

# COMPRESSED GAS CYLINDERS

## Handling

- Cylinders, whether full or empty, will not be used as rollers or supports.
- No person other than the gas supplier will attempt to mix gases in a cylinder.
- No one except the owner of the cylinder or person authorized by him will refill a cylinder.
- No one will use a cylinder's contents for purposes other than those intended by the supplier.
- All cylinders used will meet the Department of Transportation requirements published in 49 CFR Part 178, Subpart C, and Specification for Cylinders.
- No damaged or defective cylinder will be used.

## Placement

- Cylinders will be kept far enough away from the actual welding or cutting operation so that sparks, hot slag, or flame will not reach them. When this is impractical, fire resistant shields will be provided.
- Cylinders will be placed where they cannot become part of an electrical circuit.
- Electrodes will not be struck against a cylinder to strike an arc.
- Fuel gas cylinders will be placed with valve end up whenever they are in use.
- They will not be placed in a location where they would be subject to open flame, hot metal, or other sources of artificial heat.
- Cylinders containing oxygen or acetylene or other fuel gas will not be taken into confined spaces.

## Transporting, Moving, and Storing

- Valve protection caps will be in place and secured.
- When cylinders are hoisted, they will be secured on a cradle or slingboard.
- They will not be hoisted or transported by means of magnets or choker slings.
- Cylinders will be moved by tilting and rolling them on their bottom edges.
- When cylinders are transported by powered vehicles, they will be secured in a vertical position.
- Valve protection caps will not be used for lifting cylinders from one vertical position to another.
- Bars will not be used under valves or valve protection caps to pry cylinders loose when frozen. Warm, not boiling, water will be used to thaw cylinders loose.
- Unless cylinders are firmly secured on a special carrier intended for this purpose, regulators will be removed and valve protection caps put in place before cylinders are moved.

- A suitable cylinder truck, chain, or other steadying device will be used to keep cylinders from being knocked over while in use.
- When work is finished, when cylinders are empty, or when cylinders are moved at any time, the cylinder valve will be closed.
- Compressed gas cylinders will be secured in an upright position at all times except, if necessary, for short periods of time while cylinders are actually being hoisted or carried.
- Oxygen cylinders in storage will be separated from fuel-gas cylinders or combustible materials (especially oil or grease), a minimum distance of 20 feet or by a noncombustible barrier at least 5 feet high having a fire-resistance rating of at least one-half hour.
- Inside of buildings, cylinders will be stored in a well-protected, well-ventilated, dry location, at least 20 feet from highly combustible materials such as oil or excelsior. Cylinders should be stored in definitely assigned places away from elevators, stairs, or gangways. Assigned storage places will be located where cylinders will not be knocked over or damaged by passing or falling objects, or subject to tampering by unauthorized persons. Cylinders will not be kept in unventilated enclosures such as lockers and cupboards.

### **Drivers**

- Extreme care needs to be taken when moving oxygen or compressed gas cylinders.
- Driving in traffic requires complete concentration and awareness of the other drivers on the road.
- Each employer is required to determine that oxygen or compressed gas cylinders under his control are in a safe condition to the extent that this can be determined by visual inspection.
- Visual and other inspections are required to be conducted as prescribed in the Hazardous Materials Regulations of the Department of Transportation.
- Where those regulations are not applicable, visual, and other inspections are required to be conducted in accordance with the Compressed Gas Association.
- When transporting oxygen or compressed gas cylinders in a horizontal position, special compartments, racks, or adequate blocking must be provided to prevent cylinder movement.
- Regulators are required to be removed or guarded before a cylinder is transported unless the cylinders are secured on a special truck.
- Valve-protection caps are designed to protect cylinder valves from damage.
- Cylinders must not be dropped, struck, or permitted to strike each other violently.
- Rough handling, knocks, or falls are liable to damage the cylinder, valve, or safety devices and cause leakage.
- All portable cylinders used for the shipment of compressed gases must be constructed and maintained in accordance with the regulations of the U.S. Department of Transportation.
- Compressed oxygen or compressed gas cylinders must be legibly marked, for the purpose of identifying the content.
- Such markings are required to be by means of stenciling, stamping, or labeling, and must not be readily removable.
- Whenever practical, the marking must be located on the shoulder of the cylinder.
- This method conforms to the American National Standard Method for Marking Portable Compressed Gas Containers to Identify the Material Contained.

- When loading or moving cylinders by a crane or derrick; a cradle, or suitable platform must be used.
- Slings or electric magnets must not be used for this purpose. Valve-protection caps, where the cylinder is designed to accept a cap, must always be in place.
- All cylinders with a water weight capacity of over 30 pounds (13.6 kg) are required to be equipped with the means of connecting a valve protection cap, collar, or recess to protect the valve.
- Valve-protection caps must not be used for lifting cylinders from one vertical position to another. Bars must not be used under valves or valve-protection caps to pry cylinders loose when frozen to the ground or otherwise fixed. The use of warm (not boiling) water is recommended.
- Cylinder valves of empty and full cylinders must be closed before moving cylinders. Never use cylinders as rollers or supports, whether full or empty.
- Do not tamper with the numbers and markings stamped into the cylinders.
- No one must tamper with the safety devices on the cylinders or valves.
- No one, except the owner of the cylinder or a person authorized by him, shall refill a cylinder.
- A warning should be placed near cylinders having leaking fuse plugs, or other leaking safety devices; letting personnel know not to approach them with any source of ignition. Such cylinders should be plainly tagged and the supplier should be promptly notified and all instructions followed as to their return.
- Oxygen cylinders must not be kept near highly combustible material, especially oil and grease, or near any other substance likely to cause or accelerate fire. Make sure all cylinders are kept away from any source of heat.

**Stay alert when driving.** Make sure there is enough room ahead and behind to pass or stop safely.

- Leave enough space between you and the vehicle ahead of you to allow for a sudden stop. If you are following too closely, you may not be able to stop in time.
- Remember, you can help the driver behind you maintain a safe following distance by driving at a constant speed and using your signaling maneuvers in advance.
- Check the brakes, lights, signal indicators, and tires daily before heading out on the road.
- Always be aware of safety when driving in traffic; in the city or out on the highway.
- Use all safety precautions when loading and unloading the cylinders.

### **Use of Fuel Gas**

**All employees will be thoroughly instructed in the safe use of fuel gas, as follows:**

- Before a regulator to a cylinder valve is connected, the valve will be opened slightly and closed immediately. (This action is generally termed "cracking" and is intended to clear the valve of debris that might otherwise enter the regulator.)
- The valve of a fuel gas cylinder will not be cracked where the gas would reach welding work, sparks, flame, or other possible sources of ignition.
- The cylinder valve will always be opened slowly to prevent damage to the regulator.
- For quick closing, valves on fuel gas cylinders will not be opened more than one and a half turns.
- When a special wrench is required, it will be left in position on the stem of the valve while the cylinder is in use so that the fuel gas flow can be shut off quickly in case of an emergency.

- In the case of manifold or coupled cylinders, at least one such wrench will always be available for immediate use.
- Nothing will be placed on top of a fuel gas cylinder, when in use, which may damage the safety device or interfere with the quick closing of the valve.
- Fuel gas will not be used from cylinders through torches or other devices which are equipped with shutoff valves without reducing the pressure through a suitable regulator attached to the cylinder valve or manifold.
- Before a regulator is removed from a cylinder valve, the cylinder valve will always be closed and the gas released from the regulator.
- If, when the valve on a fuel gas cylinder is opened, there is found to be a leak around the valve stem, the valve will be closed and the gland nut tightened. If this action does not stop the leak, the use of the cylinder will be discontinued, and it will be properly tagged and removed from the work area.
- In the event that fuel gas should leak from the cylinder valve, rather than from the valve stem, and the gas cannot be shut off, the cylinder will be properly tagged and removed from the work area.
- If a regulator attached to a cylinder valve will effectively stop a leak through the valve seat, the cylinder need not be removed from the work area.
- If a leak should develop at a fuse plug or other safety device, the cylinder will be removed from the work area.

### **Fuel Gas and Oxygen Manifolds**

- Fuel gas and oxygen manifolds will bear the name of the substance they contain in letters at least 1-inch high which will be either painted on the manifold or on a sign permanently attached to it.
- Fuel gas and oxygen manifolds will be placed in safe, well ventilated, and accessible locations.
- They will not be located within enclosed spaces.
- Manifold hose connections, including both ends of the supply hose that lead to the manifold, will be such that the hose cannot be interchanged between fuel gas and oxygen manifolds and supply header connections.
- Adapters will not be used to permit the interchange of hose. Hose connections will be kept free of grease and oil.
- When not in use, manifold and header hose connections will be capped.
- Nothing will be placed on top of a manifold, when in use, which will damage the manifold or interfere with the quick closing of the valves.

### **Hoses**

- Fuel gas hose and oxygen hose will be easily distinguishable from each other.
- The contrast may be made by different colors or by surface characteristics readily distinguishable by the sense of touch.
- Oxygen and fuel gas hoses will not be interchangeable.
- A single hose having more than one gas passage will not be used.
- When parallel sections of oxygen and fuel gas hose are taped together, not more than 4 inches out of 12 inches will be covered by tape.
- All hose in use, carrying acetylene, oxygen, natural or manufactured fuel gas, or any gas or substance which may ignite or enter into combustion, or be in any way harmful to employees, will be inspected at the beginning of each working shift. Defective hose will be removed from service.

- Hose which has been subject to flashback, or which shows evidence of severe wear or damage, will be tested to twice the normal pressure to which it is subject, but in no case less than 300 psi.
- Hose couplings will be of the type that cannot be unlocked or disconnected by means of a straight pull without rotary motion.
- Hoses, cables, and other equipment will be kept clear of passageways, ladders, and stairs.

### **Torches**

- Clogged torch tip openings will be cleaned with suitable cleaning wires, drills, or other devices designed for such purpose.
- Torches in use will be inspected at the beginning of each working shift for leaking shutoff valves, hose couplings, and tip connections.
- Torches will be lighted by friction lighters or other approved devices, and not by matches or from hot work. Defective torches will not be used.
- Oxygen and fuel gas pressure regulators, including their related gauges, will be in proper working order while in use.

### **Oil and Grease Hazards**

- Oxygen cylinders and fittings will be kept away from oil or grease.
- Cylinders, cylinder caps and valves, couplings, regulators, hose, and apparatus will be kept free from oil or greasy substances and will not be handled with oily hands or gloves.
- Oxygen will not be directed at oily surfaces, greasy clothes, or within a fuel oil or other storage tank or vessel.

### **Manifolds**

- Fuel gas and oxygen manifolds must bear the name of the gas they contain.
- Fuel gas and oxygen manifolds must not be placed in confined spaces, but will be placed in safe, well ventilated, and accessible locations.
- Hose connections must be made so they cannot be interchanged between fuel gas, oxygen manifolds, and supply header connections. Keep hose connections free of grease and oil, and do not use adapters to interchange hoses.
- Manifold and header hose connections must be capped when not in use.
- Nothing may be placed on manifolds that will damage the manifold or interfere with the quick closing of the valves.

### **Fire Protection**

**Objects to be welded, cut, or heated must be moved to a designated safe location. If the object cannot be easily moved, all moveable fire hazards will be moved or protected.**

- If the object to be welded, cut, or heated cannot be moved and if all the fire hazards cannot be removed, positive means must be taken to confine the heat, sparks, and slag, and to protect the immovable fire hazards from them.
- Welding, cutting, or heating must not be performed in the presence of flammable paints, flammable compounds, or heavy dust concentrations.
- Fire extinguishers must be immediately available in the work area, free of obstruction, and maintained for instant use.

- When normal fire prevention precautions are not sufficient for the welding, cutting, or heating operation the "Hot Work Supervisor" will assign a fire watch. Sufficient amount of time must be allowed after completion of work to ensure that the possibility of fire does not exist. The designated fire watch must be trained in fire fighting equipment.
- Gas supplies must be shut off during lunch breaks, overnight, or during shift breaks. Hoses and torches must be removed from confined spaces.

### **Fumes and Gases (MIG and TIG Welding)**

- Welding produces fumes and gases.
- Breathing these fumes and gases can be hazardous to your health. Keep your head out of the fumes.
- When inside, ventilate the area and use local forced ventilation at the arc to remove fumes and gases.
- When ventilation is poor, wear an air-supplied respirator.
- Work in a confined space only if it is well ventilated, or while wearing an air supplied respirator. Always have a trained watchperson nearby.
- Welding fumes and gases can displace air and lower the oxygen level causing injury or death. Be sure the breathing air is safe.
- Read and understand the Material Safety Data Sheets (MSDSs) and the manufacturer's instructions for metals, consumables, coatings, cleaners, and degreasers.
- Do not weld near degreasing, cleaning, or spraying operations. The heat and rays of the arc can react with vapors to form toxic gases.
- Do not weld on coated metals, such as galvanized, lead, or cadmium plated steel, unless the coating is removed from the weld area, the area is well ventilated, and while wearing an air-supplied respirator. The coatings and any metals containing these elements can give off toxic fumes if welded.
- At the point of generation, welding fumes are exhausted through the slots on the gun. The air can be exhausted by a welding fume extractor, passed through filters, and discharged back into the workplace. The air from the welder must be cleaned before it is recirculated back into the workplace.
- Because filters can have holes, there is a possibility of inadvertently re-circulating contaminated air into the workplace. As a result, specific criteria for the recirculation of air from industrial exhaust systems should be used. In using this criterion, one must consider the probability and consequences of an air cleaner failure. In addition, a monitoring system must be used which provides adequate warning of an air cleaner failure.
- Try to use a welding system that involves a very low air flow. The air from the air cleaner can then be simply ducted outside.
- Remember, containers can be toxic, explosive, or flammable. All it takes is an errant spark to cause an explosion or flash fire if vapors are present.

**Metal fumes:** Welding fumes consist of oxides of the metal being welded and particulate contaminants from the welding rod or wire.

- Workers, who are welding, can develop metal fume fever from exposure to freshly generated welding fumes.
- Symptoms last for 24 hours and include chills, trembling, nausea, and vomiting. During this 24 hour period there is a reduction in lung function but no evidence of radiological changes in the lung. Worker exposure to welding fumes should be limited to 5 mg/m.

- The respiratory system is the primary target of injury. Metal fume fever and pneumonitis are the most common acute respiratory diseases associated with welding as a result of short-term exposures to high concentrations of fumes and gases.
- Chronic respiratory diseases such as cancer, pneumoconiosis, and bronchitis have been observed among welders exposed to welding fumes and gases (and possibly to asbestos in some instances over long periods). Cancers of the kidney and other urinary tract organs, and the subglottic area of the larynx, cardiovascular and gastrointestinal diseases, skin sensitization, hearing loss, and eye and musculoskeletal injury can occur.
- Remember, because of the diversity of welding techniques, processes, and materials used, most of these studies lack sufficient information to associate a specific chemical or physical agent with a particular health effect.
- Painted surfaces can burn and release decomposition products into the workers' breathing zone. Material safety data sheets for some automotive paints report that toxic metals such as chromium and lead are present in some formulations.
- Iron oxide: Welding on iron surfaces produces an iron oxide fume. Excessive exposure to this fume can cause the development of lung changes that show up on X-rays. However, these lung changes do not appear to be associated with any physical impairment of the lung.
- Chromium: Paints may contain chromates and **hexavalent chromium** as a pigment. These compounds can produce health effects such as contact dermatitis, irritation, and ulceration of the nasal mucosa, and perforation of the nasal septum. Certain insoluble hexavalent chromium compounds are suspect carcinogens. New data supports the danger associated with hexavalent chromium. Wear an air-supplied respirator.
- Lead: Lead adversely affects several organs and systems. The four major target organs and systems are the central nervous system, the peripheral nervous system, kidney, and hematopoietic (blood-forming) system.
- Inhalation or ingestion of inorganic lead can cause loss of appetite, metallic taste in the mouth, constipation, nausea, pallor, blue line on the gum, malaise, weakness, insomnia, headache, muscle and joint pains, nervous irritability, fine tremors, encephalopathy, and colic.
- Exposure can result in a weakness in the wrist muscles known as "wrist drop," anemia (due to lower red blood cell life and interference with heme synthesis), proximal kidney tubule damage, and chronic kidney disease. Elevated blood pressure has been positively related to blood lead levels.
- Ozone: Welding can generate ozone and nitrogen oxides. High concentrations of ozone can be emitted when welding is done on aluminum. Ozone is irritating to the eyes and upper respiratory tract.
- Remember, your lungs are a vital organ for sustaining good health.

## Compressed Gas Cylinders for New Workers

Compressed gases present a unique hazard, and depending on the particular gas, there is a potential for simultaneous exposure to both mechanical and chemical hazards.

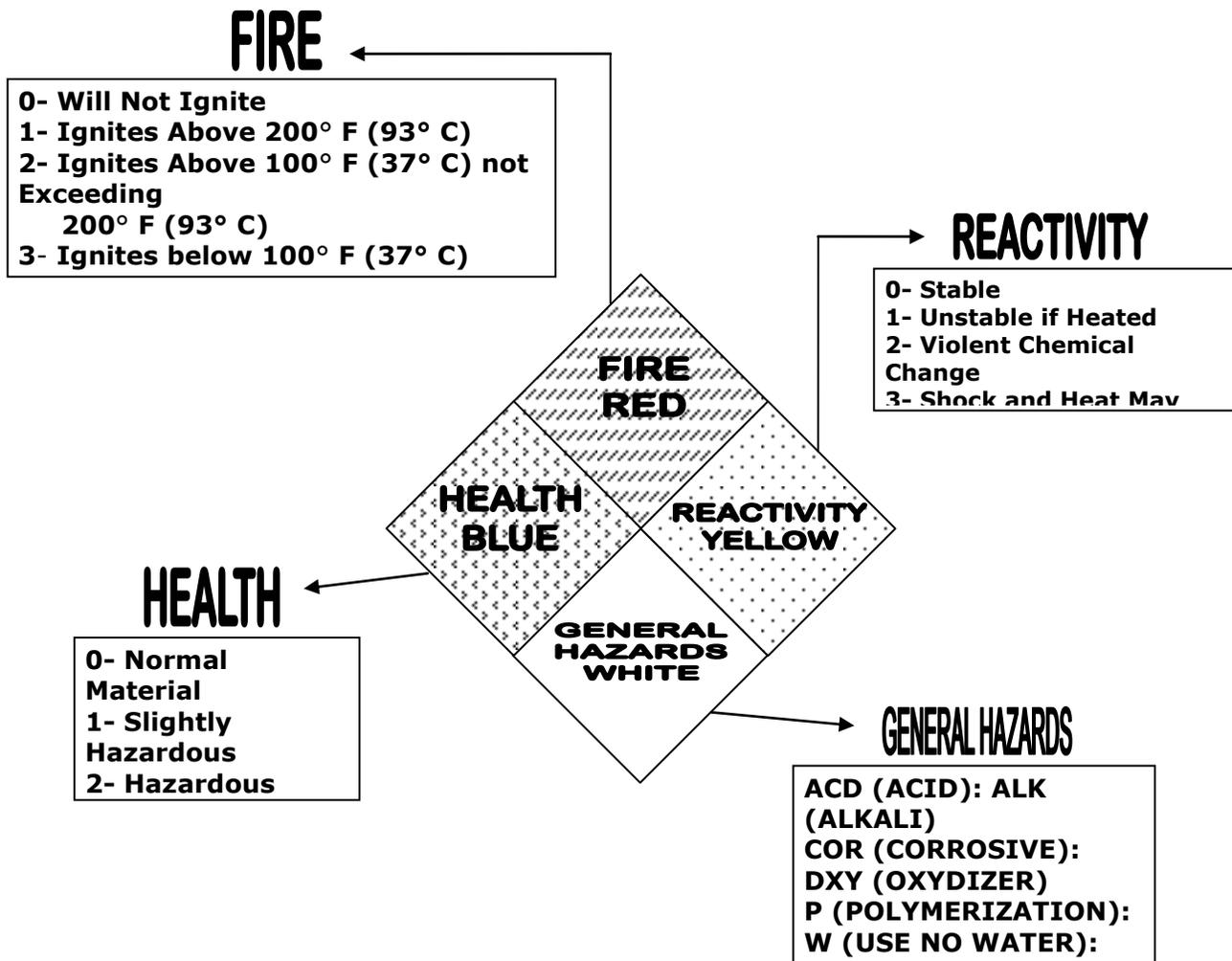
### Gases may be:

- Flammable or combustible
  - Explosive
  - Corrosive
  - Poisonous
  - Inert
  - or a combination of hazards
- When the gas is flammable, flash points lower than room temperature compounded by high rates of diffusion present a danger of fire or explosion.
  - Additional hazards of reactivity and toxicity of the gas, as well as asphyxiation, can be caused by high concentrations of even "harmless" gases such as nitrogen.
  - Since the gases are contained in heavy, highly pressurized metal containers, the large amount of potential energy resulting from compression of the gas makes the cylinder a potential rocket or fragmentation bomb.
  - Careful procedures are necessary for handling the various compressed gases, the cylinders containing the compressed gases, regulators or valves used to control gas flow, and the piping used to confine gases during flow.
  - Always use safety glasses (preferably with a face shield) when handling and using compressed gases, especially when connecting and disconnecting compressed gas regulators and lines.

**Identification:** The contents of any compressed gas cylinder must be clearly identified.

- Such identification should be stenciled or stamped on the cylinder or a label.
- Commercially available three-part tag systems may also be used for identification and inventory.
- No compressed gas cylinder should be accepted for use that does not legibly identify its contents by name.
- If the labeling on a cylinder becomes unclear or an attached tag is defaced to the point the contents cannot be identified, the cylinder should be marked "contents unknown" and returned directly to the manufacturer.
- Always read the label.
- Never rely on the color of the cylinder for identification.
- Color coding is not reliable because cylinder colors may vary with the supplier.
- Additionally, labels on caps have little value because caps are interchangeable.
- All gas lines leading from a compressed gas supply should be clearly labeled to identify the gas, the area served, and the relevant emergency telephone numbers.
  
- The labels should be color coded to distinguish hazardous gases (such as flammable, toxic, or corrosive substances) (e.g., a yellow background and black letters).
- Signs should be conspicuously posted in areas where flammable compressed gases are stored, identifying the substances and appropriate precautions (e.g., HYDROGEN - FLAMMABLE GAS - NO SMOKING - NO OPEN FLAMES).

# READING YOUR NFPA/ HAZCOM LABEL



## NUMBER RATING OF CHEMICALS

- 0- MINIMAL
- 1- SLIGHT
- 2- MODERATE
- 3- SERIOUS



## Handling and Use

- Gas cylinders must be secured at all times to prevent tipping.
- Cylinders may be attached to a bench top, individually to the wall, placed in a holding cage, or have a non-tip base attached.
- Chains or sturdy straps may be used to secure them.
- If a leaking cylinder is discovered, move it to a safe place (if it is safe to do so) and inform the supervisor. Call the vendor as soon as possible.
- Under no circumstances should any attempt be made to repair a cylinder or valve.
- Standard cylinder-valve outlet connections have been devised by the Compressed Gas Association (CGA) to prevent mixing of incompatible gases.
- The outlet threads used vary in diameter; some are internal, some are external; some are right-handed, some are left-handed.
- In general, right-handed threads are used for non-fuel and water-pumped gases, while left-handed threads are used for fuel and oil-pump gases.
- To minimize undesirable connections, only CGA standard combinations of valves and fittings should be used in compressed gas installations; the assembly of miscellaneous parts should be avoided.
- The threads on cylinder valves, regulators and other fittings should be examined to ensure they correspond and are undamaged.
- Cylinders should be placed with the valve accessible at all times.
- The main cylinder valve should be closed as soon as it is no longer necessary that it be open (i.e., it should never be left open when the equipment is unattended or not operating).
- This is necessary not only for safety when the cylinder is under pressure, but also to prevent the corrosion and contamination resulting from diffusion of air and moisture into the cylinder after it has been emptied.
- Cylinders are equipped with either a hand wheel or stem valve.
- For cylinders equipped with a stem valve, the valve spindle key should remain on the stem while the cylinder is in service.
- Only wrenches or tools provided by the cylinder supplier should be used to open or close a valve.
- At no time should pliers be used to open a cylinder valve.
- Some valves may require washers; this should be checked before the regulator is fitted.
- Cylinder valves should be opened slowly.
- Oxygen cylinder valves should be opened all the way.
- Open up the oxygen cylinder valve stem just a crack.
- Once the needle on the high pressure gauge has stopped, open up the valve all the way. This back-seats the valve.
- Oxygen cylinders must have the valve opened up all the way because of the high pressure in the cylinder.
- There is a back-seating valve on the oxygen cylinder. This prevents the high-pressure gas from leaking out through the threaded stem.
- When opening the valve on a cylinder containing an irritating or toxic gas, the user should position the cylinder with the valve pointing away from them and warn those working nearby.

- Cylinders containing flammable gases such as hydrogen or acetylene must not be stored in close proximity to open flames, areas where electrical sparks are generated, or where other sources of ignition may be present.
- Cylinders containing acetylene must never be stored on their side.
- An open flame must never be used to detect leaks of flammable gases.
- Hydrogen flame is invisible, so "feel" for heat.
- One common practice is to use a natural bristle broom to "sweep" the air in front of you.
- All cylinders containing flammable gases should be stored in a well-ventilated area.
- Oxygen cylinders, full or empty, must not be stored in the same vicinity as flammable gases.
- The proper storage for oxygen cylinders requires that a minimum of 20 feet be maintained between flammable gas cylinders and oxygen cylinders or the storage areas be separated, at a minimum, by a fire wall five feet high with a fire rating of 0.5 hours.
- Greasy and oily materials must never be stored around oxygen; nor should oil or grease be applied to fittings.
- Regulators are gas specific and not necessarily interchangeable!
- Always make sure that the regulator and valve fittings are compatible.
- If there is any question as to the suitability of a regulator for a particular gas, check with your vendor for advice.
- After the regulator is attached, the cylinder valve should be opened just enough to indicate pressure on the regulator gauge (no more than one full turn) and all the connections checked with a soap solution for leaks.
- Never use oil or grease on the regulator of a cylinder valve.

**The following rules should always be followed in regards to piping:**

- Copper piping must not be used for acetylene.
- Plastic piping must not be used for any portion of a high-pressure system.
- Do not use cast iron pipe for chlorine.
- Do not conceal distribution lines where a high concentration of a leaking hazardous gas can build up and cause an accident.
- Distribution lines and their outlets should be clearly labeled as to the type of gas contained.
- Piping systems should be inspected for leaks on a regular basis.
- Special attention should be given to fittings as well as possible cracks that may have developed.
- A cylinder should never be emptied to a pressure lower than 172 kPa (25 psi/in<sup>2</sup>) (the residual contents may become contaminated if the valve is left open).
- When work involving a compressed gas is completed, the cylinder must be turned off, and if possible, the lines bled.
- When the cylinder needs to be removed or is empty, all valves must be closed, the system bled, and the regulator removed.
- The valve cap must be replaced, the cylinder clearly marked as "empty," and returned to a storage area for pickup by the supplier.
- Empty and full cylinders should be stored in separate areas.

- Where the possibility of flow reversal exists, the cylinder discharge lines should be equipped with approved check valves to prevent inadvertent contamination of cylinders connected to a closed system.
- "Sucking back" is particularly troublesome where gases are used as reactants in a closed system.
- A cylinder in such a system should be shut off and removed from the system when the pressure remaining in the cylinder is at least 172 kPa (25 psi/in<sup>2</sup>).
- If there is a possibility that the container has been contaminated, it should be so labeled and returned to the supplier.
- Liquid bulk cylinders may be used in laboratories where a high volume of gas is needed.
- These cylinders usually have a number of valves on the top of the cylinder.
- All valves should be clearly marked as to their function.
- These cylinders will also vent their contents when a preset internal pressure is reached, therefore, they should be stored or placed in service where there is adequate ventilation.
- All compressed gas cylinders, including lecture-size cylinders, must be returned to the supplier when empty or no longer in use.
- The cylinders that contain compressed gases are primarily shipping containers and should not be subjected to rough handling or abuse.
- Such misuse can seriously weaken the cylinder and render it unfit for further use or transform it into a rocket having sufficient thrust to drive it through masonry walls.
- To protect the valve during transportation, the cover cap should be screwed on hand tight and remain on until the cylinder is in place and ready for use.
- Cylinders should never be rolled or dragged.
- When moving large cylinders, they should be strapped to a properly designed wheeled cart to ensure stability.
- Only one cylinder should be handled (moved) at a time.
- Nitrogen (N<sub>2</sub>) and carbon dioxide (CO<sub>2</sub>) are available in the form of compressed gas in cylinders.
- Nitrogen is available in a number of forms ranging from gas intended for welding, to various purity assured types, to gas mixtures where N<sub>2</sub> would be one of the components.
- Welding nitrogen is essentially a pure gas, but it has one important clarification.
- When a cylinder of welding gas is used there is an unknown possibility that some form of contaminant may have back-fed into the cylinder from a previous user.
- Possibly this could happen if the tank was being used in an application where the cylinder's internal pressure fell low enough for pressure from whatever the tank had been feeding to back-flush into the cylinder.
- Alternatively, the tank pressure may have become depleted and was re-pressurized using ordinary compressed service air.
- The most likely contaminants will be moisture, carbon monoxide, carbon dioxide, oxygen and hydrocarbons, but there is the remote possibility, of something even more exotic or toxic getting into your cylinder.
- Welding gas cylinders may not be checked by the gas supplier before being refilled and sent back out for use.

- The varying types of purity assured nitrogen gas are slightly more difficult to find and slightly more expensive in cost. Some companies offer seven types of purity assured nitrogen ranging from 99.995% to 99.9995% pure with none having a water vapor content over 1 part per million (ppm) or an oxygen content over 3 ppm.

### Most common cylinders

Cyl Size	Capy Cu Ft	Filled PSIG	Wt Lbs	Ht In	Dia In
44HH	445	6000	339	51	10
44H	332	3500	225	51	10
49	304	2640	165	55	9.25
44	234	2265	149	51	9
16	77	2000	71	32.5	7

(H) Means high pressure

PSIG = Pounds per Square Inch on the Gauge, this does not reflect atmospheric pressure which would be Pounds per Square Inch Absolute; (PSIA) = PSIA is the absolute pressure of atmospheric and internal cylinder pressure combined.

- Although you can purchase your own cylinder the most inexpensive way to use nitrogen is to rent a cylinder from your gas supplier.
- This may require filling out an application, paying a refundable cylinder deposit and buying the gas contained in the cylinder.
- Delivery by the supplier can often be arranged or they may assist you in getting the cylinder into your vehicle.
- The preferred method of transportation is for the cylinder to be chained, clamped, or otherwise solidly secured in a vertical position in the transporting vehicle with the cylinder cap in place.
- Transportation requirements vary from state to state and even city to city so inquire of your gas supplier to find a safe and legal means of moving the tank.

**NOTE:** The major expense in using compressed gas is not the cost of obtaining the gas itself, but in the equipment needed to safely handle and control it.

- Unless you borrow the mechanisms, they will have to be purchased, new or used.
- There is a temptation to forgo the expense and not use a regulator.
- A full cylinder of compressed gas will have an internal pressure of 2000+ PSIG.
- Normal atmospheric pressure is about 15 PSIA.
- If the cylinder valve was opened only slightly too far, a great deal of very high pressure gas will flow through the delivery hose and metal wand and the potential for serious injury when it began to whip around would be very great.
- For your safety, get the necessary equipment.
- If you purchase your own regulator/gauge cluster and/or your own cylinder, there is necessity for periodic maintenance.
- Regulators and gauges need to be calibrated (using a water deadweight calibrator) and cylinders need to be hydrostatically tested, typically every ten years for both.
- Ask the gas supplier for more detailed information.
- The only equipment that may come with your cylinder is the cylinder cap.
- All of the common cylinder sizes will use the CGA-580 (Compressed Gas Assembly) cylinder fitting.
- The downstream side of this fitting can be obtained with different threads, but a 1/4" NPT (National Pipe Thread) nipple is normally needed to mate with the regulator body.

- The nipple is really nothing more than just a short length of high pressure pipe.
- The CGA fittings come in a variety of metal compositions such as carbon steel, stainless steel, and brass. The best choice is one which matches the composition of the regulator body.
- If the CGA fitting and regulator are to be used only with dry, non-oxygen gasses, in a dry environment then galvanic corrosion can be disregarded so the most inexpensive metal composition can be used even if it is not the same as the regulator.
- If it is to be used in a wet area, or with oxygen containing gasses then matching metal composition becomes very important.
- When the tank is to be returned there must be some residual pressure still in the cylinder or the renter may have to pay a surcharge or lose their deposit.
- This is particularly true of purity assured gasses because the residual gas composition will be analyzed. This is done for the safety of all cylinder users.
- The regulator/gauge cluster should be carefully removed using the same procedure that is described below to put it all together.
- Care should be taken not to damage the cylinder valve threads.
- Replace the cylinder cap and transport in the same manner.

### **Argon**

- Argon is a colorless, odorless, and tasteless gas used as an inert gas.
- Argon can be shipped as a pressurized liquid.
- Argon can affect you when breathed in.
- Contact with liquefied argon can cause burns and frostbite.
- High exposure can cause rapid breathing, headache, dizziness, fatigue, loss of coordination, nausea, vomiting, unconsciousness, a coma, and eventually death.
- Remember, large amounts of argon will decrease the amount of available oxygen. Oxygen content should be routinely tested to ensure that it is at least 19% by volume. The MSDS on argon must be on the work site.
- Make sure you enclose operations and use local exhaust ventilation at the site of any chemical release.
- Ensure that when local exhaust ventilation is not used, a respirator is worn.
- Make sure to post hazard and warning information in the work area.
- Communicate all information on the health and safety hazards of argon to potentially exposed workers.
- Engineering controls are the most effective way of reducing exposure.
- Isolating operations can reduce exposure.
- Using respirators or protective equipment is less effective, but is sometimes necessary.
- When evaluating the controls present in your workplace, make sure you consider how hazardous the substance is, how much of the substance is released into the workplace, and whether harmful skin or eye contact could occur.
- Where there is skin contact with liquefied argon, immediately submerge the affected body part in warm water,
- Make sure special controls are in place for highly toxic chemicals or when significant skin, eye, or breathing exposures are possible.
- Do not enter a confined space where argon is present before checking to make sure sufficient oxygen exists.

- Make sure whenever there is skin contact with argon, immediately wash or shower to remove the chemical.
- Eye wash fountains should be provided in the immediate work area for emergency use.
- Ensure there is an emergency shower facility provided when necessary.
- Avoid skin contact with argon. Wear protective gloves and clothing.
- Where exposure to cold equipment, vapors, or liquid may occur, employees should be provided with special clothing designed to prevent the freezing of body tissues.
- All protective clothing (suits, gloves, footwear, headgear) should be clean. Make sure the clothing is available each day and put on before work begins.
- Always wear non-vented, impact resistant goggles when working where fumes, gases, or vapors from argon are present. Wear a face shield along with goggles when working with corrosive, and highly irritating, or toxic substances.
- Ensure that only a MSHA/NIOSH approved self-contained breathing apparatus with a full facepiece operated in the positive pressure mode is used in oxygen deficient environments.
- Argon itself does not burn. Extinguish a fire using an agent suitable for the type of fire. Argon containers may explode in a fire.
- Use a water spray to keep all fire-exposed containers cool. Do not get water inside containers as ice will form.
- Ensure that when employees are expected to fight fires, they are properly trained and properly equipped.
- Make sure that when any argon has leaked that you evacuate all personnel not wearing protective equipment from the area of the leak until a clean-up is complete.
- Make sure you ventilate the area of the leak to disperse the gas. Stop the flow of gas.
- When the source of the leak is a cylinder and the leak cannot be stopped in place, remove the leaking cylinder to a safe place in the open air, and repair the leak, or allow the cylinder to empty.
- When applicable, it may be necessary to contain and dispose of argon as a hazardous waste. Contact your state Department of Environmental Protection (DEP) or your regional office of the federal Environmental Protection Agency (EPA) for specific recommendations.
- Employees must be properly trained and equipped to clean-up spills. Where there are large spills and fires, immediately call your fire department.
- Make sure storage areas are dry and well-ventilated. Protect any container which contains argon, from physical damage.
- Do not use liquid nitrogen to cool containers as an explosion may occur. Make sure you are trained on argons proper handling and storage.

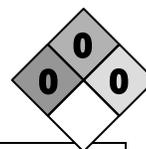
## Checklist

- Do cylinders with water-weight capacity over 30 pounds equipped have a means for connecting a valve protector or device, or a collar or recess, to protect the valve?
- Are cylinders legibly marked to clearly identify the gas contained?
- Are compressed-gas cylinders stored in areas protected from external heat sources such as flames, intense radiant heat, electric arcs, or high-temperature lines?
- Are cylinders located or stored in areas where they will not be damaged or tampered with by unauthorized persons?
- Are cylinders stored or transported in a manner that prevents them from creating a hazard by tipping, falling, or rolling?
- Are cylinders containing liquefied fuel gas stored or transported so that the safety relief devices are always in direct contact with the vapor spaces in the cylinders?
- Are valve protectors always placed on cylinders when the cylinders are not in use?
- Are all valves closed off before cylinders are moved, when cylinders are empty, and at the completion of each job?
- Are low-pressure fuel-gas cylinders checked periodically for corrosion, general distortion, cracks, or other defects that might indicate a weakness or render them unfit for service?
- Does the periodic check of low-pressure fuel-gas cylinders include inspection of the bottom of each cylinder?
- Are regulator-pressure adjusting screws released when welding or cutting is stopped for an extended period of time?



# ARGON-MATERIAL SAFETY DATA SHEET

## SECTION 1 — CHEMICAL PRODUCT AND COMPANY IDENTIFICATION



Product Identifier <b>ARGON, COMPRESSED</b>	Trade Names / Synonyms: MTG MSDS 5; ARGON; UN 1006; AR; MAT01860; RTECS CF2300000	Chemical Family: Non-metallic
Product Use WELDING		
Manufacturer's Name MATHESON TRI-GAS, INC.		Supplier's Name
Street Address 959 ROUTE 46 EAST		Street Address
City PARSIPPANY,	State NJ 07054-0624	City State
Emergency Contact: CHEMTREC 1-800-424-9300 Information Contact: 973-257-1100		Area Code Emergency Telephone
Date MSDS Prepared	MSDS Prepared By	Phone Number

## SECTION 2 — COMPOSITION/INFORMATION ON INGREDIENTS

Hazardous Ingredients (specific)	%	CAS Number	LD50 of Ingredient (specify species and route)	LC50 of Ingredient (specify species)
ARGON, COMPRESSED	100	7440-37-1		

## SECTION 3 — HAZARDS IDENTIFICATION

<b>NFPA Ratings</b> (scale 0-4): HEALTH=0 FIRE=0 REACTIVITY=0
<b>Emergency Overview:</b> Color: colorless Physical Form: gas Odor: odorless Major Health Hazards: difficulty breathing Physical Hazards: Containers may rupture or explode if exposed to heat
<b>Potential Health Effects:</b> <b>Inhalation:</b> Short Term Exposure: nausea, vomiting, difficulty breathing, irregular heartbeat, headache, dizziness, disorientation, mood swings, tingling sensation, loss of coordination, suffocation, convulsions, unconsciousness, coma. Long Term Exposure: no information is available. <b>Skin Contact:</b> Short Term Exposure: no information on significant adverse effects. Long Term Exposure: no information is available. <b>Eye Contact:</b> Short Term Exposure: no information on significant adverse effects. Long Term Exposure: no information is available. <b>Ingestion:</b> Short Term Exposure: ingestion of a gas is unlikely. Long Term Exposure: no information is available.

## SECTION 4 — FIRST AID MEASURES

<b>Inhalation:</b> If adverse effects occur, remove to uncontaminated area. Give artificial respiration if not breathing. If breathing is difficult, oxygen should be administered by qualified personnel. Get immediate medical attention.
<b>Skin Contact:</b> Wash exposed skin with soap and water.
<b>Eye Contact:</b> Flush eyes with plenty of water.
<b>Ingestion:</b> If a large amount is swallowed, get medical attention.
<b>Note To Physician:</b> For inhalation, consider oxygen.

## SECTION 5 — FIRE FIGHTING MEASURES

Flammable: No	Negligible fire Hazard. Pressurized containers may rupture or explode if exposed to sufficient heat.	
<b>Extinguishing Media:</b> carbon dioxide, regular dry chemical Large fires: Use regular foam or flood with fine water spray. <b>Fire Fighting:</b> Move container from fire area if it can be done without risk. Cool containers with water spray until well after the fire is out. Stay away from the ends of tanks. Withdraw immediately in case of rising sound from venting safety device or any discoloration of tanks due to fire. For tank, rail car or tank truck, evacuation radius: 800 meters (½ mile).		
Flashpoint (°C) and Method	Upper Flammable Limit (% by volume)	Lower Flammable Limit (% by volume)
Auto ignition Temperature (°C)	Explosion Data — Sensitivity to Impact	Explosion Data — Sensitivity to Static Discharge
Hazardous Combustion Products		
[NFPA] HEALTH=0 FIRE=0 REACTIVITY=0		

## SECTION 6 — ACCIDENTAL RELEASE MEASURES

Leak and Spill Procedures: Stop leak if possible without personal risk. Keep unnecessary people away, isolate hazard area and deny entry. Stay upwind and keep out of low areas.

## SECTION 7 — HANDLING AND STORAGE

Handling and Storage:
Store and handle in accordance with all current regulations and standards. Subject to storage regulations: U.S. OSHA 29 CFR 1910.101. Keep separated from incompatible substances.

## SECTION 8 — EXPOSURE CONTROL / PERSONAL PROTECTION

Exposure Limits	<input type="checkbox"/> ACGIH: Simple Asphyxiant	<input type="checkbox"/> OSHA PEL	<input type="checkbox"/> OTHER (SPECIFY)
Ventilation: Provide local exhaust ventilation system. Ensure compliance with applicable exposure limits.			
Personal Protective Equipment	<input type="checkbox"/> Gloves	<input type="checkbox"/> Respirator	<input type="checkbox"/> Eye
	<input type="checkbox"/> Footwear	<input type="checkbox"/> Clothing	<input type="checkbox"/> Other
<b>EYE PROTECTION:</b> Eye protection not required, but recommended. <b>CLOTHING:</b> Protective clothing is not required. <b>GLOVES:</b> Wear appropriate chemical resistant gloves. <b>RESPIRATOR:</b> Under conditions of frequent use or heavy exposure, respiratory protection may be needed. Respiratory protection is ranked in order from minimum to maximum. Consider warning properties before use. <b>For Unknown Concentrations or Immediately Dangerous to Life or Health:</b> Any supplied-air respirator with full facepiece and operated in a pressure-demand or other positive-pressure mode in combination with a separate escape supply. Any self-contained breathing apparatus with a full facepiece.			

## SECTION 9 — PHYSICAL AND CHEMICAL PROPERTIES

Physical State: Gas Molecular Formula: AR	Odor and Appearance Odorless, Colorless, Tasteless	Odor Threshold (ppm)
Molecular Weight: 39.948	Vapor Density (air = 1)	Vapor Pressure (mmHg) 500 mmHg @ -190 C
Evaporation Rate	Boiling Point (F°/C°) -303 F (-186 C)	Freezing Point (F°/C°) -308 F (-189 C)
pH	Coefficient of Water/Oil Distribution	[Solubility in Water]

## SECTION 10 — STABILITY AND REACTIVITY

Chemical Stability <input type="checkbox"/> Yes <input type="checkbox"/> No	If no, under which conditions?
Incompatibility with Other Substances: No Data available	If yes, which ones?
Reactivity, and under what conditions? Stable at normal temperatures and pressure.	
Conditions To Avoid: Protect from physical damage and heat. Containers may rupture or explode if exposed to heat.	
Hazardous Decomposition Products: Thermal decomposition products: No data available.	
Polymerization: Will not polymerize.	

## SECTION 11 — TOXICOLOGICAL INFORMATION

Effects of Acute Exposure: <b>Not Available</b>	
Effects of Chronic Exposure	
Irritancy of Product	
Skin Sensitization	Respiratory Sensitization
Carcinogenicity — IARC	Carcinogenicity — ACGIH
Reproductive Toxicity	Teratogenicity
Embryotoxicity	Mutagenicity
Name of Synergistic Products/Effects	

## SECTION 12 — ECOLOGICAL INFORMATION

Aquatic Toxicity: <b>Not Available</b>

## SECTION 13 — DISPOSAL CONSIDERATIONS

Waste Disposal: Dispose in accordance with all applicable regulations.

## SECTION 14 — TRANSPORT INFORMATION

U.S. DOT 49 CFR 172.101: Proper Shipping Name: Argon, compressed	I.D. Number UN1006
Hazard Class or Division: 2.2	Labeling Requirements: 2.2
Canadian Transportation of Dangerous Goods: Shipping Name: Argon, compressed	I.D. Number UN1006
Class: 2.2	

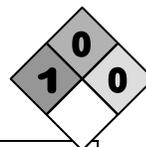
## SECTION 15 — REGULATORY INFORMATION

<p><b>U.S. Regulations:</b>            CERCLA SECTIONS 102a/103 HAZARDOUS SUBSTANCES (40 CFR 302.4): Not regulated.            SARA TITLE III SECTION 302 EXTREMELY HAZARDOUS SUBSTANCES (40 CFR 355.30): Not regulated.            SARA TITLE III SECTION 304 EXTREMELY HAZARDOUS SUBSTANCES (40 CFR 355.40): Not regulated.            SARA TITLE III SARA SECTIONS 311/312 HAZARDOUS CATEGORIES (40 CFR 370.21):            Acute: Yes            Chronic: No            Fire: No            Reactive: No            Sudden Release: Yes            SARA TITLE III SECTION 313 (40 CFR 372.65): Not regulated.            OSHA PROCESS SAFETY (29CFR1910.119): Not regulated.</p>	<p><b>STATE REGULATIONS:</b>            California Proposition 65: Not regulated.  <b>CANADIAN REGULATIONS:</b>            WHMIS CLASSIFICATION: A.  <b>NATIONAL INVENTORY STATUS:</b>            U.S. INVENTORY (TSCA): Listed on inventory.</p>
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## SECTION 16 — OTHER INFORMATION

<p><b>MATHESON TRI-GAS, INC. MAKES NO EXPRESS OR IMPLIED WARRANTIES, GUARANTEES OR REPRESENTATIONS REGARDING THE PRODUCT OR THE INFORMATION HEREIN, INCLUDING BUT NOT LIMITED TO ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR USE. MATHESON TRI-GAS, INC. SHALL NOT BE LIABLE FOR ANY PERSONAL INJURY, PROPERTY OR OTHER DAMAGES OF ANY NATURE, WHETHER COMPENSATORY, CONSEQUENTIAL, EXEMPLARY, OR OTHERWISE, RESULTING FROM ANY PUBLICATION, USE OR RELIANCE UPON THE INFORMATION HEREIN.</b></p>
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# NITROGEN-MATERIAL SAFETY DATA SHEET



## SECTION 1 — CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Product Identifier <b>Nitrogen, Compressed Gas</b>	Trade Names / Synonyms: MTG MSDS 5; MTG MSDS 67; DIATOMIC NITROGEN; DINITROGEN; NITROGEN; NITROGEN-14; NITROGEN GAS; UN 1066; N2; MAT16625; RTECS QW9700000	Chemical Family: Inorganic, gas	
Product Use WELDING			
Manufacturer's Name MATHESON TRI-GAS, INC.		Supplier's Name	
Street Address 150 Allen Road Suite 302		Street Address	
City Basking Ridge	State NJ 07920	City	State
Emergency Contact: CHEMTREC 1-800-424-9300 Information Contact: 973-257-1100 Calls Originating Outside the US: 703-527-3887 (Collect Calls Accepted)	Date MSDS Prepared	Area Code	Emergency Telephone
	MSDS Prepared By	Area Code	Phone Number

## SECTION 2 — COMPOSITION/INFORMATION ON INGREDIENTS

Hazardous Ingredients (specific)	%	CAS Number	LD50 of Ingredient (specify species and route)	LC50 of Ingredient (specify species)
Component: Nitrogen, compressed gas	100	7727-37-9		

## SECTION 3 — HAZARDS IDENTIFICATION

<b>NFPA Ratings</b> (scale 0-4): HEALTH=1 FIRE=0 REACTIVITY=0
<b>Emergency Overview:</b> Color: colorless Physical Form: gas Odor: odorless Major Health Hazards: difficulty breathing Physical Hazards: Containers may rupture or explode if exposed to heat
<b>Potential Health Effects:</b> <b>Inhalation:</b> Short Term Exposure: nausea, vomiting, difficulty breathing, headache, drowsiness, dizziness, tingling sensation, loss of coordination, convulsions, coma. Long Term Exposure: no information is available. <b>Skin Contact:</b> Short Term Exposure: no information on significant adverse effects. Long Term Exposure: no information on significant adverse effects. <b>Eye Contact:</b> Short Term Exposure: irritation. Long Term Exposure: no information on significant adverse effects. <b>Ingestion:</b> Short Term Exposure: ingestion of a gas is unlikely. Long Term Exposure: ingestion of a gas is unlikely.

## SECTION 4 — FIRST AID MEASURES

<b>Inhalation:</b> If adverse effects occur, remove to uncontaminated area. Give artificial respiration if not breathing. If breathing is difficult, oxygen should be administered by qualified personnel. Get immediate medical attention.
<b>Skin Contact:</b> Wash exposed skin with soap and water.
<b>Eye Contact:</b> Flush eyes with plenty of water.
<b>Ingestion:</b> If a large amount is swallowed, get medical attention.
<b>Note To Physician:</b> For inhalation, consider oxygen.

## SECTION 5 — FIRE FIGHTING MEASURES

Flammable: No	Negligible fire Hazard. Pressurized containers may rupture or explode if exposed to sufficient heat.	
<p><b>Extinguishing Media:</b> carbon dioxide, regular dry chemical                  Large fires: Use regular foam or flood with fine water spray.  <b>Fire Fighting:</b> Move container from fire area if it can be done without risk. Cool containers with water spray until well after the fire is out. Stay away from the ends of tanks. Withdraw immediately in case of rising sound from venting safety device or any discoloration of tanks due to fire. For tank, rail car or tank truck, evacuation radius: 800 meters (1/2 mile). Use extinguishing agents appropriate for surrounding fire. Cool containers with water spray until well after the fire is out. Apply water from a protected location or from a safe distance. Do not get water directly on material. Reduce vapors with water spray. Avoid inhalation of material or combustion by-products. Stay upwind and keep out of low areas. Consider downwind evacuation if material is leaking.</p>		
Flashpoint (°C) and Method	Upper Flammable Limit (% by volume)	Lower Flammable Limit (% by volume)
Auto ignition Temperature (°C)	Explosion Data — Sensitivity to Impact	Explosion Data — Sensitivity to Static Discharge
Hazardous Combustion Products		
[NFPA] HEALTH=1 FIRE=0 REACTIVITY=0		

## SECTION 6 — ACCIDENTAL RELEASE MEASURES

Leak and Spill Procedures: Stop leak if possible without personal risk. Keep unnecessary people away, isolate hazard area and deny entry. Stay upwind and keep out of low areas.

## SECTION 7 — HANDLING AND STORAGE

Handling and Storage:
Store and handle in accordance with all current regulations and standards. Subject to storage regulations: U.S. OSHA 29 CFR 1910.101. Keep separated from incompatible substances.

## SECTION 8 — EXPOSURE CONTROL / PERSONAL PROTECTION

Exposure Limits	<input type="checkbox"/> ACGIH: Simple Asphyxiant	<input type="checkbox"/> OSHA PEL	<input type="checkbox"/> OTHER (SPECIFY)
Ventilation: Provide local exhaust ventilation system. Ensure compliance with applicable exposure limits.			
Personal Protective Equipment	<input type="checkbox"/> Gloves	<input type="checkbox"/> Respirator	<input type="checkbox"/> Eye
	<input type="checkbox"/> Footwear	<input type="checkbox"/> Clothing	<input type="checkbox"/> Other
<p><b>EYE PROTECTION:</b> Eye protection not required, but recommended.  <b>CLOTHING:</b> Protective clothing is not required.  <b>GLOVES:</b> Protective gloves are not required.  <b>RESPIRATOR:</b> Under conditions of frequent use or heavy exposure, respiratory protection may be needed. Respiratory protection is ranked in order from minimum to maximum. Consider warning properties before use.  <b>For Unknown Concentrations or Immediately Dangerous to Life or Health:</b>                  Any supplied-air respirator with a full facepiece that is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained breathing apparatus operated in pressure-demand or other positive-pressure mode. Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode.</p>			

## SECTION 9 — PHYSICAL AND CHEMICAL PROPERTIES

Physical State: Gas Molecular Formula: N2	Odor and Appearance Odorless, Colorless, Tasteless	Odor Threshold (ppm) Not available
Molecular Weight: 28.0134	Vapor Density (air = 1) 0.967	Vapor Pressure (mmHg) 760 mmHg @ -196 C
Evaporation Rate	Boiling Point (F°/C°) -321 F (-196 C)	Freezing Point (F°/C°) -346 F (-210 C)
pH Not applicable	Coefficient of Water/Oil Distribution Not applicable	[Solubility in Water] 1.6% @ 20 C
SPECIFIC GRAVITY: Not applicable	DENSITY: 1.2506 g/L	VOLATILITY: 100%
EVAPORATION RATE: Not applicable	VISCOSITY: 0.01787 cP @ 27 C	SOLVENT SOLUBILITY: Soluble: liquid ammonia Slightly Soluble: alcohol

## SECTION 10 — STABILITY AND REACTIVITY

Chemical Stability:	If no, under which conditions?
Incompatibility with Other Substances: Yes	If yes, which ones? metals, oxidizing materials
Reactivity, and under what conditions? Stable at normal temperatures and pressure.	
Conditions To Avoid: Protect from physical damage and heat. Containers may rupture or explode if exposed to heat.	
Hazardous Decomposition Products: Thermal Decomposition Products: oxides of nitrogen	
Polymerization: Will not polymerize.	

## SECTION 11 — TOXICOLOGICAL INFORMATION

Effects of Acute Exposure: <b>Not Available</b>	
Effects of Chronic Exposure	
Irritancy of Product	
Skin Sensitization	Respiratory Sensitization
Carcinogenicity — IARC	Carcinogenicity — ACGIH
Reproductive Toxicity	Teratogenicity
Embryotoxicity	Mutagenicity
Name of Synergistic Products/Effects	

## SECTION 12 — ECOLOGICAL INFORMATION

Aquatic Toxicity: <b>Not Available</b>

## SECTION 13 — DISPOSAL CONSIDERATIONS

Waste Disposal: Dispose in accordance with all applicable regulations.

## SECTION 14 — TRANSPORT INFORMATION

U.S. DOT 49 CFR 172.101: Proper Shipping Name: Nitrogen, compressed	I.D. Number UN1066
Hazard Class or Division: 2.2	Labeling Requirements: 2.2
Canadian Transportation of Dangerous Goods: Shipping Name: Nitrogen, compressed	I.D. Number UN1066
Class: 2.2	

## SECTION 15 — REGULATORY INFORMATION

<p><b>U.S. Regulations:</b>            CERCLA SECTIONS 102a/103 HAZARDOUS SUBSTANCES (40 CFR 302.4): Not regulated.            SARA TITLE III SECTION 302 EXTREMELY HAZARDOUS SUBSTANCES (40 CFR 355.30): Not regulated.            SARA TITLE III SECTION 304 EXTREMELY HAZARDOUS SUBSTANCES (40 CFR 355.40): Not regulated.            SARA TITLE III SARA SECTIONS 311/312 HAZARDOUS CATEGORIES (40 CFR 370.21):            ACUTE: Yes            CHRONIC: No            FIRE: No            REACTIVE: No            SUDDEN RELEASE: Yes            SARA TITLE III SECTION 313 (40 CFR 372.65): Not regulated.            OSHA PROCESS SAFETY (29CFR1910.119): Not regulated.</p>	<p><b>STATE REGULATIONS:</b>            California Proposition 65: Not regulated.  <b>CANADIAN REGULATIONS:</b>            WHMIS CLASSIFICATION: A.  <b>NATIONAL INVENTORY STATUS:</b>            U.S. INVENTORY (TSCA): Listed on inventory.  <b>CANADA INVENTORY (DSL/NDSL):</b>            Listed on inventory.</p>
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## SECTION 16 — OTHER INFORMATION

<p><b>MSDS SUMMARY OF CHANGES</b></p> <p><b>8. EXPOSURE CONTROLS, PERSONAL PROTECTION</b></p>
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# Argon/Carbon Dioxide Gas Mixture MSDS

## SECTION 1 — CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Product Identifier Argon/Carbon Dioxide Gas Mixture	Trade Names / Synonyms: WM 6, WM 6.5, WM 6.7, WM 7, WM 8	Chemical Family: Inert Gas/Carbon Dioxide Mixture	
Product Use: Welding gas, specialty gas			
Manufacturer's Name MATHESON TRI-GAS, INC.		Supplier's Name	
Street Address 959 Route 46 East		Street Address	
City Parsippany	State NJ 07054-0624	City	State
Emergency Contact: CHEMTREC Domestic U.S.: 1-800-424-9300 CANUTEC (Canada): 1-613-996-6666 CHEMTREC International: 1-703-527-3887		Date MSDS Prepared	Emergency Telephone
MSDS Prepared By		Area Code	Phone Number

## SECTION 2 — COMPOSITION/INFORMATION ON INGREDIENTS

Chemical Name	CAS #	Mole %	Exposure Limits In Air					
			ACGIH-TLV		OSHA-STEL		NIOSH IDLH ppm	OTHER ppm
			TWA ppm	STEL ppm	TWA ppm	STEL ppm		
Carbon Dioxide	124-38-9	0.1-75%	5,000	30,000	5,000 10,000 (Vacated 1989 PEL)	30,000 (Vacated 1989 PEL)	40,000	NIOSH RELs TWA = 5,000 STEL = 30,000 DFG MAKs: TWA = 5,000 PEAK = 2 MAK 60 Min., momentary value
Argon	7440-37-1	Balance	There are no specific limits for Argon. Argon is a simple asphyxiant (SA). Oxygen levels should be maintained above 19.5%.					

Note: All WHMIS required information is included. It is located in appropriate sections based on the ANSI Z400.1-1998 format. This product has been classified in accordance with the hazard criteria of the CPR and the MSDS contains all the information by the CPR. See Section 16 for Definitions of Terms Used.  
(10,000 ppm = 1%)

## SECTION 3 — HAZARDS IDENTIFICATION

<b>EMERGENCY OVERVIEW:</b> This gas mixture is a colorless, non-flammable gas which is odorless or which has a sharp odor (due to the presence of Carbon Dioxide). A significant hazard associated with this gas mixture is the potential for Carbon Dioxide overexposures. Inhalation of this gas mixture can cause nausea, dizziness, headache, mental confusion, increased blood pressure and respiratory rate. Severe inhalation exposures may be fatal, due to Carbon dioxide overexposure or asphyxiation. Moisture in the air could lead to the formation of carbonic acid which can be irritating to the eyes. A cylinder rupture hazard exists when this gas mixture, which is under pressure, is subject to heat or flames.	
<b>Symptoms of over-exposure by route of exposure:</b> The most significant route of over-exposure for this product is by inhalation.	
<b>Inhalation:</b> One of the most significant health hazards associated with this gas mixture is the potential for overexposure to Carbon Dioxide. Carbon Dioxide is an asphyxiant and a powerful cerebral vasodilator. If the concentration of Carbon Dioxide reaches 10% or more, suffocation can occur rapidly. Inhalation of concentrations between 2 and 10% can cause nausea, dizziness, headache, mental confusion, increased blood pressure and respiratory rate. Carbon Dioxide initially stimulates respiration and then causes respiratory depression. Inhalation of low concentrations (3-5%) have no known permanent harmful effects. Symptoms in humans at various levels of concentration are as follows:	
<b>Concentration:</b>	<b>Symptoms of Exposure:</b>
1%	Slight increase in breathing rate.
2%	Breathing rate increases to 50% above normal; headache; tiredness.
3%	Breathing increases to twice normal rate, becoming labored; weak narcotic effect; impaired hearing; headache; increase in blood pressure and pulse rate.
4-5%	Breathing increases to four times normal rate; symptoms of intoxication become evident and slight choking may be felt.
5-10	Characteristic sharp odor noticeable. Very labored breathing, headache, visual impairment and ringing in the ears. Judgment may be impaired, followed by loss of consciousness.
>10%	Unconsciousness occurs more rapidly above 10% level. Prolonged exposure to high concentrations may eventually result in death from asphyxiation.
Releases of this gas mixture may also cause an oxygen-deficient environment. The effects associated with various levels of oxygen include disturbed muscular coordination, abnormal fatigue, disturbed respiration, nausea, vomiting, collapse, or loss of consciousness. Death may occur due to asphyxiation. It is important to note that the asphyxiating properties of Carbon Dioxide will be reached before oxygen-deficiency is a significant factor. CONTACT WITH SKIN OR EYES: Moisture in the air could lead to the formation of carbonic acid, which can be irritating to the eyes. Contact with the eyes can cause damage to the retinal ganglion cells. SKIN ABSORPTION: No component of this gas mixture presents a hazard of skin absorption. HEALTH EFFECTS OR RISKS FROM EXPOSURE: Over-exposure to this gas mixture may cause the following health effects: ACUTE: nausea, dizziness, visual disturbances, shaking, headache, mental confusion, sweating, increased heartbeat, and elevated blood pressure and respiratory rate. Severe inhalation overexposures may be fatal, due the effects of Carbon Dioxide or asphyxiation. High concentrations of the gas mixture may cause eye irritation. CHRONIC: Reversible effects on the acid-base balance in the blood, blood pressure, and circulatory system may occur after prolonged exposure to elevated Carbon Dioxide levels. Refer to Section 11 (Toxicological Information) of this MSDS for further information. TARGET ORGANS: ACUTE: Respiratory system, cardiovascular system, eyes. CHRONIC: Cardiovascular system. HMIS RATING: HEALTH = 1 FLAMMABILITY = 0 REACTIVITY = 0 PPE LEVEL = B Hazard Scale: 0 = Minimal 1 = Slight 2 = Moderate 3 = Serious 4 = Severe PPE LEVEL B = Goggles, gloves (leather for handling cylinders)	

## SECTION 4 — FIRST AID MEASURES

<b>General Information:</b> Remove to fresh air, as quickly as possible. Only trained personnel should administer supplemental oxygen and/or cardio-pulmonary resuscitation, if necessary. Seek medical attention immediately.
<b>Skin Exposure:</b> If release of this gas mixture has resulted in frostbite, warm affected area slowly. Seek immediate medical attention.
<b>Eye Exposure:</b> If release of this gas mixture has affected the eyes, seek immediate medical attention.
<b>MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE:</b> Pre-existing respiratory conditions, cardio-vascular conditions and disorders involving the "Target Organs" (see Section 3, Hazard Identification) may be aggravated by overexposure to this product.

## SECTION 5 — FIRE FIGHTING MEASURES

Flashpoint (°F/°C): Not Applicable	NFPA Ratings: HEALTH=0 FIRE=0 REACTIVITY=0	Upper Flammable Limit (% by volume) (UEL): Not Applicable	Lower Flammable Limit (% by volume) (LEL): Not Applicable
Auto ignition Temperature (°F/°C): Not Applicable	Explosion Data — Sensitivity to Impact: Not Sensitive		Explosion Data — Sensitivity to Static Discharge: Not Sensitive
Fire Extinguishing Materials: Use extinguishing materials appropriate for surrounding materials involved in the fire. Water spray should be used to cool fire-exposed containers.			
Unusual Fire and Explosion Hazards: This gas mixture does not burn; however, cylinders, when involved in a fire, may rupture or burst in the heat of the fire.			
Special Fire-Fighting Procedures: Incipient fire responders should wear eye protection. Structural fire fighters must wear Self-Contained Breathing Apparatus and full protective equipment. Immediately cool the cylinders with water spray from a maximum distance. When cool, move cylinders from fire area if this can be done without risk to firefighters.			

## SECTION 6 — ACCIDENTAL RELEASE MEASURES

<p>Leak Response: Uncontrolled releases should be responded to by trained personnel using pre-planned procedures. Proper protective equipment should be used in the event of a significant release from a single cylinder. Call CHEMTREC (1-800-424-9300) for emergency assistance. Or if in Canada, call CANUTEC (613-996-6666).</p> <p>Attempt to close the main source valve prior to entering the area. If this does not stop the release (or if it is not possible to reach the valve), allow the gas to release in-place or remove it to a safe area and allow the gas to be released there. Monitor the surrounding area for the level of Oxygen. The atmosphere must have at least 19.5 percent Oxygen before personnel can be allowed in the area without Self-Contained Breathing Apparatus.</p>
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## SECTION 7 — HANDLING AND STORAGE

<p><b>WORK PRACTICES AND HYGIENE PRACTICES:</b></p> <ul style="list-style-type: none"> <li>■ Do not eat or drink while handling chemicals.</li> <li>■ Be aware of all potential exposure symptoms; exposures to a fatal oxygen-deficient atmosphere could occur without any significant warning symptoms.</li> <li>■ All work operations should be monitored in such a way that emergency personnel can be immediately contacted in the event of a release.</li> <li>■ Workers who handle this gas mixture should wear protective clothing, as listed in Section 8 (Exposure Controls and Personal Protection).</li> <li>■ If ventilation controls are not adequate to provide sufficient oxygen content, proper respiratory protection equipment should be provided and workers using such equipment should be carefully trained in its operation and limitations.</li> <li>■ Precautions must always be taken to prevent suck-back of foreign materials into the cylinder by using a check-valve, or vacuum break, since suck-back may cause dangerous pressure changes within the cylinder.</li> </ul>
<p><b>Storage and Handling Practices:</b> Cylinders should be stored upright and be firmly secured to prevent falling or being knocked-over. Cylinders can be stored in the open, but in such cases, should be protected against extremes of weather and from the dampness of the ground to prevent rusting. Cylinders should be stored in dry, well-ventilated areas away from sources of heat or ignition. Do not allow the area where cylinders are stored to exceed 52°C (125°F).</p>
<p><b>Special precautions for handling gas cylinders:</b> Compressed gases can present significant safety hazards. The following rules are applicable to work situations in which cylinders are being used.</p> <p><b>Before Use:</b> Move cylinders with a suitable hand-truck. Do not drag, slide or roll cylinders. Do not drop cylinders or permit them to strike each other. Secure cylinders firmly. Leave the valve protection cap (where provided) in-place until cylinder is ready for use.</p> <p><b>During Use:</b> Use designated CGA fittings and other support equipment. Do not use adapters. Do not use oils or grease on gas-handling fittings or equipment. Immediately contact the supplier if there are any difficulties associated with operating the cylinder valve. Never insert an object (e.g wrench, screwdriver, pry bar, etc.) into valve cap openings. Doing so may damage the valve, causing a leak to occur. Use an adjustable strap wrench to remove over-tight or rusted caps. Never strike an arc, on a compressed gas cylinder or make a cylinder part of and electric circuit.</p> <p><b>After Use:</b> Close main cylinder valve. Replace valve protection cap. Close valve after each use and when empty. Mark empty cylinders "EMPTY".</p>
<p><b>Protective practices during maintenance of contaminated equipment:</b> Refer to current CGA Guidelines for information on protective practices during maintenance of contaminated equipment.</p>

## SECTION 8 — EXPOSURE CONTROL / PERSONAL PROTECTION

<p>Ventilation and Engineering Controls: Use with adequate ventilation to ensure compliance with exposure limits described in Section 2 (Composition and Information on Ingredients). Local exhaust ventilation is preferred, because it prevents dispersion of this gas mixture into the work place by eliminating it at its source. If appropriate, install automatic monitoring equipment to detect the level of Oxygen.</p>	
<p>RESPIRATORY PROTECTION: Maintain the Oxygen level above 19.5% in the workplace. If necessary, use only respiratory protection authorized in the U.S. Federal OSHA Respiratory Protection Standard (29 CFR 1910.134), or equivalent U.S. State standards and Canadian CSA Standard Z94.4-93. Oxygen levels below 19.5% are considered IDLH by OSHA. In such atmospheres, use of a full-facepiece pressure/demand SCBA or a full facepiece, supplied air respirator with auxiliary self-contained air supply is required under OSHA's Respiratory Protection Standard (1910.134-1998). The following NIOSH respiratory protection recommendations for Carbon Dioxide concentrations in air are provided for additional guidance in respirator selection:</p>	
<p><b>CONCENTRATION</b> Up to 40,000 ppm: Emergency or Planned Entry into Unknown Concentrations or IDLH Conditions: Escape:</p>	<p><b>RESPIRATORY EQUIPMENT:</b> Supplied Air Respirator (SAR); or full-facepiece Self-Contained Breathing Apparatus (SCBA). Positive pressure, full-facepiece SCBA; or positive pressure, full-facepiece SAR with an auxiliary positive pressure SCBA. Escape-type SCBA.</p>
<p>Personal Protective Equipment : EYE PROTECTION: Splash goggles or safety glasses. CLOTHING: Use body protection appropriate for task. Transfer of large quantities under pressure may require protective equipment appropriate to the task. GLOVES: Wear mechanically-resistant gloves when handling cylinders containing this gas mixture.</p>	

## SECTION 9 — PHYSICAL AND CHEMICAL PROPERTIES

The Following information is for the <b>Argon</b> component of this gas mixture:		
Gas Density: 0.103 lb/cu ft (1.650 kg/m <sup>3</sup> )	Odor Threshold: Not applicable	Freezing Point (F°/C) -189.2°C (-308.9°F)
Specific Gravity (air = 1): 1.38	Vapor Pressure (psia): Not applicable.	Boiling Point (@ 1 atmos.): -185.9°C (-302.6°F)
Solubility in Water: 0.056	Coefficient water/oil distribution: not applicable.	Specific Volume (ft <sup>3</sup> /lb): 9.71
Expansion Ratio: Not applicable.	Evaporation Rate (nBuAc = 1): Not applicable.	Molecular Weight: 39.95
The Following information is for the <b>Carbon Dioxide</b> component of this gas mixture:		
Gas Density: 0.1144 lb/cu ft (1.833 kg/m <sup>3</sup> )	Odor Threshold: Not applicable	Freezing Point (F°/C) -78.5°C (-109.3°F) [sublimation]
Specific Gravity (air = 1): 0.90	Vapor Pressure (psia): Not applicable.	Boiling Point (@ 1 atmos.): -185.9°C (-302.6°F): Sublimes
Solubility in Water: 0.0491	Coefficient water/oil distribution: not applicable.	Specific Volume (ft <sup>3</sup> /lb): 8.741
Expansion Ratio: Not applicable.	Evaporation Rate (nBuAc = 1): Not applicable.	Molecular Weight: 44.01
<p>The Following information is pertinent to this product:  <b>APPEARANCE, ODOR AND COLOR:</b> This gas mixture is colorless and odorless, or may have a sharp odor (depending on the level of Carbon Dioxide).  <b>HOW TO DETECT THIS SUBSTANCE (warning properties):</b> There are no distinct warning properties of this gas mixture, unless the Carbon Dioxide is at a high concentration, when the odor may be a warning property. In terms of leak detection, fittings and joints can be painted with a soap solution to detect leaks, which will be indicated by a bubble formation.</p>		

## SECTION 10 — STABILITY AND REACTIVITY

Chemical Stability: Stable at standard temperatures and pressures.	If no, under which conditions?
Incompatibility with Other Substances: Yes	Due to the presence of Carbon Dioxide, this gas mixture may be incompatible with a variety of metals, alloys, and metal acetylides (e.g., aluminum, chromium, and zirconium). Carbon Dioxide will react with alkaline materials to form carbonates and bicarbonates. The Argon component of this gas mixture is a relatively inert gas.
<p>Reactivity, and under what conditions? Stable at normal temperatures and pressure.</p>	
<p>Conditions To Avoid: Contact with incompatible materials. Cylinders exposed to high temperatures or direct flame can rupture or burst.</p>	
<p>Hazardous Decomposition Products: The Carbon Dioxide component will produce Carbon Monoxide and Oxygen when heated to temperatures above 3000°F (1648°C). The Argon component of this product does not decompose, per se, but may react with other compounds in the heat of a fire.</p>	
<p>Polymerization: Will not occur.</p>	

## SECTION 11 — TOXICOLOGICAL INFORMATION

<p><b>Toxicity Data:</b> Argon is a simple asphyxiant (SA), which acts to displace oxygen in the environment. The data (opposite right) are available for the Carbon Dioxide component of this gas mixture.</p>	<p><b>Carbon Dioxide:</b> LCLo (inhalation, human) = 9 pph/5 minutes. LCLo (inhalation, mammal) = 90000 ppm/5 minutes. TCLo (inhalation, rat) = 6 pph/24 hours; reproductive and teratogenic effects.</p>
<p><b>SUSPECTED CANCER AGENT:</b> The components of this gas mixture are not found on the following lists: FEDERAL OSHA Z LIST, IARC, NTP, CAL/OSHA, and therefore is not considered to be, nor suspected to be a cancer-causing agent by these agencies.</p>	
<p><b>Irritancy of Product:</b> Due to the formation of carbonic acid, this gas mixture can be slightly irritating to contaminated eyes.</p>	
<p><b>Skin Sensitization:</b> The components of this product are not known to be skin sensitizers.</p>	<p><b>Respiratory Sensitization</b> The components of this product are not known to be respiratory sensitizers.</p>
<p><b>Reproductive Toxicity Information:</b> The information below concerns the effects of the components of this gas mixture on the human reproductive system.</p>	
<p><b>Reproductive Toxicity:</b> This gas mixture is not expected to cause adverse reproductive effects in humans. Studies involving test animals exposed to high concentrations of Carbon Dioxide show effects (e.g. changes in testes).</p>	<p><b>Teratogenicity:</b> This gas mixture has not been reported to cause teratogenic effects in humans. Clinical studies involving test animals exposed to high concentrations of Carbon Dioxide indicate teratogenic effects (e.g., cardiac and skeletal malformations, stillbirths).</p>
<p><b>Embryotoxicity:</b> This gas mixture has not been reported to cause embryotoxic effects in humans.</p>	<p><b>Mutagenicity:</b> This gas mixture is not expected to cause mutagenic effects in humans.</p>
<p><b>BIOLOGICAL EXPOSURE INDICES (BEIs):</b> Currently, there are no Biological Exposure Indices (BEIs) determined for the components of this gas mixture.</p>	

## SECTION 12 — ECOLOGICAL INFORMATION

<p><b>Aquatic Toxicity:</b> No an adverse effect from this gas mixture on aquatic life is expected.</p>
<p><b>Environmental Stability:</b> This gas mixture will be dissipated rapidly in well-ventilated areas.</p>
<p><b>EFFECT OF MATERIAL ON PLANTS or ANIMALS:</b> Any adverse effect on animals would be related to oxygen deficient environments.</p>

## SECTION 13 — DISPOSAL CONSIDERATIONS

<p><b>PREPARING WASTES FOR DISPOSAL:</b> Waste disposal must be in accordance with appropriate Federal, State, and local regulations. Return cylinders with any residual product to Matheson Tri-Gas. Do not dispose of locally.</p>
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## SECTION 14 — TRANSPORT INFORMATION

<p>This Material is hazardous as defined by U.S. DOT 49 CFR 172.101: Proper Shipping Name: Compressed gases, n.o.s. (Argon, Carbon Dioxide)</p>	<p>I.D. Number UN1956</p>
<p>Hazard Class or Division: 2.2 (Non-Flammable Gas)</p>	<p>Labeling Requirements: Non-Flammable Gas</p>
<p>North American Emergency Response Guidebook Number (2000): 126</p>	
<p><b>Marine Pollutant:</b> The components of this gas mixture are not classified by the DOT as a Marine Pollutants (as defined by 49 CFR 172.101, Appendix B).</p>	
<p><b>Special Shipping Information:</b> Cylinders should be transported in a secure position, in a well-ventilated vehicle. The transportation of compressed gas cylinders in automobiles or in closed-body vehicles present serious safety hazards and should be discouraged. NOTE: Shipment of compressed gas cylinders which have not been filled with the owner's consent is a violation of Federal law [49 CFR, Part 173.301 (b)].</p>	
<p><b>Transport Canada Transportation Of Dangerous Goods Regulations:</b> This gas mixture is considered as dangerous goods, per regulations of Transport Canada. Use the above U.S. DOT information for the preparation of Canadian Shipments of this mixture. NOTE: Shipment of compressed gas cylinders via Public Passenger Road Vehicle is a violation of Canadian law (Transport Canada Transportation of Dangerous Goods Act, 1992).</p>	

## SECTION 15 — REGULATORY INFORMATION

<p><b>ADDITIONAL U.S. REGULATIONS:</b></p> <p>U.S. SARA REPORTING REQUIREMENTS: No component of this product is subject to the reporting requirements of Sections 302, 304 and 313 of Title III of the Superfund Amendments and Reauthorization Act.</p> <p>U.S. SARA THRESHOLD PLANNING QUANTITY: There are no specific Threshold Planning Quantities for the components of this product. The default Federal MSDS submission and inventory requirement filing threshold of 10,000 lbs (4,540 kg) therefore applies, per 40 CFR 370.20.</p> <p>U.S. SARA HAZARD CATEGORIES (SECTION 311/312, 40 CFR 370-21): ACUTE: No; CHRONIC: No; FIRE: No; REACTIVE: No; SUDDEN RELEASE: Yes</p> <p>U.S. TSCA INVENTORY STATUS: Components of this product are listed on the TSCA Inventory.</p> <p>U.S. CERCLA REPORTABLE QUANTITY (RQ): Not applicable.</p> <p><b>OTHER U.S. FEDERAL REGULATIONS:</b> Not applicable.</p> <p>U.S. STATE REGULATORY INFORMATION: Components of this product are covered under some specific State regulations, as denoted opposite right (other State regulatory lists may exist; individual States should be contacted regarding full compliance).</p>	<p><b>California - Permissible Exposure Limits for Chemical Contaminants:</b> Argon, Carbon Dioxide.</p> <p><b>New Jersey - Right to Know Hazardous Substance List:</b> Argon, Carbon Dioxide.</p> <p><b>Pennsylvania - Hazardous Substance List:</b> Argon, Carbon Dioxide.</p> <p><b>California Safe Drinking Water And Toxic Enforcement Act (Proposition 65):</b> No component of this product is on the California Proposition 65 lists.</p> <p><b>Labeling:</b> Cylinders of this gas mixture should be labeled for precautionary information per the guidelines of the CGA. Refer to the CGA for further information.</p>
<p><b>ADDITIONAL CANADIAN REGULATIONS:</b></p> <p>Canadian DSL/NDL Inventory Status: The components of this product are listed on the DSL Inventory.</p> <p><b>OTHER CANADIAN REGULATIONS:</b> Not applicable.</p> <p>Canadian Environmental Protection Act (CEPA) Priorities Substances Lists: The components of this product are not on the CEPA Priorities Substances Lists.</p> <p>Canadian WHMIS Symbols: This gas mixture would be categorized as a Controlled Product, Hazard Classes: A (compressed gas). The following symbol is required for WHMIS compliance for this gas mixture.</p>	

## SECTION 16 — OTHER INFORMATION

<p>CREATION DATE: April 5, 2000 REVISION DATE: April 11, 2002</p> <p>REVISION HISTORY: Up-date of manufacturer address and phone.</p> <p>MIXTURES: When two or more gases or liquefied gases are mixed, their hazardous properties may combine to create additional, unexpected hazards. Obtain and evaluate the safety information for each component before you use the mixture. Consult an Industrial Hygienist or other trained person when you make your safety evaluation of the end product. Remember, gases and liquids have properties which can cause serious injury or death.</p> <p>Further information can be found in the following pamphlets published by: Compressed Gas Association Inc. (CGA), 1725 Jefferson Davis Highway, Suite 1004, Arlington, VA 22202-4102. Telephone: (703) 412-0900.</p> <p>“Safe Handling of Compressed Gases in Containers” (P-1, 1999)</p> <p>“Safe Handling and Storage of Compressed Gases” (AV-1, 1999)</p> <p>“Handbook of Compressed Gases” (1992)</p>
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## SECTION 16 — OTHER INFORMATION (Continued)

### Definitions of Terms

A large number of abbreviations and acronyms appear on a MSDS. Some of these which are commonly used include the following:

<p><b>CAS #:</b> This is the Chemical Abstract Service Number which uniquely identifies each constituent. It is used for computer-related searching.</p> <p><b>EXPOSURE LIMITS IN AIR:</b></p> <p><b>ACGIH</b> - American Conference of Governmental Industrial Hygienists, a professional association which establishes exposure limits.</p> <p><b>TLV</b> - Threshold Limit Value - an airborne concentration of a substance which represents conditions under which it is generally believed that nearly all workers may be repeatedly exposed without adverse effect. The duration must be considered, including the 8-hour Time Weighted Average (TWA), the 15-minute Short Term Exposure Limit, and the instantaneous Ceiling Level (C). Skin absorption effects must also be considered.</p> <p><b>OSHA</b> - U.S. Occupational Safety and Health Administration.</p> <p><b>PEL</b> - Permissible Exposure Limit - This exposure value means exactly the same as a TLV, except that it is enforceable by OSHA. The OSHA Permissible Exposure Limits are based in the 1989 PELs and the June, 1993 Air Contaminants Rule (Federal Register: 58: 35338-35351 and 58: 40191). Both the current PELs and the vacated PELs are indicated. The phrase, "Vacated 1989 PEL," is placed next to the PEL which was vacated by Court Order.</p> <p><b>IDLH</b> - Immediately Dangerous to Life and Health - This level represents a concentration from which one can escape within 30-minutes without suffering escape-preventing or permanent injury.</p> <p><b>NIOSH</b> is the National Institute of Occupational Safety and Health, which is the research arm of the U.S. Occupational Safety and Health Administration (OSHA). NIOSH issues exposure guidelines called Recommended Exposure Levels (RELs). When no exposure guidelines are established, an entry of NE is made for reference.</p> <p><b>HAZARD RATINGS:</b></p> <p><b>HAZARDOUS MATERIALS IDENTIFICATION SYSTEM:</b> This rating system was developed by the National Paint and Coating Association and has been adopted by industry to identify the degree of chemical hazards.</p> <p><b>Health Hazard:</b> 0 (minimal acute or chronic exposure hazard); 1 (slight acute or chronic exposure hazard); 2 (moderate acute or significant chronic exposure hazard); 3 (severe acute exposure hazard; onetime overexposure can result in permanent injury and may be fatal); 4 (extreme acute exposure hazard; onetime overexposure can be fatal).</p> <p><b>Flammability Hazard:</b> 0 (minimal hazard); 1 (materials that require substantial pre-heating before burning); 2 (combustible liquid or solids; liquids with a flash point of 38-93°C [100-200°F]); 3 (Class IB and IC flammable liquids with flash points below 38°C [100°F]); 4 (Class IA flammable liquids with flash points below 23°C [73°F] and boiling points below 38°C [100°F]).</p> <p><b>Reactivity Hazard:</b> 0 (normally stable); 1 (material that can become unstable at elevated temperatures or which can react slightly with water); 2 (materials that are unstable but do not detonate or which can react violently with water); 3 (materials that can detonate when initiated or which can react explosively with water); 4 (materials that can detonate at normal temperatures or pressures). PPE Rating B: Hand and eye protection is required for routine chemical use.</p> <p><b>NATIONAL FIRE PROTECTION ASSOCIATION:</b></p> <p><b>Health Hazard:</b> 0 (material that on exposure under fire conditions would offer no hazard beyond that of ordinary combustible materials); 1 (materials that on exposure under fire conditions could cause irritation or minor residual injury); 2 (materials that on intense or continued exposure under fire conditions could cause temporary incapacitation or possible residual injury); 3 (materials that can on short exposure could cause serious temporary or residual injury); 4 (materials that under very short exposure could cause death or major residual injury).</p> <p><b>Flammability Hazard and Reactivity Hazard:</b> Refer to definitions for "Hazardous Materials Identification System".</p>	<p><b>FLAMMABILITY LIMITS IN AIR:</b></p> <p>Much of the information related to fire and explosion is derived from the National Fire Protection Association (NFPA).</p> <p><b>Flash Point</b> - Minimum temperature at which a liquid gives off sufficient vapors to form an ignitable mixture with air.</p> <p><b>Autoignition Temperature:</b> The minimum temperature required to initiate combustion in air with no other source of ignition.</p> <p><b>LEL</b> - the lowest percent of vapor in air, by volume, that will explode or ignite in the presence of an ignition source.</p> <p><b>UEL</b> - the highest percent of vapor in air, by volume, that will explode or ignite in the presence of an ignition source.</p> <p><b>TOXICOLOGICAL INFORMATION:</b></p> <p>Human and Animal Toxicology: Possible health hazards as derived from select human data, animal studies, or from the results of studies with similar compounds are presented. Definitions of some terms used in this section are: LD<sub>50</sub> - Lethal Dose (solids &amp; liquids) which kills 50% of the exposed animals; LC<sub>50</sub> - Lethal Concentration (gases) which kills 50% of the exposed animals; ppm concentration expressed in parts of material per million parts of air or water; mg/m<sup>3</sup> concentration expressed in weight of substance per volume of air; mg/kg quantity of material, by weight, administered to a test subject, based on their body weight in kg. Other measures of toxicity include TDLo, the lowest dose to cause a symptom and TCLO the lowest concentration to cause a symptom; TDo, LDLo, and LDo, or TC, TCo, LCLo, and LCo, the lowest dose (or concentration) to cause lethal or toxic effects. Cancer Information: The sources are: IARC - the International Agency for Research on Cancer; NTP - the National Toxicology Program, RTECS - the Registry of Toxic Effects of Chemical Substances. OSHA and CAL/OSHA. IARC and NTP rate chemicals on a scale of decreasing potential to cause human cancer with rankings from 1 to 4. Subrankings (2A, 2B, etc.) are also used. Other Information: BEI - ACGIH Biological Exposure Indices, represent the levels of determinants which are most likely to be observed in specimens collected from a healthy worker who has been exposed to chemicals to the same extent as a worker with inhalation exposure to the TLV. Ecological Information: EC is the effect concentration in water. BCF = Bioconcentration Factor, which is used to determine if a substance will concentrate in lifeforms which consume contaminated plant or animal matter. TL<sub>m</sub> = median threshold limit; Coefficient of Oil/Water Distribution is represented by log K<sub>ow</sub> or log K<sub>oc</sub> and is used to assess a substance's behavior in the environment.</p> <p><b>REGULATORY INFORMATION:</b></p> <p><b>U.S. and CANADA:</b> This section explains the impact of various laws and regulations on the material. EPA is the U.S. Environmental Protection Agency. WHMIS is the Canadian Workplace Hazardous Materials Information System. DOT and TC are the U.S. Department of Transportation and the Transport Canada, respectively. Superfund Amendments and Reauthorization Act (SARA); the Canadian Domestic/Non-Domestic Substances List (DSL/NDL); the U.S. Toxic Substance Control Act (TSCA); Marine Pollutant status according to the DOT; the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA or Superfund); and various state regulations. This section also includes information on the precautionary warnings which appear on the material's package label.</p>
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## **SULFUR HEXAFLUORIDE (SF6)**

SF6 is used by the electrical industry as a gaseous dielectric medium for high-voltage (1 kV and above) circuit breakers, switchgear, and other electrical equipment, often replacing harmful PCBs. SF6 circuit breakers operate to switch electric circuits and equipment in and out of the system. These circuit breakers are filled with compressed sulfur-hexafluoride gas which acts to open and close the switch contacts. The gas also interrupts the current flow when the contacts are open.

- SF6 gas under pressure is used as an insulator in gas insulated switchgear (GIS) because it has a much higher dielectric strength than air or dry nitrogen.
- This property makes it possible to significantly reduce the size of electrical gear. This makes GIS more suitable for certain purposes such as indoor placement, as opposed to air-insulated electrical gear, which takes up considerably more room.
- Gas-insulated electrical gear is also more resistant to the effects of pollution and climate, as well as being more reliable in long-term operation because of its controlled operating environment.
- Although most of the decomposition products tend to quickly re-form SF6, arcing or corona can produce disulfur decafluoride (S2F10), a highly toxic gas, with toxicity similar to phosgene.
- S2F10 was considered a potential chemical warfare agent in World War II because it does not produce lacrimation or skin irritation, thus providing little warning of exposure.
- SF6 is also commonly encountered as a high voltage dielectric in the high voltage supplies of particle accelerators, such as Van de Graff generators and Pelletrons.
- Sulfur hexafluoride is also used as a reagent for creating thrust in a closed Rankine cycle propulsion system, reacting with solid lithium as used in the United States Navy's Mark 50 torpedo.
- SF6 plasma is also used in the semiconductor industry as an etchant.
- The magnesium industry uses large amounts of SF6 as inert gas to fill casting forms.
- It is also emitted during the aluminium smelting process.

**SULFUR HEXAFLUORIDE - SF6 - UN1080**

Sulfur Hexafluoride, SF<sub>6</sub>, is used by the electricity and semiconductor industry as an insulator for high-voltage circuit breakers, switchgear, and electrical equipment. Sulfur Hexafluoride, SF<sub>6</sub>, (Sulphur Hexafluoride - IATA proper shipping name) is also used in some medical procedures, and the magnesium industry uses Sulfur Hexafluoride, SF<sub>6</sub>, to insulate the molten magnesium from contacting air during the melting process. Contact Customer Service at Specialty Gases of America, Inc. for grade/purity, specifications and availability.

**GAS INFORMATION**

SYMBOL	SF <sub>6</sub>
MOLECULAR WEIGHT	146.06
SPECIFIC VOLUME	2.60 ft <sup>3</sup> / lb
PURITY	Contact Customer Service
CGA VALVE	590

**SHIPPING INFORMATION**

DOT PROPER SHIPPING NAME	Sulfur hexafluoride
IATA PROPER SHIPPING NAME	Sulphur hexafluoride
HAZARD CLASS	2.2
ID NUMBER	UN1080
LABELS	* N
CAS NUMBER	7446-09-5
SCHEDULE B NUMBER	
ZONE	
* N = Non-Flammable Gas * F = Flammable Gas * P = Poison-Inhalation Hazard	* O = Oxidizer * C = Corrosive

OTHER:

<b>Sulfur hexafluoride</b>		CAS 2551-62-4	
SF <sub>6</sub>		RTECS WS4900000	
<b>Synonyms &amp; Trade Names</b> Sulfur fluoride [Note: May contain highly toxic sulfur pentafluoride as an impurity.]		<b>DOT ID &amp; Guide</b> 1080 126	
<b>Exposure Limits</b>	NIOSH REL: TWA 1000 ppm (6000 mg/m <sup>3</sup> )		
	OSHA PEL: TWA 1000 ppm (6000 mg/m <sup>3</sup> )		
IDLH N.D.		Conversion 1 ppm = 5.98 mg/m <sup>3</sup>	
<b>Physical Description</b> Colorless, odorless gas. [Note: Shipped as a liquefied compressed gas. Condenses directly to a solid upon cooling.]			
MW: 146.1	BP: Sublimes	FRZ: -83°F (Sublimes)	Sol(77°F): 0.003%
VP: 21.5 atm	IP: 19.30 eV	RGasD: 5.11	
Fl.P: NA	UEL: NA	LEL: NA	
Nonflammable Gas			
<b>Incompatibilities &amp; Reactivities</b> Disilane			
<b>Measurement Methods</b> NIOSH 6602			
<b>Personal Protection &amp; Sanitation</b> Skin: Frostbite Eyes: Frostbite Wash skin: No recommendation Remove: No recommendation Change: No recommendation Provide: Frostbite		<b>First Aid</b> Eye: Frostbite Skin: Frostbite Breathing: Respiratory support	
<b>Respirator Recommendations</b> To be added later			
<b>Exposure Routes</b> inhalation			
<b>Symptoms</b> Asphyxia: increased breathing rate, pulse rate; slight muscle incoordination, emotional upset; lassitude (weakness, exhaustion), nausea, vomiting, convulsions; liquid: frostbite			
<b>Target Organs</b> respiratory system			
OTHER:			

## NIOSH Pocket Guide to Chemical Hazards First Aid Procedures

Code	Definition
Eye: Irrigate immediately	If this chemical contacts the eyes, immediately wash the eyes with large amounts of water, occasionally lifting the lower and upper lids. Get medical attention immediately. Contact lenses should not be worn when working with this chemical.
Eye: Irrigate promptly	If this chemical contacts the eyes, promptly wash the eyes with large amounts of water, occasionally lifting the lower and upper lids. Get medical attention if any discomfort continues. Contact lenses should not be worn when working with this chemical.
Eye: Frostbite	If eye tissue is frozen, seek medical attention immediately; if tissue is not frozen, immediately and thoroughly flush the eyes with large amounts of water for at least 15 minutes, occasionally lifting the lower and upper eyelids. If irritation, pain, swelling, lacrimation, or photophobia persist, get medical attention as soon as possible.
Eye: Medical attention	Self-explanatory
Skin: Blot/brush away	If irritation occurs, gently blot or brush away excess.
Skin: Dust off solid; water flush	If this solid chemical contacts the skin, dust it off immediately and then flush the contaminated skin with water. If this chemical or liquids containing this chemical penetrate the clothing, promptly remove the clothing and flush the skin with water. Get medical attention immediately.
Skin: Frostbite	If frostbite has occurred, seek medical attention immediately; do NOT rub the affected areas or flush them with water. In order to prevent further tissue damage, do NOT attempt to remove frozen clothing from frostbitten areas. If frostbite has NOT occurred, immediately and thoroughly wash contaminated skin with soap and water.
Skin: Molten flush immediately/solid-liquid soap wash immediately	If this molten chemical contacts the skin, immediately flush the skin with large amounts of water. Get medical attention immediately. If this chemical (or liquids containing this chemical) contacts the skin, promptly wash the contaminated skin with soap and water. If this chemical or liquids containing this chemical penetrate the clothing, immediately remove the clothing and wash the skin with soap and water. If irritation persists after washing, get medical attention.
Skin: Soap flush immediately	If this chemical contacts the skin, immediately flush the contaminated skin with soap and water. If this chemical penetrates the clothing, immediately remove the clothing and flush the skin with water. If irritation persists after washing, get medical attention.
Skin: Soap flush promptly	If this chemical contacts the skin, promptly flush the contaminated skin with soap and water. If this chemical penetrates the clothing, promptly remove the clothing and flush the skin with water. If irritation persists after washing, get medical attention.

Skin: Soap promptly/molten flush immediately	If this solid chemical or a liquid containing this chemical contacts the skin, promptly wash the contaminated skin with soap and water. If irritation persists after washing, get medical attention. If this molten chemical contacts the skin or nonimpervious clothing, immediately flush the affected area with large amounts of water to remove heat. Get medical attention immediately.
Skin: Soap wash	If this chemical contacts the skin, wash the contaminated skin with soap and water.
Skin: Soap wash immediately	If this chemical contacts the skin, immediately wash the contaminated skin with soap and water. If this chemical penetrates the clothing, immediately remove the clothing, wash the skin with soap and water, and get medical attention promptly.
Skin: Soap wash promptly	If this chemical contacts the skin, promptly wash the contaminated skin with soap and water. If this chemical penetrates the clothing, promptly remove the clothing and wash the skin with soap and water. Get medical attention promptly.
Skin: Water flush	If this chemical contacts the skin, flush the contaminated skin with water. Where there is evidence of skin irritation, get medical attention.
Skin: Water flush immediately	If this chemical contacts the skin, immediately flush the contaminated skin with water. If this chemical penetrates the clothing, immediately remove the clothing and flush the skin with water. Get medical attention promptly.
Skin: Water flush promptly	If this chemical contacts the skin, flush the contaminated skin with water promptly. If this chemical penetrates the clothing, immediately remove the clothing and flush the skin with water promptly. If irritation persists after washing, get medical attention.
Skin: Water wash	If this chemical contacts the skin, wash the contaminated skin with water.
Skin: Water wash immediately	If this chemical contacts the skin, immediately wash the contaminated skin with water. If this chemical penetrates the clothing, immediately remove the clothing and wash the skin with water. If symptoms occur after washing, get medical attention immediately.
Skin: Water wash promptly	If this chemical contacts the skin, promptly wash the contaminated skin with water. If this chemical penetrates the clothing, promptly remove the clothing and wash the skin with water. If irritation persists after washing, get medical attention.
Breath: Respiratory support	If a person breathes large amounts of this chemical, move the exposed person to fresh air at once. If breathing has stopped, perform mouth-to-mouth resuscitation. Keep the affected person warm and at rest. Get medical attention as soon as possible.
Breath: Fresh air	If a person breathes large amounts of this chemical, move the exposed person to fresh air at once. Other measures are usually unnecessary.
Breath: Fresh air, 100% O <sub>2</sub>	If a person breathes large amounts of this chemical, move the exposed person to fresh air at once. If breathing has stopped, perform artificial respiration. When breathing is difficult, properly trained personnel may assist the affected person by administering 100% oxygen. Keep the affected person warm and at rest. Get medical attention as soon as possible.
Swallow: Medical attention immediately	If this chemical has been swallowed, get medical attention immediately.

