Cryogenic Industries

FrostByte

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IWI Cryoquip expedites a back-up system aboard a 747 jet airliner

The IWI Cryoquip vaporizers are secured in the hull of a 747 using only partial pallets for support at the heavier end of the units.

Eight ambient air vaporizers are loaded onto an Evergreen 747 charter bound for Indonesia.

IWI Cryoquip recently became involved in manufacturing and supplying a large ambient vaporization back up system for PT BOC Gases Gresik in Indonesia. The 21,000 Nm^3/hr (798,780 scfh) system comprised eight units of IWI Cryoquip model QF 3450, all aluminum ambient air vaporizers and was designed to provide back up to an ASU supplying vaporized liquid oxygen to a copper smelter.

During the manufacturing process the customer requested an expedited shipment on the back up system, to be used as an additional source of primary oxygen gas.

In order to meet the revised deadline, IWI Cryoquip worked around the clock to finish the units. Even with the intense work schedule, they could not deliver the vaporizers by normal methods and still meet their tight deadline. To overcome the problem, an Evergreen International 747 jet was chartered exclusively to fly the eight-vaporizer system from Melbourne to Indonesia. In cooperation with the airline, IWI Cryoquip manufactured special shipping crates so that the system could be loaded intact in the 747's cargo hold. The vaporizers arrived safely and in accordance with the revised schedule.

For more information, contact Joel Maclou at IWI Cryoquip, tel +61.3.9791.7888, fax +61.3.9769.2788 or jmaclou@iwi.com.au.

Inside This Issue

Testing reveals vaporizer offers cost effectiveness and efficiency

The new 5-inch fin TAI global ambient vaporizer design has been thoroughly tested to verify the performance of Cryoquip's latest innovation. Qualitative and quantitative results were obtained through a careful setup of test apparatus and complex instrumentation. Fluid flow rate, inlet pressure, and temperature, as well as ambient conditions (e.g. dry bulb and wet bulb temperatures), were monitored regularly during the test runs to ensure accurate readings. The experiments were repeated over several days to confirm the test results under varied weather conditions.

Cryoquip's ambient air vaporizer test station: the fluid's temperature is monitored at five different locations, and the flow is measured with a Pitot tube and an orifice meter.

The experimental results prove that the TAI vaporizer is able to maintain its high flow rate capacity in accordance with stated ratings. For short to medium operation time, the 5-inch fin has been proven to have superior fin efficiency to the more traditional 8-inch fin, which enhances the heat transfer rate and vaporization capacity. Containing less aluminum per linear length, 5-inch fin extrusions are cost effective and very efficient for short duration vaporization or switching applications.

TAI vaporizers have capacities from 50 Nm^3/hr up to 6,300 Nm^3/hr (1,900 scfh up to 240,000 scfh) for service with cryogenic fluids such as oxygen, nitrogen, argon, hydrogen, helium, carbon dioxide, and LNG. Besides low-pressure service up to 40 barg (580 psig), TAI vaporizers with stainless steel tubing are available for high-pressure service up to 1,000 barg (15,000 psig), for use with applications such as cylinder-filling. They can also be employed in special applications where high purity gas is required for the electronics field.

TAI vaporizers represent a standardized range of ambient vaporizers designed specifically to deliver on the promise of ex-stock delivery, low cost and high efficiency. They utilize a single element extrusion for both low and high pressure applications, from different global locations, which is unique in the industrial gas industry. ❄

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

Cryoquip wafer-style electric heaters prove useful for varied applications

Within the last few years there has been a steady conversion from standard CO_2 refrigerated tank systems to more efficient vacuum-jacketed tanks. With the loss of natural heat inleak to cause vaporization, the requirement for external tank pressure buildup systems has increased. Conventional CO_2 systems previously relied on heat leak for the primary tank pressure buildup system. Refrigeration systems were used to keep boil-off rates of the CO_2 inside the tank to a minimum. However, these refrigeration systems were maintenance-intensive and more costly. Vacuum-jacketed cryogenic tanks have become much more economical in the past few years and in many cases it now makes more sense to utilize the vacuum-jacketed tank.

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The Cryoquip wafer-style electric heater is designed for varied applications, including external pressure buildup for vacuum-jacketed CO_2 tanks.

Cryoquip opens a manufacturing facility in the United Kingdom

In order to more effectively serve its major European industrial gas customers, and to provide true global coverage, Cryoquip has opened an 800m^2 (8000ft^2) vaporizer manufacturing facility and technical sales office in Sittingbourne, England, UK. This facility enhances the coverage of Cryoquip's existing strategically located facilities in the United States, Malaysia, India, and Australia.

Cryoquip Limited is located specifically to serve the company's extensive European gas market. Cryoquip previously supplied its European customers from its US facility. The increased demands for a wider product range, shorter delivery times, commonality of product, flexibility in supply, CE marking and the advent of the new European Pressure Directive (PED) standards, have made it necessary for Cryoquip to manufacture its product range within the EEC.

Initially, the facility will manufacture the same high quality, high performance global product range of aluminum ambient vaporizers as all of the Cryoquip facilities, with capacities ranging from 50-2500 Nm^3/hour (3,000-60,000 ft^3/hr). In the near future, small capacity high pressure and electric vaporizers will be added to the product range.

Because the equipment is being made locally, Cryoquip's European customers will receive the added benefits of lower price, quicker delivery, and local assistance with installation and technical issues. Cryoquip's current technical sales office in London will be incorporated into the new facility.

For more information, contact Bryan Smith at Cryoquip Limited, tel +44.1795.438.433 or bsmith@cryoquip.com.

Cryogenic Industries Member Companies' Pump Training Workshop Schedule

Sep 11 & 12-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

Sep 27 & 28-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

Nov 7 & 8-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

Nov 13-Pump Workshop
Cryogenic Industries - China
Location: Hangzhou, China
Contact: Dave King
Hangzhou, China
Tel: +86.571.885.9026
Fax: +86.571.885.9025
dking@mail.hz.zj.cn

Nov 14 & 15-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

Nov 14 & 15-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

Avoid cryogenic liquid pump installation problems

Reliable, trouble-free pump operation is the key to low-cost cryogenic liquid pumping. When installing either reciprocating or centrifugal cryogenic liquid pumps, careful up-front planning can mean the difference between long-term reliability or excessive maintenance and consequent downtime.

This article describes the general principal issues to be addressed before and during installation of reciprocating and centrifugal pumps. Most topics apply to both types of installations. However, several additional considerations apply only to centrifugal pumps.

All Pumps

The mounting procedures and suction and discharge piping considerations described in the following paragraphs apply equally to reciprocating and centrifugal pumps.

Mounting to Pad

The flex lines connecting the piping to the suction and discharge fittings must be used to take up the stress or shrinkage when the system is cold. To ensure that the flex lines are adequate, the pump should be bolted to the pad after cooldown (not normal practice on reciprocating pumps) as this relieves any stress in the piping and allows the pump to be practically stress-free when in operation.

Therefore, the pump should be mounted in the following sequence:

1. Place pump on pad at desired location, but do not secure in place.
2. Connect suction and discharge piping.
3. Cool down pump.
4. Bolt pump to pad.

Suction Piping

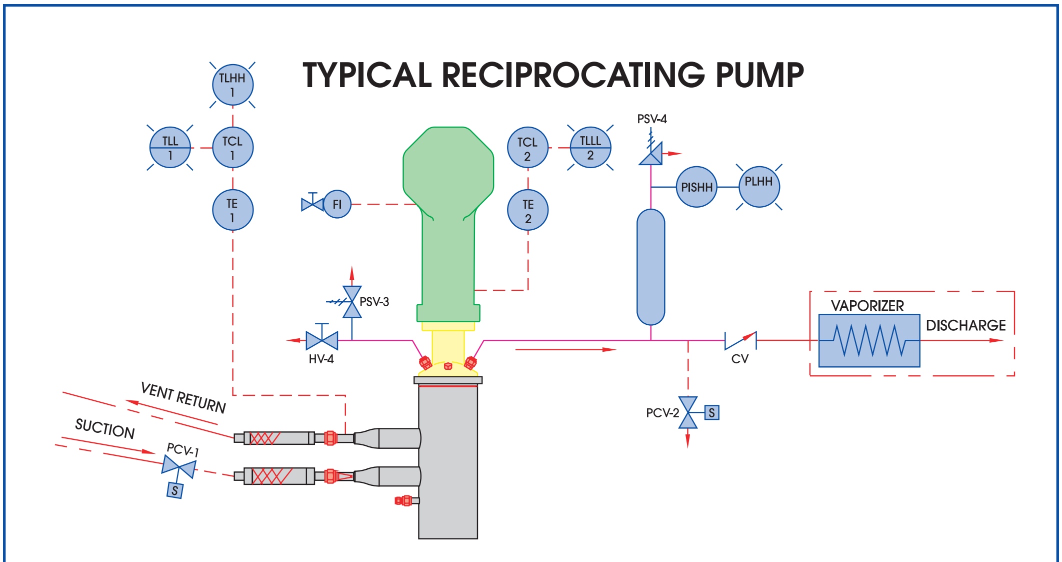
Several suction piping issues should be addressed when planning either a reciprocating or centrifugal pump installation. In general, good piping practices improve the net positive suction head (NPSH) available to the pump. System performance is, therefore, enhanced by careful piping design.

When planning the installation, take into account the location of the pump with respect to the tank and the process so as to minimize piping runs. For the suction connection, the pump should be placed at a location that limits the piping run to less than 5 feet (1.5 meters) from the tank. All pipes in the system should have a pressure rating above system design pressure. Use as few elbows as possible to minimize liquid turbulence in the line and lessen pressure drop. The suction line should have a slight and continuously downward slope to aid in maintaining liquid flow into the suction fitting. At no point should the line rise and then drop (creating a gas trap).

A gate or ball valve, rather than a globe valve, should be used in the suction line. An inlet strainer is needed in suction piping except for most ACD reciprocating pumps, which have a strainer built into the suction fitting. A differential pressure gage should be used across the suction strainer.

Avoid the use of suction piping having a different diameter from the pump inlet fitting. If the diameter is too large product flows too slowly. This permits excessive heat leak into the fluid, which may cause the pump to cavitate. Conversely, small diameter piping increases pressure losses which reduces NPSH and thereby may also cause cavitation.

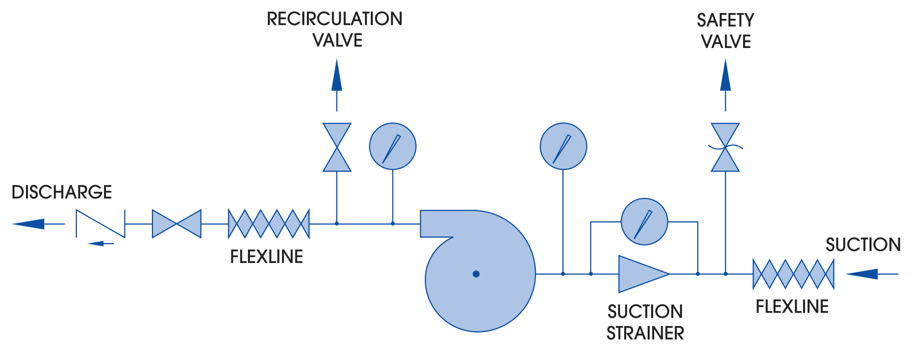
For reciprocating pumps, connect the suction fitting to a 6- to 8-inch long (15 to 20 cm) (maximum) flex line to compensate for expansion and contraction. Flex lines should not be used to compensate for misalignment or poor piping installations. Also, do not use full-length flex lines, as they add considerably to pressure drop and heat leak.



If the suction piping is relatively long, insulation should be considered. Vacuum-jacketed insulation is preferred because other conventional types of insulation may accumulate moisture, resulting in loss of insulation effectiveness and possibly causing cavitation due to heat leak. For operating cycles that are infrequent and of short duration, conventional insulation might be detrimental because the mass of insulation must be cooled down each time the pump is operated.

Whenever possible, pump suction piping should be separate from other liquid lines. If other pipes must be connected to the pump's suction pipe, a valve must be placed directly adjacent to the connection to prevent a dead-leg. A dead-leg is a void where liquid can vaporize, which adds heat to the fluid and could cause bubbles to flow into the pump and possibly cause cavitation.

TYPICAL CENTRIFUGAL PUMP



Gas Phase Return Piping

To eliminate trapping gas, the gas phase return line for a reciprocating pump should be continuously sloped gently upward toward the tank. Its diameter should match the fitting on the suction adapter, and either a gate valve or ball valve is required.

For centrifugal pumps, a gas phase recirculation line is needed on the discharge side for pump cooldown and startup. A globe valve should be installed in this line to allow throttling during startup. A discharge control valve, downstream of the recirculation valve, must be located as close as possible to the pump to control the flow to be on the "pump's curve." Allowing the pump to start against no restriction, or to fill a large volume before control is established, will cause severe cavitation and likely the inability to "catch prime."

A relief valve must be used to prevent over-pressure from vaporized trapped-liquid when the suction and gas-phase return valves are simultaneously closed. When a relief valve is installed in the gas phase return line, it is not necessary to install a second relief valve in the suction line.

Discharge Piping

Discharge piping should match the discharge fitting size and should be rated higher than the pressure required by the application. A check valve should be installed in the discharge line to prevent backflow. A pressure relief valve must be installed in the discharge piping. Centrifugal pumps must have a discharge control valve as noted above.

Relief Valves

Pressure relief valves must be used to prevent over-pressurization in all pump installations. Their use is even more critical for cryogenic fluids. Ambient heat leak will vaporize trapped liquid, which causes a large pressure increase if the fluid can not expand. Relief valves must be used at all potential trapped-liquid points. Particularly between a reciprocating pump's discharge and a downstream valve, between isolation valves, and between an isolation valve and an upstream check valve.

Centrifugal Pumps Supplied from a Trailer

The following additional issues should be considered when installing a centrifugal pump that is supplied from a trailer:

- Minimize length of flex lines, as the trailer's flexible transfer hose adds even further to the overall piping length connected to the suction fitting. This is a heat leak and cavitation issue.
- Provision should be made for supporting the trailer transfer hose in the middle of its length to prevent the hose weight from applying unnecessary stress on the suction fitting.
- A "witch's hat" strainer should be used in the suction line. Be sure that the open surface area of the strainer is 1.5 times the diameter of the suction piping. A differential pressure gage should be used across the suction strainer.

Instrumentation and Controls

Pumps must be instrumented for proper control and maintenance. As a minimum, a discharge pressure gage must be used to control the operation within the pump's design limits.

For unattended operation, fully automated systems are available to control the operation and shut down the pump if a vault occurs, such as cavitation, seal leak, or over-pressurization.

The issues discussed provide general guidance for pump installations. However, each installation is unique. Always use sound engineering practices for a pump installation. If unsure of the proper criteria, ACD, ACD CRYO, or one of our authorized worldwide service centers (see affiliate's list on page 6) recommend their engineers discuss your specific application and installation details. ❄

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Cryoquip wafer-style electric heaters...continued from page 2

The vacuum-jacketed tank requires no external refrigeration system and maintenance costs are low. However, heat leak is minimal in these tanks, and external pressure buildup equipment is required. With CO_2 applications, this is typically accomplished utilizing electric powered vaporization since the boiling point of CO_2 is too high for ambient air vaporizers to be more than minimally effective, or not even effective at all, in cold climate zones.

Cryoquip's electric aluminum wafer style design is a perfect fit for this application. Several models have been developed allowing for easy adaptation to any flow requirement. Units as low as 2 kW and as high as 150 kW are available.

Cryoquip's electric wafer pressure buildup units are designed with a low profile construction in order to take maximum benefit of the tank liquid head. In addition, the vaporizers are designed for very low pressure drops. This allows the liquid CO_2 to flow without restriction through the vaporizer and maintain the sufficient amount of return vapor to the storage tank such that the tank pressure remains stable.

The electric vaporizer comes complete with all necessary controls. The controls are mounted in an outdoor-rated electrical enclosure. A pressure switch is utilized to sense tank pressure and turn on and off an electric solenoid valve located at the inlet to the vaporizer. Under low flow conditions, ambient air is sufficient to vaporize the CO_2. As the flow requirements increase, electric heaters inside the aluminum wafers are utilized to boost the energy available for vaporization. This control approach provides the most economical solution for vaporizing the CO_2 and minimizing operating costs.

For more information, contact Patrick Billman at Cryoquip, tel +1.909.677.2060, fax +1.677.2066 or cryoquip@cryoquip.com.

Variable frequency drives add flexibility to cryogenic pumps

Variable frequency drives (VFD's) in combination with close-coupled cryogenic pumps adds many attractive features for end users. The new generation of these drives are extremely reliable with better electronic components and they are very easy to program.

The benefit of using these drives with a pump is it allows the user to control the operating range of the pump by controlling its speed. This provides greater flexibility for different applications. For example, in Europe VFD's are used with trailer systems that allow different pressures and flows for different tank types. They can also be used to limit the speed of the pump for safety reasons. If a trailer pump is being operated to fill low pressure tanks, a pressure transmitter can be installed to limit the speed and therefore reduce any risk of overpressuring the vessel.

Another benefit is it allows the pump to have a 'soft start' where it starts at a slow speed allowing the pump to catch prime before speeding up to the desired rpm. This helps eliminate deflection on the shaft, as well as minimize a shock effect that can occur if the pump is ramped up too quickly. Utilizing a VFD to operate a pump means less maintenance and longer life.

The other option for running pumps at higher speeds is to use a gearbox driven pump. However, gearbox pumps are typically more expensive and much heavier causing some handling problems. Maintenance costs for the gearbox pump are also more expensive compared to a close-coupled pump. Total life cycle costs using a close-coupled pump with a VFD are reduced when compared to the option of using a gearbox driven pump.

In addition to the common application of using a VFD with centrifugal pumps, they are also used with reciprocating pumps. There are several applications where slowing down a high-pressure cylinder filling pump can accommodate lower fill rate system requirements. Those applications would include filling medical cylinders or specialty mixed gas systems, or slowing down the pump to top off cylinders so they do not overheat.

With the technology improvements of VFD's, they have become more reliable and affordable. ACD and ACD CRYO have anticipated the increase in VFD applications and have made system designs more user-friendly.

For more information, contact Brent West at ACD CRYO, tel +49.7635.8105.0, fax +49.7635.8965 or sales@acdcryo.com.

An ACD CRYO laser tank filling centrifugal pump system with a variable frequency drive installed on a cryogenic container.

Calendar of Events

SEP 11-14 — GASEX 2000
Pattaya, Thailand
Tel 662.9600141-3, 9600461-3, Fax +662.9600140
gasex@bkkrai.com, www.ptt.or.th/gasex

SEP 16-20 — National Welding Supply Association (NWSA)
56TH ANNUAL CONVENTION, Wailea, Maui USA
Tel +1.215.564.3484, Fax +1.215.564.2175
nwsa@nwsa.com, www.nwsa.com

SEP 21-23 — IG CHINA 2000
Shanghai, China
Tel +86.10.6567.0273, Fax +86.10.6567.0275
ait@ht.rol.cn.net

SEP 23-27 — International Oxygen Manufacturers Association (IOMA)
Annual Meeting, Monte Carlo, Principality of Monaco
Tel +1.216.228.2166, Fax +1.216.228.5810
ioma@iomaweb.org, www.iomaweb.org

OCT 10-13 — CRYOGENICS 2000 IIR International Conference
Prague, Czech Republic
Tel +420.2.683.6100, Fax +420.2.684.0817
icaris@is.cz

OCT 17-18 — Semicon Southwest
Austin, TX, USA
Tel +1.512.349.2422, Fax +1.512.349.2442
tberke@semi.org, www.semi.org

NOV 14-16 — North America's Largest Metal Forming & Fab Expo
Cleveland, OH, USA
Tel 800.432.2832 (USA only), +1.815.399.8700

NOV 14-17 — GASTECH 2000 (19th International LNG, LPG & Natural Gas
Conference and Exhibition), Houston, TX, USA
Tel +44.1895.454533. Fax +44.1895.454578
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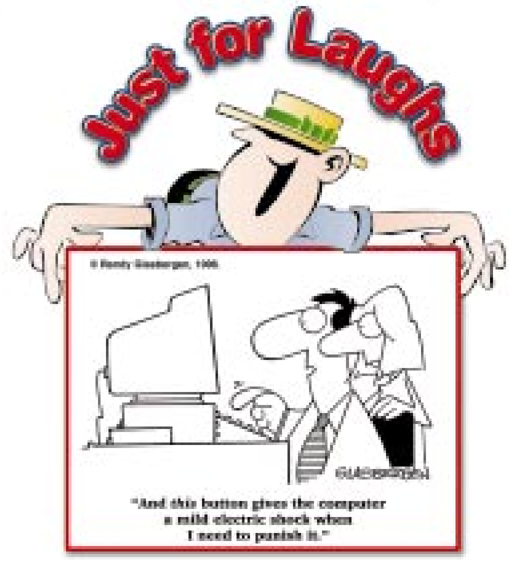

"One day, there will be no borders, no boundaries, no flags and no countries, and the only passport will be the heart."
-Tamara Robinson

Quote

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