



CGA E-4—2016
STANDARD FOR GAS
PRESSURE REGULATORS

SEVENTH 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 15-015
Industrial Gases Apparatus Committee

NOTE—Technical changes from the previous edition are underlined.

NOTE—Appendices A and B (Informative) are for information only.

SEVENTH EDITION: 2016
SIXTH EDITION: 2010
FIFTH EDITION: 2006
FOURTH EDITION: 2002

© 2016 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., 8484 Westpark Drive, Suite 220, McLean, VA 22102. You may not alter or remove any trademark, copyright or other notice from this work.

Contents	Page
1 Introduction.....	1
2 Scope	1
3 Definitions.....	1
4 General requirements.....	5
4.1 Operating temperature range	5
4.2 Materials.....	5
4.3 Cleanliness	7
4.4 Gas tightness.....	8
4.5 Mechanical resistance.....	8
4.6 Endurance	9
5 Construction requirements	9
5.1 Inlet connections.....	9
5.2 Outlet connections.....	10
5.3 Inlet filters	10
5.4 Pressure relief devices	11
5.5 Pressure adjusting mechanism	11
5.6 Pressure sensing element.....	12
5.7 Pressure gauges	12
5.8 Accessories	13
6 Performance characteristics.....	13
6.1 Pressure regulation	14
6.2 Static increment.....	14
6.3 Flow regulation	14
6.4 Flow capacity.....	15
6.5 Regulator flow coefficient, C_v	15
7 Test procedures	16
7.1 Ignition test.....	16
7.2 Leakage tests	17
7.3 Excess pressure tests	18
7.4 Endurance test	18
7.5 Performance tests	19
7.6 Production tests.....	20
8 Information and marking.....	21
8.1 Operating and maintenance instructions.....	21
8.2 Marking.....	21
8.3 Performance characteristics	22
9 Packaging.....	23
9.1 General.....	23
9.2 Special.....	23
10 References	23
11 Other related standards.....	24
 Figures	
Figure 1—Typical two-stage adjustable regulator with indirect acting valves	3
Figure 2—Typical single-stage adjustable regulator with indirect acting valve	4
Figure 3—Pressure regulation curve	14

Figure 4—Flow regulation curve at inlet pressure P_3	15
Figure 5—Schematic representation of ignition test apparatus	17
Figure 6—A typical regulator test setup	19

Tables

Table 1—Recommended test liquids	6
Table 2—Definition of performance characteristics	13

Appendix

Appendix A—Gas flow calculations (Informative)	25
Appendix B—Use of regulators on compressed gas cylinders over 3000 psi (Informative)	33

Appendix Tables

Table A-1— C_v versus equivalent sharp-edged orifice (ESEO)	25
Table A-2— M , k , P_c/P_1 , A, B, and flow correction factor values for common gases.....	26
Table A-3—Air flow versus inlet (P_1) and outlet (P_2) pressures for $C_v = 1$ at 70 °F inlet temperature.....	30

1 Introduction

This publication establishes minimum performance and safety requirements for gas pressure regulators. These requirements are based on existing technology and represent the state of the art at the time of publication. There is no intent to discourage or impede future innovation of gas pressure regulators.

This publication does not address any personnel safety or health concerns, nor does it address any environmental requirements, which can be involved in the testing or making of these devices. Each manufacturer shall address these matters relative to their operations and comply with local, state/provincial, and national regulations and laws.

2 Scope

This publication specifies requirements for regulators used with compressed gases to reduce the supply pressure from a storage cylinder, pipeline, or other source to the use pressure.

This publication contains design and manufacturing requirements relating to materials, construction, performance, test procedures, information, marking, and packaging of pressure regulators. Appendix A provides information relating to regulator flow capacity calculations. For pressure regulators used with medical gases, additional requirements are specified in CGA E-7, *Medical Gas Pressure Regulators, Flowmeters, and Orifice Flow Selectors* [1].¹

This publication does not apply to liquefied petroleum gas (LPG) pressure regulators for equipment intended for installation and use in accordance with the requirements of NFPA 58, *Liquefied Petroleum Gas Code* [2].

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 Creep

Continuing rise above set pressure, after downstream flow is shutoff due to an internal leak.

NOTE—Creep is sometimes referred to as crawl.

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