ULC Standards
Normes ULC

JOINT CANADA-UNITED STATES
NATIONAL STANDARD

ANSI/CAN/UL/ULC 404:2022

STANDARD FOR SAFETY

Pressure-Indicating Gauges for Compressed Gas Service

Approved American National Standard
ANSI

ANSI/UL 404-2022

scc ccn

SCC FOREWORD

National Standard of Canada

A National Standard of Canada is a standard developed by a Standards Council of Canada (SCC) accredited Standards Development Organization, in compliance with requirements and guidance set out by SCC. More information on National Standards of Canada can be found at www.scc.ca.

SCC is a Crown corporation within the portfolio of Innovation, Science and Economic Development (ISED) Canada. With the goal of enhancing Canada's economic competitiveness and social well-being, SCC leads and facilitates the development and use of national and international standards. SCC also coordinates Canadian participation in standards development, and identifies strategies to advance Canadian standardization efforts.

Accreditation services are provided by SCC to various customers, including product certifiers, testing laboratories, and standards development organizations. A list of SCC programs and accredited bodies is publicly available at www.scc.ca.

UL Standard for Safety for Pressure-Indicating Gauges for Compressed Gas Service, ANSI/CAN/UL/ULC 404

Ninth Edition, Dated October 21, 2022

SUMMARY OF TOPICS

This new edition of UL/ULC 404 merges relevant content from ULC/ORD-C404 with ANSI/UL 404 to create a single, joint standard applicable in both the USA and Canada.

The new requirements are substantially in accordance with Proposal(s) on this subject dated April 29, 2022.

No Text on This Page

ANSI/CAN/UL/ULC 404:2022

Standard for Pressure-Indicating Gauges for Compressed Gas Service

The first and second editions were titled High-Pressure Gas Gauges and the first edition was numbered UL 252(b).

The third, fourth, fifth, sixth, seventh, and eighth editions were titled Gauges, Indicating Pressure, for Compressed Gas Service.

First Edition – March, 1948
Second Edition – June, 1953
Third Edition – May, 1973
Fourth Edition – July, 1979
Fifth Edition – June, 1993
Sixth Edition – September, 1997
Seventh Edition – January, 2005
Eighth Edition – February, 2015

Ninth Edition

October 21, 2022

This ANSI/UL Standard for Safety consists of the Ninth Edition.

The most recent designation of ANSI/UL 404 as an American National Standard (ANSI) occurred on October 21, 2022. ANSI approval for a standard does not include the Cover Page, Transmittal Pages, and Title Page.

The Department of Defense (DoD) has adopted UL 404 on October 3, 1994. The publication of revised pages or a new edition of this Standard will not invalidate the DoD adoption.

This standard has been designated as a National Standard of Canada (NSC) on October 21, 2022.

No Text on This Page

CONTENTS

No Text on This Page

Preface

This is the Ninth Edition of ANSI/CAN/UL/ULC 404, Standard for Pressure-Indicating Gauges for Compressed Gas Service.

UL is accredited by the American National Standards Institute (ANSI) and the Standards Council of Canada (SCC) as a Standards Development Organization (SDO). ULC Standards is accredited by the Standards Council of Canada (SCC) as a Standards Development Organization (SDO).

This Standard has been developed in compliance with the requirements of ANSI and SCC for accreditation of a Standards Development Organization.

This ANSI/CAN/UL/ULC 404 Standard is under continuous maintenance, whereby each revision is approved in compliance with the requirements of ANSI and SCC for accreditation of a Standards Development Organization. In the event that no revisions are issued for a period of four years from the date of publication, action to revise, reaffirm, or withdraw the standard shall be initiated.

In Canada, there are two official languages, English and French. All safety warnings must be in French and English. Attention is drawn to the possibility that some Canadian authorities may require additional markings and/or installation instructions to be in both official languages.

Comments or proposals for revisions on any part of the Standard may be submitted at any time. Proposals should be submitted via a Proposal Request in the On-Line Collaborative Standards Development System (CSDS) at https://csds.ul.com.

To purchase UL Standards, visit the UL Standards Sales Site at http://www.shopulstandards.com/HowToOrder.aspx or call tollfree 1-888-853-3503.

This Edition of the Standard has been formally approved by the UL Standards Technical Panel (STP) on Compressed Gas Regulators and Accessories, STP 252.

This list represents the STP 252 membership when the final text in this standard was balloted. Since that time, changes in the membership may have occurred.

STP 252 Membership

Name	Represent	Interest Category	Region
Bob Carney	Western/Scott Fetzer Co.	Producer	USA
David Gailey	Lincoln Electric CO Harris Calorific	Producer	USA
Edgar Wolff-Klammer	UL Solutions	Testing and Standards Org.	USA
James Petersen	Petersen Engineering	General Interest	USA
Jason Keister	NASA Glenn Research Center	Government	USA
Marcel Mandin	Mutual Propane LTD	Commercial / Industrial User	Canada
Miles Mailvaganam	Standards Individuals	General Interest	Canada
Peter Fraley	Wika Instrument Corp.	Producer	USA
Peter Layson	Applications Engineering Group Inc.	General Interest	USA
Richard Johnson	Thomas Associates	General Interest	USA
Jeff Prusko	UL Standards & Engagement	Project Manager – Non-voting	USA
John Wade	ULC Standards	STP Chair – Non-Voting	Canada

International Classification for Standards (ICS): 17.100, 75.180.99

For further information on UL standards, please contact:

Underwriters Laboratories Inc.
Phone: (613) 755-2729
E-mail: ULCStandards@ul.com
Web site: ulse.org

This Standard is intended to be used for conformity assessment.

The intended primary application of this standard is stated in its scope. It is important to note that it remains the responsibility of the user of the standard to judge its suitability for this particular application.

CETTE NORME NATIONALE DU CANADA EST DISPONIBLE EN VERSIONS FRANÇAISE ET ANGLAISE

INTRODUCTION

1 Scope

1.1 This Standard covers minimum requirements for indicating pressure gauges of the elastic element type.

1.2 Indicating pressure gauges include:

a) High pressure gauges employed in the high-pressure side of regulators or reducing valves used on compressed gas containers or cylinders of oxygen, hydrogen, nitrogen, and other gases usually have pressure ranges of 0 – 500, 0 – 1 000, 0 – 1 500, 0 – 2 000, 0 – 3 000, 0 – 4 000, 0 – 5 000, or 0 – 6 000 pounds per square inch (psi) (The related metric gauge ranges are approximately 0 – 3.4, 0 – 6.89, 0 – 10.34, 0 – 13.78, 0 – 20.68, 0 – 27.56, 0 – 34.47, or 0 – 41.36 MPa); and

b) Differential pressure gauges employed to measure the difference between two pressures with a maximum inlet pressure of 1 000 psig (6.89 MPa).

1.3 For requirements for gauges employed in the low side of regulators with ranges of 1 000 psig (6.89 MPa) or less, refer to the Standard for Compressed Gas Regulator Accessories, ANSI/CAN/UL/ULC 252A.

2 Components

2.1 Except as indicated in 2.2, a component of a product covered by this standard shall comply with the requirements for that component.

2.2 A component is not required to comply with a specific requirement that:

a) Involves a feature or characteristic not required in the application of the component in the product covered by this standard; or

b) Is superseded by a requirement in this standard.

2.3 A component shall be used in accordance with its rating established for the intended conditions of use.

2.4 Specific components are incomplete in construction features or restricted in performance capabilities. Such components are intended for use only under limited conditions, such as certain temperatures not exceeding specified limits, and shall be used only under those specific conditions.

3 Units of Measurement

3.1 Values stated without parentheses are the requirement. Values in parentheses are explanatory or approximate information.

4 Reference Publications

4.1 The documents shown below are referenced in the text of this Standard. Any undated reference to a code or standard appearing in the requirements of this Standard shall be interpreted as referring to the latest edition of that code or standard.

ANSI/AIAA G-095A, *Guide to Safety of Hydrogen and Hydrogen Systems*

ASME B31.12, *Hydrogen Piping and Pipelines*

ASTM F1459, *Standard Test Method for Determination of the Susceptibility of Metallic Materials to Hydrogen Gas Embrittlement (HGE)*

ASTM G142, *Standard Test Method for Determination of Susceptibility of Metals to Embrittlement in Hydrogen Containing Environments at High Pressure, High Temperature, or Both*

CSA/AM ANSI/CSA CHMC 1, *Test methods for evaluating material compatibility in compressed hydrogen applications – Metals*

CSA/AM ANSI/CSA CHMC 2, *Test methods for evaluating material compatibility in compressed hydrogen applications – Polymers*

ISO TR 15916, *Basic considerations for the safety of hydrogen systems*

ANSI/CAN/UL/ULC 252A, *Compressed Gas Regulator Accessories*

CONSTRUCTION

5 Sizes

5.1 The nominal size of a gauge shall be the inside diameter of the case in inches measured at the face of the dial.

5.2 The size of a gauge shall be not less than 1.25 in (31.75 mm).

6 Dials and Pointers

6.1 A dial shall be produced in a manner which will result in the dial having sharp lines for graduations and numerals.

6.2 A pointer used on a resettable gauge shall be provided with a removable lens so that it can be reset by the user without damage to the staff or pointer.

7 Windows

7.1 A window shall be a transparent component that closes the front of the case. It shall be heat-treated glass, laminated glass, plain glass (commercial, single, or double strength plate or sheet), or plastic.

8 Hydrogen Material

8.1 Materials in contact with hydrogen shall be resistant to the action hydrogen embrittlement and hydrogen accelerated fatigue. This shall include the surface finishing techniques (e.g., electro-polishing) and welding which may also introduce hydrogen into a metal, resulting in accelerated embrittlement.

8.2 Materials and design shall be such that there will be no significant change in the functioning of the device, deformation, or mechanical change in the device, and no harmful corrosion, deformation, or deterioration of the materials. Additional consideration shall be made for nonmetallic materials since hydrogen diffuses through these much easier than through metals.

8.3 Dissimilar metals in interconnecting piping, tubing, fittings, and other components shall be avoided, or properly addressed to prevent electrolytic and/or galvanic corrosion. Metal fittings should be compatible

with metal tubing materials. If the use of materials from different galvanic groups are used, standard commercial corrosion mitigation methods shall be used.

Note: A Technical Database for Hydrogen Compatibility of Materials may be found at Sandia National Laboratory Technical Reference for Hydrogen Compatibility of Materials. Additional guidance may be found in:

- AIAA G-095A, *Guide to Safety of Hydrogen and Hydrogen Systems*
- ASME B31.12, *Hydrogen Piping and Pipelines*
- CSA/AM ANSI/CSA CHMC 1, *Test methods for evaluating material compatibility in compressed hydrogen applications – Metals*
- CSA/AM CSA/ANSI CHMC 2, *Test methods for evaluating material compatibility in compressed hydrogen applications – Polymers*
- ISO TR 15916, Basic considerations for the safety of hydrogen systems

8.4 The manufacturer shall provide documentation verifying the materials' suitability for hydrogen service. Considerations shall be given for such characteristics as permeability, creep, long-term aging, stress cracking, and retention of mechanical properties as appropriate. Acceptable materials include stainless steels (304, 304L, 308, 316, 316L, 321, 347, PH17-7, or PH18-8), aluminum alloys, copper, and copper alloys. Unacceptable materials include nickel, most nickel alloys, titanium alloys, gray iron, ductile iron, and malleable cast iron.

8.5 When the manufacturer is unable to provide conclusive evidence of the compatibility of all materials in the hydrogen gas stream or does not use the acceptable materials listed in 8.4, then the embrittlement test shall be performed.

9 Graduations

9.1 The values of the minor, or smallest, graduations on the dial shall conform to those designated in Table 9.1.

Table 9.1
Value of graduations

Range,		Graduations,	
psi	(MPa)	psi	(kPa)
0 – 500	(0 – 3.44)	Any	(Any)
0 – 1000	(0 – 6.89)	Any	(Any)
0 – 1500	(0 – 10.34)	25 or 50	(172 or 345)
0 – 2000	(0 – 13.79)	50 or 100	(345 or 690)
0 – 3000 and above	(0 – 20.69 and above)	100 or 200	(690 or 1379)

PERFORMANCE

10 General

10.1 Representative samples of each size and pressure range of pressure gauges are to be subjected to the following tests.