

# Hard Rock Mine Refuge Chambers

## The MineARC MineSAFE Standard Design Range

Designed to provide a refuge or safe haven for miners suddenly trapped in a hazardous or toxic environment.



**mineSAFE**  
STANDARD DESIGN



The world's most trusted refuge chamber in metalliferous (hard rock) and non-metal mines

MS-SD2-12-SIV-36

MineARC Systems - Built for Safety.

[www.minearc.com](http://www.minearc.com)



# Company Profile

MineARC Systems is the global leader in the manufacture and supply of emergency safe refuge solutions for the mining, tunnelling, chemical processing and disaster relief industries.

With over 20 years' experience, our dedication to ongoing research and development is driven by our key focus to continually offer the best and most advanced safety solutions on the market.

Our team of qualified engineers, electrical designers and technical experts form a global network across several international locations including;

- Perth, Western Australia
- Johannesburg, South Africa
- Dallas, Texas
- Santiago, Chile
- León, Mexico
- Beijing, China
- Reading, UK

This allows MineARC to provide 24 hour service and engineering support to our expanding list of clients in over 65 countries across the globe.

All MineARC Refuge Chambers and Safe Havens comply with the highest international regulations and recognised 'world's best practice' industry guidelines. Our key focus on quality control and product advancement has meant that MineARC Refuge Chambers have successfully saved lives in multiple real life industrial emergencies around the globe.

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Helping safeguard miners in over 65 countries, across six continents, the MineARC MineSAFE series is the world's most trusted refuge chamber in metal (hard rock) and non-metal mines.



MS-SD3-16-SIV-36

Emergency refuge forms an integral part of an underground mine's wider Emergency Response Plan (ERP). Fires, explosions, rock-falls, flooding and the release of smoke and other forms of toxic gas are the types of incidents that occur all too frequently, despite the high levels of planning and the safety precautions in place.

In these types of emergencies, when evacuation is no-longer safe or practical, emergency refuge is designed to provide a safe and secure 'go-to' area for personnel to gather and await extraction. MineARC Refuges have been successfully used around the world in multiple mine and tunnelling emergencies to save lives.

Refuge chambers should be deployed throughout the mine to create a refuge 'network' accessible to all underground personnel whilst on foot. Depending on the country/region, regulations usually state acceptable 'safe distances' between refuge chambers.



Bureau Veritas ISO 9001:2008 Quality Management Systems



MineARC® HRM Refuge Live Risk Assessment Testing



Australian C-Tick Standards: AS4100-1998, AS3570.1-18, AS2208, AS3000, AS1716-15



Canadian Standards Association (CSA)



United States National Electrical Code (NEC) 2013/14



European CE Certified to Machinery Norms

# Standard Configurations

In consultation with the world's leading mining companies and regional mining authorities, the MineARC MineSAFE has been continuously re-engineered and refined to create a safe-refuge solution that is fully integrated with today's modern underground mining environment.

Now in its fourth series, the MineSAFE Standard Design (SD) Refuge Chamber provides miners with optimum safety features, functionality and performance.

Standard configurations are available based on occupancy – from 8 to 30 people - with each model engineered for maximum durability and manoeuvrability, both above and below ground.

Ultimately an SD refuge chamber's dimensions and its rated occupancy can be custom-engineered to site specifications, without compromising on safety or performance.

Special transport configurations include narrow builds specifically tailored for shaft mines, or modular builds, allowing a complete refuge chamber to be split into smaller sections before being transported and then reassembled underground.



MS-SD1-08-SIV-36 (8 Person)   MS-SD2-12-SIV-36 (12 Person)   MS-SD3-16-SIV-36 (16 Person)   MS-SD4-20-SIV-36 (20 Person)   MS-SD5-26-SIV-36 (26 Person)   MS-SD6-30-SIV-36 (30 Person)

## Standard Dimensions

Model	Occupancy (persons)	Height (m/inch)	Width (m/inch)	Length (m/inch)	Weight (kg/lb)
MS-SD1-08-SIV-36	8	2.21 / 87"	2.25 / 89"	3.89 / 153"	4300 / 9400
MS-SD1-08-SIV-36 (w/ airlock)	8	2.21 / 87"	2.25 / 89"	5.10 / 201"	5100 / 11100
MS-SD2-12-SIV-36	12	2.21 / 87"	2.25 / 89"	4.80 / 189"	4700 / 10200
MS-SD2-12-SIV-36 (w/ airlock)	12	2.21 / 87"	2.25 / 89"	6.02 / 237"	5600 / 12400
MS-SD3-16-SIV-36	16	2.21 / 87"	2.25 / 89"	6.02 / 237"	5400 / 11900
MS-SD3-16-SIV-36 (w/ airlock)	16	2.21 / 87"	2.25 / 89"	7.23 / 285"	6200 / 13600
MS-SD4-20-SIV-36	20	2.21 / 87"	2.25 / 89"	7.23 / 285"	6000 / 13200
MS-SD4-20-SIV-36 (w/ airlock)	20	2.21 / 87"	2.25 / 89"	8.44 / 332"	6600 / 14500
MS-SD5-26-SIV-36	26	2.21 / 87"	2.25 / 89"	8.44 / 332"	8400 / 18500
MS-SD6-30-SIV-36	30	2.21 / 87"	2.25 / 89"	9.64 / 380"	8600 / 19000

Custom dimensions and occupancies available. Refuge dimensions are ultimately designed to client specifications. Weights provided are Australian standard 36hr models. Indicative weights only. Custom variations will impact final refuge chamber weight.

# Chamber Exterior Front



**STROBE LIGHTING**

- Extra low voltage
- Green & red LED

**SIREN**

- 112 dBA motion activated

**AIR VENTS / CHECK VALVES**

**PAINT**

- Sand blasted to 2.5 grit

**SEALING DOOR**

- Outward opening
- Vacuum tested seal

**PORTHOLE WINDOW**

- AS 2208
- Blast resistant upon request

**REFLECTIVE SIGNAGE**

- Safety & operational
- Optional extra: Multiple languages

**ROTATING HANDLES**

- Double locking

**FIRE EXTINGUISHER**

- Optional for non-Australian orders. Supplied separately as Dangerous Goods

**SKID BASE**

- 250 x 100mm forklift slots
- Front and rear mounted tow points
- Front mounted 25mm steel plate push blocks

The 'face' of the refuge chamber is designed primarily for easy identification and quick access during an emergency.

The strobe lighting, warning siren and reflective signage alert passers-by to the chamber's location, whilst the rotating door handles provide simple, straight forward access to the safety of the interior.

MS-SD3-12-SIV-36

# Chamber Interior

Inside a MineSAFE Standard Design Refuge Chamber, a number of vital life-support systems combine to create a safe, ongoing environment for occupants. The chamber features a MineARC Series IV Controller; the most advanced safe-refuge technology, anywhere in the world.

Systems include; primary and secondary air (oxygen) supplies, air conditioning systems, positive pressure systems, electrical systems, gas detection and CO<sub>2</sub> / CO removal.

The MineSAFE Standard Design uses MineARC's unique voice activated Series IV electrical scrubbing system in conjunction with MARCISORB chemicals to 'scrub' the build up of harmful CO<sub>2</sub> (carbon dioxide) and CO (carbon monoxide) from the air inside the refuge chamber.

In high enough concentrations, both CO<sub>2</sub> and CO can cause serious injury leading to a loss of consciousness and eventually, death. CO<sub>2</sub> and CO are expired by the occupants as part of their normal breathing activity.

Carbon monoxide can also enter the main chamber via the compressed air intake (if it becomes compromised), and as occupants enter and/or exit the main entrance, making CO<sub>2</sub> / CO scrubbing a vital necessity.

## i.V.A.N.

The digital controller interface is the operational hub of the refuge chamber. From here, all power, lighting and scrubbing systems can be managed with the push of a button.

Exclusive to the MineARC Series IV Control System, iVAN (Intelligent Voice Audio Navigation) represents a breakthrough in safe-refuge technology. iVAN is an on-board navigation assistant that guides occupants through operational procedures and can be programmed into languages other than English.

## MARCISORB Chemical Cartridges

The MineARC Series IV Scrubbing System uses pre-packaged MARCISORB chemical absorber cartridges.

MineARC's MARCISORB CO<sub>2</sub> and MARCISORB CO cartridges provide superior scrubbing capacity, are easy to load, safe to handle, and can store for long periods.

## Air Conditioning

Air conditioning is vital to combat the potentially fatal effects of heat stress. A continuous build up in heat is caused by the occupant's metabolic activity, as well as any ambient (external) heat affecting the refuge chamber's internal temperature.



**INTERIOR LED LIGHTING**

**AIR CONDITIONING SYSTEM**  
 • R410a refrigerant cooling  
 • UL listed Mitsubishi Split System

**EMERGENCY ESCAPE HATCH**  
 • Inward opening; accessible internally and externally  
 • Neoprene memory seal

**GUARDIAN CAMERA & VOIP PHONE**

**AIR (OXYGEN) SUPPLY #1: COMPRESSED MINE AIR**  
 • Low pressure air supply (120psi; 830kPa)

**MARCISORB CO<sub>2</sub> & CO CHEMICAL CARTRIDGES**

**SERIES IV DIGITAL CONTROLLER INTERFACE**

**OXYGEN SUPPLY #3: OXYGEN CANDLE + IGNITER**  
 • 2,600L oxygen produced / 60 mins ignition  
 • Military approved  
 • Optional for non-Australian orders. Supplied separately as Dangerous Goods

**CIRCUIT BREAKER**

**AURA-FX DIGITAL GAS MONITOR**

**BATTERY UPS ISOLATION SWITCH**

**OXYGEN SUPPLY #2: MEDICAL GRADE OXYGEN CYLINDERS**  
 • Minimum capacity based on G size cylinder (8,580L); quantity required outlined below:

Model	8	12	16	20	26	30
36 hr	2	2	3	3	4	4

\*Medical grade oxygen cylinders to be provided by end user.

**CO & CO<sub>2</sub> CHEMICAL STORAGE**

**NON-SLIP FLOORING**  
 • Raised, removable

**STORAGE**  
 • Under seat + cabinet

**SEATING**  
 • Ergonomically designed  
 • Durable, hard wearing fabric  
 • 500mm seating per person

## Optional Features

### Custom Design

- Custom heights, widths, lengths and designs available upon request

### Blast Shield Protection

- Polycarbonate window protector
- External protection for AC and mine air
- Protection for lights and sensors

### Blast Rating Upgrade

- Additional 100mm x 50mm upright stiffeners
- Additional lateral stiffeners

### Airlock System

- Separate flushing area prior to entry to main chamber
- Primary flushing via connection to mine air supply, regulated with simple ball valve operation
- Emergency push button flushing via 8,000L (282ft<sup>3</sup>) breathable air cylinders

### Carbon Monoxide Safety Off System (cosos)

- In-line compressed air carbon monoxide detection
- Automatically isolates compressed air feed when CO reaches 25ppm

### 60amp Macey Plug

- Medium/high voltage connectors available
- Meets Australian standard

### Transformer

- Standard 1000V Step Down to 240-220V
- Custom configurations available

# GuardIAN Chamber Monitoring

MineARC's **GuardIAN Refuge Chamber Monitoring System** is an exciting development in refuge chamber technology. GuardIAN enables real-time monitoring; providing confidence that an operation's fleet of refuge chambers are emergency ready at all times.

GuardIAN Refuge Chamber Monitoring is an on-board system that continuously monitors all vital refuge operating systems. During standby mode GuardIAN checks for component faults and monitors refuge chamber usage or entry to the chamber.

The GuardIAN Chamber Monitoring system is hosted on an internal server within the refuge chamber so that no client software installation is required. The responsive webpage is easily accessible from any computer, tablet or smartphone and features a summary of your entire refuge chamber fleet and overall operational status, with the ability to drill down to a detailed report of each chamber.

GuardIAN Chamber Monitoring provides the added advantage of remote troubleshooting assistance by MineARC Engineers, who can login to view the chamber diagnostics dashboard with sites' permission.



# GuardIAN Chamber Monitoring

## Event Logging & Fault Diagnostics

MineARC's Series IV Digital Controller links directly to the GuardIAN Network, streaming real-time system data, including automated system checks, fault logging (battery, scrubber, temperature and inverter), system diagnostics, internal and external temperature measurements, and system actions such as scrubber activation. MineARC's Aura-FX also provides real-time gas monitoring data and analysis via the GuardIAN Network dashboard.

## Live Video Monitoring & VOIP Video Phone

Internal video monitoring is provided by a remote controlled, motion activated GuardIAN IP camera. When activated, the camera will send out a live, recorded stream of the interior of the refuge chamber to the GuardIAN Network.

To assist occupants during an emergency or safety drill, chambers are also equipped with a VOIP video phone, facilitating face-to-face communication between the refuge chamber and the surface.



## UPS Battery Management

When used in conjunction with GuardIAN, the MineARC Satellite UPS System allows for real-time, remote monitoring of each individual battery. Battery faults can be identified immediately via the GuardIAN Dashboard and Alert Feed, with auto-generated event notifications sent directly to any personal device. Voltage and temperature diagnostics for each individual battery within a string can also be viewed via a graph, highlighting any fluctuations over the past 24 hours.



## Chamber Integrity Monitoring

The Compressed Air Management System (CAMS) communicates vital information relating to the integrity of the internal refuge chamber via the GuardIAN Network.

An increase in CAMS activity would indicate a breach of the refuge chamber seal, thus sending an alert to designated personnel that the chamber is compromised.

## Complete your network with GuardIAN Connect

GuardIAN Connect, powered by RFI Technology Solutions is a high speed, fit for purpose, linear access layer network, allowing the connection of the GuardIAN Nodes, Smart Lighting and Refuge Chamber to the GuardIAN Intelligence Network.

Designed specifically for an underground mining environment, GuardIAN Connect uses a single coaxial cable to carry both power and data.

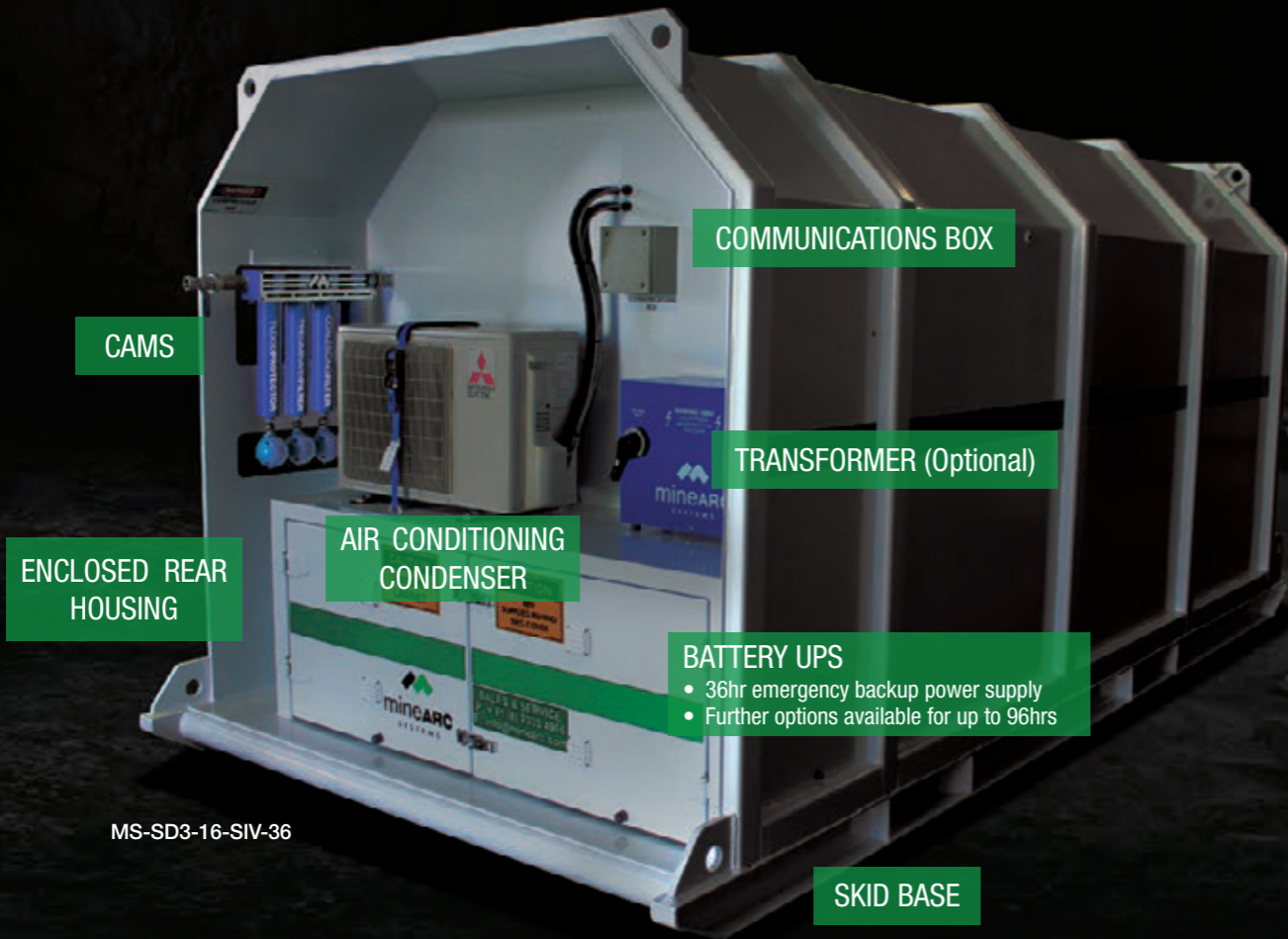


# Chamber Exterior Rear

A secure cabinet at the rear of the MineSAFE houses the refuge chamber's UPS battery back up (Uninterruptible Power Supply). The UPS is a fail-safe system that can power the refuge chamber's internal life support systems for a minimum of 24hrs, should mine power become cut-off.

The Compressed Air Management System (CAMS) allows regulated compressed air into the refuge chamber when the pressure inside

drops below 200Pa. This process optimises mine air usage and guarantees against over-pressurisation of the refuge chamber. CAMS' gas toxicity monitor automatically diverts compressed air if oxygen levels in the airline fall below a set level (18% oxygen in free air), signifying air contamination. Additionally, the incorporated flood protection valve automatically shuts down compressed air to avoid catastrophic and costly chamber damage in the event of water ingress.



# Feature Summary



5mm Steel Plate

CO<sub>2</sub> & CO Scrubbing

Breathable Air (O<sub>2</sub>) Supply

Air Conditioning

36-96hrs UPS Battery

Viewing Porthole

Gas Monitoring

Advanced Digital Controller

iVAN (Intelligent Voice Audio Navigation)

Remote Monitoring System

## Standard Features

- 5mm steel plate construction
- Blast rating: 5psi
- CO<sub>2</sub> & CO scrubbing
- Pre-packaged chemical cartridges
- Advanced digital control system
- Breathable air (O<sub>2</sub>) supply
- Air conditioning and dehumidifying
- Aura-FX Digital Gas Monitoring System
- Battery backup (UPS) - 36hrs minimum
- iVAN (Intelligent Voice Audio Navigation)
- Rear escape hatch with internal/external access
- Viewing porthole
- Stainless steel hardware throughout
- Ergonomically designed seating
- Lifting lugs, skid base and forklift slots
- Emergency food and water rations

## Standard Features

- Fully flushing, pressurised airlock
- Special dimensions and transport configurations available
- GuardIAN Refuge Chamber Monitoring
- Satellite UPS System
- Battery backup UPS upgrade to 48, 72, 96hrs
- First aid kit
- Internal LCD monitors screens
- Step-down transformer
- Overpressure blast resistance
- Receptacle plug (trailing cable connecting plug)
- Fire resistant structure
- Blast shield protection (reinforced construction) to withstand percussion blasting
- Blast rating upgrade
- Carbon Monoxide Safety Off System (COSOS)



## Optional Add-Ons: Emergency Response Products

MineARC's **ZOLL AED Range** provides the best support to help save a life. Users are provided with real-time feedback for quality, depth and rate of chest compressions; providing confidence and clarity throughout the defibrillation process.

The **Rugged Oxygen Generator (ROG)** is a portable, lightweight oxygen generator that delivers 90 litres of breathable oxygen for 15 minutes. Easy-to-use and small enough to carry in a backpack, the ROG gives immediate access to a potentially life saving oxygen supply.



## High Heat Chamber Upgrades

For MineSAFE Refuge Chambers located near the blast face of a mine, or in high temperature locations, **High Heat Chamber Upgrades** are now available. Select from a range of custom upgrades designed to provide greater comfort and extended protection for inhabitants during an emergency.

- 60°C air-conditioning system
- Insulation panels
- Battery upgrade to 48 hours
- Blast resistance options also available





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