



CGA V-7.1—2021 STANDARD METHOD OF DETERMINING CYLINDER VALVE OUTLET CONNECTIONS FOR MEDICAL GASES

THIRD EDITION

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NOTE—Technical changes from the previous edition are underlined.

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

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1 Introduction

CGA V-1, *Standard for Compressed Gas Cylinder Valve Outlet and Inlet Connections* includes valve outlet connections for more than 175 different pure gases and chemicals but includes only a few gas mixtures that have a history of commercial or medical importance for which standards were in demand [1].¹

In response to the increase in the number of industrial gas mixtures, CGA published CGA V-7, *Standard Method of Determining Cylinder Valve Outlet Connections for Industrial Gas Mixtures* [2]. CGA V-7 excludes medical gas mixtures.

Medical gases are given special treatment because of their applications involving medical patients. CGA determined that a method of selecting cylinder valve outlet connections for medical gases would help manufacturers of medical gases and medical equipment select appropriate connections for new medical gases and use existing connection assignments better. This method addresses known potential hazards to the user or the patient caused by inappropriate connections. If a medical gas equipment or medical gas manufacturer believes the existing connection assignment does not adequately address safety requirements, that manufacturer shall request a new connection assignment from CGA as detailed in CGA V-1 [1].

Where used in this standard, the term medical gases shall mean compressed gases in cylinders that are labeled as either drugs or medical devices, including gas mixtures. The definition of drugs and medical devices as it relates to these gases shall be that as promulgated by the Food and Drug Administration (FDA) in the United States and by the Health Canada Therapeutic Products Programme in Canada.

2 Scope and Purpose

2.1 Scope

This standard applies to the selection of an appropriate cylinder valve outlet connection for medical gases for pressures up to 3000 psi (20 680 kPa) at 70 °F (21.1 °C).² It does not apply to industrial gas mixtures, cylinders manifolded in transport and use, or to mixtures at higher pressures. Both threaded and pin-indexed connection assignments are included with reference to V-1 [1].

This revision replaces the use of limited standards with alternate standards for the purpose of assuring only one connection assignment will be appropriate. This revision brings consistency with ISO 407:2004, *Small medical gas cylinders—Pin-index yoke-type valve connections*, to standardize pin-indexed yoke-type valve connections globally [4].

2.2 Purpose

The purpose of this standard is to establish a procedure for selecting the appropriate cylinder valve outlet connection for medical gases. It does not attempt to identify which medical gases may be safely manufactured nor indicate that the connection is safe or effective for any medical procedure. It is the responsibility of the manufacturer, the medical community, and appropriate regulatory bodies to make those decisions.

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.

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, *Guideline for Metric Practice in the Compressed Gas Industry* [3].

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 Alternate standard**

Connection currently used that will be phased out and replaced by the standard connection within 5 years of May 12, 2021, unless otherwise stated.

3.2.2 Limited standard

Connection that is limited to the particular application as described in CGA V-1 [1].

3.2.3 Pin-indexed

Nonthreaded type of connection to the valve outlet where noninterchangeability among connections is maintained by using a series of blind holes in the valve and matching pins in the connecting part.

3.2.4 Standard connection

Connection recommended for a particular gas or gases.

4 Description of the method

The method described here shall be used in conjunction with the current edition of CGA V-1 and when appropriate, ISO 407:2004 [1, 4]. Drawings and specifications for all of the connection numbers referred to in this standard are found in CGA V-1 or ISO 407:2004 [1, 4]. Pin-index connections utilizing a double row of pins in ISO 407:2004 are assigned pin positions with letter designations. Appendix C provides corresponding pin positions utilized in CGA V-1 [1].

The method differentiates medical gases based on their physical properties (e.g., flammable, oxidizing, and toxic component levels) and then can be further differentiated based on the medical gases' intended use. Connection assignments are grouped into six categories based upon these criteria.

The selection flow diagram in Appendix A or the answers to the series of questions in Appendix B are used to determine the correct category and the recommended connection(s) for a particular gas or gas mixture.

Existing assignments that have been reassigned are presented as alternate standards in order to avoid immediately retrofitting existing equipment or designing newer device models that are compatible with existing units on the market.

5 Principles for connection assignment selection**5.1 Single medical gases assigned connections in CGA V-1**

For single gases (such as oxygen, nitrogen, helium, etc.) or air, the current connection assignment given in CGA V-1 is to be used [1]. This retains the policy of not differentiating between industrial and medical “pure” gases. However, it should be noted that the pin-index assignments in CGA V-1 are intended to be used for medical gases only [1].

5.2 Single medical gases not assigned a connection in CGA V-1 or medical gas mixtures

If a pin-indexed connection is not listed in CGA V-1 for the single gas or if the gas in question is a mixture, then the answers to the series of questions would determine which of the following six groupings best addresses the properties and in some instances the labeled intended use of the gas or gas mixture [1].

NOTE—Mixture concentrations are nominal values, normal mixture tolerances are allowed.

5.2.1 Group A

Group A consists of gases that contain oxygen greater than or equal to 20% and have no flammable components, no toxic components, and only contains one of the following:

- carbon dioxide less than or equal to 7%, with a new sub-group for carbon dioxide and oxygen mixtures that are labeled specifically for neurological therapy and contain carbon dioxide, greater than or equal to 4.9% and less than or equal to 5.2%;
- helium less than or equal to 80%;
- xenon less than or equal to 80%;
- nitrogen and oxygen mixtures containing oxygen greater than 23.5%; or
- nitrous oxide and oxygen mixtures containing nitrous oxide greater than or equal to 47.5% and less than or equal to 52.5%.

Group A excludes medical air and those labeled blood gas mixtures or lung diffusion mixtures.

These mixtures have historically had therapeutic use or in some cases short duration diagnostic use. The connections used for gases in this category are a CGA 280 standard threaded outlet connection or standard pin-indexed connections based on the specific gases, and the concentration of those specific gases in the gas mixture.

A CGA 280 standard threaded outlet connection for medical mixtures is currently and has historically been (unless noted) assigned to this group are:

- carbon dioxide and oxygen mixtures (CO_2 less than or equal to 7%);
- helium and oxygen mixtures (He less than or equal to 80%);
- nitrogen and oxygen mixtures (O_2 greater than 23.5%);
- nitrous oxide and oxygen mixture (N_2O 47.5% to 52.5%); and
- xenon and oxygen mixtures (O_2 greater than or equal to 20%).

CGA 880 standard pin-indexed connection is now and has historically been assigned to medical mixtures of carbon dioxide and oxygen mixtures (where the carbon dioxide content is less than 7%) unless the mixture is labeled and specifically intended for neurological therapy and contains carbon dioxide from 4.9% to 5.2%, in which case the mixture is assigned to a CGA 989 standard pin-indexed connection.

CGA 890 standard pin-indexed connection is currently and has historically been assigned to medical mixtures of:

- helium and oxygen mixtures (He less than or equal to 80%);
- nitrogen and oxygen mixtures (O_2 greater than 23.5%); and
- xenon and oxygen mixtures (O_2 greater than or equal to 20%).

CGA 965 standard pin-indexed connection is currently and has historically been assigned to medical nitrous oxide and oxygen mixtures (N_2O 47.5% to 52.5%).