



TECHNICAL INFORMATION SHEET 46

TRANSPORTABLE GAS CYLINDERS – VALVE LIFE

Background

Most gas cylinders are sealed closed with a cylinder valve. A specific type of valve is chosen for each type of cylinder and each gas product. The valve has to be capable of withstanding both the contained pressure within the cylinder (without leakage and be capable of withstanding a minimum of 1.5 times the cylinder test pressure) and the rigours of manual handling of the gas cylinder package. It will have for example, a means of opening and closing the valve, filling of the cylinder (usually via an outlet connection), possibly a residual pressure device, a pressure relief device, etc. In some cases it will be protected from impact damage by a valve guard, a cap, a shroud, etc.

A cylinder valve is a critically important component of a gas cylinder package. Its integrity is intrinsic to the safety of the gas cylinder package, both in transportation and in use.

When choosing and subsequently assembling the combined gas cylinder with its accessories compliance is required with the *Carriage of Dangerous Goods and the Use of Transportable Pressure Equipment Regulations* [1]. The owner of the gas cylinder package is responsible for placing the product on the market in a safe condition.

Prior to a fill, the filler of the gas cylinder is responsible for checking conformity of the cylinder and its accessories, following the standards listed in the Regulations. During and after a fill the filler is responsible for carrying out leakage tests on the gas cylinder package, which centre around checking for external leaks from the cylinder to valve interface thread and the valve spindle gland, followed by checking for internal leaks across the valve seat.

Most gas cylinder valves achieve closure through the use of a non-metallic seal, retained in a metal inner spindle which is moved axially to open or close off a gas passage via a seat cut into the body to achieve the opening and closing functionality.

The outer spindle connecting the inner spindle to the hand-wheel is sealed against leaks of the contained gas to the environment, usually through use of an O-ring seal or sometimes by using a diaphragm.

Valve service life

During valve use, ageing and physical wear is likely to occur. The effect is most pronounced on any non-metallic elements, for example, O-ring seals and the soft inner spindle seal, as these degrade with wear and over time due to ageing. Some ageing effects are not externally visible.

Some examples of these issues include:

- worn, abraded, creased spindle O-rings creating leaks;
- contaminated, moving threads creating high hand-wheel torque;
- damaged shut-off seats, meaning excessive closure force is required;
- damaged (cracked) valve seat retainers, due to excessive closure force application;
- stress corrosion of brass materials causing valve cracking and pressure release.

A good indicator that a valve may have internal faults is that the rotational torque required to open, rotate and close the valve exceeds 7 Nm.

The valve manufacturing industry recognise these effects and subjects prototype valves to a variety of tests to ensure their fitness for purpose. Tests include synthesized endurance (duty cycle) testing, enhanced material ageing tests, extreme temperature, vibration and excessive force tests. Testing is carried out in accordance with BS EN ISO 10297 [3], *Gas cylinders. Cylinder valves, Specification and type testing*.

Endurance tests are designed to ensure reliable operation in real-life conditions.

In order to validate their Valve Service Life, most valve manufacturers perform extended testing to the point of failure.

If the valve is used in a medical application (under the terms of the Medical Devices Directive [2]) the manufacturer will provide 'Instructions for Use' (typically one set per box) that define both the service life and the warranty period of the valve.

If the valve is used in industrial or food (including beverage) applications, the Valve Service Life shall be that recommended by the valve manufacturer. This may be referenced in the 'Instructions for Use' or in other documentation provided by the manufacturer.

Owners of gas cylinder packages should incorporate the recommended Valve Service Life provided by the valve manufacturer (in whatever format this is provided) into their own processes and procedures.

At the end of the recommended Valve Service Life, or at the periodic inspection and test of the cylinder (whichever comes first), gas cylinder package owners shall either make unusable for further service and scrap (and replace, if required) the valve, or, if the intention is to extend the life of the valve for an additional period, owners shall inspect and maintain the valve in accordance with BS EN ISO 22434 [5], *Transportable gas cylinders. Inspection and maintenance of cylinder valves*.

Inspection and maintenance shall only be carried out by those who hold the appropriate approval for BS EN ISO 22434 [5] and have it detailed on their United Kingdom Accreditation Service (UKAS), Schedule of Accreditation.

NOTE: During inspection and maintenance of the valve, particular attention should be paid to cleanliness and materials compatibility of any replacement parts, for example, refer to BS EN ISO 11114 [4], *Gas cylinders. Compatibility of cylinder and valve materials with gas contents*.

Each valve will be marked with the manufacturers mark and the date of manufacture to assist owners in determining the age of the valve, and the Valve Service Life.

Marking of valves

The valve manufacturer will permanently mark each valve according to the marking requirements of BS EN ISO 10297 [3].

The date marking shall be in the format YY/MM (YY-WW); or YYYY/MM (YYYY-WW).

If **inspection** of the valve is carried out in accordance with BS EN ISO 22434 [5], to extend the Valve Service Life, a revised date code will be required to be marked on the valve by the organisation providing this inspection along with a mark identifying the inspection organisation.

If **refurbishment** of the valve is carried out in accordance with BS EN ISO 22434 [5], at any time, a revised date code will be required to be marked on the valve by the organisation providing this refurbishment along with a mark identifying the inspection organisation.

If no room exists for such required marking, then the valve shall be made unusable for further service and scrapped (following an appropriate safe disposal method).

Figure 1 shows examples of marking on valves showing year / month of manufacture.



Figure 1: Example of valve markings

It is an option for the gas cylinder package owner to align the life of the valve with the next periodic inspection and test date for the gas cylinder into which it is installed.

This can be supported by the use of cylinder test rings. Test rings identify a future date when the next inspection and maintenance activity is due. This date can reflect either the remaining Valve Service Life of the valve, or the date at which the cylinder requires a periodic inspection and test, whichever is the shorter period.

Information on cylinder test rings is available in BCGA TIS 6 [6], *Gas cylinder identification. Label and colour code requirements.*

Summary of requirements

The owner of the gas cylinder package is responsible for placing the product on the market in a safe condition.

The valve manufacturer should recommend a Valve Service Life.

The valve manufacturer will mark on the valve the date of manufacture and their manufacturer's identification mark.

If the valve owner decides to extend the life of a valve, the valve shall be inspected and maintained according to the requirements of BS EN ISO 22434 [5].

The organisation carrying out this work in accordance with BS EN ISO 22434 [5] is responsible for applying a new mark, showing that they have taken responsibility for the valve and any change to its Valve Service Life.

References:

- 1) SI 2009 No. 1348, *Carriage of Dangerous Goods and the Use of Transportable Pressure Equipment Regulations* (as amended).
- 2) European Council directive 93/42/EEC of 14 June 1993 concerning medical devices (as amended). *The Medical Device Directive (MDD)*.
- 3) BS EN ISO 10297, *Gas cylinders. Cylinder valves. Specification and type testing*.
- 4) BS EN 11114, *Gas cylinders. Compatibility of cylinder and valve materials with gas contents*.
- 5) BS EN ISO 22434, *Transportable gas cylinders. Inspection and maintenance of cylinder valves*.
- 6) BCGA TIS 6, *Gas cylinder identification. Label and colour code requirements*.

For more information:

UK Legislation

British Standards Institute (BSI)

United Kingdom Accreditation Service (UKAS)

British Compressed Gases Association (BCGA)

www.legislation.gov.uk

www.bsigroup.co.uk

www.ukas.com

www.bcgaco.uk

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