CGA

Compressed Gas Association

The Standard For Safety Since 1913

CGA G-5—2017

HYDROGEN

EIGHTH EDITION

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Hydrogen Technology Committee

NOTE—Technical changes from the previous edition are underlined.

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1 Introduction

This publication is one of a series written by the Compressed Gas Association, Inc. (CGA) to provide information on the production, transportation, handling, and storage of compressed gases, cryogenic liquids, and related products.

2 Scope

This publication provides information on the physical and chemical properties of hydrogen and proper handling and use. It is intended to provide background information for personnel involved in the manufacture, distribution, and use of hydrogen. Additional technical information can be obtained from hydrogen gas manufacturers.

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.

4 General Information

4.1 Physical and chemical properties of gaseous hydrogen

Gaseous hydrogen is a colorless, odorless, tasteless, flammable, nontoxic gas. It is the lightest of all gases, having a specific gravity of 0.0696. The hydrogen content of atmospheric air at sea level is 0.5 ppm.

Gaseous hydrogen has two isomers (forms): ortho-hydrogen, in which the two atomic nuclei spin in the same direction and para-hydrogen, in which the two atomic nuclei spin in opposite directions. There are no differences in the chemical properties of the two forms of gaseous hydrogen, but there are slight differences in their physical properties. Gaseous hydrogen is a mixture of 75% ortho-hydrogen and 25% para-hydrogen at room temperature. Gaseous hydrogen is also called normal hydrogen.

Gaseous hydrogen is a flammable gas that burns with an almost invisible bluish flame. The flame is so pale in daylight that a person can feel heat or even be burned by hydrogen that was accidentally ignited without ever having seen a flame.

The flammability limits of gaseous hydrogen in air at atmospheric pressure are 4% to 75%, and the minimum autoignition temperature is 1050 °F (566 °C). The flammability limits of gaseous hydrogen in oxygen range from 4.6% to 93.9%, and the minimum autoignition temperature is 1074 °F (579 °C). When handling gaseous hydrogen, personnel shall observe all the precautions necessary for the safe handling of a flammable gas. The minimum ignition energy of gaseous hydrogen is 0.02 millijoule, which is an order of magnitude less than the ignition