

Technical complementary directive to the LEX 1.5.1: Directive on the storage of gas cylinders

June 2013, 9th August 2023
Version 2.0

1. Preamble

There are different types of gases: inert, flammable, toxic, corrosive, and/or oxidizing, Figure 1. This directive sets the storage guidelines and emergency measures to be taken in case of an accident.



Figure 1: Common hazard pictograms associated with gases. .

2. Scope of application

The provisions of this directive apply to laboratories and workshops. According to [the safety standardization guide for laboratories and workshops](#) of EPFL, the term laboratory refers to a workspace where research activities are carried out. This includes conducting experiments, process controls, quality controls, tests, calibrations, or measurements as well as material processing in the fields of chemistry, biology, and physics. The term workshop refers to a workspace that involves the manufacture, maintenance, and repair of products, objects, and scientific equipment, even on a small scale. This definition includes service platforms. The laboratories and workshops of EPFL are classified according to the types of activities and hazards present, by the users of the respective spaces in collaboration with the DSE-OHS and DES-SIS. In addition to this classification, the emissive or non-emissive nature of the activities carried out in these spaces is crucial for determining certain technical specifications of the workspace. Only the stock of cylinders (new and empty) and mobile welding stations are addressed here. Technical information on gas installations and distribution is specified in [the cylinder gas installation standardization guide](#).

3. Guidelines

3.1. General storage measures

- All pressurized gas cylinders must be stored in an EI90 gas cabinet certified according to EN 14470-2, secured vertically at 2/3 of their height with a rack and a safety chain.

- The installation of gas cabinets and gas detection must be requested through a work request (demande d'intervention, DI) opened by the concerned unit.
- The cabinet must be installed in the concerned ventilated room or a gas distribution central, as close as possible to the point of consumption. The location must be validated by the DSE.
- When handling and storing gas, the safety data sheet (SDS) must always be consulted and considered. If you have any questions, contact the OHS service via the [Support OHS](#) web page.
- All the associated pictograms must be considered when storing compressed gas bottles. Incompatibilities must be always respected (Diagram 1).

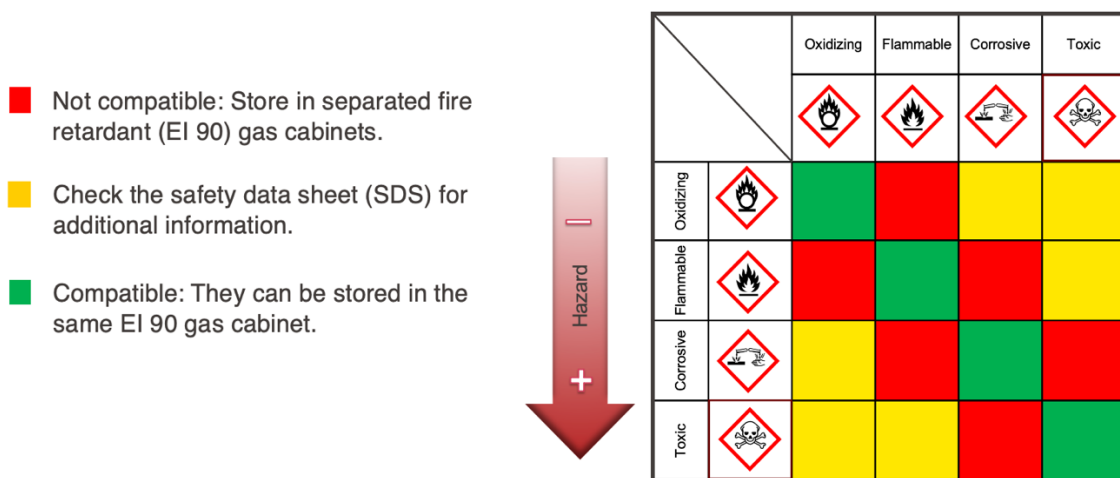


Diagram 1. Table of incompatibilities for gas storage

- For the storage of flammable, toxic, oxidizing, and corrosive gases, the gas cabinets must be ventilated and a detection system specific to the type of gas (considering all associated pictograms) must be present in the cabinet and the (ventilated) room where the gas is distributed.
- For the storage of inert gases and CO₂, the cabinets do not require extraction ventilation provided that the room is ventilated. An analysis evaluating the necessity of gas detection must be carried out by contacting the OHS service via the [Support OHS](#).
- If the room is not ventilated, the installation of the cabinet and gas detection must be requested through a dispensation request opened by the concerned unit via the [Support OHS](#).

3.2. Outdoor storage

Temporary storage of gas cylinders can be carried out in external gas warehouses authorized by EPFL. Empty or unused cylinders must be returned to the supplier as soon as possible. Until they are picked up by the supplier, empty cylinders can be stored with full cylinders of the same category. Empty cylinders must be easily identifiable.

3.3. Exceptions and dispensations

For the temporary use of small quantities of gas, compressed gas cylinders may be exceptionally installed outside an EI90 cabinet, provided that all the requirements described in point 3.3.1 are met. Any gas cylinder used under the exceptions must be directly connected to the laboratory instrument in which the gas will be used. When the cylinder is no longer in use, it must be stored in an EI90 gas cabinet without the regulator and with the safety cap placed on the cylinder or returned to the supplier.

3.3.1. Maximum volume allowed outside EI90 cabinet

- No cylinder of 50 L at 200 bars should be present in the room outside the gas cabinets.
- The maximum number of gas cylinders allowed per room outside an EI90 cabinet is 4 in total.
- As with storage in EI90 cabinets, all associated pictograms must be considered at the time of storage. Incompatibilities must also be respected (Diagram 1).
- All gas cylinders must be individually secured (one fastener per cylinder) and attached vertically to a wall, table, or fixed furniture at 2/3 of their height using a metal chain or a fastening belt.
- Depending on the hazards associated with the gas, a maximum volume is allowed per room outside the EI90 cabinets. The standard volume unit is used to determine the maximum volume of gas allowed per laboratory.

Per cylinder:

$$Nm^3 = \frac{P \text{ (Bar)} * V \text{ (L)}}{1000}$$

Nm³ = Standard volume P = Pressure V = Volume

- For inert gases, the maximum volume of gas allowed per room outside EI90 gas cabinets is 2 Nm³.
- For flammable gases, the maximum volume allowed per room outside ventilated EI90 gas cabinets is 0.8 Nm³ (a maximum of 2 cylinders out of 4). According to the fire protection directive DPI 26-15, ch. 6, flammable gases must be stored 2.5 m away from oxidizing gases and oxidizing chemical products.
- For toxic and corrosive gases, the maximum volume allowed per room outside ventilated EI90 gas cabinets is 0.2 Nm³ (a maximum of 2 cylinders out of 4). Toxic gases must always be handled under a chemical fume hood.
- For oxidizing gases, the maximum volume allowed per room outside ventilated EI90 gas cabinets is 0.8 Nm³ (a maximum of 2 cylinders out of 4). According to the [fire protection](#)

[directive DPI 26-15](#), ch. 6, oxidizing gases must be stored 2.5 m away from flammable gases and flammable chemical products.

- For gases presenting multiple hazards, the most restrictive criterion must be considered for calculating the maximum volume allowed outside the EI90 cabinet. For example, carbon monoxide (CO) is toxic (0.2 Nm³) and flammable (0.8 Nm³). Therefore, the maximum volume of CO allowed outside an EI 90 cabinet is 0.2 Nm³.
- The installation of a welding station must comply with the safety and health protection requirements for workers presented in [directive CFST 6509](#).
- For any needs that may require exceeding the maximum allowed gas volume outside the EI90 cabinet, a dispensation can be requested by contacting the OHS service via the [Support OHS](#) web page.

3.4 Compressed gas cylinder transportation

- The pressure regulator must be removed, and the safety cap placed on the cylinder during transport.
- The cylinder must be transported using an appropriate cart (a 3-wheel cart is preferable). Never drag, pull, or roll a gas cylinder.
- The cylinder must be secured to the cart before transport. The cylinder should be held with one hand on the safety cap while the other hand pulls the cart to transport the cylinder.

4. Behavior to adopt in case of accident

- Close the valve if possible.
- Evacuate the area and take shelter.
- If possible, evacuate unconscious persons without putting yourself in danger.
- Immediately alert 115 (021 693 30 00 from a mobile phone). Try to gather relevant information about the gas or mixture involved in the accident.
- Report the incident or accident via <https://go.epfl.ch/incident-management>.

5. Final provision

5.1. Enter into force

This supplementary technical directive, which came into force on June 10, 2013, was revised on August 9, 2023 (version 2.0).

Version	Modifications	Validation OHS	Validation DSE	Date
1.0	LEX 1.5.6 (abrogé)	–	E. Du Pasquier	10.06.2013
2.0	Directive Complémentaire – A. Olaya	S. Karlen	E. Du Pasquier	11.07.2024

6. Literature

Directive sur les **Laboratoires chimiques (CFST 1871)**

Cahier de normalisation sécuritaire des laboratoires et des ateliers

Cahier de normalisation des installations de gaz en cylindre

Feuillet d'information **Cylindres à gaz – utilisation et entreposage sûrs (SUVA # 66122)**

Directive de protection incendie (**AEAI DPI 26-15**).

Directive sur le soudage, coupage et techniques connexes appliquées à l'usinage des matériaux métalliques (**CFST 6509**).