

Engineered Systems

CONSULTING | SYSTEM DESIGN | MANUFACTURING | INSTALLATION | COMMISSIONING | TRAINING



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Our Engineered Systems Advantage



Consulting / Engineering Design

Our team of cryogenic experts work closely with you to provide the best solution for your application. A Chart cryogenic system is designed and engineered to specifically match the requirements you have, insuring that we maximize the return on investment of your capital employed.

In addition, Chart Bulk Storage Systems are manufactured to ISO 9001, insuring quality of the highest standards. Our experience, lean manufacturing practices and project management oversight insure your system will be delivered on schedule.

Installation / Commissioning

Our Engineered Systems team is dedicated to assuring that the installation of your system and the commissioning process are flawless.

Our Project Managers - dedicated to your project - oversee all the necessary details ensuring a successful installation and commissioning of your Engineered System.

Training

Complete technical service and onsite training are available once the system is installed. Our Engineered Systems team and technical engineering staff are readily available for support.

When you choose Chart, you get single-source accountability.

What is an Engineered System?

A Chart Engineered System is a custom, application-focused cryogenic solution that utilizes Chart products as the basis of design. System components may include Chart bulk cryogenic storage tanks, vaporizers, Chart Vacuum Insulated Piping (VIP), system automation and pressure control stations.

Examples of various applications include:

Nitrogen Applications —

Inerting Modified Atmosphere Packaging (MAP) Instrumentation Liquid Nitrogen Purge Systems for LNG Nitrogen Injection for Natural Gas Nitrogen Refrigeration Cycle Test Chambers Testing, Research & Development Aerospace **Oil & Gas Industry Applications** Electronics Manufacturing Molecular Beam Epitaxy (MBE) Vacuum Insulated Piping Food Freezing Cryobiological Storage Other Liquid & Gaseous Nitrogen Applications

Argon Applications -

Purging Inerting Steel & Metals Manufacturing Welding Laser Applications

Ethylene Applications

Refrigeration Loop Cycle Polypropylene Manufacuring Ripening Fruit







CO₂ Applications

Food Freezing & Processing Beverage Carbonation Water Treatment Greenhouse Growing Oil & Gas Applications Pulp & Paper Welding & Metal Fabrication Reduced Oxygen Packaging (ROP) Flash Freezing



Oxygen Applications -

Healthcare Pharma & Biotechnology Water & Wastewater Treatment Plants (Ozone) Steel & Metal Manufacturing Cutting, Welding & Metal Fabrication Pulp & Paper Aerospace Chemical Formulation Energy Sector Applications Glass Manufacturing Fish Farms Regasification

LNG Applications

Heating & Boiler Systems Pipeline Back Up Transportation Fueling Stations Regasification Furnace & Generator Operation Power Generation





Other Engineered Systems applications are available for Hydrogen, Helium, and Nitrous Oxide. If your requirement is not listed specifically, please call Chart Engineered Systems at 888-877-3093 for more information.

Engineered for Efficiency - Built to Last

Chart's Systems Approach

Chart works closely with each of our customers to ensure that your system is designed properly, further ensuring your system is built to and operating at peak efficiency. Built for long-term integrity, our system components and product designs provide the highest levels of performance at the lowest operating costs.





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1. Remote Fill Manifolds

Provides ability to fill multiple bulk tanks in a given system with a single CGAcompliant trailer connection.

CGA = Compressed Gas Association



2. Storage Vessel Options

Orientation: Vertical or Horizontal. Component and Piping Materials: Brass/Bronze Components with T304 Welded Stainless Steel Interconnecting Pipe & Tubing (Standard), or T314L/316L Welded or Seamless Stainless Steel Components & Interconnecting Pipe & Tubing (Option).



3. Vaporizers

Intended for gas use applications or for applications requiring significant pressure building capability. We will customize a vaporization design ensuring functionality year-round.



4. Pressure Control Manifolds (PCM)

A custom Chart PCM is designed to provide the flow you require and the pressure necessary for your application. Custom options include automation controls, filtration or cabinets to accomodate any environment.





A PLC system automates the system functionality with the use of

5. Programmable Logic Controls (PLC)

transmitting devices and actuated valves giving the site automatic control including HMI interfaces to easily adjust the parameters to your ever changing business needs.

Engineered System Commissioning and Training Services 6.

Chart will provide commissioning and training services to ensure the effective operational and functional transition from the Chart team to your team. Just let us know what your needs are, and we will provide this within the scope of our Engineered System project.

Choose Your Bulk Tank

VSCO₂ & HSCO₂ Series



Model of VSCO ₂ & HSCO ₂	6 Ton	14 Ton	30 Ton	50 Ton
Orientation	Vertical / Horizontal	Vertical / Horizontal	Vertical / Horizontal	Vertical / Horizontal
Dimensions				
Diameter/Length (in)	68 / 188	86 / 233	114 / 280	114 / 396
Height (in)	188 / 80	228 / 95	287 / 127	406 / 127
Tare Weight (Ibs)	9,400 / 9,300	17,400	39,600 / 39,700	56,900
Gross Capacity (ton)	6.8	13.2	31.1	48.1
Net Capacity (ton)	6.4	12.6	29.6	45.8
Design Specification				
ASME	\checkmark	\checkmark	\checkmark	\checkmark
MAWP (psig)	350	350	350	350
Thermal Performance (NER %/Day) in CO.	.15 / .24	.08 / .12	.05 / .08	.04 / .06

*Flow capacity rating down to a 20% contents level with a maximum fall off in tank operating pressure of 15 psig (1 bar).

Bulk Tank Customization: Don't see the model you need in our standard products? Feel free to ask about Chart's ability to customize a bulk tank to best suit your application. We encourage you to bring your ideas to us to help design a tank perfect for your needs.

VS-01 Series & HS-Series



Model of VS-01	525SC	900SC	1500SC	3000SC	6000SC	9000SC	11000SC	13000SC	15000SC
Orientation	Vertical	Vertical	Vertical	Vertical	Vertical	Vertical	Vertical	Vertical	Vertical
Dimensions									
Diameter/Length (in)	66	66	66	86	86	114	114	114	114
Height (in)	105	136	196	228	383	348	407	466	525
Tare Weight (Ibs)	3,300 (250 psig)	4,400 (250 psig)	6,200 (250 psig)	11,100 (175 psig) / 12,800 (250 psig)	19,900 (175 psig) / 21,500 (250 psig)	29,400 (175 psig) / 32,300 (250 psig)	35,200 (175 psig) / 38,700 (250 psig)	41,700 (175 psig) / 45,700 (250 psig)	48,000 (175 psig) / 52,600 (250 psig)
Gross Capacity (ton)	570	940	1,640	3,150	6,010	9,360	11,410	13,470	15,520
Net Capacity (ton)	510	850	1,580	3,030	5,770	8,990	10,960	13,060	15,060
Design Specification									
ASME	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark
MAWP (psig)	250	250	250	175 / 250	175 / 250	175 / 250	175 / 250	175 / 250	175 / 250
Thermal Performance (NER %/Day) in 0,	.55	.45	.35	.25	.15	.10	.10	.10	.10
Gas Flow Capacity* (SCFH)	9,000	9,000	9,000	18,000	18,000	42,000	42,000	42,000	42,000
Model of HS-Series	525SC	900SC	1500SC	3000SC	6000SC	9000SC	11000SC	13000SC	15000SC
Orientation	N/A	N/A	Horizontal	Horizontal	Horizontal	Horizontal	Horizontal	Horizontal	Horizontal
Dimensions									
Diameter/Length (in)	N/A	N/A	201	233	386	348	408	467	562
Height (in)	N/A	N/A	80	95	95	126	126	126	126
Tare Weight (lbs)	N/A	N/A	6,800	10,900 (175 psig) / 11,900 (250 psig)	20,400 (175 psig) / 22,000 (250 psig)	29,400 (175 psig) / 32,300 (250 psig)	35,300 (175 psig) / 38,800 (250 psig)	41,400 (175 psig) / 45,400 (250 psig)	47,700 (175 psig) / 52,300 (250 psig)
Gross Capacity (ton)	N/A	N/A	1,640	3,150	6,010	9,360	11,410	13,470	15,520
Net Capacity (ton)	N/A	N/A	1,580	3,030	5,770	8,990	10,960	13,060	15,060
Design Specification									
ASME	N/A	N/A	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark
MAWP (psig)	N/A	N/A	250	175 / 250	175 / 250	175 / 250	175 / 250	175 / 250	175 / 250
Thermal Performance (NER %/Day) in 0,	N/A	N/A	.56	.32	.22	.15	.15	.15	.15



Chart – The best value in Cryogenic Equipment and Cryogenic Engineered Systems

• **Extensive Product Line** – Chart is the largest manufacturer in the world of cryogenic equipment. Our extensive line of Cryogenic products insures that your Engineered System can be constructed to specifically match the application you have.

• **Sales Support –** Support of your Chart System does not stop after the product ships. Our sales team can provide continued support in assisting you with future Chart Engineered System needs or in arranging for ongoing support and training of your Chart System, if needed.

• **Engineering Support** – A full staff of knowledgeable and professional technical personnel is available to discuss with you what Chart equipment best meets your needs as it pertains to the unique requirements your application presents.

• **System Technical Training –** As the owner of a Chart Engineered System, Chart can commission the System for you and can subsequently train you on its operation, preventive maintenance, and troubleshooting.

• Installation & Repairs Services – As a function of working with the Chart Engineered Systems team, we can provide additional services beyond just equipment supply, including installation of your Chart System and on-site repair services as provided by our field services team.

• **New Products** – As a function of working with the Chart Engineered Systems team, we can provide additional services beyond just equipment supply, including installation of your Chart System and on-site repair services as provided by our field services team.

• **Repair Parts** – At www.chartparts.com, you will conveniently find the exact OEM part you need at any time. A full-service staff can assist you in selecting the right part you need, ship your part out as fast as the same day ordered, and keep you running 24/7!

• Warranty – We stand behind our products with the best warranties in the industry.

Saturation Pressure PSIG	OXYGEN		NITRO	DGEN	ARGON		
	Liquid Density Lbs/Ft ³	Gas Density SCF/Gal	Liquid Density Lbs/Ft ³	Gas Density SCF/Gal	Liquid Density Lbs/Ft ³	Gas Density SCF/Gal	
0	71.17	115.10	50.44	93.11	87.51	112.50	
5	70.42	113.72	49.62	91.55	85.77	110.89	
10	69.80	112.73	49.00	90.40	84.77	109.60	
25	67.86	109.59	47.50	87.63	82.46	106.61	
50	65.55	105.86	45.69	84.18	79.90	103.31	
75	63.76	102.97	44.19	81.53	77.90	100.71	
100	62.43	100.82	42.88	79.12	76.15	98.45	
150	59.80	96.57	40.70	75.08	73.16	94.59	
200	57.62	93.05	38.76	71.51	70.28	90.87	
250	55.60	89.79	36.83	67.95	67.79	87.65	

Densities at Various Saturation Pressures

Note: Density of water at 60°F = 62.30 lbs/cu ft

Argon

	Weight		G	ias	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									
	We	eight	G	ias	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.

				Carbon Dioxid	le			
		Weight	Weight Gas			Lic	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 $\rm Nm^3$ (normal cubic meter) gas measured at 1 atmosphere and 0°C. Solid measured at -109.25°F.

Conversion Data



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