MACURCO
GAS DETECTION

GAS STORAGE:
FIXED GAS DETECTION APPLICATION GUIDE

This publication is intended to serve as a guideline for the use of Macurco products. It is not to be considered all-inclusive, nor is it intended to replace the policy and procedures for any facility. If there are any doubts about the applicability of the equipment to your situation, consult an industrial hygienist or call Macurco Technical Service at 1-877-367-7891

Made in the USA

MACURCO
GAS DETECTION

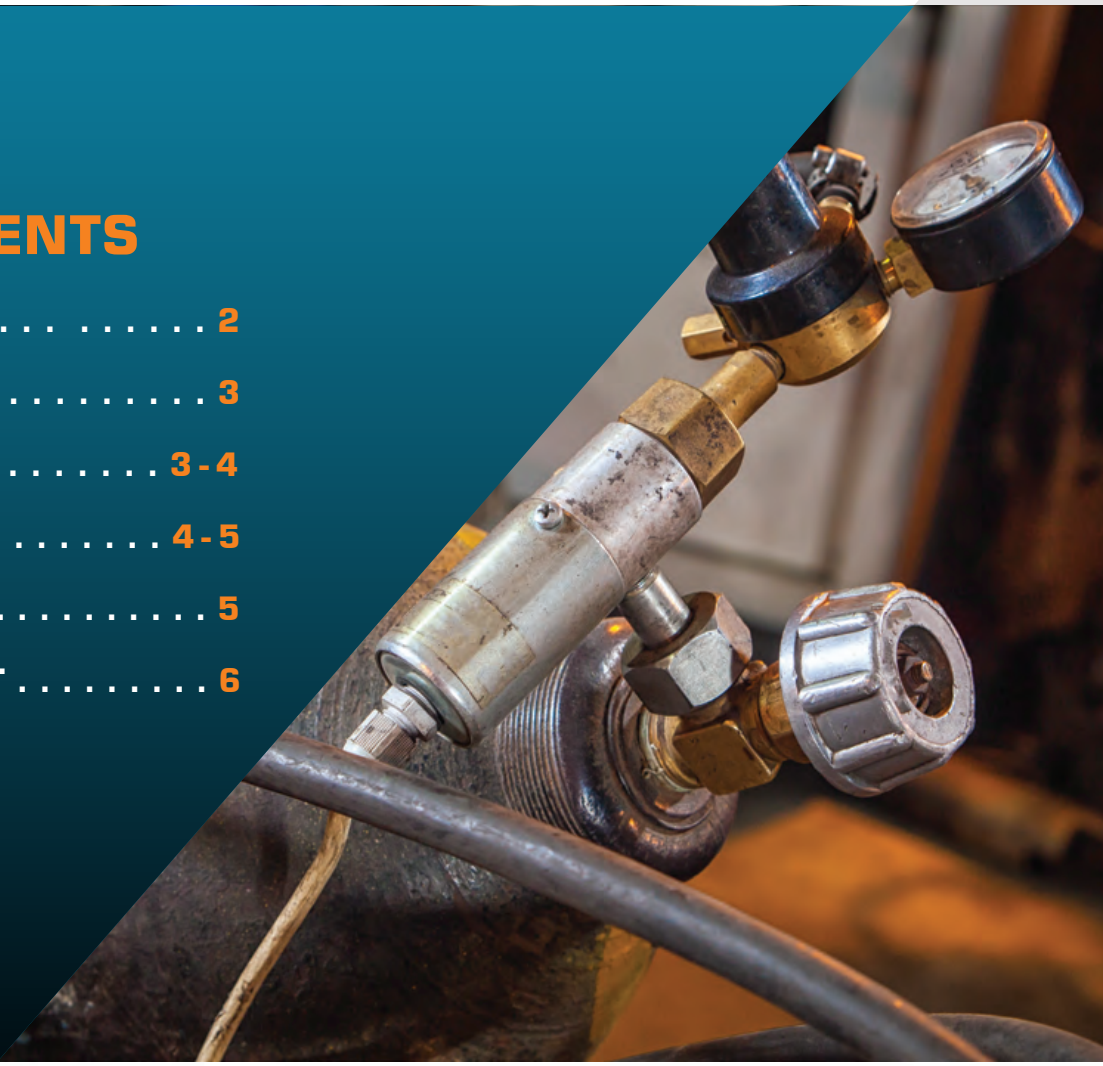


TABLE OF CONTENTS

GAS DETECTION 101

FLAMMABLE

- Having the right combination of an ignition source, oxygen, and fuel in a gas or vapor form provides for the necessary means to create a fire or explosion.
- The minimum concentration of combustible gas or vapor necessary to support its combustion in air is defined as the Lower Explosive Limit (LEL). Below this level, the gas mixture is too "lean" to burn.
- The maximum concentration of a gas or vapor that will burn in the air is defined as the Upper Explosive Limit (UEL). Above this level, the mixture is too "rich" to burn.
- The range between the LEL and UEL is known as the flammable range for that gas or vapor.
- Gases such as Methane, Hydrogen, Propane.

TOXIC

- Some gases are poisonous and are dangerous to life at very low levels. Some toxic gases have distinct odors (H_2S, NH_3) and others have no odors at all (CO).
- Very low levels inhaled, ingested, or absorbed through the skin pose adverse effects from exposure.
- Gases such as Carbon Monoxide, Nitrogen Dioxide, Ammonia, Hydrogen Sulfide.

ASPHYXIANT OR OXYGEN DEPLETING

- Where Oxygen levels are too rich, environments have the potential to become an explosive environment.
- Where Oxygen levels are too low, people within the environment can succumb to asphyxiation.
- Gases such as Carbon Dioxide, Nitrogen, Helium, Argon.

IMPORTANCE OF A FIXED GAS DETECTION SYSTEM

- **Protection of people and property 24 / 7 / 365**
- **Advance notification**
- **Explosion prevention**
- **Low-cost investment to help prevent accidents**

POPULAR GASES STORED IN TANKS / DEWARS

Gas	Ambient Air	Argon	Helium	Nitrogen	Carbon Dioxide	Oxygen	Hydrogen	Methane	Propane	Acetylene
Chemical Symbol	-	Ar	He	N_2	CO_2	O_2	H_2	CH_4	C_3H_8	C_2H_2
Color	Colorless	Colorless	Colorless	Colorless	Colorless	Colorless	Colorless	Colorless	Colorless	Colorless
Smell	Odorless	Odorless	Odorless	Odorless	Odorless	Odorless	Odorless	Odorless	Odorless	Odorless
Molecular Weight	29	39.95	4.02	28.02	44.01	32	2	16	44.1	26
Vapor Density (kg/m³)	1.205	1.661	.0664	1.165	1.842	1.331	.0899	.55	1.882	1.092
% in Atmosphere	100%	.934%	.00052%	78.084%	.0310%	20.948%	.000050%	.0002%	NA	NA
Risks	NA	Asphyxiant	Asphyxiant	Asphyxiant	Asphyxiant/Toxic	Oxidizer	Flammable	Flammable	Flammable	Flammable
LEL %	NA	NA	NA	NA	NA	NA	4	5	2.1	2.5
UEL %	NA	NA	NA	NA	NA	NA	75	15	9.5	100
Recommended Detector Mounting Height	NA	Breathing level 4-6 ft. from the floor	Breathing level 4-6 ft. from the floor	Breathing level 4-6 ft. from the floor	Roughly 12" from the floor	Breathing level 4-6 ft. from the floor	Roughly 12" from the ceiling	Roughly 12" from the ceiling	Roughly 12" from the floor	Breathing level 4-6 ft. from the floor

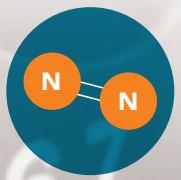
ASPHYXIANT GASES

ASPHYXIANT – A nontoxic or minimally toxic gas that reduces or displaces the normal oxygen concentration in breathing air. **Breathing of oxygen-depleted air can lead to death by asphyxiation.**

Concentration of Diluting Gas	Resulting Oxygen Concentration
.50%	20.8%
1%	20.7%
5%	19.9%
10%	19%
15%	18.2%
20%	17.4%
25%	16.7%

ARGON (Ar) – Argon is the most prevalent noble (inert) gas in the atmosphere. Argon is a key gas used in the welding process as it is non-reactive and non-toxic. It acts as a shielding agent to prevent the melting metals from coming in contact and reacting with other gases in the air. It also provides stability of the arc. **The concern with Argon is a potential build-up or leak that would displace the oxygen in an unventilated area.**

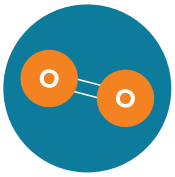
HELIUM (He) – Helium is the second lightest and second most abundant element in the observable universe behind Hydrogen. Helium in liquefied form is used in cryogenic processes, pressurizing and purge gas, and as a protective atmosphere for arc welding. **Helium is also an oxygen displacement gas that is unsafe in an unventilated area.**



NITROGEN (N_2) – Like Argon, Nitrogen is also used in the welding process as a purge gas but is also used for many other applications: preservation of food, use in pharmaceuticals, manufacturing processes, used in electronics manufacturing, chemical blanketing, controlling oxygen levels, laser cutting, cryogenic processes and many more. **As a non-toxic, non-flammable gas Nitrogen is an asphyxiant.**

CARBON DIOXIDE (CO_2) – Is produced by all aerobic organisms through the respiratory process. It is a versatile industrial material used in many different processes and products. **CO_2 is both an asphyxiant and a toxic gas.**

CO_2 PPM (% by volume)	Health Effects and Symptoms
350–450PPM (.035–.045%)	Fresh outdoor air.
400–1,000PPM (.04–.1%)	Indoor occupied spaces with good air exchange.
1,000–2,000PPM (.1–.2%)	Complaints of drowsiness and poor air.
2,000–5,000PPM (.5–.5%) Permissible Exposure Limit (PEL): 5,000 avg./8 hrs.	Headaches and sleepiness; stagnant, stale, and stuffy air. Poor concentration, loss of attention, increased heart rate, and slight nausea may be present.
>5,000PPM (.5%) avg./8 Hrs.	This indicates unusual air conditons where high levels of other gases also could be present. Toxicity or oxygen deprivation could occur. This is the permissible exposure limit (PEL) for daily workplace exposures.
30,000PPM (3%) Short Term Exposure Limit (STEL): 15 min.	Moderate respiratory stimulation, increased heart rate, and blood pressure.
>40,000PPM (4%) Immediately Dangerous to Life or Health (ILDH)	Exposure may lead to serious oxygen deprivation resulting in permanent brain damage, coma, or death.
50,000PPM (5%)	Strong respiratory stimulation, dizziness, confusion, headache, and shortness of breath.
80,000PPM (8%)	Dimmed sight, sweating, tremor, unconsciousness, and possible death.



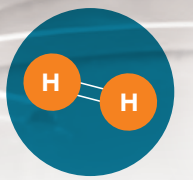
OXYGEN (O_2) – An essential element in the respiratory process for most living cells and combustion processes. Too little or too much oxygen can be dangerous. **Oxygen is an oxidizer, which is a type of chemical which a fuel requires to burn.**

O_2 (% by volume)	Health Effects and Symptoms
>24	Items such as clothing can spontaneously combust.
>22	Enriched O_2 environment, increased risk for fire or explosion.
21–22	Slightly enriched environment.
20.8–21	Normal atmosphere levels.
19.5–20.7	Slight deficient O_2 environment.
12–19.5	Less than 19.5% O_2 is defined by OSHA as a deficient atmosphere. No discernible symptoms can be detected by the individual. A risk assessment must be undertaken to understand the cause and determine whether it is safe to continue working. Reduction of physical and intellectual performance without the sufferer being aware.
12–18	Reduction of physical and intellectual performance without the sufferer being aware.
10–12	Disturbed respiration, poor circulation, worsening fatigue & loss of critical faculties, symptoms occur within seconds to minutes. Possibility of fainting within a few minutes without prior warning. Risk of death below 11%.
6–10	Nausea, vomiting, inability to move, loss of consciousness, and death. Resuscitation possible if carried out immediately.
0–6	Convulsions, gasping respiration, cessation of breathing, and cardiac arrest. Symptoms are immediate and death occurs within minutes. Fainting is almost immediate. Brain damage even if rescued.

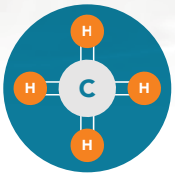
COMBUSTIBLE GASES

LEL – LOWER EXPLOSIVE LIMIT – The lowest concentration by the percentage of a gas in air that is capable of producing a flash or fire in the presence of an ignition source.

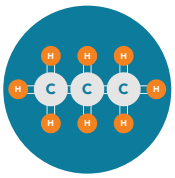
UEL – UPPER EXPLOSIVE LIMIT – The maximum concentration of a gas or vapor that will burn in the air.



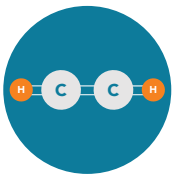
HYDROGEN (H_2) – Hydrogen is the lightest element and the most abundant chemical substance in the universe. It is used as clean energy in many applications and is a **highly combustible gas.**



METHANE (CH_4) – Methane is single carbon alkaline and the main constituent of natural gas (roughly 95%) and is used as **a common fuel source in many types of applications.**



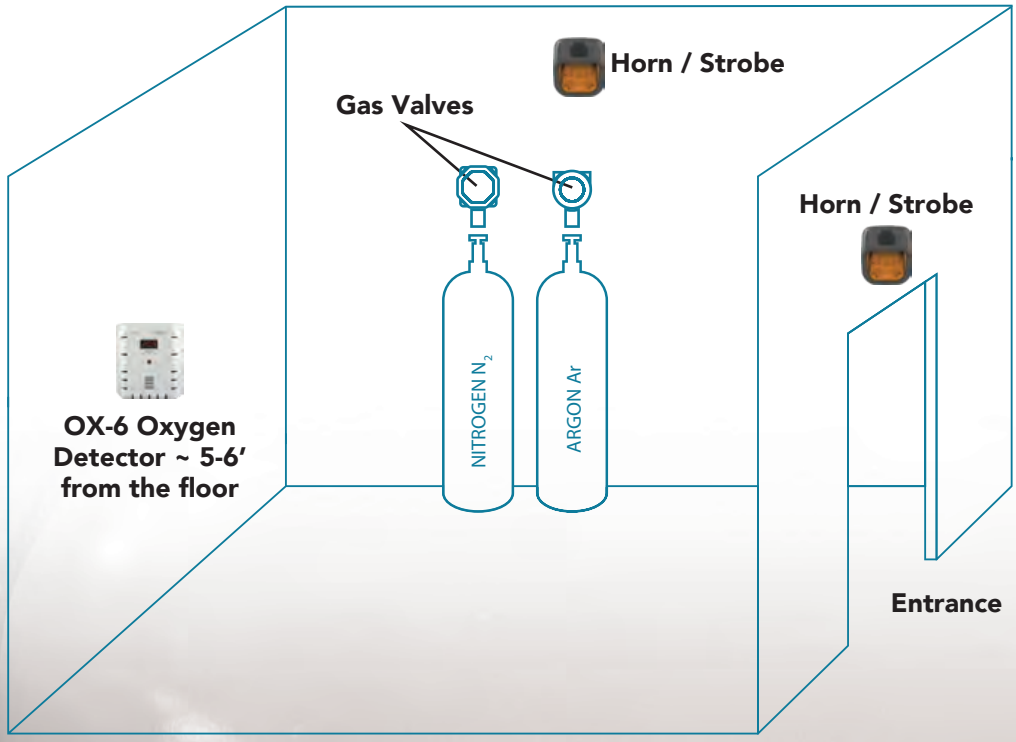
PROPANE (C_3H_8) – Propane is a three-carbon alkaline is produced as a by-product of two other processes, natural gas processing, and petroleum refining. **Propane is used as a fuel source for domestic, industrial, and transportation applications.**



ACETYLENE (C_2H_2) – Acetylene is unstable in pure form and is usually handled as a solution. **A significant source of acetylene is utilized for gas welding and cutting applications due to the high temperature of the flame.**

EXAMPLE INERT GAS STORAGE

In this example, there is a high risk of asphyxiation in the small room in the event of a gas leak. With an oxygen detector mounted roughly 5-6 feet from the floor centrally in the room and notification devices both in the room and outside prior to entering in the event of a low oxygen reading. This will minimize the risk of a dangerous event.



SELECTING THE RIGHT PRODUCT

- **What is the application?**
- **What are the gases of concern?**
- **What is the source of the gas?**
- **Is the area classified?**
- **What is the size of the room?**
- **What do you want accomplished for low level and high-level alarms?**
- **Do you need visual/audio notification?**
- **Do you need a control panel for your system?**
- **Do not forget your calibration/test kit.**

	Non-classified 6 & 12 Series	Class 1 Division 2 TXP-T40 Poly	Class 1 Division 1 TXP-T40 AL or SS
GAS DETECTORS			
NOTIFICATION			
OTHER ITEMS			Panels, Calibration Kits, Power Supplies

MAINTENANCE

DEMONSTRATION AND TRAINING

Inspect the components, equipment installation, and electrical connections for compliance with requirements. Test the alarm setpoints of the gas detection system with calibration and test gases and verify the sequence of operation. Perform demonstrations and train maintenance personnel to adjust, operate, troubleshoot, calibrate and maintain the gas detection and control systems. **Calibration and test kits should be provided with the gas detection system.** Calibration and test intervals must comply with the manufacturer's recommendations. If required, prepare a written report to record test procedures, test results, and corrective actions. The report should also cover the requirements for accessories like the acceptability of alarm types, signs, and protective equipment. **Any repair or replacement of malfunctioning units should be performed by Macurco.**

MACURCO
GAS DETECTION

Celebrating 50 years of gas detection, the Macurco product line offers equipment for residential, commercial, and industrial applications. Since 1972 Macurco has been providing detection options for a number of different gases including carbon monoxide (CO), nitrogen dioxide (NO_2), hydrogen (H_2), propane (LP), methane (natural gas), hydrogen sulfide (H_2S), ammonia (NH_3), oxygen (O_2), carbon dioxide (CO_2), and refrigerants.

Headquartered in Sioux Falls, South Dakota, Aerionics manufactures Macurco Gas Detection products. Aerionics strives to provide the highest quality detection, safety and security solutions to customers worldwide. Whether you are looking for gas detection for a security system, building automation, or HVAC system, for personal safety or for monitoring specific gases in potentially hazardous environments, Macurco has a gas detector to meet your needs.

GAS DETECTION IS ALL WE DO, AND WE DO IT BEST.

Visit **www.macurco.com** for additional product information and training.

Find us on Facebook
www.facebook.com/macurcogasdetection

LinkedIn
www.linkedin.com/company/macurco-gas-detection

Manufactured by Aerionics, Inc. Sioux Falls, SD
Phone: 1- 877-367-7891 - Email: info@macurco.com - www.macurco.com