CONNECTIONS FOR PORTABLE LIQUID CYLINDERS

AIGA 019/05

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Acknowledgement

We acknowledge and thank the Compressed Gas Association for granting permission to use the drawings in the appendix.

1 Introduction

In many Asian countries, there are no clear standards for product outlet connections and other means of product identification for portable liquid cylinders (PLCs). 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 thus a need to standardize the product outlet connections for PLCs, to eliminate production filling errors and incorrect connection of PLCs to the consumer's supply systems.

2 Scope

This document is applicable to all product outlet connections for PLCs containing liquefied nitrogen, oxygen, argon, carbon dioxide and nitrous oxide used in industrial and medical applications.

3 Definitions

Portable liquid cylinder (PLC) is a vacuum insulated cryogenic container used for the storage of the liquefied gases identified in section 2, having a maximum allowable working pressure of greater than 0.5 bar, and a capacity normally not exceeding 500 litres.

Pressure: In this document "bar" is the measure of gauge pressure unless otherwise noted (e.g. "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.

4 Connections to portable liquid cylinders

4.1 Guidelines for selection of connections

a) To eliminate the potential for incorrect product filling or withdrawal from PLCs, use connections specific to each gas or to each type of gas (e.g. use the same connection for the inert gases nitrogen and argon).

b) To prevent unsafe conditions arising from filling a container with an incorrect product and potentially compromising product integrity, these guidelines should be followed:

- Use of coupling adapters is strictly prohibited.
- The liquid, gas and vent outlet connection should be:
  - a threaded or socket connection that is silver brazed, welded or attached by other methods to the valve body in a manner that prevents removal or renders the connection or valve body outlet unusable if removal was attempted or accomplished; or
  - a permanent and integral part of the valve body; or
  - a threaded connection that has a device to deter removal of the fitting and provide some indication if removal was attempted.

4.2 Primary standard

The most commonly followed standard within the gas industry in Asia for product outlet connections comes from the Compressed Gas Association (CGA). AIGA has adopted CGA as the **primary standard** for connections for PLCs due to regional commonality and its compliance to 4.1. This **primary standard** is the single connection standard recommended by AIGA for adoption by the industry.

See Table 1 for a list of CGA connections and the appendix for drawings of the CGA connections.

Table 1- CGA Connections for PLCs

Product	Outlet connection	CGA connection number
Oxygen	Liquid	CGA 440
	Gas Use	CGA 540
	Vent	CGA 440
Nitrogen	Liquid	CGA 295
	Gas Use	CGA 580
	Vent	CGA 295
Argon	Liquid	CGA 295
	Gas Use	CGA 580
	Vent	CGA 295
Carbon Dioxide	Liquid	CGA 320
	Gas Use	CGA 320
	Vent	CGA 622
Nitrous Oxide	Liquid	CGA 326
	Gas Use	CGA 326
	Vent	CGA 624

4.3 Limited standards and transition period

Product outlet connections that are already in use at the date of this publication and that are in compliance with the guidelines in 4.1 may be designated as **limited standards** (e.g. JIGA-T-S/15/05), and as such are considered safe for continued service.

While it is recommended that the primary standard be adopted, national gas associations and/or the regulatory authorities may at their discretion determine that **limited standards** are more suitable in certain geographies or applications.

Other product outlet connections that do not fall into the limited standard category are also used within the region and AIGA recognizes that a transition period will be required to adopt the primary standard.

The length of the transition period is to be determined by each national gas association and/or the regulatory authorities. It is strongly recommended that a shorter transition period be imposed to adopt the primary standard, if the connections vary significantly from the guidelines in 4.1.

5 Other safety precautions

5.1 Identification and labelling

Proper labelling of PLCs is also critical for product identification. All labelling should be clearly visible, in the appropriate languages, and meet the guidelines in AIGA 017/05 'Labelling of Gas Containers (including associated equipment)'.

Additional labelling required are:

- Identification tags should be affixed to the gas, liquid and vent outlet connections to identify each connection.
- A warning label "DO NOT TAMPER WITH CONNECTIONS" should be visible on the container.

5.2 Handling and use

All personnel must be adequately trained prior to handling or connecting PLCs. Training should include, but is not limited to, personal protective equipment requirements, product safety, operation of equipment, and emergency procedures.

6 Product supplier's responsibility

Prior to filling and delivering PLCs, the product supplier must 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 intended service.

The supplier should ensure that the correct mating connections are in use at the customer's sites, thus avoiding the use of adaptors.

The supplier should provide training and/or training materials as required.

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

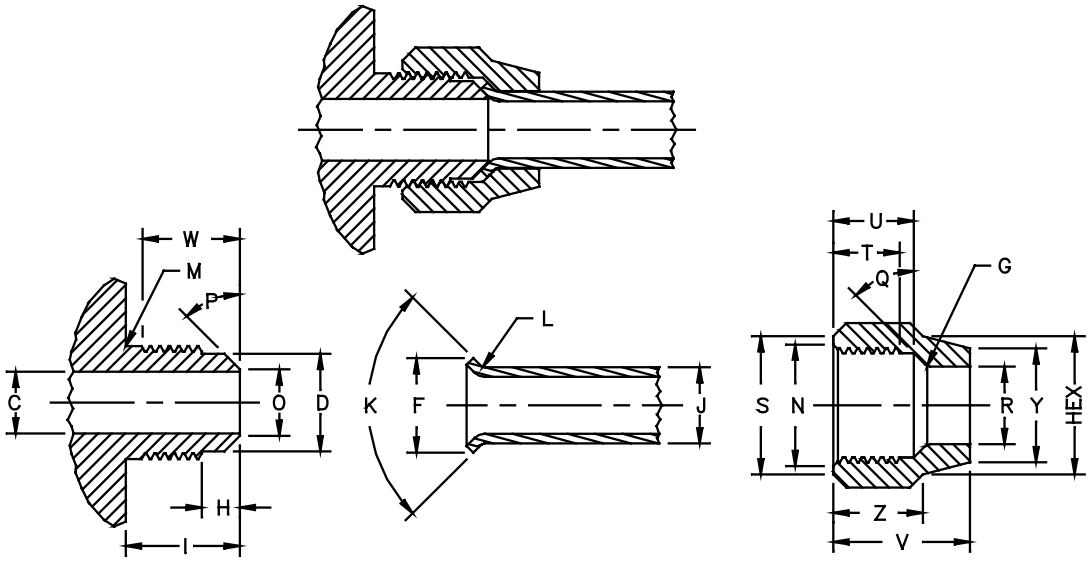
CGA: V1 – 2002	Compressed Gas Association: Standard for Compressed Gas Cylinder Valve Outlet and Inlet Connections
CGA: SB-26 – 2001	CGA Safety Bulletin: Cylinder Connections on Portable Liquid Cryogenic Cylinders
EIGA: IGC Doc 93/03/E	Safety Features of Cryogenic Liquid Containers for Industrial and Medical Gases
AIGA: 017/05	Labelling of Gas Containers (including associated equipment)
JIGA: T-S/15/05	Japan Industrial Gases Association: Handling Standards for Liquid Gas Cylinders

Appendix: CGA connection drawings

COMPRESSED GAS ASSOCIATION, INC. **CONNECTION NO. 295**

.750-16UNF-2A-RH-EXT (½" SAE Flare)①

STANDARD CYLINDER VALVE OUTLET CONNECTION FOR
PRESSURES UP TO 500 psig (3450 kPa) FOR
Cryogenic Liquid Withdrawal, Filling, and Venting of
Argon Nitrogen



VALVE OUTLET

THREAD		.750–16UNF–2A–RH–EXT	
MAJOR DIA.		.7485–.7391	(19.011–18.774)
PITCH DIA.		.7079–.7029	(17.980–17.854)
MINOR DIA.		.6718 Max.	(17.063) Max.
BORE DIA.	C	.403–.412	(10.23–10.46)
RELIEF DIA.	D	.641 ±.010	(16.28 ±0.25)
CUTBACK	H	.25	(6.4)
LENGTH	I	.75	(19.1)
UNDERCUT	M	OPTIONAL	
CHAMFER DIA.	O	.438 ±.010	(11.13 ±0.25)
ANGLE	P	45° ±1°	
FULL THREAD	W	.66 Min.	(16.8) Min.

TUBE

FLARE DIA.	F	.607–.623	(15.42–15.82)
DIAMETER	J	.500 ±.002	(12.70 ±0.05)
ANGLE	K	90° ±1/2°	
RADIUS	L	.015–.031	(0.38–0.79)

HEXAGON NUT

THREAD		.750–16UNF–2B–RH–INT (MOD.)	
MINOR DIA.		.6820–.6908(3B)	(17.323–17.546)
PITCH DIA.		.7094–.7159	(18.019–18.183)
MAJOR DIA.		.7500 Min.	(19.050) Min.
HEX		15/16	(23.8)
RADIUS	G	.047 ±.010	(1.19 ±0.25)
C'SINK DIA.	N	90° x .77–.80	(19.6–20.3)
ANGLE	Q	43°–45°	
HOLE DIA.	R	.505–.510	(12.83–12.95)
CHAMFER DIA.	S	45° x .94–.91	(23.9–23.1)
FULL THREAD	T	.44 Min.	(11.2) Min.
DEPTH	U	.53	(13.5)
LENGTH	V	.90–.81	(22.9–20.6)
DIAMETER	Y	.75 Min.	(19.1) Min.
LENGTH	Z	.59–.53	(15.0–13.5)

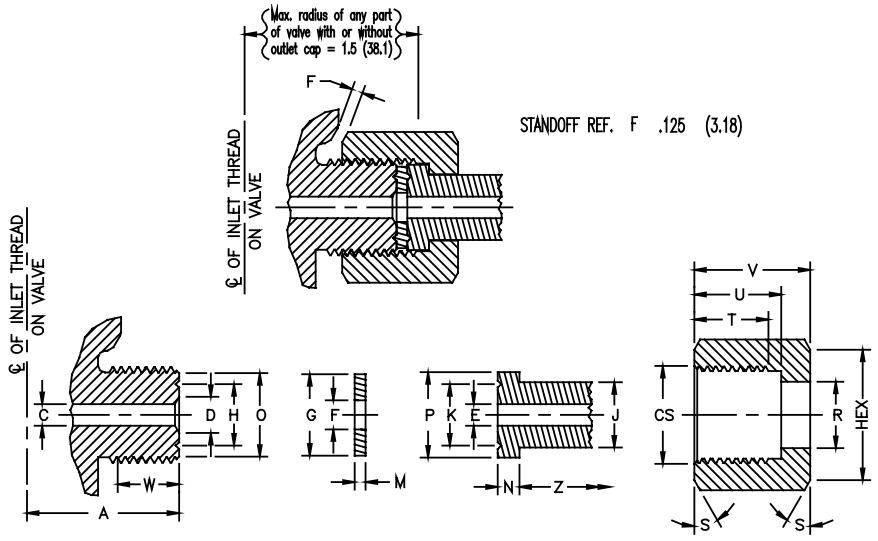
All dimensions are in inches (millimeters).

① Complies with ANSI/SAE J513f.

COMPRESSED GAS ASSOCIATION, INC. **CONNECTION NO. 320**

.825-14NGO-RH-EXT (Flat Nipple)

STANDARD① CYLINDER VALVE OUTLET CONNECTION FOR
PRESSURES UP TO 3000 psig (20 680 kPa) FOR
Carbon Dioxide (R744)



VALVE OUTLET

THREAD		.825–14NGO–RH–EXT	
MAJOR DIA.		.8250–.8200	(20.955–20.828)
PITCH DIA.		.7786–.7750	(19.776–19.685)
MINOR DIA.		.7374 Max.	(18.729) Max.
LENGTH	A	1.312 Max.	(33.32) Max.
DRILL DIA.	C	.187 ±.060	(4.75 ±1.52)
C'SINK DIA.	D	90° x .312 Max.	(7.92) Max.
GROOVE	H	.53 Dia. x .03 Deep	(13.5 Dia. x 0.8 Deep)
CHAMFER	O	45° x .719	(18.26)
FULL THREAD	W	.562 Min.	(14.27) Min.

NIPPLE ②

DRILL DIA.	E	.187 ±.060	(4.75 ±1.52)
SHANK DIA.	J	.562–.557	(14.27–14.15)
GROOVE (Optional)	K	.53 Dia. x .03 Deep	(13.5 Dia. x 0.8 Deep)
SHOULDER LENGTH	N	.187–.202	(4.75–5.13)
SHOULDER DIA.	P	.735	(18.67)
SHANK LENGTH	Z	.20 Min.	(5.1) Min.

WASHER

HOLE DIA.	F	.250 ±.015	(6.35 ±0.38)
DIAMETER	G	.703 ±.015	(17.86 ±0.38)
THICKNESS	M	.094 ±.030	(2.39 ±0.76)

HEXAGON NUT

THREAD		.830–14NGO–RH–INT	
MINOR DIA.		.7527–.7604	(19.119–19.314)
PITCH DIA.		.7836–.7872	(19.904–19.994)
MAJOR DIA.		.8300 Min.	(21.082) Min.
HEX		1–1/8	(28.6)
HOLE DIA.	R	.567–.572	(14.40–14.53)
CHAMFER DIA.	S	30° x 1.125	(28.58)
FULL THREAD	T	.562 Min.	(14.27) Min.
BORE DEPTH	U	.750 ±.015	(19.05 ±0.38)
LENGTH	V	.937 Min.	(23.80) Min.
C'SINK DIA.	CS	90° x .844	(21.44)

Limited① Standard for Methyl Bromide, Chlorotrifluoromethane (R13), Fluoroform (R23), Hexafluoroethane (R116), Tetrafluoromethane (R14)

① Also used for gas mixtures: see CGA V–7.

② Nipple may be made from 11/16 (17.5) hex material.

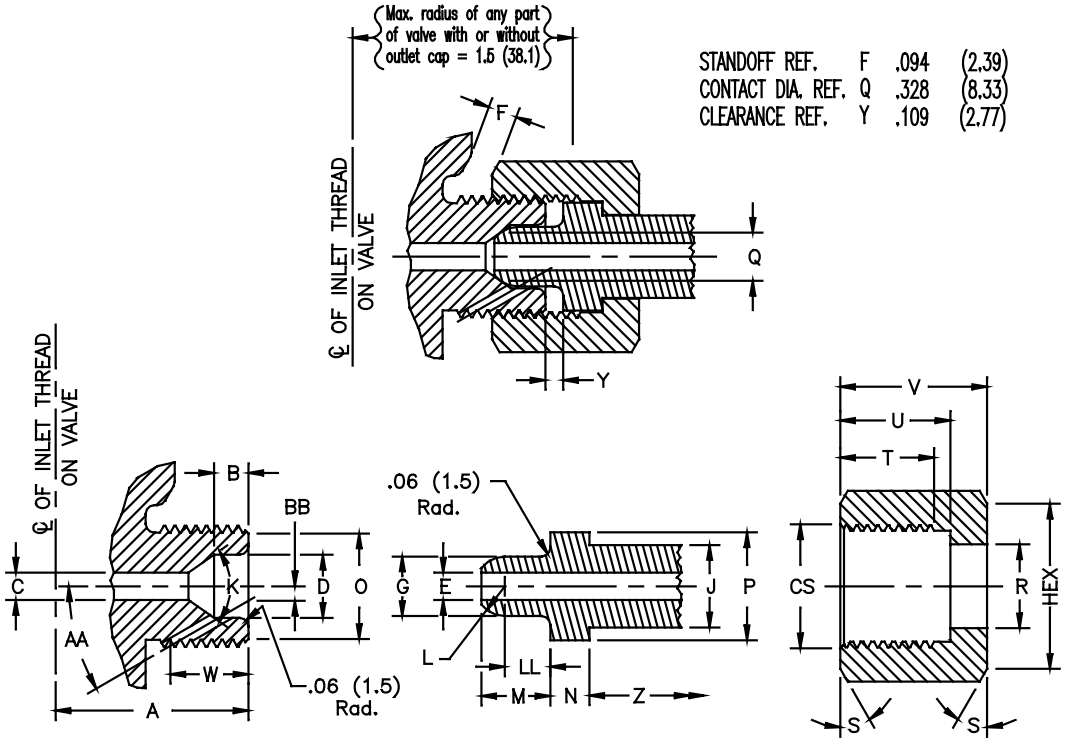
All dimensions are in inches (millimeters).

COMPRESSED GAS ASSOCIATION, INC.

CONNECTION NO. 326

.825-14NGO-RH-EXT (Small Round Nipple)

STANDARD CYLINDER VALVE OUTLET CONNECTION FOR
PRESSURES UP TO 3000 psig (20 680 kPa) FOR
Nitrous Oxide (R744a)



VALVE OUTLET

THREAD		.825–14NGO–RH–EXT	
MAJOR DIA.		.8250–.8200	(20.955–20.828)
PITCH DIA.		.7786–.7750	(19.776–19.686)
MINOR DIA.		.7374 Max.	(18.729) Max.
LENGTH	A	1.312 Max.	(33.32) Max.
BORE DEPTH	B	.234 ±.015	(.594 ±0.38)
DRILL DIA.	C	.187 ±.060	(4.75 ±1.52)
BORE DIA.	D	.430	(10.92)
ANGLE	K	70°	
CHAMFER DIA.	O	45° x .719	(18.26)
FULL THREAD	W	.531 Min.	(13.49) Min.
BLEED HOLE① DIA.		.093	(2.36)
HOLE① ANGLE	AA	30°	
OFFSET	BB	.099	(2.51)

NIPPLE ②

DRILL DIA.	E	.125 ±.015	(3.18 ±0.38)
NOSE DIA.	G	.405	(10.29)
SHANK DIA.	J	.562–.557	(14.27–14.15)
NOSE RADIUS	L	.205–.200	(5.21–5.08)
NOSE LENGTH	M	.469	(11.91)
SHOULDER LENGTH	N	.266–.281	(6.76–7.14)
SHOULDER DIA.	P	.735	(18.67)
SHANK LENGTH	Z	.20 Min.	(5.1) Min.
L LOCATION	LL	.285–.312	(7.24–7.92)

HEXAGON NUT

THREAD		.830–14NGO–RH–INT	
MINOR DIA.		.7527–.7604	(19.119–19.314)
PITCH DIA.		.7836–.7872	(19.904–19.994)
MAJOR DIA.		.8300 Min.	(21.082) Min.
HEX		1–1/8	(28.6)
HOLE DIA.	R	.567–.572	(14.40–14.53)
CHAMFER DIA.	S	30° x 1.125	(28.58)
FULL THREAD	T	.562 Min.	(14.27) Min.
BORE DEPTH	U	.750 ±.015	(19.05 ±0.38)
LENGTH	V	.937 Min.	(23.80) Min.
C'SINK DIA.	CS	90° x .844	(21.44)

All dimensions are in inches (millimeters).

① At least one bleed hole .093 (2.36) diameter located as shown, directed downward, outboard of point of nose contact and inboard of threaded end of engaged nut.

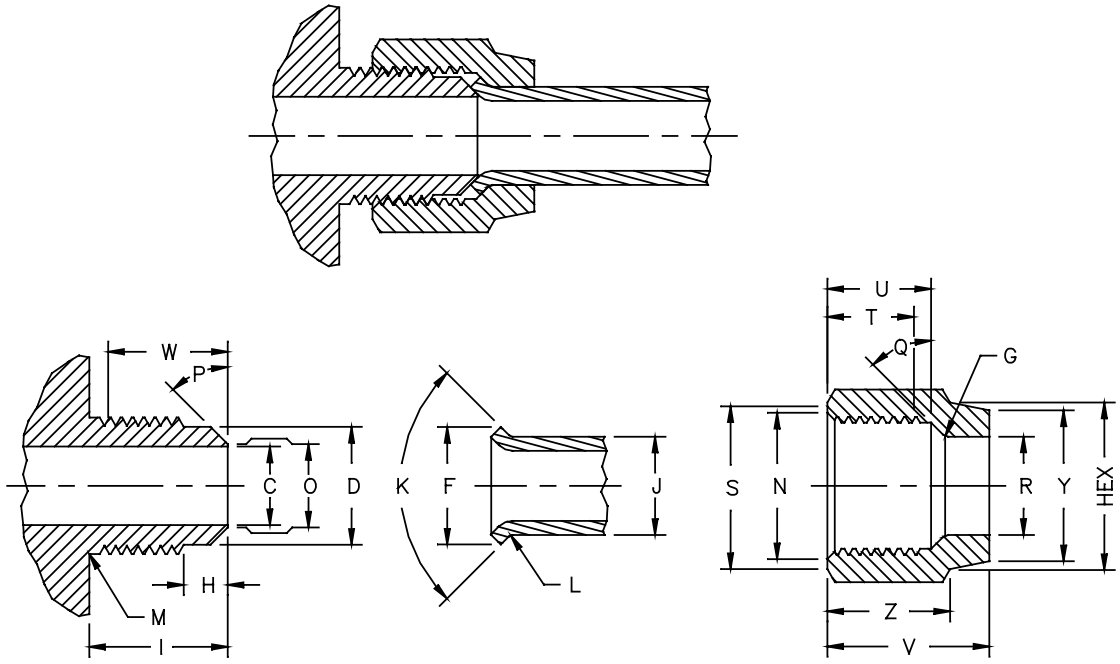
② Nipple may be made from 11/16 (17.5) hex material.

COMPRESSED GAS ASSOCIATION, INC.

CONNECTION NO. 440

.875-14UNF-2A-RH-EXT (5/8" SAE Flare)①

STANDARD CYLINDER VALVE OUTLET CONNECTION FOR
PRESSURES UP TO 500 psig (3450 kPa) FOR
Cryogenic Liquid Withdrawal, Filling and Venting of
Air (R729)
Oxygen



VALVE OUTLET

THREAD		.875–14UNF–2A–RH–EXT	
MAJOR DIA.		.8734–.8631	(22.184–21.923)
PITCH DIA.		.8270–.8216	(21.005–20.869)
MINOR DIA.		.7858 Max.	(19.959) Max.
BORE DIA.	C	.497–.506	(12.62–12.85)
RELIEF DIA.	D	.75	(19.1)
CUTBACK	H	.28	(7.1)
LENGTH	I	.88	(22.4)
UNDERCUT DIA.	M	OPTIONAL .765	(19.43)
CHAMFER DIA.	O	.531 ±.010	(13.49 ±0.25)
ANGLE	P	45° ±1°	
FULL THREAD	W	.76 Min.	(19.3) Min.

TUBE

FLARE DIA.	F	.732–.748	(18.59–19.00)
DIAMETER	J	.625 ±.002	(15.88 ±0.05)
ANGLE	K	90° ±1/2°	
RADIUS	L	.031–.015	(0.79–0.38)

HEXAGON NUT

THREAD		.875–14UNF–2B–RH–INT (MOD.)	
MINOR DIA.		.7980–.8068(3B)	(20.270–20.492)
PITCH DIA.		.8286–.8356	(21.047–21.224)
MAJOR DIA.		.8750 Min.	(22.225) Min.
HEX		1–1/16	(27.0)
RADIUS	G	.047 ±.010	(1.19 ±0.25)
C'SINK DIA.	N	90° x .90–.93	(22.9–23.6)
ANGLE	Q	43°–45°	
HOLE DIA.	R	.630–.635	(16.00–16.13)
CHAMFER DIA.	S	45° x 1.06–1.03	(26.9–26.2)
FULL THREAD	T	.55 Min.	(14.0) Min.
DEPTH	U	.66	(16.8)
LENGTH	V	1.03–.94	(26.2–23.9)
DIAMETER	Y	.94 Min.	(23.9) Min.
LENGTH	Z	.78–.72	(19.8–18.3)

All dimensions are in inches (millimeters).

① Complies with SAE J513.

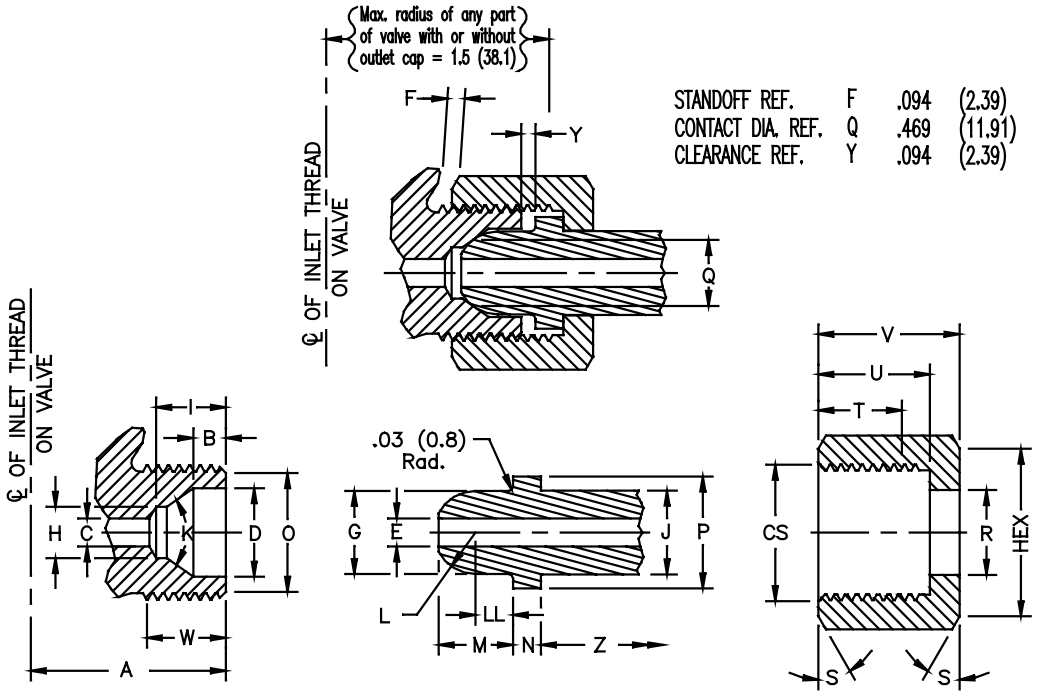
COMPRESSED GAS ASSOCIATION, INC.

CONNECTION NO. 540

.903-14NGO-RH-EXT

STANDARD CYLINDER VALVE OUTLET CONNECTION FOR
PRESSURES UP TO 3000 psig (20 680 kPa) FOR
Oxygen

WARNING — Do not use this thread for any other gas or for any gas mixture.



VALVE OUTLET

THREAD		.903–14NGO–RH–EXT	
MAJOR DIA.		.9030–.8980	(22.936–22.810)
PITCH DIA.		.8566–.8530	(21.757–21.667)
MINOR DIA.		.8154 Max.	(20.711) Max.
LENGTH	A	1.312 Max.	(33.32) Max.
BORE DEPTH	B	.219 ±.015	(5.56 ±0.38)
DRILL DIA.	C	.187 ±.060	(4.75 ±1.52)
BORE DIA.	D	.593	(15.06)
C'BORE DIA.	H	.344 Max.	(8.74) Max.
C'BORE DEPTH	I	.469 Min.	(11.91) Min.
ANGLE	K	70°	
CHAMFER DIA.	O	45° x .797	(20.24)
FULL THREAD	W	.531 Min.	(13.49) Min.

NIPPLE ①

DRILL DIA.	E	.187 ±.060	(4.75 ±1.52)
NOSE DIA.	G	.557	(14.15)
SHANK DIA.	J	.562–.557	(14.27–14.15)
NOSE RADIUS	L	.266–.297	(6.76–7.54)
NOSE LENGTH	M	.50	(12.7)
SHOULDER LENGTH	N	.187–.202	(4.75–5.13)
SHOULDER DIA.	P	.752–.740	(19.10–18.80)
SHANK LENGTH	Z	.20 Min.	(5.1) Min.
L LOCATION	LL	.216–.290	(5.49–7.37)

All dimensions are in inches (millimeters).

① Nipple may be made from 11/16 (17.5) hex material.

HEXAGON NUT

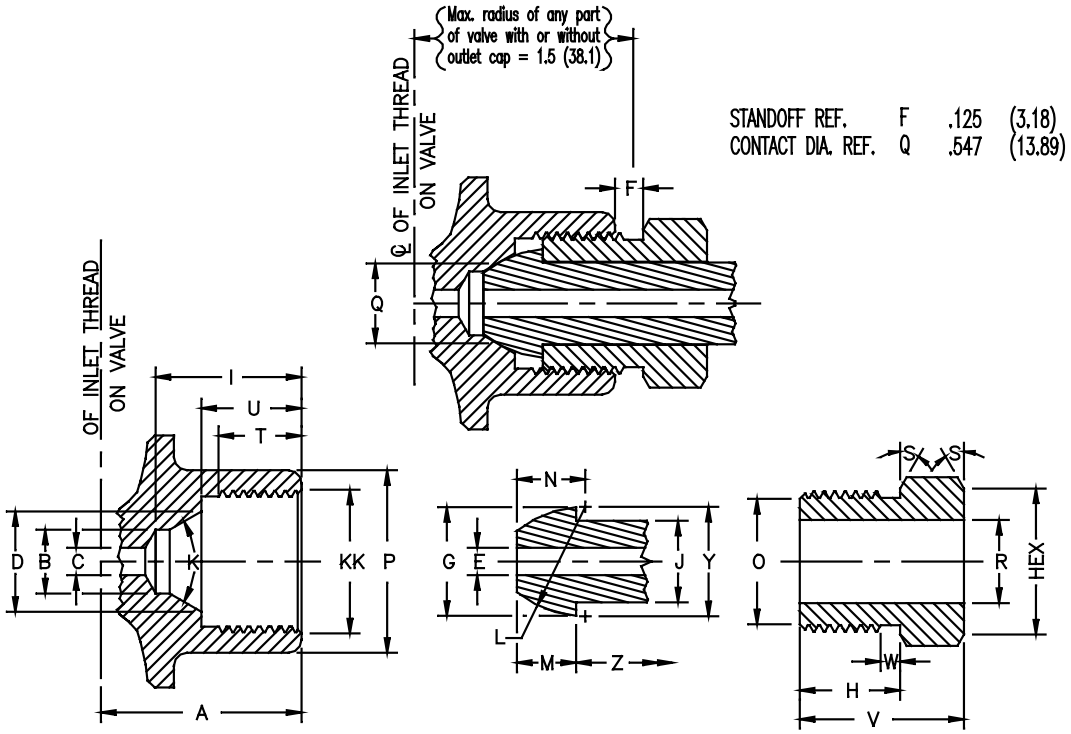
THREAD		.908–14NGO–RH–INT	
MINOR DIA.		.8307–.8384	(21.100–21.295)
PITCH DIA.		.8616–.8652	(21.885–21.976)
MAJOR DIA.		.9080 Min.	(23.064) Min.
HEX		1-1/8	(28.6)
HOLE DIA.	R	.567–.572	(14.40–14.53)
CHAMFER DIA.	S	30° x 1.125	(28.58)
FULL THREAD	T	.562 Min.	(14.27) Min.
BORE DEPTH	U	.750 ±.015	(19.05 ±0.38)
LENGTH	V	.937 Min.	(23.80) Min.
C'SINK DIA.	CS	90° x .922	(23.42)

COMPRESSED GAS ASSOCIATION, INC. **CONNECTION NO. 580**

.965-14NGO-RH-INT

STANDARD① CYLINDER VALVE OUTLET CONNECTION FOR
PRESSURES UP TO 3000 psig (20 680 kPa) FOR

Argon	Nitrogen
Helium	Tetrafluoromethane (R14)
Krypton	Xenon
Neon	



VALVE OUTLET

THREAD		.965-14NGO-RH-INT	
MINOR DIA.		.8877-.8954	(22.548-22.743)
PITCH DIA.		.9186-.9222	(23.333-23.423)
MAJOR DIA.		.9650 Min.	(24.511) Min.
LENGTH	A	1.375 Max.	(34.93) Max.
C'BORE DIA.	B	.437 Max.	(11.10) Max.
DRILL DIA.	C	.187 ±.060	(4.75 ±1.52)
SEAT DIA.	D	.687 ±.015	(17.45 ±0.38)
C'BORE DEPTH	I	1.00 Min.	(25.4) Min.
ANGLE	K	60°	
BOSS DIA.	P	1.25 Min.	(31.8) Min.
FULL THREAD	T	.562 Min.	(14.27) Min.
BORE DEPTH	U	.687 ±.015	(17.45 ±0.38)
C'SINK DIA.	KK	90° x .984	(24.99)

NIPPLE ②

DRILL DIA.	E	.187 ±.060	(4.75 ±1.52)
NOSE DIA.	G	.745	(18.92)
SHANK DIA.	J	.562-.557	(14.27-14.15)
NOSE RADIUS	L	.750	(19.05)
NOSE LENGTH	M	.406 ±.015	(10.31 ±0.38)
CENTER LINE	N	.469 ±.015	(11.91 ±0.38)
RADIUS L CENTERS	Y	.750	(19.05)
SHANK LENGTH	Z	1.12 Min.	(28.4) Min.

All dimensions are in inches (millimeters).

① Also used for gas mixtures: see CGA V-7.

② Nipple may be made from 11/16 (17.5) hex material.

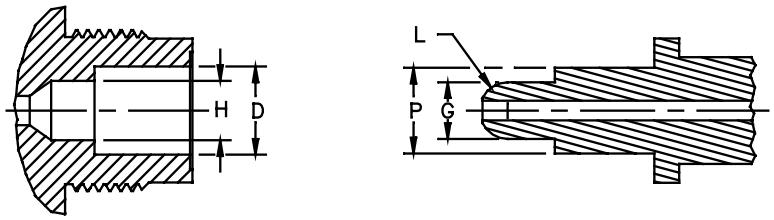
HEXAGON NUT

THREAD		.960-14NGO-RH-EXT	
MAJOR DIA.		.9600-.9550	(24.384-24.257)
PITCH DIA.		.9136-.9100	(23.205-23.114)
MINOR DIA.		.8724 Max.	(22.158) Max.
HEX		1 or 1-1/8	(25.4 or 28.6)
SHANK LENGTH	H	.687 ±.015	(17.45 ±0.38)
CHAMFER DIA.	O	45° X .859	(21.82)
HOLE DIA.	R	.567-.572	(14.40-14.53)
CHAMFER DIA.	S	30° x 1.00	(25.4)
		or	
		30° x 1.125	(28.58)
LENGTH	V	1.125 Min.	(28.58) Min.
UNDERCUT DIA.	W	.16 ±.03 x .86	(4.1 ±0.8 x 21.8)

COMPRESSED GAS ASSOCIATION, INC. **CONNECTION NO. 622**

1.030-14NGO-RH-EXT

STANDARD CYLINDER VALVE OUTLET CONNECTION FOR
PRESSURES UP TO 500 psig (3450 kPa) FOR REFRIGERATED
LIQUID WITHDRAWAL FOR
Carbon Dioxide (R744)



	VALVE OUTLET			NIPPLE			
THREAD	1.030-14NGO-RH-EXT						
MAJOR DIA.		1.0300-1.0250	(26.162-26.035)	NOSE DIA.	G	.366-.362	(9.29-9.20)
PITCH DIA.		.9836-.9796	(24.983-24.882)	NOSE RADIUS	L	.183-.181	(4.65-4.60)
MINOR DIA.		.9424 Max.	(23.936) Max.	SHOULDER DIA.	P	.551-.547	(13.99-13.90)
BORE DIA.	D	.558-.564	(14.18-14.32)				
C'BORE DIA.	H	.373-.379	(9.48-9.62)				

STANDOFF (REF)	F	.147	(3.73)
CONTACT DIA (REF)	Q	.298	(7.57)
CLEARANCE (REF)	Y	.099	(2.51)

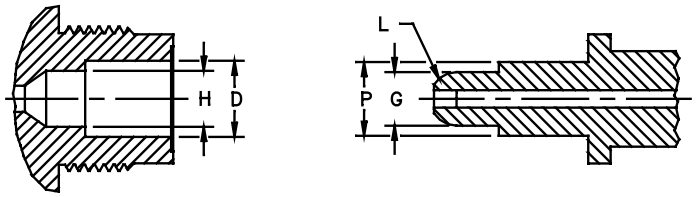
All dimensions are in inches (millimeters).

FOR OTHER DIMENSIONS SEE DRAWING NO. 620

COMPRESSED GAS ASSOCIATION, INC. **CONNECTION NO. 624**

1.030-14NGO-RH-EXT

STANDARD CYLINDER VALVE OUTLET CONNECTION FOR
PRESSURES UP TO 500 psig (3450 kPa) FOR REFRIGERATED
LIQUID WITHDRAWAL FOR
Nitrous Oxide (R744a)



VALVE OUTLET				NIPPLE			
THREAD	1.030–14NGO–RH–EXT						
MAJOR DIA.		1.0300–1.0250	(26.162–26.035)	NOSE DIA.	G	.387–.383	(9.83–9.73)
PITCH DIA.		.9836–.9796	(24.983–24.882)	NOSE RADIUS	L	.1935–.1915	(4.915–4.864)
MINOR DIA.		.9424 Max.	(23.936) Max.	SHOULDER DIA.	P	.530–.526	(13.46–13.36)
BORE DIA.	D	.537–.543	(13.64–13.79)				
C'BORE DIA.	H	.394–.400	(10.01–10.16)				

STANDOFF (REF)	F	.150	(3.81)
CONTACT DIA (REF)	Q	.315	(8.00)
CLEARANCE (REF)	Y	.102	(2.59)

All dimensions are in inches (millimeters).

FOR OTHER DIMENSIONS SEE DRAWING NO. 620