



Safe Deployment of High Pressure Inert Gas Cylinders

High-pressure gas cylinders are deployed routinely in diverse applications. Welding, scuba, outdoor premise gas supplies, refineries, and electrical power utilities all utilize high-pressure gas cylinders exposed to outdoor conditions. Nitrogen-blanketed transformers, for example use high-pressure nitrogen tanks and sulfur hexafluoride insulated high voltage cables use high-pressure tanks of SF₆. Inert gases such as helium, nitrogen, and argon do not present flammability or toxicity hazards, but filled with gas at pressures up to 180 bar (2650 psig), high-pressure inert gas cylinders present low risk hazards that can be mitigated completely with proper handling, installation, and use.

Pressure Safety

High pressure gas cylinders can withstand pressures and temperatures considerably higher than are encountered in normal use. As cylinder temperatures increase the pressure in the cylinder rises in proportion to the absolute temperature of the gas in degrees Kelvin. In the unlikely event that excessively high temperatures or pressures are encountered, cylinders are protected by a safety pressure relief device that vents the excess gas pressure in a safe and controlled manner. For inert gases, venting into an open space poses no additional hazards.

In the United States high-pressure gas cylinders are tested every five years with a hydrostatic test at 5/3 times the rated cylinder fill pressure. This test ensures that the cylinders will not burst or expand when subjected to the very high pressures that could be associated with unusually high temperatures or in the event of overfilling by the gas supplier. In the case of inert gas cylinders filled to 18 MPa, the hydrostatic test pressure is 30 MPa (4400 psig), which otherwise would not be attained until the temperature of a full cylinder reaches 225 °C (427 °F). Such high temperatures are not encountered in normal operations.

Regular hydrostatic testing ensures the cylinders' capability to withstand very high pressures. In addition, cylinders incorporate a pressure-relief device that releases excessively high cylinder pressures in a safe and controlled manner before internal pressures reach the hydrostatic test pressure level. One example is the type CG-1 pressure relief device — normally used in high-pressure inert gas cylinders — that opens at 90% of the hydrostatic test pressure, or 27 Mpa (4000 psig). This pressure is not reached in a full 18-MPa cylinder until the cylinder temperature hits 175 °C (350 °F).

Operation at Elevated Ambient Temperatures

Under normal conditions gas cylinder temperatures and pressures will remain well below the limits imposed by pressure relief devices and periodic hydrostatic testing. Ambient outdoor temperatures do not come anywhere close to the levels needed to generate such excessively high pressures. A full-cylinder pressure of 18 Mpa (2650 psig) at 25 °C will increase by about 10% to 20 MPa (2940 psig) at 52 °C (125 °F), the maximum recommended continuous temperature for high-pressure inert gas cylinders. Often, cylinders deployed outside will reach higher temperatures in daylight hours due to sun exposure or to heating in the proximity of active equipment. At 70 °C (158 °F) the internal tank pressure will rise to a maximum level of 20.7 MPa (3040 psig), which is well below the 27 Mpa (4000

psig) opening pressure of high-pressure safety relief devices mandated for use on such cylinders.

Enclosed Spaces

Operations in enclosed spaces can be hazardous. When inert gas cylinders are installed or used in enclosed spaces without sufficient ventilation, gases may build up to the point that the interior atmosphere becomes unbreathable due to a lack of oxygen. To avoid this possibility, transport, store, and use gas cylinders outside of enclosed areas. In some enclosed locations — such as transformer vaults — toxic gases emitted from the transformer may build up to dangerous levels, in excess of 50 ppm for example with carbon monoxide. To avoid this situation, always ventilate and check oxygen and toxic gas levels before entering an enclosed area regardless of whether inert gases are in use or not.

Best Practices

Deployment of high-pressure cylinders outdoors should adhere to a number of best practice guidelines.

- Purchase or lease only gas cylinders that meet all regulatory requirements¹, incorporate safety valves, and are subject to regular pressure testing.
- Acquire gases that are certified to meet all purity requirements.
- Remove regulators and cap cylinders before moving them.
- Move cylinders only when constrained on suitable cylinder carts.
- Wear boots, gloves, hard hats, and goggles appropriate to the location and task.
- Immobilize cylinders in storage or at their installation points with proper chains or other restraints.
- Install suitable pressure regulators for the application. In the case of high-performance analytical equipment this means dual-stage high-purity regulators.
- Use only regulators with high-pressure fittings that match the cylinder. Do not use fitting adapters.
- Follow proper procedures when opening the high-pressure cylinder valve.
- Install cylinders away from direct sunlight and heat sources if possible, or shield cylinders from the sun with a suitable well-ventilated enclosure.
- Do not install cylinders inside small enclosed spaces such as transformer vaults.
- Always ventilate and check oxygen and toxic gas levels before entering an enclosed area
- In case of questions or doubt, contact the local gas supplier and regulatory officials for additional guidelines.

Contact: Serveron Service and Support
 support@serveron.com
 +01 866 273-7763

¹ Regulatory bodies that issue gas cylinder standards include the United States Department of Transportation (USDOT), the Compressed Gas Association (GCA), British Standards Institute (BSI), Deutsches Institut für Normung (DIN), and the International Standards Organization (ISO).