Safe Handling of Pressurized Gases and Cylinders

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Pressurized Gases – Safety - Introduction

„Even a wall will not stop me!“
Objectives

- Protection of own life and life of others
- Physical integrity for ourselves and others
- Protection of environment as our home range
- Warranty of a safe work with a promising future
- Safeguarding and conservation of our base of life and existence
1. Dangers caused by high pressure (handling of cylinders)
   - transport, storage,
   - providing and emptying of cylinders

2. Dangerous properties of the gases (chemical characteristics)
   - toxicity
   - corrosivity
   - self ignition
   - flammability

3. Dangers for lack of Oxygen

4. Dangers by low temperatures (liquified or cryogenic gases)
If there are more than one dangerous potentials the colour of the primary source of danger has to be chosen.

The colour of the body of the cylinder is not integrative prescribed. It can be chosen by the gas supplier.

<table>
<thead>
<tr>
<th>Properties</th>
<th>Shoulder color</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Toxic and/or corrosive (1)</td>
<td>Yellow</td>
<td>Ammonia, arsine, chlorine, fluorine, carbon monoxide, nitric oxide, sulfur dioxide</td>
</tr>
<tr>
<td>Flammable (2)</td>
<td>Red</td>
<td>Hydrogen, methane, ethylene, forming gas, (nitrogen/hydrogen mixture)</td>
</tr>
<tr>
<td>Oxidizing (3)</td>
<td>Light blue</td>
<td>Oxygen mixtures, nitrous oxide mixtures</td>
</tr>
<tr>
<td>Inert</td>
<td>Bright green</td>
<td>Krypton, xenon, neon, shielding gas mixtures, compressed air</td>
</tr>
</tbody>
</table>

1) See ADR/RID for definition of toxic/non-toxic and corrosive/non-corrosive. In this case, corrosive means causing burns to human tissue.
2) See ADR/RID for definition of flammable/non-flammable.
3) See ADR/RID for definition of oxidizing/non-oxidizing.
Cylinder stamping

Flaschenprägung

Rückseite
1 Prüfzeichen des Sachverständigen
2 Jahr der nächsten wiederkehrenden Prüfung
3 Gasart
4 Datum der ersten Abnahme
5 Höchstzulässiger Fülldruck bei 15 °C
6 Eigentümerprägung

Vorderseite
1 EWG-Bauartzulassungszeichen
2 Wert von R in N/mm²
3 Herkunftsland
4 Art der Wärmebehandlung
5 Herstellerzeichen
6 Prüfüberdruck in bar
7 Datum der ersten Abnahme (Jahr/Monat)
8 Prüfzeichen des Sachverständigen
9 EWG-Prüfzeichen
10 Fabrikationsnummer
11 Garantiertem Mindest-rauminhalt in Liter
12 Leergewicht der Flasche in kg
### Optional usage of cylinders for pressurized gases (example)

<table>
<thead>
<tr>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>B1</td>
<td>pressurized gases with $t_k &lt; -10^\circ C$ except oxygen</td>
</tr>
<tr>
<td></td>
<td>Each cylinder has to be stamped as „compressed rare gas“ or „Nitrogen“ or</td>
</tr>
<tr>
<td></td>
<td>„compressed air“</td>
</tr>
<tr>
<td></td>
<td>non flammable</td>
</tr>
<tr>
<td></td>
<td>non toxic</td>
</tr>
<tr>
<td></td>
<td>rare gases (except Xenon)</td>
</tr>
<tr>
<td></td>
<td>Nitrogen</td>
</tr>
<tr>
<td></td>
<td>compressed air</td>
</tr>
<tr>
<td></td>
<td>mixtures of such pressurized gases</td>
</tr>
<tr>
<td></td>
<td>The valves and accessories have to correspond to the actual filling.</td>
</tr>
</tbody>
</table>
Cylinder coding

UN 1001
Acetylene, gasified 2.1
Einsatz Gas unter Druck, kann bei Entzündung explosionsfähiges Gas enthalten. Mit und ohne Luft explosionsfähig.

UN 1956
Verdichtetes Gas, n.a.g. 2.2
Einsatz Gas unter Druck, kann bei richtiger Entzündung explosionsfähiges Gas enthalten. Mit und ohne Luft explosionsfähig.

Content identification
manufacturer / distributor

Transportation law and
safety advices

Part of the Messer World

Gases for Life
Transportation of pressurized gas cylinders in small amounts

Requirements on the vehicle:

- Transport in motor cars or in closed vehicles should be exceptional. Transport in trailers is preferred.

- Sufficient ventilation must be guaranteed.

- Cylinders have to be protected against slipping, falling or rolling around.
Transportation of Cylinders for Pressurized Gases in Small Amounts

Improper transport is dangerous!
Storage of Cylinders

Storage of cylinders is prohibited

- below ground level
- in or near by stairwells, hallways, narrow yards, passages
- in or near by escape routes
- in garages
- in workrooms

In principle storage outside or in rooms is differentiated.
Storage of Cylinders

Unsuitable places for storage of cylinders
Storage of Cylinders

A store outside must have at least 2 open sides.

The safety distance to other facilities is 5 m. This distance can be replaced by a wall (height 2 m or more), made of non-flammable material.

Outside stores must be fenced in (height 1.5 m or more).

Stores have to be protected from unauthorized grasp.

(labels: Unauthorized entry prohibited!
No smoking or open fire!)
Storage of Cylinders

At least one fire extinguisher has to be within reach.

If there are inflammable or highly toxic gases in stock a telephone has to be within reach.

Inside of the save areas around cylinders with flammable gases there might be no ignition source.

Storing of cylinders together with combustible materials (paper, wood, flammable liquids, …) is prohibited.

Rooms for storage of cylinders have to be separated from surrounding rooms by fire retardant elements. The floor has to be non flammable.

Rooms always have to be ventilated sufficiently.

Ventilation openings should have at least 1/100 of the room area. They must be diagonal in opposite, one down on the bottom, the other on the top. Between cylinders with flammable and oxidizing gases has to be a safety distance of 2 m. (It is allowed to fill this distance with cylinders for inert gases)
Cylinders must be protected against tumbling
Storage of Cylinders – Outside

Storage of cylinders outside
Take care transporting cylinders by hand! Transport always with safety cap!
Transport of Cylinders for Pressurized Gases

„Striking distance“ of a „flying“ cylinder
Transport of Cylinders for Pressurized Gases

The power imprisoned in a cylinder

\[ p \cdot V = E \]
\[ p = 200 \text{ bar} \]
\[ V = 50 \text{ l} \]
\[ E \approx 10^7 \text{ kpm} \]

\[ h = 100 \text{ m} \]
\[ v = 160 \text{ km/h} \]

1000 kg

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Messner Gases for Life
Transport of Cylinders for Pressurized Gases

Use only suitable load attachment devices!
Transport of Cylinders for Pressurized Gases

Caution at transport up-or downstairs!
Transport of Cylinders for Pressurized Gases

No transport of cylinders and persons in an elevator at the same time!
Emptying of Cylinders

Use only convenient pressure regulators for the actual gas.

They have to be without any defect and connected safe and gas tight.
Connection of Cylinders

Before begin of work:

Prevent cylinder from tumbling!

Use personal safety equipment!
Connection of Cylinders

Remove cylinder cap!

Control valve outlet connection!
Look for damage of thread or sealing surface!

Never use damaged cylinders or valves!
Connection of Cylinders

Never use cylinders with damaged valves!

Return such cylinders to the supplier!
Connection of Cylinders

Control of the connection of the pressure regulator for damage on thread or sealing surface.

If necessary replace sealing!

Connection of pressure regulators:
Tighten the union nut by hand!

Don’t cant!

Screw tight the union nut with appropriate tool!

Don’t work with brute force!
Connection of Cylinders

Leak test

(therefore pressurize the connection by short opening of the cylinder valve. The pressure regulator has to be closed)

If there are any leaks control the sealing and replace it if necessary!
Connection of Cylinders

Schematic draw of a pressure regulator
Never use oil or grease!
Connection of Cylinders - Pressure Regulator

Safety installations in a laboratory