

Fact sheet

Gas detector design order

March 2023

Background

The Work Health and Safety (Mines and Petroleum Sites) Regulation 2022 contains requirements relating to quality of air supplied within a mine and the maximum permissible limits for contaminants in that air. To comply with these requirements, a mine operator must provide gas detection equipment at strategic locations throughout the mine. In selecting the gas detection equipment, the mine operator must also have a level of confidence that a chosen gas detector will provide accurate data under varying environmental conditions.

In accordance with section 187(1)(e) and (f) of the Regulation, the design of the following plant (referred to in this fact sheet as ‘gas detectors’) must be registered if they are used at an underground coal mine:

- (e) *electrically powered hand-held plant used to determine or monitor the presence of gas*
- (f) *electrically powered fixed installations and installations on mobile plant used to determine or monitor the presence of gas, but does not include tube bundle systems where the analyser is installed at the surface.*

The term “gas detector” is used to describe the complete grouping of component parts that constitutes gas detecting plant. The component parts of a gas detector include the gas sensor¹ and protective housing, interconnecting communications medium such as cables, optical fibre and radio links, as well as control units and transmitters that enable gas values to be displayed and output indicated so a mine operator can determine the level of a gas.

The purpose of design registration is to attest that gas detecting equipment has been designed to achieve minimum performance outcomes. The design is tested in accordance with prescribed test conditions by an independent testing facility and results are documented.

The design and the test results are peer reviewed by a person who has not been involved in the design of the equipment and who is themselves competent in the designing of gas detecting equipment. The design verifier must agree with the designer that the design and performance of the gas detector fulfils all the gazetted requirements, including any claims of equivalence for the registration application to proceed. Any areas of disagreement on the claimed design and performance must be referred to the designer for resolution.

The following documents contain further information about the design registration process:

- [Guide: Plant and item registration for mines and petroleum sites](#)
- [Position paper - fit form function](#)
- [General information release - eligibility criteria for design verifiers](#)
- [Policy: Design registrations](#)

¹ AS/NZS 60079.29.1 uses the term *sensor*, whereas AS/NZS 4641 uses the term *monitor*.

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Gas detector design order

The Regulator has published a design order that must be complied with to obtain design registration of a gas detector. The order specifies the minimum performance requirements a gas detector design must achieve.

The design order also specifies the required competencies of a testing facility.

Design of gas detectors

The standards for the design of a gas detector are identified in the design order. The design order permits alternative standards to be used in the design of the gas detectors, but the designer must document the published technical standards, or the engineering principles used to identify controls that achieve an equivalent level of safety.

This equivalence only applies to the design of the gas detector and not to the performance outcomes that the detector must demonstrate during testing.

Performance of gas detectors

The design order requires that a gas detector be tested under prescribed conditions by a suitable test facility. A test facility will assess the performance of the gas detector under different environmental conditions including changes in temperature, humidity, atmospheric pressure, air velocity, continual exposure to elevated levels of the gas, and the effects of other gases on the sensor. All are concerns in an underground mine environment.

Laboratory testing also establishes a baseline figure for response times ($t(50)$ and $t(90)$) of the gas detector for increasing and decreasing levels of gas. It also establishes how the performance of the gas detector, which includes displays and output signals, is affected by factors such as:

- the time required following energisation until it starts to accurately detect gas
- electromagnetic emissions from electrical equipment near the sensor and other components of the detector, such as cables.

The design order requires that gas detectors are tested in accordance with specified criteria for flammable gases, and for toxic gases and oxygen, as appropriate. This ensures that sensor performance, including response times and the effect of environmental conditions, and other factors, such as energisation and electromagnetic emissions, are assessed in a consistent manner.

Displays, signals and output indications

The order requires that gas detectors be designed to have integral sensors, remote sensors, or a combination of integral and remote sensors. Detectors complying with this requirement provide a display indication, alarm functions, output contacts and/or alarm signal outputs that enable decisions to be made regarding management of ventilating air, the environment and equipment operation.

Gas detectors must also be designed to provide a conditioned electronic signal or output indication that may be used to enable a person to read the gas value on a display remote to the sensor or control unit, as an input into a separate alarm or tripping system, or as an input to a mine's data acquisition and control systems for display and trending of gas levels.

Gas detectors may be designed to integrate the transmission of the conditioned electronic signal or output indication within the gas detector control unit or maintain this as a separate transmitter unit.

Generally accepted industry standard signals

Generally accepted industry standard signals are those that an end user can interpret without the use of other proprietary component parts to decode and reformat the data.

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Clause 3.2.11 of AS/NZS 60079.29.1 identifies a conditioned electronic signal or output indication as something such as 4 to 20mA current loop.

Clause 1.3.8.10 of AS/NZS 4641:2018 identifies a conditioned electronic signal or output indication as something such as 4–20 mA current loop or 3–15 psi signal.

Analogue signals

An analogue signal, such as a 4–20 mA current loop, is an electrical signal that can be measured and displayed using electrical test equipment. It may be used to provide an input into separate gas detection control units², or other control and monitoring systems, using third-party componentry such as a display unit or an alarm and trip unit. The signal may also be an input into a programmable controller to initiate alarm and tripping functions or transfer data to the mine's data acquisition systems.

Analogue signals are not limited to 4–20 mA current loops.

Digital signals

A gas detector may provide a digital output signal, rather than an analogue signal. For the digital signal to be usable by a mine operator, the structure of the digital signal must be known. Without the protocol of the digital data stream, it is not possible to interpret what the sensor is transmitting, including the gas content value the sensor has detected. A protocol converter is typically required to decode the signal and enable the gas detector data to be utilised by a mine operator. These component parts are considered to form part of the design registered plant.

Gas detector testing

To achieve design registration, a test report must be provided that confirms that a gas detector, which includes the sensor and all component parts necessary for a mine operator to determine the content of the gas in the mine atmosphere, meets the performance requirements identified in the applicable Standards. The additional component parts will include display modules, transmitter modules, a combination of the display and transmitter modules, or alarm or tripping relays. Where the sensor is remote, testing will include interconnecting cables that have been identified by the designer as suitable.

Where a gas detector incorporates the functionality of a gas detection transmitter, and the gas detection transmitter provides a digital data signal, all additional proprietary modules required to enable the mine operator to use the digital signal must be tested in conjunction with the sensor by the testing facility. The additional modules will be included as a part of the registered gas detector design.

This testing is necessary to verify that the conditioned electronic signal or output indication accurately reflects the level of gas that the sensor is being exposed to, under varying conditions.

The protocol of any software drivers used by the testing facility during the testing of a gas detector must be documented and included as a part of the design registration documentation. This enables the development of software drivers that will function with communications interfaces at that mine.

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² AS/NZS 60079.29.1 uses the term *separate gas detection control units*, whereas AS/NZS 4641:2018 uses the term *stand-alone control units*.

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