

# Know your underground enemies

## Environmental and atmospheric hazards of subterranean (Sub-T) operations

Explosive and/or toxic gases and lack of breathable air are potential hazards when entering a subterranean environment.

CO is a colorless, tasteless gas that accumulates in Sub-T areas and displaces oxygen. A byproduct of combustion, CO levels in Sub-T environments can quickly rise to toxic levels during controlled demolition or with use of internal combustion engines.

**CARBON MONOXIDE**  
(CO)

**OXYGEN**  
(O<sub>2</sub>)

Because many toxic gases can displace oxygen, O<sub>2</sub> levels must be constantly monitored. Insufficient oxygen can be immediately life threatening or contribute to hypoxia, cognitive decline, and reduced physical ability.

This highly toxic gas is a byproduct of internal combustion engines, explosives, and gas stoves. It's the most toxic of all gases formed during the detonation of explosives, so monitoring before and after controlled detonations is crucial.

**NITROGEN DIOXIDE**  
(NO<sub>2</sub>)

**CARBON DIOXIDE**  
(CO<sub>2</sub>)

This colorless, tasteless gas accumulates in Sub-T areas, displacing oxygen, and is toxic at high levels. At low concentrations it can dramatically affect cognitive and physical abilities. A natural byproduct of breathing, even small increases in the number of people in a confined space can dramatically affect CO<sub>2</sub> levels.

This highly flammable, colorless gas smells like rotten eggs. A byproduct of the breakdown of organic matter, it is heavier than air and collects in low places. Exposure at low levels can cause burning of the respiratory tract and eyes. At high concentrations, the ability to smell the gas can be instantly lost and it can be lethal in seconds.

**HYDROGEN SULFIDE**  
(H<sub>2</sub>S)



**METHANE**  
(CH<sub>4</sub>)

This colorless, odorless gas is extremely flammable and accumulates in Sub-T areas, displacing oxygen. If the ratio of methane to oxygen reaches a certain level, the mixture can ignite and explode if exposed to an ignition source. The Lower Explosive Limit (LEL) of methane is the minimum concentration of methane in air that will ignite and continue burning on its own. Monitoring for the presence of a broad range of flammable gases/vapors relative to their LEL is critical for sustained operational safety.


# Protect the force, protect the mission.

Dräger's portable gas detection equipment can help detect, avoid, and mitigate risks posed by environmental hazards in subterranean environments. These devices detect the most commonly occurring toxic and explosive gases/vapors. Real-time monitoring helps you identify and address atmospheric threats and determine if protective equipment is needed.

## COMPARISON CHART

FEATURES	 D-23637-2009 Dräger X-am® 5600	 D-14344-2017 Dräger X-am® 8000
<b>Available sensor channels</b>	1 High power port 3 Electrochemical	2 High power ports 3 Electrochemical
<b>Photo Ionization Detector (PID)</b> Capable of detecting numerous volatile organic compounds (VOCs) and flammable/explosive gases and vapors below LEL thresholds. Does not detect methane (CH <sub>4</sub> )	None	<b>PID HC, PN: 6813475</b> 10.6 eV Lamp 0-2000 ppm
<b>Flammable/explosive gas (LEL)</b> Detects a wide variety of flammable gases and vapors relative to their LEL. Detects methane (CH <sub>4</sub> )	<b>Dual IR EX/CO<sub>2</sub>, PN: 6851880</b> Dual sensor functions as an LEL and CO <sub>2</sub> sensor, maximizing the number of detected hazards 0-100% LEL (resolution 1% LEL) 0-100 Vol.-% CH <sub>4</sub> (resolution 0.1 Vol.-%)	
<b>Carbon dioxide (CO<sub>2</sub>)</b>	0-5% Vol CO <sub>2</sub> (resolution .01 Vol.-%)	
<b>Hydrogen sulfide (H<sub>2</sub>S)</b>	<b>Dual H<sub>2</sub>S / CO sensor, PN: 6813280</b> 0-100 PPM H <sub>2</sub> S (resolution 0.1ppm)	
<b>Carbon monoxide (CO)</b>	0-2000 PPM CO (resolution 1 ppm)	
<b>Oxygen (O<sub>2</sub>)</b>	<b>XXS O<sub>2</sub>, PN: 6810881</b> 0-25 Vol.-% (resolution .1 Vol.-%)	
<b>Nitrogen dioxide (NO<sub>2</sub>)</b>	<b>XXS NO<sub>2</sub>, PN: 6810884</b> 0-50 ppm (resolution 0.1ppm)	
<b>Pump for confined space entry</b>	External (Optional)	Internal
<b>Integrated Bluetooth and app integration for data sharing</b>	No	Yes (Can be enabled/disabled)
<b>Single-button activation</b>	Yes	Yes
<b>Can be programmed for silent operation</b>	No	Yes
<b>Size (W x H x D) / weight (oz.)</b>	1.8" x 5.1" x 1.2" / 8.8 oz. (Without pump)	3" x 7" x 1.6" / 19 oz.

## ACCESSORIES

 D-11855-2016 Dräger X-am® Mark II Pump	 D-4630-2019 Dräger X-dock® 6600	 D-4843-2017 Telescoping and Floating Probes
Optional external pump for clearance measurements (X-am® 5600)	Bump testing, calibration and program management at the device level (X-am® 5600 and X-am® 8000)	For confined space entry gas detection (X-am® 5600 and X-am® 8000)

# Protect the force, protect the mission.

Dräger's breathing protection equipment can provide protection when risks posed by environmental hazards in subterranean environments are detected. This equipment can protect the user against toxic gases/vapors. Quick connections and booster pumps can provide air when its needed for extended periods of time.

## BREATHING PROTECTION EQUIPMENT CHART



### FEATURES OF PSS BG 4 PLUS

Dräger PSS® BG 4 plus

	Specially designed for demanding tasks, the Dräger PSS® BG 4 plus closed-circuit breathing apparatus combines uncompromising safety with outstanding respiratory protection and wearer comfort. Innovative in design, it provides the wearer with up to four hours of breathing air in toxic environments.
<b>Optimized in conjunction with our customers</b>	Modifications to the proven Dräger PSS® BG 4 are the result of practical experience and constant monitoring to ensure the highest quality standards.
<b>Excellent for extended use</b>	The positive pressure breathing circuit protects the wearer by preventing hazardous substances from entering the sealed breathing system. Depending on the application, the apparatus can be used for up to four hours. A CO <sub>2</sub> absorber removes carbon dioxide from the exhaled air, while the breathing air is simultaneously enriched with oxygen from the oxygen cylinder.
<b>Proven wearer comfort</b>	The ergonomically shaped carrying plate, lightweight harness with adjustable shoulder straps, and easy-to-use "pull-forward" design provide more freedom of movement with less effort. Routing of the breathing hose across the shoulders ensures optimum balance on the wearer's back.
<b>All functions at a glance</b>	The Dräger PSS® BG 4 plus is equipped with the Dräger Sentinel II signal and warning unit. Controlled via large push buttons, it provides a multitude of functions. During use it quickly provides the wearer with important information, thereby reducing potential risk. Battery warning thresholds indicate current battery status.

## SUB-T SUPPORT EQUIPMENT

ST-6233-2007



Dräger K-Kart II

Transports air cylinders, providing a portable source of safe breathing air.



Dräger Cascade Breathing Air System

Expandable system provides breathing air for up to four respirators.



Dräger DOB 200 ECO

A highly mobile, efficient filling station for all common oxygen cylinders. Its compact design with rolling wheels makes it easy to transport, while the robust housing protects contents from damage. The automated filling procedure saves time and effort.



Dräger RZ 7000

With the Dräger RZ 7000 you can carry out the function and leak tests of the Dräger PSS® BG 4 plus easier and faster than ever before.

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**CORPORATE HEADQUARTERS**

Drägerwerk AG & Co. KGaA  
Moislinger Allee 53–55  
23558 Lübeck, Germany

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

**USA**

Draeger, Inc.  
7256 S. Sam Houston Parkway W.,  
Suite 100  
Houston, TX 77085  
1 800 4DRAGER  
(1 800 437 2437)

Locate your Regional Sales  
Representative at:  
[www.draeger.com/contact](http://www.draeger.com/contact)

