

Recommendations for Cooling and Heating of Gas Cylinders

1. Introduction

Gas cylinders can sometimes be used intentionally at temperatures that are lower or higher than ambient temperature.

This Technical Bulletin gives a number of recommendations and considers the cases of full and empty cylinders.

This Technical Bulletin does not address the risks of cylinders exposed to fire, where the cylinder pressure will increase dramatically and can result in bursting of the cylinder, see EIGA Safety Information 02, *Handling of Gas Cylinders during and after Exposure to Heat or Fire*

Where cylinders are heated, the method used should be assessed to ensure that the process and equipment is ATEX compliant.

2. Recommendations

2.1 Cylinder full of compressed or liquefied gases

2.1.1 Transfilling

For some applications, for example, toxic gases, cryopumping is used. Cryopumping is the transfer of gas from a cylinder to a receiving cylinder. In this case, the receiving cylinder is cooled down, for example, by using dry ice or liquid nitrogen, and consequently subject to a temperature of either -78°C or -196°C. Aluminium alloy cylinders should be used as they are not brittle at very low temperatures. If steel is used, the temperature for modern cylinder should not be below -50°C. For older steel cylinders, it can be necessary to consider temperatures that are not as low as -50°C, for example, -20°C.

This operation requires trained and qualified personnel from gas companies authorised to fill cylinders. Precautions shall be taken to avoid damaging elastomers or plastic materials in the cylinder valve.

Another solution can be heating the cylinder used as a supply source for the transfilling operation. In this case, the cylinder, either aluminium alloy or steel, shall not be exposed to a temperature greater than 65°C*, with the exception that based on a risk assessment including consideration of the type of gas and test pressure of the cylinder, companies may deviate from this limit.

NOTE: Precautions shall be taken not to over pressurise these cylinders, especially in case of liquefied gases.

2.1.1 Customer gas withdrawal

Customers can require either to fully purge a liquefied gas cylinder or to obtain a high flow rate from the cylinder. A solution can be to heat the cylinder during gas withdrawal. The temperature shall not exceed 65°C* and this operation shall not be performed if the gas company owning the cylinder has not given its authorisation. It is recommended that the equipment or device used is validated by the gas company because some equipment can generate temperature runaways and subsequent over pressurisation.

*NOTE: In case of low pressure liquefied gases, the maximum temperature shall not exceed 60°C

2.2 Empty cylinder

2.2.1 Empty cylinder without valve

The first case is an empty cylinder with no valve, typically, for the painting operation such as powder coating. Guidance can be found in either ISO 6406 *Gas cylinders - Seamless steel gas cylinders -- Periodic inspection and testing*) or ISO 10461 *Gas cylinders - Seamless aluminium-alloy gas cylinders -- Periodic inspection and testing*:

ISO 6406 states:

“In no case shall the temperature of the cylinder exceed 300°C since overheating could change the mechanical properties of the cylinder”

ISO 10461 states:

“Cylinders manufactured from heat-treatable aluminium alloys shall not be heated to temperatures exceeding 175°C unless the cylinder manufacturer recommends otherwise. Only responsible organizations that can properly control heat input and record time and temperature shall heat cylinders. The total cumulative time at temperature between 110°C and 175°C shall be limited to the time recommended by the cylinder manufacturer. Cylinder heated in accordance with these provisions shall not require further testing.

Unless otherwise recommended by the cylinder manufacturer, for cylinders manufactured from non-heat-treated alloys (e.g. AA5283), the maximum temperature shall not exceed 80°C. For temperatures between 70°C and 80°C, the exposure time shall be limited to 30 minutes. If the heat exposure time exceeds 30 minutes at temperatures greater than or equal to 70°C, or if at any time the temperature exceeds 80°C, then agreement shall be obtained from the manufacturer regarding further use of the cylinder.”

EIGA recommends scrapping cylinders constructed from aluminium alloy 5283 used for compressed and liquefied gases as described in EIGA Doc. 86 *Gas Cylinders and Valves with Restricted Use in the EU*.

Warning: Users need to be aware of the characteristics of the different types aluminium alloys.

2.2.2 Empty cylinder with valve

The other case is when cylinders are vacuum baked to achieve a very low moisture level. In this case, the same precautions as above shall apply but, in addition, the temperature applied shall be compatible with the valve materials and especially with elastomers and plastic materials. Therefore, it is recommended to not exceed 70°C unless the non-metallic materials have been validated to exceed 70°C. An alternative solution is to isolate the valve from the heating source.

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