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Mining — Air quality control systems for operator enclosures — Performance requirements and test methods



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- Engineers Australia
- Minerals Council of Australia
- Mining Electrical and Mining Mechanical Engineering Society
- OceanaGold (New Zealand)
- Resources Safety & Health Queensland
- The Australasian Institute of Mining & Metallurgy
- The Chamber of Minerals and Energy of Western Australia
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Preface

This Standard was prepared by the Australian members of the Joint Standards Australia/Standards New Zealand Committee ME-018, Mining Equipment.

The objective of this document is to specify performance and design requirements for air quality control systems for operator enclosures and their monitoring devices. The design specifications are universal in their application and do not contemplate specific mining environments. They are intended to meet identified parameters of both pressurization and respirable particulate and carbon dioxide concentrations. This document also specifies test methods to assess such parameters and provides operational and maintenance instructions. Recommendations are made for operational integration of the air quality control system.

Gases and vapours that can be a hazard in the work environment outside of the operator enclosure are excluded from this document.

This document is identical with, and has been reproduced from, ISO 23875:2021, *Mining — Air quality control systems for operator enclosures — Performance requirements and test methods* and its Amendment No. 1 (2022) which has been added at the end of the source text.

As this document has been reproduced from an International document, a full point substitutes for a comma.

Australian or Australian/New Zealand Standards that are identical adoptions of international normative references may be used interchangeably. Refer to the online catalogue for information on specific Standards.

The terms “normative” and “informative” are used in Standards to define the application of the appendices or annexes to which they apply. A “normative” appendix or annex is an integral part of a Standard, whereas an “informative” appendix or annex is only for information and guidance.

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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).

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).

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.

This document was prepared by Technical Committee ISO/TC 82, *Mining*.

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.

Introduction

Safety in mining operations is of concern to all involved in owning, developing, managing, and working in mining environments. Routine mining activities can generate airborne particulates which are hazardous to human health. Therefore, it is necessary to develop controls which limit the operator's exposure to airborne particulates while operating equipment from within the operator enclosure. With the rise in the number of countries regulating air quality in mining, construction, and industrial environments, machine manufacturers have become increasingly aware of the need for standard practices in the design and performance of operator enclosures. This document seeks to address the fundamental design requirements that will allow for operator enclosures to perform at a level that provides sustained air quality, reducing concentrations of respirable particulate matter and carbon dioxide that are harmful to human health. The emphasis of this document is in three areas: 1) design, 2) air quality control system performance testing, and 3) maintenance and operation instruction for the operator enclosure.

All operator enclosures, either on new machines or existing machines currently in operation, meeting the requirements of this document are expected to provide consistent air quality performance. The technical aspects of an operator enclosure are universal as are the design and performance testing methods. Therefore, every attempt has been made to make this an inclusive document which addresses the needs of fixed and mobile operator enclosures.

This document was developed to provide for the occupational health and safety of personnel who work inside operator enclosures. It primarily addresses air quality concerns by establishing parameters to determine air quality control system effectiveness. The control of these airborne contaminants is through an effective air quality control system (for both external air and recirculated air), dilution of CO₂, routine testing of the air within the operator enclosure, and effective maintenance throughout the life cycle of the operator enclosure. Extensive research and subsequent publications have produced a substantial body of knowledge around the air quality control systems and are the basis of this document. See Bibliography.

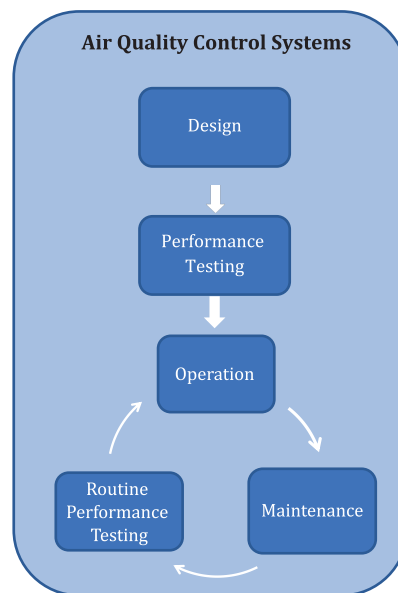


Figure 1 — Air quality control system life cycle

As illustrated in [Figure 1](#), this document presents a life cycle approach to operator enclosure air quality control system design, performance testing, and maintenance.

NOTES

Australian Standard®

Mining — Air quality control systems for operator enclosures — Performance requirements and test methods

1 Scope

This document specifies performance and design requirements for air quality control systems for operator enclosures and their monitoring devices. The design specifications are universal in their application and do not contemplate specific mining environments. They are intended to meet identified parameters of both pressurization and respirable particulate and carbon dioxide concentrations. This document also specifies test methods to assess such parameters and provides operational and maintenance instructions. Recommendations are made for operational integration of the air quality control system.

Gases and vapours that can be a hazard in the work environment outside of the operator enclosure are excluded from this document.

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 18158, *Workplace air — Terminology*

ISO 29463-1:2017, *High efficiency filters and filter media for removing particles from air — Part 1: Classification, performance, testing and marking*

ISO 29463-2, *High-efficiency filters and filter media for removing particles in air — Part 2: Aerosol production, measuring equipment and particle-counting statistics*

ISO 29463-3, *High-efficiency filters and filter media for removing particles in air — Part 3: Testing flat sheet filter media*

ISO 29463-4:2011, *High-efficiency filters and filter media for removing particles in air — Part 4: Test method for determining leakage of filter elements - Scan method*

ISO 29463-5:2011, *High-efficiency filters and filter media for removing particles in air — Part 5: Test method for filter elements*

ISO/IEC 17000, *Conformity assessment — Vocabulary and general principles*

ISO/IEC 17050-1, *Conformity assessment — Supplier's declaration of conformity — Part 1: General requirements*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO/IEC 17000, ISO 18158, ISO 29463-1 and the following 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/>

3.1 Terms related to air quality

3.1.1

airborne particle

airborne particulate

fine matter, in solid or liquid form, dispersed in air

[SOURCE: ISO 18158:2016, 2.1.2.3, modified — The preferred term "airborne particulate" has been added.]

3.1.2

hazardous to human health

in such a quantity and/or quality of *airborne particulates* ([3.1.1](#)) or *CO₂* ([3.1.7](#)) or noise, that it has adverse health effects

3.1.3

contaminated environment

area where *airborne particulates* ([3.1.1](#)) *hazardous to human health* ([3.1.2](#)) are present in the ambient air

3.1.4

breathing zone

air space around the worker's face from where they take their breath

3.1.5

ambient CO₂ level

CO₂ ([3.1.7](#)) concentration present in the air outside of the *operator enclosure* ([3.2.1](#)), to which people can be exposed

3.1.6

respirable particulate matter

materials that are deposited in the gas-exchange region of the lungs

Note 1 to entry: The median cut point for respirable particulate matter is 4,0 µm, according to ISO 7708:1995.

3.1.7

CO₂

carbon dioxide emitted as a by-product of human respiration

3.2 Terms related to the operator enclosure design

3.2.1

operator enclosure

structure that completely surrounds the operator, preventing the free passage of *external air* ([3.2.7](#)), dust or other substances into the area around the operator

[SOURCE: ISO 10263-4:2009, 3.1, modified – "part of the machine which" has been replaced with "structure that"]

3.2.2

air quality control system

operator enclosure ([3.2.1](#)) that includes structural components, *external air* ([3.2.7](#)) and recirculation air systems designed to protect an operator from environmental factors such as dust, heat, cold, wind, and *airborne particulates* ([3.1.1](#)) *hazardous to human health* ([3.1.2](#))

3.2.3

sustained quality

quality achieved through designs that work together to create an effective *air quality control system* ([3.2.2](#)) that allows *operator enclosure* ([3.2.1](#)) pressure and effective filtration to be maintained continuously between *planned maintenance intervals* ([3.2.4](#))

3.2.4

planned maintenance interval

interval when routine maintenance is performed

3.2.5

operator enclosure pressurization

situation when the *operator enclosure* (3.2.1) *external air* (3.2.7) intake is greater than the operator enclosure leakage

3.2.6

operator enclosure work environment

space inside the *operator enclosure* (3.2.1)

3.2.7

external air

controlled air entering the system or opening from outdoors before any air treatment

[SOURCE: ISO 16818:2008, 3.97]

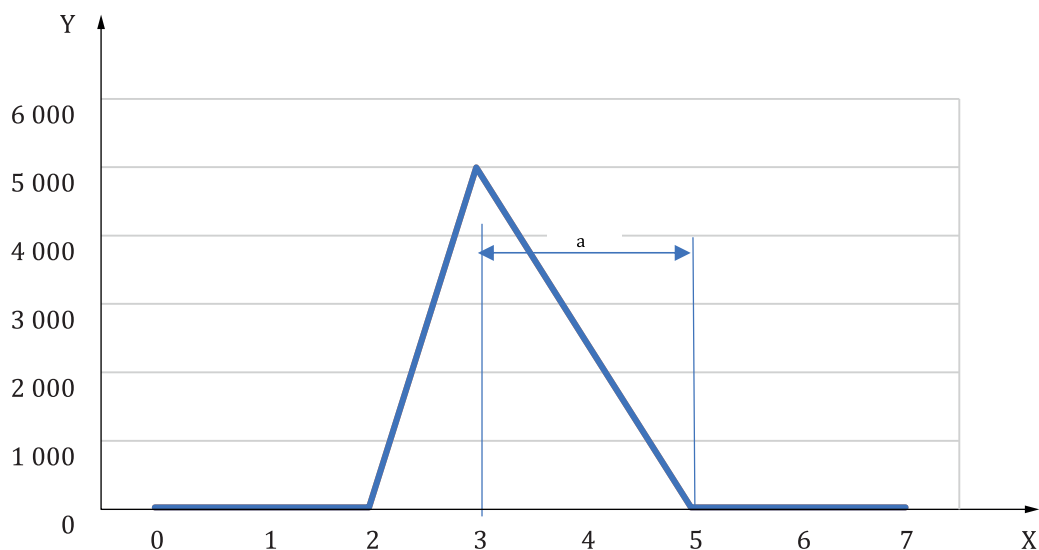
3.3 Terms related to measurement

3.3.1

decay time

time that it takes for the *airborne particles* (3.1.1) to be removed from the air inside the *operator enclosure work environment* (3.2.6)

Note 1 to entry: See [Figure 2](#).



Dust concentration within the operator enclosure starts at $7 \mu\text{g}/\text{m}^3$ and at the 2-minute interval it begins to rise. At the 3-minute interval it peaks at $5\,000 \mu\text{g}/\text{m}^3$, and at the 5-minute interval it returns to $7 \mu\text{g}/\text{m}^3$. In this example, the decay time is two minutes.

Key

X time, min

Y concentration, $\mu\text{g}/\text{m}^3$

a 2 min

Figure 2 — Decay time — Example