

Devalving Gas Cylinders

Precautions to be taken when devalving gas cylinders

Introduction

Near misses, injuries and fatalities have occurred during the incorrect devalving of cylinders that were pressurised. These operations have been associated with the uncontrolled release of gases to the environment, worker health and safety concerns from gas exposure, fires, and the catastrophic sudden release of energy.

Among several incidents reported to EIGA, one of the most serious occurred during routine maintenance work of a 20-litre water capacity aluminium alloy medical oxygen cylinder.

The hand wheel of the valve of the cylinder was broken. The cylinder was placed inside a horizontal devalving machine. During the devalving process, a violent fire occurred destroying the top part of the cylinder. The cylinder and the valve were projected a considerable distance in opposite directions.

The operator died as a result of severe burns having been covered by the combustion products from the upper part of the cylinder. Most of the shoulder of the cylinder was consumed, with approximately 2 kg of the aluminium alloy having been lost.

It is believed that the cylinder was still filled with high-pressure oxygen when the devalving process took place with the resultant fire having started at the internal neck threads of the cylinder.

This Safety Information does not address the safe release of product and purging process of gas cylinders, see EN ISO 25760, *Gas cylinders - Operational procedures for the safe removal of valves from gas cylinders*.

If a cylinder is devalved while still under pressure, the following events can occur:

- Violent ejection of parts:
 - cylinder valve and accessories, e.g. valve guard
 - cylinder - if not clamped properly

Note: devalving in the horizontal position adds additional risk of damage and injuries in case of ejection.

- Fire:
 - with oxidizing gases, e.g. oxygen
 - with flammable gases, e.g. acetylene
- Release of gas, with the following potential consequences:
 - Fire, burns, projection of hot melted metal (flammable/oxidizing gases)
 - Corrosive burns (corrosive gases)
 - Intoxication (toxic gases)
 - Anoxia/asphyxiation (hypoxic gases)
 - Blast

Recommendations

The recommendations of EIGA when devalving a cylinder are described below:

- Devalving shall only be performed by trained and qualified personnel, and it is recommended to be carried out at an appropriately equipped workstation.
- The operator performing the devalving, and the other personnel in the immediate area, shall be adequately protected, for example, using a cage around the devalving machine.
- Every devalving process shall be subject to a risk assessment to ensure safe operation. It shall consider at least:
 - cylinder;
 - type (seamless, welded, composite)
 - material, for example aluminium alloy (this can burn violently)
 - dimensions
 - working pressure
 - gas service
 - position of the cylinder in the devalving machine (horizontal, vertical)
 - devalving torque, and
 - valve type.
- Before devalving any cylinder (metallic or composite), it is critical to systematically and physically confirm absence of pressure in the cylinder by performing a test, as a faulty valve may remain closed despite the handwheel indicating an open position or the pressure gauge may indicate no pressure. The test, commonly referred as “whisper test”, consists in introducing nitrogen or air under pressure (a few bar) during a few seconds and checking that the gas flows in and out. Air shall not be used for flammable gases. An alternative for non-flammable gases is using a rubber bulb that can be pressurised by hand.
- For Residual Pressure Valves (RPVs) and Valves with Integrated Pressure Regulator (VIPRs), specific procedures and tools (e.g. “push-pin”) are required to neutralize the residual pressure device (for RPVs) or check valve (for VIPRs). The check is performed either through the valve outlet (for standard valves or RPVs) or the filling port (for VIPRs).
- Devalving a cylinder with an identified blocked or inoperable valve (i.e. a valve that in any way prevents gas from entering the cylinder) is a hazardous operation which requires specific training, knowledge and tools to depressurize the cylinder despite the valve failure. Any cylinder with a blocked or inoperable valve shall be put aside and a specialist shall take the appropriate actions. For cylinders with blocked or inoperable valves, see EN ISO 25760. It is recommended that such operation is carried out separately from the normal devalving operations.
- Some cylinder valve designs include specific features required for their intended application, e.g. quick-release valves for firefighting applications. Such valves may require particular precautions and/or tools for safe depressurization and devalving (refers to manufacturer’s user manual). Cylinders for stationary firefighting applications often come back full of gas, as they have expiry dates.
- In addition, it is important that the workflow in the facility is well organized from sorting to the devalving workstation to avoid mix-ups and mitigate the risks during devalving.
- If, after devalving, the thread of the cylinder needs to be cleaned, care shall be taken when removing residual PTFE tape or cone or other sealants from the neck thread of cylinders that contained oxidizing gases (e.g. oxygen) because of the risk of flash fires. See EIGA SI 45.
- Further details are described in EN ISO 25760.

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Additional references

Unless otherwise specified the latest edition shall apply.

EN ISO 25760 *Gas cylinders - Operational procedures for the safe removal of valves from gas cylinders* www.iso.org

EN ISO 18119 *Gas cylinders — Seamless steel and seamless aluminium-alloy gas cylinders and tubes — Periodic inspection and testing* www.iso.org

EN ISO 11623 *Gas cylinders — Composite cylinders and tubes — Periodic inspection and testing* www.iso.org

CGA-P-38 *Guidelines for devalving cylinders* www.cganet.com

EIGA Safety Information 45, *Risk of Instant Flash Fire during Cylinder Maintenance* www.eiga.eu

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