GUIDELINES ON MANAGEMENT OF WASTE GAS CYLINDERS

Doc 166/16

Revision of Doc 166/11
Guidelines on Management of Waste Composite Cylinders

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Prepared by WG-5 Environment

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Amendments to 166/11

Section	Change
All	Document extensively revised for change of scope from gas cylinders of a composite construction to apply to all gas cylinders (excluding acetylene gas cylinders) made of seamless steel, aluminium alloy, welded steel and a composite construction.
All	Editorial to align style with IHC associations

Note: Technical changes from the previous edition are not underlined.

1 Introduction

This publication provides guidelines for EIGA members including plant managers, distribution managers, line managers, environmental specialists and others involved with gas cylinder management on the safe and responsible management of all cylinders (excluding acetylene gas cylinders) at the end of their service life, also referred to as end of life. These cylinders are referred to in this publication as waste gas cylinders.

2 Scope and purpose

2.1 Scope

This publication applies to all gas cylinders (excluding acetylene gas cylinders that are covered by EIGA Doc 05, *Guidelines for the Management of Waste Acetylene Cylinders* [1][1]) made of seamless steel, aluminium alloy, welded steel and a composite construction that need to be disposed of at the end of their service life.

2.2 Purpose

This publication provides guidelines on dealing with all gas cylinders (excluding acetylene cylinders) at their end of life. It describes a recommended method of evaluating the waste management options available for such cylinders. It is intended to be used by EIGA members' technical managers, site managers, company environmental specialists and others involved with gas cylinder management.

3 Definitions

3.1 Publications 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.

3.1.2 Should

Indicates that a procedure is recommended.

3.1.3 May and need not

Indicate that the procedure is optional.

3.1.4 Will

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

3.1.5 Can

Indicates a possibility or ability.

3.2 Technical definitions

3.2.1 Cylinder

Transportable container of up to 150 litres water capacity that can be filled with gas under pressure.

[1] References are shown by bracketed numbers and are listed in order of appearance in the reference section.

4 Background to the management of waste for all gas cylinders

The industrial gases industry utilises cylinders to store and transport gases. The majority of cylinders are made of metal and have different types and methods of construction (for example seamless or welded construction). Because these cylinders contain gases under pressure, this represents a hazard to be accounted for in the management of the cylinder at the end of its life.

The majority of gas cylinders on the European market are designed constructed and tested according to National, European standards or ISO standards.

Typical cylinder materials in use in EIGA companies are:

- Steel
- Aluminium alloy
- Nickel
- For composite cylinders:
    - Liner material: seamless and welded steel, aluminium alloy or plastic.
    - Fibre material: glass, aramid or carbon fibres, or.
    - Resin: e.g. Polyester.

Gas cylinders have a long operational life, subject to retesting periods of between 5-15 years, depending on cylinder construction and gas service, and when found to be no longer satisfactory for further service, they become designated as waste. The operational life of a cylinder can be in excess of fifty years. A cylinders can be refilled and used many times and is a fully reusable and recyclable package.

Composite cylinders are found in an increasing number of applications in the industrial gases industry. The operational advantage of composite cylinders is principally a lower weight of the package for the same gas pressure compared with a conventional cylinder, which leads to an improvement in ergonomic handling and reduced environmental impact in distribution.

Composite cylinders can have a fixed lifetime according to the relevant standards (for example 10 or 20 years). Cylinders of a composite construction are more difficult to directly recycle than cylinders of a non-composite construction (steel or aluminium alloy), due to the binding together of the separate materials in the composite.

4.1 Waste management principles

4.1.1 Waste hierarchy

Follow the hierarchy for waste management methods is set out in the Directive 2008/98/EC of the European Parliament and of the Council of 19 November 2008 on waste and repealing certain Directives [2].

(a) Prevention;

(b) Preparing for re-use;

(c) Recycling;

(d) Other recovery, e.g. energy recovery; and

(e) Disposal

The principle of prevention of waste is inherent in the design and use of the gas cylinder. The gas cylinder is a robust long life package that is reusable and typically refillable many times. It is maintained and if needed repainted, revalidated and re tested to have an operational life often in excess of fifty years.

At the end of their operational life, cylinders can be recycled. For metals this is back into the metal recycling chain by melting down for reuse with other scrap metal.

4.1.2 Following the duty of care for waste

The duty of care requires that all reasonable steps are taken by the waste producer and others in the waste chain to look after any waste generated, that illegal disposal by others is prevented and that cylinders sent for treatment or disposal shall follow the transportation of waste regulations and have the appropriate traceability and documentation trail.

4.1.3 Proximity principle

Waste should be managed as close as possible to the point of waste production.

4.1.4 Pre-treatment requirements listed in landfill directive

European Union Directive (1999/31/EC) on the land fill of waste [3] reduces the acceptability of landfill as a solution. As part of the implementation of this Directive there is an EU Council Decision 2003/33/EC [4] of 19 December 2002 establishing criteria and procedures for the acceptance of waste at landfills pursuant to Article 16 of and Annex II to Directive 1999/31/EC [4].

In accordance with the acceptance criteria, there is a requirement that waste is treated before landfilling. Usually gas cylinders are only landfilled if materials of construction cannot be technically or economically recovered or used for energy recovery.

4.2 Recommendations for waste management methods

Due to the range of different materials used and the location of different waste management facilities it is not possible to recommend a single method of treatment, but instead this document sets out a process for decision on the most appropriate waste management methods for all gas cylinders (excluding acetylene gas cylinders).

4.2.1 Cylinder end of life decision

There are a number of reasons for the selection of cylinders for scrapping:

- External condition - the cylinder shell may have been subjected to fire or physical damage.
- Commercial/technical decision; for example, the cylinder is considered to be technically inefficient due to lower charging pressures or excessive weight.
- Rejection at the time of the pre-fill inspection.
- Rejection at time of periodic inspection
- Service life has been met (e.g. pre-defined service life has been exceeded or a maximum number of pressure cycles, applicable to cylinders used as pressure-buffers)

Information required before disposal includes materials of construction and recycling possibilities from the original manufacturer of the cylinder and possibly raw material suppliers.

When a cylinder is identified for scrapping the owner shall be notified, as they should agree to the disposal of their asset.

4.2.2 Waste Management (scrapping) process

The cylinder contents shall be identified and the cylinder shall be emptied and purged in accordance with EIGA Doc 30 *Disposal of gases* [5].

All labels and identification marks shall be removed and the cylinder shall be made unserviceable by:

- Removal of the valve and other accessories for reuse, recovery or disposal.
- Then one or more of the following
    - crushing the cylinder as flat as possible by mechanical means;
    - burning an irregular hole in the top dome equivalent to approximate 10% of the area of the top dome, or in the case of a thin walled cylinder in at least 3 places;
    - cutting irregular holes in the neck or base;
    - cutting the cylinder in half in an irregular manner, including the shoulder;
    - bursting in a safe manner.

In addition, see the following guidance:

- EN ISO 6406 - *Gas cylinders -- Seamless steel gas cylinders -- Periodic inspection and testing* [6]
- EN ISO 10461 - *Gas cylinders -- Seamless aluminium-alloy gas cylinders -- Periodic inspection and testing* [7]
- EN ISO 10460 - *Gas cylinders -- Welded carbon-steel gas cylinders -- Periodic inspection and testing* [8]
- EN ISO 11623 - *Transportable gas cylinders - Periodic inspection and testing of composite gas cylinders* [9]

These operations shall be subject to a workplace risk assessment taking into account hazards such as metal particles, fibres and fumes.

4.2.3 Waste treatment

Following the waste hierarchy, the following options should be assessed in order of priority

4.2.3.1 Prevention and continued use

Each time cylinders are returned for refilling there are standard procedures to check they are suitable for continued use. In addition, at time of periodic inspection, cylinders are revalidated for a further period of use e.g. 5-15 years.

Therefore, prevention and preparation for use may be considered as a standard operational procedure for cylinders through this periodic inspection and retesting, or through change of service procedures. When these procedures are carried out, the cylinders are not normally thought of as potential “waste”

Cylinders that cannot be reused according to 4.2.1 become designated as waste.

4.2.3.2 Extended Producer responsibility

Extended producer responsibility, is an environmental policy approach in which the responsibility of a producer/ manufacturer/ product maker for a product is extended to the post-consumer stage of a product’s life cycle. [10]

Consideration should be given to returning waste cylinder to the producer of the cylinder or facility recommended by the producer for treatment (recycling) and/or disposal. The facility shall hold the correct licence for management of non-hazardous waste as identified by the following waste codes that need be also referenced on the waste transfer documentation.

- Waste Code (EWC) 15 01 04 metallic packaging
- Waste Code (EWC) 15 01 05 composite packaging

If returning waste cylinders to the producer is not possible, a list of materials and recycling or recovery possibilities should be compiled. It is recommended to contact the producer for such a list.

4.2.3.3 Waste management options

First steps carried out on the site are the pre-treatment steps:

- At a minimum ensuring the cylinder is unserviceable and the valves and other accessories are removed and sent for reuse, recycling, recovery or separate disposal (see 4.2.2),
- Segregating these cylinders from other wastes not mixing materials to maximise the possibility of recycling and
- Clearly describing the waste by using the correct European Waste Catalogue code (see 4.2.3.2)

The following waste treatment options can be used. These could require a waste management licence, and are therefore normally performed off site at a licensed waste management facility.

Aluminium alloy, nickel and steel cylinders can be recycled directly, but the different metal types shall not be mixed far as technically and economically feasible.

- For composite cylinders, where technically and economically feasible, separate the materials for recycling and recovery in accordance with pre-treatment requirement e.g. cut up and separate the different materials by shredding or crushing.
- Depending on the metal content and on the acceptance criteria for the metallic waste on the waste site licence it could be possible to directly recycling the cylinder with metal wastes (without separation of materials).
- If neither of these treatment methods is technically or economically feasible then the cylinders should be segregated and sent to a suitable landfill.

5 References

Unless otherwise specified the latest edition shall apply.

[1] EIGA Doc 05, *Guidelines for the Management of Waste Acetylene* www.eiga.eu

[2] Directive 2008/98/EC of the European Parliament and of the Council of 19 November 2008 on waste and repealing certain Directives http://eur-lex.europa.eu/

[3] European Union Directive (1999/31/EC) on the land fill of waste http://eur-lex.europa.eu/

[4] EU Council Decision 2003/33/EC [4] of 19 December 2002 establishing criteria and procedures for the acceptance of waste at landfills pursuant to Article 16 of and Annex II to Directive 1999/31/EC http://eur-lex.europa.eu/

[5] EIGA Doc 30 *Disposal of gases* www.eiga.eu

[6] EN ISO 6406 - *Gas cylinders -- Seamless steel gas cylinders -- Periodic inspection and testing* www.cen.eu

[7] EN ISO 10461 - *Gas cylinders -- Seamless aluminium-alloy gas cylinders -- Periodic inspection and testing.* www.cen.eu

[8] EN ISO 10460 - *Gas cylinders -- Welded carbon-steel gas cylinders -- Periodic inspection and testing* www.cen.eu

[9] EN ISO 11623 - *Transportable gas cylinders - Periodic inspection and testing of composite gas cylinders* www.cen.eu

[10] *Development of Guidance on Extended Producer Responsibility (EPR) Final Report*, European Commission - DG Environment. 2014. http://ec.europa.eu/environment/archives/waste/eu_guidance/index.html