



Hard Rock Mine Refuge Chambers

MineARC's MineSAFE Compact Design Range

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



mineSAFE
COMPACT DESIGN



MS-CD1-04-ELVP-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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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

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.

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.



MS-CD1-04-ELVP-36

Standard Configurations



MS-CD1-04-ELVP-36
4 Person, Standard Model



Standard Model Blast Shield Model Standard Model with IT Hitch Blast Shield Model with IT Hitch Standard Model with Scoop Frame Blast Shield Model with Scoop Frame

Standard Dimensions

Model	Occupancy (persons)	Height (m/inch)	Width (m/inch)	Length (m/inch)	Weight (kg/lbs)
MS-CD1-04-ELVP-36	4	2 / 78.7	2 / 78.7	2 / 78.7	2200 / 4900
MS-CD1-04-ELVP-36 (w/ airlock)	4	2 / 78.7	2 / 78.7	3 / 118	3000 / 6400
MS-CD2-06-ELVP-36	6	2 / 78.7	2 / 78.7	2.4 / 94.5	2350 / 5200
MS-CD2-06-ELVP-36 (w/ airlock)	6	2 / 78.7	2 / 78.7	3.4 / 133.8	3200 / 6800
MS-CD3-08-ELVP-36	8	2 / 78.7	2 / 78.7	3 / 118	2900 / 6400
MS-CD3-08-ELVP-36 (w/ airlock)	8	2 / 78.7	2 / 78.7	4 / 157.3	3400 / 7500

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. Scoop Frame configuration is not available with Compact Design 8-Person due to weight restrictions.

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

The MineSAFE Compact Design (CD) is designed specifically for tight mining confines, such as single-entry development headings.

This small, compact, ultra-portable refuge chamber is easy to manoeuvre and position around site.

The Compact Design is designed for optimum autonomy. The chamber's 'extra-low-voltage' control system means it can sit stand-alone for extended periods without requiring connection to mains (mine) power.

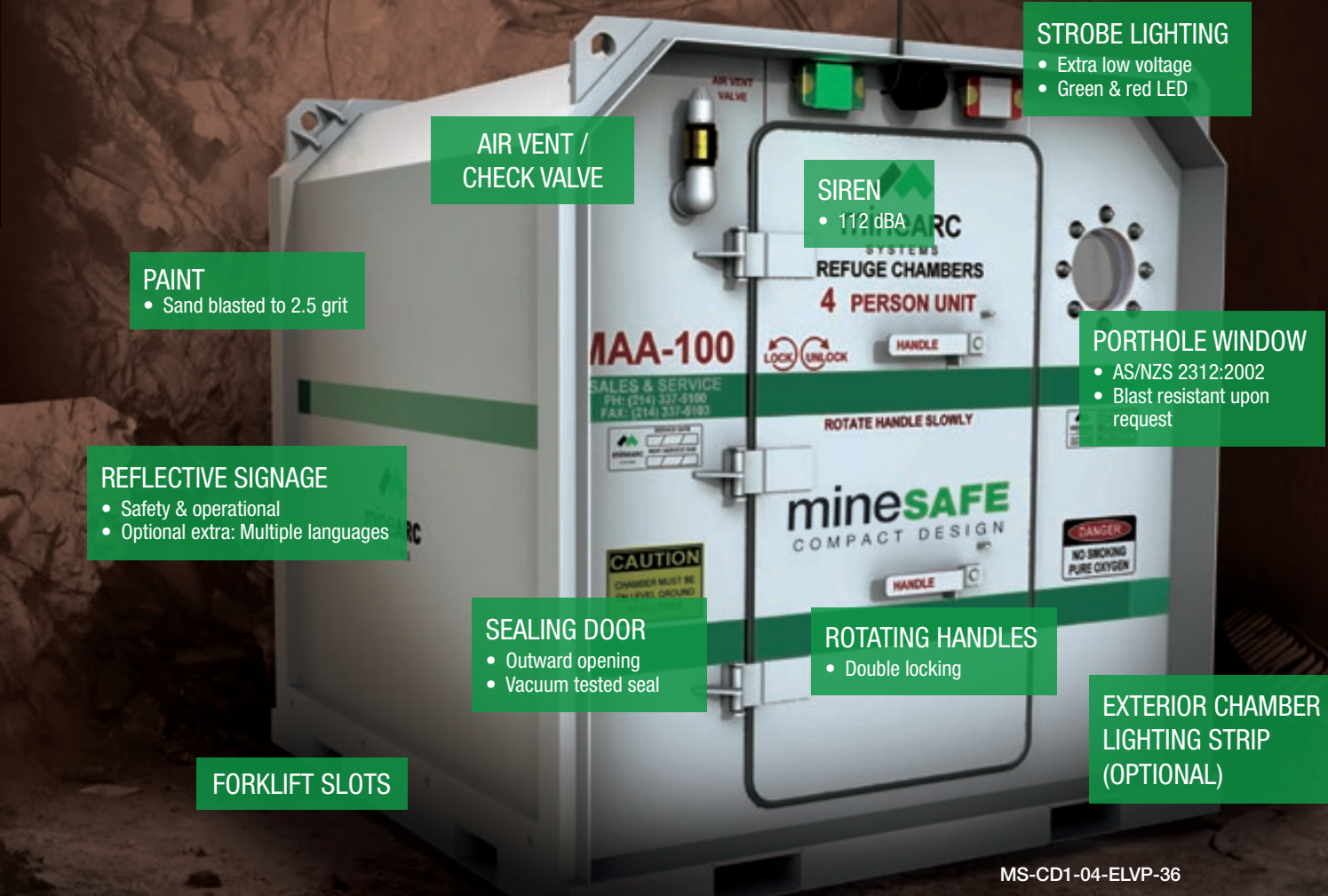
Ultimately a MineSAFE CD's dimensions and its rated occupancy can be custom-engineered to site specifications, without compromising on safety or performance. Standard configurations are based on 4, 6 and 8 person occupancies, with a range of optional features.

Chamber Exterior Front

The exterior front represents the 'face' of the refuge chamber - designed primarily for easy identification, and quick, easy access during an emergency.

The emergency lighting systems, 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.

The MineSAFE Compact Design Refuge Chamber can be taken virtually anywhere, anytime; providing personnel with a safe-refuge alternative, in every part of the mine. Personnel situated directly at the working face (e.g. drill operators), run the risk of being trapped behind a fire or other hazard further up the decline. The Compact Design has been engineered specifically for this type of scenario – providing a place of safe-refuge even in the most remote, inaccessible parts of the mine.



MS-CD1-04-ELVP-36

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 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



Chamber Interior

- R410a refrigerant cooling
- UL listed Mitsubishi Split System

- R410a refrigerant cooling
- UL listed Mitsubishi Split System

INVERTER

MEDICAL GRADE OXYGEN CYLINDERS (Not pictured)

- Minimum capacity based on G size cylinder (8,580L); quantity required outlined below:

Model	4-Person	6-Person	8-Person
36 hr	1	1	2

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

OXYGEN CANDLE KIT (Not pictured)

- 2,600L oxygen produced / 60 mins ignition; Military approved
- Supplied separately as Dangerous Goods

POWER FLUCTUATION PROTECTION

ELVP CO/CO₂ SCRUBBING SYSTEM

DIGITAL CONTROLLER INTERFACE

INTERIOR LED LIGHTING

AIR (OXYGEN) SUPPLY #1: COMPRESSED MINE AIR

- Low pressure air supply (120psi; 830kPa)

Inside a MineSAFE Compact Design Refuge Chamber, a number of vital life support systems combine to create a safe, ongoing environment for occupants.

Systems include primary and secondary oxygen supplies, air conditioning systems, positive pressure systems, electrical systems, gas detection and CO/CO₂ absorption systems (referred to as 'scrubbing' systems).

The MineSAFE Compact Design uses active chemicals and MineARC's ELVP (extra-low-voltage-portable) Scrubbing System 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 CO/CO₂ scrubbing a vital necessity.

Air Conditioning

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

Extra-Low-Voltage Controller Interface

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

MARCISORB Chemical Cartridges

The ELVP Scrubbing System uses pre-packaged MARCISORB chemical absorber cartridges. MineARC's MARCISORB CO and MARCISORB CO₂ cartridges provide superior scrubbing capacity, are easy to load, safe to handle, and can store for long periods.

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.

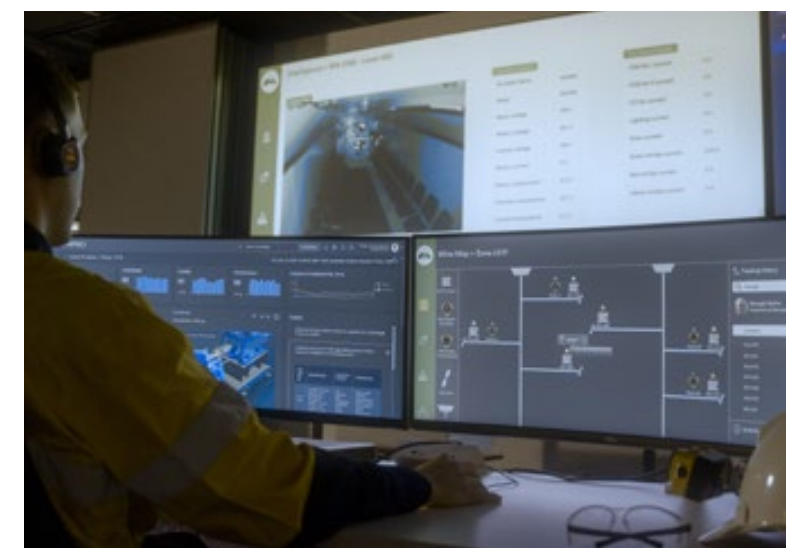
Live Video Monitoring & VOIP Video Phone

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.

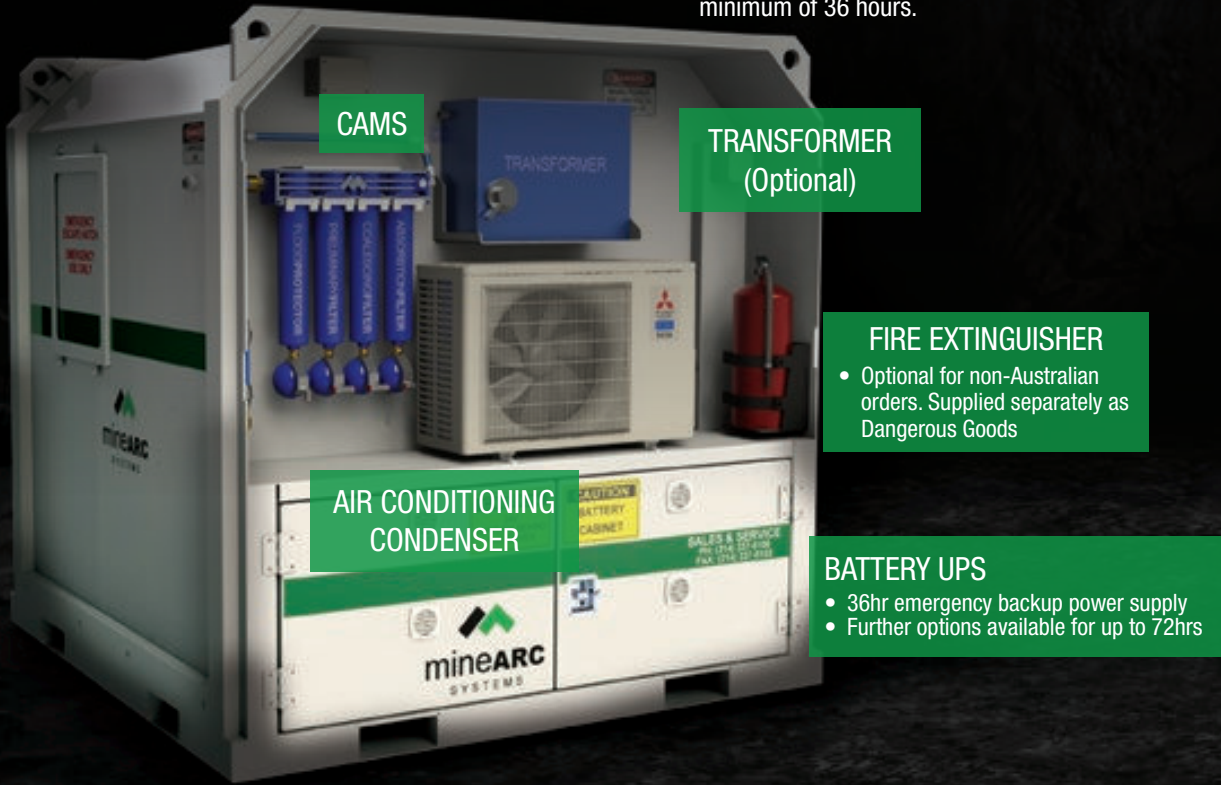
Designed specifically for an underground mining environment, GuardIAN Connect uses a single coaxial cable to carry both power and data.



Chamber Exterior Rear

The rear of a MineSAFE Compact Design Refuge Chamber houses important air filtration, electrical and backup power supply systems. A secure cabinet at the base houses the refuge chamber's UPS battery back up (Uninterruptible Power Supply). The UPS is a failsafe system that can power the refuge chamber's internal life support systems for a minimum of 36hrs, should mine power become cut-off.

The Compact Design's unique dual UPS battery bank configuration enables the chamber to sit standalone from mains power for extended durations. When on 'standby' the refuge chamber's external strobe lights and siren will still operate, alerting personnel to the refuge chamber's position. When the chamber is used in an emergency situation, the 'primary' battery bank is activated; powering the refuge chamber's entire life support systems for a minimum of 36 hours.



The CAMS air pressure sensor and a shut off valve allow air flow into the chamber to be regulated, automatically emitting periodic 'bursts' of 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. Over a 12 month period this can equate to significant financial savings.

The system's gas toxicity monitor automatically diverts mine air if oxygen levels in the airline fall below a set level (19% oxygen in free air), signifying air contamination. Additionally, the incorporated flood protection valve automatically shuts down mine air to avoid catastrophic damage due to ingress of water into the mine air or accidental hook-up to mine water.

Feature Summary



4/6/8 Person Occupancy	Breathable Air (O2) Supply
Ultra-Portable Design	Air Conditioning
5mm (1/4") Steel Plate	36 Hours Battery UPS (minimum)
CO and CO2 Scrubbing	Extra-Low-Voltage Controller
Designed for Remote Areas and Single Entry Development Headings	Can Operate in Standby Mode
Special Transport Configurations Available	Comprehensive Battery Monitoring and Charging System

Standard Features

- 5mm (1/4") steel plate construction
- CO & CO2 scrubbing
- Pre-packaged chemical cartridges
- Advanced extra low voltage control system
- 2 x sources of breathable air (O2) supply
 - CAMS
 - Medical oxygen cylinders
- Air conditioning and dehumidifying
- Aura-FX Digital Gas Monitoring System
- Battery backup (UPS) 36hrs standalone
- Side escape hatch with internal/external access
- Viewing porthole
- Stainless steel fittings throughout
- Ergonomically designed seating
- Lifting lugs and forklift slots
- Emergency food and water rations
- Fire extinguisher (optional for non-Australian orders)
- Fire blanket
- Chemical toilet

Optional Features

- Special dimensions and transport configurations available
 - I.T. Hitch or Scoop Frame
 - *Scoop available for 4/6 man only
- Fully flushing, pressurised airlock
- GuardIAN Refuge Chamber Monitoring
- Battery backup UPS upgrade
- Exterior chamber lighting strip
- Internal LCD monitor screens
- First aid kit (standard on US models)
- Step-down transformers
- Receptacle plug (trailing cable connecting plug)
- Blast rating upgrade
- Blast shield protection (reinforced construction)
- Carbon Monoxide Safety-Off-Systems (COSOS)
- Wheel package with integrated towing points
- Oxygen candle kit

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.



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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