



# CYLINDER RETEST STATIONS

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**EUROPEAN INDUSTRIAL GASES ASSOCIATION AISBL**



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**Amendments to Doc 79/13**

4.8	<u>References updated</u>
5.2.4	<u>New section added on external shot blasting</u>
5.6	<u>Section expanded for more details on valving cylinders</u>
6	<u>References section retitled and updated</u>

Note: Technical changes from the previous edition are underlined

## 1. Introduction

The periodic inspection and testing of a gas cylinder is an essential requirement for its continued use. There are few items of industrial equipment that last for so many years. The safety record of gas cylinders is excellent and reflects the integrity of the design, manufacturing and subsequent maintenance processes.

This edition of the publication incorporates updates to standards, legislations and EIGA publications.

## 2. Scope and purpose

### 2.1 Scope

This publication gives guidance on the key aspects of the periodic inspection and retesting of gas cylinders and gives a structure for the re-testing activity. It is intended specifically for those who are:

- specifying the periodic inspection and testing of gas cylinders;
- selecting inspection and testing facilities; and
- carrying out the periodic inspection and testing process.

The following cylinder types are covered in the publication:

- seamless steel;
- welded steel;
- seamless aluminium alloy;
- welded aluminium alloy;
- hoop wrapped;
- fully wrapped; and
- dissolved acetylene.

Additional requirements, which can apply for specific applications such as medical, electronics, are not covered in this publication.

This publication does not cover the requalification of existing national cylinders as described in the Transportable Pressure Equipment Directive, (TPED) [1]<sup>1</sup>

### 2.2 Purpose

To provide guidance on cylinder retest stations for EIGA Members

## 3. Definitions

### 3.1 Publication terminology

#### 3.1.1 Shall

Indicates that the procedure is mandatory. It is used wherever the criterion for conformance to specific recommendations allows no deviation.

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<sup>1</sup> References are shown by bracketed numbers and are listed in order of appearance in the reference section.

### 3.1.2 Should

Indicates that a procedure is recommended.

### 3.1.3 May

Indicates that the procedure is optional.

### 3.1.4 Will

Used only to indicate the future, not a degree of requirement.

### 3.1.5 Can

Indicates a possibility or ability.

## 4. Background to periodic inspection and testing

The periodic inspection and testing of gas cylinders has been a requirement for many years across a wide range of countries. This inspection requirement has frequently been part of the legal requirement of operating a gas cylinder, and failure to follow a prescribed test programme has been treated as a serious offence.

The requirement to test and inspect gas cylinders has evolved as national requirements, with the test periods and the test frequencies being set by the national bodies. Some degree of harmonisation in Europe had started with RID and ADR and this did establish common test periods, if not common test methods. In the 1980s the International Standards Organisation had issued a number of testing standards for a variety of gas cylinder types. With the advent of the European Harmonisation programme for gas cylinders, EN standards for cylinder testing were prepared in the 1990s. Some standards are now mandatory according to RID/ADR. This, along with the TPED [1], now means that there is a common approach to the technical standards for cylinder testing. Along with these harmonised technical requirements is a need for test stations to have a common approach for all aspects of cylinder testing including test facilities, training of personnel and a harmonised interpretation of these standards.

## 5. Test Stations

Test stations shall be compliant with the requirements of the National Competent Authority. For cylinders retested under the requirements of the TPED, the appointed inspection bodies, either Notified or Approved, shall comply with the criteria as stated in Annexes 1 and 2 of the TPED [1].

### 5.1 Test stations organisation

The cylinder test station shall have an organisation structure that complies with the principles of EN ISO IEC 17020, *Conformity assessment - Requirements for the operation of various types of bodies performing inspection*. [2]

Personnel involved in the retesting of gas cylinders shall be suitably qualified for the purpose and the quality of the work shall be under no commercial pressure.

### 5.2 Test station facilities and procedures - general

#### 5.2.1 General

There shall be adequate lighting, ventilation and workspace for the inspection and testing. Additionally, the work areas shall be clean and free of debris.

Test stations shall be equipped to vent gases in a safe manner which shall direct gases released, away from the work place, to an area where no risk is presented, e.g. to a high level.

Gas cylinders containing controlled substances, for example, toxic, corrosive, ozone depleting and flammable gases shall only be handled at locations with specialist facilities to dispose of these products that meet applicable environmental and safety requirements.

### 5.2.2 Devalving

**Warning:** *Devalving of cylinders is a potentially hazardous activity if not carried out correctly. Before any cylinder is devalved a positive check shall be carried out to ensure there is no pressure in the cylinder. For guidance see EIGA Safety Information 18, Devalving Gas Cylinders [3] and EN ISO 25760 Gas Cylinders - Operational procedures for the safe removal of valves from gas cylinders [4].*

There shall be procedures and mechanisms in place to protect the operative against a cylinder under pressure being accidentally devalved. Specific guidance is given in [EN ISO 25760](#) [4].

It is critical that working procedures describe the process to check if a valve is functioning correctly or if it is blocked. Additionally, some valves are designed to retain a small positive pressure in the cylinder, and care is needed to ensure that cylinders are completely vented when fitted with these valves, see [EN ISO 25760](#) [4].

There shall be equipment to de-valve and re-valve cylinders. This equipment shall not damage the cylinder, for example, during clamping, particularly of aluminium alloy or composite cylinders, or damage to the valve unnecessarily.

### 5.2.3 Inspection and cleaning

For hazardous gases, such as toxic and flammables, care shall be taken to ensure that cylinders have been adequately purged prior to internal inspection and cleaning.

Test stations shall have access to both internal and external cleaning facilities. Examples of cleaning methods include shot blasting, see 4.2.4, and high-pressure water jet cleaning. Where heat is applied to the cylinder, care shall be taken to ensure that the temperature limits specified are not exceeded, this specifically applies to aluminium alloy and composite cylinders, see e.g. EN ISO 18119, *Gas cylinders - Seamless steel and seamless aluminium-alloy gas cylinders and tubes. Periodic inspection and testing* [5].

**Note:** Aluminium alloy cylinders shall not be shot blasted due to their soft nature and the possibility of galvanic corrosion. Other cleaning methods, e.g. sand cleaning or wire brushing shall be carefully evaluated, preferably in conjunction with the cylinder manufacturer. For cleaning composite cylinders see EN ISO 11623 *Gas cylinders - Composite construction - Periodic inspection and testing* [6].

There shall be equipment to examine and clean cylinder neck threads that does not cause damage to the thread. There shall be thread gauges for checking neck threads as required and taps for any refurbishment. In all cases there shall have been training of personnel in the use of these gauges.

There shall be equipment for the external and internal inspection of cylinders to ensure that a thorough inspection can be made. It is recommended that lamps be sufficiently protected in case the lamp breaks and ignites any residual gas. An alternative, successfully used by a number of organisations, is optical fibre lamps. The light shall be of a suitable intensity that allows all types of defects to be detected. The test station shall have access to equipment to measure the severity of defects where required.

### 5.2.4 External shot blasting of pressure receptacles

If shot blasting is used, each retesting station shall have a written procedure for performing external shot-blasting on high-pressure cylinders. The procedure shall specify what cylinders can be shot-blasted in the shot-blasting equipment.

Composite cylinders shall not be shot blasted and need to have both specific procedures and equipment in place to clean the outside. For further guidance see EN ISO 11623 [6].

The use of incorrect shot blasting media, for example, using steel shots for aluminium alloy cylinders, can damage the cylinder. The cylinder retest station shall ensure only the appropriate blast media is used.

Proven materials include:

- For aluminium alloy cylinders
  - zinc shot
  - aluminium shot
  - ceramic shot
  - glass shot.
- For steel cylinders
  - stainless steel shot
  - ceramic shot
  - glass shot

There shall be procedures in place when changing the blast media to avoid contamination of the different types of blast media.

Dust collectors used with shot blasting machines shall be compatible with the blast media.

During the shot-blasting process, the cylinder valve, if fitted, shall be closed, protected from damage and contamination. If no valve is fitted alternative methods for protecting the inner surface shall be applied. Care should be exercised when removing the handling devices that external debris does not fall into the cylinder.

The shot-blasting machine shall be grounded to avoid any accumulation of static electricity to prevent the risk of explosion particularly from accumulation of dust.

If cylinders with residual flammable, corrosive, or toxic/highly toxic content are to be shot blasted a gas tight closure such as a plug shall be fitted.

The shot blasting of acetylene cylinders requires specific precautions due to the residual product and acetylene in the cylinder. These precautions are not included in this publication. It is recommended that acetylene cylinders are brushed to remove paint.

The residual dust from the shot blasting process shall be disposed of in accordance with local waste disposal regulations

### **5.2.5 Specific requirements for the retesting of composite cylinders with AA6061 liner material**

Investigations have shown that internal exposure to water for some composite cylinders can lead to intercrystalline corrosion of the liner and hence can reduce the fatigue life of the cylinder by a factor of up to 40 times.

Therefore, the time of exposure of the liner to water used in the hydraulic test should be minimized. Ideally the time taken to fill the cylinder with water, carry out the hydraulic test and dry the cylinder should be no more than 2 hours.

Corrosion inhibitors could be added to the water if the 2-hour limit cannot be achieved in practice. This is not permissible for food and medical applications because GMP requires the use of potable water.

### 5.2.6 Weighing

When weighing is required a suitable weigh scale shall be used, for guidance on weigh scale accuracy, see EN ISO 24431, Gas cylinders - Seamless, welded and composite cylinders for compressed and liquefied gases (excluding acetylene) - Inspection at time of filling [7].

### 5.2.7 Test equipment

Test equipment, for example, hydraulic testing and/or ultrasonic testing shall comply with the requirements of the appropriate testing standards.

There shall be adequate supply and disposal facilities for the fluid used for testing including adequate water treatment where applicable.

NOTE If the fluid is recycled, it shall be filtered to prevent carryover of contaminants, such as rust. These filters shall be periodically cleaned.

A check shall be carried out on the pH value of the recycled water. Where both steel and aluminium alloy cylinders are tested, the risk of galvanic corrosion can be minimised by either using separate circuits or imposing additional requirements to the quality and filtering of the water. For additional requirements for aluminium alloy cylinders, see EIGA Doc. 72, *Water Corrosion of Composite Cylinders with AA 6061 Liners* [8]. In some cases, there may be a requirement to use drinking water quality for the hydro testing.

If the test fluid is flammable, for example, when testing LPG cylinders, suitable precautions shall be taken to avoid the risk of an ignition of gas. Different types of cylinders, for example, high pressure and low pressure such as LPG should not be tested on the same test line. Adequate precautions shall be taken to ensure that there is no cross contamination.

The testing equipment shall be shielded to protect personnel in the event of a release of test fluid, particularly in the case of pneumatic testing.

Currently most retest stations have hydraulic test equipment that is able to apply up to 500 bar to be able to retest 300bar working pressure cylinders. Ensure that the appropriate test pressure is applied to cylinders with lower working pressure.

### 5.2.8 Drying

There shall be drying equipment to ensure that there shall be no free moisture and that this dryness is maintained until the valve is fitted, see EIGA Doc. 62 *Methods to Avoid and Detect Internal Gas Cylinder Corrosion* [9]. For aluminium alloy cylinders, reference shall be made to EN ISO 18119 [5] for allowable time and temperature limits.

### 5.2.9 Painting

There shall be appropriate equipment to paint cylinders in accordance with environmental and colour code requirements, EN 1089-3, *Transportable gas cylinders - Gas cylinder identification (excluding LPG) Part 3: Colour Coding* [10]. For aluminium alloy cylinders, reference shall be made to EN ISO 18119 [5] for allowable time and temperature limits.

If required by the cylinder owner heat-indicating coating shall be replaced with an approved material prior to being returned to service.

### 5.2.10 Repairs

Repairs to cylinders when required shall only be carried out in accordance with the relevant standards. Major repairs, which include, for example welding and heat treatment, are normally only accepted on welded steel and welded aluminium alloy cylinders.

### 5.3 Acetylene cylinders periodic inspection - specific requirements

Acetylene cylinders shall only undergo inspection at facilities specifically designated for the purpose. Acetylene inspection facilities shall be designed such that there is no source of ignition of gas.

Acetylene cylinders shall be vented in a safe manner prior to valve removal and the cylinder confirmed as being empty by weighing. It shall be checked that the valve is not blocked, see EN ISO 25760 [4].

Due to the risk of the build-up of acetylene gas which can occur if there is a rise in the ambient temperature when a cylinder has been devalved and moved from a cold atmosphere to a warmer one, the inspection process shall be performed such that only the minimum number of cylinders are devalved at any one point in the inspection process to avoid a build-up of acetylene gas and a possible explosion. Cylinders shall be devalved with adequate operator protection, see EN ISO 25760, [4].

As some cylinders with monolithic masses use asbestos as a binder, no work should be carried out on the mass, which could cause asbestos fibres to be released.

All tools used in the inspection of acetylene cylinders shall not generate sparks, (spark resistant).

No portable electronic equipment that is not certified for use in an acetylene environment shall be used, for example, mobile phones, remote control car keys, laptops.

### 5.4 Procedures

A system shall be in place to show that all procedures are followed and that no stage of the inspection process is omitted.

The procedures for the cylinder inspection process shall be part of a quality system.

There shall be formal written operating instructions for all machinery and equipment.

For welded cylinders, there shall be equipment to invert the cylinder to enable the external base area to be visually inspected, (including fusible plugs).

There shall be procedures to ensure that cylinders are internally inspected and dried before the valve is fitted.

There shall be procedures for the stamp marking of gas cylinders in accordance with the regulations for the stamp marking of gas cylinders,

Current applicable standards shall be available on site for the activity concerned.

There shall be a planned maintenance and calibration programme for all relevant equipment.

There shall be a defined system for disposal of cylinders, see EIGA Doc 05, *Guidelines for the Disposal of Acetylene Cylinders* [11].

### 5.5 Records

Records for the cylinder retest shall be in accordance with the appropriate test standard, e.g. EN ISO18119, EN ISO 11623, EN ISO 10462, EN 1803, [5,6,12,13,].

All records including details of calibrations, on-conformities and training of personnel shall be maintained.

### 5.6 Valves

There shall be suitable equipment and a system in place to ensure that the appropriate valves are fitted for the service of the gas cylinder and that the valves are installed in accordance with EN ISO 13341,

*Transportable Gas Cylinders- Periodic Inspection and Testing of welded carbon steel gas cylinders* [14]. Including the stem thread matches the cylinder internal neck thread. Specifically, care shall be taken to ensure that the maximum permitted torque value is not exceeded.

There shall be procedures in place, that define the torque required for the cylinder material and thread forms, for example steel or aluminium alloy cylinders and conical or parallel threads. Facilities may consider installing different machines with the torque pre-set rather than having one machine whose torque is adjusted for the different cylinder materials or threads.

It is recommended that valves are fitted to cylinders by hand to prevent cross threading of the valve into the cylinder. There shall be procedures in place that ensure that cylinders do not leave the test facility with valves that are only hand tight.

Where valves are reused, they shall be periodically inspected following the requirements of the TPED [1] and EN ISO 22434, [15].

### **5.7 Qualification and training of personnel**

There shall be a training scheme in place to ensure that all personnel are adequately trained for the tasks to be carried out.

There shall be periodic competency checks of all personnel.

## **6. References**

Unless otherwise stated the latest edition shall apply.

- [1] Directive 2010/35/EU of the European Parliament and of the Council of 16 June 2010 on Transportable Pressure Equipment [www.europa.eu](http://www.europa.eu)
- [2] EN ISO/IEC 17020, *Conformity assessment - Requirements for the operation of various types of bodies performing inspection* [www.cen.eu](http://www.cen.eu)
- [3] EIGA Safety Information 18, *Devalving Gas Cylinders* [www.eiga.eu](http://www.eiga.eu)
- [4] EN ISO 25760, *Gas Cylinders - Operational procedures for the safe removal of valves from gas cylinders* [www.cen.eu](http://www.cen.eu)
- [5] EN ISO 18119, *Gas cylinders - Seamless steel and seamless aluminium-alloy gas cylinders and tubes - Periodic inspection and testing* [www.cen.eu](http://www.cen.eu)
- [6] EN ISO 11623, *Gas cylinders. Composite construction. Periodic inspection and testing* [www.cen.eu](http://www.cen.eu)
- [7] EN ISO 24431, *Gas cylinders - Seamless, welded and composite cylinders for compressed and liquefied gases (excluding acetylene) - Inspection at time of filling* [www.cen.eu](http://www.cen.eu)
- [8] EIGA Doc. 72, *Water Corrosion of Composite Cylinders with AA 6061 Liners* [www.eiga.eu](http://www.eiga.eu)
- [9] EIGA Doc 62, *Methods to Avoid and Detect Internal Gas Cylinder Corrosion* [www.eiga.eu](http://www.eiga.eu)
- [10] EN 1089-3, *Transportable Gas Cylinders - Gas cylinder identification (excluding LPG) Part 3: Colour Coding* [www.cen.eu](http://www.cen.eu)
- [11] EIGA Doc 05, *Guidelines for the Disposal of Acetylene Cylinders* [www.eiga.eu](http://www.eiga.eu)
- [12] EN ISO 10462, *Gas Cylinders-Acetylene cylinders Periodic Inspection and Maintenance* [www.cen.eu](http://www.cen.eu)

- [13] EN 1803, *Transportable Gas Cylinders- Periodic Inspection and Testing of welded carbon steel gas cylinders (excluding LPG)* [www.cen.eu](http://www.cen.eu)
- [14] EN ISO 13341, *Transportable Gas Cylinders - Fitting of valves to gas cylinders* [www.cen.eu](http://www.cen.eu)
- [15] EN ISO 22434, *Inspection and maintenance of cylinder valves at time periodic inspection of gas cylinders* [www.cen.eu](http://www.cen.eu)