

# Safety

## Handling of gases and safety instructions



Safety first is the beginning of any activity. Accordingly, a number of rules and regulations need to be observed when handling compressed gases and their containers. The handling includes all activities with gases in transportable compressed gas containers, in particular the in-house transport, the storage, the supply, the emptying and actual use of the gases as well as maintenance and servicing.

Prior to handling gases, in every case, the corresponding safety data sheet needs to be read and thoroughly understood.

Statutory regulations as well as relevant standards need to be observed. Comprehensive information on the use of gases is also provided by the EIGA (European Industrial Gases Association) website: [www.eiga.org](http://www.eiga.org).

Rather than detailing all rules and regulations comprehensively, the aim of this publication is to provide some general information on safe handling of gases based on practical experience.



## Properties of gases

Before handling a gas, you need to know its specific properties, e. g. whether it is flammable, oxidizing, toxic, corrosive, mutagenic or dangerous to the environment. Some gases have several of these properties at the same time. Inert gases can displace vital atmospheric oxygen and thus have a suffocating effect. Compressed-gas containers store gases under pressure, also in a liquefied or dissolved state.

The gases' essential properties are indicated on the safety and product data sheets obtainable from Messer.

SAFETY DATA SHEET		Page: 1
Messer		Revised edition no.: 0
Argon		Date: 26 / 1 / 2015
		Supersedes: 0 / 0 / 0
EIGA003A		
<p>22 Non-flammable, non-toxic gases</p> <p><b>Warning</b></p> <p></p>		
<p><b>SECTION 1: Identification of the substance/mixture and of the company/undertaking</b></p> <p><b>1.1. Product identifier</b></p> <p>Trade name: Argon            SDS no.: EIGA003A            Chemical description: Argon            CAS No.: 7440-37-1            EC No.: 231-147-5            Index No.: —            Registration No.: Listed in Annex IV / V REACH, exempted from registration.            Chemical formula: Ar</p> <p><b>1.2. Relevant identified uses of the substance or mixture and uses advised against</b></p> <p>Relevant identified uses: Purge gas, drying gas, inerting gas, industrial and professional. Perform risk assessment prior to use. Test gas calibration gas. Laboratory use. Purging. Shield gas for welding processes. Use for manufacture of electronic/photoelectric components. Contact supplier for more information on uses.</p> <p><b>1.3. Details of the supplier of the safety data sheet</b></p> <p>Company identification: Messer Schweiz AG            Seestrasse 75            CH-5500 Lenzburg, Switzerland            Tel.: +41 62 886 41 41</p> <p><b>1.4. Emergency telephone number</b></p> <p>Emergency telephone number: +41 62 886 41 41 / ToxicInfo: +41 44 251 51 51</p> <p><b>SECTION 2: Hazards identification</b></p> <p><b>2.1. Classification of the substance or mixture</b></p> <p>Hazard Class and Category Code: Regulation (EC) 1272/2008 (CLP)</p> <p>Physical hazards: Gases under pressure - Compressed gas - Warning (CLP: Press. Gas Comp.) - H280</p> <p>Classification (EC 455/04, as EC 1999/04): Not classified as dangerous substance / mixture. Not included in Annex V. No EC-labeling required.</p> <p><b>2.2. Label elements</b></p> <p>Labeling: Regulation (EC) 1272/2008 (CLP)</p> <p>Messer Schweiz AG            Seestrasse 75, CH-5500 Lenzburg, Switzerland            Tel.: +41 62 886 41 41</p> <p>In case of emergency: +41 62 886 41 41 / ToxicInfo: +41 44 251 51 51</p>		

Safety data sheet

## Properties of gases

- Compressed gases are stored under pressure
- Flammable gases have an explosion range in combination with air or other oxidizing substances
- Self-igniting gases have an ignition temperature < 100°C. These gases can ignite already at room temperature in combination with air or other oxidizing substances even without ignition source
- Oxidizing gases maintain combustion, but are themselves non-flammable
- Corrosive gases attack many materials - especially metals - and can damage skin and mucous membranes
- Toxic gases can seriously harm or even kill human beings if inhaled or resorbed via the skin
- Environmentally hazardous gases can damage the ozone layer, aggravate global warming or pollute water
- Some gases are classified as carcinogenic, teratogenic or mutagenic and can cause long-term harm to humans





## Safe handling

### Storage

Transportable compressed-gas containers have always to be stored in an adequately ventilated environment. This is normally ensured outdoors; indoor facilities should at least be furnished with appropriate ventilation apertures arranged diagonally at opposite ends. Storage areas have to be protected against unauthorized access.

Flammable gases are stored in so-called explosion-proof zones where the use of sensors for ambient air monitoring can be reasonable. In the event of emergency they alert against a flammable atmosphere. The installation of the sensors should comply with the gas properties. In the case of gases which are lighter than air the sensors have to be fixed in the upper part and for those heavier than air in the lower part of the space. Comparably, sensors for oxygen monitoring show the presence of a breathable atmosphere.

Transportable compressed-gas containers must not be stored in traffic routes, garages, passageways, corridors, staircases or, and in particular, escape routes. Wherever possible, such containers should be positioned upright and safeguarded against toppling; if storage in a lying position is unavoidable, the containers should be safeguarded against rolling. With gases pressurised in a liquefied or dissolved state there is the danger of valve flooding. Cylinders should be placed upright for a sufficient period before withdrawal, and purged prior to a connection of pressure regulators.

Transportable compressed-gas containers should not be stored in the vicinity of flammable substances (paper, wood, flammable liquids); certain safety distances need to be redeemed in such cases.

The compressed-gas containers should be protected from the elements (rain, snow). Protection against solar radiation is not required. Distances to heat sources must be large enough to keep the compressed-gas containers' surface temperature below 50 °C.



## Operation of transportable compressed-gas containers

Gases are nowadays indispensable for a wide variety of applications. The spectrum ranges from technical gases for welding, ultra-pure gases and their mixtures for research and analyses, as well as medical gases for hospitals.

Only appropriately trained personnel is generally allowed to handle compressed-gas containers. Trainings should be repeated regularly, at least once a year. Relevant information is provided by the safety data sheet and by appropriate regulations.





**The following codes of practice must be observed in particular:**

- Acquire information on individual parameters such as pressure, maximum dischargeable quantity (for example, in the case of liquefied gases under pressure described further below, flammability, toxicity, flammability limits, material compatibility, possible reactions) work out risk assessment, prepare work instructions
- Use appropriate personal protection equipment like safety shoes or gloves
- Transport compressed-gas containers with their valve closed and cylinder cap screwed in place (without connected fittings). Use only appropriate devices for transport (for example, cylinder transport vehicles)
- Only the quantities and types of gas actually required should be provided to the workplace
- Protect containers against impermissible heating from radiators or open flames
- Secure compressed-gas containers against toppling
- Prior to initial operation (i.e. connection of compressed-gas containers), check the labels indicating hazardous materials in order to fully clarify gas types and mixture concentrations. Existent labelling should not be removed or damaged. Full and empty compressed-gas containers should be labelled to preclude any confusion between them

- Ensure adequate ventilation; if toxic gases are involved, it might be necessary to use an safety cabinet. Pay attention on the gas density (heavier or lighter than air)
- Before opening the compressed-gas container's valve, ensure that the withdrawal system has been connected gas-tight and purged if necessary, and that the following pressure controller is relieved. Prior to initial operation and at recurrent intervals later, inspect the entire gas supply system for any leakages
- To prevent excessive cooling of the cylinder valve and pressure regulator, adjust the withdrawal quantity to the type of gas and equipment dimensions. Larger withdrawal quantities require appropriate gas supply systems and possibly a parallel connection of compressed-gas containers or cylinder packs. A potentially frozen cylinder valve must be defrosted slowly.

**Special attention must be paid to the following items in the case of compressed liquefied gases at room temperature:**

- Heat of vaporization cools liquids thus cooling the containers' contents during the process of withdrawal. This leads to a drop in pressure. At high discharge quantities and/or over long operating periods, the pressure can drop below atmospheric pressure, and withdrawal is no longer possible
- Heating of a compressed-gas container to increase pressure should only take place in a water bath or air stream (while ensuring that the container's temperature remains below 50 °C). Never heat containers using an open flame or a punctual heat source! Compressed-gas containers from which gases are to be withdrawn in the liquefied state should be equipped with a dip tube. The liquid is lifted either by its own vapour pressure or via a compressed-gas cushion. Consult the supplier whether the use of such a cushion is permissible.





## Gases with special properties

### Oxygen:

Only use materials which are suitable and approved for oxygen. All system components (especially manometers, fittings and screw connections) must be kept free of oil and grease, and labelled appropriately. Check for special hazards posed by accumulation in closed rooms and observe the related regulations.



### Flammable and self-igniting gases:

The gas-tightness of the system is extremely important. Explosion protection measures should be implemented in particular. All easily flammable substances should be removed from zones susceptible to an outbreak of fire. Before initial operation of compressed-gas cylinders containing flammable or self-igniting gases, use an inert gas to purge the entire gas supply system from air and other oxidizing gases. This applies conversely during shutdown: All residual gases should be diluted to harmlessness using inert gas and then disposed of.



### Toxic gases:

Extreme caution needs to be exercised when handling toxic gases or mixtures containing them. Persons charged with handling such gases should be trained appropriately beforehand what also should be documented. Gas-tightness of the system is the number one priority. Adequately dimensioned exhaust systems are only allowed to be used. Devices for testing or warning about the presence of the involved gases help in timely to detect and prevent from accumulations hazardous to the respiratory system. Suitable breathing apparatus should remain ready at hand or even carried with you. The purge gas should be obtained from a separate cylinder to prevent unwanted gases from being carried off into the supply network. For this purpose, the purging system should be safeguarded by means of a nonreturn valve whose proper function should be checked at regular intervals. Purge gases should be routed via appropriate retention systems.



### The following restrictions apply additionally to the handling of compressed-gas containers:

- Only authorized companies are allowed to fill such containers with gases
- Compressed-gas containers must not be used as buffers or collectors for products
- Compressed-gas containers connected together always undergo pressure equalization which can cause impurities to enter the connected containers. Liquefied gases accumulate at the point of lowest temperature.

### After completion of tasks, observe the following instructions:

- At work breaks or orderly shutdown, always close the compressed-gas container's valve and relieve the pressure controller to prevent uncontrolled pressure build-up or gas escaping
- Label empty containers to prevent confusion. Pressurised containers should never be emptied to the point of full pressure equalization, in order to prevent an ingress of atmospheric air during the process of return
- Containers which might have been infiltrated by impurities through re-flux must be labelled as such and returned to the supplier together with a notice of the possible ingress. This helps prevent impure deliveries in future
- Compressed-gas containers with faults either visible or hidden but known must be clearly labelled and returned to the gas manufacturer.





## Correct cylinder replacement

To empty a compressed-gas cylinder, connect it to a gas supply system or suitable pressure regulator. The following procedure is advisable here:

Close the cylinder valve by turning the corresponding hand wheel clockwise; then relieve the cylinder pressure regulator's adjustment spring by turning the corresponding hand wheel clockwise. In this process, the adjustment cone is closed by the closing spring. In the case of hazardous gases (corrosive, toxic, flammable, self-igniting), the high-pressure section of the gas supply system is purged with inert gas. After purging the union nut can be screwed off from the cylinder valve without danger; note the turn of the threads (right-hand or left-hand).



Before connecting a new compressed-gas container, check the ring-shaped seal on the regulator's connection for cracks, score marks or similar deformations. If the seal is damaged, make sure to replace it with one made of an approved material. (Important: Wrong sealing materials can give rise to dangerous chemical reactions). Damaged or leaky valves should be repaired only by qualified staff, e.g. at the manufacturer.

Screw in the union nut first hand-tight, and then fully by means of an appropriate open-end wrench; note the turn of the threads (right-hand or left-hand). Slowly open the cylinder valve to flood the pressure controller's high-pressure section. After just one turn, the valve is fully open. Check the tightness of the connection with the help of leakage detection spray. If there is a leakage, do not try to close it by further tightening the union nut. Instead, undo the connection again, replace the seal and repeat the whole connection procedure. Then adjust the required operating pressure by turning in the hand wheel of the pressure reducer; now the gas or gas mixture can be drawn off.



Compressed-gas container valves should be opened and closed slowly, not abruptly. To permit perception of the valve setting as required, close the valve half a turn each time after opening it. Never operate a valve by force (do not use tools as an aid).

## Actions in case of a fire

In case of fire inform the responsible fire department at once. If possible remove compressed-gas containers from the hazardous zone. If this cannot be done safely, cool the compressed-gas containers by spraying them with water from a safe distance. Inform the fire department about the presence of compressed-gas cylinders in the fire zone.

## First-aid measures

First-aid measures on an occurrence of accidents involving gases are specified on the safety data sheets. The following instructions apply in general:

- An inhalation of inert gases can lead to drowsiness or even apnoea. Lead victim, while always ensuring one's own safety, to fresh air at once, and apply artificial respiration if necessary. In fresh air keep victim warm and rested.
- In case of contact of corrosive gases with skin or eyes flush the area thoroughly with water for at least 15 minutes.
- Liquefied gases at cryogenic temperatures cause cold burns on skin contact. In such cases, rinse the affected spots carefully with lukewarm water, remove any affected clothing carefully. In case of major cold burns the injured person should be bathed in lukewarm water.

Consult a doctor in all such cases.

Gases and compressed-gas containers have become indispensable helpers in our daily lives. Thanks to careful handling, accidents with such containers are very rare. With an accident-based downtime rate of just four working days per million working hours, the gas industry is one of the safest industrial sectors in the world. In order to keep it that way, we rigorously implement safety instructions at the workplace. Handling of compressed-gas containers is no problem as long as the relevant guidelines are complied with. We will gladly answer any questions you might have regarding this topic or train your staff on site.



### Messer Group GmbH

Messer-Platz 1  
65812 Bad Soden  
Phone +49 6196 7760-0  
Fax +49 6196 7760-442  
info@messergroup.com  
www.messergroup.com  
www.specialtygases.de



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# Ten rules for handling pressurised gas containers

1. Perform the risk assessment and prepare an operating instruction
2. Prior to handling pressurised gas containers the personnel should be instructed
3. Don't throw and always secure pressurised gas containers against toppling
4. Transport only with valve protection approved for the purpose, protected from slipping or rolling around
5. Protect pressurised gas containers against dangerous heating ( $< 50\text{ }^{\circ}\text{C}$ ), avoid punctual heating from open flame or radiator
6. No refilling of gas in other pressurised gas containers, prevent backflow
7. Labelling should not be removed or damaged
8. Cylinder valves and pressure regulators must be kept free of oil and grease, operate gas supply systems only manually, when not in use close the cylinder valve
9. Withdraw gas only with appropriate pressure regulator, before connecting check seal
10. Don't use damaged pressurised gas containers, but label them and inform the supplier



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**Messer Group GmbH**

Messer-Platz 1  
65812 Bad Soden  
Phone +49 6196 7760-0  
Fax +49 6196 7760-442  
info@messergroup.com  
www.messergroup.com  
www.specialtygases.de

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