



Handling of gases / 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. This handling includes conveyance (on public roads and inside company premises), storage, supply, emptying of compressed-gas containers and actual usage of the gases.

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. Specific data on individual gases can be found on the related safety and material data sheets.

Statutory regulations as well as relevant standards need to be observed in all cases. Comprehensive information on the use of gases is provided by the EIGA (European Industrial Gases Association) website: www.eiga.be.

Our safety experts will gladly provide your staff with training in the transport, storage and usage of gases. Do not hesitate to contact us!



Safety data sheet

Properties of gases



Before handling a gas, you need to know its specific properties, i.e. whether it is flammable, oxidizing, toxic, self-igniting or corrosive. Some gases have several of these properties at the same time. Although inert gases are not classified as hazardous material, they are still dangerous goods. They 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 cylinder labels and safety data sheets obtainable from Messer.

Technical data sheet

Properties of gases:

- Flammable gases have an explosion range in combination with air or other oxidizing substances
- Self-igniting gases have an ignition temperature $< 100^{\circ}\text{C}$. These gases can ignite already at room temperature in combination with air or other oxidizing substances
- Oxidizing gases support combustion but are not flammable themselves
- Corrosive gases attack many materials - especially metals - and burn skin as well as mucous membrane
- 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
- Gases are classified as carcinogenic or teratogenic can cause long-term harm to humans



Warning signs facilitate identification of gas properties

Safe handling



Storage

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.

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 on all accounts be safeguarded against rolling. With gases pressurized 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.

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

Compressed-gas containers should be protected from the elements (rain, snow etc.). Although protection against solar radiation is not prescribed, it might be advisable. Distances to heat sources must be large enough to keep the compressed-gas containers' surface temperature below 50°C.



Operation of 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 briefed personnel is generally allowed to handle compressed-gas containers. Briefings should be repeated regularly, at least once a year. Relevant information is provided by the safety and material data sheets, product specifications and 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, explosion limits, material compatibility, possible reactions; prepare work instructions
- Use appropriate personal protection equipment like safety shoes, gloves
- Whenever possible, 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 operating area
- Protect containers against impermissible heating
- 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. The 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 a 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. Large withdrawal quantities require appropriate gas supply systems and possibly a parallel connection of compressed-gas containers / cylinder packs. Frozen cylinder valves must be thawed again carefully using just warm water, a warm cloth or warm gas flow (keep away from any ignition sources in this process)

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, after which 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 a naked flame! Avoid local overheating, as even this can lead to notable rises in pressure, depending on the vapour pressure
- 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 as to whether use of such a cushion is permissible

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 via valves always undergo pressure equalization which can cause impurities to enter the connected containers by way of the communicating pipes. Liquefied gases collect 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. Pressurized 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 firmly 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 (Messer)

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 briefed appropriately beforehand. Gas-tightness of the system is the number one priority. Adequately dimensioned exhaust systems should be used wherever possible. Devices for testing or warning about the presence of the involved gases help in timely detection of accumulations hazardous to the respiratory system. Breathing apparatus should remain ready at hand.



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 non-return valve whose proper function should be checked at regular intervals. purge gases should be routed via appropriate retention systems.

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 handwheel clockwise; then relieve the cylinder pressure regulator's adjustment spring by turning the corresponding handwheel 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 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 a 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 and replace the seal. Then adjust the required operating pressure by turning in the handwheel of the adjustment spring; after that, 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 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



[Consult a doctor in all such cases.](#)

Gases and compressed-gas containers have become an indispensable part of 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 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.

Do not hesitate to contact us!



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