



# **SAFETY AUDIT / ASSESSMENT TOOL ACETYLENE PLANT AND CYLINDER FILLING**

**Doc 102.06/20**

Revision of Doc 102/03 Appendix C5

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# SAFETY AUDIT / ASSESSMENT TOOL ACETYLENE PLANT AND CYLINDER FILLING

Prepared by WG-16 Worker Safety and WG-12 Acetylene

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**Table of Contents**

1 Introduction ..... 1

2 Scope and purpose ..... 1

    2.1 Scope ..... 1

    2.2 Purpose ..... 1

3 Formats for Audit Checklists ..... 2

    3.1 Format for Audit / Assessment Tool Questions ..... 2

    3.2 Typical Format for collection of evidence and development of findings ..... 2

    3.3 Typical format for management of actions arising from the audit ..... 3

4 Acetylene Plant and Cylinder Filling – Question Set ..... 4

**Amendments to Doc 102/08**

All	Revision of Doc.102/03 Appendix C5
All	New format of Safety Audit / Assessment Tool
January 2024	Question 7.1 and 8.34: old references have been updated

## 1 Introduction

Auditing is a proactive management tool for use by an organisation or activity as a part of its management responsibilities. It is used to proactively confirm compliance, detect potential issues and facilitate future improvement

EIGA Doc. 102 *Audit Guidelines* provides an overview of audit and self-assessment processes, identifies different types of audits and lists the key points for ensuring success.

Sections 8.2 and 8.4 of Doc. 102 refers to EIGA's audit tools document series that can be used in verification of findings and evidence collection and in action plans and follow up to audits.

This publication is part of that series.

## 2 Scope and purpose

### 2.1 Scope

This publication provides a checklist focusing on a specific area of safety, health and environment, management systems and technical practices within the industrial and medical gas industry.

This checklist does not incorporate all the requirements of local or national legislation. These should be taken into consideration when planning any audit or developing audit checklists.

The tool or combination of tools used can depend upon the type of audit and the organisation, location or site characteristics.

### 2.2 Purpose

Each Safety Audit / Assessment tool contains a list of questions that may be used by the auditor in the format shown in 3.1. Each question has a sequential reference number, the question itself and where relevant a reference to the EIGA publication or external publication that provides guidance on that specific topic.

These question sets may then be use at different stages of the audit process, by combining them with additional information columns in a manual or automated audit system, depending on company systems.

Section 3.2 shows the format of how the question set may be used for collection of evidence and development of findings.

Section 3.3 shows the format of how the question set may be used for management of actions arising from the audit.

Forms may be adapted or combined depending on audit and action monitoring systems used by a company.

The Auditor should not ask the questions on this list in isolation but should read them in conjunction with EIGA Doc 102 and the referenced technical document.

**3 Formats for Audit Checklists**

**3.1 Format for Audit / Assessment Tool Questions**

Question reference	Question	Document Section Reference
<p><i>Use sequential numbering system within each section. E.g. 1.2, 1.3. Try to avoid multiple clustered questions under the same number, but describe them as separate questions.</i></p>		<p><i>In EIGA reference document or external reference document</i></p>

**3.2 Typical Format for collection of evidence and development of findings**

Question reference	Question	Document Section Reference	Yes No N/A	Description of Evidence / Comments (Ref...)	Findings (Ref...)	Recommendations for improvement (Ref Doc xxx 8.2.6)	Action Required Yes/No
<p><i>Use sequential numbering system within each section. E.g. 1.2, 1.3. Try to avoid multiple clustered questions under the same number, but word them as separate questions.</i></p>		<p><i>In EIGA reference document or external reference document</i></p>	<p><i>Answer is yes or no or question is not applicable</i></p>				

3.3 Typical format for management of actions arising from the audit

Question reference	Findings	Action(s)	By Whom	Dates	
				Target	Complete
<i>Use sequential numbering system within each section. E.g. 1.2, 1.3. Try to avoid multiple clustered questions under the same number, but word them as separate questions.</i>					

**4 Acetylene Plant and Cylinder Filling – Question Set**

- 1 General precautions
- 2 Storage and handling of carbide
- 3 Acetylene generator
- 4 Acetylene drying and purification
- 5 Acetylene compressors
- 6 HP driers
- 7 Flame arrestors
- 8 Filling racks/charging
- 9 Acetone equipment
- 10 DMF equipment
- 11 Maintenance
- 12 Emergency procedures
- 13 Acetylene cylinder construction, internal inspection, maintenance and disposal

**Note** This questionnaire is not exhaustive and may need to be complemented/adapted in order to cover all the procedures, plant and equipment on site.

	Question	Yes	No	N/A	Comment	Agreed Action	By Whom	Dates	
								Target	Compl
1.0	<b>General Precautions</b>								
1.1	Is the standard of housekeeping adequate								
1.2	Is a purging procedure issued for all major equipment								
1.3	Are all parts of rotating machinery/ equipment, shafts etc, properly guarded								
1.4	Can the plant be operated with the alarm 'main switch' in the 'OFF' position								
1.5	Is the acetylene system protected against the effect of freezing conditions								
1.6.1	Are personnel provided with the necessary protective clothing and equipment for the full range of plant								
1.6.2	Is this clothing/equipment used								
1.7	Are metal/anti-static plastic buckets used under drain valves for operation and maintenance purposes								
1.8	Are components, valves, pipework, flexible hoses etc correctly specified at the time of replacement								



	Question	Yes	No	N/A	Comment	Agreed Action	By Whom	Dates	
								Target	Compl
1.9.1	Are personnel who work on acetylene systems adequately trained and aware of the hazards associated with acetylene and this type of plant								
1.9.2	Are personnel aware of the dangers of using certain materials and metals for equipment in contact with acetylene								
1.10	Are all metal constructions/ equipment adequately earthed								
1.11	Are all floors, walls, beams, roof trusses, window ledges etc kept free from carbide dust								
1.12	Is a safe method of disposing of carbide dust in use								
1.13	Are safety signs prominently displayed around the acetylene factory, eg 'No smoking', 'Unauthorised Personnel Prohibited'.								
1.14	Are ventilation openings at high and low level kept free from obstruction								
1.15	Are all vent pipes (from relief valves etc) discharging outside the building, kept free from obstructions								

	Question	Yes	No	N/A	Comment	Agreed Action	By Whom	Dates	
								Target	Compl
1.16.1	Do all fork lift trucks meet the requirements of company/ national legislation								
1.16.2	Are they regularly inspected/ maintained								
2.0	<b>Storage &amp; Handling of Carbide</b>								
2.1	Are carbide drums/containers inspected after receipt on site								
2.2	Are operators trained to deal with damaged or hot drums/ containers								
2.3	Are other materials stored in this area								
2.4	Is a notice posted warning one not to extinguish a carbide fire with water								
2.5	Are the emergency exits properly identified and kept free from obstruction								
2.6	Is it possible to have an ingress of water into the carbide store								
2.7	Are all construction materials and storage areas kept in accordance with legal requirements, eg floor, roof, walls, doors, windows, platform, ventilation, lifting devices								
2.8	Is the store adequately ventilated								

	Question	Yes	No	N/A	Comment	Agreed Action	By Whom	Dates	
								Target	Compl
2.9.1	Do all fork lift trucks used in this area meet the requirement of company/national legislation								
2.9.2	Are they regularly inspected/ maintained								
2.10	Are unloading conditions for carbide drums and containers properly controlled, eg in event of heavy rain, rough handling etc								
2.11	Are container analysis instruments (used in connection with purging etc) calibrated regularly								
2.12	Are tools that may be used in the carbide store of an approved type								
2.13	Are carbide drums/containers kept sealed until required for use								
2.14	Is maximum carbide quantity stored kept within licensed figure								
2.15	Is carbide usage based on a 'first in', 'first out' rota								
3.0	<b>Acetylene Generator</b>								
3.1	Are adequate and legible operating instructions posted								

	Question	Yes	No	N/A	Comment	Agreed Action	By Whom	Dates	
								Target	Compl
3.2	Are clear instructions posted on how to deal with:  a blocked charging skip a blocked hopper an overheated hopper a blocked feed system generator body an overheated generator blockage at the agitator a blocked lime water outlet a blocked sludge outlet								
3.3	Is the Supervisor advised and a record kept of any unusual event								
3.4	Is adequate instrumentation available and in good working condition, eg pressure gauge, water level, temperature indicators								
3.5	Is all instrumentation and control equipment regularly inspected and calibrated								
3.6	Are all safety devices regularly tested and inspected								
3.7	Are all company recommended safety devices installed								
3.8	Are devices to prevent over-pressure, eg water seals, regularly tested								

	Question	Yes	No	N/A	Comment	Agreed Action	By Whom	Dates	
								Target	Compl
3.9	Has the generator outlet a free flow of lime water without any sign of obstruction								
3.10	Are nitrogen purges provided to generator/hopper and skip								
3.10.1	Is the nitrogen purge used at every refill								
3.10.2	Is equipment fitted to the nitrogen purge line to control flow in good working condition								
3.10.3	Is the low content alarm for supply of nitrogen purge gas checked regularly								
3.11	Is the generator internal assembly cleaned at stipulated intervals								
3.12.1	Are clear procedures followed when cleaning or maintaining a generator								
3.12.2	Do these procedures include adequate purging								
3.13	If the water supply in use fails, will an alarm be activated								
3.14.1	Is carbide feed stopped in the event of the generator temperature level reaching an alarm point								

	Question	Yes	No	N/A	Comment	Agreed Action	By Whom	Dates	
								Target	Compl
3.14.2	Is carbide feed stopped in the event of the generator water level reaching the alarm point								
3.15	Is all lifting/hoisting equipment in the generator house examined regularly								
3.16	Is the sludge drain valve checked regularly for leakage								
3.17	Hydraulic back pressure valve								
3.17.1	Is the hydraulic back pressure valve maintained at regular intervals								
3.17.2	Is the water from the overflow constantly trickling								
3.18	Static water seals								
3.18.1	Are water seals regularly checked for correct operation, eg by checking water level								
3.18.2	Are water seals protected against freezing								
3.19	Gasholder								
3.19.1	Are the bell and the guides regularly inspected for free movement								

	Question	Yes	No	N/A	Comment	Agreed Action	By Whom	Dates	
								Target	Compl
3.19.2	Are limit switches regularly inspected/tested								
3.19.3	Are ropes/chains regularly inspected/tested								
3.19.4	Are gasholders inspected at stipulated intervals								
3.19.5	Is gasholder overflow system checked at regular intervals (it needs to operate when gasholder is full and the trip does not work)								
3.20	Disposal of sludge								
3.20.1	Are guard rails and walkway across sludge/water pond maintained in a safe condition								
3.20.2	Does sludge disposal comply with the requirements of local environmental regulations								
3.21	Are personnel wearing appropriate protective clothing								
3.22	Are personnel aware that carbide sludge contains dissolved acetylene, which may create a hazardous condition								
4.0	<b>Acetylene Drying and Purification</b>								
4.1	Low pressure driers								

	Question	Yes	No	N/A	Comment	Agreed Action	By Whom	Dates	
								Target	Compl
4.1.1	Are the vessel purging procedures applied before and after shutdown, prior to reconnection to the live system								
4.1.2	Are drain lines regularly checked to be free from dissolved calcium chloride/obstruction								
4.1.3	Are drier vessels internally inspected at stipulated intervals								
4.2	Low pressure purifiers (dry)								
4.2.1	Is there a provision to purge the vessel from C <sub>2</sub> H <sub>2</sub> gas								
4.2.2.1	Are gas samples regularly tested downstream of purifiers								
4.2.2.2	Are procedures followed to avoid exhaustion of purifier material								
4.2.3	Can on-line purifier vessel be completely isolated from off-line vessel by block and bleed system, or similar								
4.2.4	Are drain valves on purifiers regularly operated and checked								
4.2.5	Is the regeneration procedure strictly followed								



	Question	Yes	No	N/A	Comment	Agreed Action	By Whom	Dates	
								Target	Compl
4.2.6	Are adequate procedures followed when disposing of exhausted purifier material, or recharging same								
4.2.7	Is temperature indication of gas stream available when regenerating purifier bed								
4.3	Low pressure purifiers (wet)								
4.3.1	Is the quality/density of the sulphuric acid in circulation monitored								
4.3.2	Is the scrubber operating temperature adequately controlled								
4.3.3	Is the quality/density of circulating caustic solution checked regularly								
4.3.4	Are tests done regularly to determine the effectiveness of the purification process								
4.3.5	Are adequate procedures followed when disposing of exhausted sulphuric acid or caustic soda, or recharging same								
4.3.6	Is pressure drop across the acid scrubber adequately controlled								
4.4	Sulphuric acid/chromic acid tank								

	Question	Yes	No	N/A	Comment	Agreed Action	By Whom	Dates	
								Target	Compl
4.4.1	Are adequate operating procedures established for the acid system								
4.4.2	Are loading/unloading procedures from the tanker/drum posted								
4.4.3	Is individual protection made available (helmet, protection screen, neoprene gloves, boots, protective clothing etc)								
4.4.4	Are warning signs properly posted								
4.4.5	Are adjacent emergency showers available								
4.4.6	Is the tank inspected regularly for corrosion								
4.4.7	Is the bund around the tank kept in good condition								
4.4.8	Is the bunded area free from rubbish								
4.5	Caustic tank								
4.5.1	Are adequate operating procedures established for the NaOH system								
4.5.2	Are loading/unloading procedures from tanker/drum posted								

	Question	Yes	No	N/A	Comment	Agreed Action	By Whom	Dates	
								Target	Compl
4.5.3	Is individual protection made available (helmet, protection screen, neoprene gloves, boots, protective clothing)								
4.5.4	Are warning signs properly posted								
4.5.5	Are adjacent emergency showers available								
5.0	<b>Acetylene Compressors</b>								
5.1	Are low pressure alarm and trip tested regularly								
5.2	Is discharge alarm/trip device tested regularly								
5.3	Are suction filters regularly checked for pressure drop								
5.4	Are operating instructions properly posted								
5.5.1	Are there emergency stop buttons placed remote from the compressor								
5.5.2	Are they tested regularly								
5.6.1	Are visible/audible alarms provided								
5.6.2	Are they tested regularly								
5.7	Are water drains from compressor kept free from obstruction								

	Question	Yes	No	N/A	Comment	Agreed Action	By Whom	Dates	
								Target	Compl
5.8	Is water temperature, oil pressure, gas temperature checked regularly								
5.9	HP oil/water separation								
5.9.1	Are the high pressure oil/water separators drained regularly								
5.9.2	Are these separators pressure tested at stipulated intervals								
5.10	Plant piping								
5.10.1	Are plant piping relief device outlets free from obstruction and in good order								
5.10.2	Is all piping regularly leak tested as per requirements								
6.0	<b>HP Driers</b>								
6.1	Are drain lines checked regularly to ensure they are free from dissolved calcium chloride/obstruction								
6.2	Is drier material inspected at regular intervals and replaced as necessary								
6.3	Are vessels inspected and tested at stipulated intervals								
6.4	Are vessels cleaned regularly								

	Question	Yes	No	N/A	Comment	Agreed Action	By Whom	Dates	
								Target	Compl
6.5	Are procedures for operation of drier drain valve established and followed								
6.6	Are the vessel purging procedures applied before and after shutdown, prior to reconnection to the live system								
7.0	<b>Flame Arrestors</b>								
7.1	Are efficient flame arrestors in use (see Doc 123 chapter on flame arrestors)								
7.2	Are they regularly inspected for pressure drop								
7.3	Are flame arrestors changed on excessive pressure drop								
7.4	Are flame arrestors taken out when cleaning the filling lines								
7.5	Do flame arrestor locations meet company requirements								
8.0	<b>Filling Racks/Charging</b>								
8.1.1	Is each filling rack independently purged at plant start-up								
8.1.2	Is gas analysed to determine air content before commencing cylinder filling								

	Question	Yes	No	N/A	Comment	Agreed Action	By Whom	Dates	
								Target	Compl
8.2	Is each filling rack pressure gauge and recorder inspected/tested at regular intervals								
8.3	Is every manifold and cylinder fill connection shut-off valve opened slowly								
8.4	Is each charging hose/pigtail non-return valve checked at stipulated intervals								
8.5	Is each charging hose/pigtail filter checked at stipulated intervals								
8.6	Are cylinders kept cool in hot weather by use of water spray								
8.7	Are charging hoses/pigtails regularly inspected and replaced								
8.8	Are operating instructions properly posted								
8.9	Is the emergency deluge system (if fitted) tested regularly								
8.10	Do any dead ended pipe sections exist								
8.11	Are all manifolds properly earthed								
8.12	Are manifolds cleaned at stipulated intervals								

	Question	Yes	No	N/A	Comment	Agreed Action	By Whom	Dates	
								Target	Compl
8.13	Are filling racks inspected/leak tested at stipulated intervals								
8.14	Are cylinder connections leak tested at connection to filling rack and intermediate pressures whilst filling								
8.15.1	Is the cylinder charging procedure posted and followed								
8.15.2	Are cylinder specifications/charts available for all types of cylinders filled								
8.15.3	Are stranger cylinder handling/ filling procedures available and followed								
8.15.4	Are cylinders overdue statutory inspection withdrawn prior to filling								
8.15.5	Are procedures in use for rejection of cylinders affected by dents/cuts, corrosion, exposure to heat and damage to valves								
8.15.6	Is there a record which shows details of all cylinders rejected for filling								
8.16	Is the pressure gauge downstream of the main inlet valve regularly observed								

	Question	Yes	No	N/A	Comment	Agreed Action	By Whom	Dates	
								Target	Compl
8.17	Is the residual gas content established before adding solvent and connecting the cylinder to the charging rack								
8.18	Is there a blowdown procedure for cylinders/bundles with high residual pressure								
8.19	Is a check carried out at the end of the charging cycle to verify that gas content of cylinders is correct								
8.20	Is the weighing machine checked regularly by the use of test weights								
8.21	Are scales regularly calibrated/ tested according to national legislation								
8.22	Is cleanliness maintained under the weighing machine platform								
8.23	Is the solvent replenishing procedure posted adjacent to the solvent machine								
8.24	Are personnel aware of the consequences of an excess, or lack, of solvent in a cylinder/bundle/ trailer								
8.25	Are clear instructions given on how to deal with cylinders containing an excess of solvent								



	Question	Yes	No	N/A	Comment	Agreed Action	By Whom	Dates	
								Target	Compl
8.26	Are operators aware of the risks involved in the use of solvents								
8.27	Are operators aware of first aid actions which should be taken in the event of solvent coming into contact with the skin or the eyes etc								
8.28	Have precise instructions been given in the method of dealing with depressurised cylinders which exceed tare weight								
8.29	Are cylinder valves checked for leaks after filling and disconnection from the filling rack								
8.30	Are fusible plugs checked for leaks after filling								
8.31	Are cylinders stored in locations remote from sources of heat								
8.32	Is cylinder storage area always kept free of gasoline, oil and other combustible materials								
8.33	Is an approved procedure posted for charging and replenishing solvent in bundles/trailers								
8.34	Is the procedure being properly followed – see Doc 26								

	Question	Yes	No	N/A	Comment	Agreed Action	By Whom	Dates	
								Target	Compl
8.35	Are warning signs and/or towaway devices used to avoid hoses connected to bundles/trailers being ruptured								
9.0	<b>Acetone Equipment</b>								
9.1	Are piping, valves, dispensers, tanks and pumps regularly checked for leaks								
9.2	Are crash barriers installed to prevent damage to equipment								
9.3	Are earthing checks of the system carried out at stipulated intervals								
9.4	Are the operators following procedure for earthing the tanker/ drum when transferring acetone to the storage tank								
9.5	Are tanker unloading instructions properly posted								
9.6	Are means of purging being used when carrying out maintenance of equipment								
9.7	Is acetone only stored in approved areas – outside filling area								
10.0	<b>DMF Equipment</b>								
10.1	Are piping, valves, dispensers, tanks and pumps regularly checked for leaks								

	Question	Yes	No	N/A	Comment	Agreed Action	By Whom	Dates	
								Target	Compl
10.2	Are crash barriers installed to prevent damage to equipment								
10.3	Are earthing checks of the system carried out at stipulated intervals								
10.4	Are the operators following procedure for earthing the tanker/ drum when transferring solvent to the storage tank								
10.5	Are tanker unloading instructions properly posted								
10.6	Are means of purging being used when carrying out maintenance of equipment								
10.7	Has a programme for monitoring DMF level in atmosphere adjacent to cylinder examiner, whilst carrying out his duties, been performed to establish procedures in use are adequate								
10.8	Is DMF only stored in approved areas – outside filling area								
11.0	<b>Maintenance</b>								
11.1	Is a planned maintenance system in use								

	Question	Yes	No	N/A	Comment	Agreed Action	By Whom	Dates	
								Target	Compl
11.2.1	When planned maintenance work is not completed as originally programmed and is re-scheduled at a later date, does inspection of the records make this clear								
11.2.2	If it does, is the nature of the work reviewed to ensure no hazard can arise from this action								
11.3	Within this system are the safety valves and relief equipment tested and overhauled at stipulated intervals								
11.4	Are personnel who carry out maintenance work on acetylene systems adequately trained and aware of the hazards associated with acetylene and this type of plant								
11.5	When pressure gauges are replaced, is there a procedure that ensures that only approved gauges are fitted, eg having less than 70% copper								
11.6	Is the electrical continuity of every component in the system regularly checked								
11.7	Is all electrical equipment in conformity with national legislation								

	Question	Yes	No	N/A	Comment	Agreed Action	By Whom	Dates	
								Target	Compl
11.8	Is a regular inspection of stuffing boxes/glands carried out between the electrical motor room and acetylene compressor areas in the way of cables/drive shafts etc to ensure gas leakage cannot occur								
11.9	Are personnel instructed about the danger of using portable electrical equipment in safety zones								
12.0	<b>Emergency Procedures</b>								
12.1	Are employees aware of the emergency procedures in case of:								
12.1.1	a hot cylinder a leaking cylinder with flame propagation a leaking cylinder without flame a cylinder rupture (eg begin total shutdown/isolation)								
12.1.2	flame on ruptured pigtail/hose or piping ruptured pigtail/hose without fire cessation of water supply								
12.1.3	a hot generator a hot carbide drum/container carbide blockage between the container/skip and the hopper carbide blockage between the hopper and the generator body blocked generator drain/pump								

	Question	Yes	No	N/A	Comment	Agreed Action	By Whom	Dates	
								Target	Compl
12.2	Are adequate instructions available for shutting down plant in emergency cases: Electrically equipment isolation nitrogen purging								
12.3	In the event of problems is the Supervisor/Manager advised								
12.4	Are approved flameproof torches readily available for use in emergency situation								
12.5	Is the remote controlled emergency inert gas supply system in good working order								
12.6	Is it tested at regular intervals								
13.0	<b>Acetylene Cylinder Construction, Internal Inspection, Maintenance and Disposal</b>								
13.1	Are all cylinder information charts/drawings/data available								
13.2	Are all details of acetylene cylinder valves available								
13.3	Are cylinders weighed off after depressurisation to ensure no residual acetylene is trapped								

	Question	Yes	No	N/A	Comment	Agreed Action	By Whom	Dates	
								Target	Compl
13.4	Are procedures in use for the removal of damaged acetylene cylinder valves where the cylinder contains gas under pressure								
13.5	Is an inspection programme designed to eliminate cylinders that have:  voids in the mass excessive tophead to filler clearance excessive side wall clearance								
13.6	Is there a procedure available covering:  preparation valve and fuse plug removal airing and purging cylinder disposal handling and disposal of pieces record keeping								
13.7	Do cylinders under vacuum have their vacuum broken by slowly bleeding acetylene into them								
13.8	Are new cylinders whose weight is less than its tare segregated for further evaluation								