ACETYLENE CYLINDER PRE-FILL CHECKS

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1 Introduction

This document describes examples of possible defects that can be found during pre-fill inspection of acetylene cylinders.

2 Scope and purpose

The document gives guidance to the operator who is executing the pre-fill inspection of acetylene cylinders. It gives examples of possible defects found during this inspection. When such a defect is found, the cylinder shall be rejected for filling.

3 Definitions

For the purpose of this publication, the following definitions apply.

3.1 Publication 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

Indicates 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

Refer to EIGA Doc 26, *Safe Filling of Acetylene Cylinder, Bundels and Battery vehicles*

4 Acetylene cylinder pre-fill checks

4.1 Cylinder Status and Type

Before the external condition of the cylinder is verified, checks shall be conducted to determine the cylinder status and type. These are checks for:

- Ownership
- Gas service
- Tare weight
- Test status
- Solvent type
- Porous material type

Cylinders not meeting the requirements for filling shall be rejected.

Step	Action
1	Check the cylinder for ownership. If the cylinder is a customer owned (private) cylinder, it shall be held aside for further checks. If the owner of the cylinder cannot be identified, it shall be rejected.
2	Where regions or countries use special cylinder identification such as bar-coding or RFID tags, check that the identification mark, code or tag is still on the cylinder, and has not been tampered with. Reject cylinders where markers are missing, damaged or have been tampered with. 
3	Check that the cylinder is an acetylene cylinder, and correctly painted, marked and labelled as an acetylene cylinder. Check that the cylinder is painted with the correct colour for acetylene according to the local cylinder identification practice. Special attention should be given to cylinders that have a different colour shade or tone than usual, as they may have been deliberately modified to look like an acetylene cylinder. If cylinders have more than one label with contradictory identification or there is doubt about the label, the cylinder shall be rejected for further investigation by the supervisor. Acetylene cylinders often have unique cylinder valves, safety devices, welded construction, valve guards or other features that identify them as in acetylene service. When compared to welded cylinders in other gas services, acetylene cylinders are substantially heavier than equivalent size welded cylinders. Acetylene cylinders always have a tare weight marking on the cylinder, valve guard or a tare tab.

Step	Action
4	Check that there is a tare weight marking on the cylinder and it is clearly and obviously marked. A cylinder with a defective or unclear tare weight marking cannot be filled safely. If there is a suspected changed or missing fixed valve guard, or suspected change of valve, the cylinder shall be rejected and referred to the supervisor to verify the tare weight stamping. If there is a difference between the stamped tare weight and a stenciled tare weight, the cylinder is rejected. Regional differences apply to the weight stamping and location. Acceptable methods/location include: • Metallic or plastic stamped ring on cylinder valve stem (tare tab) • Stamping on shoulder or valve guard, with paint highlight • Painted stencil marking in large numbers on cylinder shoulder Note: There are several terms used for the tare weight of the cylinder. These include "Empty Weight" and "Tare Mass". These terms are all interchangeable. Acetylene cylinders can have several weight markings on the cylinder. These have different meanings. Personnel conducting cylinder inspections shall be familiar with the different tare and weight markings applicable to the cylinders in local circulation to avoid confusion. See EIGA TP 56 *Tare weights of Acetylene Cylinders* [1]
	Stamped and Stencilled Tare Weight markings:  
	Cylinder Tare Tab: 
	Tare Stamping on a Valve Guard: 

Step	Action
5	Check that the cylinder is within the periodic retest period for the type of cylinder. Cylinders with different porous materials have different test periods. New cylinders have more frequent examination than cylinders that have been in service for several years. Test or exam status is indicated by the test date ring, tag, label or stamping on the cylinder depending on type and local regulation. Where test markings, tags or rings are missing or unclear, the cylinder shall be rejected. Personnel shall be familiar with the local regulations and practice for cylinder exam status markings and the cylinder exam periods.

Examples of Test/Exam markings on acetylene cylinders:

Step	Action
6	Check the solvent used in the cylinder where there is a possibility of different solvent types. Solvent type is normally stamped on the cylinder shoulder. The cylinder may also have other non-permanent markings indicating solvent type. An "A" in the shoulder marks indicating solvent weight usually indicates Acetone as a solvent. A "DMF" marking anywhere on the cylinder shoulder usually indicates Dimethylformamide (DMF) solvent. An "F" in the shoulder tare mass markings usually indicates a Solvent-Free cylinder. Acetone, DMF and Solvent-Free cylinders shall not be mixed up or confused.
7	Check that there is a marking on the cylinder about the porous material inside the cylinder and it is clearly marked. Make sure that the porous material is known to the filling site and that the corresponding filling conditions and residual gas tables are available. 

4.2 External Damage or Deterioration

Unsatisfactory external condition can be as a result of:
- Normal wear and tear and corrosion
- Abuse, modification or tampering

Cylinders not meeting the external condition requirements shall be rejected.

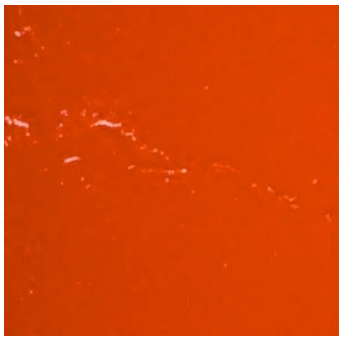
Step	Action
1	Check that the cylinder is not contaminated: • Evidence of the cylinder having been immersed in a liquid, e.g. water, oil • Excessive oil, grease, dirt or chemicals • Foreign material that may affect the cylinder weight (concrete, bitumen, mud, epoxy etc.) Reject cylinders that show signs of unacceptable contamination.  
2	Some types of cylinders can accumulate material in the foot-ring or under the cylinder base. Special attention should be paid to signs of contamination around the lower section of the cylinder. If there are signs of contamination, check the foot ring or cylinder base for trapped dirt, mud, concrete, etc. It may be possible to identify specific branches or customers where cylinders are exposed to material that will accumulate in the base. Additional care with inspecting these cylinders is required. If it is suspected there is accumulated material in the cylinder base or foot-ring, invert the cylinder and check the base.

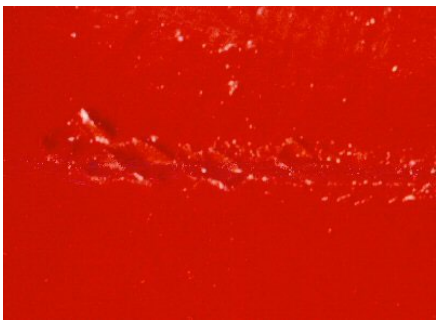
4.3 Cylinder Shell and Foot Ring

Cylinders shall be inspected for unusual or unacceptable damage or deterioration of the cylinder shell. These checks are intended to confirm the integrity of the pressurized shell of the cylinder, and its ability to contain the pressure in the cylinder. Any cylinder with any of defects in this section shall be rejected.
The rejection criteria in this section are based on:

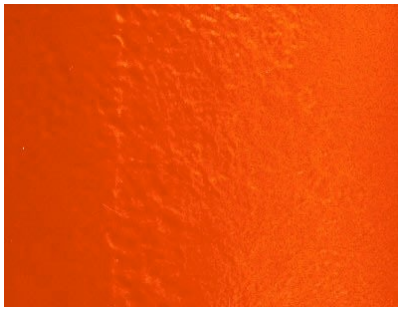
- ISO 10462 – *Gas cylinders- Transportable Cylinders for Dissolved Acetylene- Periodic Inspection and Maintenance*. [2]
- CGA C-13 – *Guidelines for Periodic Visual Inspection and Requalification of Acetylene Cylinders*. [3]

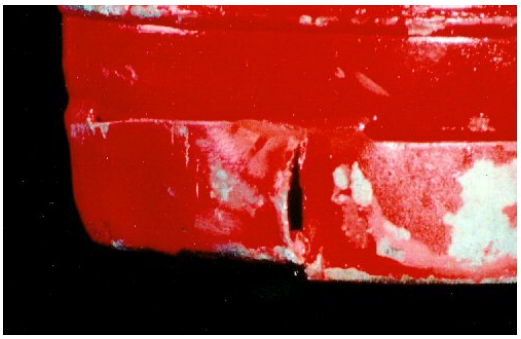
Where local regulations or industry practice are stricter, or require additional checks, the local regulations will apply as well.

Step	Action
1	Check the cylinder for bulging or swelling of the cylinder shell. Reject all cylinders with any signs of bulging or swelling. On solid drawn cylinders, slight bulging can be noted just above the base of the cylinder where the shell thickness reduces. On welded cylinders, bulging is easily noticed near the circular welds. If in doubt, use a straight-edge or steel ruler to check the cylinder. 
2	Check for any cracks, splits, rifts or laminations in the metal. Reject all cylinders with these defects. 

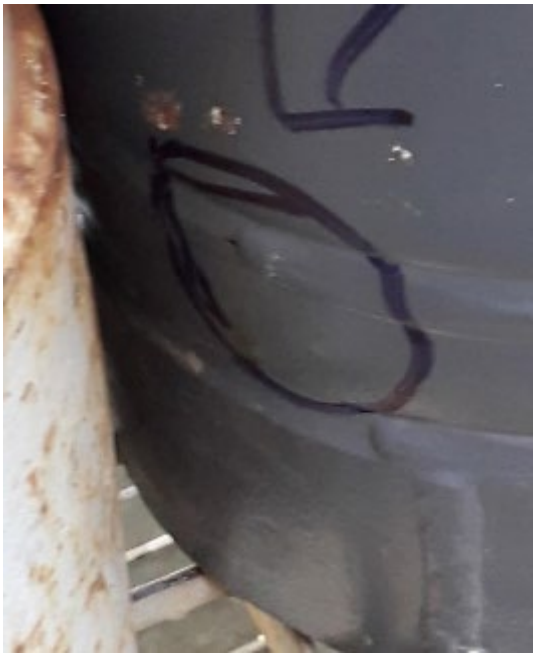
Step	Action
3	Check for any cuts or gouges. A cut or gouge is a sharp impression where surface material has been penetrated or removed. • Seamless cylinders: Reject if the depth of the cut or gouge exceeds 15% of the material thickness or the length of the cut or gouge exceeds 25% of the external cylinder diameter. • Welded cylinders: Reject if the depth of the cut or gouge exceeds 10% of the wall thickness or the length of the cut or gauge exceeds 25% of the cylinder external diameter.   
4	Check for any dents or digs. A dent or dig is a blunt or sharp impression into the cylinder where the surface of the material has not been penetrated or removed. • Reject when the depth of the dent exceeds 3% of the external diameter of the cylinder, or • Reject when the diameter of the dent is less than 15 times its depth 

Step	Action

5	Check for cylinder shell corrosion or rust. Reject all cylinders failing the criteria below:
	• General corrosion:
	  • If the original surface of the metal is no longer recognisable, or
	  • If the depth of the penetration exceeds 10% of the original wall thickness, or
	  • If the wall thickness is less than minimum guaranteed wall thickness
	• Local corrosion:
	  • If the depth of the penetration exceeds 20% of the original thickness of the cylinder wall, or
	  • If the thickness is less than the minimum guaranteed wall thickness
	• Chain, Line or Pitting corrosion:
	  • If the total length of corrosion in any direction exceeds the diameter of the cylinder and the possible depth exceeds 10% of the original wall thickness
	Cylinders with pressed-on foot rings are particularly prone to corrosion.
	Check for signs of excessive corrosion of the shell around the top of the pressed-on foot ring.
	  

6	Check for foot-ring corrosion and damage. Reject cylinders where the foot-ring is distorted or damaged, making the cylinder unstable or problematic to churn. Damage could be either due to forceful impact, dropping cylinders or corrosion. If the foot-ring is welded to the cylinder at several points, check that the welded sections have not dented into the base of the cylinder from cylinder abuse. Reject any such cylinders. If the foot-ring appears to have partially collapsed or compressed, make sure that the base of the cylinder (and base fusible or solid plugs) are not in contact with the ground. If there is any base or plug contact with the ground, reject the cylinder. Any pressed-on foot-rings that appear loose or skew are rejected. 

Step	Action
7	Check for any unauthorised repairs or modifications. This can take the form of repair of cylinder shell damage (e.g. repaired hole in cylinder, freshly painted section of cylinder) or any obvious signs of tampering. Cylinder "repairs" are commonly done with welding, epoxy or automotive body-putty filler. All cylinders with unauthorised repairs or modifications are rejected and reported to the supervisor for further action.  
8	Check for cylinder stability. This can be due to wear at the knuckle (bottom edge between the cylindrical section and base) of a seamless cylinder or partial collapse of a foot-ring. Reject cylinders that stand skew or are unstable. 
9	Check for weld damage on welded cylinders. Damage is usually caused by forceful impact. Particular attention is to be paid to the T-welds on 3-piece cylinders. Reject cylinders with weld damage. 

Step	Action
10	Check for pin-hole leaks on welds. Pin-hole leaks are sometimes seen by small stains or marks at a particular spot on a weld. This can often be seen by a small amount of brown or black tar-like substance stuck to the weld.  Reject all such cylinders with pin-hole leaks.
11	Check base and base plugs. Some cylinder designs are particularly susceptible to base corrosion and have thin metal thickness. This is especially so on 2-piece welded cylinders with concave bases. Some cylinders are fitted with either solid or fusible plugs in the base of the cylinder. It is recommended that cylinder types known to be fitted with base plugs be inverted to check condition of plugs. This is especially important where base plugs are known to leak, or where cylinders are exposed to conditions that result in accelerated base corrosion. Small base plug leaks are characterised by black or brown staining, or a tar-like substance on the plug or around the plug threads. Evidence of base fires may be seen from soot deposits in the base or on the plug. Reject all cylinders with leaking or deteriorated base plugs or excessive base corrosion.

4.4 Fire and Heat Damage

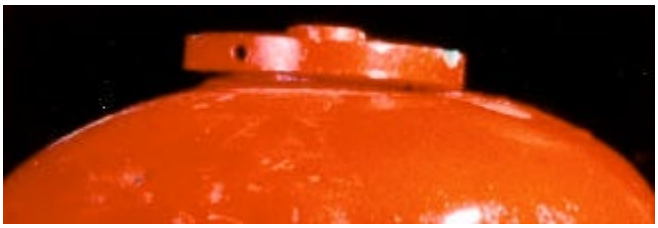
Cylinders shall be carefully examined for evidence of heat exposure or fire damage. Heat exposure or fire damage can seriously affect the safety of a cylinder. All cylinders with heat or fire damage shall be rejected.
Acetylene cylinders are more likely than most cylinders to be exposed to heat or fire, because of the general nature of the industries where they are used.
Customer gas regulator fires are a common source of heat exposure for acetylene cylinders – especially around the cylinder valve and shoulder.
Acetylene cylinders may become "hot cylinders" at a customer due to abuse. This will not always result in the cylinder rupturing. In these cases, the heat source is not external, but inside the cylinder, and the heat damage on the cylinder may show no signs of external fire.

Step	Action
1	Check for signs of fire or heat damage. Reject all cylinders with heat or fire damage evidence. This can include: • Blistered, charred, blackened or burnt paint • Burn marks on the cylinder (the burn area of a steel cylinder may be revealed by a rust patch) • Soot or fine black powder over paint • Dull oxidised appearance of the metal or painted surface • Burnt, cracked, or discoloured label or tags • Deformed or melted valve, handwheel, valve guard or carrying handle • Discoloured, melted or missing: plastic collar, test date ring or heat indicator tabs • Distortion of the cylinder, local bulging or swelling • Safety device (fusible plug or bursting disc) which has melted or burst • Missing or charred valve gland nut • Freshly painted cylinders with missing labels 
2	Check the cylinder for welding or electrical arc or gas torch burns. Reject all cylinders with signs of burns. When cylinders with torch burns are kept for a long time the burnt areas tend to rust and assist with identification. Arc burns from TIG or MIG type welders can be as small as 2mm. 

Step	Action
3	Check for signs of base plug fires. Acetylene cylinders fitted with bottom plugs can be susceptible to small leaks which can be ignited during use by the customer. This often leaves soot and smoke marks around the base of the cylinder. This is both a sign of fire exposure, and a leaking bottom plug. Reject these cylinders.

4.5 Neck Rings, Collars and Valve Guards

Checks of the neck ring/collar/guard shall be carried out as part of the pre-fill inspection.
If the neck ring, collar or valve guarding attachment shows signs of damage, looseness or loss of functionality, reject the cylinder.

Step	Action
1	Check for excessive corrosion on the neck ring/collar or the area below it. If there are any signs of the neck ring lifting or pulling away from the cylinder, reject the cylinder. 
2	Check that the neck ring or collar is not loose. Cylinders with loose neck rings are to be rejected. 
3	Check that there are no holes or gaps in the neck ring or collar that are not part of the original design. Where there are such holes or gaps, check for lifting of the ring or separation from the cylinder and reject these cylinders. Holes or gaps in collars allow water to enter under the collar and may promote accelerated hidden corrosion of the cylinder. 

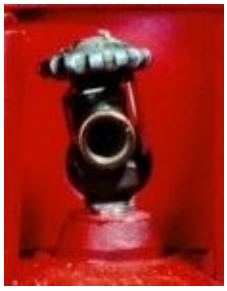
Step	Action
4	Check that there is no leaking water coming out from under the neck ring/collar. This may indicate trapped water that can cause hidden corrosion. These cylinders shall be rejected. 
5	Check for valve guard or shroud damage or corrosion. Loose valve guards are rejected. Damaged shrouds that may interfere with cylinder valve access or function are rejected. Damage could be due to forceful impact, dropping cylinder, lifting cylinder by guard or shroud. Check for cracks in the welds where bent shrouds are welded to the cylinder shoulder and reject any cylinders with weld cracks.  
6	Where valve caps are used, check thread condition on the neck ring. If these threads are clogged with dirt, excessively corroded or damaged, they could make the fitting of the valve cap difficult or impossible. Reject the cylinder. 

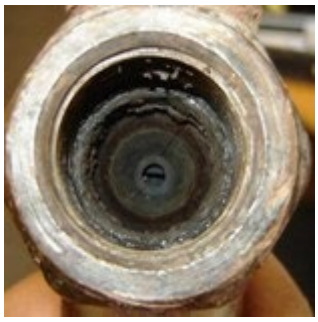
4.6 Cylinder Valve Checks

Cylinder valves shall be checked before trying to replenish the solvent or fill a cylinder. The valve is checked to make sure that it is not damaged or deteriorated and is safe to use. If the valve shows any signs of significant damage, excessive wear or abuse, the cylinder shall be rejected.
Cylinders received for pre-fill inspection may have open or leaking cylinder valves or safety devices. This can create a flammable atmosphere in the area around the cylinder. Close the valve if possible. Any cylinder with obvious or audible leakage that does not stop when the valve is closed shall be moved to a well-ventilated area for further action.
Some acetylene cylinders are fitted with Valve Integrated Pressure Regulator (VIPR) valves. These are complex cylinder valves that often incorporate:

- Shut-off valve function
- Pressure regulation or flow control devices
- Pressure gauges

These valves require special checks depending on the model used. The checking inspections given in this section are general checks and apply to VIPR valves as well.

Step	Action
1	Check that the valve is of the correct type and model for acetylene service. Reject any cylinder with an unusual or questionable valve. It is important to be familiar with the types and styles of valves used in acetylene cylinders locally. If an odd or unusual cylinder valve is noticed, this may indicate tampering, or a disguised cylinder. Cylinder valves are also commonly used to identify ownership. Only accept cylinders that have the known correct valve for the cylinder type, size and ownership.
2	Check valves are straight and undamaged. A bent valve may fail under filling pressures. Reject cylinders with bent cylinder valves or other obvious signs of impact. Cylinder valve outlets can be deformed by impact, even without the valve bending. Reject cylinders with deformed outlets.    
3	Check that there is no evidence of tampering, unauthorised modifications, or customer "repairs" to the valve. Reject any cylinders with valves that have been tampered with. Missing gland nuts, glue or thread sealant in glands, incorrect handwheel or spindle, tool marks on the valve are all signs of tampering.

Step	Action
4	Check VIPR-type valves for any damage or signs of tampering to: • Filling or customer use connections • Pressure gauges • Flow control devices Ensure that the correct checks are done for the specific model of VIPR used locally. Conduct function checks where these are required. Reject all cylinders with VIPR damage, signs of tampering or poor function. 
5	Check valve outlet for condition, excessive wear or damage. Reject cylinder valves where there is clear visual evidence of thread damage. Where thread wear is suspected, check the threads with the correct approved plug gauge (for internal threads) or ring gauge (for external threads). Reject any cylinder valves that have excessive thread damage, or where the condition of the threads is in doubt. Worn valve outlet threads pose a serious risk in the filling plant where filling connectors may come loose from the cylinder under high pressure.
6	Check that valve outlet are free from contamination such as: • Water, oil, grease, glue, gaskets, PTFE tape, sealing materials, mud, cement or insect nests Where cylinder valve outlets are contaminated or blocked, reject the cylinder. 
7	Check the valve outlet for signs of flashbacks to the cylinder. Reject cylinders with flashback evidence. Flashback evidence is usually a fine black powder or soot in the valve outlet. It easily comes off onto the finger.

Step	Action
8	Check handwheels are secure, free from sharp edges and not broken or damaged. Reject any valves that show signs of abuse or excessive force having been applied to the handwheel. If there are obvious marks to indicate the valve may have been operated by a tool or lever, a closer examination of the valve may be required. If fitted, check for damage to or tampering with the gland nut.
9	Check for signs of twisted spindles. Such indications are evidence of over tightening and possible body or seat damage. Reject valves that show obvious signs of spindle over-tightening or abuse.  Spindle valves are commonly fitted with gland nuts. Check that the gland nut is secure and has not been damaged or tampered with.
10	Check safety devices on the cylinder valve have not operated or been tampered with. If there is any question about the condition of the safety device, reject the cylinder. Cylinder valve safety devices can be a bursting disc or a fusible plug/element incorporated into the valve body.
11	Check the valve orientation of the cylinder valve with respect to: • Valve guard or shroud outlet or access area. The valve outlet should be centrally placed and allow easy and unobstructed access. • Fusible plugs in the cylinder neck. The valve outlet shall not be in line with or over a fusible plug. Where two plugs are fitted, the valve outlet should be between the two plugs. If the valve orientation is not correct, reject the cylinder.   This may also indicate tampering, a loose cylinder valve, guard or neck ring.

Step	Action
12	Check that the valve is closed. If the cylinder is returned to the plant with an open valve, there may be significant air contamination of the cylinder, or a severe loss of solvent. Close the valve and identify the cylinder for further attention by the supervisor or exam shop. There may be special solvent replenishment and filling procedures for cylinders returned with open valves.

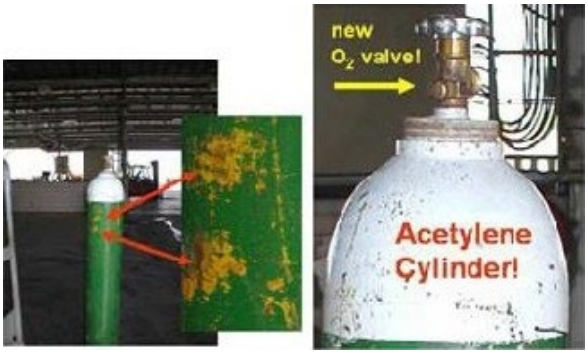
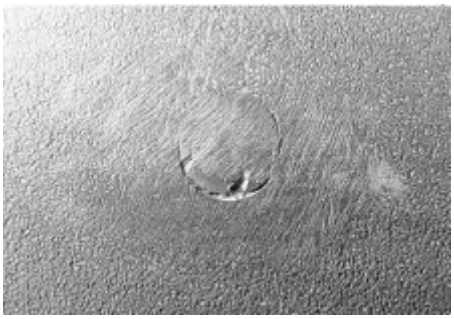
4.7 Safety Device Checks

The safety devices such as fusible plugs or bursting discs (where fitted) shall be checked as part of the visual pre-fill inspection to ensure they have not operated and appear to be in good working order. If safety devices show any signs of discharge, damage, tampering, excessive corrosion or leakage, the cylinder shall be rejected.

Step	Action
1	Check safety devices for signs of operation. If noted, reject the cylinder. Fusible plugs show discharge easily as the soft metal core will be missing. **Fusible plug with Missing Core Material**  Bursting disc assemblies are generally harder to detect. A missing plastic cap (where fitted) indicates a disc discharge.
2	Check that discharge ports or holes for bursting discs are not plugged. Reject any valve with blocked holes or other modifications. Customers are known to fill the holes with epoxy or other material to repair small leaks. **Blocked Bursting Disc Holes** 
3	Check for corrosion of the safety devices. Reject any cylinders with excessive or unusual corrosion of the safety device.
4	Check for mechanical defects or damage. Reject any cylinders with distortion or damage to the safety devices.
5	Check the bursting disc or fusible plug for any evidence of tampering. Reject any cylinders with any such evidence.
6	Check fusible plugs for evidence of the central fusible material extruding or pushing out from the plug body. Reject any such cylinders.
7	Check fusible plugs for any signs of leakage. Reject any such cylinders. Small leaks can sometimes be spotted by brown or black staining or tar around the plug threads or central fusible metal.

4.8 Disguised cylinders

There have been a number of instances where cylinders are deliberately modified to look like a cylinder from another gas service or illegally modified. Filling a cylinder not designed and constructed for acetylene service is a safety risk. The following could be indicators of unauthorised modifications or attempts to disguise a cylinder. Any cylinders showing these signs shall be rejected.

Item	Indicator
1	Contradictions between the cylinder valve type, outlet, connections, the colour coding, precautionary label and the identification of the gas (stamp-markings, label). 
2	Signs of modification to the cylinder marks/stamping/stencilling. For example, missing/deleted marks/stamping/stencilling, unusual or incorrect letters, over-stamping.
3	Signs of modification to the cylinder, e.g. strange colour coding or mechanical treatment - grinding or welding work.   
4	Chipped, flaking or damaged cylinder paint that reveals a different colour beneath.
5	Signs of modification to the cylinder valve or cap, e.g. loosened and/or missing components (gland nut, locking pin, burst disk, new or different cap).  

Item	Indicator
6	Cylinders of a given size and type should have relatively similar weight and feel. If a cylinder of similar size and type weigh either significantly more or less than typical.
7	Unusual size (volume, diameter, length) or design of the cylinder. 
8	Customer owned cylinders presented with a brand new or partly new coating which was not applied at the filling plant where it is to be filled.
9	Signs that a bar code, tag or RFID chip has been removed/replaced or tampered with.
10	Cylinders that ring when subjected to a ring test do not have porous material and are not suitable for acetylene. When moved about or bumped against other cylinders, acetylene cylinders commonly have a dull muffled sound.
11	Cylinders with liquid inside but without a porous material will rock after moving or being shaken.

5 References

Unless otherwise specified, the latest edition shall apply.

[1] EIGA TP 56 *Tare weights of Acetylene Cylinders*, www.eiga.eu

[2] ISO 10462 – *Gas cylinders- Transportable Cylinders for Dissolved Acetylene - Periodic Inspection and Maintenance*, *www.iso.org*

[3] CGA C-13 – *Guidelines for Periodic Visual Inspection and Requalification of Acetylene Cylinders*, *www.cganet.com*