



★ **Behind the scenes**
*Working hand-in-glove
with hydrocarbon process
customers*

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*The latest transfer
pump solutions utilising
Cryostar technology*

★ **CRYOSTAR in the
Asia Pacific**
*Delivering what
customers want, when
they want it*





Welcome to the fourth issue of CRYOSTAR Magazine. In previous editions and indeed in this one as well, runs the thread of diversity – one of the main pillars which enables CRYOSTAR to experience the success it does today.

In terms of the markets we serve there are industrial gas, natural gas, liquefied natural gas, clean energy and hydrogen markets. CRYOSTAR offers customers everything from centrifugal trailer pumps to large hydrocarbon turbines – all state-of-the-art.

Our customers are also diverse. They range from global industrial gas companies and engineering firms to local shipyards and utilities and distributors of industrial gas. We serve them from CRYOSTAR centres located in France, China, Singapore, Britain and across the USA and via an international network of agents.

CRYOSTAR's service offerings are equally diverse ranging from traditional to fully managed maintenance agreements which contribute to plant reliability.

But above all is the diversity of our people. Not just the twenty different nationalities, at CRYOSTAR diversity cuts across a huge range of issues – equal opportunities, nationality, gender, race..

Such diversity is reflected in everything we do. It is represented through our Code of Conduct. It gives CRYOSTAR a unique perspective in the global market. It fuels innovation within the company. It promotes flexibility as a work ethos. It encourages the CRYOSTAR team to tackle every commercial and technical challenge. It is what makes CRYOSTAR successful in all the markets we serve.

Diversity is nothing if not a quality issue: that we try to employ the best people regardless of their background; that we respond to different markets and customer needs on as flexible basis as possible; and that we believe in developing our products and services to suit customers' ever-changing requirements.

And the proof of the power of such diversity? CRYOSTAR has grown significantly over the past four years and we expect to turn over €90 million in sales in 2005.

In CRYOSTAR we consider achieving such growth is thanks to our diversity, the customers we serve, and thanks to the dedication of our 280-strong workforce – highly qualified and highly motivated people, all.

Daniel MEYER
President

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Working hand-in-glove with hydrocarbon process customers

Before any product is designed, tested, delivered and installed for customers, Cryostar is a hive of behind the scenes activity. Here, Cryostar Magazine looks at the cryogenic expander offering for hydrocarbon processes...

Behind the scenes

In the first six months of 2004 Cryostar received orders for 14 expander re-compressor units, all equipped with active magnetic bearings. This machine type is called MTC. Among its customers are Daelim, Toyo, Aker Kvaerner Engineering & Technologies and Japan Gas Corporation (JGC).

In every case, dedicated project managers ensure a smooth partnership between the customer, the end-client and Cryostar. All cabinets and related software are entirely engineered by Cryostar. This is a real advantage as it simplifies the workflow of a project.

During any hydrocarbon project, a team of highly skilled Cryostar engineers will analyse the customer's requirements in minute detail.

This allows for the cryogenic expander to be designed for perfect integration into a customer's process. This involves impellers, nozzles and diffusers being customised for individual projects using the latest state-of-the-art engineering tools.

Cryostar engineers design the nozzles, diffusers, machine components (with the exception of the bearings), related auxiliary systems and the wheels.

The wheel is engineered to achieve optimum efficiency in a wide range of operating conditions. Since high reliability, with minimal shutdown periods, is a staple customer requirement around the world, each wheel is rigorously tested and analysed.

At an early stage of the order, a modal analysis and resonance assessment are done. Once the wheel is fabricated, the predictions of the finite element analysis are verified using real-time interferometric holography.

Every cryogenic expander is also adapted to conform to the hazardous zone specified by the

customer. Often, the instrumentation is customised to meet specific customer requirements.

A rigorous customer witness-test programme concludes each project. Tests are done according to API 617 and ASME PTC 10. Vibration analysis with ADRE is also available to customers. This is done at Cryostar's state-of-the-art test facility in Hesingue, France.

Fast Facts

- > Cryostar manufactures single shaft cryogenic expanders utilising re-compressor, generator loaded and oil brake units for hydrocarbon processes;
- > Single or double units are built to API 617 (7th edition) and API 614 (4th edition) standards on a single machine skid;
- > Depending on the bearing type, a separate lube oil skid is connected to the machine skid by an intermediate skidplate;
- > The Cryostar cryogenic expander is used to provide refrigeration for the sales gas purification / treatment process in hydrocarbon processing plants;
- > Cryostar has provided expander re-compressors for ethylene plants where the moleweight was below 4 kg/kmol. Design requirements

for such applications are even more stringent than for moleweights in the area of 16-18 kg/kmol; and

- > Cryostar uses a special leak test facility at its headquarters in Hesingue - France, where the main pressure containing parts are tested with helium.

Customer case study

JGC worked closely with Cryostar engineers to fabricate two expander re-compressors for its Wafa Libian Desert Plant. The machines were designed for a power of six megawatt at a nominal operating speed of 14,400 rpm.

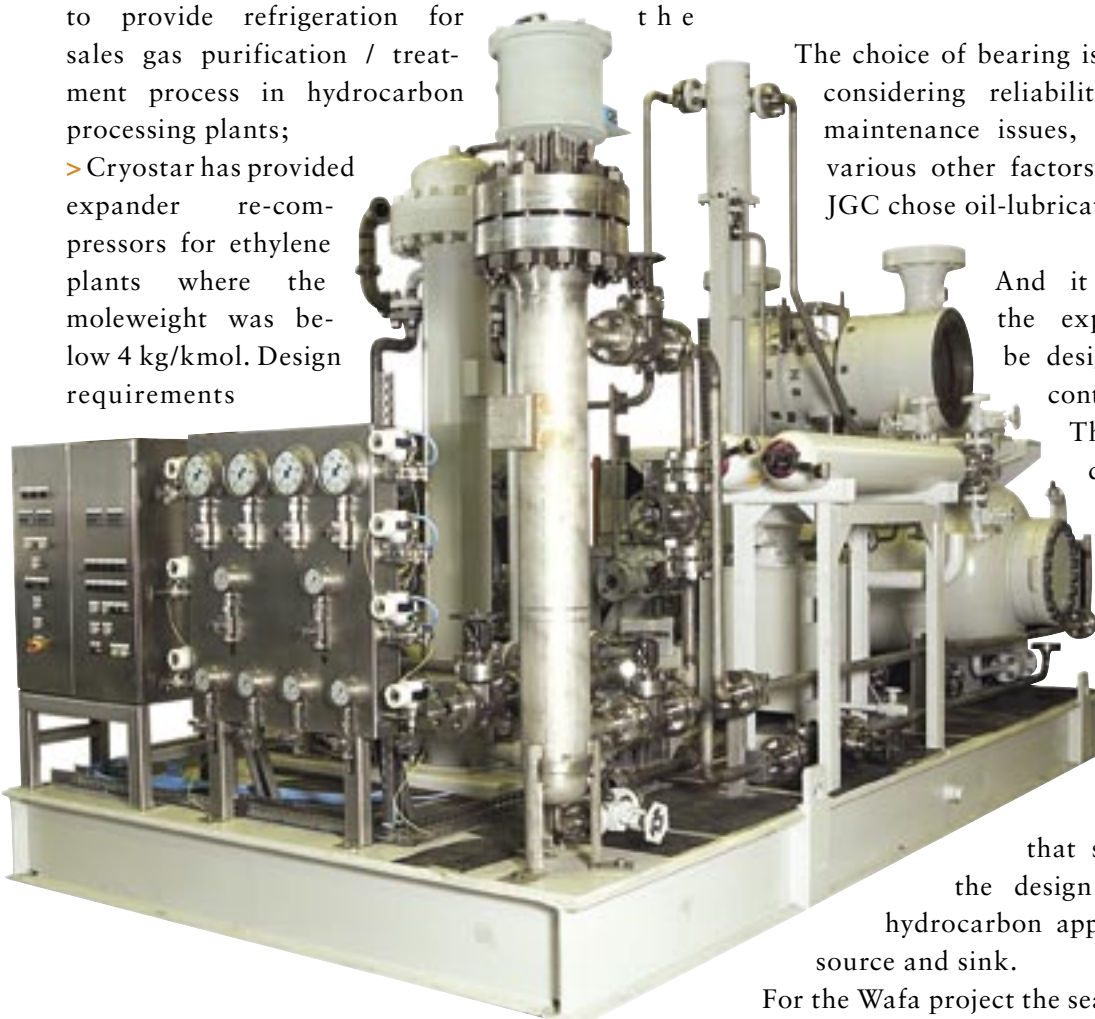
For most hydrocarbon projects Cryostar can offer its expanders using either conventional oil-lubricated bearings or active magnetic bearings. The advantages of the magnetic bearings include the absence of an oil circuit, a free floating rotor with no unbalance transmitted to the bearing carrier and lower bearing losses.

The choice of bearing is made by the customer considering reliability, ease of operation, maintenance issues, space requirement and various other factors. For the Wafa project JGC chose oil-lubricated bearings.

And it is not unusual that the expander wheel has to be designed for a high liquid content at the wheel outlet. The Wafa wheels were designed for 15 per cent (mass) liquid at the outlet. This results in a high liquid content in the inter-stage between the nozzle and the expander wheel inlet.

Another parameter that substantially influences the design of the expander for hydrocarbon applications is the sealgas source and sink.

For the Wafa project the sealgas was provided after



the first stage of the export compressor which is located downstream of the Cryostar re-compressor. This is, in many ways, an ideal solution since the gas is dry and no additional source is needed for the start-up of the expander.

For this project the sealgas supply pressure was dictated by the expander exit pressure since a cavity blow-down line was used on the expander side. Labyrinth-type seals were used in order to seal the

bearing carrier from the process side in the shaft area.

In order to minimise the process gas losses to the flare, the oil tank was also pressurised and an automatic pressure control valve was installed between the oil tank and the flare line. Both expander re-compressors are in the process of being commissioned.

News

Cryostar welcomes French trade minister

French Minister for Foreign Trade, François Loos, paid a fact-finding visit to Cryostar's headquarters in Hesingue, France. He was accompanied by the Prefect of Haut Rhin, the mayor of the City of Hesingue, Jean Ueberschlag, the MP and mayor of Saint Louis, Arlette Grosskosst, MP of Mulhouse, and department councillors and mayors of several cities from the region.

This visit was an opportunity for the Minister and the other officials to learn more about Cryostar, the products, markets and staff. M. Loos was impressed by the dynamism of the company as well as the high proportion of exports, as 90 per cent of Cryostar's products are shipped out of France, said Cryostar managing director Daniel Meyer.

He added: "On this occasion, we presented the high quality and skill level of the personnel, as well as the fact that 12 nationalities are represented at the Hesingue facility. This prestigious visit was a unique opportunity to present Cryostar locally."



New office for Cryostar China

With effect from October 1, CRYOSTAR China is relocating to: Third building No. 17 Shanxian Road, Hangzhou City, Zhejiang Province, China 310004. Tel: (86) 0571 85368331. Fax (86) 0571 85358409.

The new site provides a total work area of 650m², which includes 250m² of offices and 300m² of workshop and warehouse space. This move enables CRYOSTAR to provide a complete range of services from sales to technical support, pump repair and spare parts supplies.

Landmark China deal

CRYOSTAR has won an order for cargo handling equipment for the first two LNG carriers to be built in China for the Guangdong LNG Terminal.

The contract includes two high-duty and two low-duty compressors, two gas heaters and two LNG vaporisers per vessel. This landmark order marks the entry of China into the exclusive list of LNG carrier building nations.

Three further vessels are in the planning phase for the Fujian LNG project.

Introducing the LAZAMATIC

Trouble free? Dependable? Onboard self-diagnostics? Remote monitoring and automatic alerts? The LAZAMATIC has it all. Here CRYOSTAR magazine explores how this technology enables customers to work smarter not harder.

Gas Technology Australia (GTA), Cryostar's agent based in Queensland, has used PLC technology to engineer a 'smart' nitrogen pump skid to meet the need for a simple, trouble-free, high pressure nitrogen system for laser machines.

Utilising the reliable Cryostar SDPD reciprocating pump, the LAZAMATIC is an integrated pump package that monitors the status of the system and automatically refills a buffer of cylinders from a thermosiphon cryogenic tank.

The customer draws off from the buffer at a pressure and flow to meet the laser's demands instantaneously. So what's so smart about that?

Well, the important operational and safety parameters are continuously sensed and relayed to an onboard Micrologix PLC, which takes all appropriate actions. These include re-starting the pump to refill the buffer, stopping the pump when at pressure, sensing for pump gland leakage, monitoring for liquid nitrogen carry-over, logging hours run, and monitoring for pump loss of prime.

Normally any fault condition resulting in pump stoppage would not be detected until the customer ran out of nitrogen – but then it's too late!

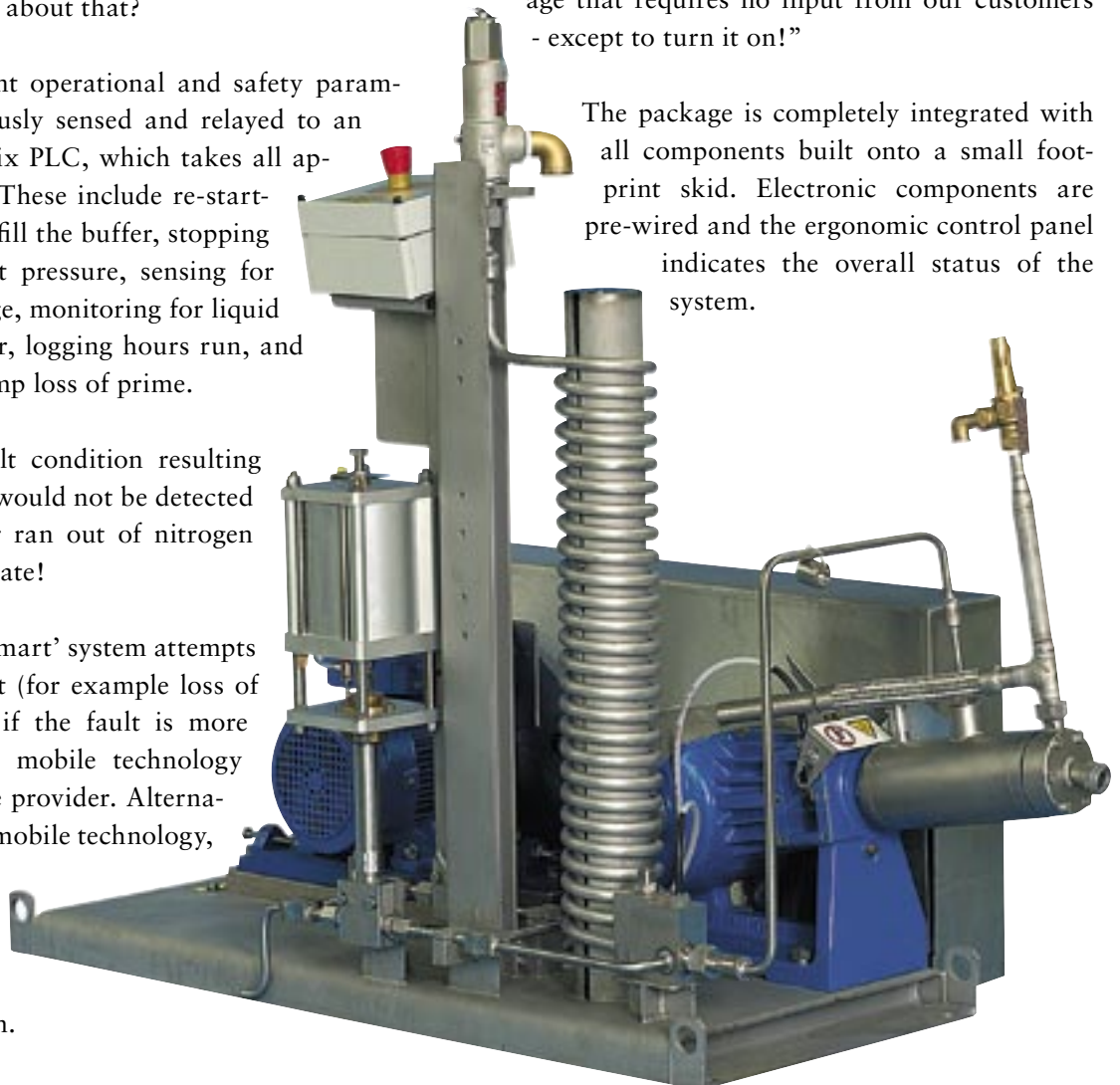
However, GTA's 'smart' system attempts to correct the fault (for example loss of prime), and then if the fault is more severe, uses GMS mobile technology to inform a service provider. Alternatively, using GMS mobile technology, GTA is able to 'dial in' at any time to interrogate the current status of the system.

In this way, proactive rather than reactive action can be taken before the customer runs out of gas. No telephone land lines are required and the system is totally self-contained.

GTA has provided Linde Gas with a large number of LAZAMATIC systems for laser installations throughout Australia. Says Mark Ward, Linde's National Sales Manager: "We have found the LAZAMATIC system to be exceedingly reliable and trouble-free and it is now our preferred system for our laser customers."

"Gas Technology has produced an excellent package that requires no input from our customers - except to turn it on!"

The package is completely integrated with all components built onto a small footprint skid. Electronic components are pre-wired and the ergonomic control panel indicates the overall status of the system.



CRYOSTAR in Asia Pacific

Fast response, after sales service and a burning desire to understand and deliver what customers want is at the heart of every successful business. CRYOSTAR is an example of this best practice and nowhere more so than in the Asia Pacific region. CRYOSTAR Magazine reports on its customer service offering.

Singapore matters. It is the regional hub for professional services. In the words of one former Indonesian government minister: “Singapore feeds off the inefficiency of its neighbours”. CRYOSTAR SINGAPORE, established since 1990, offers customers in the Asia Pacific region better communication, quicker response times and a highly efficient service.



Being part of a big regional marketplace, CRYOSTAR covers the Asia Pacific from Singapore, Malaysia, Indonesia, Thailand, the Philippines and Vietnam, to Taiwan, Korea, Japan, Australia and New Zealand – and its customer base shows it does its work well.

That success has now prompted CRYOSTAR to roll out its mechanical seal repair service to the region. The aim is to provide better after sales service support to Asia Pacific customers. More importantly, it will help improve customer efficiency and cut customers’ operating costs.

The success of CRYOSTAR in Singapore is due to its highly efficient operations team. With an average of more than five years service within the company, the local team has developed the all-important experience and understanding of customers needs.

CRYOSTAR SINGAPORE’s stock of more than 1,000 spare parts enables it to meet crucial delivery times to customers.

CRYOSTAR SINGAPORE’s stock of GBS 155 and SDPD 30/32 pumps means a customer order can be filled instantly.

CRYOSTAR SINGAPORE processes equipment renewal for customers across the region.

CRYOSTAR SINGAPORE provides customers with regular updates on procedures for returning of equipment to France for renewal.

CRYOSTAR SINGAPORE provides follow-up on renewal cost reports and shipment of equipment back to the customer.

Despite the financial crisis of 1997/98 and more recently SARS in 2003, demand for CRYOSTAR services in the Asia Pacific has grown steadily. This is a trend the company expects to continue because CRYOSTAR SINGAPORE prides itself on meeting customer requirements in terms of sales of pumps, spare parts enquiries and after sales support.

For sales of pumps, servicing of industrial gas products from pumps to turbine and LNG compressors, sales of spare parts – with a 100 per cent support via a nationwide sales and service network.

Driving down the cost of dry dock

Equipment maintenance on LNG ships is a high priority for ship operators and owners. Cryostar's commitment and dedication contributes to optimise safe and reliable equipment operation while optimising interventions and costs.

With over 130 LNG vessels equipped with Cryostar technology, our Dry Dock Kits not only summarise 30 years of Cryostar experience in rotating machinery, but also the practical experience of many chief engineers, gas engineers and LNG vessel owners.

Cryostar's global presence and forward thinking partnership approach has enabled the company to ramp up its service offering to the marine market. Cryostar now provides cost-effective solutions to parts rotation (avoiding any worries about shelf life expiration dates!), inexpensive storage, guaranteed availability of parts and provides customers with highly skilled engineers, any time, any place. And it's all aimed at helping to drive down the overall cost of dry dock.

Even though Cryostar's cargo handling technology (compressors, heaters, and vaporisers) is robust, designed and tested for decades of use, equipment still requires periodical maintenance.

This is achieved when the vessel finally comes into dry dock. In general, this happens every 24 to 30 months and only two of the four cargo compressors are overhauled each time. This means the maintenance cycle per machine is approximately five years.

And Cryostar is always there with the right parts, the right engineer and the right advice. Cryostar technicians and support teams are experienced in the dry docking process of LNG vessels. Their priority is to inspect compressors, replace distressed parts and keep the owner up to date on the condition of his machines.

States Shukei Horiuchi, Technical Superintendent, No.2 LNG Ship Management Team, NYK Line: "LNG cargo handling is an important operation, which always requires 100 per cent and more on the safety front. This makes Cryostar's compressors critical machines. They must remain available and reliable at all times.





Photo Qatargas

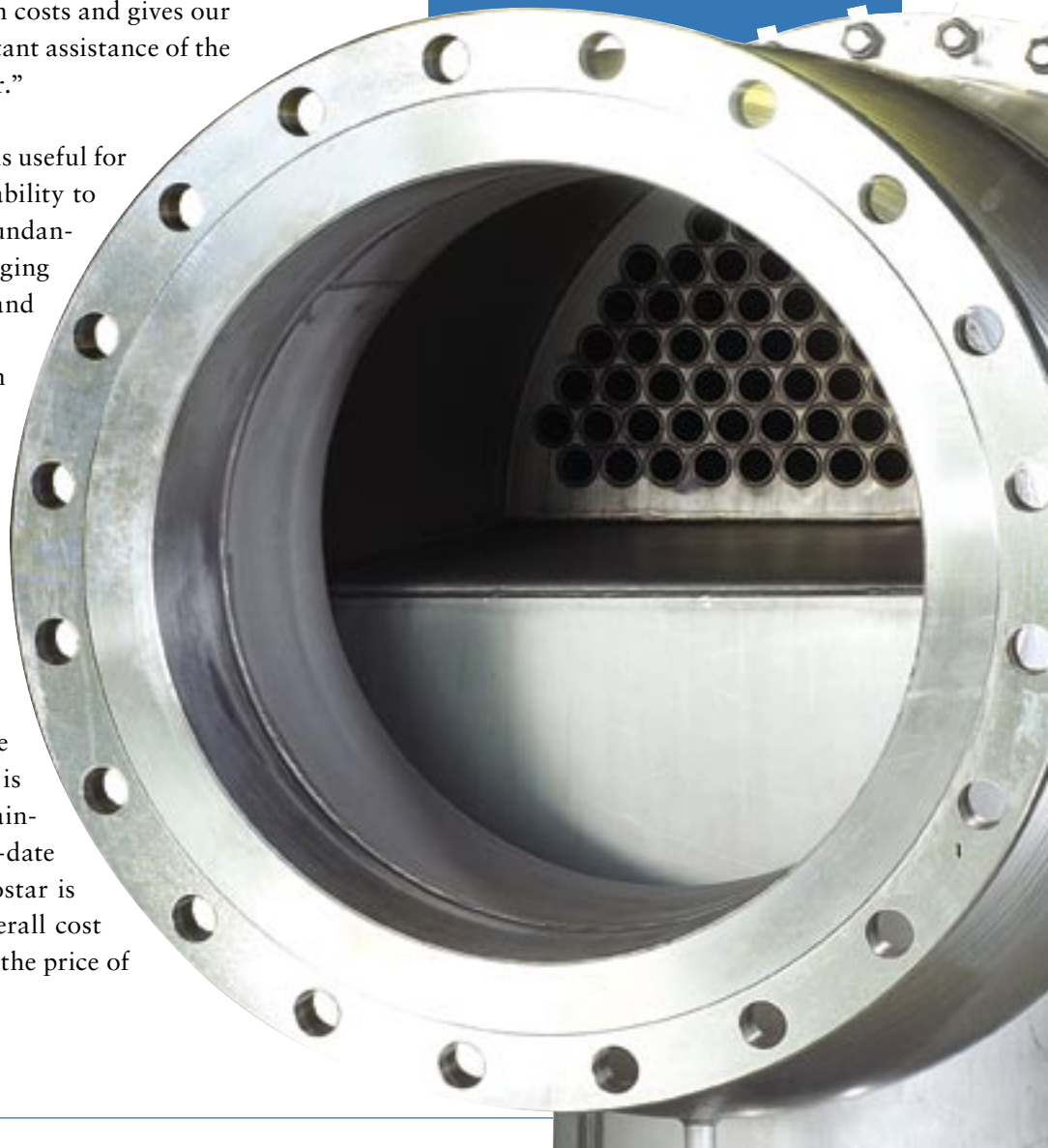
One of the ten Qatargas LNG vessels equipped with Cryostar technology during the 1990's. At present these vessels dry dock in Singapore and Dubai, and if the owner chooses another location in the future, Cryostar shall be there too.

“The maintenance of this equipment is a high priority for us, so we don't hesitate to call on Cryostar to come to the dry dock to do what only they know best. But maintenance is also cost. So working with Cryostar helps optimise our own long term costs and gives our vessels the advantage of the constant assistance of the original equipment manufacturer.”

Cryostar's presence at shipyards is useful for many activities, not least is the ability to follow up on any potential redundancies that today's rapidly changing world can bring to electronics and technology.

Cryostar's advice and proven experience with cutting edge electronics has recently allowed the company to propose PLC updates for equipment fast becoming obsolete. Updates that can quickly be retrofitted, are widely available and highly reliable.

Although no one can see into the future, Cryostar's commitment is to keep customers' machine maintenance flexible, reliable, up-to-date and cost effective. In brief, Cryostar is here to assist in reducing the overall cost of dry-docking, in turn reducing the price of LNG transportation.



GBSD pumps in range

Cryostar is proud to announce the introduction of the Transfer Pump GBSD range, designed for use in stationary or road tanker applications. The technology is based on a gearbox-free direct-coupled pump system and variable frequency drive...

The new GBSD pump range completes Cryostar's range of GBS / CBS series pumps. Available in two models, GBSD 185/3 and GBSD 155/4.5, this system does not operate through a gearbox but is driven by a variable frequency drive with power capacity up to 37 KW.

The system is capable of providing enhanced performances versus CBS / GBS type pumps (27 bars in liquid nitrogen & 30 bars in liquid oxygen applications). The pumps are much simpler to maintain by using a direct-coupled transmission, cutting out the need for gearbox oil.

The GBSD pump uses some of the same Cryostar technology as the GBS / CBS pump series. For example, the permacold barrier, comprised of a hollow shaft, thermal insulated distance piece between the pump and the motor to provide a lower thermal conductivity; front opening of the casing; high hydraulic efficiency closed

GBSD (model)	185 (impeller Ø in mm)	/	3 (impeller tip width)
Applications	Stationary pump for liquid transfer Road tankers		
Liquids pumped	LOX, LIN, LAr, LCO2, LN2O, LNG		
Drive type	Direct coupled		
Variable Frequency Drive	37 KW – 72 A		
Design pressure	Up to 30 bar / 435 PSI		

impeller; helical inducer; and of course the reputable Cryostar long-life composite mechanical shaft seal.

The direct coupling of the pump also means a much lower noise level (75 dBa). The cold end is similar to the GBS or CBS pump and can therefore be easily replaced on existing installations without having to exchange the complete pump unit.

Cryostar offers replacement kits allowing customers to return existing GBS or CBS pumps for upgrading to a GBSD-type unit. As the pump gearbox is eliminated, weight is also reduced (CBS 185/3=215 kg – GBSD 185/3 = 160 kg) along with its overall dimensions.

Finally, this system becomes more flexible through its variable frequency converter that can be connected either to the Mixtran-type alternator at 50 or 60 Hz for an independent operation, or to the external network.



Events

★ November 3-5, 2004

IG - China 2004, 6th Annual China International Exhibition on Gases Technology, Equipment and Application, China National Agricultural Exhibition Center (Hall 2), Beijing, China

★ December 1-3, 2004

CWC's 5th Annual World LNG Summit, the strategic LNG industry event, Westion Excelsior Hotel Rome, Roma, Italy.

★ December 6-8, 2004

H2PS, The 2004 Hydrogen Production and Storage Forum, Washington Marriott, Washington, D.C. USA.

★ January 25-27, 2005

WeldMex 2005, Mexico's largest Exposition for Welding Equipment and Supplies, Mexico World Trade Center, Mexico City, Mexico. For more details:

www.weldmex.com

★ March 14-17, 2005

GASTECH 2005, The 21st International Conference & Exhibition for the LNG, LPG and Natural Gas Industries, Bilbao International Exhibition Centre, Bilbao, Spain.

For more details:

www.gastech.co.uk

★ April 26-28, 2005

The AWS Welding Show 2005, Dallas Convention Center, Dallas - TX, USA.



Tools and datas: Nitrous Oxide Conversion Data

We have decided to dedicate this section of our magazine to include usefull tools and datas that are handy in our industry. In this issue, the Nitrous Oxide Conversion Data table.

	Weight		Gas		Liquid	
	Pounds (Lb)	Kilograms (KG)	Cubic Feet (SCF)	Cubic Meters (Nm ³)	Gallons (Gal)	Liters (L)
1 Pound	1.000000	0.453592	8.726000	0.229366	0.097738	0.369977
1 Kilogram	2.204622	1.000000	19.237536	0.505665	0.215475	0.815661
1 SCF Gas	0.114600	0.051982	1.000000	0.026285	0.011201	0.042399
1 Nm ³ Gas	4.359850	1.977595	38.044053	1.000000	0.426122	1.613046
1 Gal Liquid	10.231466	4.640915	89.279770	2.346747	1.000000	3.785412
1 L Liquid	2.702867	1.226000	23.585219	0.619945	0.264172	1.000000

SCF (Standard cubic foot) gas at 1 atmosphere and 70°F (21.1°C).
Liquid measured at 1 atmosphere and boiling temperature.

Nm3 (normal cubic meter) gas measured at 1 atmosphere and 0°F (-17.7°C)
All values rounded to nearest 4/5 significant numbers



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