

Acetylene Cylinder Base Corrosion

Footrings on welded construction cylinders

This Safety Information is intended to raise awareness of hazards and safety measures necessary regarding the filling of acetylene cylinders of welded construction with footrings.

Corrosion of the base of welded acetylene cylinders with a welded, non-ventilated footring has become an increasing concern as these cylinders age. This cylinder design is more susceptible to failure in comparison to a seamless cylinder (with or without footring) for a number of reasons, including:

- There is less thickness to the base in the area of greatest corrosion i.e. there is less tolerance of corrosion before failure.
- The welded, non-ventilated footring is retaining the moisture/salt so when exposed, the base with the footring is suffering for longer and to greater degree.
- The non-ventilated footring defines a boundary – underneath it there is corrosion but often external and above it there is no corrosion. The operator does not get an indication of the state of the base under the footring by looking at the area outside the footring.

Two “loss of containment” events have occurred during filling (one in 2012 and a second in 2020), where the base has opened, and the porous material has been ejected leading to the cylinder shell going upwards.



Also warning events have occurred - the base of the cylinder with footrings has leaked during filling.



The impact or consequence of these events

The two loss of containment events have:

- led to physical injury
- exposed the operator to potential asbestos inhalation from the porous material
- led to a contamination of the fill hall by the porous material
- caused equipment and facility damage

None of the leaking cylinders has led to an event – they have been “near miss” without direct consequence.

All cylinders involved in events have been scrapped.

Factors relating to the risk of failure

The failures, both events and leaks, have been reviewed for the following risk factors.

1. The style or design of the footing.
The footing that is welded rather than shrunk onto the base of the cylinder is more vulnerable to corrosion due to accumulation or trapping of material under the weld.
The non-ventilated footing without slots that allow air movement is more vulnerable to corrosion than one with ventilation slots due to the inability of the area under the footing to dry.



Non-ventilated footing



Ventilated footing

2. The thickness of the material in the area subject to corrosion
Different manufacturers and models of welded cylinders have differing thicknesses of metal under the base. Greater thickness provides more allowance for corrosion before failure.
3. The exposure to corrosive conditions
Both the supplier/filler and the customer potentially expose the cylinder to base corrosion.
Leaving the cylinder in water, especially water of enhanced corrosion characteristics (sea water, chemically contaminated water or snow) for extended time (weeks, months or years) is increasing the risk.

Safety recommendations for fillers of acetylene cylinders with footings

The company that fills the cylinder must have procedures in place to confirm that the cylinder is safe to fill.

EIGA doc 123, *Code of Practice Acetylene*, refers the filler to EN ISO 11372, *Gas cylinders – Acetylene cylinders - Filling conditions and filling inspection for Acetylene cylinders*, for details of the prefill inspection, which includes the phrase

“3.2.2. Verification of serviceable condition

It shall be established that each cylinder is in a serviceable condition before filling. It shall therefore be established that the cylinder is clean and free from foreign material, so that the cylinder can be assessed for mechanical damage that would otherwise prevent it from being filled safely, that it does not exhibit any abnormalities that could impair the safety, including arc burns, severe corrosion, heat/fire damage, or have any

other significant mechanical damage". [1,2]

This should include inspection of the underside of the base before filling cylinders considered at greater risk of base corrosion.

For cylinders considered at greater risk of base corrosion the filler should propose the following options to the owner/operator of the cylinder fleet:

1. That, at time of requalification, the inspection of base of the cylinder described in EN ISO 10462, *Periodic inspection and maintenance of Acetylene cylinders*, be reinforced with extra training and auditing relating to base corrosion. [3]

This may involve for cylinders considered at greater risk

- a. Extra equipment to improve the base inspection;
- b. Supervisory assistance;
- c. Detailed "pass / fail" criteria – photos and/or wall thickness measurement (see annex).

2. The protection of the base against corrosion

The manufacturer (in case of new cylinders) and the owner (in case of cylinders in use) of the cylinder may treat the base of the cylinder to protect from corrosion. There are a number of different protective methods ranging from

- a. painting the base the same as the rest of the body of the cylinder;
- b. enhanced anti corrosive painting of the base (marine primers etc.);
- c. electro galvanisation applying a zinc layer to the steel before painting.

These are only examples of options and some require the cylinder's steel to be exposed and clean before application so may not be applicable to cylinders already in service.

3. Increased frequency of base inspection

Without changing the requalification period, it may be suitable to undertake base inspections more frequently for the cylinders considered at greater risk. For instance, before shipping the cylinder to the filler that the owner/operator of the cylinder inspect the base. There are multiple options for how to undertake this more frequent style of inspection (tilting, mirrors, cameras etc.) but all rely upon the training and experience of the person undertaking the inspection. Specific training and auditing is recommended as this may not be the person trained for requalification of the cylinder.

4. Handling equipment

The equipment used during the handling may be causing exposure e.g. a pallet design might have no drainage and therefore potentially mean the cylinder base is left in a pool of water. Improving the handling equipment may be a way of reducing exposure to corrosion.

5. Duration and location of exposure

Both the duration of exposure and the condition of storage impact the rate of corrosion

The owner may be able to monitor where the cylinder has been and for how long it has been in that location. Long duration (e.g in excess of 3 months) or locations of greater corrosion risks imply the need for greater vigilance.

NOTE: Cylinders considered as greater risk include but not limited to:

- Welded cylinders with non-ventilated footing
- Cylinders exposed to long stay duration outdoor
- Cylinders exposed to storage in potentially aggressive atmospheric conditions (offshore, shipping companies, mining, corrosive chemical industry)