

# CONNECTIONS FOR TRANSPORTABLE AND STATIC BULK STORAGE TANKS

AIGA 024/05

Asia Industrial Gases Association

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# CONNECTIONS FOR TRANSPORTABLE AND STATIC BULK STORAGE TANKS

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# 1 Introduction

In many Asian countries, there are no clear standards for product inlet/outlet connections for transportable and static storage vessels for bulk liquefied and compressed gases. The prevalence of large numbers of alternative connections within the industry and the consequent dependence on adaptors to connect between them is regarded as being potentially hazardous. Hence there is a high risk of the wrong product(s) being introduced to the consumer's supply system.

The hazards associated with connecting the wrong products to the consumer's supply system include loss of production, property damage and injury to personnel.

There is a need for standardization of the product connections for bulk liquefied and compressed gases to eliminate filling errors at source and the incorrect product delivery to the consumer's supply systems.

Adoption of these standards should mitigate the risks associated with filling transportable equipment and or static tanks with the incorrect product and also minimize the need for using adapters.

#### 2 Scope

This document is pertinent to connections associated with the filling and discharge of transportable and static storage vessels for bulk liquefied and compressed gases.

It applies specifically to the following list of gases for industrial and medical applications

Liquefied oxygen Liquefied nitrogen Liquefied argon Liquefied carbon dioxide Bulk gaseous hydrogen Bulk gaseous helium

#### 3 Definitions

Adaptor :	A device enabling two different yet acceptable CONNECTIONS for the SAME PRODUCT (See Table 1, 2 and 3) to be coupled for product transfer.
Connection :	A recognized standard device and its mating device that discriminate between products defined in the scope of this document and typically mounted on the inlets/outlets of a transportable and static storage vessel(s) and or their transfer hoses.
Pressure :	In this document, bar shall indicate gauge pressure unless otherwise
	noted, i.e. (bar, abs) for absolute pressure and (bar, dif) for differential pressure.
Shall :	The use of the word "shall" in this document implies a very strong concern or instruction.
Should :	The use of the word "should" in this document indicates a recommendation.
Static storage vessel :	Static storage vessels are designed to be mounted on foundation typically at production and consumer sites.

Transportable storage vessel(s):	Transportable storage vessel(s) are designed with a permanent chassis or designed to be transported on a chassis such as an ISO frame. Multiple vessels may be mounted on a single chassis.
Transfer Hose :	Transfer hoses may be considered as an extension to the transportable or static storage vessel connections. They may also be considered as adaptors provided they meet the intent as per the definition.

#### 4 Connections

#### 4.1 Guidelines for connection selection

- Connections must discriminate and thus be product specific and must not be in conflict. "In conflict" meaning that the same connection is used for dissimilar products by different suppliers or in different geographic regions.
- Connections must be constructed of material compatible with the product service.
- Connections must be of reliable design and construction to eliminate failure during product transfer. Connections should be designed so that they cannot be modified easily to accommodate the transferring of other product.

#### 4.2 Acceptable standard connections

### 4.2.1 Liquefied oxygen, nitrogen and argon

Based on a survey of the connections in use in Asia and on the guidelines in this document, the following 3 categories of connections are classified as the **ACCEPTABLE STANDARD CONNECTIONS** for continued use.

- CGA ACME threaded type
- Indexed plate type
- Ramped bayonet claw type

It is further recommended that the national gas associations adopt a single connection standard from those listed above giving priority to fill connections for transportable storage vessels.

Product	Туре	Connection No. / size	Appendix No.
Liquefied argon	CGA	AR-15 (1 ½")	A
		AR-25 (2 ½")	В
	Index plate	DN-40-LAR (40 mm)	K(i),K(iv), K(v), K(vi)
	Ramped bayonet claw	1.25" RH (1 ¼")	L
Liquefied	CGA	NI-15 (1 ½")	С
nitrogen		NI-25 (2 ½")	D
	Index plate	DN-40-LIN (40 mm)	K(ii), K(iv), K(v), K(vi)
	Ramped bayonet claw	1.5" LH (1 ½")	М
Liquefied	CGA	OX-15 (1 ½")	E
oxygen		OX-30 (3")	F
	Index plate	DN-40-LOX (40 mm)	K(iii), K(iv), K(v), K(vi)
	Ramped bayonet claw	1.5"RH (1 ½")	N

# Table 1: Acceptable standard connections for liquefied oxygen, nitrogen and argon

#### 4.2.2 Liquefied carbon dioxide

Based on a survey of the connections in use in Asia and on the guidelines in this document, the following categories of connections are classified as the **STANDARDS** for continued use.

Table 2:	Standards	for lic	uefied	carbon	dioxide
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Product	Туре	Connection no. / size	Appendix No.
Liquefied carbon dioxide	CGA	CO <sub>2</sub> -1-1/2 " CO <sub>2</sub> - 3 "	G H

#### 4.2.3 Bulk compressed hydrogen and helium gas

Based on a survey of the connections in use in Asia and on the guidelines in this document, the following categories of connections are classified as the **STANDARD CONNECTIONS** for continued use.

### Table 3: Standards for bulk hydrogen and helium gas

Product	Туре	Connection no. / size	Appendix No.
Bulk hydrogen	CGA	CGA 1350 (1")	1
Bulk helium	CGA	CGA 1340 (1")	J

#### 5 Safety precautions

#### 5.1 General

- Any product conversion of transportable or static storage vessels should only be carried out by qualified personnel following documented procedures.
- Connections should be adequately affixed to transportable and static storage vessels as well as transfer hoses such that they cannot be easily removed.
- Cautions should be taken to ensure that transfer hoses cannot be misused and result in the transfer of incorrect product. Adequate controls are required to ensure that transfer hoses are fitted with the correct connections.

#### 5.2 Identification and labelling

- Connections should be adequately identified for the product service
- Proper labelling for transportable and static storage vessels is also critical for proper product identification. All labelling should be clearly visible, in the appropriate languages and meet the guideline in AIGA 017/05 – 'Labelling of gas containers and associated equipment'.

#### 5.3 Control of the use of adaptors

- The use of adaptors should be limited and if possible eliminated.
- Strict procedure and control should be in place to control the fabrication, storage and the use of adaptors.
- Can only be designed to adapt between ACCEPTABLE STANDARD CONNECTIONS for same product service.

Adaptors should be permanently constructed by means such as welding, silver soldering or brazing.

#### 6 Supplier responsibility

Prior to fill and delivery of transportable and static storage vessels, the product supplier has the responsibility to ensure that the containers are correctly labelled and fitted with the appropriate connections.

Connections should be visually inspected prior to filling to verify that there is no damage and that they are suitable for the service intended.

Suppliers should ensure that the correct mating connections are available at receiving / delivery sites thus mitigating the use of adaptors.

Suppliers are responsible for developing and implementing appropriate procedures for the fabrication, storage and use of adaptors.

Suppliers should provide adequate training for all personnel involved in transferring of bulk liquefied and compressed gases included but not limited to the requirement of this standard.

#### 7 Implementation

National gas associations and product suppliers should adopt this standard in its entirety with full compliance not later than December 2010.

#### 8 References

AIGA 017/05 CGA: V 6-2000 CGA: V 6.1-2000 CGA: V 10-2001 Labelling of gas containers and associated equipment Standard cryogenic liquid transfer connections Standard carbon dioxide transfer connections High pressure gas trailer connections

# Appendix A - CGA Connection No. AR-15 -Liquid argon

1-1/2 in (38 mm) Liquid argon connection





#### FIXED END

THREAD	2.7 - 4 STUB ACME-2G-RH-EXT
MAJOR DIA.	2.7000 - 2.6875 (68.580 - 68.263)
PITCH DIA.	2.6117 - 2.5868 (66.337 - 65.705)
MINOR DIA.	2.5300 - 2.5051 (64.262 - 63.630)
Α	2.250 (57.15) MIN
В	0.870 - 0.740 (22.10 - 18.80)
С	0.800 (20.32) MIN
D	1.230 - 1.270 (31.24 – 32.26)
E	0.078 - 0.109 (1.98 - 2.77)
F	1.50 (38.1) DIA.
G	1.930 (49.02) MIN DIA.
Н	2.200 (55.88) MAX DIA.
J	2.500 (63.50) MAX DIA.

#### HOSE NUT AND HEADPIECE

THREAD	2.7 - 4 STUB ACME-2G-RH-INT
MINOR DIA.	2.5500 - 2.5625 (64.770 - 65.088)
PITCH DIA.	2.6250 - 2.6500 (66.675 - 67.310)
MAJOR DIA.	2.7200 - 2.7450 (69.088 - 69.723)
N	2.250 (57.15) MIN DIA.
Р	2.040 - 1.920 (51.82 - 48.77)
R	1.380 (35.05) MIN
S	1.020 - 0.740 (25.91 – 18.80)
U	1.830 (46.48) MAX DIA.
V	2.180 (55.37) MIN DIA.
W	2.745 (69.72) MIN DIA.

\*See Section 3.1.

NOTE: Dimensions are shown in inches (mm).

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## Appendix B —CGA Connection No. AR-25 – Liquid argon

2-1/2 in (64 mm) Liquid argon connection standard







#### FIXED END

THREAD	3-13/16 - 4 ACME-2G-RH-EXT
MAJOR DIA.	3.8125 - 3.8000 (96.838 - 96.520)
PITCH DIA.	3.6715 - 3.6445 (93.256 - 92.570)
MINOR DIA.	3.5425 - 3.5020 (89.980 - 88.951)
A	2.250 (57.15) MIN
В	1.020 - 0.840 (25.91 – 21.34)
С	0.680 (17.27) MIN
D	1.000 - 1.090 (25.40 – 27.69)
E	0.078 - 0.109 (1.98 - 2.77)
F	2.50 (63.5) DIA.
G	3.015 (76.58) MIN DIA.
Н	3.200 (81.28) MAX DIA.
J	3.500 (88.90) MAX DIA.
К	3.500 (88.90) MAX DIA.

NOTE: Dimensions are shown in inches (mm).

#### HOSE NUT AND HEADPIECE

THREAD	3-13/16 - 4 ACME-2G-RH-INT
MINOR DIA.	3.5625 - 3.5750 (90.488 - 90.805)
PITCH DIA.	3.6875 - 3.7145 (93.663 - 94.348)
MAJOR DIA.	3.8325 - 3.8525 (97.346 - 97.854)
N	3.250 (82.55) MIN DIA.
Р	2.010 - 1.920 (51.05 - 48.77)
R	1.630 (41.40) MIN
S	1.020 - 0.840 (25.91 - 21.34)
U	2.900 (73.66) MAX DIA.
V	3.180 (80.77) MIN DIA.
W	3.855 (97.92) MIN DIA.

\*See Section 3.1.

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# Appendix C—CGA Connection No. NI-15 – Liquid nitrogen

1-1/2 in (38 mm) Liquid nitrogen connection standard





#### FIXED END

THREAD	2.4 - 4 STUB ACME-2G-RH-EXT
MAJOR DIA.	2.4000 - 2.3875 (60.960 - 60.643)
PITCH DIA.	2.3124 - 2.2879 (58.735 - 58.113)
MINOR DIA.	2.2300 - 2.2055 (56.642 - 56.020)
A	2.250 (57.15) MIN
В	0.870 - 0.740 (22.10 - 18.80)
D	1.230 - 1.270 (31.24 – 32.26)
E	0.078 - 0.109 (1.98 - 2.77)
F	1.50 (38.1) DIA.
G	1.930 (49.02) MIN DIA.
Н	2.205 (56.01) MAX DIA.
K	2.200 (55.88) MAX DIA.

NOTE: Dimensions are shown in inches (mm).

#### HOSE NUT AND HEADPIECE

TUDEAD	
THREAD	2.4 - 4 STUB ACME-2G-RH-INT
MINOR DIA.	2.2500 - 2.2625 (57.150 - 57.468)
PITCH DIA.	2.3250 - 2.3495 (59.055 - 59.677)
MAJOR DIA.	2.4200 - 2.4445 (61.468 - 62.090)
Р	2.040 - 2.000 (51.82 - 50.80)
S	1.020 - 0.740 (25.91 – 18.80)
U	1.830 (46.48) MAX DIA.
V	2.180 (53.54) MIN DIA.
W	2.445 (62.10) MIN DIA.

\*See Section 3.1.

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# Appendix D— CGA Connection No. NI-25 – Liquid nitrogen





#### FIXED END

3-1/2 - 4 ACME-2G-RH-EXT
3.5000 - 3.4875 (88.900 - 88.583)
3.3600 - 3.3338 (85.344 - 84.679)
3.2300 - 3.1907 (82.042 - 81.044)
2.250 (57.15) MIN
1.020 - 0.840 (25.91 – 21.34)
0.950 - 1.030 (24.13 – 26.16)
0.078 - 0.109 (1.98 - 2.77)
2.50 (63.5) DIA.
3.015 (76.58) MIN DIA.
3.190 (81.03) MAX DIA.
3.190 (81.03) MAX DIA.

#### HOSE NUT AND HEADPIECE

\*See section 3.1.

NOTE: Dimensions are shown in inches (mm).

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# Appendix E— CGA Connection No. OX-15 – Liquid oxygen





#### FIXED END

THREAD	2-1/2 - 4 ACME-2G-RH-EXT
MAJOR DIA.	2.5000 - 2.4875 (63.500 - 63.183)
PITCH DIA.	2.3624 - 2.3379 (60.005 - 59.383)
MINOR DIA.	2.2300 - 2.1933 (56.642 - 55.710)
A	2.125 (53.98) MIN
В	1.020 - 0.840 (25.91 – 21.34)
D	0.046 - 0.093 (1.17 - 2.36)
E	0.078 - 0.109 (1.98 - 2.77)
F	1.50 (38.10) DIA.
G	1.930 (49.02) MIN DIA.
Н	2.190 (55.63) MAX DIA.
K	2.190 (55.63) MAX DIA.

#### HOSE NUT AND HEADPIECE

THREAD	2-1/2 - 4 ACME-2G-RH-INT
MINOR DIA.	2.2500 - 2.2625 (57.150 - 57.468)
PITCH DIA.	2.3750 - 2.3995 (60.325 - 60.947)
MAJOR DIA.	2.5200 - 2.5400 (64.008 - 64.516)
Р	1.812 (46.02) MAX
Q	0.980 - 0.735 (24.89 - 18.67)
S	1.020 - 0.840 (25.91 - 21.34)
U	1.830 (46.48) MAX DIA.
V	2.172 (55.17) MIN DIA.
W	2.540 (64.52) MIN DIA.
	*See Section 3.1.

NOTE: Dimensions are shown in inches (mm).

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# Appendix F— CGA Connection No. OX-30 – Liquid oxygen

3 in (76 mm) Liquid oxygen connection standard



FIXED EN	D	
THREAD		4-¼ - 4 ACME-2G-RH-EXT
MAJOR D	IA.	4.2500 - 4.2375 (107.950 - 107.633)
PITCH DIA	۹.	4.1090 - 4.0813 (104.369 - 103.665)
MINOR DI	IA.	3.9800 - 3.9385 (101.092 - 100.038)
A	2.000	(50.80) MIN
В	1.020	- 0.980 (25.91 – 24.89)
D	0.046	6 - 0.078 (1.17 – 1.98)
E	0.078	3 - 0.109 (1.98 – 2.77)
F	3.00	(76.2) DIA.
G	3.685	5 (93.60) MIN DIA.
Н	3.940	) (100.80) MAX DIA.
K	3.940	) (100.80) MAX DIA.

4-¼ - 4 ACME-2G-RH-INT
IA. 4.0000 - 4.0125 (101.600 – 101.918)
A. 4.1250 - 4.1527 (104.775 – 105.479)
DIA. 4.2700 - 4.2900 (108.458 – 108.966)
1.937 (49.20) MAX
1.080 - 1.045 (27.43 – 26.54)
1.250 - 0.850 (31.75 – 21.59)
3.620 (91.95) MAX DIA.
3.922 (99.62) MIN DIA.
4.290 (108.97) MIN DIA.

\*See Section 3.1.

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#### Appendix G – CGA 1-1/2" Carbon dioxide connection

2.065-2.075 DIA. 1.955-1.965 DIA.

.850-.870

.240-.260

G

Н

J

Standard for CO<sub>2</sub> liquid and vapour transfer





NOTE:	DIMENSIONS	ARE	SHOWN	IN	INCHES.	UNSPECIFIED	TOLERANCES	ARE	±.015	
Compressed G	as Association, In	c. This	material is	repr	oduced from	CGA V-6.1, Stand	lard Carbon Dioxide	e Trans	sfer	

R S T

U

.500 R. 1.090-1.110

1.501-1.511 DIA.

1.937 DIA.

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#### Appendix H – CGA 3" Carbon dioxide connection

Standard for CO<sub>2</sub> liquid and vapour transfer



# NOTE: DIMENSIONS ARE SHOWN IN INCHES. UNSPECIFIED TOLERANCES ARE ±.015

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All dimensions are in inches (millimeters).

 $\oplus$  In the United States, the fill pressure of carbon monoxide is limited. See 49 CFR 173.302(f).

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# Appendix K (i) Index Plate - DN 40 LAR- Liquid argon



# Appendix K (ii) Index Plate - DN 40 LIN – Liquid nitrogen



# Appendix K (iii) Index Plate - DN 40 LOX – Liquid oxygen



# Appendix K (iv) Index Plate – Fixed end piece





# Appendix K (v) Index Plate – Studs









Appendix L - Ramped bayonet claw coupling – Liquid argon 1.25" RH – Liquid argon



Appendix M – Ramped bayonet claw coupling – Liquid nitrogen 1.5" LH - Liquid nitrogen

Printed 11 Aug. 2005]

SECTION Y -

SECTION X - X

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SECTION A - A

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SECTION B - B

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Appendix N – Ramped bayonet claw coupling – Liquid oxygen 1.5" RH - Liquid oxygen