



Innovation. Experience. Performance.®



Phone
1-800-400-4683

Fax
1-952-758-8275

Worldwide
1-952-758-4484

Chart Inc.
407 Seventh Street NW
New Prague, MN 56071

www.microbulk.com

www.chart-ind.com



www.microbulk.com

©2008 Chart Inc
P/N 11926802

MicroBulk Systems



*Ensuring cryogenic supply capabilities.
Any application - Any time*



Ensuring cryogenic supply capabilities. Any application - Any time



Innovation. Experience. Performance.®

Our Integrated MicroBulk Advantage

Chart's MicroBulk system is engineered and manufactured to the highest quality standards to provide you with the safest and most reliable system available. Because we pioneered the concept, we understand the applications and flexibility our partners require to make their MicroBulk business successful. That's why we offer the widest range of ORCA mobile delivery systems and Perma-Cyl storage vessels available. Additionally, we understand the importance of preventing gas outages for your customer so we offer a full product line of telemetry systems to suit your business needs. And finally, to make our MicroBulk partners successful, we offer full marketing materials complete with sales and technical training.



Engineering Design

Our integrated MicroBulk advantage is based on a system that incorporates patented and proven innovative technologies. Every component is designed, built and tested to create the safest and most reliable MicroBulk delivery system available today.



Installation Ready

Only Chart allows you to custom build a Perma-Cyl to match your customer's application and budget. With eight sizes and three pressures, there's a Perma-Cyl to match your business strategy.



Telemetry Capable

The Cyl-Tel electronic liquid level gauge is designed exclusively for the Perma-Cyl. Packed with user-friendly features, the Cyl-Tel is ready to work with many remote monitoring systems.



Marketing Services

Our sales process doesn't stop with the equipment supply. We offer electronic sales tools, customized literature, marketing assistance and sales training to make our authorized partners positioned for growth in the MicroBulk market.

When you choose Chart, you get single-source accountability from the integrated MicroBulk system through business support.

The Chart MicroBulk Advantage

ORCA Delivery

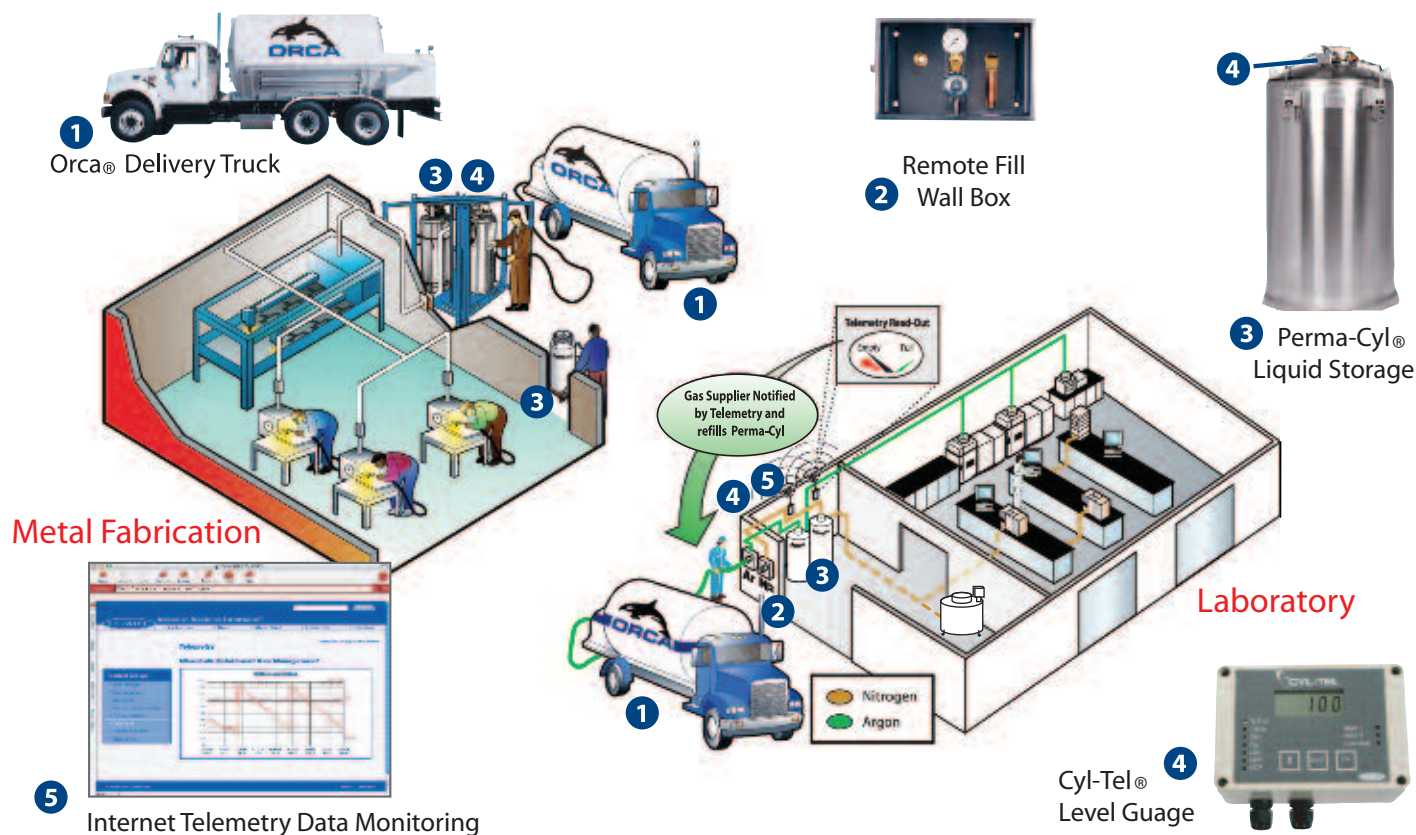
- Fast, reliable, accurate filling
- On-site refilling reduces your costs
- Provides better gas management

Perma-Cyl Storage

- Installed and dedicated to your application
- Eliminates cylinder handling
- Achieve a higher purity gas supply

Cyl-Tel Remote Monitoring

- Eliminates product run-out
- User-friendly contents read-out
- Guarantees a continuous gas supply



1 Liquefied gases are delivered to the customer's facility with the ORCA cryogenic delivery truck. Key controls and components on the ORCA allow the driver to safely and quickly deliver the proper amount of liquid accurately into the Perma-Cyl storage vessel or small bulk tanks.

2 When the Perma-Cyl storage vessel is installed indoors, an external wall box can be added for remote filling. This allows the gas delivery to safely take place without the driver entering the building in most installations.

3 Liquefied gases are stored at ultra-cold temperatures in the vacuum-insulated Perma-Cyl. Customized controls for the application on the Perma-Cyl maintain the vessel at the proper delivery pressure and deliver gas or liquid on demand.

4 The Cyl-Tel electronic level gauge accurately monitors the cryogenic liquid level and is telemetry ready for remote monitoring or connection to customer monitoring systems.

5 Telemetry systems allow the gas supplier to remotely monitor the Perma-Cyl liquid level to maximize delivery efficiency without the risk of product outages.

MicroBulk to Meet the Needs of Any Application

Metal Fabrication



Welding - GMAW/MIG, GTAW/TIG and Laser Beam Welding

Metal fabrication uses many different welding processes for the wide range of materials, thickness and product applications. Many of these unique and specialized welding processes use inert shielding gas or the combination of gases to obtain the maximum weld quality and optimized productivity. For single gas requirements, MicroBulk provides you with all the benefits of Bulk in an economical compact package. And for mixed gas applications, the Medley solution provides on-site gas blending directly from liquid storage for the most accurate mixture available and at the lowest cost.



Cutting - Laser, Oxy Fuel and Plasma

All thermal cutting techniques utilize gases to assist in the cutting process. High-pressure nitrogen and oxygen are used as an assist gas to rapidly remove the molten metal from the cut zone or burn it away during the laser cutting process. To maintain maximum laser uptime and achieve the best cut quality, it is critical that the gas supply be uninterrupted and the required pressures and flows for the material and thickness being cut are maintained. Oxy Fuel and Plasma cutting processes have similar requirements. Only Chart offers an engineered "High-Pressure, High-flow Package" to customize your Perma-Cyl for these demanding applications.

Analytical / Laboratory



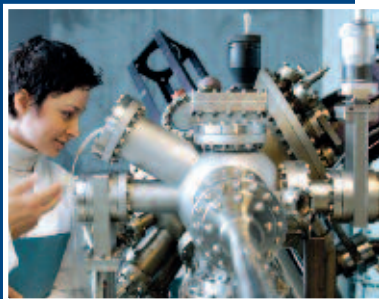
ICP/ICP-MS - Inductively Coupled Plasma/Mass Spectrometry GC - Gas Chromatograph

A continuous flow of high purity argon gas is required for ICP/ICP-MS systems to repeatedly process material samples trouble-free. With Chart's UHP Grade Perma-Cyl option and MicroBulk's short delivery chain, you can be assured of getting the proper purity of argon necessary for peak equipment performance. Similarly, GC's get the same benefits with a Perma-Cyl in nitrogen service. And with MicroBulk and telemetry, you get a continuous supply of uninterrupted gas so you never have to change cylinders or restart a sample test from a gas outage.



Biological Storage and Research

A sufficient supply of high-quality liquid nitrogen is needed to keep valuable biological samples stored indefinitely. Any interruption in supply can result in the loss of many years of research. With the optional vacuum-insulated liquid withdrawal valve on the Perma-Cyl, you get a continuous supply of quality liquid to your freezer - reducing liquid losses and giving you more control. Adding telemetry to the liquid supply, allows you and your gas supplier to monitor the Perma-Cyl liquid level via the internet for added security. For requirements that prohibit a permanent installation, the Perma-Cyl 230 caster base is an excellent choice.



MBE - Molecular Beam Epitaxy

MBE is the method of laying down layers of materials with atomic thickness on a substrate (epitaxial growth). This is done by creating a "molecular beam" of a material that impinges on the substrate in a high-quality vacuum chamber. A cryogenic screening around the substrate minimizes flux of atoms from the chamber walls. During this process, it is imperative that the liquid nitrogen supply be stable and of good quality (the right pressure and temperature) to prevent contamination of the substrate or interruption of the process. MicroBulk eliminates liquid product outages and the hassle of troubleshooting piping controls associated with liquid cylinder exchanges. When you order a Perma-Cyl built with the vacuum-insulated withdrawal, you get engineered controls designed for this demanding liquid application.

Metal Processing



Heat Treating • Cryotempering • Thermal Spray Coating

Heat treating and cryotempering processes are dependent on the quality of the nitrogen gas and liquid supply to maintain production at peak performance. With the MicroBulk system directly piped to the equipment or conveniently transported with the caster base Perma-Cyl, these applications are assured of a consistent supply of nitrogen with minimal operator intervention. In the thermal spray coating process, oxygen or argon is used at high pressure and high flows. With the Perma-Cyl VHP ZX coil option, your gas supply will exceed these requirements and provide long-term trouble-free service.

Medical



Oxygen Therapy • Hyperbaric Chamber • Cryotherapy

Medical applications have some of the most stringent gas requirements and the MicroBulk system meets these requirements with NF grade availability. Liquid oxygen for respiratory therapy is easily and safely dispensed from a Perma-Cyl into the Liberator® and Stroller style systems to lower distribution costs. Similarly, the Perma-Cyl is an excellent solution as the main oxygen gas supply for hyperbaric chambers. NF grade nitrogen can also be supplied for gas applications to operate pneumatic surgical tools and supply liquid for medical uses such as cryotherapy.

General Processing



Food and Beverage Packaging

In beverage packaging, liquid nitrogen is used to create a positive pressure in non-carbonated drinks to improve the containers rigidity for lower-cost handling. Additionally, this process eliminates oxygen to improve the products shelf life. For food packaging, nitrogen gas yields the same benefits and when combined with carbon dioxide and carbon monoxide for processing meat, a longer shelf life of the desired red color is maintained. The Perma-Cyl gives you optimum control of your liquid and gas supply for maximum production uptime.



Purging and Blanketing

Inert purging and blanketing with nitrogen or argon gas is a common processing step in many manufacturing applications. These range from pharmaceutical to chemical to the wine industry, and they require a secure supply of gas for optimum processing results. With a dedicated Perma-Cyl and the optional telemetry system, you are assured of a continuous, oxygen-free gas supply because cylinder change outs are eliminated.



Electronic Manufacturing and Testing

Electronic grade manufacturing requires an Ultra High Purity gas stream void of contamination. The Perma-Cyl UHP is built with all stainless steel construction from the internal vaporizer to the exterior plumbing to maintain gas purity. And with the MicroBulk delivery system, the reduced handling results in higher purity over conventional cylinder supplies. In a related business, printed circuit board testing performed in liquid nitrogen-powered environmental test chambers require quality liquid at the point of use. For intermittent uses or small chambers, the Perma-Cyl series offers a variety of options to customize the installation for optimum benefits.

Ensuring cryogenic supply capabilities. Any application - Any time

ORCA



All ORCA models feature an exclusive "Smart" flow metering system that contains no moving parts for an accurate, trouble-free service life. The ORCA controls automatically sense the Perma-Cyl float shut-off for a safe and reliable fill.

HL Models

The HL models incorporate an external pump for oxygen service or an innovative submerged pump for inert service. The submerged pump eliminates cool down time and completes a Perma-Cyl fill in 3 to 15 minutes without product loss under normal conditions.

PT & XT Models

Designed for smaller markets or as a starter system, the PT1000 delivers product efficiently from an innovative Pulse Technology process. This pump-less design uses a high-pressure pulse tank that integrates with the low-pressure main tank for a low-loss and low cost delivery solution. The XT-Series includes this feature plus a pulse pressure design to benefit larger deliveries from the main tank.

The ORCA Delivery System

Standard and Custom Delivery Units



PT-1000



HL-2000



Patent no.'s - 5,616,838
5,682,750

Chart Exclusive -
Submerged pump for inert service. Eliminates cool down losses and reduces delivery time.



XT-2500

MODEL	PT-1000		XT-2500		XT-2900		PT/XT
Gas Services	LIN, LAR and LOX		LIN, LAR and LOX		LIN, LAR and LOX		
Dispense Method/Technology	Pulse Transfer		Pulse Transfer & Pulse Pressure		Pulse Transfer & Pulse Pressure		
Pressure Builder Type	HP ² & ZX technologies		HP ² & ZX technologies		HP ² & ZX technologies		
Design Code	ASME and CGA-341		ASME and CGA-341		ASME and CGA-341		
SPECIFICATIONS	Overall Unit	Main Tank	Overall Unit	Main Tank	Overall Unit	Main Tank	Pulse Tank
Gross Capacity (gal/ltrs)	1146 / 4338	1067 / 4039	2406 / 9108	2327 / 8809	2963 / 11,216	2884 / 10,917	79 / 300
Capacity* ** - CGA-341 (gal/ltrs)	1093 / 4137	1014 / 3838	2295 / 8688	2216 / 8388	2819 / 10,671	2740 / 10,372	79 / 300
Capacity** - MC338 (gal/ltrs)							
MAWP (psig/bar)		50 / 3.4		245 / 16.9		245 / 16.9	350 / 24.1
Overall Length (in/cm)	207 / 526	145 / 368	308 / 782		336 / 853		
Overall Height (in/cm)	111 / 282	86 / 218	111 / 282		111 / 282		
Diameter/Width (in/cm)	72 / 183	72 / 183	72 / 183		72 / 183		
Tare Weight (lbs/kg)	6700 / 3038		12,100 / 5488		13,490 / 6119		
PERFORMANCE							
Dispense Rate (gpm/lpm)	10-40 / 38-151		10-60 / 38-227		10-60 / 38-227		10-40 / 38-151
Max. Dispense Pressure (psig/bar)	325 / 22.4		235 / 16.2		235 / 16.2		325 / 22.4
Max. Receiving							
Tank Pressure*** (psig/bar)	225 / 15.5		135 / 9.3		135 / 9.3		225 / 15.5
Optimum Receiving Vessel	Small to Medium Perma-Cyl		Small Bulk		Small Bulk		Perma-Cyl
REQUIREMENTS							
Power	12 VDC x 10 Amp		12 VDC x 10 Amp		12 VDC x 10 Amp		
Truck ****	Single axle sized for service, below FET		Double axle sized for service		Double axle sized for service		
Air ride required	GW 23,500 lbs to 31,000 lbs		GW 32,000 lbs to 46,000 lbs		GW 32,000 lbs to 46,000 lbs		
Trailer ****			Available - consult factory		Available - consult factory		

* With road relief valve at 25.3psig

*** For optimum single hose, no-loss fill

** Maximum fill levels depend on vehicle specifications

**** Customer supplied per Chart's requirements

MicroBulk Systems



Chart Exclusive -
 "Smart" flow metering system monitors flow electronically with no moving parts (standard on all models)

The ORCA Advantage

- Fast on-site filling of the Perma-Cyl storage system with auto shut-off and small bulk tanks
- Exclusive low maintenance submerged pump for instant starts and continuous delivery (HL)
- Pump-less pulse transfer plus pulse pressure technology reduces equipment costs and associated maintenance costs (PT/XT)
- Single Hose Delivery system minimizes contamination and cool down losses
- Exclusive quick-disconnect maintains service integrity, reduces contamination and speeds up delivery time



Delivery assist option for high pressure applications



HL Series controls and plumbing

- Push-button Programmable Logic Control (PLC) with manual override simplifies operator training
- Electronic pump speed control allows driver to safely optimize delivery rate (HL)
- National Institute of Standards & Technology (NIST) and California Weights & Measures approved delivery system
- Stainless steel and bronze plumbing for long service life
- Robust inner vessel support system for rugged road conditions

HL-2000		HL-2800		HL-3300		HL-4200	
LIN, LAR and LOX		LIN, LAR and LOX		LIN, LAR and LOX		LIN	
Submerged Pump/External Pump		Submerged Pump/External Pump		Submerged Pump/External Pump		Submerged Pump	
Pump force-feed		Pump force-feed		Pump force-feed		Pump force-feed	
ASME, MC338 and CGA-341		ASME, MC338 and CGA-341		ASME, MC338 and CGA-341		ASME, MC338 and CGA-341	
Overall Unit		Overall Unit		Overall Unit		Overall Unit	
2144 / 8100		2880 / 10,890		3399 / 12,850		4654 / 17,620	
2037 / 7700		2736 / 10,340		3263 / 12,340		4468 / 16,910	
1907 / 7210		2561 / 9680		3023 / 11,430		4139 / 15,670	
50 / 3.4		50 / 3.4		50 / 3.4		50 / 3.4	
200 / 508		244 / 620		273 / 693		346 / 878	
87 / 221		87 / 221		87 / 221		87 / 221	
80 / 203		80 / 203		80 / 203		80 / 203	
8000 / 3636		9000 / 4090		10,000 / 4545		11,560 / 5244	
4 - 40 / 15 - 151 (1)		4 - 40 / 15 - 151 (1)		4 - 40 / 15 - 151 (1)		4 - 100 / 15 - 378	
225 / 15.5	250 / 17.2	225 / 15.5	250 / 17.2	225 / 15.5	250 / 17.2	400 / 27.6	
175 / 12.1	200 / 13.8	175 / 12.1	200 / 13.8	175 / 12.1	200 / 13.8	350 / 24.1	
Perma-Cyl & Small Bulk		Perma-Cyl & Small Bulk		Perma-Cyl & Small Bulk		Perma-Cyl & Bulk	
12 VDC x 30 Amp & 480 VAC x 30 Amp		12 VDC x 30 Amp & 480 VAC x 30 Amp		12 VDC x 30 Amp & 480 VAC x 30 Amp		12VDC x 30 Amp & 480 VAC x 50 Amp	
Single or double axle sized for service		Double axle sized for service		Double axle sized for service			
GVW 32,000 lbs to 46,000 lbs		GVW 32,000 lbs to 46,000 lbs		GVW 32,000 lbs to 46,000 lbs			
Available - consult factory		Available - consult factory		Available - consult factory		Trailer Only	

MAWP, Maximum Allowable Working Pressure / NIST, National Institute of Standards and Technology / FET, Federal Excise Tax / DP, Differential Pressure
 Specifications subject to change without notice.

(1) Models Available with 80 100 gpm @ 400 psi submerged pump for Nitrogen and Argon service.

Perma-Cyl Storage Systems



The Perma-Cyl Storage System Built for Your Application



2000L



1000L



230L

The innovative Perma-Cyl storage system incorporates a top fill float designed to allow single-hose filling without losses. It automatically shuts off the ORCA delivery unit for a safe and reliable fill.

Perma-Cyl Benefits:

- The first fill-at-site solution for packaged or cylinder gas users
- Fast filling capable
- Single hose no-loss/low-loss filling
- Automatic fill shutoff when used with Orca
- Extended holding times
- Telemetry ready with Cyl-Tel gauge

The Perma-Cyl storage systems allows users to enjoy the benefits of on-site gas delivery. Gone are the hassles, waste, and expense of full-for-empty gas cylinders. Using Perma-Cyls, there are no cylinders to change, no residual gas losses, no back, hand or foot injuries from handling cylinders, and no lost or damaged cylinders.

Perma-Cyls are reliable, efficient, and more economical than comparable transportable cylinders. Designed for a higher level of thermal efficiency, Perma-Cyls can hold their gas contents longer with lower pressure rise than other similar sized vessels. Their extraordinary thermal quality limits product losses during extended periods of little gas use.

Product Advantages

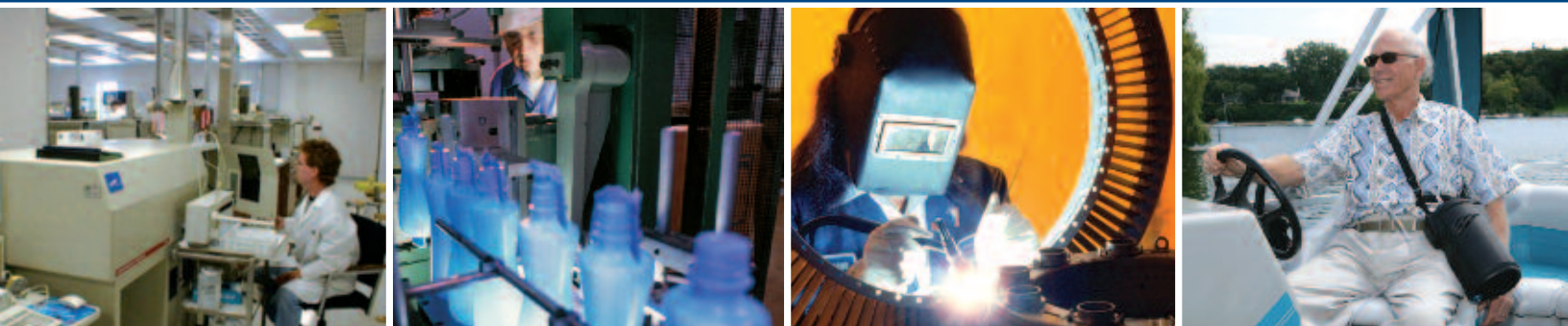
- Sizes, pressures and configurations to meet most applications
- Capacities from 230 liters to 2000 liters (60.8 gal to 528.3 gal)
- Pressures from 235 psi to 500 psi (16.2 bar to 34.5 bar)
- Patented automatic fill shut-off feature with optional fill box allows for remote filling from outside the building or compound when a Perma-Cyl is installed indoors
- Orca automatically safely stops the fill process when Perma-Cyl is full
- Patented Cyl-Tel gauge supports remote alarms or telemetry communications
- High-pressure high flow models for laser assist applications
- Combination pressure control regulators with micrometer adjustment knob or screw
- Outdoor or indoor installation and operation



Patent no.'s - 5,787,942 • 5,954,101

Chart Exclusive -

Internal top float assembly assures a safe and reliable fill.



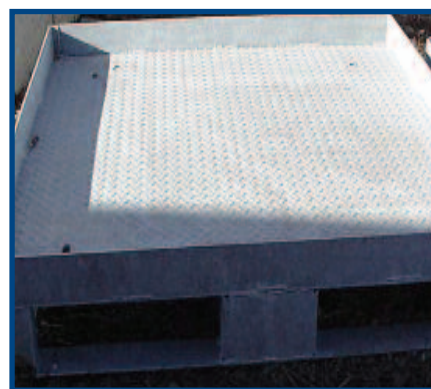
Options and accessories engineered to enhance Perma-Cyl installations in any application.



Exterior stainless steel wall box for remote filling. Shown with optional CYL-TEL gauge.



Optional ZX/HP² vaporizer coil for high pressure, high flow gas applications. (optional on 1500/standard on 2000)



Lab/fork-lift base is designed to catch or drain water – zinc coated for corrosion resistance. (Standard on 1500 and 2000)



UHP-Stainless steel plumbing for high purity applications



Exclusive Cryogenic Quick-Connect improves speed, cleanliness, and maintains service integrity.



Vacuum-jacketed valve for efficient liquid withdrawal. (half-inch inner pipe)

Perma-Cyl Storage Systems

SPECIFICATIONS																
DESCRIPTION	230L MP, LCCM Sq/Rnd Base w/Casters	230L HP, LCCM Sq/Rnd Base w/Casters	265L MP, LCCM Sq/Rnd Base w/Casters	265L HP, LCCM Sq/Rnd Base w/Casters	300L MP Plate Base	450L HP Plate Base	450L MP Plate Base	450L HP Plate Base	450L VHP Plate Base	700L HP Plate Base	1000L HP Plate Base	1000L VHP Plate Base	1500L HP Pallet Base	1500L VHP Pallet Base	2000L HP Pallet Base	2000L VHP Pallet Base
CAPACITY (Liters)																
Gross	240	240	276	276	330	450	450	450	450	688	1,056	1,056	1,550	1,550	2,042	2,042
Net	230	230	265	265	300	420	420	420	420	645	950	950	1,455	1,455	1,945	1,945
CAPACITY (Gallons)																
Gross	63.4	63.4	72.9	72.9	81.2	118.9	118.9	118.9	118.9	181.8	279.0	279.0	409.5	409.5	539.5	539.5
Net	60.8	60.8	70.0	70.0	79.3	111.0	111.0	111.0	111.0	170.4	251.0	251.0	384.4	384.4	513.9	513.9
MAWP																
psig	235	350	235	235	300	350	250	350	500	350	350	500	350	500	350	500
bar	16.2	24.1	16.2	16.2	20.7	24.1	17.2	24.1	34.5	24.1	24.1	34.5	24.1	34.5	24.1	34.5
MAXIMUM PRE-SET OPERATING PRESSURE																
psig	125	300	125	125	250	300	125	300	450	300	300	450	300	450	300	450
bar	8.6	20.7	8.6	8.6	17.2	20.7	8.6	20.7	31.0	20.7	20.7	31.0	20.7	31.0	20.7	31.0
DESIGN SPECIFICATIONS																
	DOT	DOT	DOT	DOT	ASME	DOT	ASME	ASME	ASME	ASME	ASME	ASME	ASME	ASME	ASME	ASME
STORAGE CAPACITY (1)																
Nitrogen																
SCF	5,024	4,734	5,769	5,769	7,380	8,875	10,332	10,332	10,332	15,860	24,350	24,350	35,790	35,790	47,847	47,847
Nm ³	142	134	152	152	193	271	272	272	272	449	689	689	1,013	1,013	1,257	1,257
Oxygen																
SCF	6,244	5,930	7,186	7,186	9,100	11,124	12,760	12,760	12,760	19,600	30,070	30,070	44,220	44,220	59,089	59,089
Nm ³	177	168	189	189	184	315	336	336	336	554	850	850	1,250	1,250	1,553	1,553
Argon																
SCF	6,073	5,763	6,982	6,982	8,850	10,812	12,478	12,478	12,478	19,160	29,400	29,400	43,220	43,220	57,786	57,786
Nm ³	172	163	183	183	234	306	328	328	328	542	832	832	1,223	1,223	1,519	1,519
CO₂																
SCF	N/A	4,500	N/A	N/A	N/A	8,312	N/A	8,200	8,200	12,608	19,960	19,960	29,340	29,340	38,048	38,048
Nm ³	N/A	N/A	N/A	N/A	N/A	235	N/A	232	232	357	564	564	830	830	1,000	1,000
THERMAL PERFORMANCE (2) (NER%/Day)																
N ₂	1.8%	1.8%	2%	2%	1.2%	1.9%	1.6%	1.6%	1.6%	1%	1%	1%	1%	1%	1%	1%
O ₂ -Ar	1.12%	1.12%	1.4%	1.4%	.74%	1.2%	1%	1%	1%	.62%	.62%	.62%	.62%	.62%	.62%	.62%
CO ₂	.6%	.6%	N/A	N/A	.4%	.6%	.5%	.5%	.5%	.3%	.3%	.3%	.3%	.3%	.3%	.3%
GAS DELIVERY RATE (LIN/LAR/LOX)																
SCF/H	400	400	400	400	500	575	575	575	575	660	960	960	1,350	1,350	1,350	2,000 ⁽³⁾
Nm ³ /h	10.5	10.5	10.5	10.5	14.1	15.1	15.1	15.1	15.1	18.6	25.2	25.2	35.4	35.4	35.4	52.4
GAS DELIVERY RATE (CO₂)																
SCF/H	N/A	133	N/A	N/A	N/A	192	192	192	192	220	320	320	450	450	450	667
Nm ³ /h	N/A	3.8	N/A	N/A	N/A	5.4	5.4	5.4	5.4	6.2	9.0	9.0	12.7	12.7	12.7	17.5
DIMENSIONS																
Diameter																
in	26	26	26	26	26	30	30	30	30	42	42	42	48	48	48	48
mm	660	660	660	660	660	762	762	762	762	1,067	1,067	1,067	1,219	1,219	1,219	1,219
Height																
in	61.8/62	61.8/62	64.6/64.8	64.6/64.8	68	68	68	68	68	60	81	81	91	91	117	117
mm	1,570/1,575	1,570/1,575	1,641/1,646	1,641/1,646	1,727	1,727	1,727	1,727	1,727	1,524	2,058	2,058	2,311	2,311	2,970	2,970
Tare Weight																
lbs	300	340	340	340	450	688	605	688	812	1,065	1,750	2,250	3,080	3,350	3,860	3,860
kg	136	154	154	154	204	312	274	312	368	483	794	1,020	1,395	1,518	1,751	1,751

All specifications are subject to change without prior notice.

1) Values are based on net capacity at 0 psig (0 bar) for ASME vessels. CO₂ vessels are based on net capacity at 300 psi (20.7 bar). DOT vessels are per code.

2) Values are based on gross capacity.

3) Optional 3,500 SCF/H (92 Nm³/h) model available.

All dimensions are measured from the floor to the top of the handling ring. All of the plumbing components fit under the handling ring.

Patents: 5,787,942 • 5,954,101 • 5,136,852 • 6,542,848 - Other Patents Pending

DOT- Department of Transportation, 4L Code

ASME- American Society of Mechanical Engineers, Section VIII, Division 1

Specifications subject to change without notice.

Contact Factory for Canadian and New York City Approvals.

Build Your Own Perma-Cyl

Custom build your Perma-Cyl to match your customer's application and your business operation

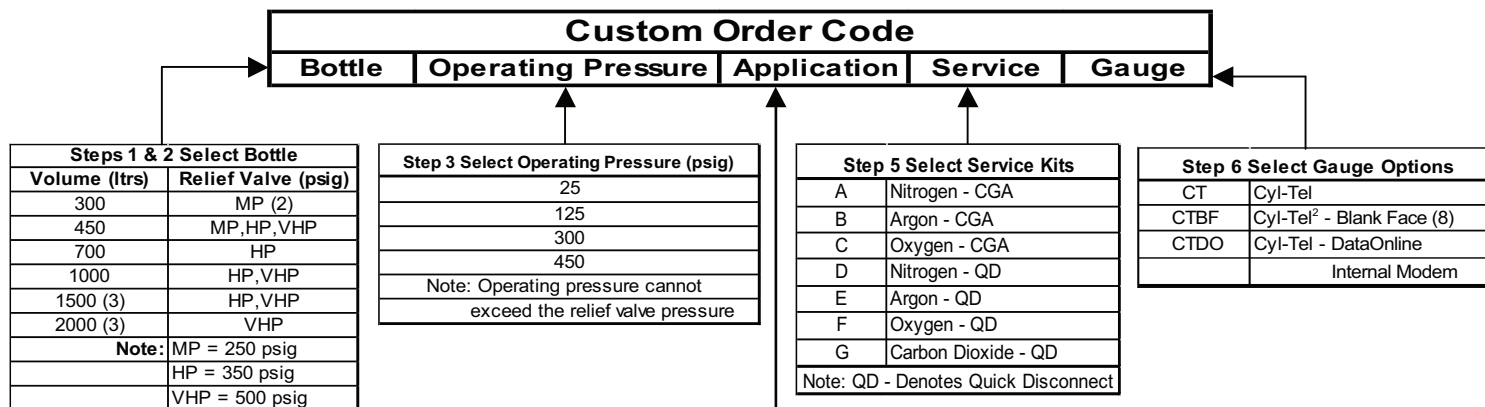
Features & Benefits of customizing your Perma-Cyl

- Perma-Cyl operating and relief valve pressures match the application
- Select the ideal operating pressure for your customer's product delivery
 - Select the ideal relief valve pressure for your customer's optimum hold time and your asset flexibility requirements
- Optional features available to isolate key controls
- Reduce on-site maintenance time and costs
- Perma-Cyl is "installation ready" for direct shipment to customer site
- Reduce pre-installation time, costs and unnecessary shipping
 - Eliminate tank inventory (1)

How to Build Your Perma-Cyl

1. Select bottle Volume.
2. Select bottle Relief Valve Pressure.
3. Select Operating Pressure.
4. Select Application Package.
5. Select Service Kit.
6. Select Gauge Option.

The Perma-Cyl Wizard Software Program can assist you in this process, it's that simple!



Step 4 Select Option Package for the Application

Option Package	Tank Configuration	4-way Gauge Isolation Valve (3)	Regulator Isolation Valves	Liquid Withdrawal Ball Valve	25 to 50 PSI Secondary Relief w/Isolation	CO ₂ Package (4)	ZX SuperCharged PB System	HP ² PB System
01	Chart Standard							
02 (5)	Cyl-Tel Gauge Service Valve	X						
03	Service Valves	X	X					
04	Low Pressure Liquid	X		X	X			
05	CO ₂ Service	X	X			X		
07 (6)	Fast Pressure Builder Recovery	X	X				X	
09 (7)	High Flow PB and Vaporizer	X	X					X

Notes:

- (1) Target ship date: Five working days or less ARO providing the bottle is in stock.
- (2) Available with 300 psi Relief Valve for option package 05.
- (3) Models 1500 and 2000 come standard with integral fork-lift/lab metal base and Cyl-Tel gauge 4-way isolation valve.
- (4) CO₂ Package includes: Standard restaurant QD fill fitting, CO₂ standard top fill tube, patented Sure-Fill system (for complete fill of any size tank), manifold vent assembly for Sure-Fill regulator outlet and safeties, regulator isolation valves, and an external pressure building drain valve (top of tank) to maintain a working PB system.
- (5) Standard on 1500 and 2000 models.
- (6) Option Package is only available on 1000, 1500 and 2000 VHP models.
- (7) Option Package is only available on 2000 VHP model.
- (8) Cyl-Tel² blank face shipped from factory. Contact DataOnline for proper cellular radio front face and battery pack for wireless telemetry.

Ensuring cryogenic supply capabilities. Any application - Any time

Cyl-Tel & Cyl-Tel² Gauges



Innovation. Experience. Performance.®



Cyl-Tel is a digital electronic level gauge designed specifically for the Perma-Cyl. The Cyl-Tel provides an accurate reading when selecting one of the seven user-friendly units. Designed for rugged applications, it has a water-resistant case suitable for outdoor use. The Cyl-Tel is also telemetry-ready for a wide variety of systems, including OnSite.



Patent no. - 6,542,848

CYL-TEL is standard on 300L and larger Perma-Cyls (optional on smaller models)

Product Advantages

- ▶ Improves customer readability by eliminating calibration charts
- ▶ Programmable to tank geometry and service for improved accuracy
- ▶ Improves customer security
- ▶ Telemetry ready outputs adaptable to many systems
- ▶ Optional interface board available for 1-5VDC and 4-20mA outputs
- ▶ Battery or 12V DC powered (required for telemetry)
- ▶ Accommodates telephone modem board or Cyl-Tel² wireless front panel with internal batteries



The Cyl-Tel² is a wireless telemetry tank monitoring system designed by Chart in partner with DataOnline exclusively for the MicroBulk market. The Cyl-Tel² is a low cost, reliable, easy to install and user-friendly liquid level gauge with built-in cellular communications. It is powered by a battery pack for installation flexibility.

Product Advantages

- ▶ Integrated cellular wireless communications
- ▶ Internal battery-powered for indoor or outdoor installations
- ▶ DataOnline managed information



Optional DataOnline telephone modem for Cyl-Tel



Optional CYL-TEL² for wireless communication with DataOnline

Telemetry Systems



Product Advantages

- Accurate, up-to-date measurements of liquid levels
- Self-administered system for maximum service and flexibility
- Account customization for best cost/benefit
- Up to four data ports per call
- Tank and line pressure readings for troubleshooting capabilities
- Email, pager or cell phone alarm capability
- Analog telephone line based
- Easy integration with other gas markets



OnSite Modem



Product Advantages

- Secure Internet based data service
- Automated data collection and reporting
- Fault tolerant and redundant system
- Advanced analysis and trending algorithms
- Email, fax or pager alarm notifications
- Data feeds into corporate SAP® system
- Integration with other data services



DataOnline provides information management services throughout the DataOnline web portal. With 24/7 availability, fault tolerance and redundancy over a secure Internet connection, DataOnline customers are assured that their data is executed via a safe and reliable platform.

Ensuring cryogenic supply capabilities. Any application - Any time



Chart Online Marketing Services

As Chart Industries, Inc. continues to provide distributors and customers with the best products and services in the industry, we would like to introduce you to an innovative marketing support tool designed to assist you in selling more! Chart Online Marketing Services is like having your very own 24/7 marketing department providing you the marketing materials needed to drive customers to you. But this is much more than just a site to download product photos, you now have the ability to truly customize brochures, spec sheets and posters with your local contact information and company logo.

3 Easy Steps To Getting Onto Our Website To Order Marketing Materials!



1. Go to www.chart-ind.com, and click on D&S Marketing Services button.



2. Enter your User Name and Password.



3. Choose a category that you are interested in.

chartparts.com

Chart Parts Website

It's Easy to Use! Check out the Benefits

- Personalized account information
- Order history & shipment tracking
- Shopping cart stores your parts before you buy
- Parts available for all makes and models
- 24/7 ordering and order tracking
- Same-day shipment on all stock parts



For All Your Parts Needs...
www.chartparts.com

SCF of GAS / Liter of LIQUID

Gas Densities at Liquid Pressures

Conversion Data

Pressure psig	Argon	Nitrogen	Oxygen	CO ₂	Pressure psig	Argon	Nitrogen	Oxygen	CO ₂
0	29.69	24.60	30.36		225	23.58	18.35	24.24	20.34
25	28.24	23.17	28.89		250	23.17	17.89	23.83	20.07
50	27.32	22.26	27.97		275	22.77	17.43	23.43	19.82
75	26.60	21.53	27.25	22.40	300	22.37	16.96	23.03	19.58
100	25.98	20.89	26.63	21.96	325	21.98	16.47	22.64	19.34
125	25.43	20.33	26.09	21.57	350	21.43	15.96	22.25	19.11
150	24.93	19.80	25.59	21.23	375	21.19	15.42	21.86	18.88
175	24.46	19.30	25.12	20.91	400	20.79	14.80	21.47	18.66
200	24.01	18.82	24.67	20.61	425	20.39	14.07	21.08	18.44

Argon

	Weight		Gas		Liquid	
	Pounds (Lb)	Kilograms (Kg)	Cubic Feet (SCF)	Cubic Meters (Nm ³)	Gallons (Gal)	Liters (L)
1 Pound	1.0	0.4536	9.671	0.2543	0.08600	0.3255
1 Kilogram	2.205	1.0	21.32	0.5605	0.18957	0.7176
1 SCF Gas	0.1034	0.04690	1.0	0.02628	0.008893	0.03366
1 Nm ³ Gas	3.933	1.7840	38.04	1.0	0.3382	1.2802
1 Gal Liquid	11.630	5.276	112.5	2.957	1.0	3.785
1 L Liquid	3.072	1.3936	29.71	0.7812	0.2642	1.0

Nitrogen

1 Pound	1.0	0.4536	13.803	0.3627	0.1481	0.5606
1 Kilogram	2.205	1.0	30.42	0.7996	0.3262	1.2349
1 SCF Gas	0.07245	0.03286	1.0	0.02628	0.01074	0.04065
1 Nm ³ Gas	2.757	1.2506	38.04	1.0	0.4080	1.5443
1 Gal Liquid	6.745	3.060	93.11	2.447	1.0	3.785
1 L Liquid	1.782	0.8083	24.60	0.6464	0.2642	1.0

Oxygen

	Weight		Gas		Liquid	
	Pounds (Lb)	Kilograms (Kg)	Cubic Feet (SCF)	Cubic Meters (Nm ³)	Gallons (Gal)	Liters (L)
1 Pound	1.0	0.4536	12.076	0.3174	0.1050	0.3977
1 Kilogram	2.205	1.0	26.62	0.6998	0.2316	0.8767
1 SCF Gas	0.08281	0.03756	1.0	0.02628	0.008691	0.0329
1 Nm ³ Gas	3.151	1.4291	38.04	1.0	0.3310	1.2528
1 Gal Liquid	9.527	4.322	115.1	3.025	1.0	3.785
1 L Liquid	2.517	1.1417	30.38	0.7983	0.2642	1.0

SCF (Standard Cubic Foot) gas measured at 1 atmosphere and 70°F.
Liquid measured at 1 atmosphere and boiling temperature.

Nm³ (normal cubic meter) measured at 1 atmosphere and 0°C.
All values rounded to nearest 4/5 significant numbers.

Carbon Dioxide

	Weight			Gas		Liquid		Solid
	Pounds (Lb)	Tons (T)	Kilograms (Kg)	Cubic Feet (SCF)	Cubic Meters (Nm ³)	Gallons (Gal)	Liters (L)	Cubic Feet (Cu Ft)
1 Pound	1.0	0.0005	0.4536	8.741	0.2294	0.11806	0.4469	0.010246
1 Ton	2000.0	1.0	907.2	17,483.0	458.8	236.1	893.9	20.49
1 Kilogram	2.205	0.0011023	1.0	19.253	0.5058	0.2603	0.9860	0.2260
1 SCF Gas	0.1144	—	0.05189	1.0	0.02628	0.013506	0.05113	0.0011723
1 Nm ³ Gas	4.359	0.002180	1.9772	38.04	1.0	0.5146	1.9480	0.04468
1 Gal Liquid	8.470	0.004235	3.842	74.04	1.9431	1.0	3.785	0.08678
1 L Liquid	2.238	0.0011185	1.0151	19.562	0.5134	0.2642	1.0	0.02293
1 Cu Ft Solid	97.56	0.04880	44.25	852.8	22.38	11.518	43.60	1.0

SCF (Standard Cubic Foot) gas measured at 1 atmosphere and 70°F.
Liquid measured at 21.42 atmospheres and 1.7°F.
Solid measured at -109.25°F.

Nm³ (normal cubic meter) gas measured at 1 atmosphere and 0°C.
All values rounded to nearest 4/5 significant numbers.