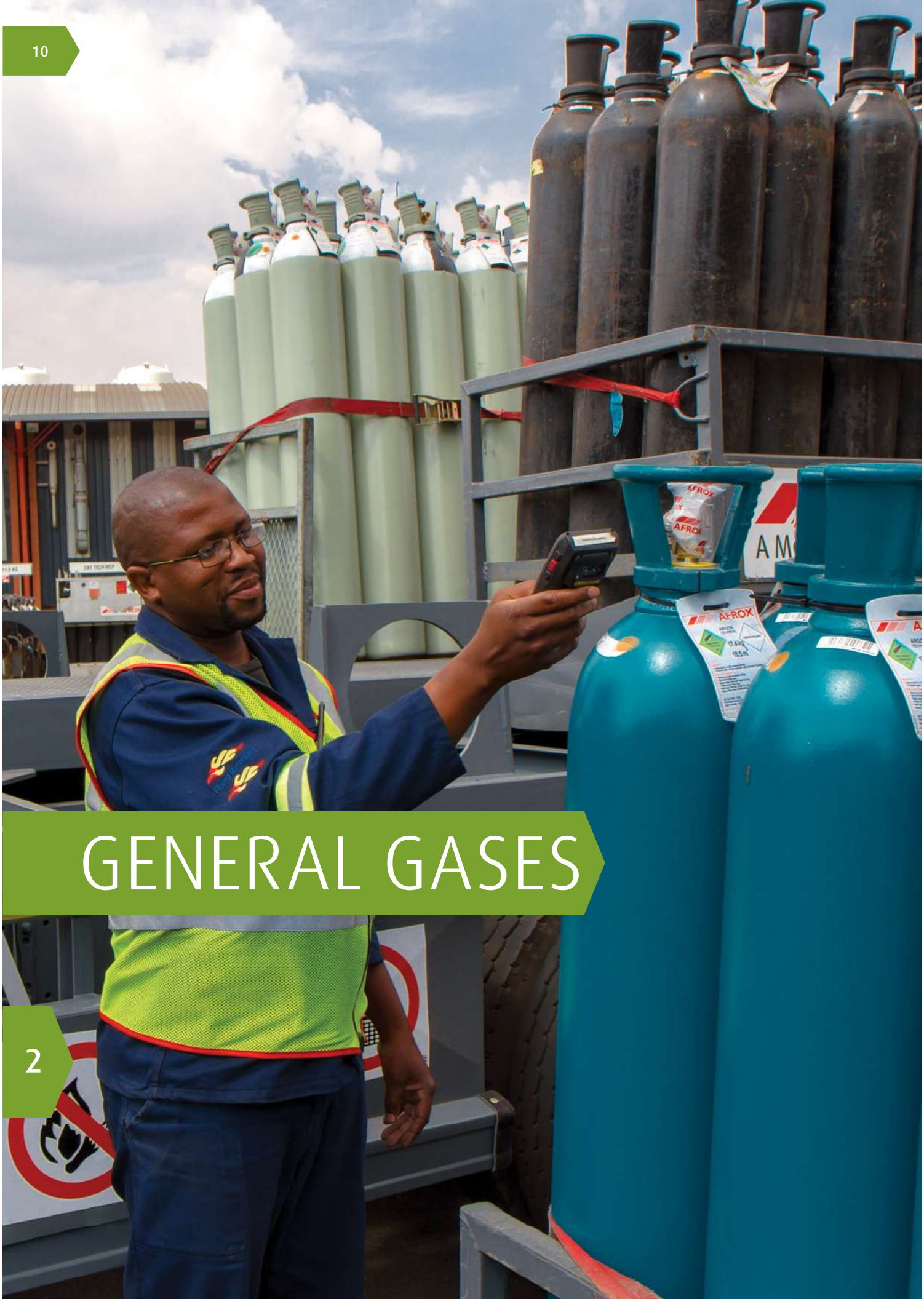


GENERAL GASES

2

GENERAL GASES INFORMATION

How do I safely connect a gas cylinder to an appliance?

When connecting your gas appliance to the gas cylinder, always ensure that the connection is made correctly and is gas tight. A smell of gas will be detected if the connection is not tight. All gas appliances have rubber or fibre washers to seal the gas tightly at the point of connection to the gas cylinder. Always check that this washer or seal is in place and in good condition. The rubber or fibre seals and hoses do wear and need to be checked periodically and replaced occasionally. Some 'Handi' tips:

- Only open valve 1½ turns
- When lighting gas appliances that don't have auto ignition:
  First light the match or lighter, hold it to the gas burner, then open the gas. The gas will ignite immediately and the flame temperature will go from 0 to 1 970°C instantly. To ensure that fresh air is always available, have a window slightly open when using gas appliances, even in cold weather
- Ensure LPG cylinders are always placed on a firm surface
- Always shut off the gas supply at the cylinder valve when the appliance is not in use
- It is very important to keep the gas jets clean. Before connecting the appliance to the gas cylinder, make sure that the valve is free of dirt and dust.

Like all electrical installations, it is legally required that fixed LPG appliances are fitted and piped to a gas cylinder(s) outside, and they must be installed by a certified LPG installer. Contact your Handigas dealer or Afrox Customer Service Centre on 0860 020202.

Identification of Bulk Cryogenic Products

OXYGEN (0_2)

SHIPPING NAME: Oxygen, Refrigerated Liquid

UN Number: 1073

ERG: 122

Oxygen is a colourless, odourless and tasteless gas that supports life and combustion. All elements, except rare gases, react with oxygen, over a wide range of temperatures, to form oxides. Oxygen is 1,1 times heavier than air and is slightly soluble in water.

1073

011 873 4382 | 011 873 4382

NITROGEN (N_2)

SHIPPING NAME: Nitrogen, Refrigerated Liquid

UN Number: 1977

ERG: 120

Nitrogen is colourless, odourless and tasteless. It is non-flammable, will not support combustion and is not life-supporting. The gas is slightly lighter than air and is only slightly soluble in water. When liquid nitrogen is vaporised and then heated, it consumes a large amount of heat, making it an ideal coolant.

1977

011 873 4382 | 011 873 4382

ARGON (Ar)

SHIPPING NAME: Argon, Refrigerated Liquid

UN Number: 1951

ERG: 121

Argon is a colourless, odourless, tasteless and non-toxic gas. Argon, along with helium, neon, krypton, xenon and radon, is also known as a "rare" gas. Argon forms no known chemical compounds. The gas is 1,38 times heavier than air and is slightly soluble in water.

1951

011 873 4382 | 011 873 4382

CARBON DIOXIDE ($C0_2$)

SHIPPING NAME: Carbon Dioxide, Refrigerated Liquid

UN Number: 2187

ERG: 120

Carbon dioxide is a slightly toxic, odourless, colourless gas with a slightly pungent, acidic taste. It will not burn or support combustion. It is 1,52 times heavier than air and is very soluble in water, forming carbonic acid. Carbon dioxide will sublime at atmospheric pressure and -78°C to solid form (dry ice).

2187

011 873 4382 | 011 873 4382

NITROUS OXIDE (N_20)

SHIPPING NAME: Nitrous Oxide, Refrigerated Liquid

UN Number: 2201

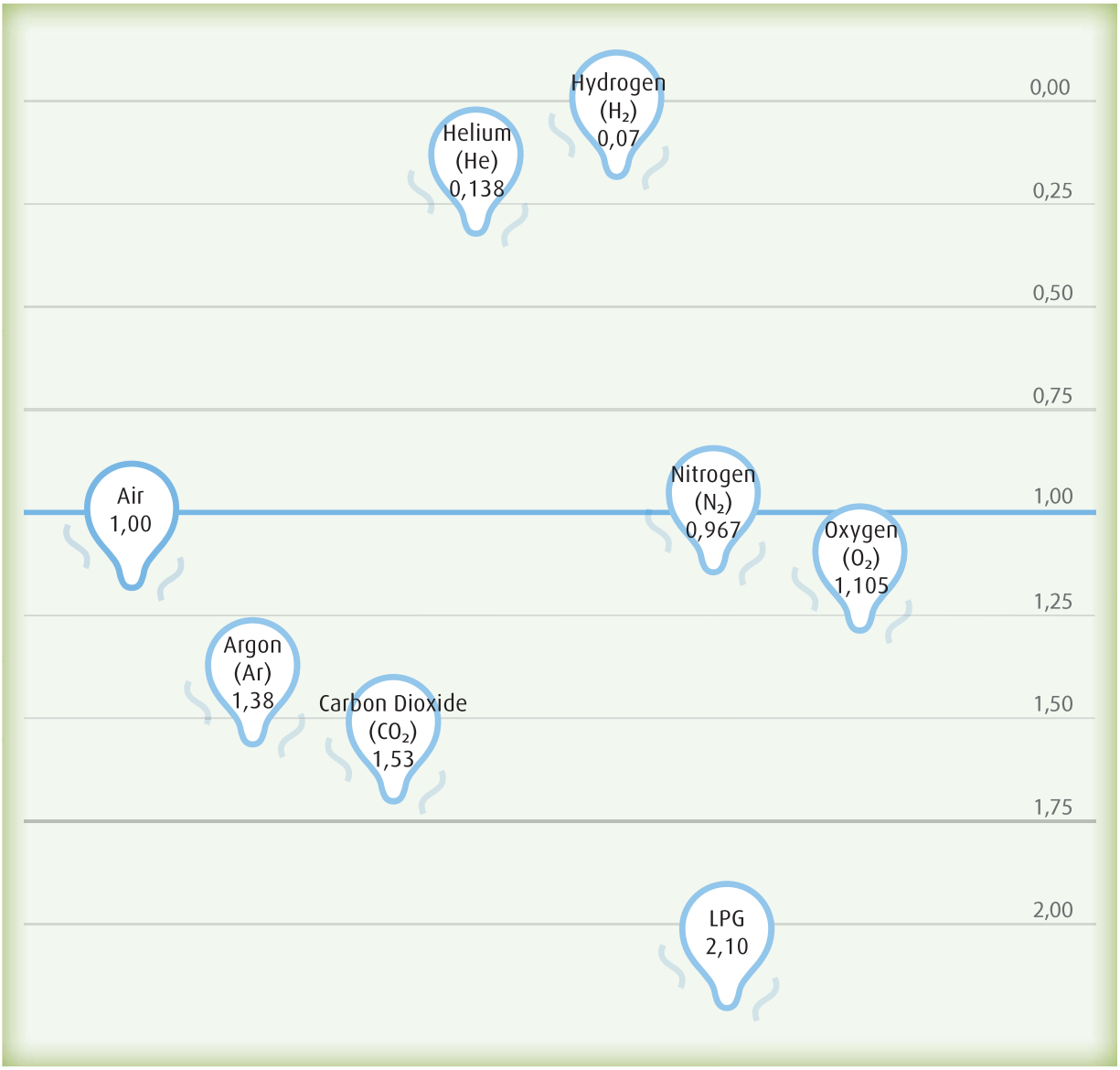
ERG: 122

The chemical formula symbol for nitrous oxide is N_20 - two atoms of nitrogen and one of oxygen. The gas is also known as laughing gas because about 180 years ago, a young British scientist name Sir Humphrey Davy discovered that inhaling N_20 resulted in strange uncontrolled behaviour. He was working on the effects of certain gases on the body and had almost killed himself by inhaling methane to see what would happen. In 1801, he caused a sensation at a public lecture by giving N_20 to volunteers from the audience.

2201

011 873 4382 | 011 873 4382

Relative Gas Densities



Gas Conversion and Reference Tables

Pressure Equivalents Quick Reference Chart

Millibar							
kPa	bar	mb	atms	kg/cm²	psi	mm Hg	Metres H_2O @ -20°C
1,0	0,010	10,000	0,010	0,010	0,145	7,501	0,102
100,000	1,0	1,000,000	0,987	1,020	14,504	750,063	10,216
0,100	0,001	1,0	0,001	0,001	0,015	0,750	0,010
101,325	1,013	1,013,250	1,0	1,033	14,696	760,001	10,351
98,067	0,981	980,665	0,968	1,0	14,223	735,560	10,018
6,895	0,069	68,948	0,068	0,070	1,0	51,715	0,704
-0,133	-0,001	-1,333	-0,001	-0,001	-0,019	1,0	0,014
9,789	0,098	97,890	0,097	0,100	1,420	73,424	1,0

Characteristics Summary

	Gas	Symbol	Cylinder Colour	Characteristics
	Acetylene	C_2H_2	Maroon	Distinctive garlic smell. Will ignite and burn instantly when in contact with ignition sources. However, it is lighter than air. Requires minimum energy to ignite in air or oxygen. Never use copper or alloys containing more than 70% copper or 43% silver with acetylene.
	Argon	Ar	Peacock blue	Odourless. Heavier than air. Does not burn. Inert. Will cause asphyxiation in absence of sufficient oxygen to support life. Will readily collect in the bottom of a confined area. At high concentrations, almost instant unconsciousness may occur, followed by death. The prime danger is that there will be no warning signs before unconsciousness occurs.
	Carbon dioxide	CO_2	Light brundswick green	Odourless and slightly acidic gas. Will cause asphyxiation. Heavier than air. Will collect in ducts, drains and low lying areas.
	Helium	He	Mid brown	Inert but asphyxiant at high concentrations. Lighter than air.
	Hydrogen	H_2	Signal red	Odourless. Much lighter than air. Will collect at the highest point in any enclosed space unless ventilated at a high level. Fire and explosion hazard. Very low ignition energy.
	Nitrogen and oxygen-free nitrogen	N_2 or N	Shoulder black and body French Grey	Odourless. Does not burn. Inert, except at extremely high temperatures, but does not support life, so will cause asphyxiation if insufficient oxygen is present. At high concentrations, almost instant unconsciousness may occur, followed by death. The prime danger is that there are no warning signs before unconsciousness occurs.
	Oxygen	O_2	Black	Odourless. Generally considered non-toxic at atmospheric pressure. Will not burn, but supports and accelerates combustion. Materials not normally considered combustible may be ignited by sparks in oxygen rich atmospheres. For more information, contact Afrox before using any materials for oxygen service that have not been supplied for use with oxygen and marked accordingly.
	LPG	Approx. 60% C_3H_8 40% C_4H_{10}	Dark admiralty grey (Branded Handigas)	Standard LPG sold by Afrox is 'stenched' (odourised) and has a fish-like smell. Will ignite and burn instantly in contact with ignition sources. Is heavier than air and will collect in ducts, drains, etc., and low lying areas. Fire and explosion hazard. Requires minimum energy to ignite in air or oxygen.

* **Know Your Gases** – Users should always have Afrox material safety data sheets for each of the gases stored and used. Other industrial gases, special gases and medical gases are available from Afrox. If you transport, store or use any of these gases, you should always possess the relevant Afrox material safety data sheets and other safety information. Some special gases may be either toxic, flammable or corrosive and you need to take special precautions when handling them.

Note: MSDS available from www.afrox.com

Gas Volume Conversion

Gas	Cubic Metres Gas @ 20°C and 101,33 kPa (Atmosphere)
	1 kg
Acetylene	0,917
Air	0,829
Argon	0,601
Carbon dioxide	0,544
Helium	6,01
Hydrogen	11,96
Methane	1,497
Nitrogen	0,858
Nitrous oxide	0,543
Oxygen	0,751
LPG	0,484

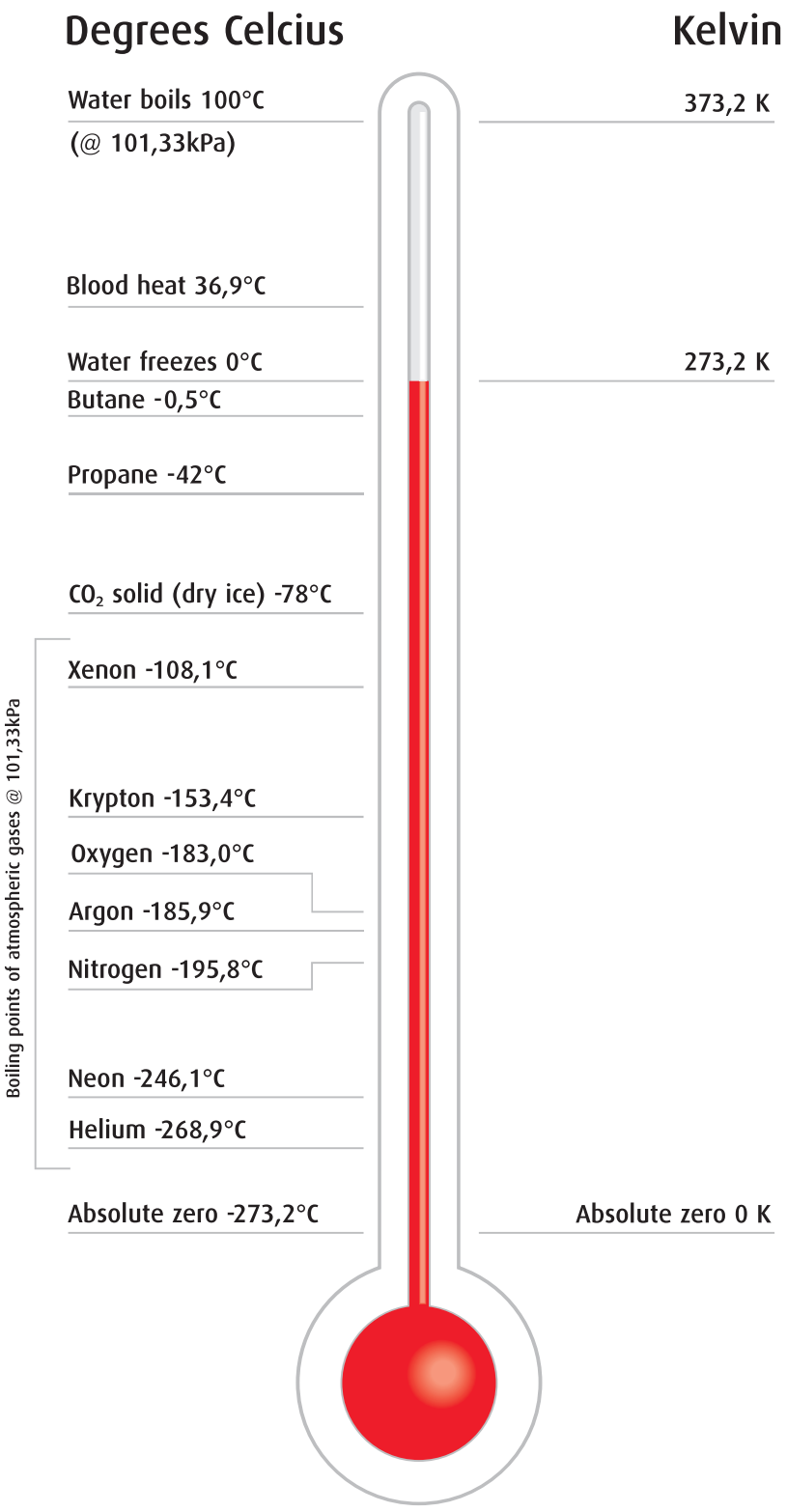
Note: 1 m³ = 1 000 ℓ

Gas	Storage Conditions	Liquid Volume @ Storage Condition (ℓ)	Mass (kg)	Gas Volume @ 20°C and 101,33 kPa (m³)
Argon (Ar)	-185,9°C B.Pt @ 101,33 kPa	1,0	1,39	0,84
		0,72	1,0	0,60
		1,20	1,66	1,0
Carbon dioxide (CO_2)	-26°C and 1 500 kPa (g)	1,0	1,03	0,56
		0,97	1,0	0,54
		1,78	1,84	1,0
Nitrogen (N_2)	-195,8°C B.Pt @ 101,33 kPa	1,0	0,81	0,69
		1,24	1,0	0,86
		1,44	1,16	1,0
Oxygen (O_2)	-183,0°C B.Pt @ 101,33 kPa	1,0	1,14	0,86
		0,88	1,0	0,75
		1,17	1,33	1,0
*LPG	20°C and 750 kPa (g)	1,85	0,54	0,26
		2,10	1,0	0,49
		3,81	2,06	1,0
*Propane	20°C and 870 kPa (g)	1,0	0,51	0,27
		1,96	1,0	0,54
		3,65	1,88	1,0

*Quoted at 20°C as per South African trade metrology regulations.
LPG based on 60/40 propane/butane mixture.

Parts Per Million	%
1 ppm	0,0001
5 ppm	0,0005
10 ppm	0,001
50 ppm	0,005
100 ppm	0,01
500 ppm	0,05
1 000 ppm	0,1
10 000 ppm	1,0

The Cryogenic Thermometer



General Conversion and Reference Tables

Length		
1 millimetre (mm)	—	0,0393 701 inches
1 centimetre (cm)	10 millimetres	0,393 701 inches, 0,032 208 4 feet
1 decimetre (dm)	10 centimetres	3,937 01 inches
1 metre (m)	10 decimetres (100 cm)	39 370,1 inches, 3,280 843 feet, 1,093 614 yards
1 decametre (dam)	10 metres	10,936 14 yards
1 hectometre (hm)	10 decametres (100 m)	109,361 4 yards
1 kilometre (km)	10 hectometres (1 000 m)	3 280,843 feet, 1 093,614 yards, 0,621 371 miles

Area		
1 square millimetre (mm^2)	—	0,001 550 square inches
1 square centimetre (cm^2)	100 square millimetres	0,155 square inches, 0,001 076 39 square feet
1 square decimetre (dm^2)	100 square centimetres	15,50 square inches
1 square metre (m^2)	100 square decimetres (10 000 cm^2)	10,763 915 square feet, 1,195 99 square yards
1 are	100 square metres (1 square decametre)	119,599 square yards
1 hectare (ha)	100 ares (10 000 square metres)	11 959,9 square yards, 2,471 05 acres
1 square kilometre (km^2)	100 hectares (1 000 000 square metres)	0,386 102 square miles

Volume (cubic)		
1 cubic millimetre (mm^3)	—	0,000 061 024 cubic inches
1 cubic centimetre (cm^3)	1 000 cubic millimetres	0,061 024 cubic inches
1 cubic decametre (dm^3)	1 000 cubic centimetres (1 litre)	61,024 cubic inches
1 cubic metre (m^3)	1 000 cubic decimetres (1 000 litre)	35,317 76 cubic feet, 1,307 95 cubic yards

Volume (fluid)		
1 millimetre (ml)	—	0,035 195 fluid oz
1 centilitre (cl)	10 millilitres	0,351 95 fluid oz
1 decilitre (dl)	10 centilitres	3,519 5 fluid oz, 0,175 975 pints
1 litre (ℓ)	10 decilitres	1,759 75 pints, 0,219 969 gallons, 0,264 18 US gallons
1 decalitre (dal)	10 litres	2,199 69 gallons
1 hectolitre (hl)	10 decalitres (100 litres)	21,996 9 gallons
1 kilolitre (kl)	1 000 litres (1 m^3)	219,969 gallons

Mass		
1 milligram (mg)	(1 000 micrograms) mg	0,015 432 36 grains
1 centigram (cg)	10 milligrams	0,154 323 6 grains
1 decigram (dg)	10 centigrams	1,543 236 grains
1 gram (g)	10 decigrams (1 000 milligrams)	15,432 36 grains, 0.035 274 avoir oz
1 decagram (dag)	10 grams	0,352 74 avoir oz
1 hectogram (hg)	10 decagrams	3,527 4 avoir oz, 15 432,358 grains
1 kilogram (kg)	10 hectograms (1 000 grams)	2,204 622 6 litres, 2,204 622 6 lbs
1 tonne (t)	1 000 kilograms	19,684 1 cwts, 0,984 207 tonne, 1 102 311 short tonnes (2,000 lb tonnes)

Celsius to Fahrenheit

°C	°F	°C	°F	°C	°F	°C	°F	°C	°F	°C	°F
300	572	92	197,6	64	147,2	36	96,8	8	46,4	-20	-4,0
290	554	91	195,6	63	145,2	35	95,0	7	44,6	-21	-5,8
280	536	90	194,0	62	143,6	34	93,2	6	42,8	-22	-7,6
270	518	89	192,2	61	141,8	33	91,4	5	41,0	-23	-9,4
260	500	88	190,4	60	140,0	32	89,6	4	39,2	-24	-11,2
250	482	87	188,6	59	138,2	31	87,8	3	37,4	-25	-13,0
240	464	86	186,8	58	136,4	30	86,0	2	35,6	-26	-14,8
230	446	85	185,0	57	134,6	29	84,2	1	33,8	-27	-16,6
220	428	84	183,2	56	132,8	28	82,4	0	32,0	-28	-18,4
210	410	83	181,4	55	131,0	27	80,6	-1	30,2	-29	-20,2
200	392	82	179,6	54	129,2	26	78,8	-2	28,4	-30	-22,0
190	374	81	177,8	53	127,4	25	77,0	-3	26,6	-31	-23,8
180	356	80	176,0	52	125,6	24	75,2	-4	24,8	-32	-25,6
170	338	79	174,2	51	123,8	23	73,4	-5	23,0	-33	-27,4
160	320	78	172,4	50	122,0	22	71,6	-6	21,2	-34	-29,2
150	302	77	170,6	49	120,2	21	69,8	-7	19,4	-35	-31,0
140	284	76	168,8	48	118,4	20	68,0	-8	17,6	-36	-32,8
130	266	75	167,0	47	116,6	19	66,2	-9	15,8	-37	-34,6
120	248	74	165,2	46	114,8	18	64,4	-10	14,0	-38	-36,4
110	230	73	163,4	45	113,0	17	62,6	-11	12,2	-39	-38,2
100	212	72	161,6	44	111,2	16	60,8	-12	10,4	-40	-40,0
99	210,2	71	159,8	43	109,4	15	59,0	-13	8,6	-45	-49,0
98	208,4	70	158,0	42	107,6	14	57,2	-14	6,8	-50	-58,0
97	206,6	69	156,2	41	105,8	13	55,4	-15	5,0	-55	-67,0
96	204,8	68	154,4	40	104,0	12	53,6	-16	3,2		
95	203,0	67	152,6	39	102,2	11	51,8	-17	1,4		
94	201,2	66	150,8	38	100,4	10	50,0	-18	-0,4		
93	199,4	65	149,0	37	98,6	9	48,2	-19	-2,2		

Force

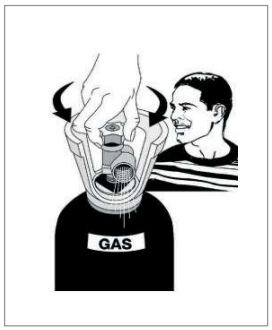
Pounds Force (lbf)	Newtons (N)	Newtons (N)	Pounds Force (lbf)	Tons Force (tonf)	Kilonewtons (kN)	Kilonewtons (kN)	Tons Force (tonf)
1	4,448 22	1	0,224 809	1	9,964 02	1	0,100 361
2	8,896 44	2	0,449 618	2	19,928 04	2	0,200 722
3	13,344 67	3	0,674 427	3	29,892 06	3	0,301 083
4	17,792 89	4	0,899 236	4	39,856 08	4	0,401 444
5	22,241 11	5	1,124 045	5	49,820 10	5	0,501 805
6	26,689 33	6	1,348 854	6	59,784 12	6	0,602 166
7	31,137 55	7	1,573 663	7	69,748 14	7	0,702 527
8	35,585 78	8	1,798 472	8	79,712 16	8	0,802 888
9	40,034 00	9	2,023 281	9	89,676 18	9	0,903 249
10	44,482 22	10	2,248 090	10	99,640 20	10	1,003 610

Note: 1 MPa and 1 N/mm² are the same.

Cylinder Safety Precautions

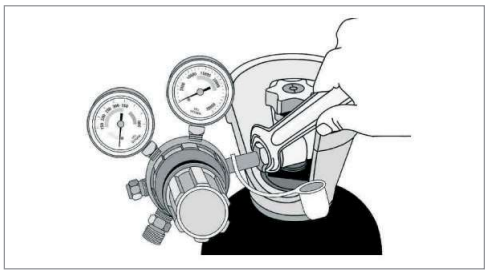
There are no higher priorities than the health and safety of our employees, customers, suppliers and the community, and the protection of the environment.

Cylinder Safety

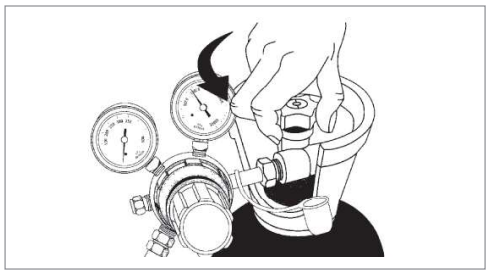


1. Before attaching a regulator to a cylinder, the cylinder valve should be wiped with an oil-free cloth. Then rapidly open and close the cylinder valve to blow out any dust or dirt. This also ensures that empty cylinders are not being connected. Direct valve outlet away from people in the vicinity and keep well clear of the gas being vented.

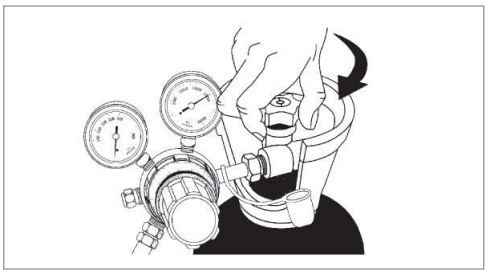
   NB: Never vent toxic and/or flammable gases.



2. Be sure to select the correct regulator for the gas you are using. Connect the regulator to the cylinder valve using the correct spanner. Do not use excessive force but make certain that the joint is gas tight. Ensure the regulator thread connections are in a good condition before connecting.



3. Attach and tighten the hose connection to the regulator outlet and check that the torch or other equipment to be used is properly connected at the other end of the hose. Open the cylinder valve 1½ turns slowly and set the regulator delivery pressure. Check for leaks using the recommended leak detection spray or solution.



4. Close the cylinder valve and release the pressure from the torches, hoses and regulators when the equipment is not in use, is being moved or if the cylinders are empty.

Ten Steps to Cylinder Safety	
1	Read labels and Material Safety Data Sheet (MSDS) before use.
2	Store upright and use in well ventilated, secure areas away from pedestrian or vehicle thoroughfare.
3	Guard cylinders against being knocked violently or being allowed to fall.
4	Wear safety shoes, glasses and gloves when handling and connecting cylinders.
5	Always move cylinders securely with an appropriate trolley. Take care not to open the valve when moving a cylinder.
6	Keep in a cool, well ventilated area, away from heat sources, sources of ignition and combustible materials, especially flammable gases.
7	Keep full and empty cylinders separate.
8	Keep ammonia-based leak detection solutions, oil and grease away from cylinders and valves.
9	Never use force when opening or closing valves, or tamper with the cylinder or valve.
10	Don't repaint or disguise markings and damage. If damaged, return cylinders to Afrox immediately.

Cylinder Valve Safety

When working with cylinders or operating cylinder valves, ensure that you wear appropriate protective clothing – leather gloves, safety boots and safety glasses.

When moving cylinders, ensure that the valve is not accidentally opened in transit.

Before operating a cylinder valve:

- Ensure that the system you are connecting the cylinder into is suitable for the gas and pressure involved.
- Ensure that any accessories (such as hoses attached to the cylinder valve, or the system being connected to) are securely connected. A hose, for example, can potentially whip around dangerously if it is accidentally pressurised when not restrained at both ends.
- Stand to the side of the cylinder so that neither you nor anyone else is in line with the back of the cylinder valve.

When operating the cylinder valve:

- Open it by hand by turning the valve hand-wheel anti-clockwise. Use only reasonable force.
- Ensure that no gas is leaking from the cylinder valve connection or the system to which the cylinder is connected. DO NOT use ammonia-based leak detection fluid as this can damage the valve. Approved leak detection fluid can be obtained from an Afrox Gas & Gear.
- When finished with the cylinder, close the cylinder valve by hand by turning the valve hand-wheel in a clockwise direction. Use only reasonable force. Do not use mechanical aids to close the valve.

Remember NEVER tamper with the valve. If you suspect the valve is damaged, DO NOT use it. Report the issue to Afrox and arrange for the cylinder to be returned to Afrox.

Leak Detection Fluids for Compressed Gas Applications

Why use a leak detection fluid?

For safety and economic considerations, it is good practice to frequently check your own gas systems and cylinders for leaks.

You can do this by either applying a leak detection fluid to the valve and other potential leakage points, or by spraying a leak detection fluid onto the required areas on the cylinder/valve.

Why is the correct choice of leak detection fluid important?

Selecting an incorrect leak detection fluid can lead to:

- Weakening of brass cylinder valves or brass components; and
- Risk of flames or an explosion.

What should I consider when choosing a leak detection fluid?

- **DO** select leak detection fluids that are compatible with brass and oxygen.
- **DO** carefully use the pre-formulated or correctly diluted leak detection fluid.
- **DO NOT** use leak detection fluids that contain ammonia or halides (e.g. chlorides).
- **DO NOT** use naked flames to check for leaks.

What does Afrox recommend?

Afrox recommends purpose-designed leak detection solutions specially formulated for the purpose.

Leak detection fluid products

- Safetest W012045 leaktest detection spray.

Handling Gas Cylinders — General Safety

- **DO** use mechanical aids (ramps, trolleys, forklifts, scissor lifts) in preference to direct manual handling of cylinders.
- **DO** remove any connected equipment (e.g. regulator) AND refit any supplied valve protection cap and/or valve outlet gas tight cap/plug prior to moving cylinders.
- **DO** ensure cylinders are positively secured to mechanical lifting/handling devices prior to movement.
- **DO** familiarise yourself with and observe appropriate safe lifting techniques/postures prior to manually handling heavy or large gas cylinders.
- **DO** assess the load weight and dimensions before attempting any lift.
- **DO** use suitable personal protective equipment (PPE) – wear safety footwear and leather gloves to protect against falling/slipping cylinders crushing hands or feet during moving.
- **DO** ensure a positive hand grip prior to commencing a manual lift.
- **DO** ensure that loads are equally shared when attempting two-person lifts.
- **DO** note environmental conditions prior to handling cylinders – wet, hot or cold cylinders may diminish the quality of hand grip and footing may be compromised.
- **DO NOT** bear-hug cylinders to effect a lift.
- **DO NOT** lift or lower cylinders where the operator's hands are above shoulder height or below mid-thigh height.
- **DO NOT** edge-roll cylinders up or down steps of 250 mm or higher.
- **DO NOT** edge-roll cylinders over discontinuous or soft surfaces.
- **DO NOT** attempt to catch or restrain a falling cylinder.
- **DO NOT** attempt to handle cylinders if you are fatigued, physically compromised or under the adverse influence of medication or alcohol.
- **DO NOT** drop cylinders as a method of transfer – this may seriously damage the cylinder or its valve, resulting in their failure and product release.

Consider this before handling your cylinders...

"Think before you lift"

"Don't bear-hug cylinders"

"Team lifts share the load"

Transporting Gas Products Safely Including Cryogenic Receptacles

Transporting cylinders in enclosed vehicles

Use of enclosed vehicles for cylinder transportation is NOT RECOMMENDED by Afrox.

Customers who choose to transport cylinders in enclosed vehicles do so at their own risk.

Please ensure you are aware of the dangers:

- A lack of ventilation can cause asphyxiation.
- A cylinder in the boot of a car can leak and cause an explosion.
- Fold-down back seats are not designed to prevent cylinders from penetrating into the passenger compartment and could injure passengers in a frontal crash.
- Cylinders cannot be adequately restrained when placed on passenger seats, in the boot, or against the cargo barrier of station wagons or hatch-backs, and can become projectiles in an accident.

Afrox offers a cylinder delivery service (additional charges may apply) if the customer does not have suitable transportation.

However, if the customer insists on transporting the cylinders in an enclosed vehicle, they should:

- Ensure that at least one window is open at all times and the ventilation fan is on high speed when transporting the cylinders.
- Avoid transporting cylinders in the passenger compartment.
- Ensure that the cylinders are unloaded as soon as possible after arrival at the destination (ventilation decreases considerably when the vehicle is stopped or parked).
- Ensure that the cylinders are not stored or left unattended in the vehicle overnight or for long periods (more than one hour).

Transporting cryogenic receptacles

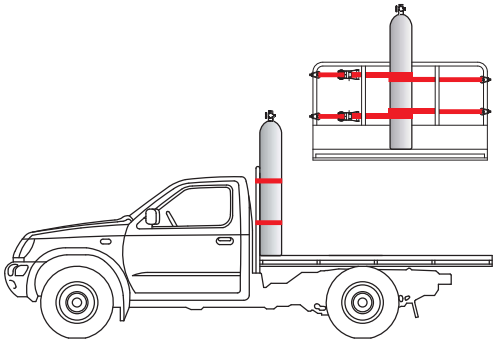
When transporting liquid nitrogen dewars or dry ice by private car or station wagon:

- Do not transport cryogenic receptacles with inert gases, or containers with dry ice, in the passenger compartment.
- Be aware that liquid nitrogen and dry ice are asphyxiants and, if stored or transported in an enclosed vehicle, can rapidly displace the available oxygen inside the vehicle, causing occupants to lose consciousness or can lead to death.

- Be aware that, in the event of an accident, the occupants may have liquid nitrogen spilt on them, causing severe burns to the skin.
- Check the suitability of the container for transport and storage of liquid nitrogen. The only suitable container is a liquid nitrogen flask designed for the purpose. No alternatives can be used. For example, a thermos flask is not suitable for carrying liquid nitrogen.

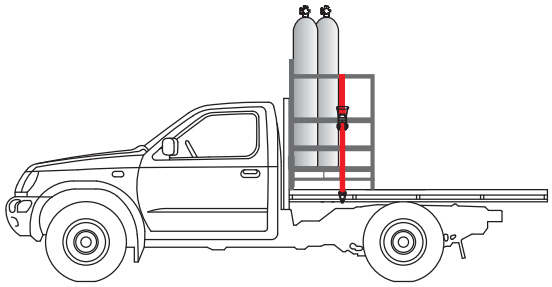
Transporting cylinders upright

- Liquefied gases and acetylene cylinders must be transported in an upright position.
- Cylinders should be restrained, with a lashing strap rated 1 tonne, to the vehicle body or contained within a purpose-built frame.
- If transported upright against a headboard:
  - The total weight of the cylinders should not exceed 250 kg
  - At least two horizontal straps should be applied.

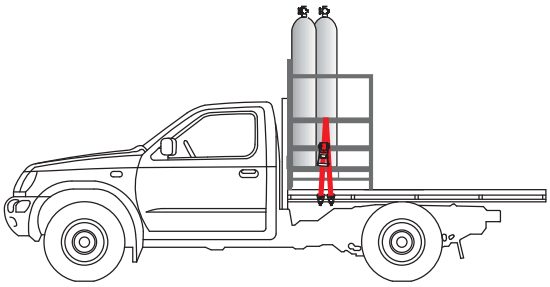


Two lashing straps, each rated at 1 tonne, should be used to restrain the cylinders in an upright position

Transporting cylinders in a pallet



Pallet must be placed against the headboard



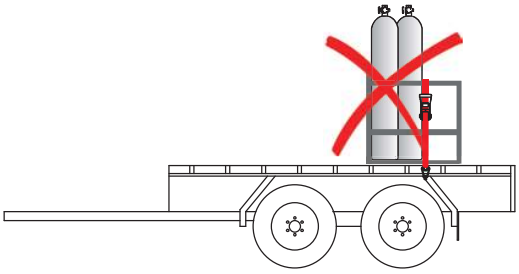
At least one tie-down strap must be used

- A maximum of three loose cylinders will be supplied to customers. It is recommended that greater numbers be supplied strapped in Afrox cylinder pallets (service charges may apply).
- If transported in a pallet in a utility or light truck:
  - The pallet should be placed against a headboard with the open end facing rearwards
  - At least one tie-down strap rated to 2 tonnes should be applied, or two when looped around the pallet rail.

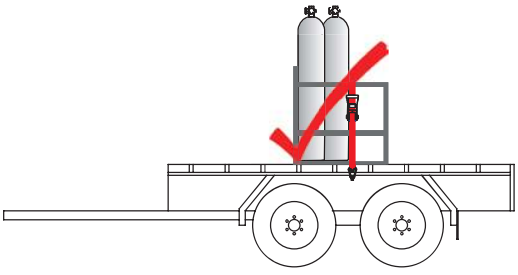
Transporting cylinders in a pallet on a trailer

If cylinders are transported in a pallet on a trailer:

- The pallet should be placed with the open end facing rearwards.
- The pallet should be positioned so that there is a downward force on the tow coupling.
- At least one tie-down strap should be applied rearward of the middle of the pallet, to prevent it tipping forward.



The pallet must be positioned to enable downward force on the tow coupling

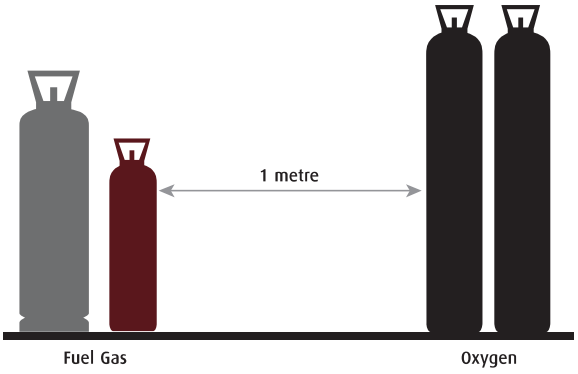


Use at least one tie-down strap as shown

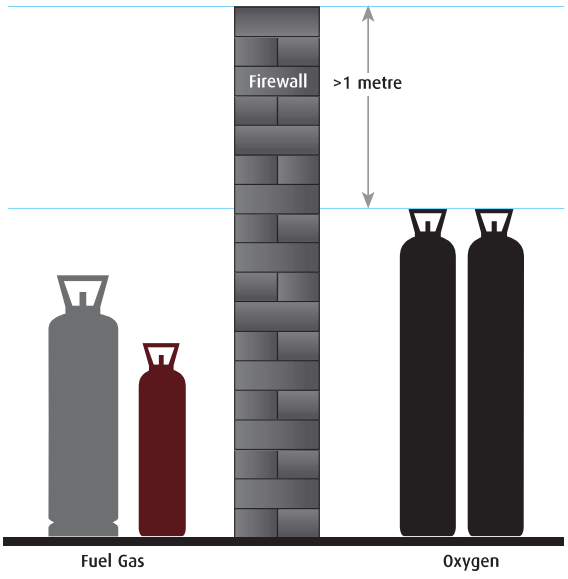
Storing Your Cylinders Safely

All cylinders should be considered and treated as full, regardless of their content. This means:

- Keep cylinders away from heat sources (e.g. flames or heaters).
- Do not store cylinders near combustible materials or flammable liquids.
- Keep flammable gases away from sources of ignition.
- Keep cylinders in well drained areas, out of water pools or ponds.
- The storage area should be kept well ventilated and clean at all times.
- Do not store in confined spaces.
- Avoid below-ground storage where possible. Where impractical, consider enclosed space risks.
- There should be good access to the storage area for delivery vehicles. The ground surface should be level and firm (preferably concrete).
- The storage area should be designed to prevent unauthorised entry, to protect untrained people from hazards and to guard cylinders from theft.
- Different types of gases must be stored separately, in accordance with SANS 10263-2 (The storage and handling of gases in cylinders).
- Stores must clearly show signage in accordance with National Dangerous Goods regulations. This includes Class Diamonds, HAZCHEM, no smoking and naked flame warning signs.
- Full and empty cylinders should be kept separate.
- Toxic and corrosive gases should be stored separately, away from all other gases.
- Liquefied flammable gases and acetylene cylinders must be stored upright, to keep the safety devices in the vapour phase, on a firm, level floor (ideally concrete). This is also preferable for most other gas cylinders.
- Store cylinders away from heavy traffic and emergency exits.
- Rotate stock of full cylinders, and use cylinders on a 'first in, first out' basis.
- Never repaint or obscure a cylinder label, even if the cylinder is rusty, dirty or damaged. This can result in unsafe situations.
- Never apply any unauthorised labels or markings to cylinders, unless advised by Afrox to identify faulty cylinders.
- Avoid storing cylinders below 0°C. Some mixtures may separate below this temperature.
- Regularly check for leaks and faults.
- Keep ammonia-based leak detection solutions, oil and grease away from cylinders and valves.
- Never use force when opening or closing valves.



OR



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Storage of Fuel Gases

Within the storage area, oxygen should be stored at least one metre from fuel gases cylinders. The use of a firewall may provide the required separation.

Note: Wall must be a minimum of one metre higher than the tallest cylinder.

Afrox Cylinder Identification

1	Gas name and grade
2	Dangerous Goods Classification
3	Contents of cylinder at standard temperature and pressure (20°C @ 101,3 kPa)
4	Hazard phrase*
5	Precautionary phrase*
6	United Nations numbering system for safe handling, transport and storage
7	Afrox gas item code
8	All hours emergency call number

*Always refer to Material Safety Data Sheet (MSDS)

Useful References

- Afrox Material Safety Data Sheets (MSDS), which are available at www.afrox.com or from your local Afrox office.

The following relevant statutory information and South African Standards are available from relevant Government and Standards offices:

- Occupational Health and Safety Act and Regulations 85/1993
- SANS 10019: Transportable containers for compressed, dissolved and liquefied gases - Basic design, manufacture, use and maintenance
- SANS 10232: Dangerous Goods - Initial Emergency Response Guide
- SANS 10087 parts 1 - 8: The storage and handling of LPG
- SANS 10263-2: The storage and handling of gases in cylinders
- SANS 10234: Global harmonised system of classification and labelling of chemicals

Plan For Emergencies

In case of emergency:

Call Afrox on **0860 020202**

- If a cylinder is damaged, contact Afrox immediately.
- People who have a responsibility for storing or using gas cylinders should be trained appropriately, should be made aware of the dangers and should be familiar with any emergency procedures.
- Storage area layouts and emergency procedures should be carefully planned.

Packing Data

The cylinders and valves supplied by Afrox are all manufactured to recognised South African and international standards.

Afrox-made industrial gases and industrial gas mixtures are supplied with cylinder outlet connections that comply with the requirements of SANS 10019.

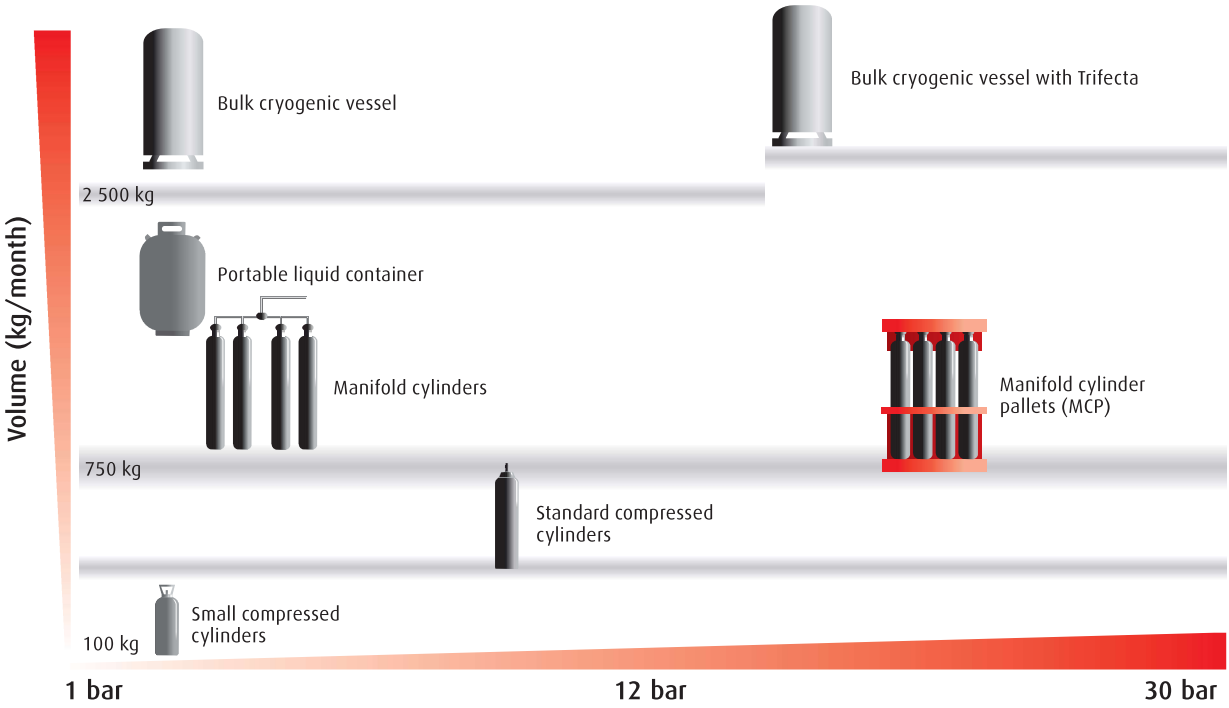
Cylinder sizes and valve connections for all industrial gas cylinders provided by Afrox are detailed in this section. You should also note that the regulators recommended throughout this manual come equipped with the correct valve connection for their intended service.

Note: Some imported and/or industrial grade gas cylinders may have other connections not listed in this catalogue. Please contact Afrox on 0860 020202 for further details.

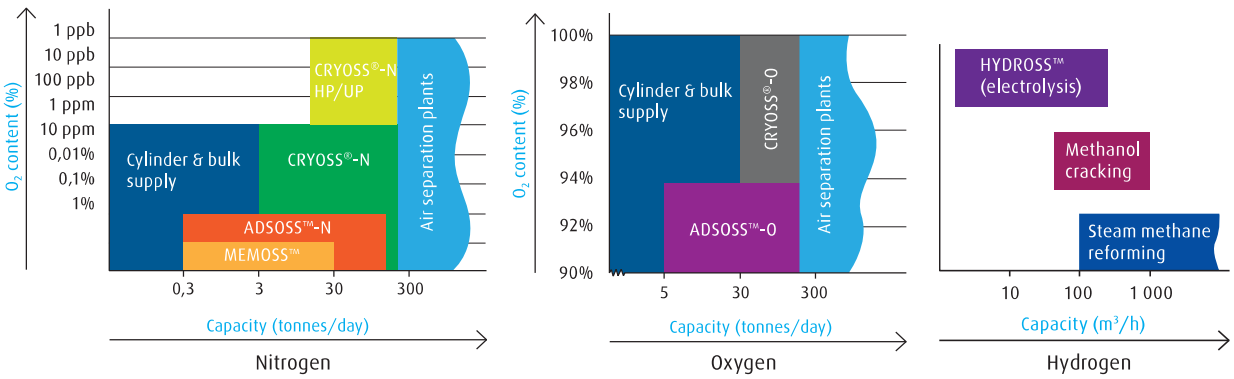
Supply Options

Optimising your business efficiencies

Your gas supply can influence your productivity. Frequent handling and changeover of cylinders can increase non-productive time, reduce your efficiency and ultimately increase your operational costs. To optimise your efficiency, you need to match your demand with your gas supply. Afrox offers a full range of gas products and services that help to make your business more efficient and productive.



ECOVAR® – On-site Gas Supply Options



Compressed cylinders

Afrox offers a wide range of single high pressure cylinders suitable for small volumes of gas. Available in many sizes and pressures, Afrox cylinders offer a high degree of versatility and flexibility.

Cylinder manifolds

Two or more compressed cylinders can be manifolded together in banks to provide a larger supply source. A manifold usually consists of two independent sets of controls to permit alternate or simultaneous operation of the two cylinder banks.

Manifolded cylinder pallets (MCPs)

Manifolded cylinder pallets or packs consist of a number of cylinders connected together with a single or dual outlet. The MCP package can comprise both pure and mixed gases, providing an uninterrupted supply of gas that can easily be transported by a forklift.

Portable cryogenic containers (PCCs)

Afrox offers a range of portable liquid containers suitable for small volumes of liquid.

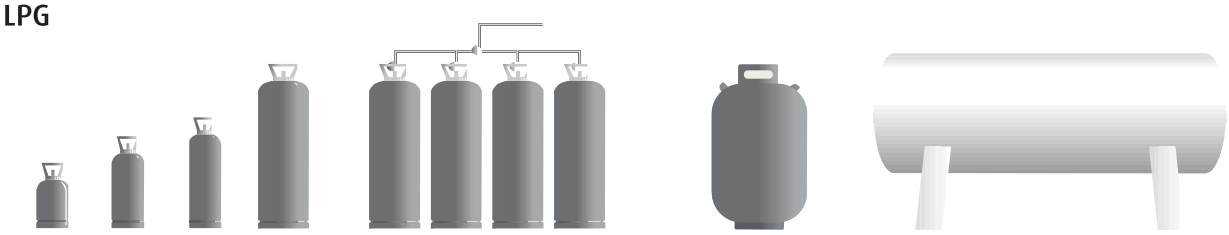
Bulk supply

For customers with high volume requirements and operations suited to piped supplies of gas, a bulk cryogenic storage vessel installed on-site offers the most efficient, convenient solution.

Afrox telemetry

The Afrox telemetry monitoring system constantly gauges the volume in your storage vessel. Afrox will automatically deliver gas as required.

LPG



Nominal Dimensions of LPG Vessels - Horizontal						
Size	**4,5 m³**	**9 m³**	**22,5 m³**	**45 m³**	**70 m³**	**90 m³**
Net Liquid Capacity (*l*)*	3 600	7 200	18 000	3 600	56 000	72 000
Net Mass Capacity (kg) approx*	1 969	3 938	9 846	19 692	30 632	39 384
Approximate Height (mm)	1 450	1 900	2 270	2 700	On Rec	On Rec
Approximate Width (mm)	1 060	1 450	2 060	2 450	On Rec	On Rec
Approximate Length (mm)	5 600	5 620	7 400	10 300	On Rec	On Rec
Plinth Area (long/wide) (m²)	$^{7,6}/_{3,1}$	$^{7,7}/_{3,5}$	$^{9,5}/_{4,2}$	On Rec	On Rec	On Rec
Net Weight (kg) approx	2 200	3 300	6 500	12 500	On Rec	On Rec
Max Working Pressure	1 725 kPa	1 725 kPa	1 725 kPa	1 725 kPa	1 725 kPa	1 725 kPa
Anticipated Working Pressure	600/800 kPa	600/800 kPa	600/800 kPa	600/800 kPa	600/800 kPa	600/800 kPa

Nominal Dimensions of LPG Vessels - Vertical				
Size	**2,25 m³**	**4,5 m³**	**9 m³**	**22,5 m³**
Net Liquid Gas Capacity (*l*)*	1 800	3 600	7 200	18 000
Net Mass Capacity (kg) approx*	985	1 969	3 938	9 846
Approximate Height (mm)	3 820	4 210	7 480	7 700
Approximate Width (mm)	1 070	1 380	1 380	2 110
Plinth Area (m²)	12,5	12,5	12,5	16
Net Weight (kg) approx	2 100	2 900	4 400	8 600
Max Working Pressure	1 725 kPa	1 725 kPa	1 725 kPa	1 725 kPa
Anticipated Working Pressure	600/800 kPa	600/800 kPa	600/800 kPa	600/800 kPa

*Note: Net mass based on 60/40 propane/butane mixture with liquid density 0,547
Net liquid capacity (*l*) based on filling to 80% of total volume

Individual Cylinder Tracking

Afrox has launched a pioneering tracking system that will enable us to operate the most effective and fully integrated cylinder tracking system available in the market today; ensuring that we are better positioned to serve the needs of our customers.

All Afrox Industrial , Special, Hospitality and Medical cylinders are tracked on this system. Refrigerants and LPG cylinders are excluded.

How does cylinder tracking work?

- All Afrox gas cylinders (Industrial, Special and Medical gas cylinders) now carry a unique barcode, which is scanned during delivery using a state-of-the-art handheld device.
- All tracked cylinders supplied by Afrox have their barcode scanned at each stage of delivery and return to Afrox.
- Customers are required to acknowledge receipt and collection of cylinders by providing our delivery drivers with an electronic signature on a handheld device.
- The Delivery Advice Note is created after all cylinders have been scanned.
- The Delivery Advice Note lists the serial numbers of all tracked gas cylinders supplied and returned, providing detailed information to help you manage cylinder stocks.
- Every transaction will be recorded and uploaded to our fully integrated Cylinder Tracking Management System.
- Every cylinder supplied by us will be scanned and automatically allocated to the customer's account.
- Every cylinder returned to or collected by us will be scanned and automatically removed from your account.

What benefits does cylinder tracking offer to our customers?

- Peace of mind through increased levels of traceability of tracked gas cylinders.
- Improved invoice accuracy and cylinder management, making it easier to do business with Afrox.
- Greater reliability and accuracy of stock holdings to help you improve internal cost management.
- Improved handling of gas cylinder enquiries, saving time and effort.

An important change to how you may currently manage your cylinders

It is important to be aware that if you have swapped, or inadvertently changed cylinders with another Afrox customer, any returned cylinders will be deducted from the original customer account, not from the returning account.

However, if cylinders are moved within a customer's own organisation, this does not impact the overall cylinder holdings, as the system automatically updates the account accordingly.

Additional benefits in doing business with Afrox

Safety First

- No need to worry about testing your cylinders and valves – we do it for you.
- We look after cylinder repair and replacements.
- With us, you can work according to the highest safety standards.

Zero Investment

- We invest in cylinders for you – meaning no cylinder purchasing or deposit costs.
- You don't need to hold extra cylinders during maintenance.
- We free up your time so you can get on with the job at hand.

Flexible solutions

- You are free to select and swap between gas types and cylinder sizes.
- You can choose to pick up from any of our retail outlets or agents or have your cylinders delivered.
- Pricing is flexible, adapting to your consumption.

Latest Technologies

- We invest in new cylinder packages for you.
- You have access to state-of-the-art technologies such as lightweight cylinders and high-tech valves.
- We constantly innovate new technologies to add value to your business.

Reliable Partner

- Get access to our broad product range.
- Benefit from our large scope of services.
- We offer extensive technical and safety support.
- You have the convenience of a dense network of retail outlets and agents with one-stop shopping at selected stores.