



HIGH PURITY GASES FOR THE SEMICONDUCTOR INDUSTRY

*Ultra High Purity Delivery of
Electronics Specialty
Gases in Europe*

Air Liquide Technology
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Air Liquide Technology

Air Liquide Electronics supplies thousands of cylinder throughout Europe, which represent more than 250 different packages !

CYLINDER MATERIALS

- Carbon Steel cylinders can be used for virtually every compressed gas.
- Aluminum has advantages for low weight and clean interior. Its used is limited with certain gases.
- Stainless Steel is used for special applications (WF6, ClF3).
- Electroless Nickel Coating Carbon Steel cylinder is primarily used for corrosives which require stringent metals purity.

SURFACE PREPARATION

The appropriate surface technology is employed to maintain the quality and the purity of the products.

VALVES

Air Liquide Europe employs both conventional packed valves and tied diaphragm valves.

CONNECTIONS

The main connections are CGA, CGA-DISS, DIN or NF outlets.



Pneumatic Valves

- *Reliability: the automatic valve locking reduces the propagation of a potential accident*
- *Repetitiveness: Closed/Opened are performed each time identically according to the optimal valve use*

CGA-DISS Valve Outlet

- *Prevents interchangeability*
- *Small dead volume*
- *Right handed connection*
- *A more durable connection (better leak rate than current connection)*
- *Safety improved through mechanical segregation*

Cylinder Treatment

- *Air Liquide Electronics has developed cylinder surface treatments that preserve the stability and the purity of gases*
- *Each treatment is designed for the purity specifications you can expect for your gases*

Surface Preparation

The quality of gases is dependant from the elimination of the contamination processes within the cylinder :

- Impurities desorption: gas atoms locked up in small roughness cylinder walls
- Particulate contamination: Particles generated by Cylinder wear
- Hydrocarbon contamination: grease coming from material handling
- Moisture: Residual water.



Air Liquide Europe has adapted different treatment profiles to gas properties and customers request :

- Strict selection of cylinders and valves,
- UNIQUAL™ treatment, nickel coating
- Cleanroom cylinder preparation
- Returned-cylinder processing.

UNIQUAL™ TREATMENT

- Mechanical polishing of inner cylinder surface
- Surface cleaning (Solvent jet washing, Drying)
- Valve mounting
- Pressure and leak tests
- Vacuum baking
- Passivation (Electroless nickel coating or Chemical Process)
- RGA Analysis

Nickel-coated cylinder are primarily used for corrosive gas products. Air Liquide has developed coating specifications to ensure quality coatings (Coating thickness and porosity).



Cylinder / Bulk Specifications

CYLINDERS

		Service Pressure	Internal Water volume	Outside diameter	Height w/out valve	Height to centerline of valve	Tare Weight w/out valve
		Bars	Liters	mm	mm	mm	Kg
B0.4	Carbon Steel	200	0.45	60	230	270	1.2
	Aluminum	200	0.4	66	230	260	0.8
B1	Carbon Steel	200	1.03	83	280	310	2.1
	Aluminum	200	1	76	335	370	1.2
B2	Carbon Steel	200	2	100	350	380	4
	Aluminum	200	2	118	309	339	2.9
B5	SS 316L	96	5	141	490*	520	13.1
	Carbon Steel	200	5.1	140	420	450	8.8
	Aluminum	200	5.1	141	420	450	6.0
B10	SS 316L	96	10	141	910*	940	22.1
	Carbon Steel	200	10.1	140	830	870	14.2
B20	Carbon Steel	200	20.6	229	820	870	30.2
	Aluminum	200	20	206	900	950	21.7
B45	Aluminum	200	45	228.6	1650	1680	54.5
B50	Carbon Steel	200	50.6	229	1500	1530	64.5
	Aluminum	200	50	246	1500	1530	49.8

* Cylinder with a pedestal

The above data is provided for approximate guidance only. Please contact your sales office if specifications are critical and for precise dimensions.

TUBE TRAILERS

The length of the tubes is 20 feet. The amount of tubes per trailer is limited by allowable weight.

TON UNITS

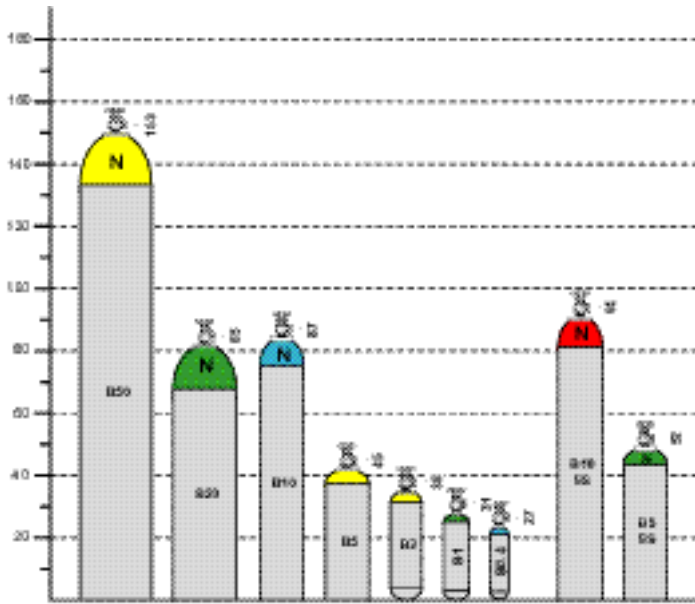
Ton units represent larger cylinder. They can be drum or sphere.

6, 9, 12, 16, 18 OR 28 PACKS

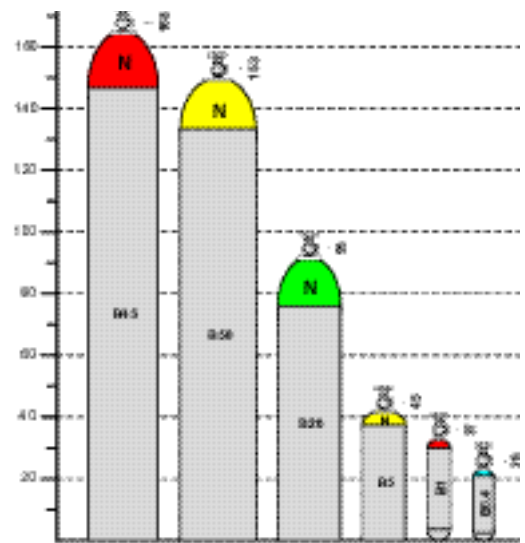
A group of 6, 9, 12, 16, 18 or 28 cylinders manifold together.



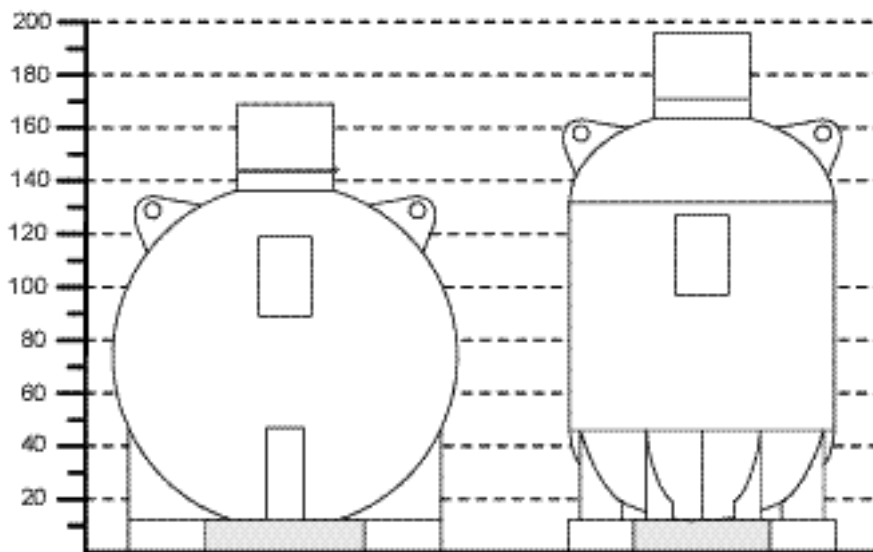
STEEL CYLINDERS (DIMENSIONS IN CM)



ALUMINIUM CYLINDERS (DIMENSIONS IN CM)



SPHERE AND DRUM (DIMENSIONS IN CM)



Cylinder Shoulder Color

The European EN 1089-3 Cylinder Color Standard is replacing existing national standard. Two "N" letters on the shoulder will designate the new cylinders. Concerning gas mixtures, Air Liquide has decided to use only one single color : the one of the main hazard.



Toxic and/or corrosive
Yellow



Flammable
Red



Oxidant
Light Blue



Inert
Green

Valve Specifications

PACKED VALVE

One of the oldest design valves. Primarily used for corrosive and liquefied gases. The sealing is a metal to metal seat.



DIAPHRAGM PACKLESS VALVE

This valve is employed in non corrosive gas service. The diaphragm valve incorporates a "soft seat" (non-metallic) which is typically Kel-F, Nylon or Teflon.



TIED DIAPHRAGM VALVE

This optimizes the design for corrosive gas service, eliminates particle shedding moving parts and minimizes the surface area of the wetted cavity. The valve incorporates a "soft seat" which can be Kel-F, or PVDF.



RESTRICTED FLOW ORIFICE (RFO)

A small screw which is inserted in the orifice of the valve outlet to limit the flow rate of a hazardous gas.

PNEUMATIC ACTUATOR

Fits on the top of the valve replacing the handwheel mode of operation. Conversion of a manual valve to a pneumatic valve is not likely unless the manual has a certain style body which will adapt to the actuator.



Valve Outlet Connections

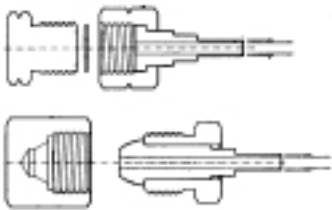
TYPICAL CONNECTION

A typical connection consists of four parts : the valve outlet, a nipple, a nut and a gasket. The surface finishes, gasket materials and mechanical condition are critical.

Gasket materials are non-metallic or metallic. Non-metallic gaskets can be made from different materials (PTFE, Nylon, Fiber).

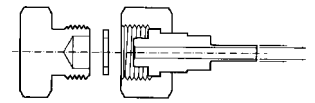
CYLINDER CONNECTIONS

The valve outlets on all containers supplied by Air Liquide Electronics are to a recognized standard :

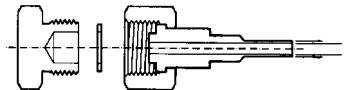


Typical CGA

- DIN477 German Standard
- CGA V 1 1994 American Standard
- JIS B 8246 1996 Japanese Standard
- AFNOR NF-E 29-650 French Standard



Typical DIN



Typical JIS

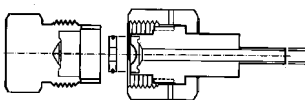
In North America, outlet connections are designed by the letters CGA (Compressed Gas Association).

Sometimes an ultra-high integrity connection is preceded by DISS (Diameter Index Safety System). DISS cylinder connections are used in the Semiconductor industry where the highest levels of purity and the lowest leak rate connections are required.

The sealing contact surfaces are much more sophisticated than those of a general industrial connection. The key to successful sealing of the DISS connection is the extremely smooth finish of the sealing surfaces.

The CGA has published two technical bulletins:

- “TB-14: Torque Guidelines for CGA Outlet Connections”
- “TB-9 : Guidelines for the Proper Handling and use of the CGA 630/710 Series “Ultra high Integrity Service” Connections”



Typical DISS



Products

Chemical Name	Formula	Characteristics	Neutral	Flammable	Oxidiser	Toxic	Corrosive	Shelf Life (months)
Ammonia	NH3	Liquefied Gas						24
Arsine	AsH3	Liquefied Gas						36
Boron Trichloride	BCl3	Liquefied Gas						24
Boron Trifluoride	BF3	Compressed Gas						24
Chlorine	Cl2	Liquefied Gas						24
Chlorine Trifluoride	ClF3	Liquefied Gas						12
Deuterium	D2	Compressed Gas						12
Diborane	B2H6	Compressed Gas						6
Dichlorosilane	SiH2Cl2	Liquefied Gas						24
Disilane	Si2H6	Liquefied Gas						12
Germane	GeH4	Liquefied Gas						12
Hydrogen	H2	Compressed Gas						12
Hydrogen Bromide	HBr	Liquefied Gas						24
Hydrogen Chloride	HCl	Liquefied Gas						24
Hydrogen Fluoride	HF	Liquefied Gas						12
Hexafluoro-1,3-butadiene	C4F6	Liquefied Gas						12
Hexafluoroethane	C2F6	Liquefied Gas						36
Hexafluoropropylene	C3F6	Liquefied Gas						36
Methyl Fluoride	CH3F	Liquefied Gas						36
Nitrogen Trifluoride	NF3	Compressed Gas						24 - 36
Octafluoropropane	C3F8	Liquefied Gas						36
Octafluorocyclobutane	C4F8	Liquefied Gas						36
Octafluorocyclopentane	C5F8	Organic Liquid						12
Phosphine	PH3	Liquefied Gas						36
Silane	SiH4	Compressed Gas						36
Silicon Tetrafluoride	SiF4	Liquefied Gas						24
Sulfur Hexafluoride	SF6	Liquefied Gas						36
Tetrafluoromethane	CF4	Compressed Gas						36
Trifluoromethane	CHF3	Liquefied Gas						36
Tungsten Hexafluoride	WF6	Liquefied Gas						24

ACTUAL VALVE OUTLET PROPOSED					VALVE PROPOSED
DISS (UHP CGA)	United States CGA	Germany DIN	France AFNOR	Japan JIS	
		DIN 6	NF C		SS diaphragm seal type
DISS 632	(CGA 350)	DIN 1	NF E		SS Packed needle stem design /diaphragm seal type, Pneum./Manual
DISS 634 (pneumatic valve)	DIN 8	NF J			SS diaphragm seal type
(CGA 330)	DIN 8	NF J			SS Packed needle stem design
	DIN 8	NF J			SS Packed needle stem design
DISS 728 (pneumatic valve)			JIS 26L		SS diaphragm seal type
		DIN 1			
		DIN 1	NF E		SS diaphragm seal type, Pneumatic / Manual
DISS 636 (pneumatic valve)		DIN 5	NF J		SS Packed needle stem design or SS diaphragm seal type
		DIN 1	NF E		SS diaphragm seal type
	CGA 350	DIN 1			SS Diaphragm seal type
		DIN 1	NF E		Packed needle stem design
		DIN 8	NF J		SS Packed needle design or SS diaphragm seal type
		DIN 8	NF J		Packed needle design
			NF J		Packed needle design
	CGA 660	DIN 6			SS diaphragm seal type
	CGA 660 (Ton-Tank)	DIN 6	NF C		Packed needle design or diaphragm seal type
			NF C		Diaphragm seal type
	CGA 350				Brass Diaphragm seal type
DISS 640 (pneumatic valve)		DIN 8	NF J		SS Packed needle stem design or SS diaphragm seal type
		DIN 6	NF C		SS or Brass diaphragm seal type
DISS 716		DIN 6	NF C		SS or Brass diaphragm seal type or SS Tied diaphragm seal type
DISS 716					SS Tied diaphragm seal type
		DIN 1	NF E		SS Diaphragm seal type, Pneumatic / Manual
DISS 632		DIN 1	NF E		SS Diaphragm seal type, Pneumatic / Manual
		DIN 8	NF J		SS Packed needle seal type
		DIN 6	NF C		SS diaphragm seal type
		DIN 6	NF C		Brass Packed needle valve or SS/Brass diaphragm seal type
		DIN 6	NF C		SS or Brass Diaphragm seal type
		DIN 8			SS diaphragm seal type or VCR outlet

Standards: CGA V1 1994, DIN477 Teil1, AFNOR-NF E29-650, JIS B8246 1996

The above data is provided for approximate guidance only. Different valve outlets and packaging are available, please consult your Air Liquide representative.

Safety Rules

In order to use Special Gases safely, it is essential that the cylinders are stored, handled and used with the correct equipment, and that the properties of the gases are understood.

NEUTRAL / INERT GASES



They are colorless and odorless, as well as nonflammable and nontoxic but in sufficient concentrations asphyxiating. Use of adequate ventilation and monitoring of the oxygen content in confined places will minimize the danger of asphyxiation.

FLAMMABLE AND PYROPHORIC GASES



Gases which may be ignited or explode when they accumulate between the lower and upper explosive limits for a specific gas.

Pyrophoric gases are highly flammable and reactive. They may spontaneously burn or explode when release into air.

Cylinders of flammable gases should only be used in areas that are remote from ignition sources and well ventilated. Flammable gases should never be released into the air.

COMBUSTIVE OR OXIDIZING GASES



Gases which may promote the rapid combustion or reactivity of flammable gases or materials. These gases should not be stored with flammable gases due to their fire or explosive hazard.

CORROSIVE GASES



Reactive gases which may degrade materials and cause permanent damage to body tissues upon direct contact. Special safety precautions are required when handling, using and storing corrosive gases.

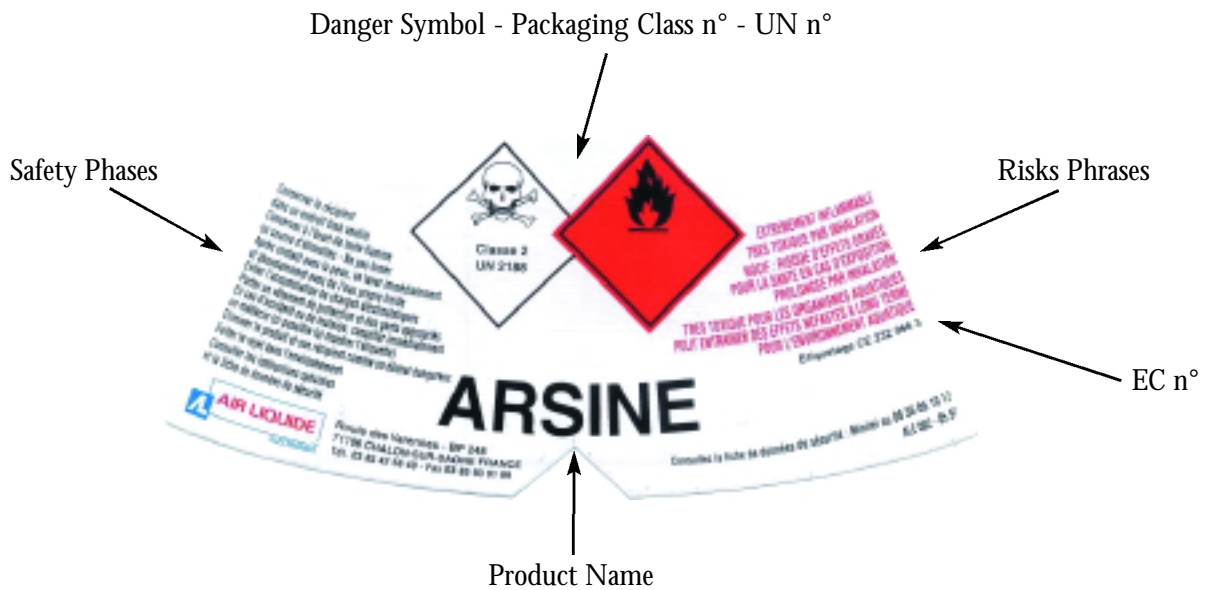
TOXIC GASES



Highly poisonous gases that may be immediately dangerous to life and health if accidentally released. Use toxic gases in a well ventilated area.

They can be high pressure, flammable or non-flammable, and/or oxidizing in addition to their toxicity.

Cylinder Labelling



Hydrotest Period

Most cylinders require a periodic requalification known as a hydrostatic retest. The basic steps for this process are as follows:

- Empty the cylinder and remove the valve
- Internal / External inspection
- Cylinder Pressurization
- Measure the elastic expansion

This test will determine if the cylinder walls have deteriorated.

Europe	3 years for corrosive gases (except Fluor, Ammoniac and Chlorine which are 5 years) 5 years for toxic gases 10 years for non-toxic, non-corrosive gases
America	In general, the standard hydrotest period for DOT high pressure cylinders is 5 years. This is true for all aluminum cylinders, regardless of the product service.
Japan	3 years for cylinders built before March, 31st 1988 5 years for cylinders built after March, 31st 1988

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