



# **CGA G-6.12—2016**

(Formerly PS-5)

## **STANDARD FOR THE SUITABILITY OF CARBON STEEL CONTAINERS FOR STATIONARY CARBON DIOXIDE STORAGE**

**FIRST EDITION**

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Work Item 12-056  
Carbon Dioxide Committee

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NOTE—Technical changes from PS-5—2008 edition are underlined.

FIRST EDITION: 2016

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<b>Contents</b>	<b>Page</b>
1 Introduction.....	1
2 Scope .....	1
3 Definitions.....	1
4 Prudent engineering practice .....	2
4.1 Documentation/certification .....	2
4.2 Repair.....	2
4.3 Fitness for service .....	2
4.4 Noncyclic service.....	2
4.5 Minimum design metal temperature and repressurization .....	2
5 In-service tanks .....	3
5.1 Equipment recommendations.....	3
5.2 Service inspection and calibration recommendations .....	3
5.3 Training and monitoring program .....	4
6 Removal from service.....	4
7 References .....	4

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## 1 Introduction

The carbon dioxide industry has been using carbon steel pressure vessels for storage of liquid carbon dioxide since the 1940s. These vessels were constructed to standards set by the *ASME Boiler and Pressure Vessel Code*, Section VIII, Division 1 (ASME Code), which is the recognized standard in the United States and Canada for the construction of pressure vessels [1].<sup>1</sup>

The ASME Code was revised in 1987 to further increase the margin of safety for certain grades of steel in low temperature service. Most carbon dioxide vessels manufactured before 1976 were constructed of grades of carbon steel rated with a minimum design metal temperature (MDMT) of  $-20^{\circ}\text{F}$  ( $-28.9^{\circ}\text{C}$ ) and would not meet current code requirements for MDMT at stamped maximum allowable working pressure (MAWP) for vessel thickness greater than or equal to 1/2 in. Almost all of these vessels were manufactured with SA-212 or SA-515 carbon steels. It should be noted that SA-212 steel has been discontinued from ASME Code Section II and Section VIII, Division 1 [1].

The performance record of the approximately 10 000 North American steel carbon dioxide containers made of the now restricted grades shows they are safe and reliable when operated within design conditions. There have been only five known incidents in the United States of stationary carbon dioxide container failures. These failures were related to overpressure, improper modification, or existence of fracture critical flaw. Pressure vessel failures can be violent, high energy incidents causing extensive damage.

## 2 Scope

This publication covers stationary carbon dioxide tanks manufactured with SA-212 or SA-515 carbon steels rated with a MDMT of  $-20^{\circ}\text{F}$  ( $-28.9^{\circ}\text{C}$ ), which do not meet current code requirements for MDMT at stamped MAWP.

## 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 Can

Indicates a possibility or ability.

#### 3.1.4 May

Indicates that the procedure is optional.

### 3.2 Technical definitions

#### 3.2.1 Authorities having jurisdiction (AHJ)

Local, state, provincial, federal, or other bodies having regulatory authority over the equipment being installed or used.

#### 3.2.2 Cyclical service

Typical bulk customer tanks and plant tanks are not considered to be in cyclical service, as defined in ASME Code Section VIII, Division 2 [1].

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