



CGA G-1.12—2023 MECHANICAL INTEGRITY OF GENERATOR SYSTEMS IN ACETYLENE PLANTS

SECOND EDITION

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PREFACE

As part of a program of harmonization of industry standards, the Compressed Gas Association (CGA) has published CGA G-1.12, *Mechanical Integrity of Generator Systems in Acetylene Plants*, jointly produced by members of the International Harmonization Council.

This publication is intended as an international harmonized 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 (EIGA), 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.

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NOTE—Technical changes from the previous edition are underlined.

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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 CGA G-1.10, *Guideline for the Safe Operation of Acetylene Generators* [1].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 [CaC₂]

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.

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.

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