



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



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 25 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 80 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 80 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 9001:2015 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.

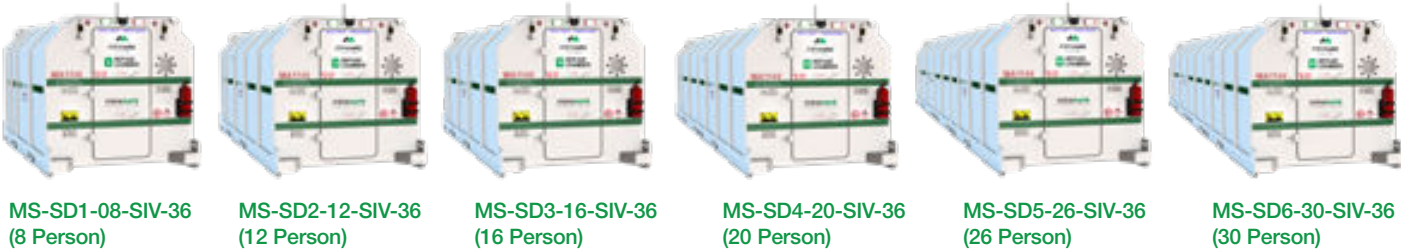
Standard configurations are available based on occupancy – from 8 to 30 people - with each model engineered for maximum durability and manoeuvrability, both above and below ground.



MineSAFE Standard Design Refuge Chamber (MS-SD2-12-SIV-36)

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.



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

EXTERIOR CHAMBER LIGHTING STRIP (OPTIONAL)

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 CO₂ / 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 CO₂ (carbon dioxide) and CO (carbon monoxide) from the air inside the refuge chamber.

In high enough concentrations, both CO₂ and CO can cause serious injury leading to a loss of consciousness and eventually, death. CO₂ 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 CO₂ / 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 CO₂ 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.



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 (282ft³) 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 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.

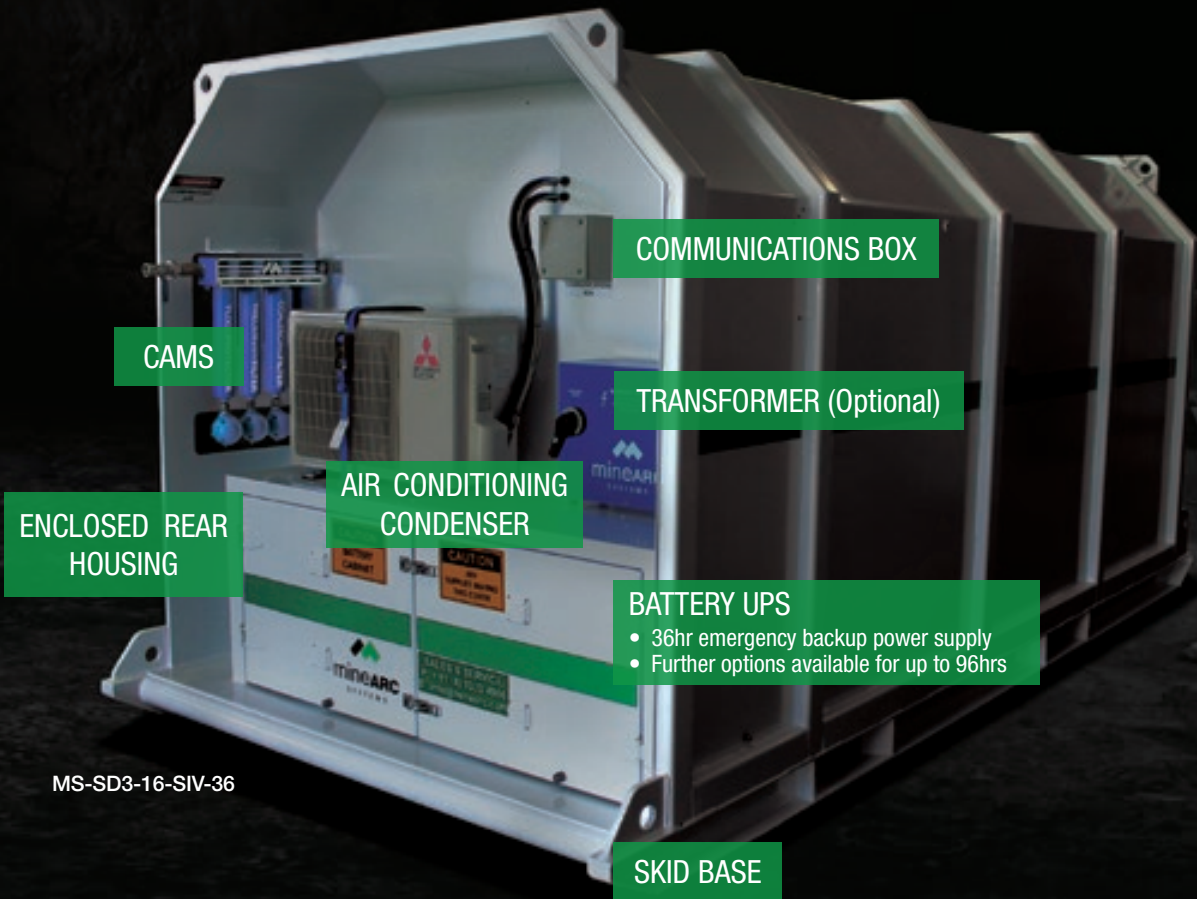


Chamber Exterior Rear

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.



MS-SD3-16-SIV-36

Feature Summary



MS-SD2-12-SIV-36

5mm Steel Plate

CO₂ & CO Scrubbing

Breathable Air (O₂) 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
- CO₂ & CO scrubbing
- Pre-packaged chemical cartridges
- Advanced digital control system
- Breathable air (O₂) 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

Optional 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
- Exterior chamber lighting strip
- Internal LCD monitor 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: Automated External Defibrillator

MineARC's **ZOLL AED Range** provides the best support to help save a life. An Automated External Defibrillator (AED Plus) with Real CPR Help by ZOLL provides users with real-time feedback for quality, depth and rate of chest compressions; providing confidence and clarity throughout defibrillation.

The ZOLL AED Plus has the lowest total cost of ownership compared to other automated external defibrillators on the market. Longer-lasting batteries and pads mean fewer replacement parts, adding up to considerable cost savings over time and rescue readiness in a cardiac arrest emergency.

Zoll AEDs provide life-saving defibrillation wherever they're needed, whether it's inside a refuge chamber, wall-mounted in a crib room or carried with emergency response gear for real-time incident response.



Also Available: EnviroLAV Toilet System

The EnviroLAV is the latest innovation in self-contained, portable toilet systems – ideal for the use in underground mining.

Designed to be simple to operate and maintain, the EnviroLAV is a semi-permanent structure that can be used both above and below ground wherever there is access to compressed air or electricity. The EnviroLAV requires emptying just once every 12 months, based on standard usage in optimal conditions.

For more information please visit www.minearc.com



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