

This document licensed for the sole use of the purchaser. It may not be shared with any other person or used after the expiration date without the express written permission of the CGA. Any unauthorized use, reproduction, distribution, or modification of this printed page will result in a \$5,000 liquidated damages fee plus loss of access to CGA publications for one year for your company.

CGA G-1.9—2013

**RECOMMENDED PRACTICES FOR
MAINTAINING THE PROPER SOLVENT
LEVEL IN ACETYLENE CYLINDERS**

SECOND EDITION



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 12-033
Acetylene Committee

NOTE—Technical changes from the previous edition are underlined.

SECOND EDITION 2013

FIRST EDITION: 2008

© 2013 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.

Contents	Page
1 Introduction.....	1
2 Scope and purpose	1
2.1 Scope	1
2.2 Purpose	1
3 Definitions.....	1
4 Construction and function of acetylene cylinders	2
4.1 General.....	2
4.2 Shell.....	2
4.3 Porous mass (filler).....	2
4.4 Solvent.....	3
4.5 Free volume.....	3
5 Solvent adjustment theory	4
5.1 General.....	4
5.2 Cylinder temperature	4
5.3 Cylinder pressure	4
5.4 Cylinder weigh-in	4
5.5 Residual acetylene	4
5.6 Solvent addition calculation	5
6 Solvent adjustment in practice	6
6.1 General.....	6
6.2 Example determination of required solvent addition	6
6.3 New cylinder information	7
6.4 Determination of solvent addition in clusters, bundles, or trailers containing only DMF solvent	7
7 Acetone tables.....	8
7.1 General.....	8
7.2 Acetone residual gas tables	9
7.3 Acetone unitary table.....	14
7.4 Acetylene solubility in acetone (included for reference)	14
8 Dimethylformamide tables.....	15
8.1 General.....	15
8.2 Dimethylformamide residual gas tables	15
8.3 Dimethylformamide unitary table.....	19
8.4 Acetylene solubility in DMF (included for reference)	19
9 References	20
10 Additional references.....	20

Figure

Figure 1—Typical volume distribution for a 145 ft ³ cylinder	3
---	---

Tables

Table 1—Residual gas for acetone at 30 °F to 40 °F.....	9
Table 2—Residual gas for acetone at 40 °F to 50 °F.....	10
Table 3—Residual gas for acetone at 50 °F to 60 °F.....	10
Table 4—Residual gas for acetone at 60 °F to 70 °F.....	11
Table 5—Residual gas for acetone at 70 °F to 80 °F.....	11
Table 6—Residual gas for acetone at 80 °F to 90 °F.....	12
Table 7—Residual gas for acetone at 90 °F to 100 °F.....	12

Table 8—Residual gas for acetone (MC or B)	13
Table 9—Unitary values table (lb of acetylene per lb of acetone above saturation gas)	14
Table 10—Solubility values based upon formula (g/kg)	14
Table 11—Residual gas for DMF at 30 °F to 40 °F.....	15
Table 12—Residual gas for DMF at 40 °F to 50 °F.....	16
Table 13—Residual gas for DMF at 50 °F to 60 °F.....	16
Table 14—Residual gas for DMF at 60 °F to 70 °F.....	17
Table 15—Residual gas for DMF at 70 °F to 80 °F.....	17
Table 16—Residual gas for DMF at 80 °F to 90 °F.....	18
Table 17—Residual gas for DMF at 90 °F to 100 °F.....	18
Table 18—Unitary values (lb of acetylene per lb of DMF above saturation gas)	19
Table 19—Solubility values based upon formula (g/kg).....	19

1 Introduction

This publication is one of a series compiled by the Compressed Gas Association, Inc. (CGA) to meet the demand for information on compressed gases, cryogenic liquids, and related products.

2 Scope and purpose

2.1 Scope

This publication covers recommendations for maintaining the proper solvent level in acetylene cylinders. While the background, precautions, and general procedures given apply to all solvents in use with acetylene, special emphasis is given to the use of acetone and dimethylformamide (DMF).

Included are residual gas tables based upon the best available data that reflects current industry practice. The expected accuracy of these values is approximately $\pm 10\%$, and should be used as a guide only. Note that these tables make use of acetylene solubilities as generated by the appropriate formulas as found in ISO 11372, *Gas cylinders—Acetylene cylinders—Filling conditions and filling inspection* [1].¹

The guidelines contained in this publication apply to acetylene cylinders manufactured to:

- U.S. Department of Transportation (DOT) Specifications 8 and 8AL found in Title 49 of the U.S. *Code of Federal Regulations* (49 CFR) 178.59 and 178.60 and used per 49 CFR 173.303 as well as older specifications cylinders ICC-8, ICC-8AL, DOT E-6517, DOT E-7542, or DOT E-10320 [2]; or
- Specifications TC 8WM and 8WAM found in Canadian Standards Association (CSA) B339, *Cylinder, Spheres, Tubes and Other Containers for the Transportation of Dangerous Goods*, and used in accordance with *Transportation of Dangerous Goods Regulations* of Transport Canada (TC) found in CSA B340, *Selection of Cylinders, Spheres, Tubes, and Other Containers for the Transportation of Dangerous Goods, Class 2*, as well as older specifications cylinders CTC-8, CTC-8AL, or CTC-8WC [3, 4, 5].

2.2 Purpose

This publication has been prepared as a guide for maintaining the proper solvent level in acetylene cylinders. It should be of interest to acetylene manufacturers, acetylene production and distribution personnel, authorized acetylene cylinder reinspection facilities, welding gas distributors, safety personnel, and users of acetylene.

3 Definitions

For the purpose of this publication, the following definitions shall apply.

3.1 Acetylene cylinder shell

Metal pressure vessel manufactured for and according to standards reserved for acetylene transport, storage, and usage.

3.2 Filler porosity

Water volume of the filler material expressed as a percentage of the filler volume.

3.3 Maximum permissible settled pressure

Maximum gas pressure allowed in an acetylene cylinder defined as:

- 250 psig (1720 kPa) at 70 °F (21.1 °F) per DOT regulations;² and
- 1.9 MPa at 15 °C per TC regulations.

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

² 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* [6].