



COMPRESSED GAS ASSOCIATION, INC.

POSITION STATEMENT

PS-5—2008

14501 GEORGE CARTER WAY, SUITE 103
CHANTILLY, VA 20151
703-788-2700
cga@cganet.com

SUITABILITY OF CARBON STEEL CONTAINERS FOR STATIONARY CARBON DIOXIDE STORAGE

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 & Pressure Vessel Code*, Sec. VIII, Div. 1 (ASME Code), which is the recognized standard in the United States and Canada for the construction of pressure vessels [1].

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 that would not meet the current code requirements. Almost all of these were manufactured with SA-212 and SA-515 carbon steels.

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 four known incidents in the United States of stationary carbon dioxide container failures. One failure was due to an obstructed relief valve, the second was due to an improperly modified vessel, and the third was due to brittle fracture of an SA-212 vessel that had been converted from a liquefied petroleum gas rail car. CGA does not have sufficient information regarding the fourth incident.

Prudent engineering practice for carbon dioxide containers manufactured with SA-212 and SA-515 carbon steels are:

- Containers other than those certified and manufactured to the ASME Code should be removed from service unless equivalent pressure vessel documentation is available.
- Carbon steel carbon dioxide containers manufactured of SA-212 or SA-515 shall not be modified by welding.
- Those that require overhauls, major repairs, or show signs of corrosion should be considered for scrapping, rather than extending their service life.
- Adequate measures should be taken to ensure these carbon dioxide containers are operated at temperatures warmer than the minimum design metal temperature shown on the ASME data plate, typically -20°F (-28.9°C), which corresponds to an equilibrium pressure of 200 psig (1380 kPa).¹
- Carbon dioxide containers that contain liquid carbon dioxide colder than the minimum design metal temperature should be temporarily removed from service. Repressurization and a return to service should only be done under the direction of someone knowledgeable of the properties of carbon dioxide, the grade of steel used to fabricate the container, and who uses appropriate procedures. For additional information, see CGA G-6.7, *Safe Handling of Liquid Carbon Dioxide Containers That Have Lost Pressure* [3].

References

Unless otherwise specified, the latest edition shall apply.

[1] *ASME Boiler & Pressure Vessel Code*, ASME International, Three Park Avenue, New York, NY 10016.
www.asme.org

¹ kPa shall indicate gauge pressure unless otherwise noted as (kPa, abs) for absolute pressure or (kPa, differential) for differential pressure. All kPa values are rounded off per CGA P-11, *Metric Practice Guide for the Compressed Gas Industry* [2].

[2] CGA P-11, *Metric Practice Guide for the Compressed Gas Industry*, Compressed Gas Association, Inc., 4221 Walney Rd., 5th Floor, Chantilly, VA 20151. www.cganet.com

[3] CGA G-6.7, *Safe Handling of Liquid Carbon Dioxide Containers That Have Lost Pressure*, Compressed Gas Association, Inc., 4221 Walney Rd., 5th Floor, Chantilly, VA 20151. www.cganet.com

PLEASE NOTE:

The information contained in this document was obtained from sources believed to be reliable and is based on technical information and experience currently available from members of the Compressed Gas Association, Inc. and others. However, the Association or its members, jointly or severally, make no guarantee of the results and assume no liability or responsibility in connection with the information or suggestions herein contained. Moreover, it should not be assumed that every acceptable commodity grade, test or safety procedure or method, precaution, equipment or device is contained within, or that abnormal or unusual circumstances may not warrant or suggest further requirements or additional procedure.

This document is subject to periodic review, and users are cautioned to obtain the latest edition. The Association invites comments and suggestions for consideration. In connection with such review, any such comments or suggestions will be fully reviewed by the Association after giving the party, upon request, a reasonable opportunity to be heard. Proposed changes may be submitted via the Internet at our web site, www.cganet.com.

This document should not be confused with federal, state, provincial, or municipal specifications or regulations; insurance requirements; or national safety codes. While the Association recommends reference to or use of this document by government agencies and others, this document is purely voluntary and not binding unless adopted by reference in regulations.

A listing of all publications, audiovisual programs, safety and technical bulletins, and safety posters is available via the Internet at our website at www.cganet.com. For more information contact CGA at Phone: 703-788-2700, ext. 799. E-mail: customerservice@cganet.com.

Work Item 07-021
Carbon Dioxide Committee

FOURTH EDITION: 2008
THIRD EDITION: 2003
SECOND EDITION: 1996
FIRST EDITION: 1992

© 2008 The Compressed Gas Association, Inc. All rights reserved.

All materials contained in this work are protected by United States and international copyright laws. No part of this work may be reproduced or transmitted in any form or by any means, electronic or mechanical including photocopying, recording, or any information storage and retrieval system without permission in writing from The Compressed Gas Association, Inc. All requests for permission to reproduce material from this work should be directed to The Compressed Gas Association, Inc., 14501 George Carter Way, Suite 103, Chantilly VA 20151. You may not alter or remove any trademark, copyright or other notice from this work.