

CGA V-6—2014

**STANDARD BULK
REFRIGERATED LIQUID
TRANSFER CONNECTIONS**

SIXTH 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 13-008
Bulk Distribution Equipment and Standards Committee

NOTE—Technical changes from the previous edition are underlined.

SIXTH EDITION: 2014
FIFTH EDITION: 2008
FOURTH EDITION: 2000
THIRD EDITION: 1993

© 2014 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., 14501 George Carter Way, Suite 103, Chantilly VA 20151. You may not alter or remove any trademark, copyright or other notice from this work.

Contents	Page
1 Introduction.....	1
2 Scope and purpose	1
2.1 Scope	1
2.2 Purpose	2
3 Definitions.....	2
3.1 Publication terminology	2
3.2 Technical definitions	2
4 Standard connection components.....	2
4.1 Nut.....	2
4.2 Headpiece	3
4.3 Fixed end.....	3
4.4 Gasket	3
4.5 O-ring.....	3
5 Design considerations	3
5.1 Prevention of cross connection	3
5.2 Sizes and functions of connections	3
5.3 Materials of construction.....	4
5.4 Pressure rating	4
5.5 Marking.....	4
5.6 Use of adapters in product transfers	4
5.7 Lugs on nut.....	4
5.8 Headpiece protection	4
5.9 Cleaning	4
6 References	5
7 Additional References	5

Table

Table 1—Assignment of standard connections.....	1
---	---

Appendices

Appendix A—Standard connections	6
Appendix B—Obsolete/limited standard connections	23

Appendices Tables

Table A-1—Letter code description for dimensions on drawings of standard connections.....	6
Table B-1—Letter code description for dimensions on drawings of obsolete/limited standard connections.....	23

1 Introduction

Before the design and evolution of standard connections, each company involved in liquid transport used a variety of proprietary connections. CGA member companies recognized a need for development of a standardized fittings system and selected specific designs for evaluation.

Prototypes were produced for testing starting in 1972. Tests were then conducted to ensure that connections could be made to prototypes submitted by each of the companies and could not be connected to fittings for products other than those intended. A one-year test was carried out in specific geographical areas where interfaces between the existing and proposed standard fittings were least likely. The results of this test program were deemed successful.

2 Scope and purpose

2.1 Scope

Liquid and vapor transfer connections for the industrial gases listed in Table 1 are specified in this standard and in Appendix A. An obsolete/limited standard flanged connection system for oxygen, nitrogen, and argon is also specified in Appendix B. The specified connections are intended for use with liquid transport equipment, such as: cargo tanks, portable tanks, and railway tank cars, but do not apply to barges and marine tankers. Termination points at liquid production plants and on stationary storage vessels that directly interface with this transport equipment are also included. The connections in this standard are intended for use exclusively with the specified products. These connections are not intended for use on uninsulated or insulated (DOT 4L) cylinders, tubes, or on small equipment using connections less than 1 in (25 mm). The physical design of the fittings, other than the connection configuration at the coupling point, is also beyond the scope of this standard.

Specialized vacuum-jacketed bayonet connections, which are required for some cryogenic products, are not included in this standard.

Table 1—Assignment of standard connections

Product	Size		Standard connection number
	in	mm	
Argon	1-1/2	38	AR-15
	2-1/2	64	AR-25
Carbon Dioxide	1	25	CO ₂ -10
	1-1/2	38	CO ₂ -15
	2	51	CO ₂ -20
	3	76	CO ₂ -30
	4	102	CO ₂ -40
Liquefied natural gas (LNG)	3	76	LNG-30
Nitrogen	1-1/2	38	NI-15
	2-1/2	64	NI-25
	3	76	NI-30
Nitrous oxide	1	25	N ₂ O-10
	1-1/2	38	N ₂ O-15
Oxygen	1-1/2	38	OX-15
	2	51	OX-20
	3	76	OX-30

2.2 Purpose

Before the adoption of the standard connection, companies involved in the transport of industrial gases used a variety of proprietary connections. This standard has been developed to offer standard transfer connections that provide mechanical protection for product integrity to decrease possible incidents from product transfill errors at transport equipment loading and unloading stations. Also, using industry standard connections eliminates the need for adapters.

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. Shall 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

Indicate 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 Cryogenic liquid

Refrigerated liquefied gas having a boiling point colder than -130°F at 14.7 psia (-90°C at 101.3 kPa, abs).^{1, 2}

3.2.2 Maximum allowable working pressure (MAWP)

Highest allowable pressure the connection can be subjected to, including pressure resulting from the action of pumps or other transfer means.

3.2.3 Obsolete/limited standard connections

Are no longer commonly used but are considered acceptable. These connections were intended primarily as a transfer connection for transport unloading into stationary storage containers.

3.2.4 Standard connections

Include the size, placement, and profile of threads and the design, configuration, and location with respect to threads of portions of the fittings intended to provide the pressure seal when in use. Dust cover, plug, or blind flange, associated piping and hose or other appurtenances are not included.

4 Standard connection components

4.1 Nut

This component is the female portion of the fitting and is generally attached to the product transfer hose.

¹ 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, *Metric Practice Guide for the Compressed Gas Industry* [1].

² References are shown by bracketed numbers and are listed in order of appearance in the reference section.

4.2 Headpiece

The nut is designed to swivel on the headpiece. One end of the headpiece is rigidly affixed, typically to the product transfer hose; the other end forms the pressure sealing surface.

4.3 Fixed end

The fixed end is the male portion of the fitting and is rigidly attached generally to the transport, stationary container or product loading station. It is intended as a connection point for the product transfer hose.

4.4 Gasket

The gasket, where required, is designed to fit within a cavity of the fixed end to form a pressure tight seal with the headpiece. Specific gasket design may vary. Gaskets should be manufactured from oxygen compatible material.

4.5 O-ring

A sealing O-ring is optional in the carbon dioxide 2-in (51 mm), 3-in (76 mm), and 4-in (102 mm) size union seat, but is suggested for use with railcars. The O-ring material shall be compatible with the product.

5 Design considerations

5.1 Prevention of cross connection

This connection standard uses varying threads, sealing surfaces, and positions with respect to the thread location to prevent the cross coupling of dissimilar products. Acme threads of a specific diameter have been specified for each size. In addition to these distinctions, left hand threads are reserved for flammable products, right hand threads are to be used for inert and oxidizing products.

5.2 Sizes and functions of connections

The size of the connection is based on the internal bore of the fixed end for the standard connections.

Nitrogen, oxygen, and argon:

- The 1-1/4 in (32 mm) or 1-1/2 in (38 mm) size is primarily intended for use as cargo and portable tank connections for unloading to storage containers at product usage locations; and
- The 2 in (51 mm), 2-1/2 in (64 mm), or 3 in (76 mm) size is primarily intended for use as loading connections for cargo and portable tanks at production facilities and as connections for railway tank cars.

Carbon dioxide:

- The 1 in (25 mm) size is primarily intended for the vapor return connection for storage containers;
- The 1-1/2 in (38 mm) size is primarily intended for the liquid supply connection for storage containers;
- The 2 in (51 mm) size is primarily intended for liquid supply connections; and
- The 3 in and 4 in (76 mm and 102 mm) is primarily intended for higher flow liquid supply connections.

Nitrous oxide:

- The 1 in (25 mm) size is primarily intended for the vapor return connection for storage containers; and
- The 1-1/2 in (38 mm) size is primarily intended for the liquid supply connection for storage containers.

5.3 Materials of construction

The materials of construction shall be compatible with the product and of sufficient strength to withstand the anticipated transfer pressures and temperatures:

- Nitrogen, oxygen, argon, and LNG shall be rated for -320°F (-196°C); and
- Carbon dioxide and nitrous oxide shall be rated for -130°F (-90°C).

Appropriate materials include, but are not limited to, stainless steel, brass, and copper alloys.

5.4 Pressure rating

The connection shall be rated by the manufacturer for a pressure coincident with the designated service. The bursting pressure of these transfer connections shall not be less than four times the design pressure of the tank or four times the highest pressure to which it can be subjected in service by the action of the pump or other device.

In Canada, connections used on stationary storage vessels should be registered as fittings in accordance with CSA B51, *Boiler, Pressure Vessel and Pressure Piping Code* [2].

5.5 Marking

The product, size, and maximum allowable working pressure (MAWP) shall be permanently identified on the connection fixed end and nut.

5.6 Use of adapters in product transfers

Adapters to make connections between standard or obsolete/limited standard connections are permitted for transfer of the same fluids.

Adapters to make connections for different products, not limited to products discussed in this standard, are considered hazardous and their use is discouraged.

This standard does not recognize the use of adapters between connections for different fluids except for specific requirements, such as purging in maintenance operations.

5.7 Lugs on nut

The lug dimensions are not indicated in this standard's drawings. Lugs are intended to be struck with a hammer or similar device. The manufacturer will size the lugs so the fitting will not be over torqued when struck with a reasonable hammer blow. Carbon dioxide and nitrous oxide, 1 in (25 mm), 1-1/2 in (38 mm), and 2 in (51 mm) connections do not have lugs.

5.8 Headpiece protection

The nut on carbon dioxide and nitrous oxide fittings can slip back to expose the seating surface to possible damage. Therefore, consideration should be given by providing means to restrain the nut through the use of a snap ring or other device.

5.9 Cleaning

The components shall be cleaned to meet the appropriate level of service. Oxygen and nitrous oxide shall be cleaned for oxygen service per CGA G-4.1, *Cleaning Equipment for Oxygen Service* [3].

Caps and plugs, attached with chains, are strongly recommended for all hoses and connections to keep them dry and clean when not in use.

6 References

Unless otherwise specified, the latest edition shall apply.

[1] CGA P-11, *Metric Practice Guide for the Compressed Gas Industry*, Compressed Gas Association, Inc., 14501 George Carter Way, Suite 103, Chantilly, VA 20151. www.cganet.com

[2] CSA B51, *Boiler, Pressure Vessel, and Pressure Piping Code*, Canadian Standards Association, 5060 Spectrum Way, Mississauga, ON L4W 5N6, Canada. <http://shop.csa.ca>

[3] CGA G-4.1, *Cleaning Equipment for Oxygen Service*, Compressed Gas Association, Inc., 14501 George Carter Way, Suite 103, Chantilly, VA 20151. www.cganet.com

7 Additional References

ASME B1.1-2003, *Unified Inch Screw Threads (UN and UNR Thread Form)*, American Society of Mechanical Engineers International, Two Park Ave., New York, NY 10016. www.asme.org

ASME B1.5-1997 (Published 1999), *Acme Screw Threads*, American Society of Mechanical Engineers International, Two Park Ave., New York, NY 10016. www.asme.org

ASME B1.8-1988 (Reaffirmed 1994), *Stub Acme Screw Threads* American Society of Mechanical Engineers International, Two Park Ave., New York, NY 10016. www.asme.org

ASME B31.3-2012, *Process Piping*, American Society of Mechanical Engineers International, Two Park Ave., New York, NY 10016. www.asme.org