

KAM rule 09 Gas cylinders in working areas

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1. Changes

The KAM rule has been updated for various names and departments. An addition has also been made to the effect that each organisation must maintain an up-to-date overview of gas cylinders present in working areas.

2. Purpose

Various different organisations at the USPB site use different types of gas cylinders in working areas. This KAM rule describes the statutory and safety measures with regard to installing and using gas cylinders in working areas.

3. Responsibilities

The responsibilities concerning the observance of this KAM rule are as follows:

The head of the department has final responsibility for the observance of this KAM rule by the staff members of his/her organisation unit.

The staff members of the department are responsible for:

- Setting up and connecting and disconnecting gas cylinders;
- In the event of incidents and/or calamities with gas cylinders (e.g. the release of toxic gases, fire, explosion) to act in accordance with the applicable incident procedure of the organisation and [KAM rule 15m Reporting \(near\) environmental incidents](#).

The staff members of PSP logistics are responsible for:

- The supplier's activities, who delivers and disposes of the gas cylinders, including the correct transfer of the gas cylinders to the user. For this, see [KAM rule 03 'Hazardous substances'](#)

4. Working method

4.1 Hazards

Using gas cylinders can pose hazards to the surroundings (environment) and the working conditions. In particular, this concerns the consequences arising from gas cylinders being exposed to heat sources. This may cause the pressure in a gas cylinder to increase so much that it fails. A gas cylinder can also fail because when heated, the gas cylinder material loses its strength. These incidents may be accompanied by an explosion, resulting in rocket-like forces and flying metal shards.

If a gas cylinder contains a flammable gas, the contents of the gas cylinder will also burn when it bursts open as a result of heating through fire. Usually, with gas cylinders, this results in a jet of flame. The contents of gas cylinders that are filled with a liquefied flammable gas could burn briefly in the form of a fire ball. Apart from being flammable and explosive, gases may also be toxic or corrosive. In practice, gas cylinders often have a colour indication (on the top) to indicate the properties of the gas. The most common colour codes on gas cylinders are shown in table 1.

Table 1. Colour on the top of the gas cylinder and the property of the gas (most common).

Colour of gas cylinder	Property of the gas
Clear green	Choking
Red	Flammable
Light blue	Accelerates the fire
Yellow	Toxic or corrosive

Furthermore, for a number of gases it is important to counter the spread of environmentally harmful substances.

When liquefied gases (e.g. cryogenic gases) are released, there is a danger of oxygen displacement from the air. When released, a liquefied gas can expand excessively.

A detection system for the oxygen concentration (with a warning signal) is specified for storing large cryogenic containers (in storage areas). In these cases, an extraction at a height of 20 cm above the floor is essential.

4.2 Using gas cylinders in working areas

The use of gas cylinders in working areas must be restricted to a minimum. Only gas cylinders for which the gas in question cannot be taken from the central gas network can (in exceptional cases) be considered for installation and use in a space. Gas cylinders are stored in a gas cylinder cabinet, as much as possible outside.

4.3 Overview of gas cylinders in working areas

Each organisation at the USPB site has an overview of which gas cylinders are used in which specific room. This overview can also be maintained per organisation at the departmental level or building level, and it is necessary for the complete and correct information of the emergency services (e.g. the fire brigade) during incidents and calamities.

4.4 Safety measures when using gas cylinders

If for certain activities a gas cylinder is required in a working space (e.g. for analyses), then the following safety precautions must be taken.

4.4.1 Setting up gas cylinders

- gas cylinders for which the approval period has elapsed may no longer be used and must be disposed of. The user must keep an eye on the final period for re-inspection;
- gas cylinders should always be secured (wall or table bracket) and protected against mechanical damage;
- gas cylinders that are not secured in a fixed place, must be stored in a fixed place after working hours (gas cylinders cabinet);
- piping, accessories and packaging material must be demonstrably maintained/inspected;
- gas cylinders may not block any exits and may never be placed near lifts, passageways and other places where they can be hit by heavy moving or falling objects;

- gas cylinders may never be handled roughly. Shocks, falling or hitting other hard objects must be avoided, because this may result in the gas cylinder wall cracking under the internal pressure;
- gas cylinders must always be easily accessible, be able to be removed quickly and not be set up in the immediate vicinity of other flammable substances;
- empty gas cylinders must be handled and stored in the same way as filled gas cylinders. They must be stored separated by type as much as possible;
- Valves must be fitted:
 - immediately before or after the pipe enters a building;
 - at the end of each branch from a fixed pipe to a user device;
 - in the piping that enables the pipe to be wholly or partly flushed with an inert gas.

4.4.2 Connecting and disconnecting gas cylinders

- Protective caps may not be removed, unless no connection is possible with the reducer device without unscrewing;
- before use, the stamp on the gas cylinder should be checked, to verify that it contains the intended gas type and the test date has not elapsed. If the contents of the gas cylinder are unknown due to the lack of any indication, marking or label, the gas cylinder must be returned unused to the supplier (via PSP to Lindegas);
- when connecting and disconnecting the reducer devices, the following measures and indications are important:
 - sound and properly fitting packing rings must be used;
 - the packing material must be suitable for the gas in question;
 - the connections must be clean;
 - the valve may only be vented with flammable or toxic gases outside, never vent using hydrogen or acetylene, not even in the outside air;
 - gas cylinders with flammable gases always have a left-hand thread, which can be recognised by the notches in the corners of the nut;
 - old packing rings must be removed and destroyed, so that they cannot be reused;
 - the use of alloys containing more than 63% copper is prohibited with acetylene;
 - no silver solder may be used for soldered joints (acetylide-formation);
 - materials that are only used for disconnecting gas cylinders must be stored after disconnecting in a dust-free space, free of oils, greases and other chemical substances;
 - equipment, screw thread, connections, couplings and pipes for use with oxygen must be absolutely free of oil and grease;
 - it is recommended to have packing material, hose connections, hose clamps etc. in stock for the gases that are in use;
- suitable pressure regulators must be chosen in cases when gas is used in systems where a lower pressure is allowed than the available gas cylinder pressure. An expert (e.g. the supplier) must be consulted for the suitability and reinspection of the pressure regulator;

- regulators, meters, hoses and other equipment, that are intended for use with a special type of gas or group of gases, may not be used on any gas cylinders that contain gases with very different chemical properties; an expert must first be consulted for this;
- connections that do not fit may never be forced. Screw thread or connections of control devices or other equipment must be the same as on the connection on the gas cylinder;
- open the valve slowly. The valve opening must be pointed in a direction where there are no people;
- only the designated keys and/or tools may be used when opening. The key must stay on the (opened) gas cylinder;
- if a valve has become stuck due to rust, or opens with difficulty, the valve may not be opened by force. Valves fitted with a hand wheel may never be opened using a key or pliers. The use of a hammer is not allowed;
- before taking the gas cylinder into use, all valves must be checked for leakages. This may never be done with a naked flame (i.e. do not use open fire). Soap suds is usually suitable for this;
- if it is found (e.g. through periodic inspection) that the hoses are not in good condition (e.g. through cracks, porous), then the hoses must be replaced;
- before uncoupling a regulator, the gas cylinder valve must be closed. A loose protective cap must be replaced;
- if a gas cylinder is not in use, the valve must be closed and the reducer valve (pressure regulator) must be released;
- valves must be easily accessible.

4.4.3 Repairing gas cylinders

- Gas cylinders, valves and safety devices (pressure regulators) may never be repaired or changed by inexperienced personnel;
- damaged and/or leaky gas cylinders, that can no longer be closed by tightening the packing sleeve, must be immediately taken into the outside air after tightening and marked with the word 'defective' or 'leaks' respectively;
- the necessary measures must be taken to prevent fire, explosion and poisoning hazards. On the release of a flammable or toxic gas, the company emergency organisation must be warned (telephone number +31 (0)30-274 2444) and if applicable, Stichting ALT (KAM rule 15m);
- numbers, approving authority stamps etc. may never be removed without the permission of the relevant competent bodies (i.e. Lloyd's Register, formerly Stoomwezen), neither may markings, labels or any recognition colours be removed that indicate the contents of the gas cylinder and/or the permissible filling weight;
- gas cylinders may never be sprayed in another colour.

4.4.4 Gas cylinders with toxic substances

- before commencing the activities, employees who work with toxic gases must be aware of the properties and the hazards posed by these gases. The VIB/MSDS and the information on the labels should be consulted for this;
- toxic gases may only be worked with in areas with proper mechanical ventilation, such as

properly extracted fume-cupboards;

- employees must be aware of the PPE (personal protective equipment) that are mandatory. Gas masks with suitable filter canisters, fresh air or compressed air masks must be available in areas where work is done with toxic gases. These gas masks must be available in a place that is recognisable to everyone, e.g. in a clean cupboard with a glass window to prevent contamination or soiling;
- keep the filter canisters and mask/face pieces packed in a closed plastic bag (to prevent any moisture problems).

4.4.5 Additional requirements for oxygen

- All parts of an oxygen line that may be subject to a pressure between 2,500 kPa (25 bar) and 15,000 kPa (150 bar) must be made of copper, brass or stainless steel. Parts of an oxygen pipe, which may be subject to a pressure in excess of 15,000 kPa (150 bar) must be made of copper or brass;
- all parts of oxygen installations, which may come into contact with oxygen, must be free of oil, paint and dust;
- before taking an oxygen installation into use, it must be degreased with a non-flammable degreasing agent and then flushed with nitrogen;
- the connection of a gas cylinder to a collecting pipe for oxygen must be such that it is impossible to connect anything except oxygen cylinders to it, all this in accordance with NEN 3268.

4.4.6 Maximum quantity of gas cylinders

The total quantity of cylinders that may be present in working areas without a **gas cylinder cabinet**, per fire compartment (a floor, or a part of a building separated from the rest of the building by walls, floors or a ceiling with a fire resistance of at least 60 minutes), may not exceed a collective water capacity of 125 litres of filled and empty gas cylinders.

4.4.7 Gas cylinder cabinet

A gas cylinder cabinet must be installed outside the premises. Only in exceptional situations may the gas cylinder cabinet (fire safety storage cabinet for gas cylinders) be installed inside the premises. For this, prior consultation must be held with the relevant safety expert of the organisation.

A gas cylinder cabinet must comply with the specifications of the latest version of [PGS15](#), such as an implementation in accordance with the standard NEN-EN-14470-2 (fire resistance of at least 60 min) and the collective water capacity amounts to no more than 220 litres per gas cylinder cabinet.

Only gas cylinders of the same category may be stored in the same gas cylinder cabinet. The

ventilation duct in the gas cylinder cabinet must be effectively and sufficiently constructed for the gas cylinders present. This means that the ventilation duct must be connected to the outside air and that account must be taken of the hazard aspects of the gases in defining the type of ventilation.

No more than two gas cylinder cabinets may be installed per fire compartment (so a maximum of 440 litres).

The following instructions are also applicable when using a gas cylinder cabinet:

- open fire prohibited. The applicable prohibition signs are attached to the cabinet;
- gas cylinders with gases posing similar hazard properties must be stored together. Gas cylinders with gases that can react with each other must be stored separately in different fire compartments;
- keep flammable gases separate from other gases (except for inert gases);
- do not place any equipment in the vicinity with a higher surface temperature of 250 °C, and such that contact between the stored substances and these parts is excluded;
- vents must be present in the outside walls of the cabinet (for storage outside the premises). The openings may not be closable.

5 Abbreviations and terminology

Gas cylinder	a cylindrical, metal pressure container with a water capacity of no more than 150 litres, which is intended for multiple use and that is fitted with a connection with a globe valve or needle valve
Gas cylinder cabinet	a fire safety storage cabinet that complies with the requirements of NEN –EN-14470-2
Collective water capacity	the total capacity (in litres of water) of the filled and empty (uncleaned) gas cylinders
Inert gases	noble gases and nitrogen
'Rules'	'rules for pressure vessels' which have been drawn up by Lloyd's Register (formerly Stoomwezen).
PGS15	Series of publications on hazardous substances 15 chapter 6 storage of gas cylinders
MSDS	Material Safety Data Sheet
VIB	Safety data sheets of the substance
PSP	Poonawalla Science Park B.V.
USPB	Utrecht Science Park Bilthoven

6 Appendices and references

References to web pages:

- SelfService: <http://www.usp-bilthoven.nl/diensten-services>

Reference to rules and regulations and guidelines:

- Series of publications on hazardous substances PGS15, latest version: <http://www.publicatiereeksgevaarlijkstoffennl/publicaties/PGS15.html>

References to connected KAM rules:

KAM rules of St. ALt, <https://stichting-alt.nl/kam-regels/>:

- KAM rule 07 Disposal of (hazardous) waste
- KAM rule 15m Reporting (near) environmental incidents
- Reporting incidents, see the relevant KAM rule/procedure per organisation.