MECHANICAL INTEGRITY OF GENERATOR SYSTEMS IN ACETYLENE PLANTS

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EUROPEAN INDUSTRIAL GASES ASSOCIATION AISBL

AVENUE DE L'ASTRONOMIE 30 • B – 1210 BRUSSELS

Tel: +32 2 217 70 98

E-mail: info@eiga.eu • Internet: www.eiga.eu

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Prepared by WG12 Acetylene

As part of a programme of harmonisation of industry standards, the European Industrial Gases Association, (EIGA) has published EIGA Doc 239, *Mechanical Integrity of Generator Systems in Acetylene Plants*, jointly produced by members of the International Harmonisation Council and originally published by the Compressed Gas Association as CGA G-1.12, *Mechanical Integrity of Generator Systems in Acetylene Plants*.

This publication is intended as an international harmonised standard for the worldwide use and application of all members of the Asia Industrial Gases Association (AIGA), Compressed Gas Association (CGA), European Industrial Gases Association, and Japan Industrial and Medical Gases Association (JIMGA). Each association's technical content is identical, except for regional regulatory requirements and minor changes in formatting and spelling.

EUROPEAN INDUSTRIAL GASES ASSOCIATION AISBL
Avenue de l'Astronomie 30 B 1210 Brussels Tel +32 2 217 70 98
E-mail: info@eiga.eu Internet: www.eiga.eu

Table of Contents

1 Introduction

This publication has been developed to give guidance on mechanical integrity (MI) of acetylene generator systems. A mechanical integrity program is intended to ensure that equipment does not fail in a way that causes or enhances a catastrophic release of highly hazardous chemicals.

Elements of a mechanical integrity program ensure that equipment is designed, manufactured, installed, operated, and maintained in a manner that results in safe and reliable performance. MI addresses the effects that equipment suffers in some form of material degradation and damage with an increasing likelihood of failure over the lifetime, sometimes described as aging, and actions taken to identify and mitigate these effects.

The mechanical integrity of an acetylene generator system can be ensured:

- by a documented program of procedures, training, inspections, and tests; and
- through preventive and predictive maintenance based upon good engineering practice, applicable codes, standards, equipment specifications, and manufacturers' recommendations.

2 Purpose and Scope

2.1 Purpose

This publication is intended for designers, manufacturers, and operators within the acetylene industry. Its purpose is to give guidance on development of mechanical integrity programs for acetylene generators. The user of this publication should review the model mechanical integrity plan and create a site-specific mechanical integrity plan.

2.2 Scope

This publication gives guidance on the mechanical integrity of acetylene generator systems using calcium carbide added to water, known as wet generation. This guideline is limited to vessels and systems with a maximum operating pressure of 15 psi (1 bar).

This publication includes the following elements of an MI program:

- identification of equipment and systems that are part of an MI program including criteria of selection based on credible failure mechanism and consequence;
- minimum maintenance recommendations for the MI covered equipment and systems;
- minimum inspection and testing recommendations for the MI covered equipment and systems; and
- industry acceptable inspection/testing deficiencies of MI covered equipment and systems.

This publication identifies potential failure scenarios for acetylene generator components. The failure scenario shall be a credible one that does not depend on multiple abnormal conditions taking place at one time. The scenario also does not depend on the failure of a safety protection device such as a pressure relief device.

The publication identifies the consequences of each failure scenario:

- If the component failure leads to an uncontrolled release of a hazardous material, the consequence of the failure is considered a loss of containment. In this publication, the main hazardous material is acetylene. Calcium carbide release is potentially hazardous as, if exposed to water, it will create acetylene carbide lime (also known as calcium hydroxide or lime slurry) is potentially hazardous because the lime water is normally saturated with acetylene and can release acetylene if the temperature rises. Loss of containment can lead to a fire, explosion, environmental impact, or personnel hazard. In this case, the consequence of the component failure is considered a mechanical integrity event. For these consequences, this publication lists the following recommended practices: inspection method, minimum recommended frequency of inspection, and the acceptance criteria for the inspection;

- If the component failure leads to a controlled release of a hazardous material (for example, the discharge of a pressure relief device to a safe location), the consequence of the component failure is considered an operational issue only and is not covered by this publication; and
- Minor leaks on the low pressure part of an acetylene plant are considered to be an operational issue, not MI.

Auxiliary systems are excluded from this publication if their failures do not lead to an uncontrolled release of a hazardous material.

For details on the operation of acetylene generators, see EIGA doc 237, *Safe Operation of Acetylene Generator Systems or* CGA G-1.10, *Guideline for the Safe Operation of Acetylene Generators* [1,2].[1]

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

3.2.1 Backflow prevention device

Double check valve arrangement device used to ensure proper backflow prevention of water/acetylene.

3.2.2 Calcium carbide [CaC_2]

Nonflammable chemical compound of calcium and carbon that reacts with water to produce acetylene gas and carbide lime.

3.2.3 Calcium carbide island

Unreacted calcium carbide floating on the liquid surface in the generator.

[1] References are shown by bracketed numbers and are listed in order of appearance in the reference section.

3.2.4 Carbide lime [$Ca(OH)_2$]

Calcium hydroxide (calcium hydrate) derived from the reaction of calcium carbide and water.

3.2.5 Fill cart

Container vessel, typically conical (funnel) shaped, with a bottom valve. This unit is used to transfer calcium carbide from transportation packages to the generator feed hopper.

NOTE—Fill carts can also be referred to in the industry as a buggy, skip, cart, transfer hopper/cart.

3.2.6 Generator feed hopper

Conical shaped container/vessel permanently installed on the generator and used to supply calcium carbide to the generator for acetylene production.

3.2.7 Hot spot

Phenomenon where calcium carbide accumulates and the reaction with water allows it to potentially exceed the ignition temperature of acetylene inside a generator.

3.2.8 Inert gas

Gas that is noncombustible and nonoxidizing.

3.2.9 Wet generation

Process of making acetylene gas where calcium carbide is added to a quantity of water that is more than re-quired for calcium carbide reaction. The excess water is used as a heat sink.

4 Generator system

4.1 Function

The generator system converts calcium carbide and water into acetylene gas and carbide lime while controlling the process within normal operating pressure and temperature ranges. See Figure 1 for an example of a wet acetylene generator system.

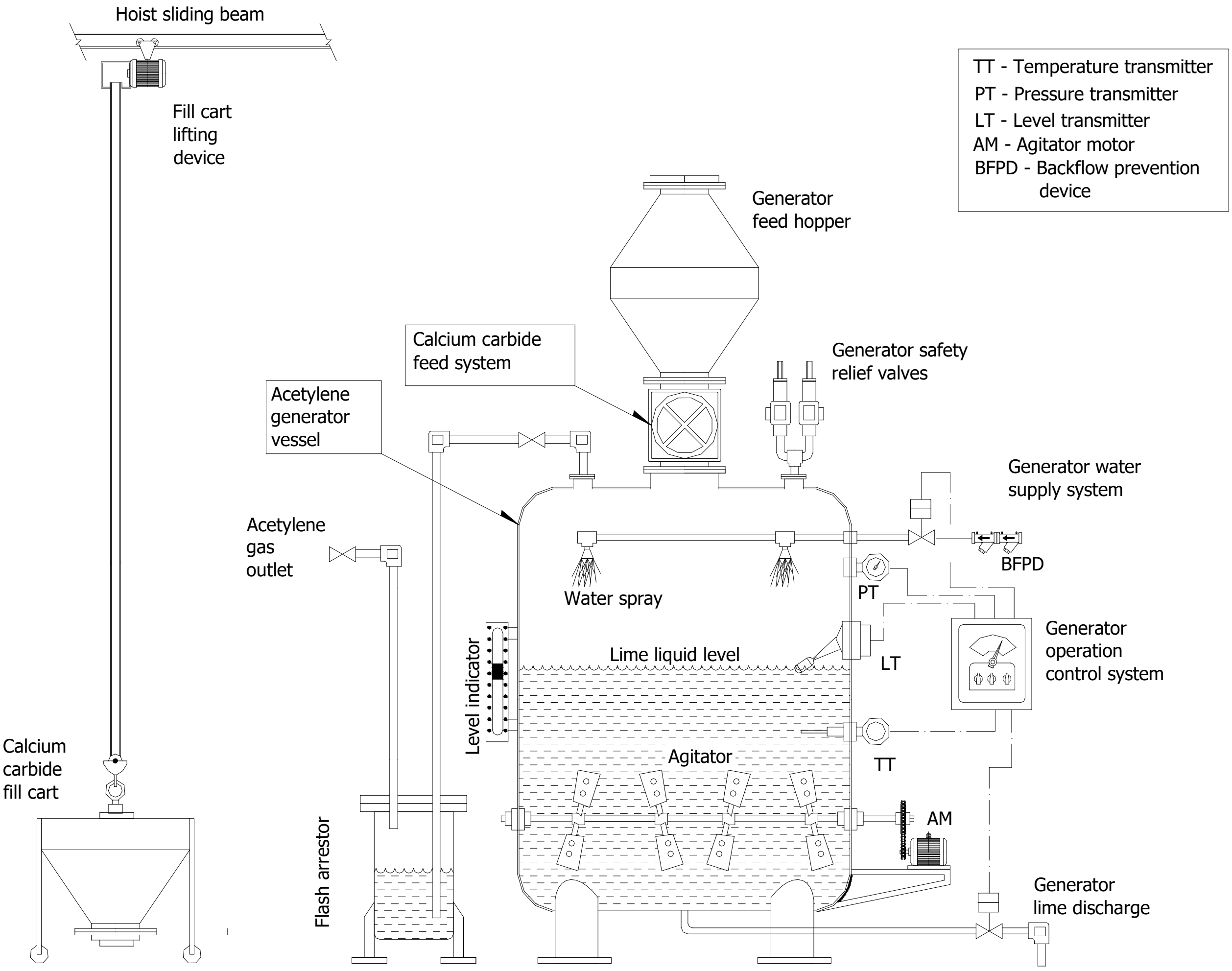

Figure 1 - Example of a wet acetylene generator system

4.2 Component listing

The following is a list of components typically found in acetylene generator systems (see Figure 1 for a typical acetylene generator system):

- calcium carbide fill cart (see 4.4.1);
- fill cart lifting device (hoist) (see 4.4.2);
- generator feed hopper (see 4.4.3);
- calcium carbide feed system (see 4.4.4);
- acetylene generator vessel (see 4.4.5);
- generator water supply system (see 4.4.6);
- generator operation control system (see 4.4.7);
- generator safety relief system (see 4.4.8);
- generator agitator and/or grates (see 4.4.9);
- generator carbide lime discharge system (see 4.4.10);
- flashback protection (see 4.4.11); and
- inert gas supply system (see 4.4.12).

4.3 Boundaries

Any portion of the acetylene generation system that has acetylene in it as part of normal operation or that can have acetylene in it with a single point of failure (mechanical or operational) is considered within the acetylene generator boundary limits. This includes the following:

- Acetylene generation system, beginning at the calcium carbide feed hopper. Portable storage and transportation containers for calcium carbide are not included;
- Generator vessel and all equipment and controls that are mounted in, on, or directly attached to it. The acetylene discharge is part of the generator up until the last automatic or manual isolation block valve(s) or until the boundary is changed to process piping or a different piece of equipment;
- Instrumentation, controls (gauges, transmitters, flow indicators, audible and visual alarm indicators, etc.), and critical valves that can directly control or affect the generator operation regardless where they are located;
- Safety relief devices and associated vent piping;
- Carbide lime discharge system including the piping from the generator and any manual or automatic block valve(s) up to the point the carbide lime is discharged to atmosphere and the holding vessel/pond and any secondary containment of the intermediate and final holding;
- Controls of the purge equipment associated with the generator up to the point it is covered by another process; and
- Controls of the water feed system until it is isolated with a double check backflow preventer, or until it is covered by another process.

4.4 Component failure modes and action to take

The following tables summarize failure mechanisms and recommended actions, see Tables 1-12. The minimum recommended frequency does not apply if there are conflicting manufacturer or legal requirements or if an individual company has data to justify longer intervals.

4.4.1 Calcium carbide fill cart

The calcium carbide fill cart provides a means to transfer calcium carbide from bulk shipping containers to the generator feed hopper.

Table 1 - Calcium carbide fill cart potential failure mechanisms

Credible failure mechanism for MI consideration	Consequence	Inspection method	Minimum recommended frequency	Acceptance criteria
Damaged or deteriorated base and cone connection of fill cart to hopper inlet	Could have steel to steel contact causing sparks	Operational issue not MI		
Failure of lifting bar	Hopper could fall, damaging equipment and spilling calcium carbide	Visual inspection	6-month intervals	Verify no damage, corrosion, cracks, or defects
Fill carts, flowbin or turn-bin discharge valve stuck open or closed	Spills calcium carbide or be unable to use calcium carbide that is exposed to atmosphere	Operational issue not MI		

Credible failure mechanism for MI consideration	Consequence	Inspection method	Minimum recommended frequency	Acceptance criteria
Wear of lifting lugs on turnbins/flowbins	Turnbins/flowbins could drop, damaging equipment and spilling entire contents of turnbin/flowbin calcium carbide. Falling bin could cause injury to employee. Equipment damage could lead to acetylene release	Visual inspection	2.5-year intervals	Verify no damage, corrosion, cracks, or defects
Earthing connection fault	Potential ignition of acetylene	Operational not MI		

4.4.2 Hoisting equipment

In acetylene plants, hoisting equipment (also referred to as a fill cart lifting device) is used to raise the calcium carbide fill cart or bulk container to a level where calcium carbide can be transferred into the fill hopper or generator feed hopper. To reach the hopper, the hoist travels laterally along rails or an I-beam trolley. Most hoisting equipment is remotely operated by manual controls that activate pneumatic or electrical motors. The hoisting hook is raised and lowered by means of a drum or lift-wheel around which a cable is wrapped.

Table 2 - Fill cart, turnbin, and flowbin lifting devices potential failure mechanisms

Credible failure mechanism for MI consideration	Consequence	Inspection method	Minimum recommended frequency	Acceptance criteria
Support structure, cable, or hook fails due to damage, corrosion, or insufficient load rating	Turnbins/flowbins could drop, damaging equipment and spilling entire contents of turnbin/flowbin calcium carbide. Falling bin could cause injury to employee. Equipment damage could lead to acetylene release	Visual inspection	12-month intervals	Verify no damage, corrosion, cracks, or defects
Lifting mechanism gears fail during calcium carbide transfer	Turnbins/flowbins could drop, damaging equipment and spilling entire contents of turnbin/flowbin calcium carbide. Falling bin could cause injury to employee. Equipment damage could lead to acetylene release	Visual inspection	12-month intervals	Components in good working condition

4.4.3 Generator feed hopper

Generator feed hoppers are vessels that supply calcium carbide to the feed system as needed.

Table 3 - Generator feed hopper potential failure mechanism

Credible failure mechanism for MI consideration	Consequence	Inspection method	Minimum recommended frequency	Acceptance criteria
Corrosion	Calcium carbide spill and acetylene release	Visual inspection	12-month intervals	Manufacturer design limitations for vessel
External mechanical damage	Calcium carbide spill and acetylene release	Visual inspection	12-month intervals	Manufacturer design limitations for vessel
Failure of gasket/seal	Minor acetylene gas leak into the generator room	Operational issue not MI		

Credible failure mechanism for MI consideration	Consequence	Inspection method	Minimum recommended frequency	Acceptance criteria
Carbide content (level) indicator failure	Calcium carbide spill and acetylene release	Check MI (for instrumented solutions undertake calibration)	12-month intervals	Components in good working condition

4.4.4 Calcium carbide feed system

The calcium carbide feed system controls the transfer and flow rate of calcium carbide into the acetylene generator vessel, which is typically based on acetylene pressure or the level of the gasholder. The feed system typically consists of a screw conveyor, gravity feed, magnetic vibrator, differential pressure valve, or some type of dumping hopper system and isolation valves.

Table 4 - Calcium carbide feed system potential failure mechanisms

Credible failure mechanism for MI consideration	Consequence	Inspection method	Minimum recommended frequency	Acceptance criteria
Electrical motor wiring failure	Operation will stop	Operational issue not MI		
Slack adjuster malfunction or failure	Operation will stop	Operational issue not MI		
Screw feed/vibrator seal deterioration	Leak of moist acetylene gas into hopper can cause hot spots, which could ignite acetylene gas in the generator hopper	Visual inspection	12-month intervals	Verify no damage, cracks, lime buildup, or deformation
Buildup of carbide lime or calcium carbide on calcium carbide feed control valve seat	Leak of moist acetylene gas into hopper can cause hot spots, which could ignite acetylene gas in the generator hopper	Visual inspection	12-month intervals	No permanent deposits of lime or calcium carbide on the calcium carbide seat/valve
Weak or broken spring on calcium carbide feed control valve	Leak of moist acetylene gas into hopper can cause hot spots, which could ignite acetylene gas in the generator hopper	Visual inspection	12-month intervals	Spring in operating condition
Malfunction of hydraulic system that opens calcium carbide seat	Malfunction causes fail close of the calcium carbide seat/valve and loss of production. Operational issue	Operational issue not MI		
Wrong size of carbide or contaminants (ferrosilicate or plastics)	Blockage or friction or damage of the carbide feed system	Quality control/ Supplier audit	At change of suppliers	Supplier delivers specified carbide quality
Failure of feeding tube isolation device	Impossible to isolate generator from hopper	Visual inspection	12-month intervals	Device in operating condition

4.4.5 Acetylene generator vessel

The generator vessel contains the reaction of calcium carbide with water to produce acetylene gas, carbide lime, and heat. The generator vessel includes access covers and hatches, grating, electric motors, control valves, and manual valves. The access covers and hatches provide an opening for calcium carbide to be put into the system and/or access to the equipment for maintenance. The grating (where installed) is a platform upon which the calcium carbide reacts under the water level and is rotated periodically to remove ferrosilicates. The electric motors are used for driving calcium carbide feed systems and agitators. The control valves automatically control the flow of materials (calcium carbide, carbide lime, water, etc.) into or out of the generator. The manual valves allow the isolation and manual flow control of materials into and out of the generator.

Table 5 - Generator vessel potential failure mechanisms

Credible failure mechanism for MI consideration	Consequence	Inspection method	Minimum recommended frequency	Acceptance criteria
Corrosion	Lime spill and uncontrolled acetylene gas release, which can create a flammable atmosphere in a confined area	Visual inspection	12-month intervals	Manufacturer design limitations for vessel
Gasket/seal failure at flanges	Minor acetylene gas leak into the generator room	Operational issue not MI		
Buildup of lime inside generator, blockage due to silica build-up in the generator	Operational issue. No release	Operational issue not MI		
Loss of liquid seals in water trap	Operational issue. Release to safe location	Operational issue not MI		
Access cover and hatch gasket failure, corrosion, latch or bolt failure, wear on linkage parts	Minor acetylene gas leak into the generator room	Operational issue not MI		
Pipe or fitting corrosion	Minor leak	Operational issue not MI		

4.4.6 Generator water supply system

The generator water supply system includes piping, backflow prevention device, valve actuator, low pressure and flow (proximity) switches, recirculation, or city water system.

Table 6 - Water supply system potential failure mechanisms

Credible failure mechanism for MI consideration	Consequence	Inspection method	Minimum recommended frequency	Acceptance criteria
Backflow device failure	Leaks water and acetylene gas into water supply system	Backflow device functionality inspection	12-month intervals	Backflow device is functioning and operating as designed
Interruption of water supply to generator	Calcium carbide island formation can cause hot spots, which could ignite acetylene gas in the generator	Visual inspection and functional check	12-month intervals	Flow rate and flow pattern is according to design
Fresh water supply check valve failure, pluggage of water supply, and/or water meter failure	Backflow of acetylene into water supply	Test check valves	12 month-intervals	Proper functionality
Plugging of filters	No water flow to generator. Operational issue. No release	Operational issue not MI		

4.4.7 Generator operation control, instrumentation system, and alarms/trips

The generator operation control system includes devices to measure and control level, temperature, pressure, and flows to ensure safe and efficient generation process.

Following is the list of typical generator alarms and trips:

- Generator high/low water level trip and alarms. Devices (e.g., float switches, electronic sensors, etc.) that control high and low water levels in generator by regulating water supply and can interrupt calcium carbide feed when low water level alarm is activated;
- Generator high temperature trip and alarm. High temperature cut out switch that stops calcium carbide feed in case of excessively high temperature in generator;

- Generator high pressure trip and alarm. Pressure cut out switch that stops calcium carbide feed in case of excessively high pressure in generator;
- Agitator motor current transmitter and rotation failure alarm switch; and
- Low water pressure switch and alarm (water supply to generator). Cut out switch that stops calcium carbide feed in case of water pressure failure.

Following is the list of typical generator operational controls not classified as a MI issue:

- High/low generator pressure switch, controls calcium carbide supply to generator by cutting off calcium carbide feed at higher pressure setpoint and restarting when the pressure drops to lower setpoint;
- Generator temperature switch, controls temperature of generation process by regulating water supply to generator and scrubber;
- Generator pressure gauge;
- Generator water level indicator; and
- Generator water temperature indicator.

Table 7 - Generator operation control system potential failure mechanisms

Credible failure mechanism for MI consideration	Consequence	Inspection method	Minimum recommended frequency	Acceptance criteria
Malfunction of the high water level detection system	High water level in generator, risk of water entering calcium carbide supply system	Functional proof test	12-month interval	Correct setpoint actuation, no water flow, and no calcium carbide feed into generator at higher level setpoint
Malfunction of the low water level detection system	Low water level in generator leads to unreacted calcium carbine	Functional proof test	12-month interval	Correct setpoint actuation, no calcium carbide feed into generator at low water setpoint
Malfunction of temperature sensor, blockage of sensor stem, and/or electronics damage of high temperature cut out switch	Steam in the generator and resulting in moisture in the carbide feed system	Functional proof test	12-month intervals	Correct setpoint actuation, no calcium carbide feed to generator at high temperature setpoint
Liquid level indicator tubing plugging or component damage	Level indicator malfunction, inaccurate liquid level reading, not reliable as a generator liquid level monitoring/ reference device	Operational issue not MI		
Lime buildup on temperature sensor of high temperature cut out switch	High temperature cut out switch malfunction and potential undetected high temperature in generator	Clean temperature sensor	Each time generator is cleaned	Clean from lime deposits
Agitator alarm malfunction and current output transmitter wiring damage	Agitator rotation failure not detected, calcium carbide island formation, internal hotspots, discharge of unreacted calcium carbide	Functional proof test	12-month intervals	Alarm actuation at agitator “no rotation” condition, no calcium carbide feed to generator
Pressure switch or sensor damage/malfunction	Loss of control on calcium carbide supply to generator, risk of increased pressure when malfunction occurs at higher setpoint and operation of pressure relief system	Operational issue not MI		

Credible failure mechanism for MI consideration	Consequence	Inspection method	Minimum recommended frequency	Acceptance criteria
Pressure gauge damage/malfunction	Inaccurate pressure reading, not reliable as a generator pressure monitoring/reference device. Can cause unsafe purging operation	Operational issue not MI		
Liquid level indicator (sight glass type) opaque due to adhered lime	Water level is not visible	Operational issue not MI		

4.4.8 Generator safety relief system

System components include all relief valves utilized on acetylene generator system. Relief valves and vent piping provide a means to relieve excessive pressure from the generator system (vessel, piping, calcium carbide hoppers, and feed equipment). Equipment may also be used to assist in purging the generator and auxiliary equipment.

Table 8 - Mechanical relief system potential failure mechanisms

Credible failure mechanism for MI consideration	Consequence	Inspection method	Minimum recommended frequency	Acceptance criteria
Malfunction; failure to relieve at proper set point due to spring loaded PRV	Possibility of vessel overpressurization resulting in vessel being compromised	Function check	12-month interval	Functional and relieving at correct set point
Malfunction; failure to relieve due to lime deposits	Possibility of vessel overpressurization resulting in vessel being compromised	Function check	12-month interval or OEM recommendations	Functional
Malfunction; failure to seal during normal operation	Release of acetylene to atmosphere.	Operational issue not MI		
Vent line piping blockage	Reliance on backup relief devices	Operational issue not MI		

Table 9 - Water trap relief system potential failure mechanisms

Credible failure mechanism for MI consideration	Consequence	Inspection method	Minimum recommended frequency	Acceptance criteria
Lack of water	Release of Acetylene	Operational issue, not MI		

4.4.9 Generator agitator and/or grates

The agitator (where installed) is a driven or rotating shaft with paddles/blades in the generator vessel. It is designed to prevent calcium carbide islands from forming on the surface of the water (especially with dusty calcium carbide) and hot spots from forming on the bottom of the vessel. In addition, the agitator improves mixing efficiency and reaction rates of acetylene generation.

In low pressure generators, grating is designed to have calcium carbide settle on it while reacting underwater. To remove solids, the grate can be manually rotated into a 90-degree position.

Table 10 - Agitator and grate potential failure mechanisms

Credible failure mechanism for MI consideration	Consequence	Inspection method	Minimum recommended frequency	Acceptance criteria
Agitator shaft/paddle wear/breakage	Calcium carbide island formation, internal hotspots, discharge of unreacted calcium carbide	Visual inspection	Whenever the generator is cleaned, not to exceed 12 months	No wear or defect which could cause a failure.
Agitator motor/linkage failure with alarm installed	Activates alarm	Operational issue not MI		
Agitator motor/linkage failure without alarms	Calcium carbide island formation, internal hotspots, deflagration inside generator due to reacted calcium carbide	Periodic visual inspection by operator	Hourly	Shaft is rotating at both ends
Manual grate corrosion creates a hole in grate	Unreacted calcium carbide builds up in generator which can lead to blockage of lime discharge	Operational Issue not MI		

4.4.10 Generator carbide lime discharge system

Generator carbide lime discharge systems are designed to remove carbide lime, the coproduct of the reaction between calcium carbide and water in the acetylene generation process. It consists of level sensors, automatic and manual lime discharge valves, and associated piping, controls and instrumentation. The carbide lime is removed from the generator system into a separate containment area, which is outside of the scope of this publication.

Table 11 - Generator lime discharge system potential failure mechanisms

Credible failure mechanism for MI consideration	Consequence	Inspection method	Minimum recommended frequency	Acceptance criteria
Carbide lime discharge automatic valve fail open	Uncontrollable discharge of carbide lime and possible increased release of acetylene into classified area (lime pit)	Operational issue not MI		
Blockage of carbide lime discharge pipe	Increased water level in the generator body; water can enter in the hopper	Visual inspection	12-month intervals	Device in operating condition

4.4.11 Flashback protection

Flashback arrestors (including check valves) are designed to stop acetylene deflagrations in the piping in both directions. Check valves are valves that mechanically prevents the back flow of gas/liquid into or out of the generator system.

Table 12 - Flash arrestor and check valve potential failure mechanisms

Credible failure mechanism for MI consideration	Consequence	Inspection method	Minimum recommended frequency	Acceptance criteria
Flashback arrestor malfunction (e.g., loss of liquid seal, check valve failure, etc.) Loss of water in the flashback arrestor	Self-disclosing failure check valves. Seals swell and block line leading to low pressure at compressor inlet	Operational issue not MI		
Corrosion and loss of water in flashback arrestor	Acetylene gas release and failure to quench fire	Visual inspection flashback arrestor for corrosion	5-year intervals or after a long period of shutdown (3 months or longer)	Manufacturer design limitations for vessel

4.4.12 Inert gas supply system

Nitrogen (or other inert gas) supply systems are used for purging equipment. Inert gas displaces acetylene in piping and equipment prior to disassembly and displaces air after reassembly prior to reintroducing acetylene. The system includes the inert gas supply piping, valves, and instrumentation downstream of the local isolation valve and gas analyzer if used. During normal operations, calcium carbide totes and hoppers are purged with inert gas before they are opened for calcium carbide transfers.

Table 13 - Nitrogen purge potential failure mechanisms

Credible failure mechanism for MI consideration	Consequence	Inspection method	Minimum recommende d frequency	Acceptance criteria
Malfunction of nitrogen monitoring alarm system (e.g., pressure, flow transmitters, etc.)	Inadequate nitrogen supply for purging of equipment/system	Calibration of instruments	12-month intervals	Alarms functioning at ±10% deviation of set point
Malfunction of emergency nitrogen purge system	Inadequate nitrogen supply for generator emergency	Proof test of nitrogen purge	12-month intervals	Nitrogen purge system in operating condition
Excessive nitrogen flow or pressure	Excessive pressure and flow could damage system, causing inert or flammable gas release through safety relief valves	Operational issue not MI		
Insufficient nitrogen flow or pressure (with or without alarm)	Insufficient pressure or flow and inability to purge feed hopper and shipping container	Operational issue not MI		

5 Records

When giving guidance on inspection methods and inspection frequencies, it is not required to have all of these inspections recorded in written format (e.g., daily routine pre-use visual inspections of equipment are not commonly recorded). Inspections should be recorded according to formal regulations, company policy, etc.

6 References

Unless otherwise specified, the latest edition shall apply.

[1] EIGA Doc 237, *Safe Operation of Acetylene Generator Systems,* www.eiga.eu

[2] CGA G-1.10, *Guideline for the Safe Operation of Acetylene Generators*, www.cganet.com