

# Diving cylinders: Guidance on internal corrosion, fitting valves and filling

## HSE information sheet

## Diving Information Sheet No 10

### Introduction

This diving information sheet is part of a series of information sheets providing guidance on diving at work. The information is also relevant to the recreational diving sector.

It details the hazards of internal corrosion in diving cylinders and provides guidance on precautions to minimise the chance of such corrosion occurring. In addition, guidance on the appropriate standards to be employed during the fitting of valves and the precautions to be taken during cylinder filling is provided.

### Cylinder internal corrosion

Research has shown that corrosion rates inside diving cylinders can be significantly faster than corrosion rates in air at atmospheric pressure. The amount of water needed to produce this corrosion is very small and might not be enough to be identified by the user, for example by shaking. The speed and extent of this internal corrosion has been sufficient to cause some affected cylinders to leak and, in one case, fail catastrophically during filling. Many of these cylinders have been 'in date' for periodic inspection (2.5 years) and externally appear to have been in very good condition.

To prevent this corrosion it is important that the following precautions are taken to minimise the chance of water entry:

- Avoid emptying cylinders underwater.
- Do not charge cylinders (such as delayed surface marker buoy cylinders) that have been emptied underwater by decanting from another cylinder – water from the empty cylinder may enter the 'charging cylinder' during the process.
- Before connecting a cylinder to a charging whip, momentarily crack open the cylinder valve and gas supply valve to blow out any moisture at the connection interface.

If there is any chance of water having entered a cylinder it is strongly recommended that it is submitted to an internal visual inspection in accordance with BS EN 1802<sup>1</sup> or BS EN 1968<sup>2</sup> before refilling.

### Fitting cylinder valves

Cylinder valves should always be fitted by persons who are competent to do so and in accordance with the manufacturer's instructions.

It is recommended that the procedures detailed in ISO 13341<sup>3</sup> are used for fitting cylinder valves. It is noted that the scope of this standard excludes diving gas cylinders. However, as there is no other appropriate standard the torque values stated in this standard should be used unless the manufacturer states a different value.

It is also recommended that cylinders are internally examined in accordance with BS EN 1802 or BS EN 1968 before fitting valves. This will ensure that any contaminants, moisture or corrosion present are identified and eliminated before the cylinder is closed by the valve.

There have been a number of cases where cylinder valves manufactured to the EN standard (EN 144-1<sup>4</sup>) are being fitted to cylinders where the neck form is to the DIN standard (DIN 477-6<sup>5</sup>) and vice versa. Mixing these standards is considered unsound engineering practice.

### Cylinder filling

Cylinder filling should only be conducted by a competent person who should wear appropriate personal protective equipment (for example, eye and hearing protection).

There is a risk of injury from high-pressure flexible hoses if there is a failure of the hose or cylinder fittings during the charging process. In accordance with British Compressed Gases Association (BCGA) Code of Practice No 4<sup>6</sup> and HSE publication *Compressed air*

safety HSG39,<sup>7</sup> it is recommended that charging whips are fitted with a restraining line to minimise this risk.

## References

- 1 BS EN 1802:2002 *Transportable gas cylinders. Periodic inspection and testing of seamless aluminium alloy gas cylinders* British Standards Institution
- 2 BS EN 1968:2002 *Transportable gas cylinders. Periodic inspection and testing of seamless steel gas cylinders* British Standards Institution
- 3 BS EN ISO 13341:1998 *Transportable gas cylinders. Fitting of valves to gas cylinders* British Standards Institution
- 4 BS EN 144-1:2000 *Respiratory protective devices. Gas cylinder valves. Thread connections for insert connector* British Standards Institution
- 5 DIN 477-6:March 1983 *Gas cylinder valves for test pressures up to 300 bar and 450 bar; with cylindrical thread for valve stem and gas cylinder neck for breathing apparatus – Sizes – Threads* Deutsches Institut für Normung 1983
- 6 *Industrial Gas Cylinder Manifolds and Gas Distribution Pipework (excluding acetylene)* Code of Practice CP4 British Compressed Gases Association 2005
- 7 *Compressed air safety* HSG39 (Second edition) HSE Books 1998 ISBN 978 0 7176 1531 5

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