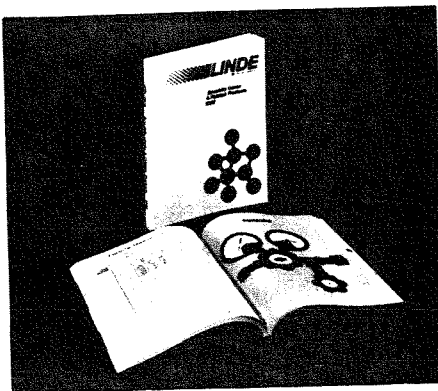


SPECIALTY GASES AND RELATED PRODUCTS

The specialty gases business began more than sixty years ago when Linde developed the process for producing rare atmospheric gases. Today, LINDE specialty gases can be found in laboratories, factories and hospitals; advancing technology, improving manufacturing methods and even saving lives. Selecting your specialty gases from the most experienced and versatile supplier offers the following advantages:

AVAILABILITY — Over six hundred Linde distribution points can supply you with any of our specialty gases. And there are hundreds of pure and mixed gases. They are available in a wide variety of packages — including glass bulbs, high pressure and low pressure cylinders, ton containers, storage tanks and trailers.

CONVENIENCE — Linde supplies not only the gases, but also a complete



line of equipment for controlling them — regulators, flow-meters, valves, manifolds and much more.

QUALITY — Because Linde manufactures most of its specialty gases, you are assured of stringent quality control procedures during all stages of production.

PRODUCT INFORMATION — The LINDE Specialty Gases and Related Products Catalog is an informative and useful tool for industrial gas users. This year's catalog contains completely reorganized sections on Pure Gases and Mixed Gases. In addition to adding Metric measurements, these pages make it easier to read about Linde's huge selection of specialty gases. Sections on electronic materials, special application gases and adsorbents have been brought up-to-date. The equipment section includes descriptions and illustrations of regulators and flowmeters to explain the operation of these common gas handling devices. The catalog is complete with index, glossary of terms, product safety information and tables of Metric equivalents. To get your copy of this 214 page publication ask your Linde supplier for L-3500.

U.S. GOVERNMENT SPECIFICATIONS

U.S. Government contracts require that the products purchased meet certain government specifications. The industrial gases listed in this section of the catalog have been tested for impurities and meet the government specifications shown.

Specifications fall into a variety of categories including Federal, Military, NASA and more. Where a particular grade of gas is listed, e.g., Grade A, B, C, only that grade (or grades) meets the corresponding government specifications.

ACETYLENE

LINDE acetylene meets the following government specifications:

Federal BB-A 106b, 1/20/75 [Grade B* (welding and cutting)] [Grade B* (industrial)].

ARGON

LINDE argon meets the following U.S. Department of Defense specifications:

MIL-A-18455B*, 3/20/62

MIL-P-27415, 8/2/76 [Grade B*]

These specifications may be required for use by the Departments of the Army, Navy and Air Force.

HELIUM

LINDE helium meets the following government specifications:

Federal Specification BB-H-1168b, 5/9/77;

Military Specification MIL-P2-27407a 11/28/78;

NASA George C. Marshall Space Flight Center Specification MSFC-SPEC 264C 9/15/69.

Air Force Purchase Description
AFPID 9135-13, 5/23/69.

HYDROGEN

LINDE hydrogen meets the following specifications:

Federal Specification BB-H-886C, 4/10/78

Military Specification
MIL-P-2-27201B, 6/30/71

NASA George C. Marshall Space Flight Center Specification MSFC-SPEC-356A, 4/15/67.

NITROGEN

LINDE nitrogen meets the following government specifications:

Federal BB-N-411c, 1/3/73 [Type I (gaseous), Class I (oil free), Grades A, B, and C*] [Type II (liquid), Class I (oil free), Grades A, B, and C*]

USAF MIL-P-27401C, 1/20/75
(propellant nitrogen) [Type I (gaseous)] [Type II (liquid)]

OXYGEN

LINDE oxygen meets the following government specifications:

Federal BB-O-925a, 8/22/61 (oxygen for industrial use) [Type I* (gaseous)] [Type II (liquid)]

USAF MIL-P-25508E, 1/6/75 [Type I (gaseous)] [Type II (liquid)]

USAF MIL-O-27210E, 7/21/77
[Type I* (gaseous)] [Type II (liquid)]

*Subject to modification. See your Linde supplier for further information.

NOTE: It is not possible to list all applicable government specifications. Ask your Linde supplier if you need further information.

LINDE® GAS DISTRIBUTION EQUIPMENT

Linde maintains complete step-by-step control over the manufacture of its unexcelled range of gas distribution and storage equipment. Cylinders and containers are designed to meet the highest industry standards. All LINDE cylinders meet or exceed applicable DOT specifications, whatever the application, your Linde supplier has the equipment to meet your exact gas requirements.

High-Pressure Cylinders

Since gases have a relatively low density, a given volume of gas at atmospheric pressure can be considerably reduced by compressing it into a cylinder under greater pressure. These cylinders must be constructed to withstand the high pressures involved. LINDE high-

pressure gas cylinders not only meet DOT specifications but must also meet additional rigid specifications established by Linde. Quality control, from chemical analysis of molten steel to final testing, is rigidly controlled. A variety of cylinders sizes is available for all industrial gases.

LINDE Acetylene Cylinders

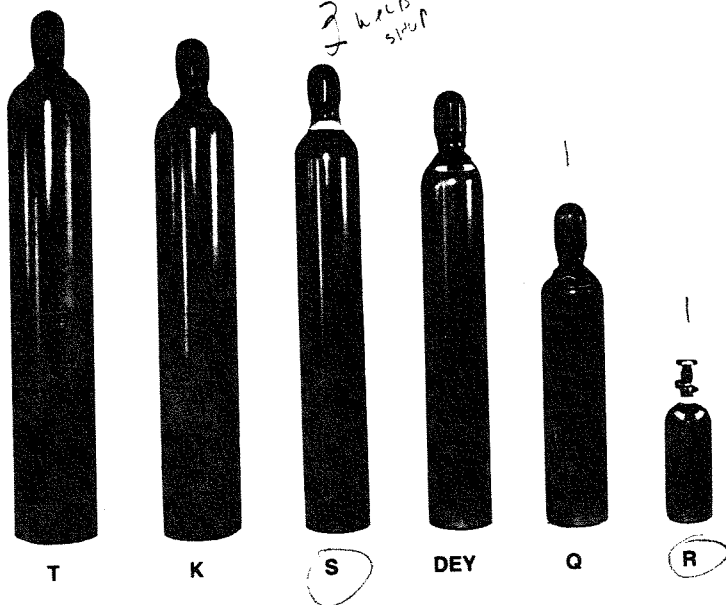
Although acetylene is compressed into cylinders at a lower pressure than other industrial gases, LINDE acetylene cylinders are manufactured to the same high standards as those used for other gases. Acetylene in commercial cylinders is supplied dissolved in acetone since acetone will hold more than 400 times its own volume of dissolved acety-

lene at 70°F and 250 psi full cylinder pressure. Linde has developed a special filler to retain the acetylene-acetone solution. This exclusive high porosity filler provides reduced cylinder weight, increased cylinder capacity and improved charging and discharging rates.

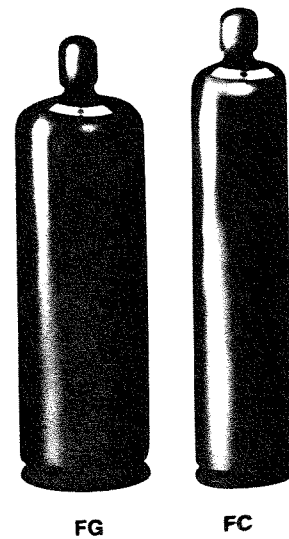
LINDE FG-2 Low-Pressure Cylinders

LINDE FG-2 fuel gas is shipped and stored in cylinders manufactured in accordance with DOT specification 4BA for appropriate service pressure. As with all other LINDE cylinders they must also meet Linde's own stringent specifications.

HIGH-PRESSURE CYLINDERS



FUEL GAS CYLINDERS



IDENTIFICATION OF GASES IN CYLINDERS

Identification of the gas content of compressed gas cylinders is established by means of the chemical or trade name of the gas marked on the cylinder.

This accepted means of identification is used by the industry in general in conformance with the methods established by the American National Standards Institute (ANSI) under its General Acceptance Method. The provisions apply as set forth in the *American Standard Method of Marking Compressed Gas Cylinders to Identify Gas Content*, published by ANSI.

While cylinders are painted in various colors and combinations of colors, these

colors do not provide identification of gas contents and should not be used for that purpose. Suppliers do not intend that users rely on cylinder color to identify gas content.

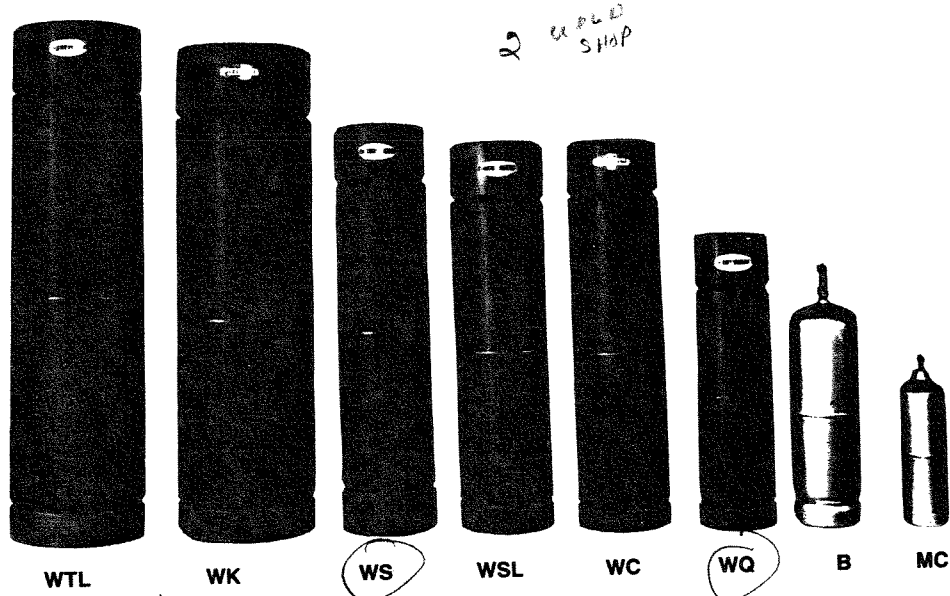
There are many reasons why cylinder colors cannot serve as a dependable key to cylinder contents. For example:

1. There are hundreds of gases and combinations of gases. To use a separate color or color combination to identify each gas would lead to mistakes.
2. Compressed gas cylinders receive hard service that may damage, discolor, or conceal paint.

3. Many people have defective color vision and cannot distinguish between certain colors.
4. Colors appear differently under some light sources such as fluorescent and mercury vapor lamps.
5. Some suppliers use cylinder colors unlike those used for the same gas by other suppliers.

For these reasons, it is *important* that users should *identify gas contents of cylinders by reading the cylinder marking. DO NOT* be influenced by cylinder color.

ACETYLENE CYLINDERS



LINDE® LIQUID CONTAINERS

Oxygen, nitrogen, argon, helium and hydrogen are available in liquefied form in special cryogenic containers. These portable supply units are designed to transport, store and deliver the contents. Some of these units are for gas or liquid service only, others can supply both gas and liquid. In some cases the liquid is converted to gas through accessory manifolds or dispensed in liquid form by simply opening the withdrawal valve.

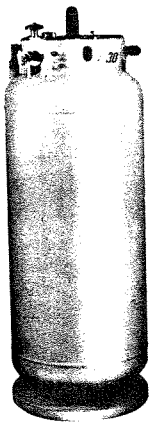
Whatever the application, filling dewars or refrigerators, direct liquid use or gas service, there is a LINDE liquid cylinder to meet the need. Among the features of LINDE liquid cylinders are:

- built-in automatic pressure building systems — for immediate discharge at required pressures (except LS-156 and LS-160)
- built-in vaporizers — for direct gas usage without auxiliary equipment
- complete mobility — lift by hooks, wheel on cylinder trucks
- super-insulation and advanced vacuum technology — keep evaporation losses at a minimum
- specially-designed heat-shielded helium cylinders — no need for nitrogen shielding

Available LINDE Containers

- GP/30 for gas service from liquid oxygen, nitrogen and argon
- GP/45 for gas and liquid service from liquid oxygen, nitrogen and argon
- LS-110 for liquid nitrogen service
- LS-156 for liquid service of oxygen, nitrogen and argon; for gas service with vaporizing manifolds
- LS-160 for liquid nitrogen service
- LSHe-30 for liquid helium service
- SS-100 for liquid helium service
- LSH-150 for liquid hydrogen service

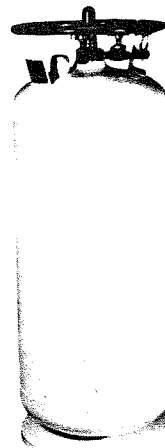
Refer to Cylinder and Valve Data (pages 1/9-11) for general specifications.
Consult your Linde supplier for complete information about liquid containers.



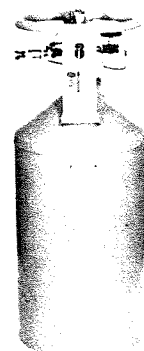
GP/30



GP/45



LS-160



LSHe-30

CYLINDER AND VALVE DATA

OXYGEN, NITROGEN AND MIXTURES THEREOF

Gas	Cylinder Style	Contents (cf)	Full Cyl. Pressure at 70° F. (psi)	Height incl. Cap. (in.)	Outside Diameter (in.)	Approximate Weight		Cylinder Valve Outlet Connection CGA No.
						Full (lb.)	Empty (lb.)	
OXYGEN	T	330	2,640	60	9-1/4	172	146	540
	K, KL	244	2,200	56	9	153	133	540
	LK	244	2,200	56	8-15/16	134	114	540
	D	122	2,200	48	7-1/2	126	116	540
	E, Y	122	2,200	48	7	92	82	540
	Q	80	2,200	35	7-1/8	70	65	540
	XL	70	2,200	41	6	54	49	540
	S	150	2,200	51	7-3/8	92	80	540
	R	20	2,200	19	5-3/16	13-1/2	12	540
LIQUID OXYGEN	LS-110	3,350	—	58	20	517	240	—
	LS-156	4,200	—	62	20	572	224	—
	GP/30	3,000	—	58	20	468	220	540
	GP/45	4,500	—	62-1/4	20	623	250	540
OXYGEN-NITROGEN	K	*	2,200	56	9	* †	133	540†
NITROGEN	T, TL	300	2,640	60	9-1/4	165	143	580
	K	224	2,200	56	9	149	133	580
	D	112	2,200	48	7-1/2	124	116	580
	S	138	2,200	51	7-3/8	90	80	580
	Q	73	2,200	35	7-1/8	70	65	580
	R	18	2,200	19	5-3/16	13-1/2	12	580
LIQUID NITROGEN	LS-110	2,700	—	58	20	435	240	—
	LS-156	3,410	—	62	20	471	224	—
	LS-160B	3,930	—	58	20	503	218	—
	GP/30	2,440	—	58	20	399	220	580
	GP/45	3,640	—	62-1/4	20	514	250	580
NITROGEN-HYDROGEN	HK	*	2,000	56	9	*	133	350

* Dependent on relative proportions of component gases.

† Less than 5% oxygen, CGA 580; 5-23% oxygen, CGA 590; over 23% oxygen, CGA 296.

AIR, HYDROGEN, ACETYLENE AND FG-2

COMPRESSED AIR (For industrial and breathing purposes)	T	305	2,640	60	9-1/4	172	146	346
	K, KL	229	2,200	56	9	150	133	346
	LK	229	2,200	56	9	131	114	346
	D	116	2,200	48	7-1/2	124	116	346
	E, Y	116	2,200	48	7	90	82	346
	Q	77	2,200	35	7-1/8	71	65	346
	S	136	2,200	51	7-3/8	90	80	346
	R	19	2,200	19	5-3/16	13-1/4	12	346
	HYDROGEN	HE	96	2,000	48	7	81-1/2	81
D, HD		104	2,000	48	7-1/2	116-1/2	116	350
H, HK		191	2,000	56	9	134	133	350
HS		118	2,000	51	7-3/8	78-1/2	78	350
T		*	2,400	60	9-1/4	145	143	350
K		*	2,000	56	9	134	133	350
HYDROGEN-ARGON	T	*	2,400	60	9-1/4	*	143	350
	K	*	2,000	56	9	*	133	350
HYDROGEN-NITROGEN	T	*	2,400	60	9-1/4	*	143	350
	K	*	2,000	56	9	*	133	350
LIQUID HYDROGEN	LSH-150	4,500	—	58	20	189-1/2	166	—
ACETYLENE	WTL	390	250	44-3/8	12-1/2	207	180	510
	WK	304	250	42	12-7/8	245	223	510
	WSL	130	250	33-1/2	8-1/2	78	69	510
	WS	130	250	35-1/2	8-1/2	79	70	510
	WC	111	250	37-1/2	8-1/2	94	87	510
	WQ	60	250	24-1/4	7-5/8	56	52	510
	B	40	250	23	6-1/4	26	23-1/2	520
	MC	10	250	14	4	8	7	200
LINDE FG-2	FC	470*	137	52-1/4	10	109	55	510
	FG	939†	137	50-1/2	14.5	174	70	510

* Equivalent to 52 lb.

† Equivalent to 104 lb.

ARGON, ARGON MIXTURES, HELIUM AND HELIUM MIXTURES

Gas	Cylinder Style	Contents (cf)	Full Cyl. Pressure at 70° F. (psi)	Height incl. Cap. (in.)	Outside Diameter (in.)	Approximate Weight		Cylinder Valve Outlet Connection CGA No.
						Full (lb.)	Empty (lb.)	
ARGON	T, TL	330	2,640	60	9-1/4	177	143	580
	K	242	2,200	56	9	158	133	580
	AS	78	2,200	35	7-1/8	73	65	580
	S	150	2,200	51	7-3/8	95	80	580
LIQUID ARGON	LS-110	3,290	—	58	20	580	240	—
	LS-156	4,035	—	62	20	641	224	—
	GP/30	2,900	—	58	20	519	220	580
	GP/45	4,320	—	62-1/4	20	697	250	580
ARGON-OXYGEN	T	*	2,640	60	9-1/4	*	143	580
ARGON-OXYGEN-CO ₂ (STARGON™)	T	344	2,640	60	9-1/4	175	143	580
	S	156	2,200	51	7-3/8	95	80	580
	Q	86	2,200	35	7-1/8	70	60	580
ARGON-HYDROGEN	HK	*	2,000	56	9	*	133	350
ARGON-CARBON DIOXIDE	T	*	2,640	60	9-1/4	*	143	580
ARGON-NITROGEN	T	*	2,640	60	9-1/4	*	143	580
HELIUM	T	286	2,640	60	9-1/4	146	143	580
	H, HK	213	2,200	56	9	135	133	580
	S	134	2,200	51	7-3/8	82	80	580
	HS	134	2,200	51	7-3/8	82	80	580
LIQUID HELIUM	LSHe-30	800	—	44-1/4	18-3/4	91-1/2	83	—
	LSHe-100	2,663	—	62	20	272†	200	—
ARGON-HELIUM	T	*	2,640	60	9-1/4	*	143	580
	H	*	2,200	56	9	*	133	580
HELIUM-ARGON-OXYGEN	K	214	2,200	56	9	135	133	580
HELIUM-ARGON-CARBON DIOXIDE	K	213	2,200	56	9	135	133	580

* Dependent on relative proportions of component gases. † Includes shipping skid.

LINDE® STORAGE TANKS

As your needs for industrial gases grow, a bulk storage system, engineered by Linde may be advisable. Linde provides a line of cryogenic tanks and related control and safety equipment which have been specially designed to provide a flexible choice of storage and withdrawal capabilities. Standard tanks range in size from 500- to 11,000-gallon capacities. Even larger sizes are available. These units can be used for either withdrawal of the liquid product, or the supply of medium-pressure gas, using vaporizers and control equipment.

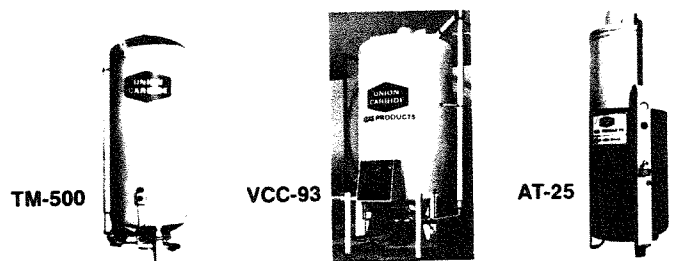
LINDE TM-500 STORAGE TANK

The TM-500 — smallest of Linde's Standard Line Tankage — is unmatched as a reliable supply unit for industrial withdrawal of cryogenic fluid, either as a liquid or gas. The empty tank weighs 5450 lb. and has a net capacity of 530 gallons. At maximum working pressure of 250 psig, its flow capacity through a 5/8 in. withdrawal connection is 2000 cfh using one tank-mounted vaporizer, or 4000 cfh using two vaporizers. Average fill (75 percent of capacity) normally tops a reserve supply of 15,300 ft³ of oxygen, 12,300 ft³ of nitrogen, or 14,900 ft³ of argon.

LINDE AT-25 STORAGE TANK AND A-1 VAPORIZER

LINDE VCC-93 STORAGE TANK

Consult your Linde supplier for complete information and specifications.



SPECIFICATIONS

	TM-500	VCC-93	AT-25
Outside Diameter	5 ft (1.53 m)	5 ft (1.53 m)	3 ft (0.91 m)
Overall Height	15 ft 6 in. (4.72 m)	13 ft (4 m)	8 ft 9 in. (2.7 m)
Site Area Required	9 ft x 11 ft (Built-In Vaporizer) (2.7 m x 3.4 m)	11 ft x 11 ft (3.4 m x 3.4 m)	6 ft x 7 ft (1.8 m x 2.1 m)
Capacity (NTP)*			
Oxygen	61,000 ft ³ (1708 m ³)	90,000 ft ³ (2520 m ³)	25,000 ft ³ (700 m ³)
Nitrogen	49,300 ft ³ (1380 m ³)	73,000 ft ³ (2044 m ³)	20,000 ft ³ (560 m ³)
Argon	59,600 ft ³ (1669 m ³)	88,000 ft ³ (2464 m ³)	24,000 ft ³ (672 m ³)

* At 70°F and 1 atmosphere