CONTENTS

Page

Page

INTRODUCTION

Fixed gas detection systems have been used for many years to perform safety instrumented functions. Like any instrumented system, a fixed gas detection system commonly comprises of a single or multiple gas detector input(s), a control unit and a single or multiple final element(s) or output(s). Additional peripheral equipment may be incorporated into a fixed gas detection system e.g. a gas sampling system or a gas conditioning system. If a fixed gas detection system, including any relevant peripheral equipment is to be effectively used for safety instrumented functions, it is essential that the total system achieves certain minimum standards and performance levels.

It is important to understand that the number of sensing points and their appropriate location, their redundancy, the management of regular maintenance, specifically response checking or calibration, and other gas detection specific features (such as design of gas sampling systems) are all likely to have a far greater effect on the integrity of the overall Safety Instrumented System (SIS) than the required Safety Integrity Level (SIL) or SIL-capability of any of the individual functional units. This, however, does not exclude the requirement for each Safety Instrumented Function (SIF) to have a stand-alone functional integrity.

This international standard addresses the minimum standards and performance levels of a fixed gas detection system which is based on the use of electrical, electronic or programmable electronic systems (E/E/PES) for any application where there is either a risk reduction target stated or if the gas detection system is used as an additional safe guarding system.

This international standard does not apply to portable gas detectors or fixed gas detection systems when there is no risk reduction target stated. However, this standard could be used as a best practice document for such devices or systems.

The expression ‘gas detection system’ within this international standard is generic and applies to standalone fixed gas detectors, which might have their own internal alarm trip levels and switching outputs up to complex standalone fixed gas detection systems (Annex A – Typical Applications).

This international standard takes into consideration the possible complexity of the supply chain which a gas detection manufacturer, seller or system integrator might encounter which includes, but is not limited to:

- the use of standalone gas detectors which are integrated into an overall safety system by a gas detection equipment manufacturer, seller or system integrator (or equivalent)
- the design and use of fixed gas detection sub-systems, including any associated and/or peripheral gas detection equipment which are integrated into an overall safety system by a gas detection equipment manufacturer, seller or system integrator (or equivalent)
- the design and use of a complete fixed gas detection system, including associated and/or peripheral gas detection equipment which is the overall safety system

NOTE 1 IEC 61508 Parts 1, 2 and 3 cover the design of the stand-alone gas detector, control unit or final element. Guidance on the design of peripheral equipment is included within this international standard.

Before this international standard can be applied, it is important to understand and categorise the application of the fixed gas detection system. The three main applications are:

- as a prevention system – the total system or an individual instrumented control loop has a safety function and safety integrity clearly defined.
- as a mitigation system – the total system or an individual instrumented control loop has a safety function and safety integrity clearly defined.
- as an additional safe guarding system – this covers those fixed gas detection systems or individual instrumented control loops which operate in parallel (secondary) to an

instrumented safety system, where the demand on the fixed gas detection system or individual instrumented control loop is only when the primary instrumented safety system fails or another layer of protection fails.

Under no circumstances should the use of an additional safeguarding gas detection system contribute to the Hardware Fault Tolerance (HFT) declaration for the instrumented safety system.

A fixed gas detection system, as shown in Figure 1, may operate several times per year subject to the application, therefore this international standard accepts that the demand rate associated with 'on demand' (low demand) should be specified in the safety requirements (e.g. a reference could be "> 1/yr but <10/yr").

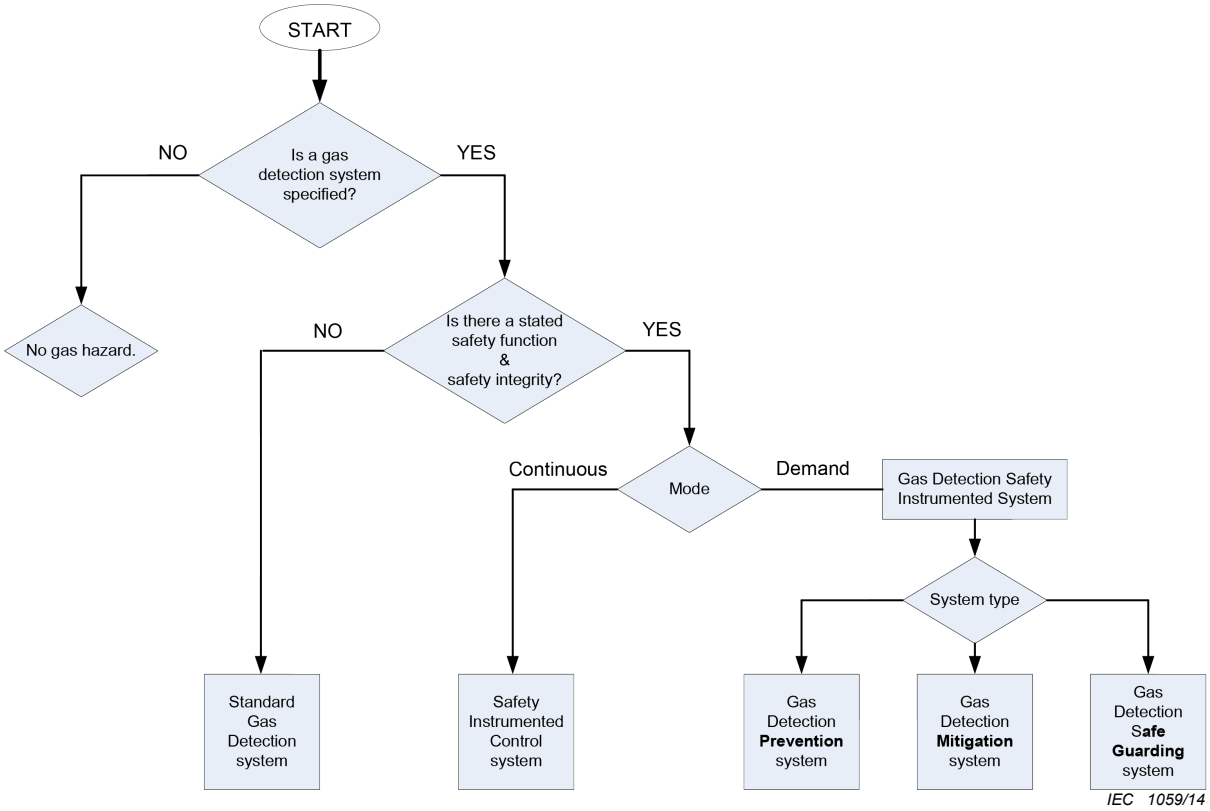

Figure 1 – Gas Detection System Architecture

To assist with the possible complexity and unique requirements associated with fixed gas detection systems, a fixed gas detection system may be broken down into functional units. Each functional unit can vary in complexity; a functional unit may be a simple gas detector or a combination of components which form peripheral equipment. Each functional unit is independently assessed against this international standard and/or IEC 61508 during the initial design phase of the functional unit, thus allowing safety data to be contributed to a functional unit.

NOTE 2 Basic elements of a sub-system/system (e.g. a gas detector, logic controller/solver, etc.) are designed as a product in compliance with IEC 61508 Parts 1, 2 and 3.

Each functional unit is then assembled in line with this international standard to deliver a complete fixed gas detection system. It is not necessary to re-assess individual functional units when they are used in a different configuration – it is only necessary to evaluate the combination of functional units.

This international standard is based on the safety lifecycle model detailed in IEC 61508, but adds additional and supportive information to assist with particular phases of this typical safety lifecycle.

This international standard specifies those requirements under 'Functional Safety Management' which all persons or companies who are involved in the supply chain of a fixed gas detection system should comply with.

NOTE 3 Functional Safety Management applies to all stages of the safety lifecycle irrespective of the product, subsystem, system supply or service being supplied.

For this document, the SIL capability excludes consideration of gas detection coverage or the transport of gas or vapour to the measuring point – IEC 60079-29-2 is pertinent to these two subjects.

Table 1 gives a broad suggestion as to the most relevant clauses to the typical tasks to be performed.

Table 1 – Typical Job Descriptions and Most Relevant Clauses

Applies to	Definitions	Conformance to this International standard	Gas detection unique features	Functional safety management	General requirements	Gas detection unique requirements	Alternative control units (logic solvers)	Factory acceptance testing	Installation and commissioning	System validation (SAT)	Operation and maintenance	System modification	System de-commissioning	Documentation
Clause	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**
Consultant		+++		+++										
Contractor		+++		+++										
Vendor		+++		+++										
System Integrator		+++		+++										
Manufacturer		+++		+++										
NOTE Each category above will have personnel in several of the categories below.														
General management	+	+	+		+	+	+	+	+	+	++	++	+	+
Design engineering / management	+++	+	+++		+++	+++	+++	+	+	+	++	+++	++	++
System engineer / management	+++	+	+++		+++	+++	+++	+++	++	++	+	+++	++	++
Installation engineering / management	++	+	++		+	++	+	+	+++	++	+	++	++	++
Commissioning engineer / management	++	+	++		++	++	+	+	+++	++	+	++	++	++
Service engineer / management	++	+	++		++	++	+	+	++	++	+++	+++	+++	++
Quality engineer / management	++	+	+++		+++	+++	+	+++	++	+++	+	++	+	+++
Training officers	+++	+	+++		+++	+++	++	+	+	+	+++	+	+	++
Operation & maintenance	+	+	++		+	++	+	++	+	+++	+++	+++	+++	+++

"+++" Most appropriate "++" Advisable "+" Useful

The end-user, regulator and certification authorities need to be familiar with the entire family of IEC 61508 standards.

NOTE See Annex B for guidance on the life cycle of gas detection.

AUSTRALIAN/NEW ZEALAND STANDARD

Explosive atmospheres

Part 29.3:
Gas detectors—Guidance on functional safety of fixed gas detection systems

1 Scope

This International standard gives guidance for the design and implementation of a fixed gas detection system, including associated and/or peripheral gas detection equipment, for the detection of flammable gases/vapours and Oxygen when used in a safety-related application in accordance with IEC 61508 and IEC 61511. This International standard also applies to the detection of toxic gases.

Other parts of this international standard and pertinent local, national and international standards separately specify the performance requirements of a gas detector and a gas detection control unit (logic solver). These standards are commonly known as Metrological Performance Standards and are concerned with the accuracy of the measured value, the overall system performance, but not the device or system integrity with respect to the safety function. This international standard applies to the integrity of the safety function.

NOTE In certain jurisdictions, it can be a requirement for a Certification Body to certify the performance of equipment for the measurement of flammable gases, vapours, toxic gases and/or Oxygen used in life safety applications.

This international standard sets out safety-related considerations of fixed gas detection systems, including associated and/or peripheral gas detection equipment in terms of the framework and philosophy of IEC 61508, and introduces the particular requirements demanded by a fixed gas detection system as shown in Figure 2.

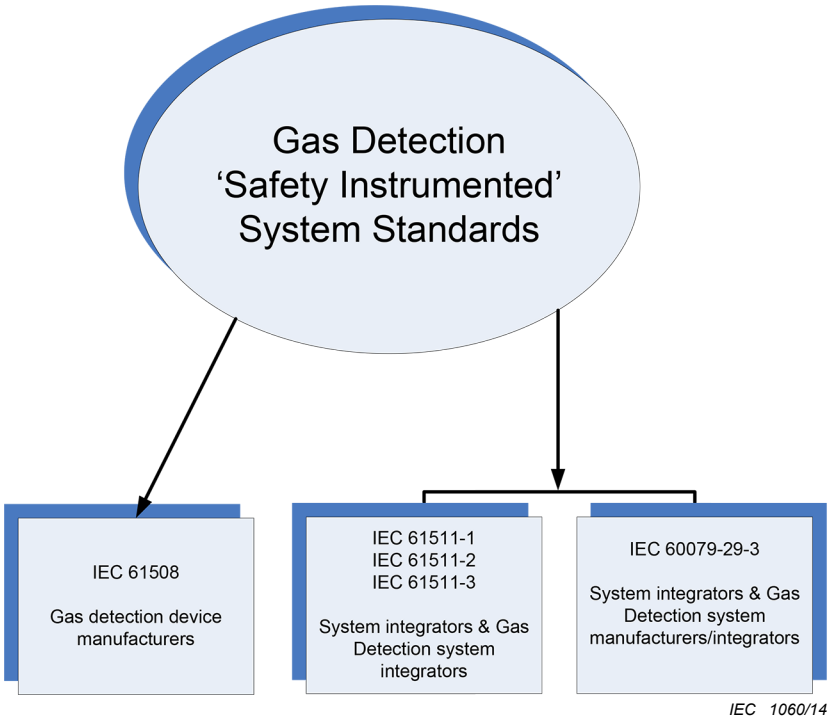

Figure 2 – Related Safety Instrumented System Standards