Liquid Nitrogen Dosing

System Solutions for LN_2 Service

DOSERS | SYSTEM DESIGN | MANUFACTURING | TRAINING | INSTALLATION | CONSULTING

Dosers Product & Services Catalog

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Innovative Design, Technology & Reliability

Across Chart, we pride ourselves on designing innovative products with advanced technology and high reliability to enhance customer value. Our understanding of our customer's business needs and end-use applications has helped us achieve a wide product portfolio of solutions. We provide the right product for the application – driving a competitive advantage for our customer and our company.

Dosing The World One Drop At A Time

Chart offers complimentary use of this LN_2 logo on your packaging.

We offer the following comprehensive solutions to meet your needs:

Engineering Design

Our sales and engineering teams will document your system specifications and propose the most efficient and economical solution that meets the system's performance requirements.

On Site Demonstrations

"How do I know it will work with my production line?" is the number one question we are faced with from potential customers. We prove it will work on YOUR production line by bringing the system and our trained staff to install the equipment for a real-time demonstration.

Quality Manufacturing

Our experience ensures that your order is completed to high quality standards and on schedule. Each and every system goes through rigorous quality control and assurance before shipping.

24/7 After Sales Support

After sales support is available through an operator and voice messaging system, day or night. See page 18 for details.

When you choose Chart, you get single-source accountability from the engineered solution through post-installation service.

LN_2 Dosing Applications

Chart Inc. has been mastering liquid nitrogen (LN_2) dosing applications for over 25 years. Based on the physical characteristic that one part of liquid nitrogen warms and expands into 700 parts of gaseous nitrogen, Chart dosing systems are primarily used to pressurize and/or inert (N_2 flush) products and its packaging. As new packaging technologies and products evolve, so has a demand for refined dosing results. Chart has met these challenges with innovation, key partnerships and detailed application analysis.

How it works

LN_2 is supplied to the doser by a vacuum insulated hose and flows into the dosing head. A sensor detects the speed of the line (encoder compatible for higher speeds), and a second sensor detects the presence of a container. When a container is detected, the dosing head actuated valve opens and dispenses the exact amount of pure LN_2. A PLC (Programmable Logic Controller) is the brains behind integrating the sensors, controls and human interface via a touch-screen display.

Pressurization in Packaging Applications

A precise dose of liquid nitrogen is delivered immediately before capping or seaming. The trapped LN_2 quickly vaporizes, pressurizing the container. In hot fill applications, the nitrogen pressure counteracts the vacuum created when a hot product cools.

Key Benefits:
- Package Rigidity
- Eliminate Package Paneling
- Ease of Labeling
- Lighter Weight Packaging
- Glass to Plastic Transition
- Oxygen Reduction

Proven Applications:
- Bottled Water
- Energy Shots
- Flax Seed Oil
- Juices (Hot & Ambient Fill)
- Teas
- Vinegar

Case Study: *Lighter Weight Packaging*
Documented 9 gram reduction in PET bottle weight using Chart's MicroDose™ technology. This equates to ~$2.64MM annual savings for one production line running at 700 bottles/minute; assuming the cost of PET resin to be $0.80/lb.

Preservation Applications

An exact dose of liquid nitrogen is introduced seconds before the seamer or capper. The small dose of liquid nitrogen gasifies, 700 times its volume, in the process. The large volume of gaseous nitrogen pushes the oxygen out of the container.

Key Benefits:
- Oxygen Reduction
- Extended Shelf Life
- Efficient Nitrogen Consumption
- Stabilizing Organic Products

Proven Applications:
- Automobile Oil
- Beer
- Condiments
- Wine

Case Study: *Oxygen Reduction*
Documented extended shelf life studies show a 90-95% reduction in headspace oxygen content and a 59% reduction in total package oxygen when compared to a traditional gaseous nitrogen purge of headspace.

Case Study: *Extended Shelf Life*
Documented extended shelf life studies show an increase from 63 to 80 days providing larger batching flexibility at production runs, which improves overall costs.

Paso Robles Wine Country was named 2013 Wine Region of the Year by Wine Enthusiast Magazine. Our customer in that area states that it's "all because of the doser!"

LN_2 Dosing Applications

Freezing Applications

A dose of liquid nitrogen is introduced to "lock in" and surface freeze the product (novelty ice cream) before it's transferred to a traditional tunnel or spiral freezer. Recently, Chart has been partnering with retail ice cream shops to fast freeze customized desserts with liquid nitrogen to enhance the taste and texture.

Key Benefits:
- Maintain Product Integrity
- Aid in Packaging/Labeling
- Enable New Products to Market
- Enhance Flavor and "Smoothness"

Proven Applications:
- Dipped Ice Cream Cone
- iCream Café

Case Study: ***Maintain Product Integrity***
Documented account of better overall aesthetics of the dipped ice cream cone due to liquid nitrogen flash freezing as it provides stability and support throughout the packaging process.

Modified Atmosphere Packaging (MAP) Applications

A large dose of liquid nitrogen is introduced into the package seconds before the seamer or capper. The dose of LN_2 gasifies, 700 times its volume, in the process. The large volume of gaseous nitrogen pushes the oxygen out of the container.

Key Benefits:
- Oxygen Reduction
- Extended Shelf Life
- Reduce Nitrogen Consumption
- Stabilizing Organic Products

Proven Applications:
- Baby Formula
- Coffee
- Nuts
- Trail Mix

Case Study: ***Reduce Nitrogen Consumption***
Documented nitrogen savings show a 46% reduction in nitrogen spend when using Chart's liquid nitrogen dosing system compared to traditional gaseous nitrogen purging.

CryoDoser FleX® Liquid Nitrogen Dosing

The CryoDoser FleX® Liquid Nitrogen Dosing System is the first doser with the ability to serve every dosing application within one unit. Chart Inc. has designed a brand new dosing system that can be used from the slowest production lines to the fastest. The most efficient dosing system to date, the CryoDoser FleX system is the only liquid nitrogen doser you need. The CryoDoser FleX unit is offered with two controllers, the Craft Custom and the Pack Premier.

With two premium controller options, more standard functions than any other doser offered before, and a brand new all-around design, the CryoDoser FleX system is ready to change the market.

Features

- **Compact Size** – enables installation in limited spaces
- **Discrete Dosing** – Craft Custom (750 cpm) and Pack Premier (2000+ cpm)
- **SoftDose™ Compatible** – Chart's proven technology for hot fill, powder and granular applications
- **MicroDose™ Standard** – the Pack Premier has a controller function that allows dosing pressure adjustments
- **RemoteDose™ Standard*** – monitor, troubleshoot and make adjustments while connected to your VPN**
- **ExacTrack™** – with the new EDS (Electric Dosing System), supreme accuracy is achieved. Proportionally control the amount the actuator opens and make dosing duration changes in increments of 0.1 ms.
- **Warranty** – four (4) year vacuum warranty; highest in the industry one (1) year controller warranty

** Results achieved at Chart laboratory conditions.*
*** Access to the internal network is necessary for this function.*

How it Works

LN_2 is supplied to the CryoDoser FleX unit by a vacuum insulated hose and flows into the dosing head. A sensor detects the speed of the line (encoder compatible); a second sensor detects the presence of a container. When a container is detected, the dosing head opens and dispenses an exact amount of pure LN_2. A PLC (Programmable Logic Controller) is the brains behind integrating the sensors, controls and human interface via a touch-screen HMI (Human Machine Interface) display.

Key Benefits

- **Lightweight PET** – reduce the weight of PET for cost and environmental savings
- **Glass to PET Transition** – eliminate glass safety hazards and weight of containers
- **Container Rigidity** – maintain shape even with lighter weight containers
- **Eliminate Paneling** – increase the internal pressure to offset paneling issues
- **Oxygen Reduction** – create an inert environment to preserve product freshness
- **Extend Shelf Life** – minimize oxygen levels
- **Ease of Labeling** – consistent container rigidity creates an efficient labeling process
- **Reduce Nitrogen Consumption** – measurable and repeatable liquid doses
- **Maximize Warehouse Storage Space** – increasing product stackability utilizes less square footage
- **Stabilize Organic Products** – extend shelf life without preservatives

Choose Your Doser

	CryoDoser FleX®	CryoDoser FleX®
		
Model	**Craft Custom**	**Pack Premier**
Package/Container		
LN_2 Volume/Head Space	2 Liters	2 Liters
Body		
Arm/Head Type	Interchangeable	Interchangeable
Integrated Purge	✓	✓
Head Pressure psi (bar)	0.2 – 0.49 (0.014 – 0.03)	0.2 – 0.49 (0.014 – 0.03)
Controller		
Discrete Dosing cpm (cph)	750 (45,000)	2000+ (120,000+)
Dose Duration (ms)	5 – 1000 (1 ms intervals)	1 – 1000 (0.1 ms intervals)
PLC Platform	Siemens	Siemens
Encoder Compatible		✓
Dynamic Dose Duration™	✓	✓
ExacTrack™ (Line Speed Auto Detect)		✓
Fixed Delay	✓	✓
Container Speed Compensated Mode		✓
Multiple Languages	✓	✓
Ethernet Ready		✓
Recipe Storage	✓	✓
Fill Level Height Adjustment (SoftDose Aid)	✓	✓
SoftDose™ Technology *(page 10)*	Option	Option
RemoteDose™ Web Technology *(page 11)*		✓
MicroDose™ Technology *(page 11)*	✓	✓
DoserEASE™ Electric Actuator *(page 13)*	✓	Option
Electric Dosing System (EDS) Actuator *(page 12)*		Option
ThermoPurge™ Option	Option	Option

Doser Customization:

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

Choose Your Doser

	CryoDoser®	UltraDoser®		
				
Model	**2K**	**2K**	**500S**	**150S**
Package/Container				
LN_2 Volume/Head Space	Medium	Small	Small	Small
Body				
Arm/Head Type	Flexible	Rigid	Rigid	Rigid
Quick Service Auto Defrost	✓			
Head Pressure	0.9 psi (0.06 bar)	0.45 psi (0.03 bar)	0.45 psi (0.03 bar)	0.45 psi (0.03 bar)
Controller				
Discrete Dosing cpm (cph)	2000 (120,000)	2000 (120,000)	500 (30,000)	150 (9,000)
Dose Duration (ms)	5.5-1000 (0.1 ms intervals)	5.5-1000 (0.1 ms intervals)	15-1000 (1 ms intervals)	20-1000 (1 ms intervals)
PLC Platform	Allen-Bradley or Siemens	Allen-Bradley or Siemens	Siemens	Siemens
Encoder Compatible	✓	✓		
Line Speed Auto Detect	✓	✓		
Electronic Dose Targeting	✓	✓	✓	
Fixed Delay Mode	✓	✓	✓	✓
Container Speed Compensated Mode	✓	✓	✓	
Multiple Languages	✓	✓		
Ethernet Ready	✓	✓		
Recipe Storage	✓	✓		
SoftDose™ Technology *(page 10)*	Option	Option	Option	Option
RemoteDose™ Web Technology *(page 11)*	Option	Option		
MicroDose™ Technology *(page 11)*	✓	✓		
Electric Dosing System *(page 12)*	✓	✓	Option	Option

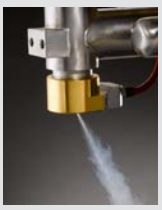
Choose Your Doser

Model	Inerter™ 2K	Inerter™ 500S	Inerter™ 150S
Package/Container			
LN_2 Volume/Head Space	Large	Large	Large
Body			
Arm/Head Type	Rigid	Rigid	Rigid
Quick Service Auto Defrost			
Head Pressure	≥3 psi (0.20 bar)	≥3 psi (0.20 bar)	≥3 psi (0.20 bar)
Controller			
Discrete Dosing cpm (cph)	2000 (120,000)	500 (30,000)	150 (9,000)
Dose Duration (ms)	5.5-1000 (0.1 ms intervals)	15-1000 (1 ms intervals)	20-1000 (1 ms intervals)
PLC Platform	Allen-Bradley or Siemens	Siemens	Siemens
Encoder Compatible	✓		
Line Speed Auto Detect	✓		
Electronic Dose Targeting	✓	✓	
Fixed Delay Mode	✓	✓	✓
Container Speed Compensated Mode	✓	✓	
Multiple Languages	✓		
Ethernet Ready	✓		
Recipe Storage	✓		
SoftDose™ Technology *(page 10)*	Option	Option	Option
RemoteDose™ Web Technology *(page 11)*	Option		
MicroDose™ Technology *(page 11)*	✓		
Electric Dosing System *(page 12)*	Option	Option	Option

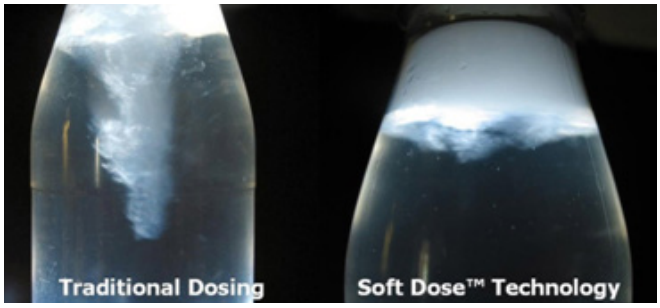
SoftDose™ Technology

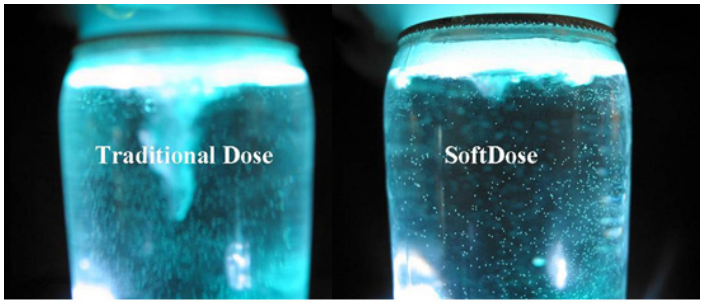
The SoftDose technology places or sprays liquid nitrogen on the surface of the product rather than penetrating the product surface essentially eliminating any product splash and delivering consistent container pressure. Various options are tailored to a specific product, package or application.

A new feature that the CryoDoser FleX® LN_2 Dosing System offers is adjustable fill level heights. From the controller interface, the fill level percentage can be adjusted to create a lower head pressure. Liquid nitrogen pressure is based upon liquid column height. By lowering the fill level within the doser, a lower pressure at the dosing head can be achieved. This can be used with or without our specialized SoftDose additions. Setting the fill level height is simple and can be adjusted anytime. The fill level settings can also be saved within the recipe function for the Pack Premier systems. This feature is patent-pending and is only available from Chart's CryoDoser FleX Liquid Nitrogen Dosing Systems.

	Standard	Diverging	Ventelator	Regar	Hot Chute	Side Chute
						
Container Type	Narrow to wide mouth opening	Narrow to wide mouth opening	Narrow to wide mouth opening	Wide mouth opening	Narrow to wide mouth opening	Narrow to wide mouth opening
Recommended Dose Mode*	Discrete or Continuous	Discrete	Continuous	Discrete	Discrete	Continuous
Recommended Speed*	Any	Any	Any	Up to 900 cpm (54,000 cph)	Up to 400 cpm (24,000 cph)	Any
Recommended Application*	Non-carbonated ambient liquids	Hot fill liquids	Hot fill liquids	Dried goods	Limited space near capper	Powders, granular products
High-wattage Heater Package			Optional	Optional	✓	✓

* Chart recommendations only – actual application results and selection may vary based on other conditions or factors.





RemoteDose™ Web Technology

RemoteDose technology allows control access to the CryoDoser FleX™ Pack Premier LN_2 Dosing System when connected to the customer intranet. The operator, manager or engineer can view the process, load recipes or create recipes from their office desktop computer or mobile device.

Troubleshooting before running to troubled machine

You can confirm possible causes of errors to prepare for necessary actions and tools before running down to the point of the problem on a mobile device anywhere.

* Requires local intranet connection

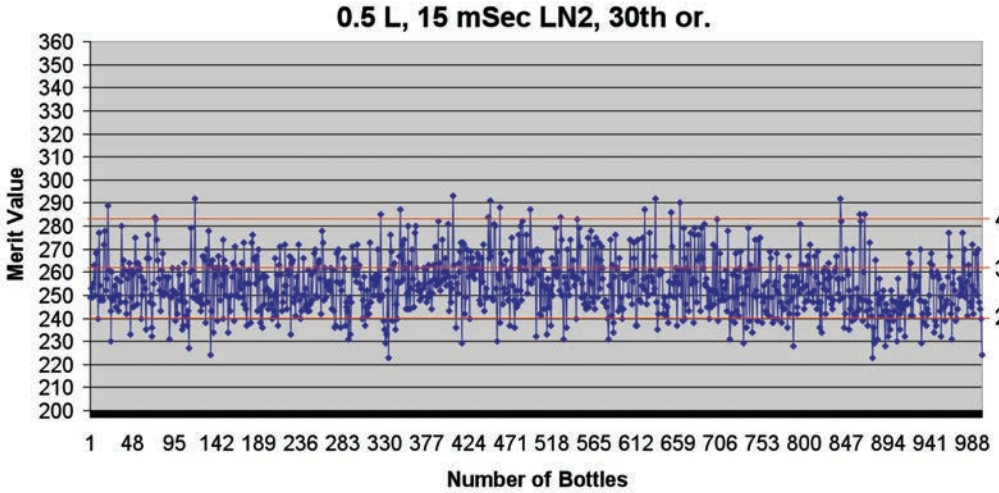
Remote Monitoring/Command allows for a hardwired connection between the CryoDoser Flex Pack Premier system and a customer controller.

Controller Interface:
- ✓ System Enable
- ✓ System Standby
- ✓ Dose Enable/Disable
- ✓ Ready Signal
- ✓ Running Signal
- ✓ Warning Signal
- ✓ Fault Signal

Sensor Interface:
- ✓ Container Detect
- ✓ Timing Sensor
- ✓ Line Speed Frequency

MicroDose™ Technology

MicroDose technology was developed in response to market demands to precisely dose LN_2 into ultra light weight packaging to comply with tight container pressure specifications. Utilizing various sensors to detect filling line speed, pocket detection, bottle presence, inputs independent of the filler and electronic adjustments for fine tuning, 3 +/-1 psi (0.21 bar +/- 0.07 bar) internal bottle pressure is achieved at the 99% level.



Results:
Sample size 1,000
99% - 2 to 4 psi (0.14 – 0.28 bar)
56% - 3 psi (0.21 bar)

4 psi (0.28 bar)
3 psi (0.21 bar)
2 psi (0.14 bar)

Electric Dosing System (EDS) Electric Actuated Dosing with ExacTrack™

The Electric Dosing System (EDS) with ExacTrack™ Superior Dosing Accuracy is the elite liquid nitrogen dosing actuator. The EDS is powered from the Pack Premier Controller using electric current rather than gas pressure. The actuation speed of five milliseconds and dose duration resolution of 0.1 milliseconds provides supreme accuracy. Accuracy is the most important feature when filler line speeds approach 2000 containers per minute. Faster actuations means increased repeatability of each discrete dose. Dosage accuracy also means less product rejects due to low pressure or high headspace oxygen levels. The EDS can actually discrete dose above 2000 containers per minute. This is the fastest discrete dosing capability in the industry. On top of that, the EDS' all stainless construction and solid manufacturing makes it wash-down safe and more resistant to corrosive products.

The EDS is available with the CryoDoser FleX Pack Premier. The EDS is ExacTrack ready and can provide the best accuracy in the industry. ExacTrack dosing monitors the container line speed and adjusts timing delay and dose duration as speed increases or decreases. ExacTrack dosing allows the user to precisely tune the dosing system giving a more consistent dose result in each container. A typical ExacTrack system consists of three sensors: container detect, container timing and line speed. The ExacTrack timing and duration is user customizable within the Recipe Manager.

Key Benefits

- Higher cycle speeds compared to electro-pneumatic and pneumatic actuators
- Improved discrete dosing repeatability
- Supreme accuracy with ExacTrack technology
- Long life-cycle actuations reduces maintenance and cost of ownership
- All stainless steel construction provides corrosion resistance
- Quieter operation compared to pneumatic actuators

Electric Actuator Standard Edition (EASE)

The DoserEASE™ Electric Actuator is the electric replacement for the standard pneumatic actuator that has been used on Chart Dosers for more than a decade. The EASE eliminates the need for two separate sources to operate the doser. Gaseous nitrogen for purging and liquid nitrogen can be pulled from the same source now that gas is not needed to activate the dosing head.

The actuation speed is improved from the standard pneumatic actuator. This coupled with a dose duration resolution of one millisecond provides improved repeatability in the dosage of each container. The EASE can discrete dose at speeds up to 750 containers per minute and can also perform continuous dosing if needed. The EASE functions with one sensor or two depending on the application. The EASE comes standard with the CryoDoser FleX™ Craft Custom LN_2 Dosing System.

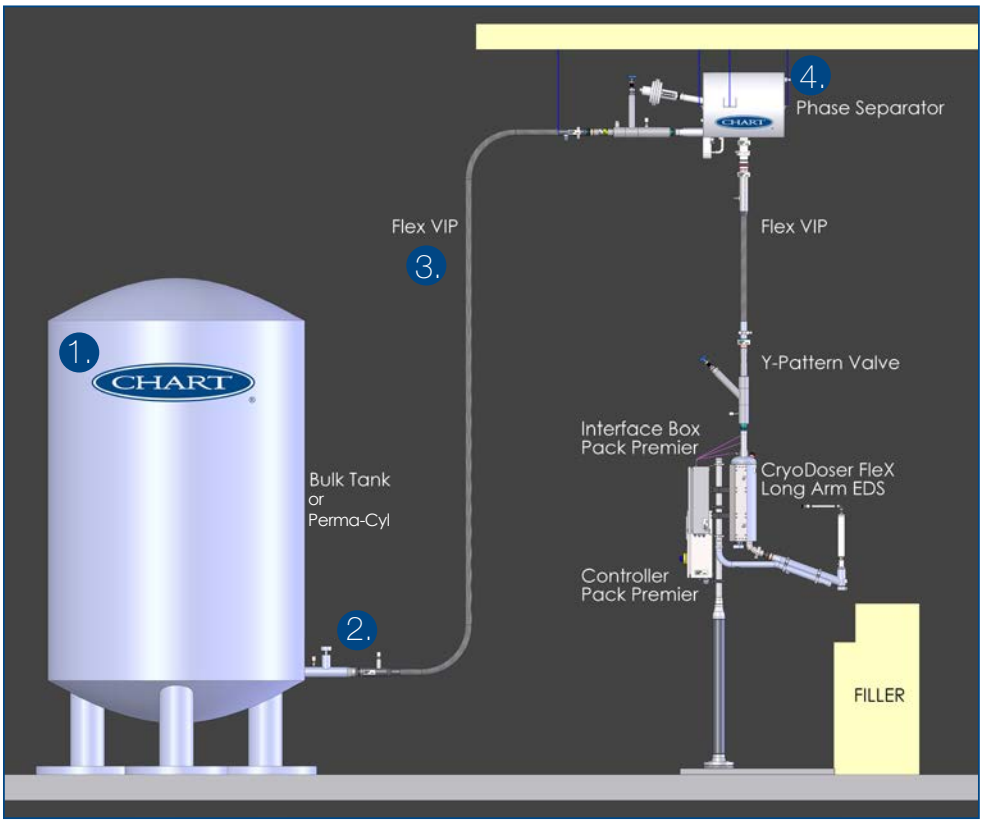
Key Benefits

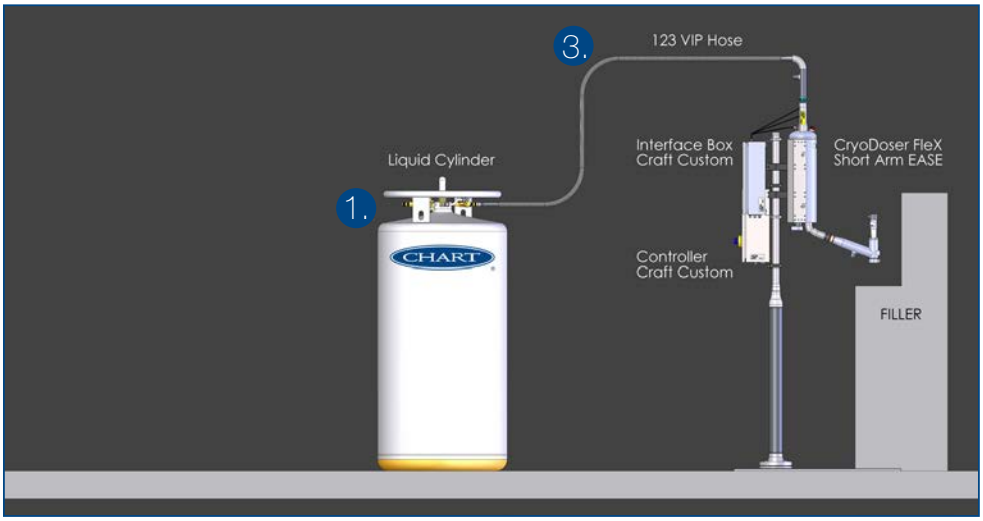
- Higher cycle speeds compared to electro-pneumatic and pneumatic actuators
- Improved discrete dosing repeatability
- Long life-cycle actuations reduce maintenance and cost of ownership
- Fully sealed construction provides corrosion resistance
- Quieter operation compared to pneumatic actuators
- Low profile design fits well into the low clearance, linear filler systems

Engineered for Efficiency—Built to Last

A Turnkey Approach

Chart engineers work closely with our customers to ensure that the total system is designed properly, making the dosing system as effective as possible. Chart's turnkey approach ensures consistent, quality liquid to keep your doser operating at peak efficiency. Built for long-term integrity and industry leading efficiency, these systems give our customers the highest performance at the lowest operating cost, while having a single point of contact.





Choices of Liquid Supply:
Bulk Tank, Perma-Cyl® or Liquid Cylinder

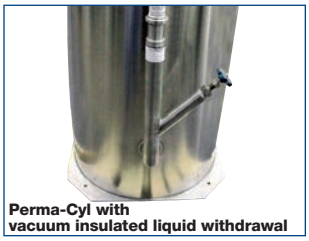
1. Vacuum Insulated Storage

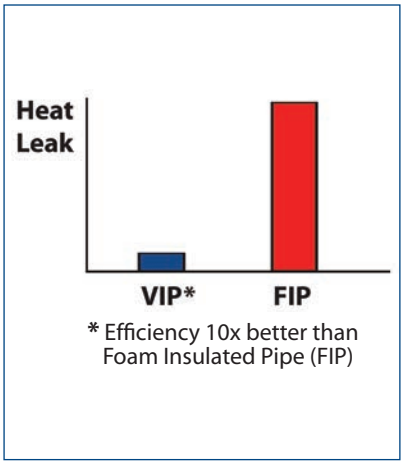
Chart offers the most comprehensive line of liquid nitrogen storage systems available today. From bulk tank storage to Perma-Cyl® MicroBulk Storage Systems (MicroBulk.com) to Dura-Cyl® Liquid Cylinders, we have the right LN_2 supply solution for your dosing needs. Our equipment is thermally efficient with reliable controls for long-term trouble-free operation. See more on pages 16 – 19.

2. Vacuum Insulated Withdrawal

Cryogenic pipe systems often require valves to properly control the liquid flow to the application. Strategically located valves control flow to a branch of the system or into a use-point. A vacuum insulated valve has the benefit of extremely low heat leak for minimum gas boil-off, and it eliminates unsafe ice build-up and dripping water issues.


Bulk tank with
vacuum insulated liquid withdrawal


Perma-Cyl with
vacuum insulated liquid withdrawal

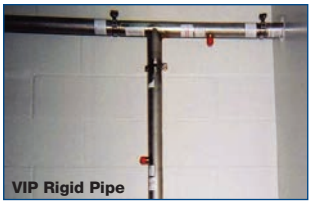


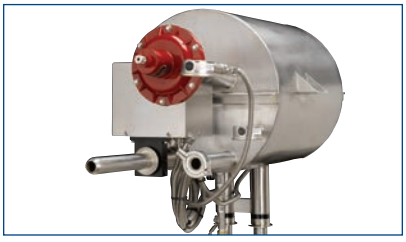
* Efficiency 10x better than
Foam Insulated Pipe (FIP)

3. Vacuum Insulated Pipe

Vacuum insulated pipe (VIP) is the foundation for a system's heat loss efficiency and long-term integrity. Chart offers a complete line of both Engineer to Order flexible and rigid vacuum insulated pipe that provides the most efficient and diverse method of transferring quality liquid nitrogen to ensure peak doser performance. See more on pages 20 & 21 or visit ChartVIP.com.


VIP Flex Pipe


VIP Rigid Pipe



4. Phase Separator

Chart's vacuum insulated Phase Separator provides extremely high quality, low pressure liquid nitrogen on demand. The level of liquid nitrogen inside is controlled automatically. The reservoir is vented to atmosphere at all times ensuring the pressure inside is equal to atmosphere. This results in a continuous supply of unsaturated liquid nitrogen at a precise pressure to the doser. See more on page 21.

	Dura-Cyl® Liquid Cylinders - Footring			
All data for N_2	Dura-Cyl 180	Dura-Cyl 180	Dura-Cyl 200	Dura-Cyl 200
Pressure	LP	MP	LP	MP
Dimensions				
Diameter	20”	20”	20”	20”
Height[1]	64.3”	59.8”	66.6”	66.6”
Tare Weight (lbs)	210	300	210	320
Full Weight (lbs)	540	580	559	618
Thermal Performance (NER %/Day)	1.5	1.9	1.85	1.85
Storage Capacity (Net/DOT)[2][3]				
Gal	49	49	52	52
Liters	185	185	196	196
Gas Flow				
SCFH	–	350	–	400
Nm^3/h	–	9.2	–	10.5
Design Specification				
DOT/CTC Rating	4L100	4L200	4L100	4L200
MAWP (psig)	22	230	22	230
Standard Design Features				
Internal Pressure Builder	X	X	X	X
Liquid Withdrawal	X	X	X	X

[1] All dimensions are measured from the floor to the top of the sight gauge protector.
[2] Gas capacities at DOT4L limits. See manual P/N 10642912 for details.
[3] Most of the Dura-Cyl models are available with permanently installed CGA fittings for medical applications. Contact Customer Service for details.

	Dura-Cyl® Liquid Cylinders - Caster Base					
All data for N_2	Dura-Cyl 120 RB	Dura-Cyl 230 RB	Dura-Cyl 230 RB	Dura-Cyl 230 SB	Dura-Cyl 230 SB	Dura-Cyl 265 SB
Pressure	LP	LP	MP	LP	MP	MP
Dimensions						
Diameter	20”	26”	26”	26”	26”	26”
Height[1]	51.0”	57.2”	57.2”	56.8”	56.8”	59.5”
Tare Weight (lbs)	177	296	311	325	340	418
Full Weight (lbs)	377	697	675	726	704	812
Thermal Performance (NER %/Day)	2.0	1.5	1.8	1.5	1.8	2.0
Storage Capacity (Net/DOT)[2][3]						
Gal	29	61	61	61	61	70
Liters	110	230	230	230	230	265
Gas Flow						
SCFH	–	–	400	–	400	400
Nm^3/h	–	–	10.5	–	10.5	10.5
Design Specification						
DOT/CTC Rating	4L100[4]	4L100	4L200	4L100	4L200	4L200
MAWP (psig)	22	22	230	22	230	230
Standard Design Features						
Internal Pressure Builder	X	X	X	X	X	X
Liquid Withdrawal	X	X	X	X	X	X

[1] All dimensions are measured from the floor to the top of the sight gauge protector.
[2] Gas capacities at DOT4L limits. See manual P/N 10642912 for details.
[3] Most of the Dura-Cyl models are available with permanently installed CGA fittings for medical applications. Contact Customer Service for details.
[4] Dura-Cyl 120LP is not TC approved.

	Perma-Cyl® MicroBulk Storage Systems			
All data for N_2	Perma-Cyl 1000	Perma-Cyl 1500	Perma-Cyl 2000	Perma-Cyl 3000
Pressure	HP	HP	HP	HP
Dimensions				
Diameter	42”	48”	48”	59”
Height	82”	92”	118.5”	122”
Tare Weight (lbs)	1500[3]	2200[4]	2600[4]	3300[4]
Thermal Performance (NER %/Day)[1]	1.0	1.0	1.0	1.0
Storage Capacity (Net/ASME)[2]				
Gal	251	385	515	715
Liters	950	1455	1945	2707
Gas Delivery Rate				
SCFH	320.0	450.0	450.0	450.0
Nm^3/h	9.0	12.7	12.7	12.7
Design Specification				
ASME	X	X	X	X
MAWP (psig)	350	350	350	350
Standard Design Features				
Internal Pressure Builder	X	X	X	X
VJ Liquid Withdrawal – ½"	X	X	X	X

[1] Values are based on gross capacity.
[2] Values are based on net capacity at 0 psig (0 barg) for ASME vessels
[3] Weights do not include lab base option. (base option: 265 lbs)
[4] Weights include lab bases.

	Bulk Storage Systems			
All data for N_2	VS-525-DSS	VS-900-DSS	VS-1500-DSS	BulkLite® 1400
Orientation	Vertical	Vertical	Vertical	Horizontal
Dimensions				
Diameter	66”	66”	66”	72”[2]
Height	105”	136”	196”	69”
Tare Weight (lbs)	3300	4400	6200	4800
Thermal Performance (NER %/Day)	.89	.73	.56	.45
Storage Capacity (Net/ASME)				
Gal	510	850	1580	1320
Liters	1931	3218	5981	4996
Gas Flow Capacity[1]				
SCFH	9000	9000	9000	2000[3]
Nm^3/h	237	237	237	56.6
Design Specification				
ASME	X	X	X	X
MAWP (psig)	250	250	250	250
Standard Design Features				
External Pressure Builder	X	X	X	X
VJ Liquid Withdrawal – 1"	X	X	X	X

[1] Flow capacity rating down to a 20% contents level with a maximum fall off in tank operating pressure of 15 psig (1 bar).
[2] Tank width @ forklift brackets. Length = 187"
[3] Eight hours continuous flow @ 80% duty cycle in room temp. with LN_2.

	Euro-Cyl® Liquid Cylinders
All data for N_2	180 / 24 MCR LFT
Dimensions	
Diameter (mm)	508
Height (mm)	1622
Tare Weight* (kg)	135
Maximum Full Weight (kg)**	285
Storage Capacity	
Gross Liquid* (liters)**	196
Net Liquid (liters)	186
Thermal Performance (NER** %/Day)**	2.9
Gas Flow (Nm^3/hr)	9.2
Maximum Relief Valve Setting (bar)	24
Rupture Disk Setting (bar)	32
Code	TPED (EN1251, ADR)

** At 10 bar pressure ** NER = Nominal Evaporation Rate *** Tank plus product at saturated pressure O_2 bar for O_2, N_2, Ar and triple point for CO_2 and N_2O*

	Euro-Cyl® 600 to 1000 Liters			
All data for N_2	600/24 M12	600/37 M12	800/24 M12	1000/24 M12
Dimensions				
Diameter (mm)	900	900	1050	1100
Base Dimension (LxW) (mm)	1010 x 1010	1010 x 1010	1130 x 1130	1180 x 1180
Height (mm)	2050	2050	2100	2150
Tare Weight* (kg)	625	700	765	830
Maximum Full Weight (kg)**	1083	1158	1376	1591
Storage Capacity				
Gross Liquid* (liters)**	601	601	801	997
Net Liquid (liters)	571	571	761	947
Gas (Nm^3)**	369	369	492	612
Thermal Performance (NER** %/Day)**	1.6	1.6	1.5	1.5
Gas Flow / with aux. Vaporizer				
(Nm^3/hr)	21/30	21/28	25/35	27.5/42
Maximum Relief Valve Setting (bar)	24	37	24	24
Code	TPED (EN1251)			

** Additional product vaporizer adds approximately 20 kg ** At 0 barg pressure *** Volume tolerance is ± 4%*
***** NER = Nominal Evaporation Rate*

	Euro-Cyl® Low Pressure					
All data for N_2	120/4 SB	180/4	230/4 RB	230/4 SB	600/8	1000/8
Dimensions						
Diameter (mm)	508	508	660	660	965	1067
Base Dimension (LxW) (mm)	650 x 675	508	660	715 x 715	1030 x 1030	1130 x 1130
Type of Base	square	round	round	square	pallet	pallet
	caster base	footring	caster base	caster base	frame	frame
Height (mm)	1290	1613	1391	1391	1915	2165
Tare Weight (kg)	94	109	125	143	550	720
Maximum Full Weight (kg)**	186	259	309	327	1066	1482
Storage Capacity						
Gross Liquid (liters)**	120	196	240	240	673	993
Net Liquid (liters)	114	186	228	228	639	943
Thermal Performance (NER* %/Day)**	2	1.9	1.8	1.8	1.6	1.5
Maximum Relief Valve Setting (bar)	1.5/4*	1.5/4*	1.5/4*	1.5/4*	8	8
Rupture Disc Setting (bar)	7	7	7	7	N/A	N/A
Code	TPED					

** Tanks supplied with 4 bar relief valve is optional ** Tank plus product at saturated pressure 0 bar *** NER = Nominal Evaporation Rate*

Single-Source Accountability

System Design Engineering

Our experienced sales engineers will document your system specifications and propose the most efficient and economical solution that meets your performance requirements.

Dosing Lab Services

Let us help you develop and improve your product packaging, aid in proof of concept, and share insight through our CA lab services. Send us your samples and we'll provide preliminary data, feedback, and consulting to assist with development work to help you realize the benefits of liquid nitrogen dosing.

Installation & Supervision

Our experienced technicians provide installation, start up, commissioning, and training to assure long-term trouble-free operation. Contact us for a site visit and free estimate.

24/7 Technical Support

Our technical support staff is one phone call away. Our trained technicians are available to respond to immediate technical inquiries, provide onsite assistance and training, perform system audits, and assist with plan preventative maintenance (PM) requirements.

Vacuum Insulated Pipe

Categories	Engineer to Order VIP
Top Three Benefits	1. Ultimate Flexibility – Chart's five design platforms can be configured to meet your budget, performance and installation needs. 2. Capable – From molecular beam epitaxy to deep space simulation Chart vacuum insulated pipe is capable of meeting your application needs 3. High Performance – Chart's mantra is to protect the molecule by offering the ultimate radiation, convection and conduction performance available.
MAWP*	150/400 psig**
Nominal Inner Diameters	½" to 10"
VIP Price	$$$
Installation Price	$$
Cool Down Relative Cost	$
Design Effort	High
Connections	• MVE® Shrink-Fit Bayonet™ • Flange • Field welded • Custom
Engineering Capability	Experienced staff to handle cryogenic system solution of all levels of complexity including Sales Engineers, Field Technicians, Customer Service, Project Managers, Project Engineers, Staff Engineers and Designers.

* MAWP = Maximum Allowable Working Pressure

** Dependent upon overall pipe design.

Engineer to Order Technical Information

Model	10	20
Inner Diameter (ID)	5/8" (15.875 mm)	1¼" (31.75 mm)
Outer Diameter (OD)	1.8" (45.7 mm)	2.6" (66.04 mm)
Minimum Flexible Bend Radius	18" (457.2 mm)	30" (762 mm)
Hole Required	3" (75 mm)	4" (100 mm)
Maximum Operating Pressure	200 psi (13.8 bar)	125 psi (8.6 bar)

(1) MVE® Shrink-Fit Bayonets™ only
(2) Close Tolerance Bayonets only

C-Flex Vacuum Insulated Transfer Hoses

Super flexible vacuum insulated liquid nitrogen transfer hoses are used in a wide variety of applications including tool connections and custom OEM applications. The coaxial bellowed construction allows for optimal flexibility. The use of lightweight stainless steel reduces cool-down loss to an absolute minimum. C-Flex hoses are protected by a stainless steel spiral wrap or a braided outer cover.

- **Custom Manifolds Available** – utilize vacuum insulated tees, elbows, bayonets, and valves to custom tailor the configuration (Consult factory)
- **High Pressure Requirements** – optional inner braid for higher pressure applications (Consult factory)
- **Minimal Cool Down & Steady State Losses** – compared to standard non-insulated transfer hoses
- **Integrated pump out**

C-Flex Technical Specifications

Model	04S	06S	08S	08B
Inner Diameter (ID)	¼" (6.3 mm)	⅜" (9.5 mm)	½" (12.7 mm)	½" (12.7 mm)
Outer Diameter (OD)	1.25" (31.8 mm)	1.65" (41.9 mm)	1.90" (48.3 mm)	1.80" (45.72 mm)
Minimum Flexible Bend Radius	7" (177 mm)	8" (203 mm)	10" (254 mm)	10" (254 mm)
Minimum Static Bend Radius	5" (127 mm)	6" (152 mm)	8" (203 mm)	7" (177 mm)
Maximum Operating Pressure	150 psi (10.3 bar)	150 psi (10.3 bar)	150 psi (10.3 bar)	150 psi (10.3 bar)

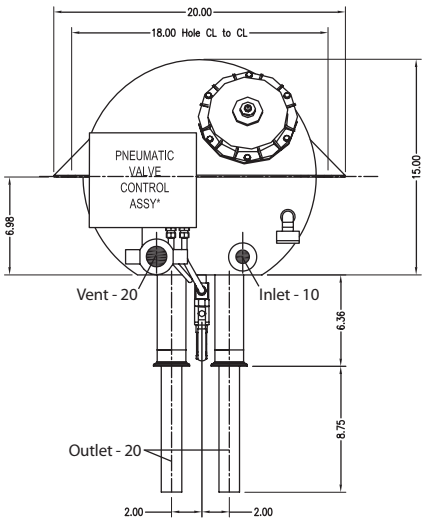
S: Spiral wrap outer covering **B:** Braided outer covering
C-Flex hoses are available in standard or custom lengths up to 60 feet.

123 Vacuum Insulated Transfer Hoses

Inner Flex Diameter: ¼ in.
Standard Length: 10 ft.
Outer Wrap: Spiral
End1 Fitting: 45° Flare
End2 Fitting: 625 Bayonet @ elbow
123 Style Options:
Overall Length: Varied
End Fittings: Varied

Phase Separator Technical Specifications

Materials	Stainless Steel 300
Controller Dimensions	14"H x 6.5"D x 2.5"W (356 mm H x 165 mm D x 64 mm W)
Number of Outlets	2 to 10 (even increments) - 20 Size
Capacity/Operational Volume	2 & 4 outlets: 4.63 gallons (17.53 liters) 6, 8, & 10 outlets: 12.19 gallons (46.14 liters)
Weight	**Empty Condition:** 60 - 85 lbs (27.2 - 38.6 kg) **Full Condition:** 100 - 163 lbs (45.4 - 73.9 kg)
System Utilities	**Electricity:** 110 - 220VAC, 50 - 60Hz **Gaseous Nitrogen:** Minimum 50 psi (3.45 bar), maximum 100 psi (6.89 bar) **Liquid Nitrogen:** Maximum 125 psi (8.62 bar); 80 psi (5.52 bar) optimal
Certifications	NEMA 4X, CE
Options	Custom sizes, ASME coded pressure vessels, backpressure regulator (10 psi/0.7 bar max)



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