

## 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. Mechanical properties of cylinders, therefore cylinder's integrity, can be affected by cooling or heating.

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 [1].

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 (dry ice) or -196°C (liquid nitrogen). Aluminium alloy cylinders should be used for cryopumping, as they are not brittle at very low temperatures.

The temperature that steel cylinders designed and manufactured in accordance with ISO 9809 series [2] are exposed to, should not be below -50°C.

For steel cylinders designed in accordance with older standards and regulations, it can be necessary to consider temperatures that are not as low as -50°C, for example, according to Council Directive 84/525/EEC [3] a Charpy test at -20°C is required and should be used as a lower temperature limit.

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 to heat 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, if a risk assessment including consideration of the type of gas and test pressure of the cylinder is completed and acceptable, companies may deviate from this limit.

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

##### 2.1.2 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

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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 EN ISO 18119 [4].

EN ISO 18119 [4] states for seamless steel cylinders:

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

EN ISO 18119 [4] states for seamless aluminium alloy cylinders:

*“In no case shall the temperature of seamless aluminium-alloy cylinders exceed that recommended by the manufacturer since overheating can change the mechanical properties of the cylinders.*

*Cylinders manufactured from AA 6XXX heat-treatable aluminium alloys (e.g. AA 6061) shall not be heated to temperatures exceeding 175 °C. Only testing facilities that can control heat input and record time and temperature shall heat cylinders. The total cumulative time at temperatures between 110 °C and 175 °C shall be limited to the time recommended by the cylinder manufacturer. Cylinders heated in accordance with these provisions shall not require further testing.*

*An external heat source shall not be applied (e.g. to dry an external coating) to AA 7XXX heat-treatable (e.g. AA 7032 or AA 7060) seamless aluminium-alloy cylinders and tubes unless approved by the cylinder or tube manufacturer.*

*Unless otherwise authorized by the cylinder manufacturer, the maximum temperature shall not exceed 80 °C for seamless aluminium-alloy cylinders manufactured from non-heat-treated alloys (e.g. AA 5283). The exposure time shall be limited to 30 min for temperatures between 70 °C and 80 °C. If the heat exposure time exceeds 30 min 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 the 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 [5].

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

In the case of composite cylinders, EN ISO 11623 [6] states:

*“It is therefore essential that information on precise heat-effect temperatures from the cylinder manufacturer be available; in the absence of this information, cylinders shall not be exposed to a temperature exceeding 70 °C during refurbishment. If the cylinder manufacturer confirms (i.e. either on a cylinder label or through documentation) that the allowable temperature is greater than 70 °C, then the manufacturer’s recommendations shall be followed during refurbishment.”*

### 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.

## References

Unless otherwise specified, the latest edition shall apply.

- [1] EIGA Safety Information 02, *Handling of Gas Cylinders during and after Exposure to Heat or Fire*
- [2] ISO 9809 series, [www.iso.org](http://www.iso.org)

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