Training Package

TP 15/15

Pre-fill Inspection of Gas Cylinders
Pre-fill Inspection of Gas Cylinders

Disclaimer

All publications of AIGA or bearing AIGA's name contain information, including Codes of Practice, safety procedures and other technical information that were obtained from sources believed by AIGA to be reliable and/or based on technical information and experience currently available from members of AIGA and others at the date of the publication. As such, we do not make any representation or warranty nor accept any liability as to the accuracy, completeness or correctness of the information contained in these publications.

While AIGA recommends that its members refer to or use its publications, such reference to or use thereof by its members or third parties is purely voluntary and not binding.

AIGA or its members make no guarantee of the results and assume no liability or responsibility in connection with the reference to or use of information or suggestions contained in AIGA's publications.

AIGA has no control whatsoever as regards, performance or non performance, misinterpretation, proper or improper use of any information or suggestions contained in AIGA's publications by any person or entity (including AIGA members) and AIGA expressly disclaims any liability in connection thereto.

AIGA's publications are subject to periodic review and users are cautioned to obtain the latest edition.
Introduction

- During routine use, cylinders and bundles may be subjected to irregular treatment, mechanical damage, fire damage or contamination. A pre-fill inspection of cylinder package is necessary to ensure that the cylinder is safe to fill.
- Pre-fill inspection guidelines as established and are contained in various cylinder codes and regulations are not adhered to by fillers.
- Several incidents have occurred due to inadequate pre-fill inspection.
Scope

- General Pre-fill inspection guidelines for cylinders and bundles.
- Specific requirements of Aluminium and composite cylinders.
- These guidelines do not cover Acetylene cylinders.
Why to check?

Each gas cylinder needs to be inspected at the time of filling

- to ensure that it has no visible defects which render it
  - unsafe for filling
  - unsafe for use

- to ensure Cylinder complies with regulatory requirements with regard to national colour coding, marking, labeling and accessories (fittings like valve protection, etc.)

- to ensure that the valve is functional and is correct for the gas service (both valve and the outlet specific to gas being filled)
Pre-fill Inspection checks

Pre-fill checks can be broadly divided into five steps:

- General visual checks
- Cylinders - external checks (composite cylinders additional checks)
- Checks for internal contaminants
- Valve checks
- Cylinders – accessories & attachments
Pre-fill Inspection checks

- Refillable & non refillable
- Leaking cylinders/valves
- Strangers/own cylinders
- Ownership, test status, service pressure and gas service
- External cylinder damage checks
- Cylinder internal - general
- Valve checks
- Check labels
- Safety device checks
- Special checks for aluminum & composite cylinders
- Residual liquid/tare weight checks for liquefied compressed gases
General checks

- Type of Cylinders: Refillable or non-refillable
- Steel, Aluminum or composite cylinders
  - Additional checks required for composite cylinders
- Extra caution is needed for private / stranger cylinders.
- Repaired cylinders
- Leaking valves

**Warning:**
Non refillable cylinders must not be re-filled

**Examples of Non-refillable cylinders**
Check cylinder markings & colour code (if any) to verify:

- Ownership
- Cylinder number
- Test status (some companies use Test date rings)
- Test station mark (recognized marking?)
- Service pressure and Test pressure
- Gas service
- Specification
- Approved to fill in the country
- Banned / restricted cylinders
- Manufacturer
Typical Stamp Marking of ISO standard (UN) cylinders

Figure 1 - ISO Cylinder Markings
Examples of Restricted / Banned cylinders & valves

- Some countries have established lists of specific cylinder types and valves that are no longer considered safe for their original design conditions.

  *IGC Doc 86/09 gives Negative Cylinders and Valve lists by country

- Any Safety Alerts issued by the manufactures, Regulatory authorities for recalls or withdrawals should be followed.
Cylinder- External checks

Contamination/damage

- Contamination
  - Grease, oil, dirt, bitumen, concrete, paint etc
- Cylinder body damage
- Fire & heat damage
- Weld mark/arc burn
- Neck rings/collar checks

- Cylinders with any of the defects shall not be filled and shall be sent to the test shop for further checks and decision.
- Never fill any cylinder if you have any doubt about its condition.

Do not fill the cylinders with these damages: Must be inspected and approved by the Test shop/Competent person.
Cylinder body damage examples

- Bulge
- Dents/digs
- Cuts or gouges
- General corrosion
- Chain/line/pitting corrosion
- Cracks
- Base corrosion
Cylinder body damage examples

- Arc Burn
- Markings Removed
- Cut
Cylinder body damage – Specifications removed
Cylinder- External checks - fire or heat damage

Look out for

- Blistered, charred or burnt paint
- Burn marks on the cylinder (the burn area of a steel cylinder may be masked by the evidence of rust)
- Soot over paint
- Dull oxidized appearance of the metal or painted surface
- Burnt, cracked, or discolored label
- Deformed hand wheel, valve guard or carrying handle
- Discolored, melted or missing: plastic collar, test date ring or heat indicators
Unauthorized modification- examples
(refer to EIGA Safety Alert SA-05)

Typical 43.7 ltr DOT Cylinder

Typical 47 ltr cylinder

Incident 44 ltr DOT cylinder

Cylinder with a welded plug

Welded plate ground and painted

Internally welded cylinder

H=137 cm

H=127 cm

10 cm
Cylinder Hammer Test

Some regulations require hammer test

- Hammer test should be done before filling cylinders to test cylinder integrity
- A hammer test is not required for aluminum cylinders and cylinders filled with liquefied compressed gases.
- Strike the side of the cylinder at approximately mid height with a light tap using a ½ lb. ball peen hammer or similar tool.
- A clear bell-like tone that gradually fades indicates that the cylinder is free of contaminants and corrosion.
- A dull thud indicates that the cylinder may contain corrosion products, or liquid or solid contaminants. If you hear a dull thud, tag the cylinder, and send it to the Test Shop.

Note: The hammer test is effective for detecting significant quantities of contaminants and severe corrosion. The test will not detect small quantities of these impurities.
Odour test

Some regulations require odour test

- If specifically required, this test is done only on Oxygen, Medical O2 and breathing/diving grade of air gases.
- At facilities where a local regulation prohibits this test for health reasons, a properly calibrated on-line or portable hydrocarbon analyzer may be substituted.
- Odour Test must not be done on any special gases, flammable gases and any gas that may present a health hazard.
- Never place your nose directly on the gas stream.
- Crack open the valve for a very brief time and reclose it.
- If there is no sufficient gas in the cylinder, introduce a small amount oil free Nitrogen and carry out test.
- Refer to CGA P-15 for further details.
Valve checks

- Ensure that the valve is of correct type for the gas service.
- Check valves to ensure they are straight and not damaged. A bent valve may fail under filling pressures.
- Check that there is no evidence of valve tampering, missing cassette, loose back plugs, incorrect hand wheel or twisted/rounded spindle.
- Check that valves are free of oil, dirt, grit, or other contaminants.
- Outlet threads are to be clean and free from tape, threads not worn out.
Valve checks

Twisted square drive spindle

Valve contamination
Valve checks – Thread engagement with cylinders

- Check the extent of valve thread entry into the cylinder neck visually
- Taper thread valves have some threads visible, typically
  - 1 to 3 threads for 25E/BS 1 inch
  - 3-6 threads for ¾ NGT threads
- Parallel threads: No threads Visible

<table>
<thead>
<tr>
<th>Tapered Threads</th>
<th>Code</th>
<th>Thread Designation</th>
<th>Origin</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>17E</td>
<td>17.4 ISO/DIS 11111</td>
<td>Europe</td>
</tr>
<tr>
<td></td>
<td>25E</td>
<td>25.8 ISO/DIS 10920.2</td>
<td>Europe</td>
</tr>
<tr>
<td></td>
<td>V1</td>
<td>20 X 14 JIS B 8240</td>
<td>Japan</td>
</tr>
<tr>
<td></td>
<td>V2</td>
<td>28 X 14 JIS B 8245</td>
<td>Japan</td>
</tr>
<tr>
<td></td>
<td>V3</td>
<td>28 X 14 JIS B 8245 (reduced length)</td>
<td>Japan</td>
</tr>
<tr>
<td></td>
<td>W6</td>
<td>0.6-14 AS2473</td>
<td>Australia</td>
</tr>
<tr>
<td></td>
<td>W71</td>
<td>0.715-14 AS2473</td>
<td>Australia</td>
</tr>
<tr>
<td></td>
<td>W1</td>
<td>1-14 AS2473</td>
<td>Australia</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Straight Threads</th>
<th>Code</th>
<th>Thread Designation</th>
<th>Origin</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1SP</td>
<td>M18 X 1.5</td>
<td>Europe</td>
</tr>
<tr>
<td></td>
<td>2SP</td>
<td>M25 X 2</td>
<td>Europe</td>
</tr>
<tr>
<td></td>
<td>3SP</td>
<td>M30 X 2</td>
<td>Europe</td>
</tr>
</tbody>
</table>

Note: Code designates diameter in ISO standards.

Table 3 - Select International Thread Codes

---

Asia Industrial Gases Association, 3 Harbour Front Place, 09-04 Harbour Front Tower 2, Singapore 099254. Internet: www.asiaiga.org
Residual Pressure Valve checks

Residual pressure valve (RPV) keeps some product inside the cylinder. An RPV reduces the risk of internal corrosion and product contamination. It is important to check if the RPV valve is not defective:

- Using a suitable mechanical tool, disengage the RPV, and listen for pressure release.
- If no positive pressure is observed, the RPV mechanism is not working.

**Warning:** Do not fill cylinders with defective RPV valves.
Checks on Pressure Relief Devices

Some cylinders are fitted with valves having pressure relief devices like burst discs, fusible plugs or combination devices.

- Check externally for corrosion, damage, plugging of flow channels.
- Check for leakages, extrusion of fusible metal through the flow passages.
- Check for mechanical damages like bent, distorted or tampered

**Warning:**
Do not fill cylinders with defective or damaged Relief Devices.
Collars / accessories checks

- Check for loose / damaged neck rings. Corrosion on the shoulder
- Broken valve guards
Aluminium cylinders – special requirements

- Only fill compatible gases/chemicals in Aluminum cylinders. Refer to ISO 11114-1 (examples: HCL shall not be filled in Aluminum cylinders).
- When the cylinders are exposed to heat/fire and cooled, mechanical properties might change without any visible burn marks on the metal surface.
  - Inspect of labels, paint or any other material for heat damage/deformation
  - Aluminium cylinders should be fitted with high temperature exposure indicators or heat sensitive indicator to identify cylinders exposed to high temperatures
  - Some Aluminum Alloy Cylinders are prone to Sustained Load Cracking (SLC), example: AA6351/6082. Refer to IGC Doc 57/11/E

**Warning:** Filling aluminum cylinders that have no means to identify whether or not were exposed to heat/fire may lead to cylinder failure/rupture.
Pre-fill inspection criteria for Composite cylinders

These cylinders are subjected to the same pre-fill criteria as other cylinders.

- External visual Inspection: To look for mechanical, chemical damage—normally clearly visible to the naked eye. Do not fill if any of the below defects are noted—Send to the retest station for further examination.
  - Abrasion
  - Cuts
  - Impact damage
  - Fire damage
  - Chemical damage

Do not fill the cylinders with these damages: Must be inspected and approved by the Test shop/Competent person.
External damage on Composite cylinders- Abrasion

Figure 1a: Level 1 abrasion damage — Superficial abrasion

Level 2 abrasion damage — Depth of abrasion between 5% and 15% of thickness (fully wrapped cylinder)

Level 3 abrasion damage — Severe abrasion over 15% of thickness
Composite cylinders, damage from cuts

Level 2 damage from cuts — Depth of cut between 10 % and 30 % of thickness (hoop wrapped cylinder)
External damage due to impact

- Level 1 impact damage — Superficial impact damage
- Level 3 impact damage — Depth of damage over 15% of thickness (fully wrapped cylinder)
De-lamination

Figure 4: De-lamination damage greater than Level 2 .4.1.5
Heat or fire, structural damage and chemical attack

Level 1 – Heat Damage - Surface charring

Level 3 – Heat or Fire Damage

Structural Damage

Chemical attack

Asia Industrial Gases Association, 3 Harbour Front Place, 09-04 Harbour Front Tower 2, Singapore 099254. Internet: www.asiaiga.org
Checks on cylinder bundles

- Ownership
- Cylinder test status
- Gas Service
- Frames and manifold damage
- Valves
- Cylinders
- Tare weight for liquefied gases must be legible

Slide 33
References

- CGA C-15: Filling of Industrial and Medical Non-Flammable Compressed Gas Cylinders. standard by Compressed Gas Association
- IGC Doc 86/09: Gas cylinders and valves with restricted use in the EU
- ISO 24431:2006: Gas cylinders -- Cylinders for compressed and liquefied gases (excluding acetylene) -- Inspection at time of filling
- ISO 11114-1: Gas Cylinders – Compatibility of cylinder and Valve with gas Contents – Part 1: Metallic elements
Thank you

website: http://www.asiaiga.org