



ELF seal hits the market

ACD has introduced its long-anticipated Extended Life Flex (ELF) seal. In development and beta testing for more than a year, the ELF seal features a new state-of-the-art bellows assembly and rotating ring.

The wear rates for the ELF seal are significantly better than those for other mechanical contacting seals currently on the market. To arrive at this discovery, ACD tested more than 20 combinations of contacting materials used between the nosepiece of the bellows and ring seals. Testing revealed significant wear patterns on conventional materials. As a result, ACD expanded its search to include materials used in the aerospace industry. These materials yielded positive results in both in-house and field-testing.

Tom Willaredt of Messer in San Diego, California, USA installed two ELF seals into troubled applications where conventional seals were used. According to Willaredt, the results have been outstanding. "We had been replacing seals at least once per month because of higher suction pressures and difficult argon applications, so when ACD asked us to test the ELF seals, we accepted. We installed the ELF seals last year and the pumps are still running with the same seals. The ELF seals are a significant improvement over anything we have used," he said.

The ELF seals use an aerospace grade carbon on a new welded bellows assembly that mates with a new sintered



silicon carbide composite ring seal. This combination has yielded results far surpassing expectations by ACD Engineering and by customers who have field-tested the seals at beta sites.

The ELF seals will be available in three phases:

1st phase—ELF seals are available today in new pumps for the 1x2x4.5, 1.5x2.5x6, and 1.5x3x6. These sizes include the LECTRAN system and AC-18 hydraulic boost pumps.

2nd phase—ELF seals will be available for the popular TC-21, 1.5x2.5x10 trailer pumps, both jackshaft (J) and hydraulic drive (HD) units.

Final phase—ELF seals will become available for standard Cosmodyne (TC) and ACD (AC) brand pumps not included above.

ACD plans to have ELF seals available for the pumps listed above by the end

of September 1999. They will be standard in all new mechanical seal pumps. For replacement, the seals will be sold as kits only, complete with bellows, ring seal, and all necessary shims, bushings, and o-rings.

Contact ACD, ACD CRYO (formerly Cryopump) or one of ACD's authorized worldwide sales and service centers to purchase ELF seal kits.

For more information, contact Richard Young at tel +1.949.261.7533, fax +1.949.261.6285 or email ryoung@acdcom.com.

INSIDE THIS ISSUE

- ▶ Cryoquip releases vaporizer sizing program 2
- ▶ NOVA pump is patented 2
- ▶ Cryopump changes its name to ACD CRYO 3
- ▶ ACD focuses on R&D efforts 4
- ▶ "China Special" pump a success in China 7
- ▶ Calendar of events 8



Cryoquip introduces a Windows® version of its vaporizer selection program

Cryoquip, Inc. has introduced a Windows® version of its popular vaporizer selection program. Dubbed the “Cryoquip Ambient Vaporizer Evaluation System” (CAVES), the program helps customers select and size ambient air vaporizers for cryogenic service.

Until now, the program was available in DOS format only. The new version is a 32-bit application that can interface with Windows 3.1, Windows 3.11, Windows 95, or Windows NT operating systems. Using the menu-based software, users can navigate through the system by pointing and clicking the mouse instead of typing DOS commands.

“Because we designed this program for a Windows-based environment, we were able to add new features that take advantage of the graphical interface and user-friendliness that generally come with Windows applications. These include mouse-controlled capability and an on-screen help file, both of which make it easier to select the proper vaporizer models,” said Vincent Schmitt, Application Engineer.

In sizing ambient air vaporizers, the flow rate, climatic conditions, and operating duration dictate the surface area needed for vaporization and superheating. The larger the flow rate and duration, the more surface area needed. As the vaporizer operates, performance decreases due to increasing ice formation on the surface, which impedes the heat transfer. Hence, selecting the proper vaporizer is paramount to ensuring maximum production. CAVES selects the proper vaporizer for you by predicting exit gas temperature as a function of run time and pressure drop across the equipment.

The program’s calculations deal with complex transient analysis of heat transfer and fluid mechanics in both single-phase and two-phase flow. It utilizes the American Institute of Chemical Engineers’ DIPPR (Design Institute of



Physical Property Research) and NIST (National Institute of Standard Testing) thermodynamic database, which includes density, specific heat, viscosity, thermal conductivity, etc., at various temperatures and pressures of several fluids to supply necessary input data. The rate of ice growth is a direct function of the amount of water moisture in the air and the length of time the ice has been forming. These variables are used to calculate frost density and thermal conductivity. The analysis is performed zone by zone by calculating exit temperature, zone length, and overall heat transfer coefficient, which are used as a starting point for the next zone. Furthermore, total pressure drop is a sum of accelerational and frictional pressure drop in each zone that varies from liquid phase to gas phase, in addition to pressure drop due to two-phase flow.

Below is a summarized method for sizing vaporizers using CAVES:

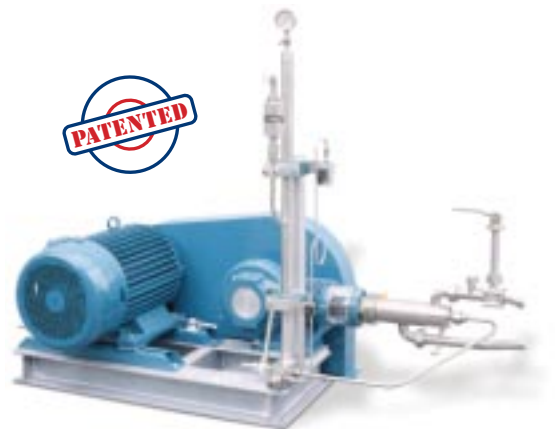
- Enter the process design data, such as the type of cryogenic fluid, inlet pressure, run time, ambient temperature, and relative humidity.
- Select a vaporizer model that has a similar rating based on flow rate and run time.
- Observe the gas exit temperature relative to the ambient temperature and pressure drop.

For more information, contact Patrick Billman at Cryoquip, +1.909.677.2060 or pbillman@cryoquip.com.

European and U.S. patents awarded for the NOVA pump

ACD CRYO AG (formerly Cryopump AG) introduced the innovative, easy-to-maintain, high-pressure reciprocating pump Series NOVA in the Spring of 1997. Since then, this pump has proven its capability and reliability in many customer installations all over the world for cylinder filling up to 400 bar (5800 psig) for LIN, LOX and LAR.

In late 1997, the European Patent Office awarded the European Patent No. EP 0 730 092 B1 for the NOVA pump. Recently, the U.S. Patent Office awarded the NOVA the U.S. Patent No. 5860798.



Key features of the NOVA include:

- flow-through design
- low pump mass for faster cool-down and lower gas losses
- single seal cartridge for quick and easy replacement
- positive pump feed
- lower NPSHR
- reduced cold creep during idling
- very low operating noise
- lower operating cost

For more information, contact Walter Eggs at ACD CRYO AG, +41.61.413.0230 or info@acdryo.com.





Cryopump changes its name to ACD CRYO, moves headquarters

Cryogenic pump manufacturers and service providers Cryopump AG and Cryopump GmbH, sister companies of U.S.-based ACD, have changed their names to ACD CRYO AG and ACD CRYO GmbH, respectively. The change is part of a plan that will enable all three companies to integrate their pump designs into a single, worldwide product line.

“By combining the know-how, the engineering resources, and the product lines, we will be able to offer better support to our customers in Europe, in the United States, and all over the world,” said Walter Eggs, General Manager of ACD CRYO.

One of ACD CRYO’s first moves towards offering better support will be to expand its service department in Bad Bellingen, Germany. This will enable the company to respond faster to requests for repair and field maintenance assistance. In the near future, ACD CRYO will also begin conducting pump maintenance training seminars for its customers.

Although the name has changed, customers will still receive the same high quality products and service they have become accustomed to under the Cryopump name. Pump manufacturing will continue at the German facility while expanding testing and service capabilities.

Although the name has changed, customers will still receive the same high quality products and service they have become accustomed to under the Cryopump name.

“The Cryopump name has become synonymous with high quality and high performance in Europe. By combining the pump designs of ACD and Cryopump, customers will benefit by having a focused product

line, access to better training and maintenance service, and the support of an international organization that has 30 years of experience,” said Richard Young, Director of Pump Products for ACD.

Coinciding with the name change, ACD CRYO headquarters (formerly Cryopump AG) in Aesch has moved to Muenchenstein, Switzerland, a suburb of Basel.

For more information, contact Walter Eggs:

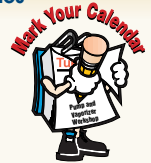
ACD CRYO AG
Gutenbergstrasse 1
CH-4142 Muenchenstein,
Switzerland
Tel +41.61.413.0230
Fax +41.61.413.0233
info@acdcrयो.com

ACD CRYO GmbH
Rheinauenstrasse 2
D-79415 Bad Bellingen,
Germany
Tel +49.7635.8105.0
Fax +49.7635.8965
info@acdcrयो.com

Cryogenic Industries Member Companies' Pump and Vaporizer Training Workshop Schedule

May 5-Vaporizer Workshop
Cryoquip/Cryogenic Industries-Malaysia
Location: Manila, Philippines

Contact: Steve Kellett
Selangor, Malaysia
Tel +60 (3) 365.9075
Fax +60 (3) 365.9077
sgkellett@aol.com



May 10-Vaporizer Workshop
Cryoquip/Cryogenic Industries-Malaysia
Location: Taipei, Taiwan

Contact: Steve Kellett
Selangor, Malaysia
Tel +60 (3) 365.9075
Fax +60 (3) 365.9077
sgkellett@aol.com

May 18-Pump Workshop
ACD/Cryogenic Industries-Malaysia
Location: Calcutta, India

Contact: Steve Kellett
Selangor, Malaysia
Tel +60 (3) 365.9075
Fax +60 (3) 365.9077
sgkellett@aol.com

May 20-Pump Workshop
ACD/Cryogenic Industries-Malaysia
Location: Bangalore, India

Contact: Steve Kellett
Selangor, Malaysia
Tel +60 (3) 365.9075
Fax +60 (3) 365.9077
sgkellett@aol.com

May 22-Pump Workshop
ACD/Cryogenic Industries-Malaysia
Location: New Delhi, India

Contact: Steve Kellett
Selangor, Malaysia
Tel +60 (3) 365.9075
Fax +60 (3) 365.9077
sgkellett@aol.com

May 25 & 26-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

ACD R&D shifts gears to meet

Striving to meet the needs of its customers, ACD has focused its recent efforts on improving existing pump products and developing new ones. To this end, the company has created a Product Team and restructured its Research & Development program.

The Product Team consists of eight people from Cryogenic Industries' member companies. It provides a global perspective of product quality and performance, and provides direction to improve and develop needed pump products. Viewed as ACD's steering committee for all pump products, the Product Team establishes priorities and overall product strategies for short-, medium-, and long-term planning.

With the help of the Product Team, R&D is concentrating its efforts not only on standard pumps but also on customized pumps. The R&D group has already produced positive results this year in both product development and customer satisfaction and further progress is expected. The following are some of the current R&D programs at ACD.

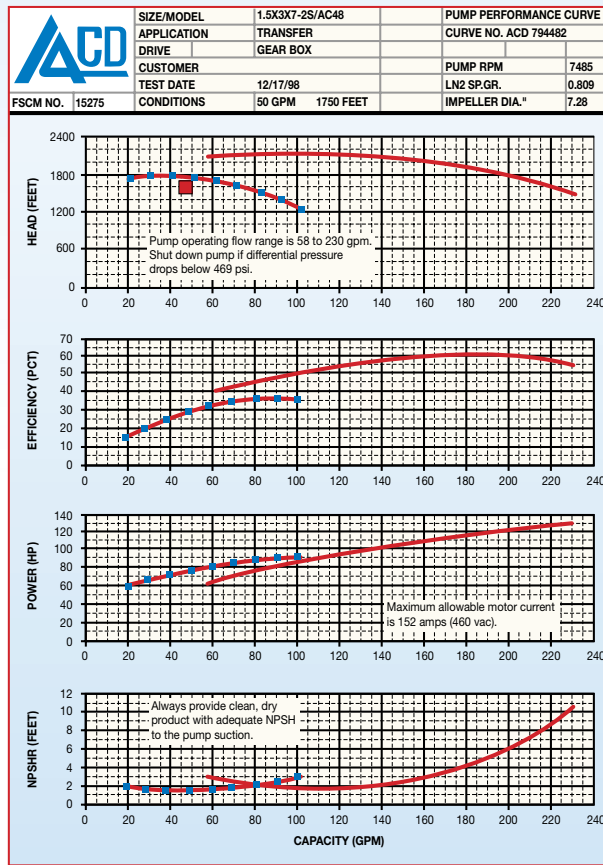
AC-48 gearbox pump with mechanical seal



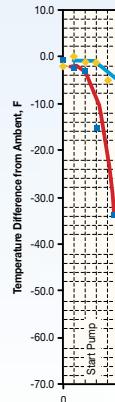
The AC-48 gearbox pump is a rugged and reliable centrifugal pump.

Its applications include intermittent or pipeline backup systems and liquid cylinder filling. ACD has taken costs out of the pump by using a new proprietary mechanical seal system rather than a labyrinth seal design. The new sealing system allows higher second stage pressures to be taken back to the first stage suction, lowering the actual pressures on the mechanical seal itself. ACD has also developed a new, narrow port

AC48 Performance Curve



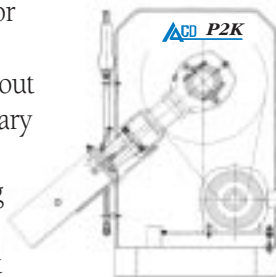
The P2K pump line will feature lower operating speeds, a sump style cold end (similar to ACD's existing Cryo-Chem or 'SP' series pumps), improved shaft seal and packing designs, universal control panel, improved skid design for easy maintenance, and large flow range of 0.5 - 4.5 gpm (1.9-17.1 lpm), based on pressure requirements from 3,000-6,000 psi (207-414 bar). Standard accessory kits will be available to comply with multiple storage tank configurations (thermosiphon, cold converter, etc.) and operational requirements (loss of prime detection, cool down temperature sensing, etc.) for our global product line.



impeller, which provides higher heads at lower flows, complying with market demand for liquid cylinder filling applications.

P2K high-pressure pump line

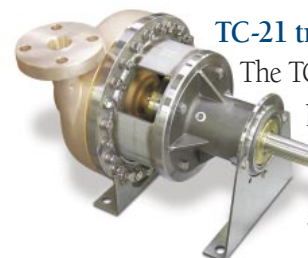
In 1999, ACD will finalize a yearlong program of field testing multiple pump configurations at various beta sites.



The new P2K pump line is being developed in response to customer requests to improve overall reliability while decreasing maintenance requirements. ACD plans to release the P2K pump to the market in mid-1999.

The P2K pump line includes four configurations:

- P2K-S Standard sump with grease lubrication
- P2K-O Standard sump with oil lubrication
- P2K-Z Sub-Zero™ sump with grease lubrication
- P2K-ZO Sub-Zero™ sump with oil lubrication



TC-21 trailer pump

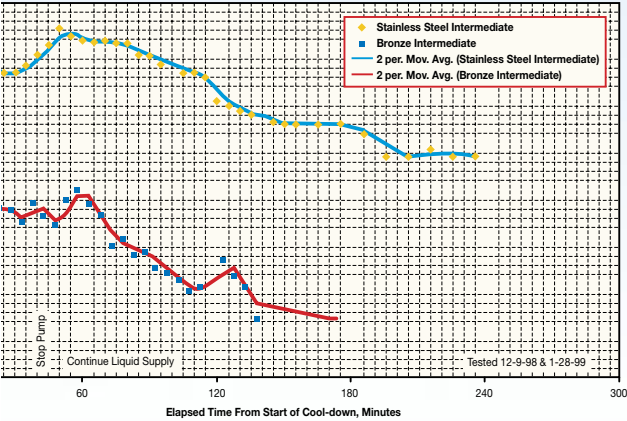
The TC-21 trailer pump has been an industry standard for

customer demands



TC21J 10" Trailer Pump

Cold Soak Temperature Difference from Ambient Bearing Housing at Intermediate Flange



many years. Recent field tests and customer data have shown most trailer pumps have a higher than normal bearing failure rate, caused by cold migration from extended cool down periods during normal daily operations. As a result of these findings, ACD was prompted to conduct tests using a new stainless steel intermediate to slow down the cold migration and keep the bearing grease warmer during extended cool down periods. Initial results were positive with significant improvement in keeping the bearing housing warmer. The pump was placed at a beta site for actual field-testing/operations and data collection early in 1999. ACD plans to offer the stainless steel intermediate as a standard option to both the TC-21 jackshaft (J) and hydraulic drive (HD) configurations.

Universal control panels

Over the years, ACD has accumulated many different types of pump brands carrying several different control panels. ACD has now standardized to one control panel for all cylinder

filling pumps, regardless of brand name.

The universal control panel comes standard with all cylinder filling pumps, and can be easily upgraded to include loss of prime detection, cool down temperature sensing, and other key operating safety features. The panel also includes an hour meter. The advantages of the universal panel are standardization, lower overall costs to upgrade, and more safety features.

Standard installation kits—reciprocating pumps

Recent reductions in our major customers' workforces have resulted in fewer experienced technicians who fully understand how to properly install and operate cryogenic pumps. To minimize downtime and potential pump failures due to improper installations and operation of high-pressure cylinder filling pumps, ACD has developed standard installation kits for all types of storage tank applications: thermosiphon, low-pressure, cold converter, and atmospheric.

The installation kits provide all necessary suction and discharge flex sections, valves, suction manifold, and miscellaneous hardware needed for proper installation of all reciprocating pumps. These kits are sold as standard options with each pump.

Seal kits—centrifugal pumps

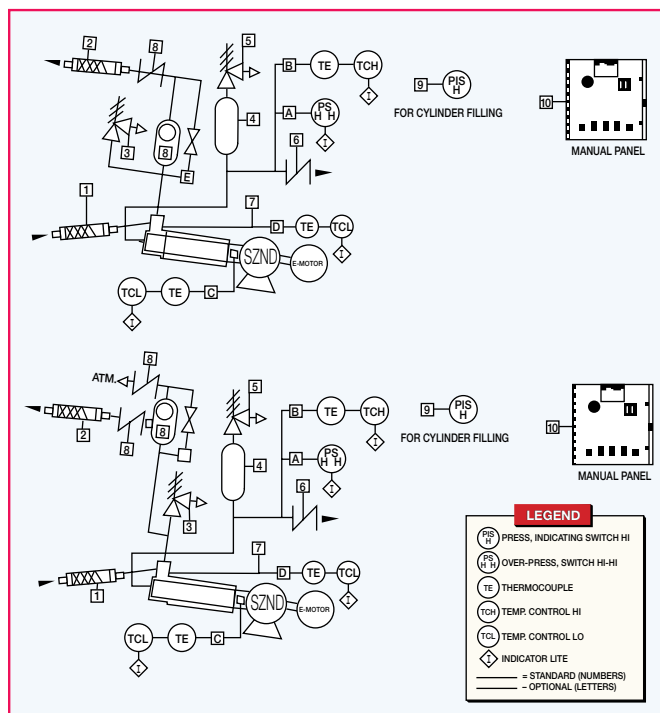
Standard seal kits are now available for all ACD and Cosmodyne centrifugal pumps. To minimize mechanical seal problems, customers can purchase complete kits from ACD or one of our authorized service centers. The kits include the bellows seal, rotating ring, and all bushings, shims, and o-rings necessary to properly install the seal in a centrifugal pump. Seal kits are also available for all new ELF seals being released. Customers receive savings of 25% when purchasing the kit compared to purchasing the individual parts.

For seal kit part numbers referenced for your pumps, please contact ACD or an authorized service center and reference

Product Information Bulletin PBS-010.

Seals—reciprocating pumps

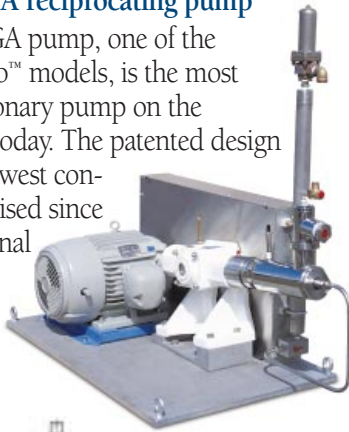
ACD has upgraded its cylinder filling pumps with new shaft seals. Instead of Teflon hat seals to seal the shaft or piston, ACD has upgraded to a more modern, energized seal. This seal is now being used in ACD's NDPD, SZND, SZGA, NOVA, and P2K pumps.



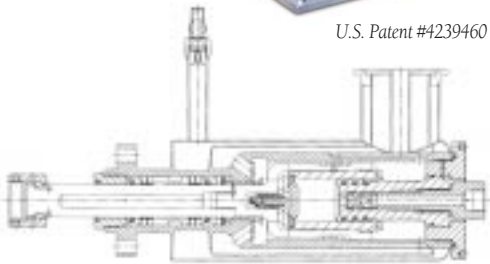
Continued on page 6

SZGA reciprocating pump

The SZGA pump, one of the Sub-Zero™ models, is the most revolutionary pump on the market today. The patented design is the newest concept devised since the original NDPD design.



U.S. Patent #4239460



With recent installations, ACD has recognized needed areas of improvement with the SZGA cold end. Expedited efforts to modify the suction valve assembly, suction adapter, and cold end chamber have provided early success. ACD continues to monitor these improvements and is optimistic these changes will provide the needed benefits to customers without compromising performance and reliability standards.

Other programs

- Oxygen compatible lubricants—improving performance/duration
- SP-1640 & SP-1740 (Cryo-Chem) pump—changing skid design, easier maintenance
- CO₂ LECTRAN System—using new CO₂ pump line with existing LECTRAN units (see Fall 1998 issue of FrostByte)
- John Crane seals—compatibility with larger sizes for process applications
- ELF seals—compatible with other Cosmodyne models and sizes (see article in this issue of FrostByte)

For more information, contact Richard Young at +1.949.261.7533 or ryoung@acocom.com.



HEADQUARTERS:

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

SOUTH AMERICA:

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

EAST COAST USA:

Cryoquip, Inc.
Allentown, PA USA
Tel +1.610.437.1867
Fax +1.610.770.0766
lhimmie@aol.com

EAST COAST USA:

Cryogenic Industries
Allentown, PA USA
Tel +1.610.437.0507
Fax +1.610.770.0766
cryoind@aol.com

CHINA:

Cryogenic Industries
Hangzhou, China
Tel +86.571.885.9026
Fax +86.571.885.9025
diking@mail.hz.zj.cn

PACIFIC RIM:

Cryogenic Industries
Selangor, Malaysia
Tel +60 (3) 365.9075
Fax +60 (3) 365.9077
sgkellett@aol.com

NORTHERN EUROPE AND SPAIN:

Cryogenic Industries
London, England UK
Tel +44.181.932.3100
Fax +44.181.932.3101
cryogenic.uk@btinternet.com

EUROPE:

Cryoquip, Inc.
London, England UK
Tel +44.181.932.3100
Fax +44.181.932.3101
Tero.Hagelin@btinternet.com



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



Santa Ana, CA USA
Tel +1.949.724.8636
Fax +1.714.641.1921
cryocal@ix.netcom.com



Imperial, PA USA
Tel +1.724.695.1910
Fax +1.724.695.1926
pittcryo@pulsenet.com



Selangor, Malaysia
Tel +60 (3) 365.4800
Fax +60 (3) 365.4798
fychan@tm.net.my



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



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



Atlanta, GA USA
Tel +1.404.696.8113
Fax +1.404.696.8116
tfarmer@bellsouth.net



Selangor, Malaysia
Tel +60 (3) 365.4800
Fax +60 (3) 365.4798
fychan@tm.net.my



North York, Ontario, Canada
Tel +1.416.502.1950
Fax +1.416.502.1952
cryocan@istar.ca



Murrieta, CA USA
Tel +1 909.677.2060
Fax +1 909.677.2066
cryoquip@cryoquip.com
www.cryoquip.com



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



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



Airport West,
Victoria, Australia
Tel +61 (3) 9330.2444
Fax +61 (3) 9330.1015
rmross1@ibm.net

“China Special”—A success for ACD in China

When people talk about cryogenic centrifugal pumps, they normally talk about the required flow rate and the head produced. While it is true that these two characteristics are the main features for all kinds of pumps, with cryogenic liquids there are other things that often need consideration.

In the case of pumping liquid argon, new high purity argon processes—introduced into China for the first time in 1998—demand cryogenic process pumps that have virtually no possibility of product contamination.

In response to this new process requirement, ACD applied its 35 plus years of experience and designed a liquid argon pump specifically for this new process demand. The result is the “China Special,” a state-of-the-art labyrinth seal pump specially designed for high purity liquid argon processes. To date, this new product has been a great success in the China marketplace.

By working closely with the Chinese customers and absorbing information and suggestions from Chinese process engineers, ACD was able to develop a new design based on its traditional single and dual labyrinth seal pumps. The reason it earned the name “special” is due to the following special features:

- **Convenient source of seal gas.** Only one source of seal gas is needed for this pump—either N₂ or clean, dry air. The need for valuable argon gas to be supplied as seal gas is eliminated.
- **No contamination.** Processes that require regular labyrinth seal pumps normally experience product contamination while using seal gas if other than the product is being pumped. The “China Special” has two regulators on the seal gas system that accurately adjust the seal gas pressure to 1 psi (0.069 bar) lower than the reference pressure, thus pre-



venting the possibility of leakage and contamination while creating a positive flow.

This design eliminates product contamination due to the seal gas.

- **Long life.** According to Chinese process requirements, the pumps are designed for 20,000 hours of continuous service.

It is extremely important that process pumps are reliable and efficient. Coupled with product purity, all three criteria play a crucial role to achieve financial objectives for plant operation. The “China Special” fulfills these important criteria perfectly.

By the close of 1998, ACD had received orders for more than 30 “China Specials” from Chinese customers. That number is increasing due to the recognized value of this new pump. Ninety percent of all new air separation plants being built in China are scheduled to have ACD’s “China Special” process pumps installed for liquid argon service.

For more information, contact Dave King at Cryogenic Industries—China, +86.571.885.9026 or dking@mail.hz.zj.cn.

Profiles

Bob Lilly joins ACD as Product Development Manager

Bob Lilly joined ACD in March 1999 as Product Development Manager. A 25-year industry veteran, Lilly’s main responsibility is serving as project leader for the company’s new P2K high-pressure reciprocating pump line. He also supports Sub-Zero™ pump design and testing, assists with market development and field operations, and reviews product designs with Engineering in an effort to upgrade ACD’s existing high-pressure pump lines.

CryoCal hires Brian Jones as Sales Manager

Brian Jones joined the CryoCal sales team in late 1998. His main responsibility as Sales Manager includes providing sales and service support for ACD’s and CryoCal’s products and services. Working out of CryoCal’s facility, near ACD in Santa Ana, Calif., Jones works closely with ACD’s engineering and regional sales teams to support independent welding distributors and certain major customers in the western United States.

Brent West named Sales and Marketing Manager for ACD CRYO

Brent West has been named Sales and Marketing Manager for pump manufacturer ACD CRYO (formerly Cryopump). In his new position, West will be responsible for increasing sales and marketing efforts in Europe, Africa, and the Middle East, and for supporting efforts to integrate the Cryopump and ACD brand pumps into a single, worldwide product line.

CALENDAR OF EVENTS

- MAY 26–29 ENERGIA '99-3rd INTERNATIONAL EXHIBITION & CONFERENCE ON POWER OIL AND GAS, Fisa Maipú, Santiago, Chile;
Contact Juan F Moreno, Tel +56.2.231.6515
Fax +56.2.233.4981, ptodlez@puntodiez.cl
- JUN 7–10 ASME TURBO EXPO LAND, SEA & AIR '99, Indianapolis, IN USA
Tel +1.404.847.0072, Fax +1.404.843.2517, www.asme.org/igti
- JUN 9–10 CHEMICAL ENGINEERING EXPO, Houston, TX USA
Tel +1.203.847.9599, Fax +1.203.840.0656, www.che.com
- JUN 20–23 NATURAL GAS IN THE AMERICAS 5
Port of Spain, Trinidad
Contact Christopher Esson, Tel +1.847.768.0816, Fax +1.847.768.0842
esson@igt.org
- JUN 22–25 MIOGE '99–MOSCOW 5th MOSCOW INTERNATIONAL OIL & GAS EXHIBITION, Krasnaya Presnya Exhibition Complex
Tel +44.171.286.9720, Fax +44.171.266.1606, oil+gas@ite-exhibitions.com/org
- JUL 11–12 THE 16th SPACE CRYOGENICS WORKSHOP, Quebec City, Canada
Contact Louis J. Salerno, Tel +1.650.604.3189, Fax +1.650.604.0487
lsalerno@mail.arc.nasa.gov
- JUL 12–16 CRYOGENIC ENGINEERING CONFERENCE/INTERNATIONAL CRYOGENIC MATERIALS CONFERENCE (CEC/ICMC) '99
Montreal, Quebec, Canada; contact Monica Park, Tel +1.909.677.1638
Fax +1.909.677.5078, mpark@gocougs.wsu.edu, www.cec-icmc.org
- JUL 13–16 OIL AND GAS MALAYSIA '99, GAS & PETROCHEMICAL ENGINEERING CONFERENCE, Kuala Lumpur, Malaysia
Tel +1.201.652.7070, Fax +1.201.652.3898



“Frankly sir, we’re tired of being on the cutting edge of technology.”

Don't wait for extraordinary opportunities. Seize common occasions and make them great.

—Orison Swett Marden

Quote



CRYOGENIC INDUSTRIES

25720 Jefferson Avenue
Murrieta, CA 92562-9524 USA

BULK RATE
US POSTAGE

PAID

SANTA ANA, CA
PERMIT NO. 949

