CRYOGENIC INDUSTRIES

FrostByte

Volume 10 No. 3 A Newsletter from Cryogenic Industries Fall/Winter 1999

Cryoquip supplies vaporizer system for Sea Launch program

Cryoquip recently supplied an ambient air vaporizer system to Sea Launch, the first company to launch a commercial satellite into orbit from a floating platform at sea.

Designed for a flow rate of 20,000 to 40,000 SCFH (566 to 1132 Nm^3/hr), the vaporizer system was used to drain excess liquid oxygen and liquid nitrogen from the flexible 65 ft. (19 m) long vacuum jacketed filling lines used to move cryogenic products from the dock to the shipboard tanks.

Each vaporizer featured eight-finned heat transfer elements with internal grooves for high capacity performance and fast defrosting. They also were constructed using Cryoquip's patented "spar" link design for enhanced load carrying capability. To meet the unique requirements of the portable Sea Launch service, the system was mounted on a skid to achieve maximum mobility and versatility.

Sea Launch uses a specially designed command ship and floating platform to launch satellites at sea.

Comprised of the world's leading aerospace and maritime companies, Sea Launch was formed in 1995. The organization successfully launched its first rocket, carrying a demonstration payload, in March 1999. Using highly automated systems, the Sea Launch rocket can carry payloads up to 11,000 lbs. (5,000 kg) into geostationary transfer orbit.

The main components of the program include a home port facility in Long Beach, CA, USA; the Sea Launch Commander, a vessel that serves as a rocket assembly factory and floating mission control center; and the Odyssey, a self-propelled, floating platform from which satellites are launched. The company's first commercial launch—a 7,600 lbs. (3,447 kg) DIRECTV 1-R direct broadcast satellite—occurred in October.

The vaporizers designed and manufactured by Cryoquip for Sea Launch are used to drain excess LOX and LIN from the dock to shipboard tanks.

Inside This Issue

Cryoquip adds vacuum jacketed pipeline systems to its product portfolio

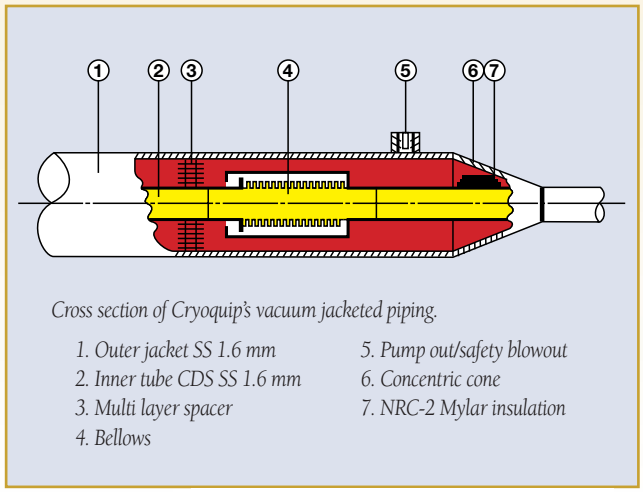
As a result of the recent merger between Cryoquip, Inc. and IWI Cryo Systems Pty Ltd of Australia, Cryoquip has added stainless steel, vacuum jacketed liquid cryogen pipeline systems to its portfolio of products.

Cryogenic liquids such as liquid nitrogen, oxygen and argon, commonly known as cryogens, are normally stored at low pressure by maintaining them at low temperatures, approximately -320º F (-200ºC). Any heat input to these liquids causes evaporation and, hence, losses. To transfer these liquids from point of storage to point of use without significant losses requires the use of pipelines with an extremely high degree of insulation.

Conventionally insulated pipelines are sometimes used, but these generally cause excessively high losses, especially when the transfer distance is long. In addition, conventionally insulated pipelines often require high driving pressure to overcome the reduction in flow rate caused by the boiling of the liquid within the line. These high pressures further increase losses due to the effect of "flash off" gas necessary to provide the gas at the required low temperature. The most efficient pipeline insulation is a combination of high vacuum and multi-layer super insulation. High vacuum minimizes condensation and heat transfer by convection. Multi-layer super insulation minimizes heat transfer by radiation.

Six inch vacuum pipeline destined for Thailand.

Pipeline installed in Taiwan.



Cross section of Cryoquip's vacuum jacketed piping.

1. *Outer jacket SS 1.6 mm*
2. *Inner tube CDS SS 1.6 mm*
3. *Multi layer spacer*
4. *Bellows*
5. *Pump out/safety blowout*
6. *Concentric cone*
7. *NRC-2 Mylar insulation*

Cryoquip's vacuum insulated pipeline systems, constructed entirely from stainless steel and utilizing highly efficient NRC-2 Mylar super insulation, are more efficient than foam insulated systems and can reduce gas transfer losses caused by heat inleak by up to 19%. During controlled tests, foam insulated and vacuum insulated pipeline systems were directly compared with both systems operating 24 hours a day for a total of 100 days. During that period of time, the foam insulated line lost 540 lbs./ft (800 kg/m) of liquid nitrogen while the vacuum insulated line lost only 10% of that amount. The cost savings equated to more than $15,000 U.S. dollars.

Two types of super-insulated, vacuum jacketed pipeline systems are available to suit differing installation types: a prefabricated, modular system or an assembled on-site standard component system. The modular system is prefabricated, assembled and tested in Cryoquip's facilities in easily transportable sections, which are supplied to site fully tested and evacuated. Each section is easily joined together by means of low loss bolted, flanged bayonet couplings. This system enables installation by the customer's own personnel, if required, reducing system costs.

Alternatively, the standard component system allows complete or partial on-site fabrication utilizing either prefabricated sections or fabricated on-site-to-suit sections with all joints welded and evacuated on site. This system offers considerable cost savings and eliminates the need for expensive site surveys. It also avoids the problems associated with last minute route changes, which normally lead to major delays and costly modifications to already manufactured sections. However, it is less flexible with regard to future expansion of the pipeline system.

The integrity of all the vacuum jacketed pipeline systems is ensured by the use of special materials and construction techniques, including Helium Mass Spectrometry leak detection, the highest quality construction, long-term vacuum decay testing, and a stringent quality control system. Project needs are evaluated on a custom basis and a solution specific to the needs of the application is proposed, without compromise.

For more information, contact Ralph Day at IWI Cryoquip Pty Ltd, tel +61.3.9791.7888, fax +61.3.9769.2788 or rday@iwi.com.au.

ACD *P2K* storage and cylinder filling pump progress continues

Phase II of the ACD *P2K* pump development program is nearly complete as final testing at multiple beta sites continues. Delivery of production units will begin as early as February 2000.

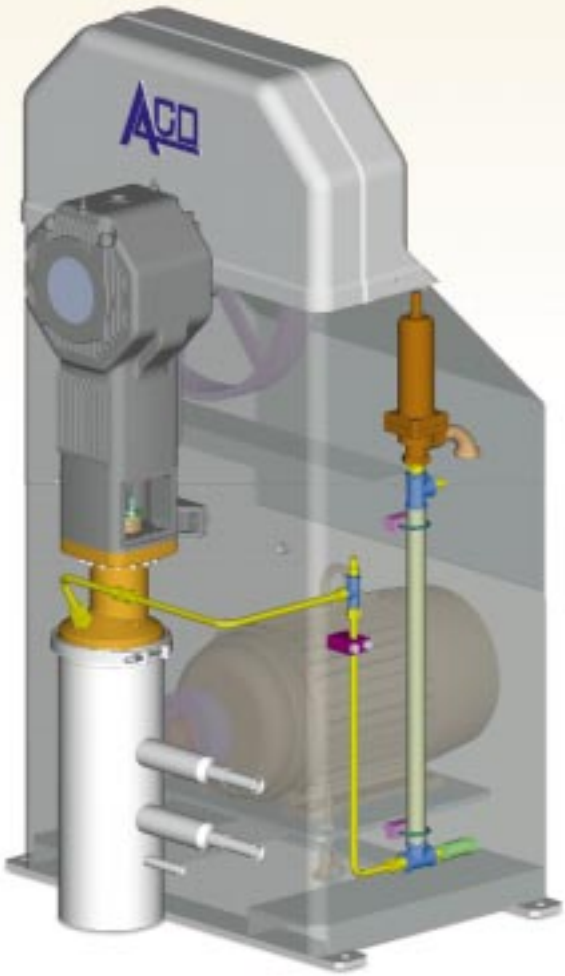
The *P2K* pump features a vertical pump assembly, which eliminates gravitational side loading on the piston and provides smoother suction valve operation. It utilizes a V-band clamp to secure the cold end to the intermediate, greatly reducing maintenance time accessing the cold end compared to a bolted design.

A major safety advantage of the *P2K* pump is positioning of the motor on the backside of the pumping skid. In case of a liquid oxygen leak from the pump or connections, the motor is safely separated with a steel barrier. This arrangement will prevent liquid oxygen from dripping onto the motor and creating a possible fire or explosion hazard.

The *P2K* pump and spare parts are fully interchangeable with the PD3000.

Individual spare parts and spare part kits are available through the authorized ACD service network. Customers now have the advantage of the new *P2K* pump features and they can utilize the service center network to repair and service their PD3000. Kits are available to upgrade existing PD3000 models with *P2K* parts to take advantage of material, component, and sub-assembly improvements.

For further information, contact Bob Lilly at tel +1.949.261.7533, fax +1.949.261.6285 or blilly@acdcom.com.



Millennium *P2K* Model

Cryogenic Industries Member Companies' Pump Training Workshop Schedule

Feb 8 & 9, 2000 – Pump Workshop
CryoCal, Inc.
Location: Santa Ana, CA USA

Contact: Mike Coco
Santa Ana, CA USA
Tel +1.949.724.8636
Fax +1.714.641.1921
cryocal@internetconnect.net

Mar 15 & 16 – Pump Workshop
ACD CRYO
Location: Bad Bellingen, Germany

Contact: Brent West
Bad Bellingen, Germany
Tel +49.7635.8105.0
Fax +49.7635.8965
info@acdcryo.com

Mar 23 & 24 – Pump Workshop
Pittsburgh Cryogenic Services, Inc.
Location: Imperial, PA USA

Contact: Carl Henningson
Imperial, PA USA
Tel 800.327.6461 (USA only)
Tel +1.724.695.1910
Fax +1.724.695.1926
pittcryo@pulsenet.com

Apr 18 & 19 – Pump Workshop
CryoAtlanta, Inc.
Location: Atlanta, GA USA

Contact: Tom Farmer
Atlanta, GA USA
Tel 888.217.9355 (USA only)
Tel +1.404.696.8113
Fax +1.404.696.8116
tfarmer@bellsouth.net

Cosmodyne bolsters customer relations with after-sale service

Cosmodyne's commitment to customer satisfaction continues well beyond delivery of one of its plants. The field service staff stands by ready to assist customers anywhere in the world, twenty-four hours a day, seven days a week.

"We believe it's the after-sale service that keeps the customers returning," said Customer Services Manager Mike Livingston. "Our goal is to maintain long-term relationships with our customers by providing the timely, high quality service they need to keep their plants running dependably and efficiently year after year."

On-site assistance and trouble-shooting and tuning by remote computer access are just two examples of how Cosmodyne Customer Services can help. Here is a brief list of the value-added services offered:

- technical assistance during plant erection and commissioning

"Our goal is to maintain long-term relationships with our customers by providing the timely, high quality service they need to keep their plants running dependably and efficiently year after year."

- hands-on and formal training of customer personnel on site and at our facility
- factory and on-site plant performance testing
- extended warranty coverage and extended service contracts
- spare parts support
- troubleshoot plant operational problems (on site, by phone, or by computer link)
- plant performance upgrades
- periodic plant performance audits with comparison against test results
- plant turnaround assistance
- follow-up operator training programs

For more information, contact Mike Livingston at Cosmodyne, tel +1.310.320.5650, fax +1.310.320.5688 or info@cosmodyne.com.

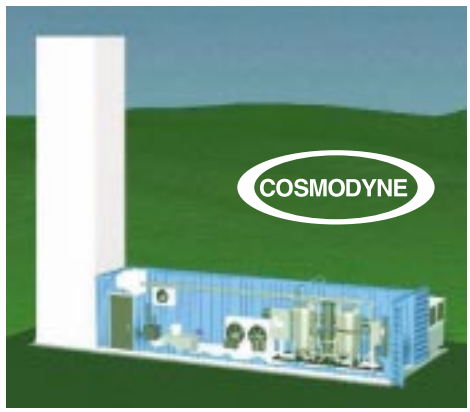
Cosmodyne adds nitrogen generators to product line

Cosmodyne has expanded its product line with the addition of the TGN-400 and 900 self-refrigerated nitrogen gas plants. These units are self-sufficient, unlike liquid assist systems, because refrigeration is produced using a turboexpander instead of injected liquid nitrogen. The self-refrigeration capability makes it possible for the TGN to be installed anywhere, including locations where it is economically restrictive or impractical to deliver liquid nitrogen.

Another key feature of the TGN is its automatic control system, which allows the plant to operate unattended. The system can also be accessed and controlled remotely.

As an added advantage, the TGNs produce a small amount of liquid that can be used to top off a back-up system. Additionally, the unit is modular, power efficient and economically priced.

The TGN generator is currently available in two standard sizes: 400 Nm^3/hr and 900 Nm^3/hr. Other sizes are being added to this product line and will be introduced to the market in the near future.



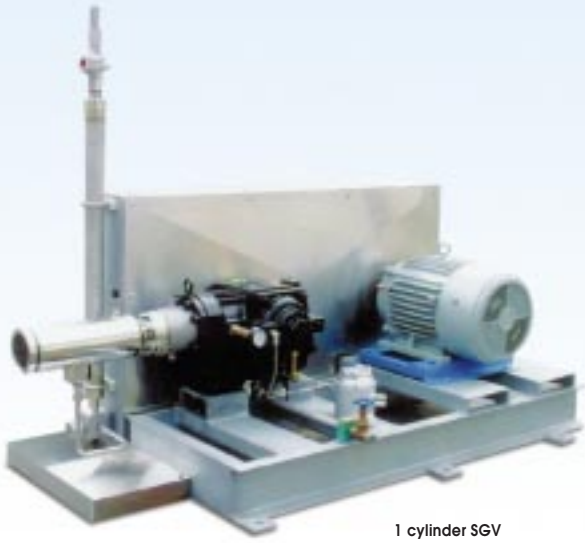
For more information, contact Joan Boitano at Cosmodyne, tel +1.310.320.5650, fax +1.310.320.5688 or info@cosmodyne.com.

SGV pump ideal for liquid hydrogen, high-pressure applications

The SGV Series reciprocating pump model provides high-pressure/flow combinations for storage filling and special medium to heavy-duty applications. As a result of recent design improvements, it has since become ACD's best pump, and an industry standard, for high-pressure liquid hydrogen applications.

A major improvement was the redesign of the pump's vacuum jacketed cold end and suction adapter. ACD has been able to minimize heat leak losses, providing many benefits from reduced cooldown losses to overall economical operation of the pump. Additionally, refinements in the cold end assembly extended seal life and enhanced pump volumetric efficiency.

Another key feature of the SGV design is its oil pressure lubricated drive. The drive contains an integral oil pump that enables clean operation without the need for external oil reservoirs. The pump can be either belt driven from electric motors or foot mounted for use with hydraulic drives, allowing for extended pump duty.



1 cylinder SGV

3 cylinder SGV

The SGV comes complete with a vacuum jacketed cold end with pressure oil lubricated drive end, a positive locking coupling, standard suction adapter with Monel strainer, distance piece with purge ports, hot dipped galvanized steel skid, TEFC motor, high-pressure relief valve with discharge line and surge chamber, drip pan (for liquid hydrogen only) and suction/vapor return manifold for multiple cylinders. Models are available in complete pump skid assemblies with auxiliary piping components included to ensure safe, reliable, and efficient liquid hydrogen pumping.

Optional accessories include vacuum jacketed suction adapter (standard for liquid hydrogen), foot mounted configuration with no motor, manual or automatic control panel, loss of prime detector for cavitation protection, and cooldown lock-up control.

This modular, compact, heavy-duty pump is available in single, double or triple cylinder configurations for a wide range of flow options. In addition to liquid hydrogen, the pump can be used with nitrogen, oxygen, argon, and methane.

For more information, contact Richard Young at ACD, tel +1.949.261.7533 or acd@acdcom.com.

Specifications

	1.25 bore x 1.38 stroke (32 mm x 35 mm)	1.625 bore x 1.38 stroke (41 mm x 35 mm)
Flow Range		
gpm	0.94–14.95	1.6–25.28
lpm	3.57–18.62	6.08–31.92
LH_2 (gpm)	0.90–14.40	1.52–24.38
Pump Design Rating		
hp	15–200	15–200
kw	11–149	11–149
Maximum Working Pressure		
psi	10000	6000
bar	690	414
NPSPR		
psi	5	5
bar	2.9	2.9

Cryogenic Industries unveils new web site

Cryogenic Industries has revamped its web site. Sporting a bold new look, it is easier to navigate and contains up-to-the-minute information. The site includes a list of member companies and their products and services, an interactive map that allows a company search by product or region, and an archive of news releases and FrostByte newsletters for direct access to the most recent company news. Additional e-mail links and a new form make it easy to contact us without leaving the site.

To learn the latest about Cryogenic Industries, visit us at http://www.cryoind.com.

IWI joins Cryogenic Industries

IWI Cryo Systems, an Australian vaporizer and vacuum jacketed pipe manufacturer, has merged with Cryoquip (Australia), a member of Cryogenic Industries, to form IWI Cryoquip Pty Ltd.

According to Ken Hallworth, Cryogenic Industries Director, "Cryoquip is already the premier vaporizer producer and this combination substantially enhances our ability to deliver a global response capability."

For more information, contact Ken Hallworth at Cryogenic Industries, tel +1.909.696.7840 or info@cryoind.com.

Members of CRYOGENIC INDUSTRIES

HEADQUARTERS:
Cryogenic Industries
25720 Jefferson Avenue
Murrieta, CA 92562 USA
Tel +1.909.696.7840 • Fax +1.909.698.7484
info@cryoind.com • www.cryoind.com

ACD
Santa Ana, CA USA
Tel +1.949.261.7533
Fax +1.949.261.6285
acd@acdcom.com
www.acdcom.com

COSMODYNE
Torrance, CA USA
Tel +1.310.320.5650
Fax +1.310.320.5688
info@cosmodyne.com
www.cosmodyne.com

CRYOQUIP
Murrieta, CA USA
Tel +1.909.677.2060
Fax +1.909.677.2066
cryoquip@cryoquip.com
www.cryoquip.com

ACD East Coast USA
Allentown, PA USA
Tel +1.610.437.0507
Fax +1.610.770.0766
cryoind@aol.com
www.acdcom.com

COSMODYNE EUROPE
Muenchenstein, Switzerland
Tel +41.61.413.0230
Fax +41.61.413.0233
hannr@cosmodyne.com
www.cosmodyne.com

CRYOQUIP East Coast USA
Allentown, PA USA
Tel +1.610.437.1867
Fax +1.610.770.0766
lhimmie@aol.com
www.cryoquip.com

ACD CRYO
ACD CRYO AG
Muenchenstein, Switzerland
Tel +41.61.413.0230
Fax +41.61.413.0233
info@acdcryo.com
www.acdcryo.com

China
Cryogenic Industries
Hangzhou, China
Tel +86.571.885.9026
Fax +86.571.885.9025
dking@mail.hz.zj.cn
www.cryoind.com

CRYOQUIP Europe
London, England UK
Tel +44.208.932.3100
Fax +44.208.932.3101
Tero.Hagelin@btinternet.com
www.cryoquip.com

ACD CRYO
ACD CRYO GmbH
Bad Bellingen, Germany
Tel +49.7635.8105.0
Fax +49.7635.8965
service@acdcryo.com
www.acdcryo.com

South America
Cryogenic Industries
Miramar, FL, USA
Tel +1.954.450.5509
Fax +1.954.450.8738
ort37@aol.com
www.cryoind.com

IWI CRYOQUIP
Dandenong, Victoria, Australia
Tel +61 (3) 9791.7888
Fax +61 (3) 9769.2788
rday@iwi.com.au
www.cryoquip.com

CRYOCAL INC
Santa Ana, CA USA
Tel +1.949.724.8636
Fax +1.714.641.1921
cryocal@internetconnect.com
www.cryoind.com

Malaysia
Cryogenic Industries
Selangor, Malaysia
Tel +60 (3) 365.4801
Fax +60 (3) 365.4798
jestes@pc.jaring.my
www.cryoind.com

CRYO-CHEM Australia
Dandenong, Victoria, Australia
Tel +61 (3) 9791.7888
Fax +61 (3) 9769.2788
rday@iwi.com.au
www.cryoquip.com

CRYOQUIP Malaysia
Selangor, Malaysia
Tel +60 (3) 365.4800
Fax +60 (3) 365.4798
cryoquip@po.jaring.my
sgkellett@aol.com
www.cryoquip.com

CryoAtlanta, Inc.
Atlanta, GA USA
Tel +1.404.696.8113
Fax +1.404.696.8116
tfarmer@bellsouth.net
www.cryoind.com

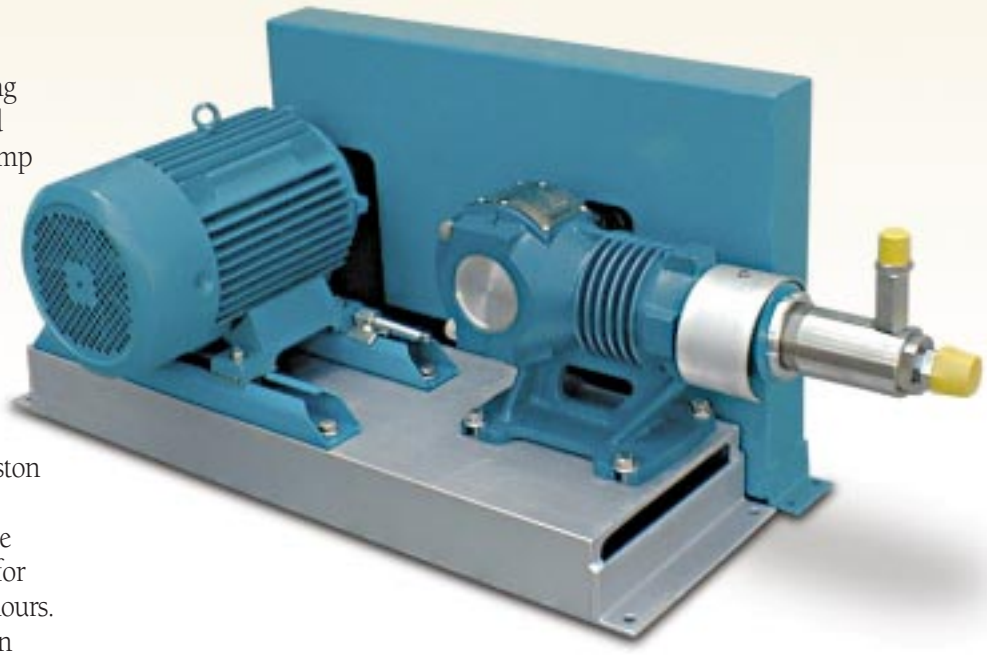
CRYOQUIP India
Lullanagar, Pune, India
Tel +91.212.614425
Fax +91.212.614725
munjal@pn2.vsnl.net.in
www.cryoquip.com

CryoCanada
North York, Ontario, Canada
Tel +1.416.502.1950
Fax +1.416.502.1952
cryocan@istar.ca
www.cryoind.com

PITTSBURGH Cryogenic Services, Inc.
Imperial, PA USA
Tel +1.724.695.1910
Fax +1.724.695.1926
pittcryo@pulsenet.com
www.cryoind.com

ACD CRYO and ACD offer RPSA 40 pump for cylinder filling, halon applications

For cylinder filling and halon applications, ACD CRYO and ACD offer the RPSA 40 floating piston cryogenic pump. Designed to withstand rugged wear, the pump is easy to operate and requires minimum maintenance. It can be used to pump carbon dioxide, nitrous oxide or halon.



One of the key features of the RPSA 40 is its floating piston. Because the pump is small and the piston is short, the floating piston is used to compensate for the forces (movement) of the drive end. This results in extended life for the cold end and longer running hours. Additionally, the piston is tungsten carbide coated, which increases seal life by reducing wear.

Maintenance is made easy, thanks to a simple cold end design assembly. The pump's heavy-duty grease lubricated drive, which does not require regreasing, also reduces maintenance while increasing drive life.

The RPSA 40 comprises a cold end, grease lubricated drive assembly, electric motor, galvanized steel base plate with belt guard, surge chamber, relief valve, suction strainer, and control panel (optional in Europe). Optional accessories include a manifold, suction hose, and distribution block.

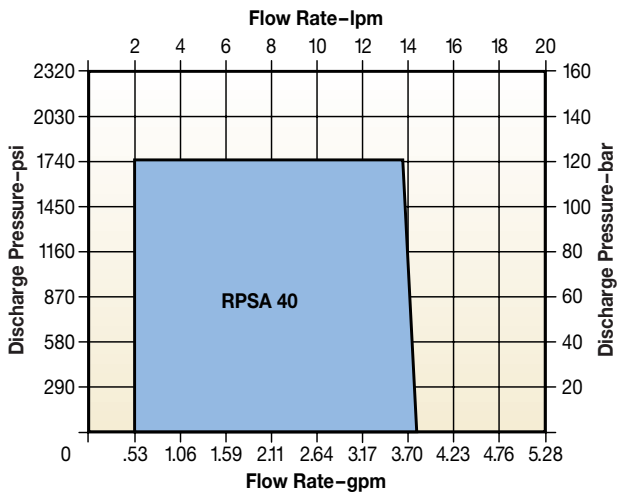
Single and dual cylinder configurations are available with flow rates ranging from 0.8–6.34 gpm (3–24 lpm) and a maximum working pressure of 1740 psig (120 bar).

For more information, contact Brent West at ACD CRYO, tel +49.7635.8105.0 or info@acdcryo.com.

Specifications

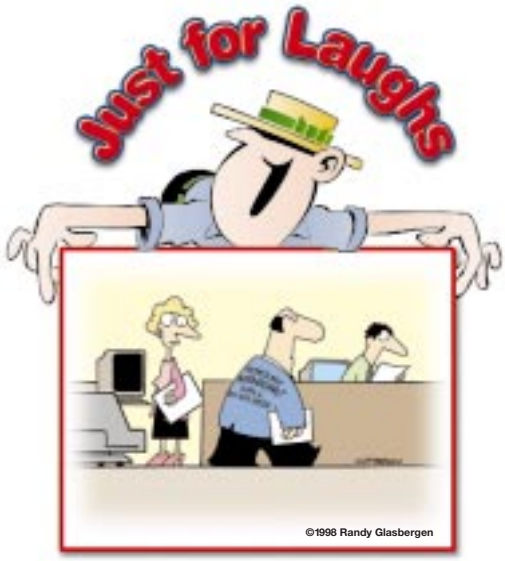
	Single cylinder configuration	Dual cylinder configuration
Flow Rate		
gpm	3.5	6.34
lpm	14.5	24
Suction Pressure		
psig	116–435	116–435
bar	8–30	8–30
Maximum Working Pressure		
psig	1740	1740
bar	120	120

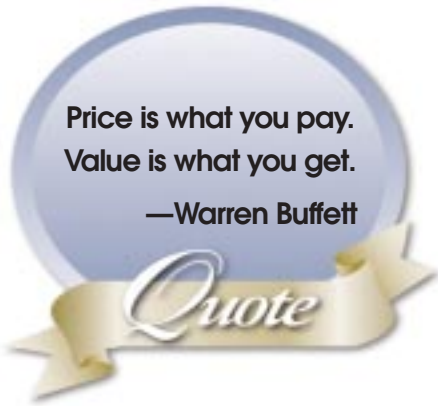
Pump Performance Map



Calendar of Events

DEC 1–3	SEMICON JAPAN, Chiba, Japan Makuhari Messe, Tel +1.650.964.5111, Fax +1.650.967.5375 semihq@semi.org, www.semi.org
JAN 27–29 2000	22nd NATIONAL SEMINAR ON INDUSTRIAL GAS Kathmandu, Nepal, Contact Secretary Pankaj Gupta Tel +91.11.625.5730, Fax +91.11.625.5732 AAIGMA@gems.vsnl.net.in or gasindia@giasdl01.vsnl.net.in http://caitindia.org/aiigma
FEB 9–11	NWSA 2000 SPRING MANAGEMENT CONFERENCE Baltimore, MD USA, Contact NWSA, Philadelphia, PA USA Tel +1.215.564.3483, Fax +1.215.564.2175, nwsa@nwsa.com, www.nwsa.com
FEB 16–19	OIL & GAS THAILAND 2000, Bangkok, Thailand Contact Alun Jones, Tel +44.171.862.2071, Fax +44.171.862.2073 ajones@montnet.com, www.montnet.com
FEB 19–20	WORKSHOP ON SPACE CRYOGENICS, Bangalore, India Contact Dr. A.G. Anath, Tel +1.91.80.341.5269, Fax +1.91.80.341.5297
FEB 21–25	ICEC 18: 18th INTERNATIONAL CRYOGENIC ENGINEERING CONFERENCE WITH EXHIBITION Bombay, Powai, Mumbai, India Tel +91.22.576.7537, Fax +91.22.576.7385, www.iitb.ernet.in
MAR 5–9	12th INTERSOCIETY CRYOGENICS SYMPOSIUM AT AIChE SPRING MEETING, Atlanta, GA USA Contact Robert Thorogood (AIChE) bob.thorogood@processplants.boc.com
MAR 19–21	NWSA 2000 SPRING MANAGEMENT CONFERENCE Chicago, IL USA, Contact NWSA, Tel +1.215.564.3484 Fax +1.215.564.2175, nwsa@nwsa.com, www.nwsa.com
APR 10–13	THE WELDING & METAL FABRICATION SHOW 2000 Birmingham, UK, Contact DMG Business Media Ltd Tel +44.1737.768611, Fax +44.1737.855463/855469





CRYOGENIC INDUSTRIES
25720 Jefferson Avenue
Murrieta, CA 92562-9524 USA