125 years of heartfelt dedication

Dräger

ChargeAir™ System

Developments in SCBA-Based Escape Equipment

Draeger Safety Inc.
Engineered Solutions

1. **Introduction & Description**
2. History of Use
3. Recent Developments
4. Future Developments

Introduction:

- In-lieu of SCSR's, the proposed use of Self-Contained Breathing Apparatus (SCBA) in escape plans is an emerging alternative technology.

System Description:

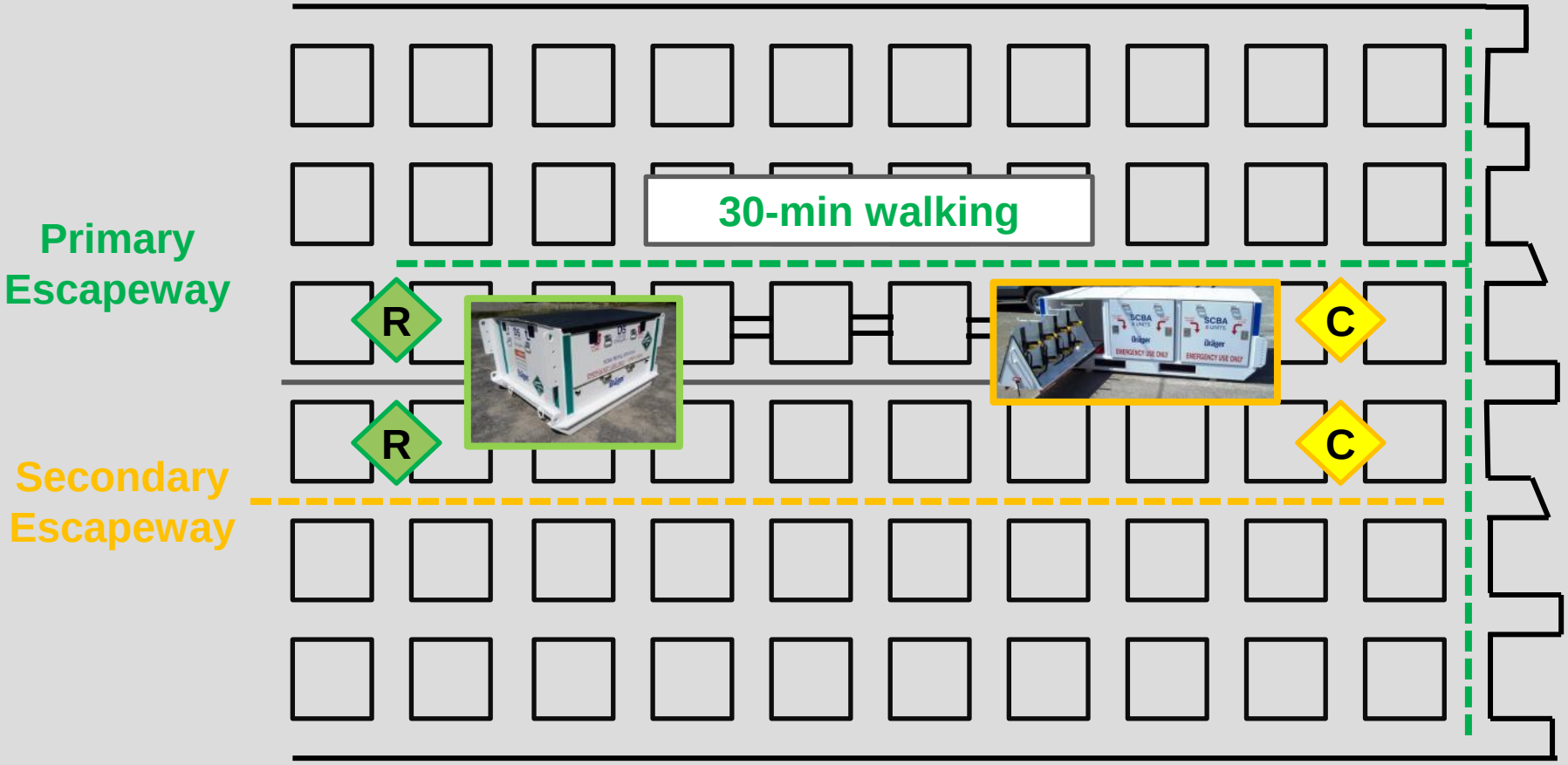
1. SCBA

   Self **C**ontained **B**reathing **A**pparatus

2. Storage Caches

3. Refill Stations

System Description:



System Description:

- What is the advantage?

- SCBA Technology offers:
  - Enhanced safety features
  - Improved user comfort
  - Ability to support firefighting efforts
  - Serviceability
  - Long-term cost-effectiveness

In this presentation:

- Historical & current developments in this field of SCBA Escape equipment.
- Improvements in technology and equipment.
- Areas to enhance SCBA refill stations in both performance and maintenance.
- Additionally, as related technologies and improved equipment develop, standards and “common practices” evolve for:
  - approval
  - system ratings
  - planning and use
  - maintenance and testing

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Dräger ChargeAir™
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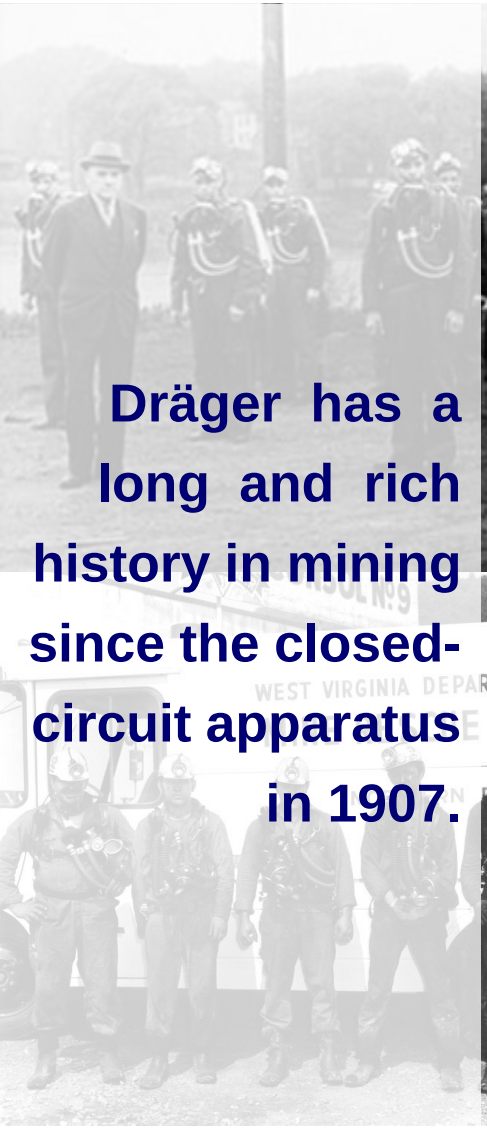
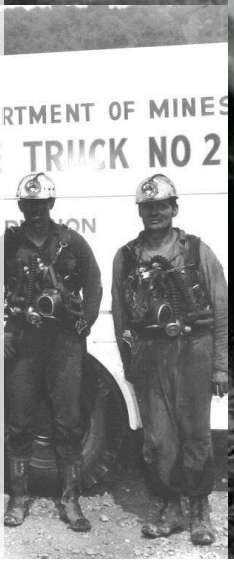
Dräger has a long and rich history in mining since the closed-circuit apparatus in 1907.





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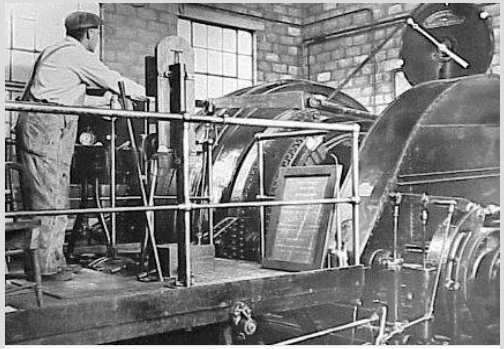

“Stand and Fill” or “Wear and Fill” used by Hoist-men and Cage-tenders

Aeroquip Fitting approved

1960’s **1970’s** **1980’s** **1990’s** **2000’s** **Present**

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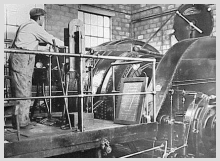
1998, Dräger Australia designs the FREEK systems for Australian coal mines. Application was for escape and underground fire fighting teams.



1960's **1970's** **1980's** **1990's** **2000's** **Present**

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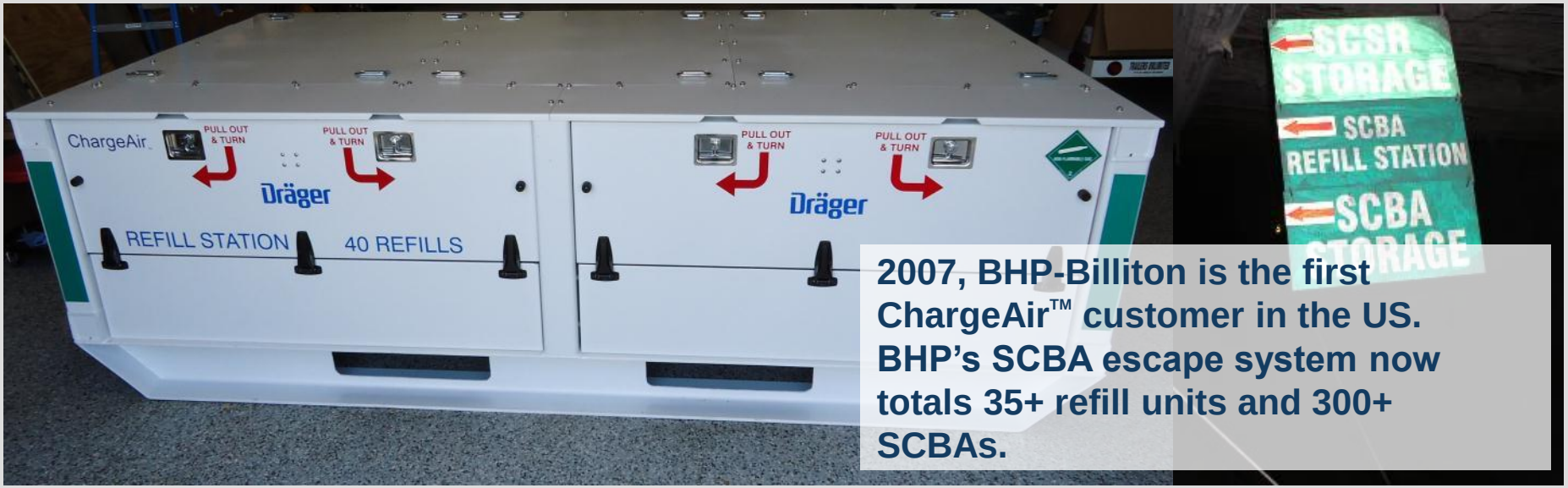
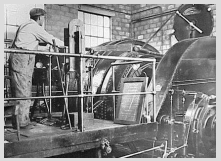
Developments in SCBA-Based Escape Equipment



2007, BHP-Billiton is the first ChargeAir™ customer in the US. BHP's SCBA escape system now totals 35+ refill units and 300+ SCBAs.



1960's 1970's 1980's 1990's 2000's Present

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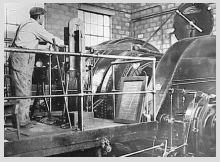
Developments in SCBA-Based Escape Equipment

Presently, ChargeAir is used by 5 U.S. coal companies. ChargeAir is used both for fire fighting and as part of approved-ERP escape plans.



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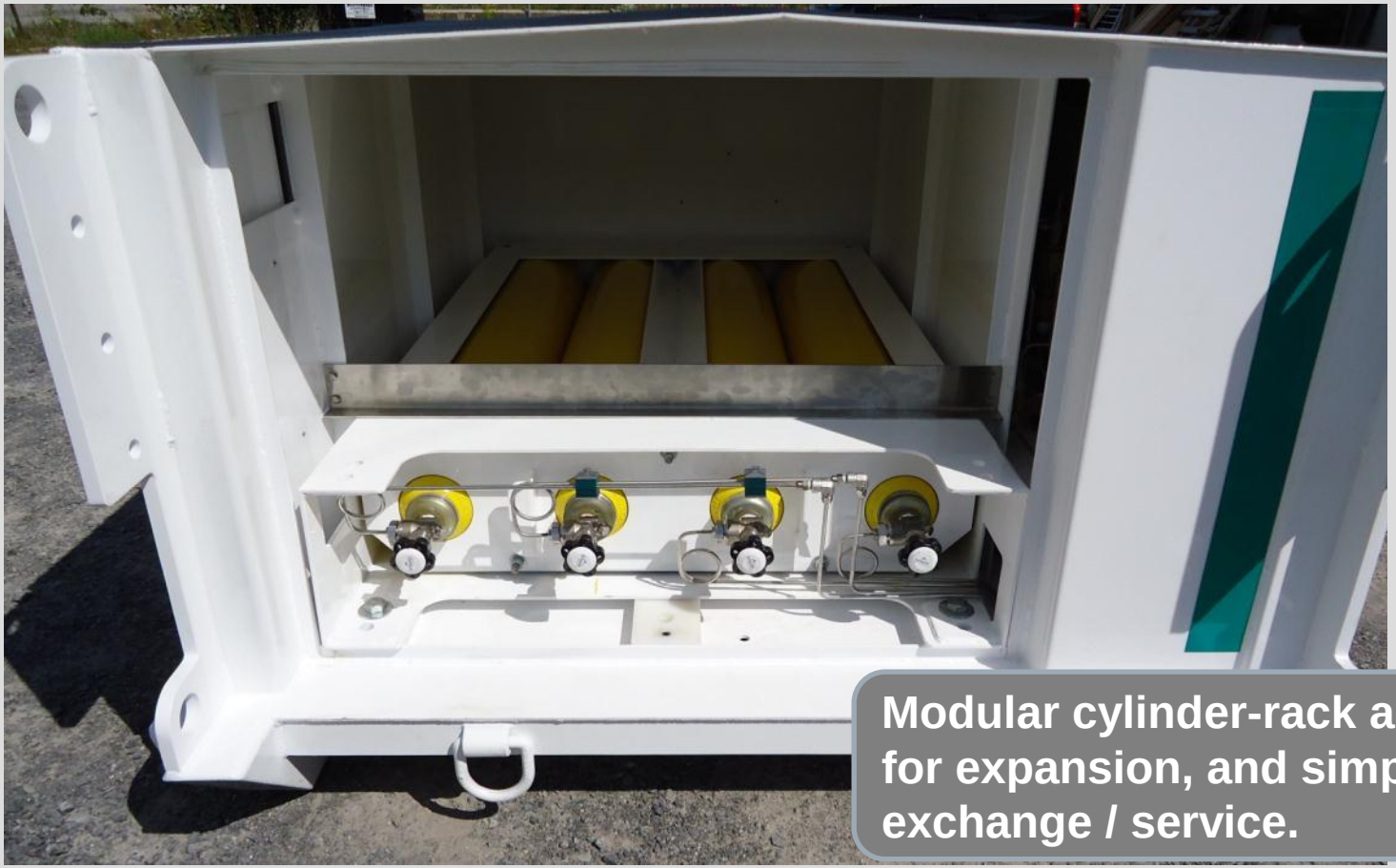
Improvements in Refill Stations

- New: smaller foot-print, high-efficiency model

New pneumatic arrangement makes the new refill technology +25% more efficient.

Improvements in Refill Stations

- New: smaller foot-print, high-efficiency model



Modular cylinder-rack allows for expansion, and simple exchange / service.

Improvements in Refill Stations

- New: smaller foot-print, high-efficiency model

Removable panels allow for enhanced accessibility

Improvements in Refill Stations

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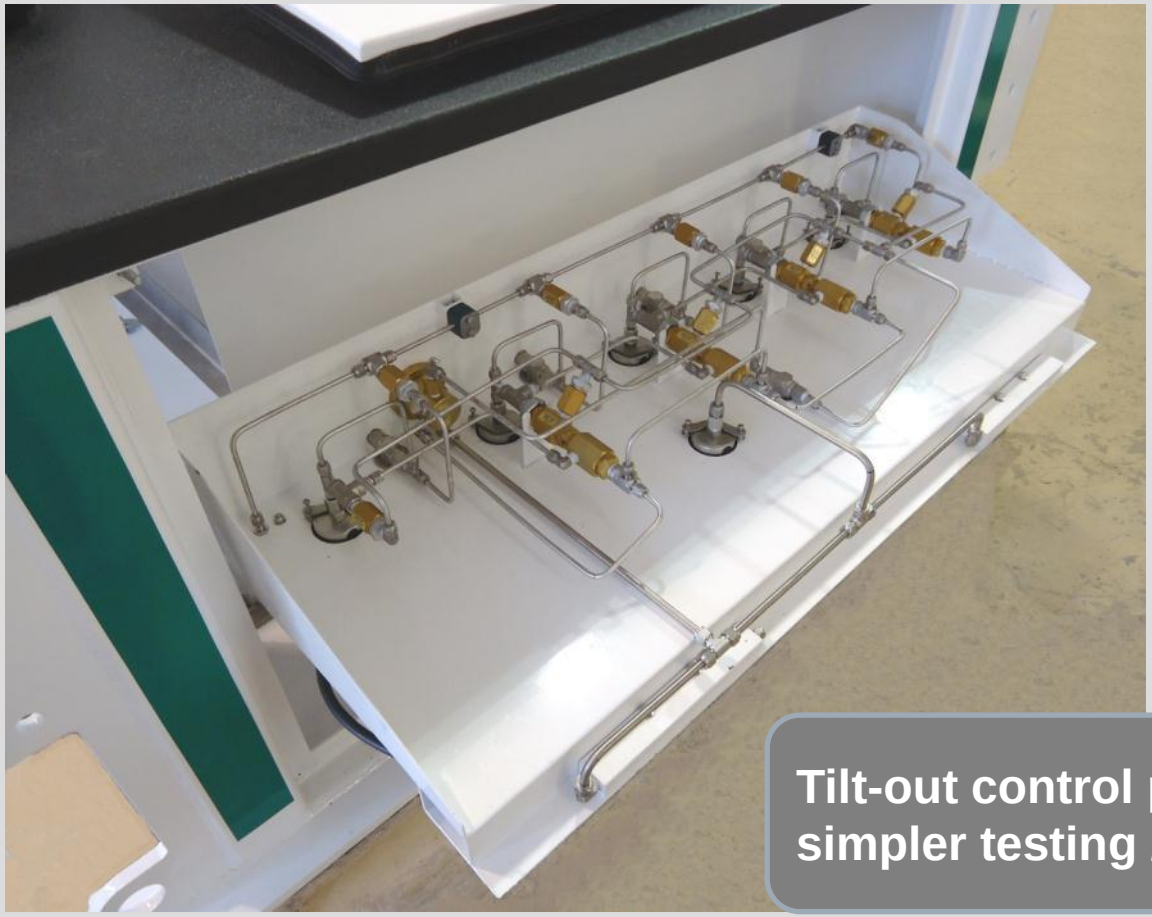
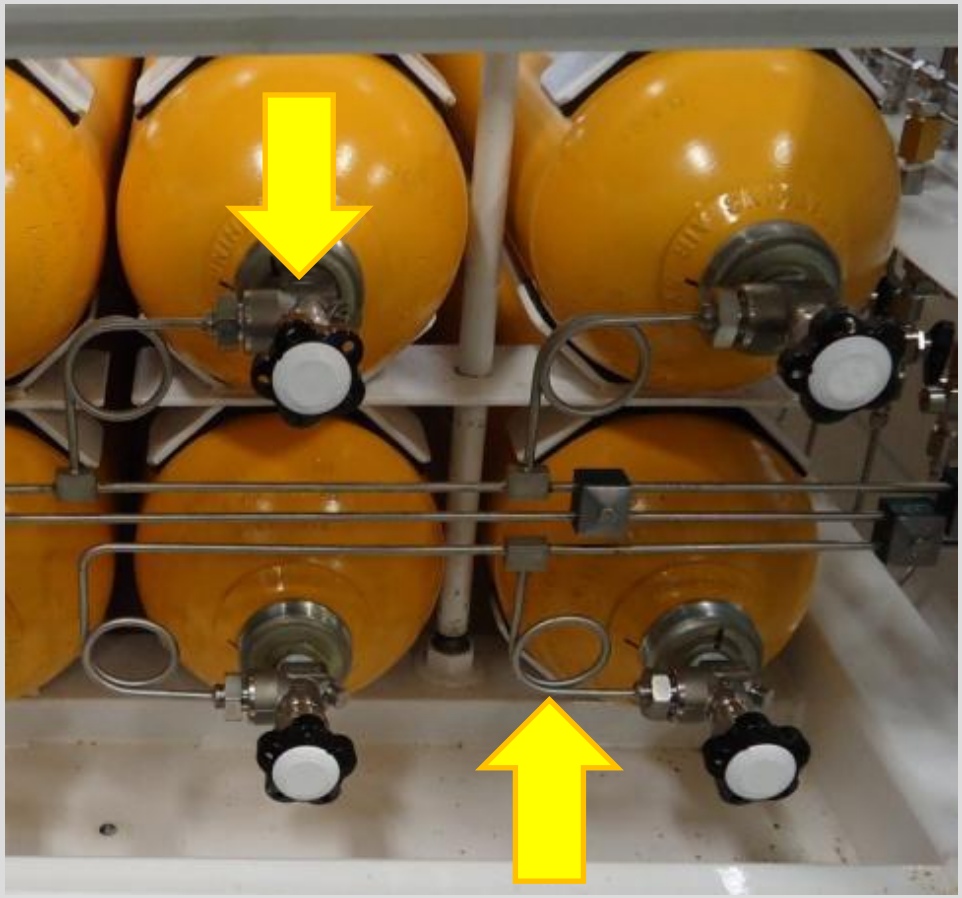


Tilt-out control panel for simpler testing / maintenance.

Improvements in Compressed Gas Storage & Components

- Monel Valves
  - required for all compressed gas cylinders underground

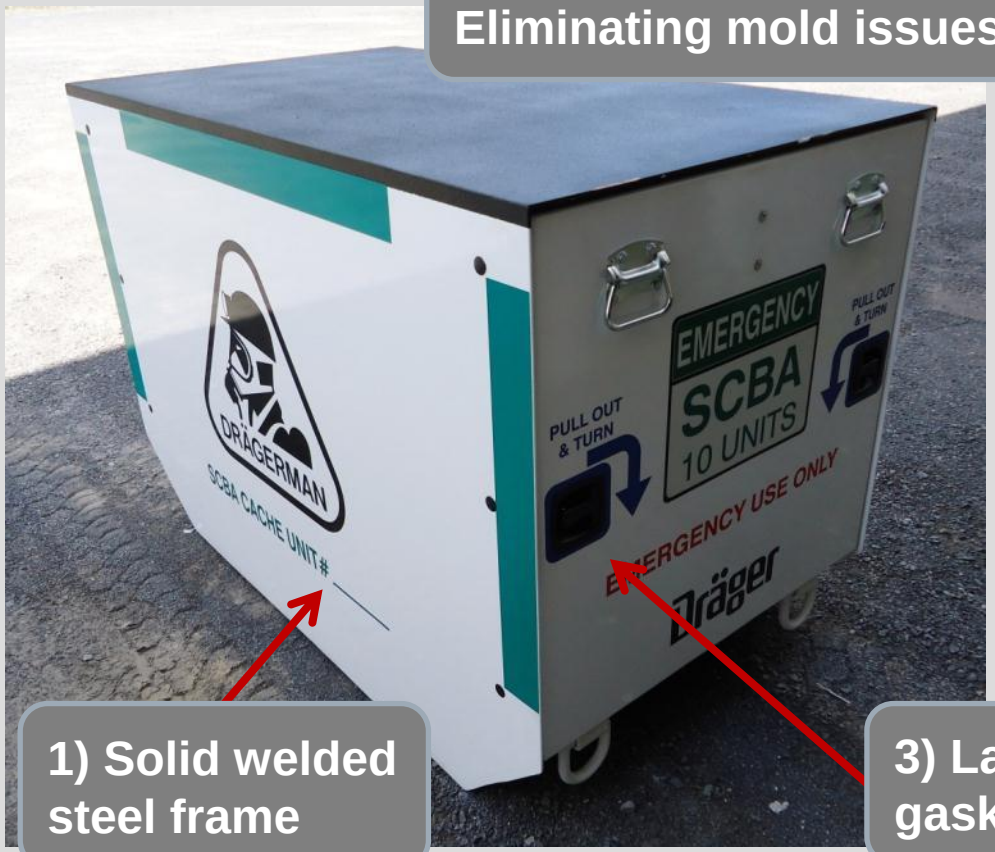
- Welded Manifolds
  - reduces potential leak-points
  - reduces regular user-maintenance

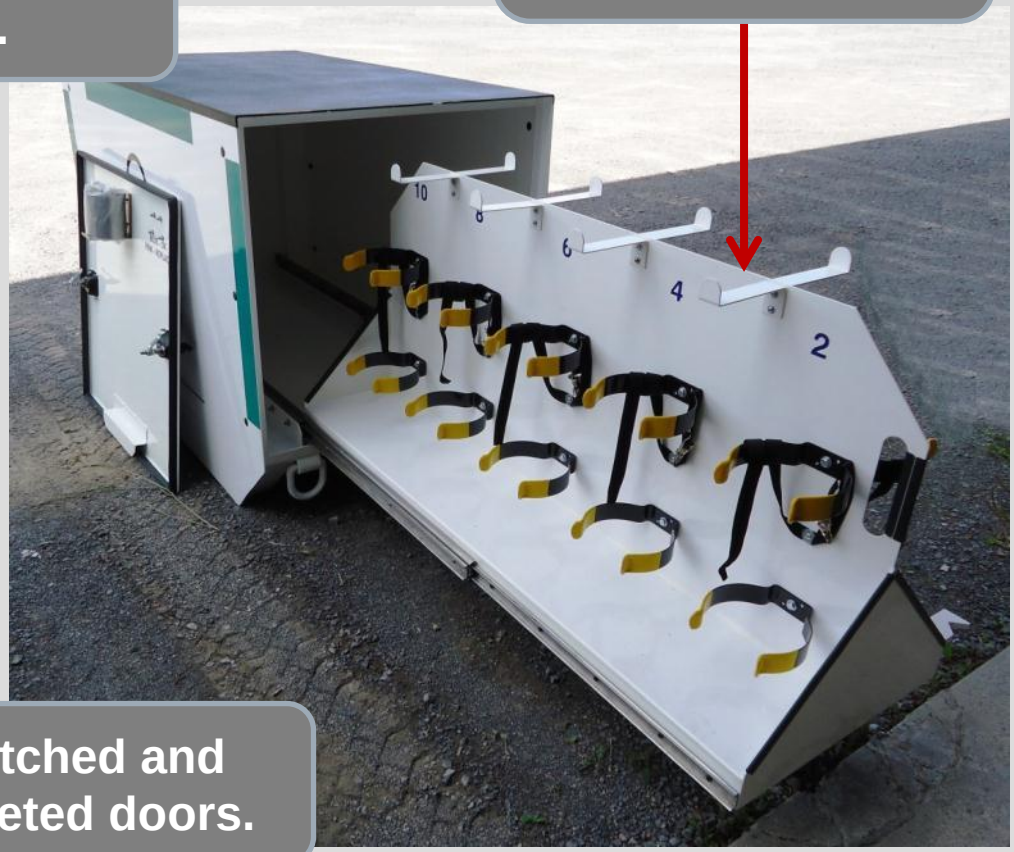


Improved Storage Caches

2) Water-proof and dust-proof. Eliminating mold issues.

Removable door and ball-bearing slide-out drawer.





1) Solid welded steel frame

3) Latched and gasketed doors.

Cache C10 Module

Modular bolting points allow for expansion to further available options

Cache C10 Module

Available sled bolts-on to accommodate larger storage units.

Also can be used for wheel-equipped tow package equipment.

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Future Developments:

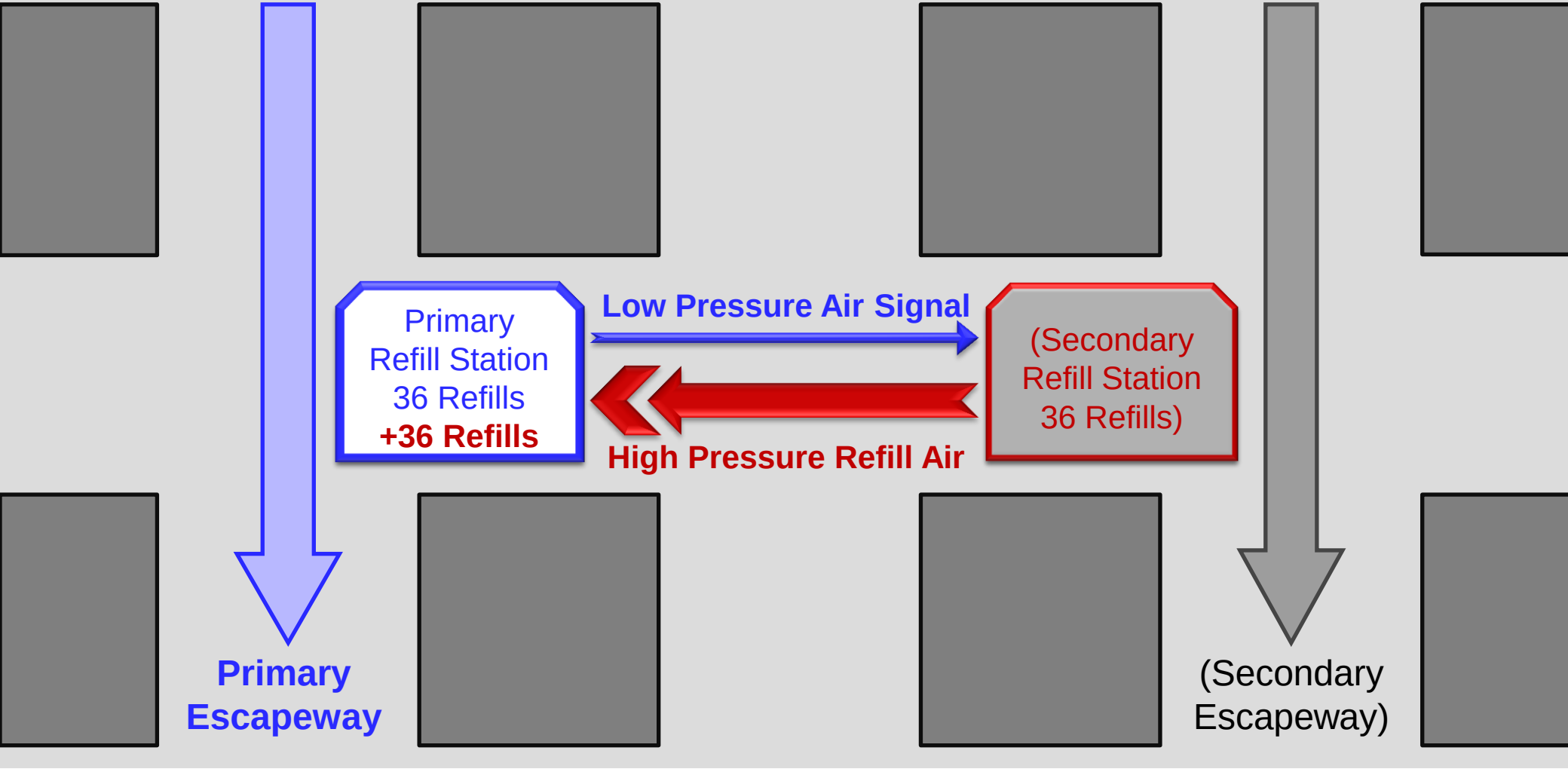
- Connectivity & Remote activation of refill stations
- Firefighting Efforts
- Enhanced Product Standardization

Future Developments: RAPidAir (patent pending)

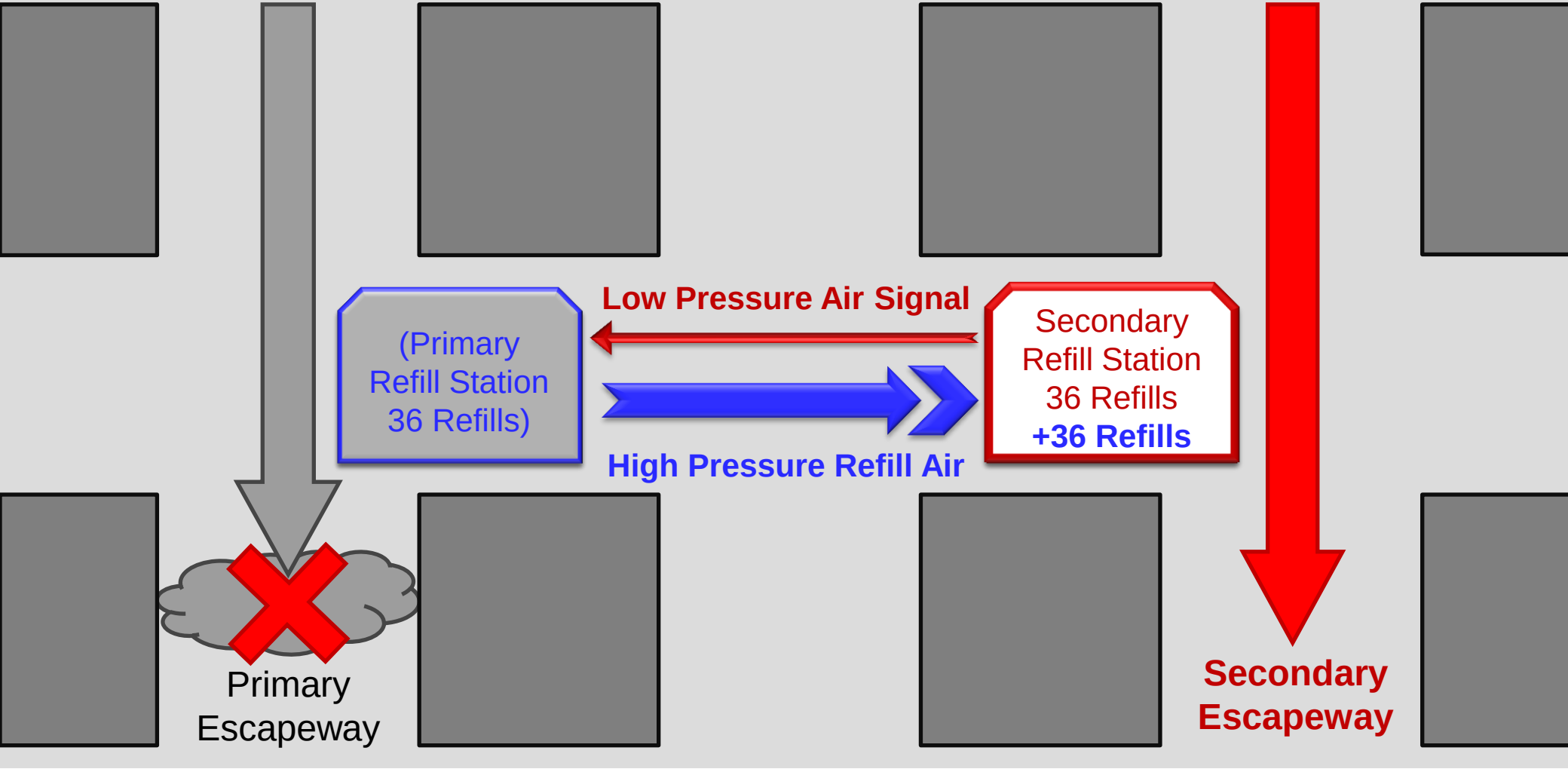
Remotely Activated Panel

- RAPidAir is a new technology which pneumatically connects refill stations in primary and secondary escapeways.
- It allows the primary and secondary refill stations to remotely activate each other, to share high-pressure breathing air.
- It increases safety by doubling available capacity and drastically enhancing fill speeds.

Scenario #1: Escape using the primary escapeway (secondary station air is avail.)



Scenario #2: Primary Escapeway becomes impassable (system is bi-directional)



Future Developments: RAPidAir

The benefit of this connection and remote activation is two-fold:

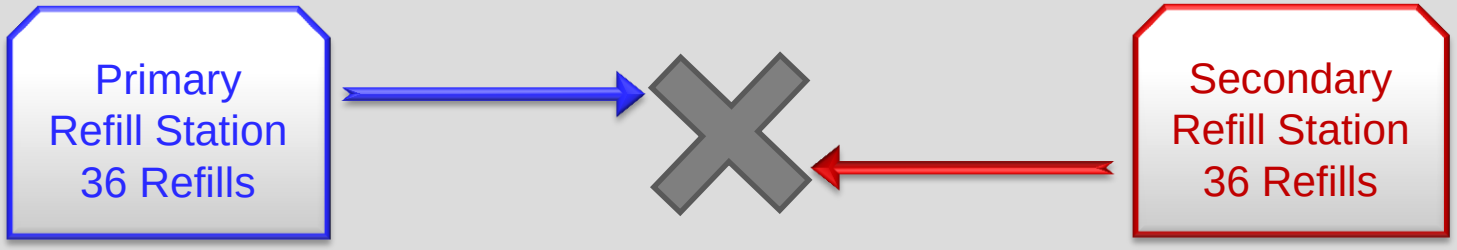
- **Increased refill capacity:** Miners refilling at either station have access to the air stored in both stations. This "back-up" volume of air **doubles** the refill capacity at either station.

- **Decreased Refill Time:** Since the volume of air available has increased, the SCBA refill times are enhanced. Refill station performs **EACH** of it's 36 rated refills in less than **65 seconds** per SCBA.

Future Developments: RAPidAir

The features of the RAPidAir system make it safe:

- Lines remain **unpressurized** until activated. In the event of damage to the lines (e.g. - roof-fall, fire, puncture, accidental disconnect, etc.) no pressurized breathing air is released.
- Signal air is controlled by individual refill station operators – **only** activated by operators, and can be shut-off at any time.
- Check valves prevent back-flow of air – refill stations **cannot** lose capacity when connected.



Future Developments: Firefighting Efforts

- SCBA technology offers a clear advantage to fire brigades

- ChargeAir enhances that system by enabling firefighters to quickly and safely refill without removing respiratory protection.

Future Developments: Firefighting Efforts

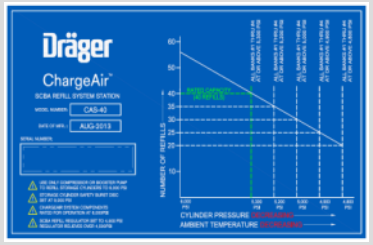
- Storage equipment for essential equipment and tools.

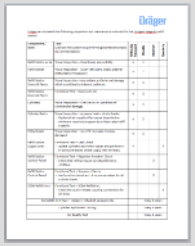
Future Developments: Enhanced Product Standardization

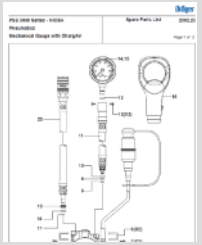
- Evolving technology and evolving applications comes with an evolving need for standardization in codes, and areas of “common practice”.

Future Developments: Enhanced Product Standardization

- Dräger is working towards product development in this area which enhances ChargeAir and SCBA as life-saving devices.
  - ANSI standards for signage on emergency and life-saving equipment.
  - Working with approval agencies, assisting in testing, usability studies.
  - Developing industry standards for system capacities and ratings, inspection schedules, and maintenance requirements.







- The larger goal is to find guidelines and standards surrounding the technology that make it safer.

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Thank you for your attention.