



UL 144

STANDARD FOR SAFETY

LP-Gas Regulators

*UL COPYRIGHTED MATERIAL –
NOT AUTHORIZED FOR FURTHER REPRODUCTION OR
DISTRIBUTION WITHOUT PERMISSION FROM UL*



Documents
Document Sharing Hub

UL Standard for Safety for LP-Gas Regulators, UL 144

Eighth Edition, Dated May 25, 2012

Summary of Topics

This new edition of ANSI/UL 144 includes revisions to the construction requirements for overpressure protection and revisions to the overpressure shutoff (OPSO) feature tests.

The new and revised requirements are substantially in accordance with Proposal(s) on this subject dated December 2, 2011.

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system, or transmitted in any form by any means, electronic, mechanical photocopying, recording, or otherwise without prior permission of UL.

UL provides this Standard "as is" without warranty of any kind, either expressed or implied, including but not limited to, the implied warranties of merchantability or fitness for any purpose.

In no event will UL be liable for any special, incidental, consequential, indirect or similar damages, including loss of profits, lost savings, loss of data, or any other damages arising out of the use of or the inability to use this Standard, even if UL or an authorized UL representative has been advised of the possibility of such damage. In no event shall UL's liability for any damage ever exceed the price paid for this Standard, regardless of the form of the claim.

Users of the electronic versions of UL's Standards for Safety agree to defend, indemnify, and hold UL harmless from and against any loss, expense, liability, damage, claim, or judgment (including reasonable attorney's fees) resulting from any error or deviation introduced while purchaser is storing an electronic Standard on the purchaser's computer system.

The requirements in this Standard are now in effect, except for those paragraphs, sections, tables, figures, and/or other elements of the Standard having future effective dates as indicated in the note following the affected item. The prior text for requirements that have been revised and that have a future effective date are located after the Standard, and are preceded by a "SUPERSEDED REQUIREMENTS" notice.

No Text on This Page

*UL COPYRIGHTED MATERIAL –
NOT AUTHORIZED FOR FURTHER REPRODUCTION OR
DISTRIBUTION WITHOUT PERMISSION FROM UL*



Documents

Document Sharing Hub

MAY 25, 2012

1



ANSI/UL 144-2012

UL 144

Standard for LP-Gas Regulators

The First and Second editions were titled Pressure Regulators for LP-Gas. The Third through Sixth editions were titled Pressure Regulating Valves for LP-Gas.

First Edition – December, 1959

Second Edition – April, 1971

Third Edition – October, 1973

Fourth Edition – March, 1978

Fifth Edition – August, 1985

Sixth Edition – April, 1994

Seventh Edition – April, 1998

Eighth Edition

May 25, 2012

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

The most recent designation of ANSI/UL 144 as an American National Standard (ANSI) occurred on May 25, 2012. ANSI approval for a standard does not include the Cover Page, Transmittal Pages, Title Page, or effective date information.

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

UL's Standards for Safety are copyrighted by UL. Neither a printed nor electronic copy of a Standard should be altered in any way. All of UL's Standards and all copyrights, ownerships, and rights regarding those Standards shall remain the sole and exclusive property of UL.

COPYRIGHT © 2012 UNDERWRITERS LABORATORIES INC.

**UL COPYRIGHTED MATERIAL –
NOT AUTHORIZED FOR FURTHER REPRODUCTION OR
DISTRIBUTION WITHOUT PERMISSION FROM UL**



Documents

Document Sharing Hub

No Text on This Page

*UL COPYRIGHTED MATERIAL –
NOT AUTHORIZED FOR FURTHER REPRODUCTION OR
DISTRIBUTION WITHOUT PERMISSION FROM UL*



Documents

Document Sharing Hub

CONTENTS

INTRODUCTION

1 Scope	5
2 General	6
2.1 Units of measurement	6
2.2 Components	6
2.3 Undated references	6
2.4 Terminology	6
3 Glossary	7
4 Service Pressure and Temperature Ratings	8

CONSTRUCTION

5 Assembly	9
6 Materials	9
7 Bodies and Bonnets	11
8 Bonnet Vent Openings	12
9 Bonnet Caps	13
10 Springs	14
11 Diaphragms	14
12 Linkage Mechanisms	14
13 Hose Assemblies	14
14 Pressure-Regulating Adjustments	14
15 Regulator Overpressure Protection	15

PERFORMANCE

16 General	18
17 Deformation Test	19
18 Regulating Adjustment Test	20
19 Leakage and Strength of Mechanism Test	21
20 Changeover Leakage Test	21
21 Swivel Coupling Leakage Test	22
22 Excess Pressure Test	22
23 Strength of Body Test	23
24 Lock-Up Test	23
25 Flow Test	24
25.1 General	24
25.2 Test method	25
26 Pressure Relief Test	26
27 Type I Relief Flow Valve Capacity Test	26
28 Type II Relief Valve Flow Capacity Test	27
29 Overpressure Shutoff (OPSO) Feature Tests	27
29.1 General	27
29.2 Activation test	28
29.3 Leakage and strength test	30
29.4 OPSO feature endurance test	31
29.5 Repeated tests	34
30 Endurance Test	34
31 Service-Reserve Indicator Endurance Test	35

UL COPYRIGHTED MATERIAL –
NOT AUTHORIZED FOR FURTHER REPRODUCTION OR
DISTRIBUTION WITHOUT PERMISSION FROM  **Documents**
Document Sharing Hub

32 Service-Reserve Indicator Impact Test	35
33 Freezing Rain Test	35
34 10-Day Moist Ammonia-Air Stress Cracking Test	38
35 LP-Gas Compatibility Tests	38
36 Volume Change Test	38
37 Weight-Loss Test	39
38 Accelerated-Aging Test	39
39 Low Temperature Test	40

MANUFACTURING AND PRODUCTION TESTS

40 General	40
------------------	----

MARKING

41 General	40
------------------	----

.....

**UL COPYRIGHTED MATERIAL –
NOT AUTHORIZED FOR FURTHER REPRODUCTION OR
DISTRIBUTION WITHOUT PERMISSION FROM UL**



Documents
Document Sharing Hub

INTRODUCTION

1 Scope

1.1 These requirements cover pressure regulators for use with LP-Gas equipment.

1.2 Regulators covered by these requirements are intended for use in non-refrigerated systems in accordance with the following standards:

- a) Liquefied Petroleum Gas Code, (National Fire Codes, Vol. 2) NFPA 58;
- b) National Fuel Gas Code (IAS/A.G.A. Z223.1), NFPA 54;
- c) Outdoor Cooking Gas Appliances, IAS/A.G.A. Z21.58; and
- d) Standard on Recreational Vehicles (RVIAA119.2) (National Fire Codes, Vol. 7), NFPA 501C.

1.3 These requirements do not cover:

- a) Compressed gas regulators;
- b) Gas appliance pressure regulators;
- c) Regulators for use in chemical, petroleum, or utility power plants; pipeline or marine terminals; or related storage facilities at such plants or terminals;
- d) Combination gas control valves for gas appliances;
- e) Regulators for use in oxygen-fuel, gas-welding, and cutting operations; and
- f) Regulators for use in engine fuel (automotive and/or marine) applications.

The requirements for (a) – (e) are covered in the Standard for Compressed Gas Regulators, UL 252, and in the Standard for Gas Appliance Pressure Regulators, IAS/A.G.A. Z21.18, and in the Standard for Combination Gas Controls for Gas Appliances, IAS/A.G.A. Z21.78, respectively.

1.4 The assigning of flow ratings to regulators is not within the scope of these requirements, and observations of flow values are required to ascertain stability characteristics within the manufacturer's rated capacity. These requirements include tests to verify outlet pressure stability characteristics within the manufacturer's rated capacity. The manufacturer is to submit this data prior to the investigation of the device. See the Flow Test, Section 25, regarding the outlet pressure instability definition.

2 General

2.1 Units of measurement

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

2.2 Components

2.2.1 Except as indicated in 2.2.2, a component of a product covered by this standard shall comply with the requirements for that component.

2.2.2 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.

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

2.2.4 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.

2.3 Undated references

2.3.1 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.

2.4 Terminology

2.4.1 The term "regulator" as used in this standard refers to a device placed in a gas line for reducing, controlling, and maintaining the pressure in that portion of the piping system downstream of the device.

3 Glossary

3.1 For the purpose of this standard the following definitions apply.

3.2 **MANIFOLD, AUTOMATIC CHANGEOVER** – A unit that combines two high-pressure regulators into a single unit that is intended to be connected to the inlet of a second stage regulator. It incorporates two inlet connections with a single outlet connection, which is intended for use with dual or multiple cylinder installations. It incorporates a service-reserve indicator or provision for attachment of a service-reserve indicator. The manifold automatically changes the LP-Gas vapor withdrawal from the designated service cylinder to the designated reserve cylinder without interruption of service. A switching device is manually selected to alternate between the service and reserve cylinders.

3.3 **LOCKUP PRESSURE** – The outlet pressure of the regulator under no-flow conditions.

3.4 **OVERPRESSURE SHUTOFF (OPSO) FEATURE** – A feature that shuts off the flow of LP-Gas vapor when the outlet pressure of the regulator reaches a predetermined maximum pressure.

3.5 **REGULATOR, AUTOMATIC CHANGEOVER** – An integral two stage regulator that combines two high pressure regulators and a second stage regulator into a single unit. It incorporates two inlet connections that is designed for use with dual or multiple cylinder installations. The system automatically changes the LP-Gas vapor withdrawal from the designated service cylinder(s) to the designated reserve cylinder(s) without interruption of service. It incorporates a service-reserve indicator or provision for attachment of a service-reserve indicator. The service-reserve indicator gives a visual indication of the cylinder(s) that are supplying the system. A switching device is manually selected to alternate between the service and reserve cylinders.

3.6 **REGULATOR, FIRST-STAGE** – A type of high-pressure regulator for LP-Gas vapor service designed to reduce pressure from the container to a nominal pressure of 2 – 10 psig (13.7 – 68.7 kPa).

3.7 **REGULATOR FLOW CAPACITY** – The maximum flow rate of a regulator at conditions as specified by the manufacturer, usually given in units of BTU/hr and which is based upon factory setting of inlet and outlet (delivery) pressures.

3.8 **REGULATOR, HIGH-PRESSURE** – A pressure regulator for LP-Gas liquid or vapor service designed to reduce pressure from the container to a lower pressure in excess of 1.0 psig (6.9 kPa).

3.9 **REGULATOR, INTEGRAL TWO-STAGE** – A pressure regulator that combines a high pressure regulator and a second-stage regulator into a single unit.

3.10 **REGULATOR, MANUAL CHANGEOVER** – A single stage regulator with a manifold that contains two inlets that allow LP-Gas to flow from one inlet or the other using a handle or lever through the single stage regulator to the gas consuming equipment. It is designed to be used with two LP-Gas containers. When the supply is exhausted from one container, the lever or handle must be manually moved to allow LP-Gas to flow from the second container.

3.11 **REGULATOR, SECOND-STAGE** – A pressure regulator for LP-Gas vapor service designed to reduce first-stage regulator outlet pressure to a pressure equal to or less than 14 inch (356 mm) water column [nominal 11 inch (279 mm) water column].

3.12 **REGULATOR, SINGLE-STAGE** – A pressure regulator for LP-Gas vapor service designed to reduce pressure from the container to a pressure of 1 psig (6.9 kPa) or less [nominal 11 inch (279 mm) water column].

3.13 REGULATOR, SPECIAL-PURPOSE HIGH PRESSURE – A pressure regulator for LP-Gas designed to reduce the prevailing cylinder, tank or other pressure in excess of 1 psig (6.9 kPa) to a lower pressure. This regulator is not intended for installation in two-stage piping systems that serve 1/2 psi appliance systems.

3.14 REGULATOR, SPECIAL-PURPOSE LOW PRESSURE – A pressure regulator for LP-Gas vapor service designed to reduce high pressure or first stage regulator outlet pressure to a maximum pressure of 1 psig (6.9 kPa) or less. This regulator is not intended for installation in two-stage piping systems that serve 1/2 psi appliance systems.

3.15 REGULATOR, TWO PSIG SERVICE – A type of regulator for LP-Gas vapor service designed to reduce first-stage regulator outlet pressure to a pressure of 2.5 psig (17.2 kPa) or less [nominal 2 psig (13.8 kPa)].

3.16 REGULATOR, INTEGRAL TWO PSIG SERVICE – A pressure regulator that combines a high pressure regulator and a two psig service regulator into a single unit.

3.17 SERVICE-RESERVE INDICATOR – A device that gives a visual indication when the regulator system has switched from the designated “service” cylinder to the designated “reserve” cylinder.

3.18 VALVE, TYPE I RELIEF – A valve that is constructed to relieve pressure resulting from seat leakage due to the inability of the seat mechanism to achieve lock-up.

3.19 VALVE, TYPE II RELIEF – A valve that has a start-to-discharge setting in accordance with Table 15.1 and is constructed to limit regulator outlet pressure to 2 psig (13.8 kPa) [for second-stage, integral two-stage and automatic changeover regulators when used as part of a two-stage regulator system] or 5 psig (34.9 kPa) [for two psig service and integral two psig service regulators when used as part of a 2 psig regulator system] when tested in accordance with the Type II Relief Valve Flow Capacity Test, Section 28.

4 Service Pressure and Temperature Ratings

4.1 The maximum inlet pressure rating of a single-stage, first-stage, high-pressure, integral two-stage, or integral two psig service regulator shall not be less than 250 psig (1.7 MPa).

4.2 The maximum inlet pressure rating for a second-stage or two psig service regulator shall be 10 psig (68.7 kPa).

4.3 Regulators covered by these requirements shall be capable of being used when exposed to ambient temperatures within the range of minus 40°C – plus 55°C (minus 40°F – plus 130°F).

CONSTRUCTION

5 Assembly

5.1 A regulator shall include all the components required for its intended function. The components shall be planned for assembly as a unit.

5.2 A regulator that is designed for field adjustment shall be provided with convenient means of adjustment.

Exception: A regulator for portable equipment is not required to be adjustable.

5.3 A screw, bolt, or lever-pin hole shall not extend through the outer wall of the regulator body into a gas-handling chamber unless closed by a threaded plug or that which is determined to be the equivalent to prevent leakage of gas.

5.4 A valve seat or disc shall be attached to its holder by a method that does not permit the disc to loosen and work out of position when tested in accordance with the requirements in the Leakage and Strength of Mechanism Test, Section 19, and the Endurance Test, Section 30.

5.5 A holder and disc assembly shall be constructed to preclude the trapping of air or gas in back of the disc that expands and forces the disc out of its position in the holder.

5.6 A regulator having an external adjusting screw shall be constructed so that turning the screw clockwise will increase the regulator outlet pressure. See the Exception to 14.1.

5.7 A means to determine the outlet pressure of the high pressure regulator portion in an integral two-stage or integral two psig service regulator shall be provided.

5.8 Automatic Changeover Manifolds and Automatic Changeover Regulators shall incorporate a service-reserve indicator, or provision for attachment of a service-reserve indicator.

6 Materials

6.1 A part of a regulator in contact with LP-Gas shall be resistant to the action of the fluid under the service conditions to which it is subjected.

6.2 With reference to the requirement in 6.1, elastomeric materials are to be subjected to the LP-Gas Compatibility Test, Section 35; the Accelerated-Aging Test, Section 38; and the Low Temperature Test, Section 39. Polymeric materials are to be subjected to the LP-Gas Compatibility Test, Section 35, and the Accelerated-Aging Test, Section 38.

Exception: Acetal polymers, chlorotrifluoroethylene polymers, tetrafluoroethylene, fluorinated ethylene propylene polymers, and polyamides of composition polyhexamethylene adipamide or polycaprolactam polymers (nylon 6, 6/6, or 6/16) are only to be subjected to the Accelerated-Aging Test, Section 38.

6.3 When corrosion of a part interferes with the function of the regulator or corrosion results in deterioration, the part shall be of a corrosion-resistant material or be provided with a corrosion-resistant protective coating.

6.4 A protective coating shall provide resistance against corrosion to a degree not less than that provided by the protective coatings specified in 6.5.

6.5 Cadmium plating shall be minimum 0.0003 inch (0.0076 mm) thick, and zinc plating shall be minimum 0.0005 inch (0.013 mm) thick.

Exception: When threads constitute the major portion of the area of a part, the thickness of the cadmium or zinc plating shall be minimum 0.00015 inch (0.0038 mm) thick.

6.6 The body and bonnet of a regulator shall be made of one of the materials specified in (a) – (g), or of a specification that has been determined to be the equivalent. A nonmetallic material shall not be used for the body or bonnet of a regulator.

- a) Aluminum alloys, as specified in Standard Specification for Aluminum-Alloy Sand Castings, ASTM B26/B26M; Standard Specification for Aluminum-Alloy Die Castings; ASTM B85, Standard Specification for Aluminum or Aluminum-Alloy Bar, Rod, and Wire; ASTM B211, or Standard Specification for Aluminum-Alloy Permanent Mold Castings, ASTM B108.
- b) Ductile (nodular) iron as specified in the Standard Specification for Ferritic Ductile Iron Pressure-Retaining Castings for Use at Elevated Temperatures, ASTM A395, or Grade 60-40-18 or 65-45-12 as specified in the Standard Specification for Ductile Iron Castings, ASTM A536.
- c) Malleable iron as specified in the Standard Specification for Ferritic Malleable Iron Castings, ASTM A47.
- d) High-strength Gray Iron Class 40B as specified in the Standard Specification for Gray Iron Castings, ASTM A48.
- e) Copper alloys complying with Standard Specification for Copper and Copper Alloy Forging Rod, Bar, and Shapes, ASTM B124; Standard Specification for Steam or Valve Bronze Castings, ASTM B61; Standard Specification for Composition Bronze or Ounce Metal Castings, ASTM B62; Standard Specification for Copper-Alloy Die Castings, ASTM B176; Standard Specification for Copper and Copper-Alloy Die Forgings (Hot-Pressed), ASTM B283; Standard Specification for Copper Alloy Sand Castings for General Applications, ASTM B584 or Standard Specification for Free-Cutting Brass Rod, Bar and Shapes for Use in Screw Machines; ASTM B16.
- f) Steel.
- g) Zinc alloys AG 40A, AG 40B, AC 41A, or AC 43A as specified in the Standard Specification for Zinc-Alloy Die Castings, ASTM B86.

6.7 A body of a service-reserve indicator shall comply with 6.6. A non pressurized service-reserve indicator housing or cap is permitted to be constructed of non-metallic materials.

7 Bodies and Bonnets

7.1 A body and a bonnet of regulators and manifolds shall withstand the stresses of connecting the regulator to piping, as well as other stresses imposed by service conditions, without developing leakage at joints, permanent deformation, or other damage which impairs the serviceability of the regulator. See the Deformation Test, Section 17, the Strength of Body Test, Section 23, and the Endurance Test, Section 30.

7.2 A body of a service indicator shall withstand the stresses of connecting the indicator to piping or tubing. See the Deformation Test, Section 17, and Service-Reserve Indicator Endurance Test, Section 32.

7.3 A flange of a body and a bonnet of a regulator or manifold constructed to be clamped together shall withstand the stresses imposed by normal tightening of the clamping screws or bolts. Clamping screws or bolts shall be spaced close to preclude the necessity of using excessive force in tightening to obtain joints tight against leakage. See the Leakage and Strength of Mechanism Test, Section 19, and the Strength of Body Test, Section 23.

7.4 When warping of a casting affects the tightness of fluid-confining joints or the required fit of parts, the casting shall be stress-relieved to reduce the risk of warping.

7.5 The inlet of a regulator shall conform to one of the following:

- a) CGA No. 510 or 600 fitting in accordance with the Standard for Compressed Gas Cylinder Valve Outlet and Inlet Connections, CGA V-1;
- b) Standard for Pipe Threads, General Purpose (Inch), ANSI/ASME B1.20.1;
- c) Automotive Tube Fittings, SAE J512;
- d) Cast Copper Alloy Fittings for Flared Copper Tubes, ANSI/ASME B16.26; or
- e) A CGA No. 791 or 810 appliance portion of the cylinder connection device in accordance with the Standard for Adapters and Cylinder Connection Devices for Portable LP-Gas Cylinder Assemblies, UL 2061 or the Standard for Cylinder Connection Devices, ANSI Z21.81 and described in Compressed Gas Association V-1, Standard for Compressed Gas Cylinder Valve Outlet and Inlet Connections. If the Type CGA 791 inlet connection is integral with the regulator body so that the connection cannot be removed in service, the flow limiting device as required by UL 2061 is allowed to be part of the regulator construction, complying with material requirements of this standard. The performance of the inlet connection-regulator combination shall be in accordance with UL 2061 and this standard.

Exception: The regulator is not prohibited from being provided with an inlet connection other than those previously described, when it is marked in accordance with 41.1(i).