

The logo for AIGA, consisting of the letters 'AIGA' in a bold, white, sans-serif font, centered within a solid blue square.

# **A REFERENCE GUIDE FOR INDUSTRIAL GAS CYLINDER VALVE OUTLET CONNECTIONS**

**AIGA 98/17**

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## 1 Introduction

The main reason for standardizing valve outlet connections is to prevent product mix-up and interconnection of non-compatible gases.

This will enhance both safety and quality during filling and usage of various gases and gas mixtures.

## 2 Scope and Purpose

The document is a practical guide for the selection of cylinder valve outlets for industrial gases and gas mixtures.

Medical and electronics grade gases are not covered in this document.

The document does not apply to connections for cryogenic gases withdrawal and gases for breathing equipment. (For guidelines on these container types see "AIGA 019, Connections for portable liquid cylinders" or "AIGA 016, Safety Features of Portable Cryogenic Liquid Containers for Industrial and Medical Gases").

## 3 Definitions

Terminology:

- *Shall* indicates that the procedure is mandatory. It is used wherever conformance to specific recommendation allows no deviation.
- *Should* indicates that a procedure is recommended.
- *May* and *Need not* indicate that the procedure is optional.
- *Will* is used only to indicate the future, not a degree of requirement.
- *Can* indicates a possibility or ability.

## 4 Valve Selection and Usage

### 4.1 Valve Outlet Connections

Applicable national regulation needs to be followed in countries where one exists.

Following is the recommended standard for selecting industrial gas cylinder valve outlet connections in countries where a national regulation does not exist.

ISO 5145      Cylinder Valve Outlets for Gases and Gas Mixtures – Selection and Dimensioning [1]

ISO 5145 [1] presents a system for determining valve outlets for gas cylinders for all gases or gas mixtures. It will be of interest and use for those countries that have no national standards or regulations.

It is recommended to use ISO 5145[1] when selecting cylinder valves for 300 bar or above.

### 4.2 Selection of Valves

There shall be suitable equipment and a system in place to ensure that the appropriate valves are fitted for the service of the gas cylinder and that the valves are installed in accordance with ISO 13341 [2] and/or national approved standard where available, including the stem thread matching the cylinder internal neck thread.

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<sup>1</sup> References are shown by bracketed numbers and are listed in order of appearance in the reference section.

Special care shall be taken to ensure that the maximum permitted torque value is not exceeded while fitting a valve.

### 4.3 Commonly Used Cylinder Valves

Following are the commonly used valve types for Industrial Gases

- Standard Valves
- Residual Pressure Valves
- Pressure Reducing Valves
- Valves with Integrated Pressure Regulators

The design of the valves can be either:

- Packed Valves
- Diaphragm Valves (tied and non tied)
- 'O' ring seal Valves.

### 4.4 Valve Operation

Major steps in valve operation are

- Use spindle key or hand wheel type valves
- If using spindle key, do not over-torque by using lever extension. Follow manufacturer's instructions on torque levels.
- Open and close valves slowly

Pneumatically operated valves are sometimes used for special applications. Follow manufacturer's instruction for operating these valves

### 4.5 Valves with Parallel Threads

Valves with parallel threads and 'O' rings are recommended for use with Aluminium Alloy cylinders. This would prevent the scenario where the cylinder neck thread seizes onto the valve's brass thread when over-tightened.

When the taper threaded valves are used on aluminium Alloy cylinders, especially for higher pressure and toxic and flammable gases, shrink-on neck collars should be fitted. The collar keeps the threads under compression.

Note: No PTFE tape or similar sealant shall be used on the parallel threaded valves and compatibility of O-rings with gas being filled shall be ensured

### 4.6 Residual Pressure Valve (RPV)

Residual Pressure Valves (RPVs) are also known as Minimum Pressure Retaining (MPR) valves.

A RPV maintains positive pressure within the cylinder, thus avoiding atmospheric contamination of the contents in case the cylinder valve is left open.

RPVs can be both with and without non-return devices.

In case of RPVs with non-return feature, a special fill connector is required during filling to deactivate the non-return function.

## 5 Valve Protection

Valve guards or valve caps should be used on all cylinders with a neck ring / collar provision to accommodate valve protection. This can

- protect valves from damage during transportation and handling
- improve safety during cylinder handling (for example, the valve protection helps to prevent valve shear during accidental fall of cylinders thus avoiding a projectile situation or hazards of gas released from the cylinder)

Valve protection should not impede the attachment of regulators or other accessories and should be designed in accordance with ISO 11117 [3] or equivalent standard.

Valve protection may not be present when there is no gas pressure inside the cylinder.

Valves without any protection shall be tested for High Impact Strength as per ISO 10297 [4], at a minimum. However, valve protection offer much greater protection if a cylinder should fall.

## 6 Cylinder Valve Maintenance

Any attempt to repair a valve should be done by the manufacturer or by trained personnel in accordance with manufacturer' guidelines.

Where valves are reused, they shall be periodically inspected and refurbished as necessary. If there is no national standard on valve refurbishment, it is recommended to use ISO 22434:2006 [5].

Rejected valves should not be repaired and reused.

The valves shall be inspected for external damage and usability during Pre-fill Inspection.

## 7 Adaptors

Adaptors shall not be used while making connections to the cylinder valves. Adaptors defeat the purpose of standardizing cylinder valve outlet connections based on the gas properties and associated hazards.

Several serious incidents have occurred in the past due to inappropriate usage of adaptors, leading to mixing of non compatible gases or filling wrong gas in cylinders.

Use of adaptors can only be considered with a proper review, control and approval by a competent person in the organization. The use of a work permit system is to be included when there is a need for temporary use of adaptor for the work.

## 8 Commonly Used Standards and Valve Connections in Asia

The following table lists the commonly followed standards and valve outlet connections for some of the industrial gases in countries in Asia.

Some countries allow import of cylinders with valve outlet connections suited to the country of origin.

**Commonly Followed Standards and Valve Outlet Connections for various Countries in Asia:**

Gas Name	Formula	Flammable	Toxic	Chinese Standard GB 15383-2011		Korean Standard KSB 6214		Thai Standard TIS 88-2517		CGA V-1 (Taiwan, Philippines)		Indian Standard IS 3224		JIS B 8244 (Acetylene) & 8246 (Japan, Taiwan)		BS 341 (Singapore, Indonesia, Malaysia)	
				Outlet N°	Screw thread of outlet	Outlet N°	Screw thread of outlet	Outlet N°	Screw thread of outlet	Outlet N°	Screw thread of outlet	Outlet N°	Screw thread of outlet	Outlet N°	Screw thread of outlet	Outlet N°	Screw thread of outlet
Acetylene	C2H2	y	n	14	Ø5	W22	W22mm -14-LH-INT	300	.825"-14 NGO -RH -EXT	510	.885"-14 NGO -LH-INT	2	G 5/8 LH	As per JIS B 8244		2, 4	5/8 BSP.F.-L.H.
Air	-	n	n	5	G5/8 RH & W21.8-14RH	W22	W22mm-14-RH-INT	540	.903"-14 NGO-RH-EXT	346	.825"-14 NGO-RH-EXT	19	G 7/8A RH	A1	W22mm -14-RH-EXT	3	5/8 BSP.F.-R.H.
Ammonia	NH3	n	y	7	G1/2 RH	W22	W22mm-14-RH-INT	240	3/8"-18 NGT-RH-INT	240	3/8"-18 NGT-RH-INT	9	G 1/2A RH	A1	W20mm-14-LH-EXT	10	1/2 BSP.M.-R.H.
															W22mm-14-LH-EXT		
															W26mm-14-LH-EXT		
Carbon dioxide	CO2	n	n	2	G5/8 RH	W22	W22mm-14-RH-INT	320	.825"-14 NGO -RH -EXT (flat nipple)	320	.825"-14 NGO -RH -EXT	7	EXT W21.8 x 1.814-RH	A1	W22mm -14-RH-EXT	8	0.860-14 TPI Whit.-RH
Argon	Ar	n	n	3	G5/8 RH	W22	W22mm-14-RH-INT	580	.965"-14 NGO-RH-INT	580	.965"-14 NGO-RH-INT	20	G 3/4A RH	A1	W22mm -14-RH-EXT	3	5/8 BSP.F.-R.H.
Nitrogen	N2	n	n	3	G5/8 RH	W22	W22mm-14-RH-INT	580	.965"-14 NGO-RH-INT	580	.965"-14 NGO-RH-INT	20	G 3/4A RH	A1	W22mm -14-RH-EXT	3	0.860-14 TPI Whit.-RH
Helium	He	n	n	3	G5/8 RH	W22	W22mm-14-RH-INT	580	.965"-14 NGO-RH-INT	580	.965"-14 NGO-RH-INT	20	G 3/4A RH	A1	W22mm -14-RH-EXT	3	5/8 BSP.F.-R.H.
Hydrogen	H2	y	n	6	G5/8 LH	W22	W22mm-14-LH-INT	350	.825"-14 NGO -LH -EXT	350	.825"-14 NGO -LH -EXT	2	G 5/8 LH	A1	W22mm -14-LH-EXT	4	5/8 BSP.F.-L.H.
Methane	CH4	y	n	6	G5/8 LH	W22	W22mm-14-LH-INT	350	.825"-14 NGO -LH -EXT	350	.825"-14 NGO -LH -EXT	2	G 5/8 LH	A1	W22mm -14-LH-EXT	4	5/8 BSP.F.-L.H.
Carbon monoxide	CO	y	y	8	W21.8-14 LH	W22	W22mm-14-LH-INT	350	.825"-14 NGO -LH -EXT	350	.825"-14 NGO -LH -EXT	2	G 5/8 LH	A1	W24mm -14-LH-EXT	4	5/8 BSP.F.-L.H.
Oxygen	O2	n	n	10	G5/8 RH	W23	W23mm -14-RH-INT	540	.903"-14 NGO-RH-EXT	540	.903"-14 NGO-RH-EXT	3	G 5/8 RH	A1	W22mm -14-RH-EXT	3	5/8 BSP.F.-R.H.

Country	Industry Standard	Remarks
Bangladesh	BS 341	
China	GB 15383-2011	
India	IS 3224	
Indonesia	No specific standard	Follows BS 341
Japan	JIS B 8244	Other international standards (eg. CGA V-1) are also used
	JIS B 8246	
Malaysia	BS 341	Industrial below 250 bar
	ISO 5145	Industrial above 250 bar
Philippines	No specific standard	Follows CGA V-1
Pakistan	BS 341	
Sri Lanka	No specific standard	Follows BS 341
Singapore	No specific standard	BS 341 is commonly used except Nitrogen where BS 8 is used
South Korea	KSB 6214	
Taiwan	No specific standard	Follows CGA V-1, JIS
Thailand	TIS 88-2517	Follows CGA V-1

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