

Safety Advice.

8 – (Re-)filling gases.



1. Introduction

There are good reasons to refill gases. For example, it seems advantageous to fill the contents of one large gas cylinder into several small gas cylinders because these can be transported more easily to diverse building sites. Nevertheless, there are serious reasons why this should not be done, as shown by accidents and mishaps.

2. Legal situation

Anyone who fills gas into a gas cylinder is operating a filling installation. Even if the equipment for filling consists only of two gas cylinders and a connecting hose, it is a filling installation. The same applies for an air compressor used to fill compressed air into gas cylinders. Filling installations used to fill gases into containers to be given to third parties may usually only be operated if they have been examined positively by an expert and / or if the relevant authority has awarded type approval. Filling installations that serve exclusively the filler's own requirements often do not require approval.

3 . Personal requirements

Safe operation of a filling installation requires specialist knowledge. The employees concerned must be appropriately qualified so that they can fill gas cylinders safely.

4. Technical requirements

4.1. Filling installations

The technical design of a filling installation (materials, pressure resistance, requirements for the installation room, ventilation, fire and explosion protec-

tion) must take the properties of the relevant gas into consideration in order to ensure safe continuous operation of the filling installation. These properties are as follows:

- filling pressure in the cylinder,
- density (lighter or heavier than air),
- state in the cylinder (gaseous or liquid),
- chemical reactivity (a gas is either flammable or fire-stimulating or inert, i.e. chemically inactive),
- effect on humans (all gases except for oxygen are either suffocating, caustic or toxic),
- corrosive action (gases can corrode metals and cause rubber or plastics to decompose).



Hazard warning

4.2. Gas cylinders

a) Codes are engraved on the collars of the gas cylinders that give specialists information on the properties of the cylinder, filling conditions, examination date, etc. Some of these codes must be checked before the cylinders are filled.

b) The engraved marking on the gas cylinder showing the type of gas and the qualification approval label indicate that the cylinder is suitable and approved for this gas. Despite this, it is occasionally noticed that certain gas cylinders can no longer be safely used because of the

damaging long-term effect of the gas on the cylinder material. Such cylinders should not be filled but must be sorted out and made unfit for use.

c) Every gas cylinder must be subjected to an external visual inspection before it is filled. It should be checked that the cylinder has no obvious defects such as dents, scores, cracks, dangerous corrosion, unauthorized welds. In these cases the cylinder should not be filled.

d) Gas cylinders that are filled should not contain foreign substances that

- can react dangerously with the cylinder material, e.g. humidity that causes the formation of rust,
- can react dangerously with the gas to be filled, e.g. air in a cylinder that is filled with flammable gas,
- can dangerously alter the quality of the gas to be filled, e.g. hazardous substances in a cylinder to be filled with respiratory air.

e) Every gas cylinder must be examined „officially“ at defined intervals. It is checked whether the pressure resistance and the condition of the inside and outside of the cylinder justifies further use. A passed examination is confirmed by an engraving on the cylinder. A gas cylinder that has not been examined in time must not be filled.

f) Corresponding to their different chemical properties the different types of gas have cylinder valves with different connecting threads. In this way dangerous confusion of gases is prevented. For example, it is not possible to use a filling installation that complies with the regulations to fill hydrogen into an oxygen cylinder. However, the connecting threads do not take into account the different physical properties of the gases, e.g. pressure. In Germany therefore, the flammable gases hydrogen

and propane have the same connecting thread although their filling pressures are extremely different (hydrogen up to 300 bar, propane max. 8 bar). Technically possible, filling gas from a hydrogen cylinder into a propane cylinder would be lethally dangerous with the risk of the cylinder bursting.

4.3. Special information for oxygen

Oxygen is a fire-stimulating gas that can react with all flammable materials to cause a fierce fire. This also includes materials that do not burn in air, e.g. some common metals. This property of oxygen is all the more prominent, the greater the pressure is. If high-pressure oxygen flows into a low-pressure area – which happens during filling – the surrounding material may ignite due to a so-called surge. This process is aggravated by the presence of traces of oil and grease or any other particles. All parts in contact with oxygen must therefore be free of contamination.

4.4. Special information for acetylene

In contrast to all other gas cylinders, acetylene cylinders are filled inside completely with a solid porous mass. The pores contain a liquid solvent – usually acetone – in which the acetylene dissolves. This kind of storage virtually makes the dreaded explosive decomposition reaction of acetylene impossible. However, the safety effect of the porous mass and the solvent is only possible if the solvent and acetylene are present in the cylinder in certain proportions. The quantity of solvent must be checked before the cylinder is filled and corrected if necessary.

4.4. Special information for pressurized liquid gases

Some gases are filled into cylinders as a liquid under pressure, e.g. propane or



carbon dioxide. Filling factors have been defined for pressurized liquid gases. They state how many kilograms of gas can be filled per litre of hollow space in the cylinder. It must be ensured that this filling factor is maintained during filling, i.e. these gases are filled according to weight. If the permissible filling quantity is exceeded so that the cylinder is over-filled, the pressure in the cylinder can become so great at the slightest heating that it bursts.

5. Summary

Refilling gases is not explicitly forbidden. However, before gases are filled, it should be checked that

- the filling installation complies with safety requirements and is allowed to be operated according to valid regulations,
- employees are properly qualified,
- the gas cylinders to be filled are approved and suitable for the foreseen purpose,
- the special information is observed when

oxygen, acetylene or pressurized liquid gases are filled.

Even if only one of these conditions is not fulfilled, gas should not be filled in the interests of safety.