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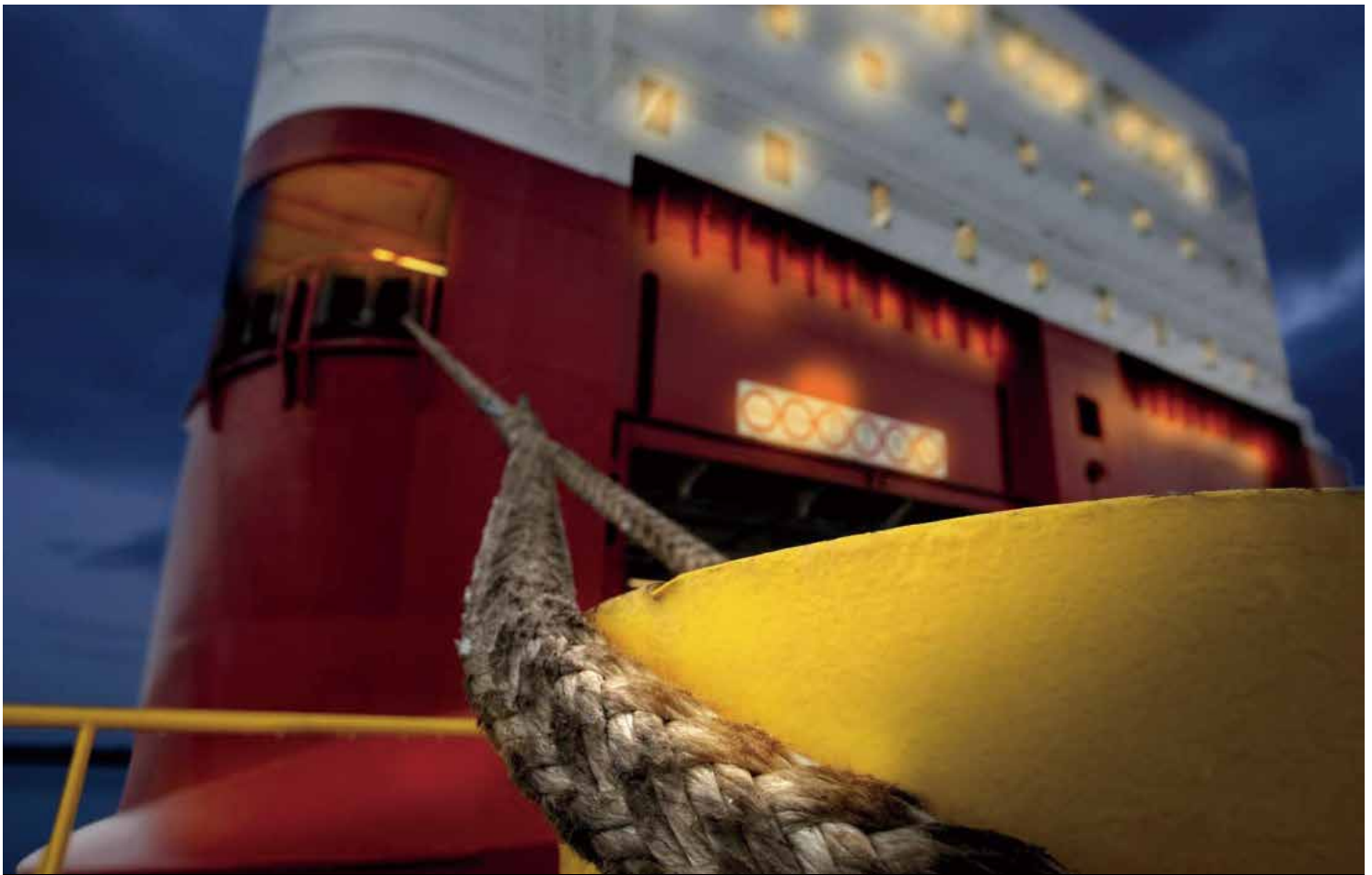
Korea monthly shipbuilding magazine

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2015. 10

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Official Magazine

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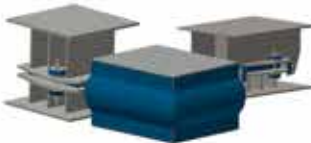


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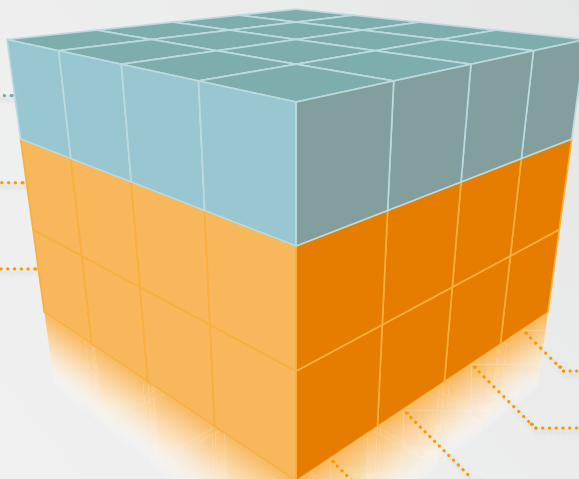
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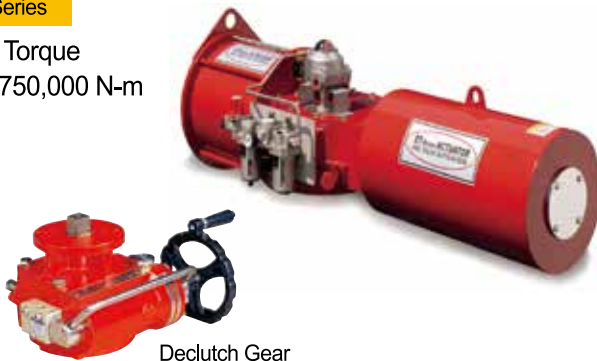
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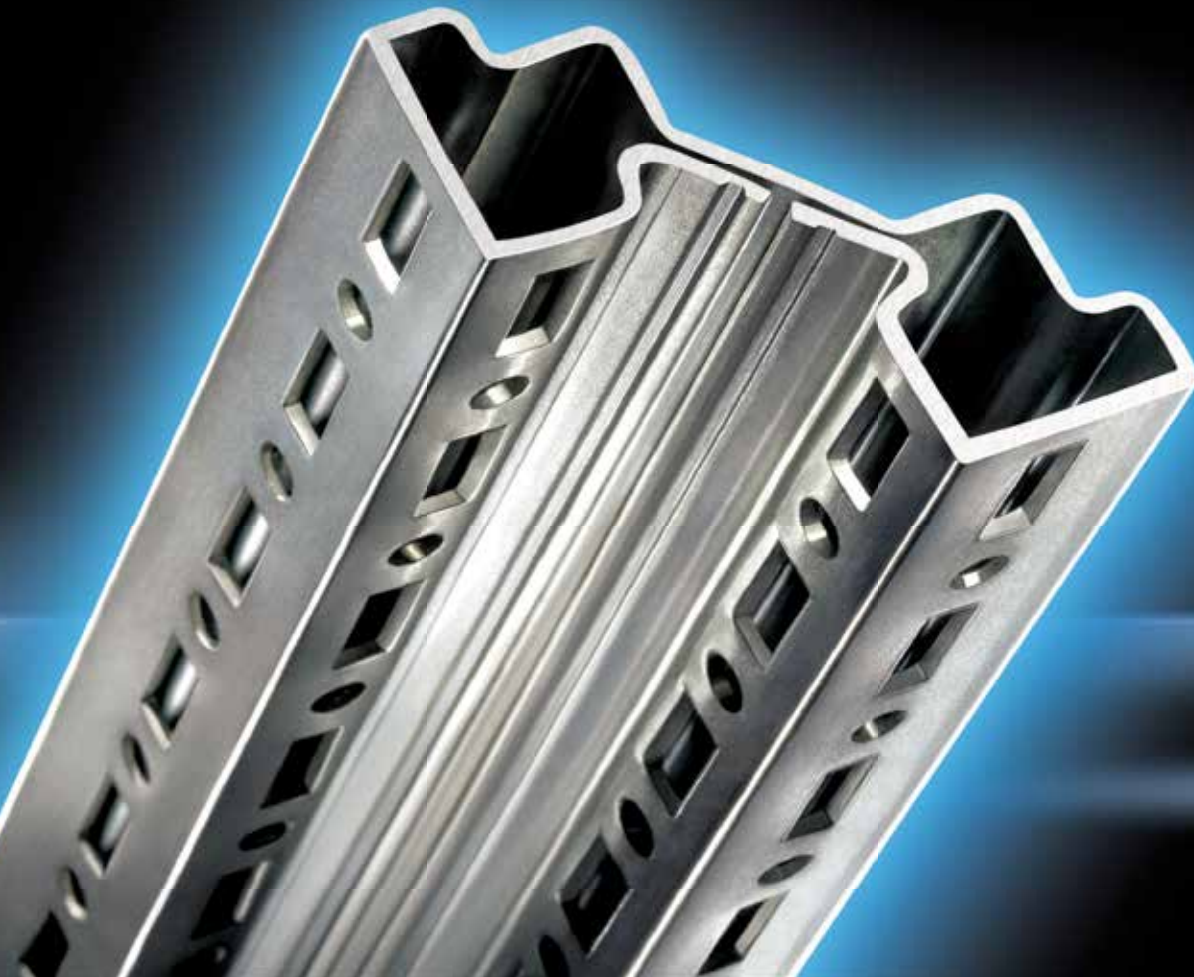
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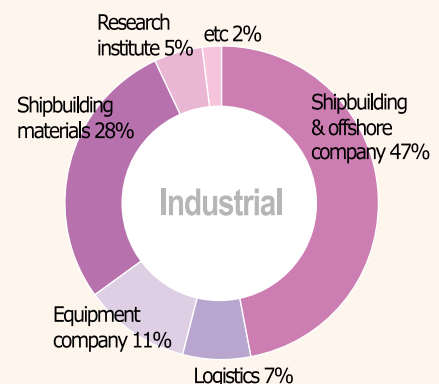
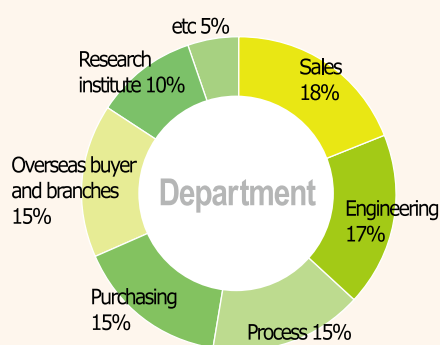
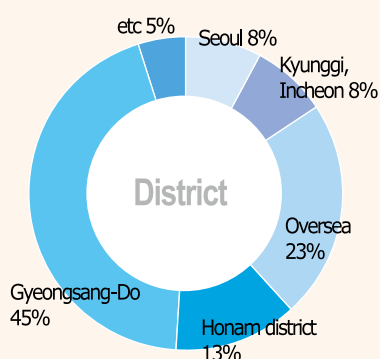
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ABB's Azipod D electric propulsion named Innovation of the Year

ABB has been awarded the Innovation of the Year Award for the recently introduced Azipod D electric propulsion product at the Electric & Hybrid Marine World Expo in Amsterdam, the Netherlands.

The Innovation of the Year Award identifies pioneering technologies that push the boundaries and contribute to making electric and hybrid propulsion possible and viable. The winner was selected by an international jury consisting of 38 maritime journalists, industry experts and academics.

ABB introduced the Azipod D in March 2015. ABB's gearless Azipod propulsion system is already the preferred choice of cruise vessels, icebreakers, ice-going cargo vessels and offshore accommodation ships. With the Azipod D, shipping segments such as offshore drilling, construction and support vessels and ferries will have even more choices to benefit from the higher flexibility,

reliability and energy efficiency provided by Azipod propulsion technology.

"We are delighted that our contribution to the further expansion of electric propulsion is recognized as Innovation of the Year. The flexibility that electric propulsion provides is key to future success in shipping, and therefore it is easy to understand why electric propulsion is growing many times faster than the world's fleet," said Heikki Soljama, Managing Director for ABB's marine and ports business. "Azipod D allows a wider range of vessel types to benefit from the proven reliability and flexibility that have made Azipod the leading propulsion system across numerous ship types, such as cruise vessels and icebreakers."

Azipod D provides designers and ship builders with increased design flexibility in order to accommodate a wide range of hull shapes and propeller sizes, as well as simplicity of installation of the propulsion units. The Azipod



D requires up to 25 percent less installed power, which is partly due to the new hybrid cooling that increases the performance of the electric motor by up to 45 percent. ABB's Azipod D propulsion power ranges from 1.6 megawatts to 7 megawatts (MW) per unit. ABB was also named Propulsion Manufacturer of the Year for the second consecutive year.

ABB Azipod D 전기추진 '올해의 혁신기술'로 선정

ABB의 최신 Azipod D 전기추진 제품이 '올해의 혁신기술상'을 수상했다. 올해의 혁신기술 어워드(The Innovation of the Year Award)는 해양저널리스트, 산업전문가 및 학자 등 38인의 국제심사위원단에 의해 전기 및 하이브리드 추진기술 발전에 기여하고, 그 지평을 넓히는 선도기술을 선정해 시상하고 있으며, 네덜란드 암스테르담에서 개최된 Electric & Hybrid Marine World Expo에서 시상식이 진행됐다. Azipod D는 ABB가 지난 2015년 3월 출시한 제품이다. ABB Gearless design Azipod 전기추진시스템은 이미 크루즈선, 쇄빙선, ice-going 카고 및 해

양 숙박 선박(offshore accommodation ships)에서 널리 사용되고 있다. 이번 Azipod D 출시와 함께 시추선, 해양지원선 및 페리와 같은 선형까지 Azipod 추진 기술의 더욱 향상된 유연성, 안전성 및 에너지 효율성을 누릴 수 있게 되었다.

ABB 마린 및 항만 사업부 헤ikki 솔자마(Heikki Soljama) 대표는 "전기추진 라인 개발에 쏟아 부었던 노력이 올해의 혁신기술 선정까지 이어져 기쁘게 생각한다. 전기추진이 가진 유연성은 미래 해상 운송에 있어 핵심요소다. 그렇기에 전기추진시장이 세계의 선단보다 몇 배 더 빠르게 성장하고 있다"고 전했다. 덧붙여 그는 "크루즈선, 쇄빙선 등 다양한 선박에 적용하며 검증한 신뢰도와 유연성으로

Azipod는 선두적인 추진 시스템으로 인정받게 되었고, 이제 Azipod D와 함께 더 넓은 범위의 선형에 제공할 수 있게 되었다"라고 말했다.

Azipod D는 조선소 및 설계 회사들에 설치의 용이성뿐 아니라 다양한 프로펠러 크기 및 선형에 부합할 수 있도록 디자인 측면에서도 유연성을 제공한다. 또한 하이브리드 쿨링을 통해 추진모터 성능을 최고 45%까지 향상시킴으로써 최대 25%까지 설치전력을 감소한다. Azipod D의 Power range는 1.6Mw~7Mw이다.

한편 ABB는 2년 연속 '올해의 추진 제조업체 (Propulsion Manufacturer of the Year)'로 선정된 바 있다.

LR to class world's largest heavy lift crane vessel

LR has won a contract to class the world's largest heavy lift crane vessel (NSCV) for the Netherlands-based Heerema Group. The semi-submersible vessel will be constructed at the newly opened Sembcorp 'Mega yard'

in Singapore.

The dual-fuel LNG and MGO vessel is due to be delivered in the fourth quarter of 2018 and will be a key asset in the offshore market and a leading player in the installation

and decommissioning of offshore facilities. It follows another significant Heerema project, the delivery of the LR-classed Aegir deep-water construction vessel (DCV) in 2013 (see article in the January 2014 Horizons).

The NSCV project, which has a contract value of around \$1 billion, is further strengthened by the involvement of the Dutch crane specialist Huisman Equipment BV, which will fabricate two tub-mounted 10,000 tonne cranes for the vessel in their Chinese production facility.

While the vessel is impressive in scale, Heerema are committed to the protection of the environment and will include an Inventory of Hazardous Materials (IHM) and boast a full complement of LR's ECO notations including NOx Tier III compliance, LNG propulsion and compliance with the ballast water management convention (BWMC) to ensure efficient operation in some of the world's most sensitive environmental areas.

The state-of-the-art vessel will also have dynamic positioning capabilities in excess of the DP (AAA) standard along with compliance with a range of coastal state requirements including Norwegian Maritime Authority (NMA), UK and USCG requirements which means it will be capable of deep and ultra-deep sea operations on a truly global scale.

"Our contract with Jurong Shipyard represents the next critical step in our plans to introduce the NSCV to the market. The fact that we decided to press on with our plans



in these times of low oil prices, shows our belief in the offshore oil and gas industry and demonstrates our continued commitment to offer unparalleled installation services to the industry," said Jan-Pieter Klaver, CEO of Heerema Marine Contractors.

HHIC held a naming ceremony for 2 units of 180,000-ton bulk carriers

Hanjin Heavy Industries and Construction (HHIC) announced on August 26 that it held a naming ceremony for 2 units of 180,000-ton bulk carriers at its Yeongdo shipyard in Busan. It is the first time in 4 years after 2011 that a naming ceremony was held in Yeongdo shipyard of HHIC. These bulk carriers are 180,000 DWT capesize eco-friendly bulk carriers ordered by Ciner to HHIC in 2013 and christened 'Mehmed Fatih' and 'Vittoria', respectively. HHIC has proactively pressed ahead with efforts to tide over difficulties, refraining from low-price bidding in commercial vessel segment where orders were placed with low prices amid recession in shipbuilding

industry, and resumed production of commercial vessels in July 2013. The ground-breaking ceremony for Mehmed Fatih made headlines as it was the first commercial vessels to be built in 3 years. An official from HHIC said, "The concerted efforts of all employees and subcontractors have culminated in successful construction and delivery of these vessels.



We will further sharpen our competitive edge to regain our reputation as a leader in shipbuilding industry."

한진중공업, 18만톤급 벌크선 2척 명명식

한진중공업은 지난 8월 26일 부산 영도조선소에서 18만톤급 벌크선 2척에 대한 동시명명식을 가졌다고 밝혔다. 한진중공업 영도조선소에서 명명식이 거행된 것은 지난 2011년 이후 4년만이다. 이날 명명식을 가진 선박은 지난 2013년 지네르사에서 한진중공업에 발주한 18만 DWT 케이프사

이즈급 친환경 벌크운반선으로 각각 "메흐멧 파티흐(Mehmed Fatih)"와 "비토리아(Vittoria)"로 이름 붙여졌다.

한진중공업은 조선업황 침체로 저가수주가 만연하자 상선 수주를 전면 중단하고, 이후 선제적인 저가노력을 펼쳐왔으며, 지난 2013년 7월 상선 생산을 재개했다. 당시 3년만의 상선 착공식으로 화제가 됐

던 선박이 바로 오늘 명명된 메흐멧 파티흐호다. 한진중공업 관계자는 "생산 공백기 영향을 최소화하기 위해 전 임직원과 협력업체들이 합심해 혼신을 다한 결과, 성공적으로 선박을 인도할 수 있게 되었다"며, "옛 명성을 되찾을 수 있도록 수주 경쟁력을 확보해 조선산업의 선두역할을 해낼 것"이라고 밝혔다.

SSME reached a milestone of its 200th vessel, taking a first step towards normalization of business

Sungdong Shipbuilding & Marine Engineering (SSME) delivered 115,000-ton product carrier 'STI CARNABY' to Singapore-based Navig8 on September 13, reaching a milestone of 200th vessel in 8 years after it delivered its first vessel in 2007. SSME has accomplished its 200th vessel milestone faster than any other shipyards specializing in construction of medium and large-sized vessels.

This product carrier, the third vessel out of 10 units ordered in 2013, measures 249.9 m in length, 44 m in width and can sail at an average speed of 14.5 knots. Particularly, this vessel is a new model designed to increase energy efficiency.

Additionally, this vessel is outfitted with BWTS (Ballast Water Treatment System) and maintains IHM (Inventory of Hazardous Materials) on board to detect hazardous materials prior to repair and disposal of vessels, thus meeting requirements of both fuel

efficiency and environmental performance.

SSME, ranked the 9th worldwide in terms of order backlog, has continued on fast growth path, delivering 34 vessels in 2010 and about 30 vessels on

average each year since 2007 when it delivered 13 vessels. Particularly, SSME has taken top spot in global market for Suezmax-class tankers and Capesize-class bulkers, etc. Besides, SSME has maintained a steady track record in successfully building vessels such as medium and large-sized container-ships, shuttle tankers, etc.

An official from SSME said, "SSME reached a milestone of 200th vessels in a short period of time thanks to all employees'



enthusiasm and commitment to shipbuilding even in the midst of difficulties. Again, I express my deep gratitude to all employees who have made relentless efforts, ship owners, creditors, and local residents who have kept up trust in SSME. We will guard ourselves from complacency and start with a renewed mind, thinking that our next vessel is the first vessel, not 201th vessel, and putting more energy into normalization of business."

성동조선해양, 200번째 선박 인도로 경영 정상화 신호탄

지난 9월 13일 성동조선해양이 2007년 첫 선박을 인도한 이후 8년 만에 200번째 선박인 115,000톤급 정유운반선 '에스티아이 카나비(STI CARNABY)'호를 싱가포르 나비8(Navig8)사에 인도했다. 중대형 선박을 건조하는 조선사들 중에서 200호 달성까지 가장 빠른 속도다.

지난 2013년 발주된 총 10척의 시리즈선 중 세 번째로 건조된 이 선박은 길이 249.9m, 폭 44m로 평균 14.5노트로 운항할 수 있으며 에너지 효율을 높

이기 위해 새롭게 개발된 선형이다. 또한 BWTS(Ballast Water Treatment System) 및 선박 수리와 폐선 시 위험물질을 사전에 인지할 수 있도록 하는 IHM(Inventory of Hazardous Materials) 등을 적용시켜 연료 효율성과 친환경 기능을 모두 만족하는 선박으로 건조됐다. 수주잔량 기준 세계 9위의 성동조선해양은 2007년 13척 인도를 시작으로 2010년 34척 등 연평균 30여척에 달하는 선박을 지속적으로 인도하며 빠르게 성장해왔다. 특히 수에즈맥스급 탱커, 케이프사이즈급 벌크 등에서는 세계 1위를 차지하는 기염을 토하는 등 이 분야 시장에서 강세를 보이고 있으며 중

대형 컨테이너선과 셔틀탱커 등도 꾸준히 건조해 오고 있다.

성동조선해양 관계자는 "힘든 시간들 속에서도 오로지 조선에 대한 임직원들의 열정과 애정으로 단기간에 200척 인도를 달성하게 됐다"며 "지금껏 수고해 준 임직원들의 헌신과 성동조선해양을 믿어 준 선주들과 채권단 관계자들, 지역민들에게 다시 한번 감사의 말씀을 전하며 다음 번 인도호선은 초심으로 돌아가 201호가 아닌 1호선의 인도라고 생각하며 경영정상화에 매진하겠다"고 전했다.

ITMA developed ship instrument EDI report system

ITMA, an IT company specializing in shipbuilding and offshore industries, announced that it would press ahead with commercialization of cloud-based ship instrument EDI report system from October this year.

This system was developed through a project led jointly by Ministry of Science, ICT

and Future Planning (MSIP) and National IT Industry Promotion Agency (NIPA) and supported by Busan Metropolitan City to spur commercialization of local SW convergence products. This project was also participated by Convergence of IT Devices Institute Busan, Total Soft Bank, ITMA, and

U-Engine Cloud.

This ship instrument EDI system enables report of loading, unloading, transshipment of ship instruments, and provides users with capability to make inquiry and correction report related to report applications. As essential information can be automatically

fed into the system via log-in, report can be submitted with simple entry.

Additionally, information on report processing status is provided in real time, increasing convenience of works.

This system is linked to small and medium-sized ERP system, enabling basic management of operations related for customers, containers, vessels, etc. Moreover, this system provides capabilities for inbound and outbound BL management, etc., and therefore can streamline works in small and medium-sized shipping agents, agencies, and ship instrument manufacturers.

Particularly, this ship instrument EDI system is offered at more affordable price without initial investment cost than other cloud-based report system available in the market. ITMA is providing some support for

customization development to make this system tailored to enterprises.



아이티엠에이, 선용품 EDI 신고 시스템 개발

조선해양 IT전문기업 아이티엠에이(ITMA)는 클라우드 기반 선용품 EDI 신고 시스템을 개발해 오는 10월부터 본격적인 사업화에 착수한다고 밝혔다. 이 시스템은 미래창조과학부와 정보통신산업진흥원에서 추진하고 부산광역시가 지원하는 지역 SW융합 제품 상용화 지원사업을 통해 개발됐다. 한편, 이 사업에는 부산IT융합부품연구소, (주)토탈소프트뱅크,

아이티엠에이, 유엔진클라우드가 참여했다.

선용품 EDI시스템은 선용품에 대한 적재, 하선, 환적을 신고할 수 있도록 구성되어 있으며 신고신청서에 대한 조회 및 정정신고의 기능을 가지고 있다. 로그인을 통해 필수정보가 자동 입력되도록 구성되어 있어 간단한 입력만으로 신고가 가능하며 신고항목에 대한 처리상태를 실시간으로 알려줘 업무의 편의를 제공한다.

또한 이 시스템은 중소형 ERP시스템과 연계되어 있

어 거래처, 컨테이너, 선박 등 기업의 기본적인 운용 관리가 가능하며 Inbound 및 Outbound BL 관리 등의 기능도 사용할 수 있어 중소형 선사대리점, 에이전시, 선용품 업체에서 효율적인 활용이 가능하다. 특히 클라우드 기반으로 시장에 있는 일반 신고시스템에 비해 초기도입 비용 없이 저렴한 비용으로 사용할 수 있으며, 아이티엠에이는 기업에 적합하도록 커스터마이징 개발을 일부 지원하고 있다.

Singapore ambitious to be at helm as Asian gas demand lifts off

Singapore is currently Asia's oil trading epicentre but has recently spent nearly 2 billion Singapore dollars on developing the country's first LNG import terminal. The International Energy Agency has also cited Singapore as the most-likely and best-placed location as a hub for liquefied natural gas (LNG).

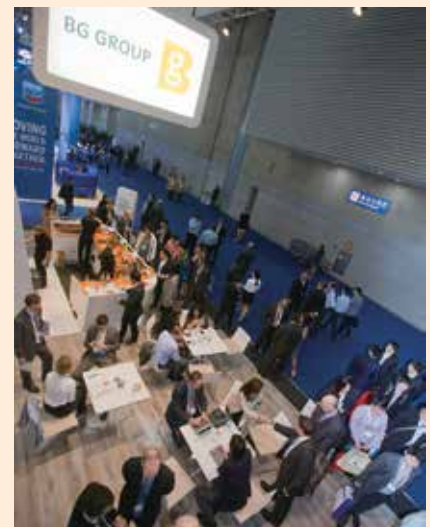
With its strong track record in the maritime, offshore engineering, and refining industries, the city state's gas trading ambitions fall suitably in place with the rest of its supply chain offerings.

In bringing together the world's leading investors, stakeholders and players across the gas and LNG supply chain and related industry sectors, Singapore - after having recently celebrated its Golden Jubilee - will now welcome the international energy community at Gastech Conference & Exhibition from 27 to 30 October 2015.

Across 4 days, over 120 commercial and

technical expert authorities and thought-leaders will cover topics such as Gas Market Outlook, Contracting, Pricing & Trading, Shipping, FLNG Innovation with Containment & Storage. Local and international C-level executives representing key investor, procurement and supplier interests across the natural gas and LNG industry and its related sectors will be able use these dedicated sessions to find the most relevant and critical ideas and issues related to their business.

With only 2 months left, over 1,000 international, regional and local conference delegates and VIPs have already confirmed their attendance. Keynotes, panellists and attendance have already been confirmed from local and international organisations including BG Group, Singapore LNG, IE Singapore, Pavilion Energy, Energy Market Authority, Pacific Oil & Gas, and InterOil among some. Gastech Conference & Exhibition is hosted by BG Group. The event is also supported by



the Energy Market Authority (EMA) Singapore, International Enterprise (IE) Singapore and the Singapore Exhibition & Convention Bureau (SECB), and will be held in association with the Singapore International Energy Week (SIEW).

2CH~32CH 다채널 멀티측정시스템

측정	압력, 온도, 유량, 속도, 거리, 토크, 진동, 오염도 외
특징	USB, RS232, CAN포트, 2GB내장 메모리 내장배터리, 무료소프트웨어

유량계



압력&온도센서



별매품: ONE 솔루션 휴대용 측정기
모델: PFM Series (12~757lpm)
측정: 압력, 온도, 유량

멀티측정기



그 외 센서



HYDROTECHNIK

50년 전통 테스트커플링 세계최초개발사
유체측정의 토탈 솔루션 제공

커플링&호스



오염도 측정기



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TYPICAL APPLICATIONS

- | | |
|---------------------------------|---|
| ▶ Floating Production Platform | ▶ GEO Services/FPSO |
| ▶ Sub-Sea Operations Vessels | ▶ Chemical Tankers |
| ▶ Harsh Environment Jack-Up Rig | ▶ Dynamically Positioned Drilling Ships |
| ▶ Deep Water Jack-Up Rig | ▶ General Marine/Offshore Use |
| ▶ Semi-Submersible Drilling Rig | ▶ Product Tankers |
| ▶ Offshore Steam Rentals | ▶ Cargo Vessels |

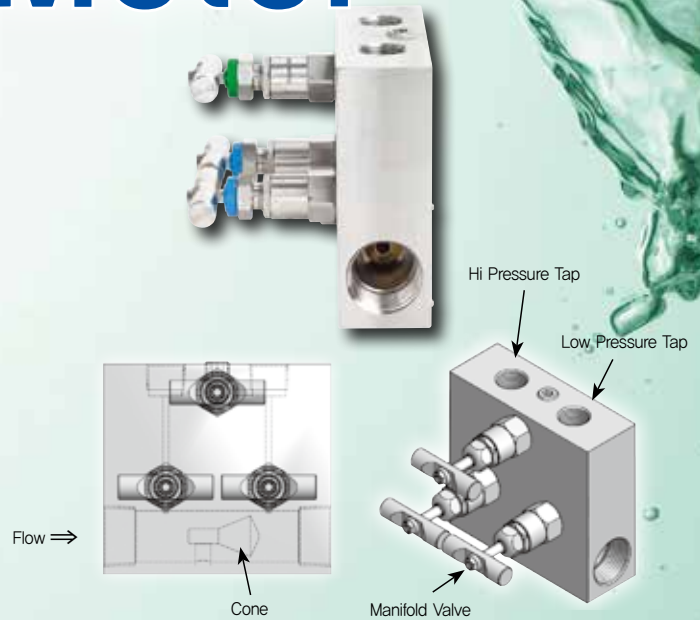
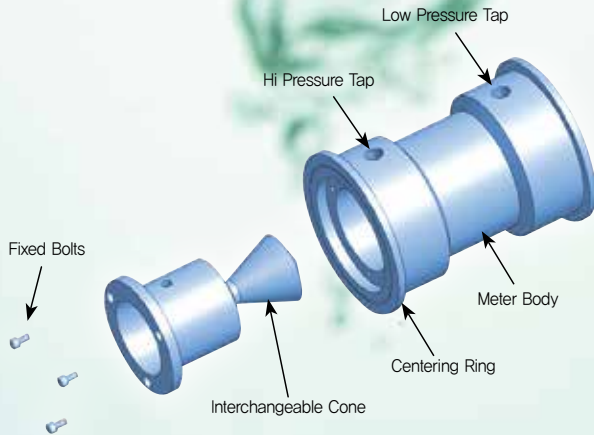
FULLY CONTAINERIZED STEAM SYSTEMS AVAILABLE



STEAM GENERATOR



Cone Meter



HFV-WM (Wafer type Cone Meter)

IVCM (Integral Valve Cone Meter)

DP HiCone Meter

DP HiCone Meter는 일반적인 차압유량계의 일종이며 차압유량계와 같은 물리적 원리에 따라 유량을 측정합니다. 조임부 역할을 하는 Cone은 Meter body 중앙에 위치하여 유체의 흐름에 따라 유속을 증가시키고 차압을 발생시킵니다. 두 개의 검출 Tap은 High 와 Low pressure를 DP 전송기로 보내 유량을 지시합니다.

70 % 전단 3D 후단 1D의 짧은 직관부를 가짐에 따라 플랜트 건설에 최대 70 %까지 원가를 절감하는 효과를 가집니다. (미국 CEESI에서 API 22.2 TESTING)

±8 % Cone Meter는 제조공정상의 사소하게 보이는 차이에도 교정하지 않으면 최대 ±8 %의 오차가 발생할 수 있습니다. 정확도 ±0.5~1 % 수준의 정밀한 유량측정을 위해서는 반드시 교정을 해야 합니다. (미국 CEESI에서 발표한 내용중)

하이트롤에서 생산되는 Cone Meter는 ISO 17025 국제공인 교정시스템에 의해 교정하며 ±0.5 %의 정확도를 가집니다.



HFV-WM

HFV-WM은 Meter body의 교체 없이 Cone을 교체하여 유량 범위를 변경할 수 있으며, 과도한 유속 또는 슬러지 물체의 충격으로 인한 Cone의 변형에 쉽게 교체 사용할 수 있는 특징을 가지고 있다. 또한, Water형태로 설치가 용이하고 모든 구성품이 정밀 기계가공되어 측정정확도가 우수하며, 용접부가 없어 압력부의 건전성이 확보 되었다.



(특 허 : 제 10-0915088호)

IVCM

IVCM은 차압식 유량계의 필연적 구성품인 Manifold Valve를 Meter body와 일체형으로 제작하여 공정시 발생할 수 있는 연결부의 Leak를 최소화 하고, 설치 공사 비용 및 시간을 줄이는 장점을 가진다.



(특 허 : 제 10-0915089호)



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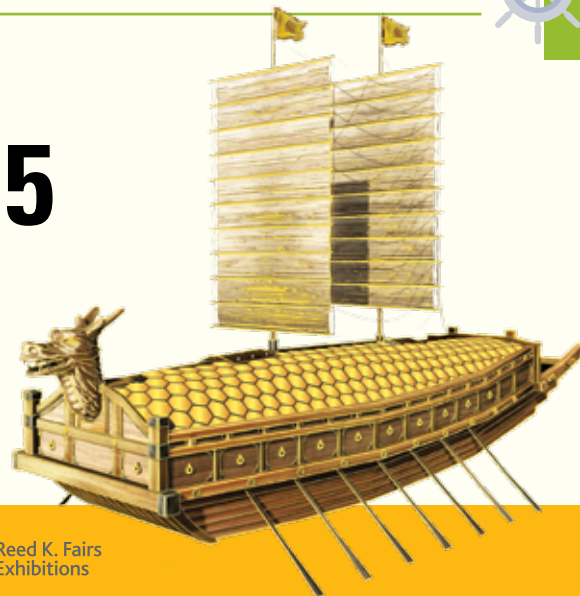
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KORMARINE 2015

OCT 20 - 23

BEXCO, BUSAN, KOREA



KORMARINE 2015 which marks 19th anniversary this year is slated to open in BEXCO (Busan Exhibition & Convention Center), Busan for 4 days from October 20 to 23. This year's event will be the biggest in its history, attracting about 1,000 exhibitors from 45 countries, despite downturn in global shipbuilding and offshore industries. KORMARINE 2015 is expected to draw approximately 4,000 foreign buyers and 80,000 visitors from about 90 countries worldwide.

Particularly, KORMARINE Conference and World Ocean Forum will be held in parallel with KORMARINE 2015, helping keep finger on the pulse of latest trends of shipbuilding & offshore industries and technologies and offering an insight into the future through specialized programs for each sector.



- | | |
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| 1. 'KORMARINE 2015' OVERVIEW | p.32 |
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| 2. KORMARINE CONFERENCE 2015 | p.33 |
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| 3. OVERVIEW OF MAJOR EXHIBITORS | p.36 |





'KORMARINE 2015', the festival for global shipbuilding & offshore industries, just around the corner!

- Featuring about 2,200 booths, a 15% increase from previous year's roof



KORMARINE 2015 will bring together world's renowned shipbuilding and offshore companies under one roof. The 19th International Marine, Shipbuilding & Offshore Exhibition 'KORMARINE 2015' is only about 20 days away. This year's event will run for 4 days from October 20 to 23 in BEXCO, Busan.

KORMARINE 2015 is organized by Ministry of Trade Industry & Energy, Busan Metropolitan City, Korea Offshore & Shipbuilding Association, Korea Marine Equipment Association, and Reed K. Fairs. This year's event, the biggest in its history, attracted about 1,000 exhibitors from 45 countries in the fields of shipbuilding, offshore plant, and oil & gas industries, featuring 2,200 booths with aggregate exhibition area reaching up to 38,000sqm which is 15 % up from previous years.

KORMARINE 2015 witnessed an increase in participation of oil & gas companies, reflecting recent advancement of shipbuilding and offshore industries into oil & gas sector. To accommodate such increase and induce participation of new exhibitors, the show site was extended to outdoor exhibition space.

Major exhibitors in KORMARINE 2015 include leaders in global shipbuilding and offshore industries, such as Hyundai Heavy Industries (HHI), ABB, Siemens, GE, Rockwell, Bosch, Rolls-Royce, MTU, MAN Diesel & Turbo, etc.

In addition, KORMARINE 2015 will attract domestic leading companies, including LS Cable & System, KCC, LG CNS, etc., domestic middle-standing companies such as NK, Panasia, Techcross, Kangrim, and SMEs (small and medium-sized enterprises) such as Jungwoo, Luxco, etc. In outdoor exhibition space, global companies are showcasing

their products and technologies, including INMARSAT, a world's leader in satellite communications, SPX, TOKYO KEIKI.

Moreover, 13 national pavilions of countries, including Germany, U.K., Norway, Netherlands, Denmark, etc., were further expanded to allow visitors to understand trends of industry and latest technologies of leading countries in global offshore market at a glance. This year's event featured new national pavilions of Sweden, Greece, Taiwan, etc., helping spur participation of related companies.

Besides, KORMARINE Conference which has evolved into an international conference will be centered around the theme "Green Technology, Green Opportunity", providing unique platform for sharing the latest information. KORMARINE Conference aims to put forth new vision, helping raise awareness towards technology for green environment to accommodate the changes in global shipbuilding and offshore industries. Particularly, KORMARINE 2015 will be held in conjunction with the 9th World Ocean Forum and KORMARINE Conference and offer many spectacles such as Kormarine Award, marine music concert, etc., including auxiliary events like export plaza, technology seminar, etc.

Kormarine 2015, the festival for global shipbuilding and offshore industries, has become quantitatively bigger than Kormarine 2013 even in the midst of crisis facing global shipbuilding and offshore industries. Eventually, Kormarine 2015 is expected to add vitality to domestic and global industries, bolstered by expansion of international exchange in global shipbuilding and offshore industries.

KORMARINE CONFERENCE 2015

- To be held in parallel with the 9th World Ocean Forum

- Evolving into an international conference

KORMARINE CONFERENCE 2015 which has been transformed into an international conference will provide a platform to exchange ideas on latest issues facing each sectors, attended by global experts from ship financing institutions, shipping companies, shipyards, marine equipment manufacturers, classification societies, universities, research institutes, and public organizations.

This year's conference will take place simultaneously with the 9th World Ocean Forum. The opening ceremony will be held with great fanfare in the main conference room on the third floor of Conference Center, the Exhibition Hall 1 on October 20. In-depth presentations will be offered by about 40 experts from 15 countries, covering 10 themes (shedding light on the present and future of market, finance, green shipbuilding, green shipping, and offshore plants, energy, etc) under the slogan "Green Technology, Green Opportunity".

October 20 - Grand Opening

Keynote Speech - *Dr. Gi Tack LIM (IMO, Secretary-General, Korea)*
IMO's Role for Sustainable Development and Use of Ocean

October 21

Morning Session 1 : Organized by Korea Maritime & Ocean University

Keynote Speech - *Mr. Gerardo URIA (API, Vice President, USA)*

The Market for Ship Finance and Risk Management in Shipping

- *Prof. Manolis G. KAVUSSANOS*

Shipping Lanes & Commodity Trading - *Mr. Henning GLOYSTEIN*

Unchanged Melody of Eco-ship - *Mr. Sok Je LEE*

Overview of Global Ship Finance - *Prof. Nikos NOMIKOS*

Busan International Finance Center : Now and the Future

- *Mr. Sam Jin WHANG*

Keynote Speech - *Blue growth for a Green Future (Ms. Dilek AYHAN, Norwegian Ministry of Trade, Norway)*

Successful Launching of ME-GI in the LNG Fueled Ship Market

- *Mr. Jong Suk KIM*

The State of Art of LFS & LNG Carrier - *Mr. Odin KWON*

Impact of Eco Ship - *Mr. Bo Ra LEE*

Status of Gas Fueled LNG Carriers

- *Mr. Stavros HATZIGRIGORIS, Mr. Andreas SPERTOS*

Shipping and ICT Convergence - *Mr. Seog Hwan KANG*

Ecoship and its Economy - *Dr. Jong Seo YANG*

October 22

Morning Session 2 : Organized by MAN Diesel & Turbo
Technical Development & Acceleration Issues

- *Mr. Tommy RASMUSSEN*

Gas Engine and Tier III Application - *Mr. Lars BRYNDUM*

LNG and Other Alternatives as Fuel for Marine Use

- *Mr. Ole GROENE*

BOG Compressor for MDT ME-GI Engine

- *Mr. Kei YASHIKI*

Energy Development and Commercial Prospect in the Arctic

- *Dr. Ho Seong Daniel LEE*

Footprint of LNG in Korea and KOGAS Strategy

- *Dr. Ki Dong KIM*

High-manganese Austenitic Steel for LNG Application

- *Dr. Ki Hwan KIM*

Audit Experience of Hi-Mn Steel - *Mr. Hwa Yong AN*

9th World Ocean Forum 2015

MAIN PROGRAM

Opening Session Welcome Remarks & Keynote Speech

Session 1 : Energy & Resources

Session 2 : Ocean policy & Ocean strategy

Session 2-1 : Assessing Ocean Policies of China, Japan and Korea for 21st Century

Session 2-2 : How to Deal with Regional Maritime Conflicts Regarding Maritime Cooperation?

Session 3 : Environment- Climate and Ocean Science

Session 4 : Sustainable Green Fisheries and Aquaculture : *Way forward*

Session 4-1 : Fisheries Management

Session 4-2 : Blue Growth Initiative

Session 5 : International Conference on Arctic Vision 2015

Session 6 : KORMARINE Conference 2015

Special Session 1 : Re-architecting Marine Policy under the UN Post-2015 Regime, Hosted by KMI

Special Session 2 : Port Repositioning for Value Creation, Hosted by KMI

Special Session 3 : Global Maritime HR Forum 2015, Hosted by LEE CONVENTION

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- ▶ CE, Ex, FM, SIL2 인증 취득
- ▶ PC로 사용조건 설정

General Specification

• APAQ-H/L
Analog Adjustable 2-Wire Transmitters
In Head type / Rail mount type
Input Pt100 or Thermocouple
Output 4 to 20 mA (2Wire)

• MINI PAQ-H/L
Basic Programmable 2-Wire Transmitter
In Head type / Rail mount type
Input Pt100 or Thermocouple
Output 4 to 20 mA (2Wire)

• IPAQ-H/L
Isolated 2-Wire Transmitters
In Head type / Rail mount type
Input Pt100 or Thermocouple
Output 4 to 20 mA (2Wire)

• IPAQ C520/R520
Hart Compatible Universal Dual-input 2-Wire Transmitters
In Head type / Rail mount type
Input Pt100 or Thermocouple
Output 4 to 20 mA (2Wire)

• PROF IPAQ-H/L
Universal High-performance Profibus-PA Transmitters
In Head type / Rail mount type
Input Pt100 or Thermocouple
Output 4 to 20 mA (2Wire)



APAQ-H/L



MINI PAQ-H/L



IPAQ-H/L



IPAQ C520/R520



PROF IPAQ-H/L

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온도기술
Thermo Sensor



대리점
모집

General Specification

•NR Series
Tube type RTD
Pt100, KP100, Pt500, Pt1000 etc.

•ST Series
M.I.sheath type Thermocouple
N, K, J, T, E calibration

•SR Series
M.I.sheath type RTD
Pt100, KP100, Pt500, Pt1000 etc.

•CT Series
Ceramic tube type Thermocouple
C, B,R, S calibration

•NT Series
Tube type Thermocouple
N, K, J, T, E calibration

•TT Series
Temp. Transmitter
In head Pt100 or T/C



반도체



LCD/OLED



식음료



철강



조선



INOR



KORMARINE 2015 Profiles of major exhibitors

- Attracting about 1,000 exhibitors from 45 countries

KORMARINE 2015 will attract about 1,000 exhibitors, including leading domestic and overseas companies such as Hyundai Heavy Industries (HHI), one of the biggest shipyards in Korea, ABB, GE Marine, Danfoss, Panasia, Kukdong Electric Wire, etc. This year's event is expected to be even bigger than last year's and the largest in its history, featuring approximately 2,200 booths, 15 % up from 2013.

ABB	Booth No. 3H07
Beijer Electronics	Booth No. 4F17
Danfoss	Booth No. 4T23
E-Tec	Booth No. 6A08
FLUTEK	Booth No. 4T13
GE Marine	Booth No. 3J09
KUKIL INNTOT	Booth No. 4C23
Intellian	Booth No. 3H39
Kukdong Electric Wire	Booth No. 3E31

NICOMATIC	Booth No. 7A11
PANASIA	Booth No. 3I07
PEPPERL+FUCHS	Booth No. 6A22
Remitite	Booth No. 4P17
Rockwell Automation	Booth No. 5M03
SAMYANG METAL	Booth No. 3H45
SUNGMOON	Booth No. 7D04
Wärtsilä	Booth No. 4M03
YOKE Industrial	Booth No. 4J23

ABB unveils newest Azipod thruster to growing electric propulsion market

ABB

ABB, the leading power and automation technology group, is presenting its newest addition to the Azipod family – the Azipod D – in Korea at Kormarine. This new product will allow a wider range of vessel types to

benefit from the proven reliability and flexibility that have made Azipod the leading propulsion system across numerous ship types.

ABB's gearless Azipod propulsion system is already the preferred

choice of cruise vessels, icebreakers, ice-going cargo vessels and offshore accommodation ships. With the Azipod D, shipping segments such as offshore drilling, construction and support vessels and ferries will have even more choices to benefit from the higher flexibility, reliability and energy efficiency provided by Azipod propulsion technology.

"We're excited to expand the Azipod propulsion family and make the benefits of electric propulsion available to a wider range of ships. Shipowners and operators demand solutions that are reliable and improve their competitiveness in a volatile market – the Azipod D is our answer to these demands," said Peter Terwiesch, President of ABB's Process Automation Solution.

The electric propulsion behind ABB's Azipod units enables ship owners and operators to enjoy higher profitability of their vessels by lowering maintenance costs and cutting fuel consumption. Benefits of the Azipod D propulsion system also include superior maneuverability, competitive investment cost, ease of service and maintenance, and a significant performance increase compared to mechanical thrusters.

This new Azipod thruster family member provides designers and ship builders with increased design flexibility in order to accommodate a wide range of hull shapes and propeller sizes, as well as simplicity of installation of the propulsion units. The Azipod D requires up to 25 percent less installed power. This is partly due to the fact that the new hybrid cooling increases the performance of the electric motor by up to 45 percent.

ABB's Azipod D propulsion power ranges from 1.6 megawatts to 7 megawatts (MW) per unit. The characteristics of Azipod propulsion make it particularly appealing to the offshore shipping segments



where most vessels operate in dynamic positioning mode and require highest reliability. In conjunction with electric propulsion, Azipod propulsion system is the ideal solution to meet varying power demand, high propulsion efficiency and flexibility, all of which are typical requirements of the offshore industry.

According to Clarkson's Research, the leading shipbroker and research firm, the number of vessels with electric propulsion has been growing at a pace of 12 percent per year over the last decade, three times faster than the world's fleet.

Marine Type HMI for IoT Era

Beijer Electronics

Beijer Electronics is a fast growing technology company with extensive experience of industrial automation and data communication. The company develops and markets competitive products and solutions that focus on the user. Since its start-up in 1981, Beijer Electronics has evolved into a multinational group present in 22 countries.

The company is listed on the NASDAQ OMX Nordic Stockholm Small Cap list under the ticker BELE.

Product: A world of hardware choices And all you need is one software iX HMI gives you all the hardware options you need. Choose from popular industrial panels or specialized panels



designed for rugged and marine environments, which perform reliably where other HMIs won't. You can even choose integrated soft control and soft motion functions.

Technology: Functionality for advanced users iX HMI has support for .NET technology, providing options for advanced developers to design specialized functionality. Use C# scripting or .NET components. Extend the application with CODESYS SoftControl and SoftMotion, boosted by EtherCAT communication.

Danfoss products are everywhere on the ship

Danfoss

Offering the lowest possible ratio of CO₂ emission and energy consumption per tonne of goods transported, shipping is well known as the most environmentally friendly means of goods transport available.

For example, Maersk Triple E container ships can transport 1 kg of goods a distance of 330 km per kg CO₂ emission. By comparison, the equivalent distance in rail transport is 20 km, and in air freight only 1.7 km, shipping therefore comprises an important element of the infrastructure in our global society. Throughout the ship, Danfoss is on board making the ship a greener place to be: ensuring safety, improving comfort, and reducing energy consumption.

Around the globe

From fishing trawlers to cruise ships to supertankers, anywhere around the globe, you will find Danfoss on board. Enhanced performance and reliability are the answers to a diversity of marine challenges – and these are achievable via high-quality Danfoss components.

In the engine room, heavy-duty applications benefit from Danfoss pressure and temperature sensors and controls, as well as variable speed drives for motor control. These components provide general-purpose regulation for engine room ventilation, fuel conditioning,



cooling water, rudder control and firefighting installations.

Danfoss IXA marine emission sensors provide on-line measurements of NO, NO₂, SO₂ and NH₃. The sensors are placed directly into the exhaust pipe, and continuously deliver near-real time gas measurements - which can be used for advanced engine control and optimization of after treatment systems like e.g. Selective Catalytic Reduction (SCR), Exhaust Gas Recirculation (EGR) and scrubber systems.

The rudder and other components require hydraulic operation, controlled with the aid of Danfoss hydraulic pumps and controls. Water and utility management on the ship both benefit from optimization via Danfoss high pressure pumps, fluid controls and VLT® drives.

E-Tec and its exclusive Anti-Icing technology

E-Tec

In KORMAINE 2015, E-Tec showcase of 'Heat Tracing' and 'Anti-Icing' technologies.

Heat tracing is a technology of preventing equipment on vessels from heat loss. Furthermore, anti-icing is a new technology preventing the equipment from freezing and keeping them accessible all the time especially for ships operating in extremely cold climate.

What is so special about this anti-icing is that it has been relaunched as a system not only for equipment, but for safety of crew. Heat Walkway is one of anti-icing items. This item protects crews from safety accidents by preventing the surface of walkways exposed to cold climate from freezing. Also, Heated Handrail, which is also used to assist crews' safety by having heating system



Heated Handrail

inside itself, has already been developed.

Including the above-mentioned items, E-Tec is currently holding domestic patents for 6 anti-icing items and preparing for international patents.

The biggest advantage of E-Tec is that E-Tec is capable of designing, procurement, production, installation and commissioning - so called 'Turn-Key'. Since E-Tec has been registered on Samsung Heavy Industries (SHI)'s vendor list in 2009, E-Tec has participated in various projects such as Drillship, Semi-rig, LNG Carrier, Shuttle

Tanker and moreover, E-Tec is currently showing good performance in Hyundai Heavy Industries (HHI) and Daewoo Shipbuilding & Marine Engineering (DSME).

Having its location in Geoje, E-Tec has its own laboratory equipped with a cold chamber to test the performance of their products under the severe environmental condition. Due to the newly opened North Pole Route and thereby increasing demand of anti-icing, E-Tec will exert every effort in technical development.

Energy Saving Applications

FLUTEK

FLUTEK has been delivering approximately 250 ship sets of steering gear and 150 ship sets of deck machinery per year for various kinds of vessels and maintaining its highest market share of the world since its establishment in 2000 as a member of Kawasaki Group.

FLUTEK also produces hydraulic pumps, motors and valves for marine and various industrial markets itself as a professional hydraulic manufacturer.

FLUTEK guarantees the best quality and reliability in all products by its rich technical knowhow and quality assurance system.

FLUTEK will introduce newly developed energy saving systems at KORMARINE Exhibition in Busan in October 2015 by displaying Motor control type steering gear, Electric deck machinery with wireless remote controller and Energy-servo system that can help



increase of efficiency, reduction of power consumption and noise.

FLUTEK quickly takes in high requirements of the market and its newly upgraded technology will make a great contribution for energy and labor saving as well as safety navigation in operation and management of the ship.

GE Marine to Showcase the Advanced Marine Technology at Kormarine 2015

GE Marine

Consolidating the expertise and leveraging the technology from GE's various business units, GE Marine is set to support the marine industry. This integrated approach makes GE Marine's offering simpler, more reliable and more cost-effective. GE Marine will demonstrate how it utilizes its cross-industry portfolio to provide value for shipyards, ship operators and owners at Kormarine 2015.

SeaLab and Vessel Performance Analyzer (VesPA) - GE's SeaLab combines the company's expertise and solutions to work

directly with naval architects and vessel designers to create better ships. Assisted by GE's VesPA, an analytic tool that provides real-time comparisons of multiple electrical configurations, a recent design investigation in GE's SeaLab has shown that careful system design reduced the installed power requirement by 25 % compared to the baseline design.

GE Marine Mapper (GEMM) - GEMM provides our experts with recent vessel location including details of installed equipment and ser-

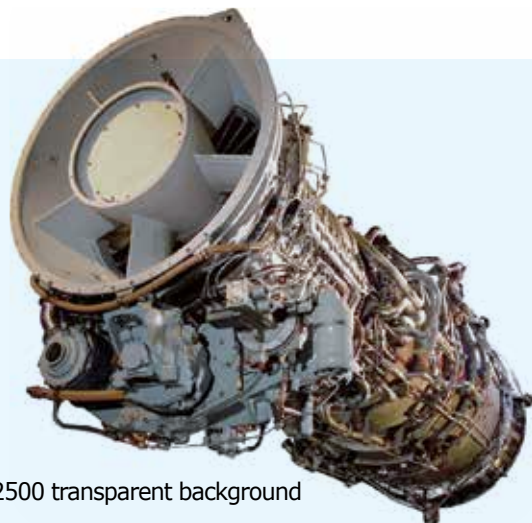


vice and maintenance data. GE's global network of local service centers ensures that you'll have the resources to prevent and correct issues.

SeaStream Dynamic Positioning (DP) - GE's mariner-friendly package of marine controls and displays acknowledges the unique skills and high expectations of the mariners operating the dynamic positioning system, allowing them to focus on ship handling rather than operating a complex system.

SeaStream Insight - SeaStream™ Insight is the latest innovation in marine remote monitoring and asset support. It provides a holistic view of onboard systems; allowing operators to access the true state of the assets. It offers remote monitoring capability which allows GE experts to understand problems in real time, reducing 3rd party service cost and enabling faster service. The predictive analytics enables predictive maintenance, reducing downtime and increasing customers' revenues.

250 Series Diesel Engine - GE is a leading manufacturer of medium-speed diesel engines. In our 250 series marine engine, we've combined the best features of earlier engine designs with advanced features to deliver efficiency, reliability and performance advantages. It also meets IMO Tier III in-engine, without the use of Selective Catalytic Reduction (SCR) or urea after-treatment.



LM2500 transparent background

Integrated Compressor Line (ICL) - ICL is a centrifugal compressor directly driven by high-speed electric motors for applications up to 15 MW / 20,000 hp. It delivers high efficiency and reliability, fast start/stop, low maintenance, low operating cost, and a much broader operating range compared to conventional compressors. ICL is the ideal compression solution when a small footprint and low noise level are important.

Korean shipyards are leaders in building vessels. GE sees tremendous opportunities in collaborating with Korean shipyards and marine companies, helping them retain their leading position.

Industrial Gasket for Oil & Gas, On/Offshore Plant

KUKIL INNTOT

In 1982, to reduce the dependence of overseas of the industrial product, Sealing, KUKIL INNTOT has been developing and cultivating the domestic Sealing industry in order to make profit by domestic production. We were first to achieve ISO9001 and API SPEC 6A standard certification among the same industry. By receiving various prizes such as "President Prize of New Technology utilization", "The best Trading man of the Month", "Chosen as Model for Minor Enterprise", "Excellent Minor Enterprise on Technology Competition Power", "and Bronze Medal in R.O.K. Technology Competition" we are in charge of developing the key industry outside and inside of the country.

PRODUCTS RANGE

- Gasket : Spiral Wound Gasket, Metal Jacketed Gasket, Ring Joint Gasket, Hiflex Gasket, Serrated Gasket, Non-Asbestos



Sheet Gasket, etc

- Packing : VOC Packing, Braided Packing, etc
- Insulation Kit : Insulation Gasket, Insulation Sleeve, Insulation Washer, etc

World-leading intelligent design - Intellian at KORMARINE 2015

Intellian

Intellian is the global leader in maritime satellite communication antenna technology, with a 35.6 % share of the market. A position confirmed earlier this year by the 4th Edition of the COMSYS Maritime VSAT Report. "Intellian now leads the market under a single brand having achieved spectacular results since 2012," the report comments.

The South Korean-headquartered company is the industry's fastest growing satellite antenna technology company, now in its eleventh year, having followed a sharp trajectory of growth since entering the market. Strategically located to deliver highly responsive customer service, Intellian has offices in Seoul, Irvine, Rotterdam, Southampton, Busan and Rio de Janeiro.

Serving a wide range of industries, including Commercial Maritime, Oil & Gas, Defense & Intelligence and Luxury Yachting, with a unique 3-year warranty on all product lines, Intellian has built on its success in the stabilized TVRO market to develop a varied and comprehensive range of antenna systems. Intellian's extensive technical capabilities cover TVRO, FleetBroadband and maritime VSAT, combining Multi-band and Ka-band RF technologies enabling High-Throughput Satellite (HTS) services, with a proven track record of delivering inno-

vation and technology that connects and inspires.

At KORMARINE 2015 Intellian will be showcasing their new GX terminals, designed for the world's first global high-speed broadband network – Inmarsat's Global Xpress. Intellian's full range of GX-ready products

feature a simple, intuitive, graphically-based antenna remote control software, which includes features such as remote management and control from anywhere in the world, and one touch commissioning. The GX100 and the compact GX60, currently the only one available on the market, will both be on display at the Intellian stand.

Intellian will also be exhibiting their FleetBroadband series, some of the simplest and smallest communications products in the marine industry today. With three different models depending on data speed required, the FB150, FB250 and FB500 open up global coverage using Inmarsat's dependable FleetBroadband network.



Global leading cable supplier for ships and offshore facilities

Kukdong Electric Wire

Nexans brings energy to life through an extensive range of cables and cabling solutions that deliver increased performance for our customers worldwide. Nexans' teams are committed to a partnership approach that supports customers in four main business areas: Power transmission and distribution (submarine and land), Energy resources (Oil & Gas, Mining and Renewables), Transportation (Road, Rail, Air, Sea) and Building (Commercial, Residential and Data Centers). Nexans' strategy is founded on continuous innovation in products, solutions and services, employee development, customer training and the introduction of safe, low-environmental-impact industrial processes.

We have an industrial presence in 40 countries and commercial activities worldwide, employing close to 26,000 people and generating sales in 2014 of 6.4 billion euros. Nexans is listed on NYSE Euronext Paris, compartment A.

Kukdong Electric Wire (Kukdong), a Nexans company, is the leading



cable supplier for the shipbuilding and offshore markets. Kukdong has developed and manufactured the cables used in ships and offshore facilities since its establishment and has gained reputation as the world's leading manufacturer and supplier of the onboard marine cables. Specifically, Kukdong has climbed to the high growth path in tandem with the domestic shipbuilding industry playing a key role in



the nation's economic growth.

The turning point for Kukdong came in 2003 when it became a member of Nexans Group, the world's leader in the cable industry, thus paving the way for another great leap forward. In particular, the merger between Nexans and Kukdong has created synergic effect for both companies. Nexans has become the undisputed leading company in the field of marine cables used in ships and offshore facilities and expanded its production base in Asia, the world's fastest growing region. That is consistent with the Nexans Group's policy for scaling up investment in the developing regions and growing markets.

Meanwhile, Kukdong has been allowed to have access to the latest

technology, global sales network, advanced business management techniques of Nexans, which are essential for the company's transformation into a global company. As a majority of ship owners are concentrated in Europe, Nexans which is already registered as a vendor is better-positioned to enter European markets than unregistered domestic companies. In addition, Nexans can deliver whole products in full package much faster through its plants worldwide.

There are 4 Nexans Research Centers in Nexans Group and one of them is located in Jincheon which is the only one built out of Europe area. NRC Jincheon is specialized in rubber compounds and contributes to drive innovative products.

Winner of rectangular connectors & high density solutions

NICOMATIC

Nicomatic is a French family SME business created in 1976. Today, all products are manufactured in-house with special expertise in stamping, moulding, screw-machining, assembly & cabling.

Nicomatic is a recognized player in the connector field specializing in niche markets with miniaturized rectangular connectors and high density solutions (2 mm pitch) for harsh environments, low profile MIL connectors, cabling for harsh environment and FFC flat cables. Our main markets are avionics and defence industry for marine, air force and army. For marine industry, we are specializing in rocket ship and submarine.

Nicomatic is successfully certified EN9100 with a 100 % mark at its first attempt for all company processes. The company further demonstrates its capability to serve defence and aerospace markets.

Nicomatic places a fundamental importance on quality & services on a global level and delivers its standard products & modular product ranges -



millions of part numbers - in less than a week to everywhere in the world!

In 2014, Nicomatic launched Korean Subsidiary in Seoul to provide technical and commercial support. South Korea has undertaken several Defense modernization programs and Nicomatic wishes to help our local partners succeeding in their projects.

PANASIA opens the Mi-eum Era to Make its way up once again

PANASIA

PANASIA announced that it had moved its operations to the new company headquarter located in the Mi-eum Industrial Complex at the end of last December and celebrated its 25th anniversary and the opening of Mi-eum headquarter before kick starting of the operation. PANASIA expects to improve its efficiencies in production and quality managements, as well as profitability and productivity by

combining its head office, parts manufacturing facilities, and R&D center which had been dispersed over Busan, Gim-hae, and Ji-sa Science Complex, respectively.

As of August 2015, in preparation to meet the surge in demands for BWTS, in line with the execution of Ballast Water Management Convention of International Maritime Organization (IMO), endorsed

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by 44 countries, which accounts for 32.86% of the global fleets, PANASIA has increased its manufacturing capacity to meet demands for 1,200 vessels a year by integrating the advanced core components facility and the assembly production line. PANASIA's strategic move improved its competencies in many areas such as productivity, cost reduction, high product quality, and shortened delivery time.

PANASIA did not just expand and improve its manufacturing capabilities. PANASIA designed and built its new headquarter in many ways that everyone at PANASIA can reach their full potential while enjoying their work environments and has named its new building "Happy Work Campus". In addition to many welfare and recreational facilities, which include a dormitory, a fitness center, and indoor golf range, a maternity and nursing room is available for female employees at the new headquarter. A multi-purpose hall, which may be used for events and performances, educations and trainings, as well as a staff cafeteria is also in operation. With an objective to provide its employees with comfortable, yet environmentally friendly working atmosphere, PANASIA equipped its new headquarter building with the latest renewable and energy saving technologies such as solar power generation systems, LED lightings with as much natural lightings as possible, and power-saving 'ondol' floor heating, system.



PANASIA, which has been actively participating musical performances at exhibitions at home and abroad with a concept of combining technology and art, has made being in harmony with the environment the first priority in its newly constructed buildings by integrating as much natural environment of the Mi-eum Complex as possible into its building designs and implemented such traditional Korean architecture styles as 'kiwa damjang', slate tiled fences, and 'palgakjeong', octagonal pavilion. 'Biyeong', an installation art designed by Professor Mr. Seong-min Hong of the department of architecture at Pukyong University, has been featured at the guest house of the Mi-eum Headquarter to represent PANASIA's soaring to the new future and this is expected to become the new icon of PANASIA.

Showcase Remote-I/O-Systems at Kormarine 2015

PEPPERL+FUCHS

In KORMAINE 2015, PEPPERL+FUCHS showcase of Remote-I/O-Systems. The Remote-I/O-Systems presented on theACHEMA enable conventional field devices to be connected at control level via a serial bus.

Remote-I/O-Systems take into account the requirement to "gather" the input and output points in the field near the sensors and actuators. As a result, these systems are often installed in hazardous areas in Zone 2 or Zone 1.

Remote-I/O-Systems represent a way to migrate from old to new technology and make it possible to "switch" from one technology to the other. In doing so, remote I/O devices capitalize on the benefits of fieldbus technology and the conventional wiring setup.

The spectrum of applications for remote I/O in process automation ranges from the chemical industry, petrochemical industry, and oil and gas industry (both onshore and offshore) to the pharmaceutical industry, process industry, food and beverage industry, and water treatment

industry, all the way through to hazardous areas in machine and plant engineering.

Intelligent Approach to Modernization

Remote I/O systems from Pepperl + Fuchs make it considerably easier to modernize process control systems, and provide remote access to HART field devices for increased monitoring and diagnostic functions. The existing field devices can usually be retained and even their wiring can still be used. For more extensive changes to systems with decentralized remote I/O stations, the systems save on wiring, technical project planning, and assembly costs.



Global leader for fire-retardant solutions certified with J-90 and H-120 classes

Remitite

Remitite has developed and supplied world top class fire-retardant and non-flammable solutions and materials for major domestic and overseas shipbuilding and offshore plant projects.

All of the Remitite products have class certificates by major certification societies such as MED, ABS, BV, DNV, LR, and KR. There is a total of about sixty certificates. Especially, EDT-629, our recently developed product is the only fire-retardant solution in the world which has both J-90 and H-120 class certificates.

Remitite has been recognized as a highly reliable leading edge manufacturer in the areas of shipbuilding and marine plants through many projects including Goliat, Teekay, BP (Q204), and Barzan.

The products we supply to major shipyards worldwide are:

- Cable & Pipe Penetration Sealing System : RS-105&RRS-15
- Putty Type Sealing Compound : FS-7200
- Fire-retardant Sealant : Si-701
- Non-combustible Sealant : HFS-90
- Elastomeric Bearing : EB-153
- Flexible Fire Seal Joint : EDT-629
- Fire-retardant, Anti-noise & Anti-vibration Device : FS-X1
- Vinyl Sheet & Carpet Adhesive : RF-7077
- Ceramic Tile Adhesive : GME-90

All products listed above are manufactured in the southern part of



EDT-629: Excellent for pipe penetration seals, escape tunnel seals, hatch seals in various sizes and shapes with fire protection ratings of J-90 and H-120.

RS-105&RRS-15: Excellent cable and pipe penetration sealing system with intumescence and heat absorption properties certified for A-60 and H-120 classes.



FS-7200: Excellent for sealing cable coamings, wire's bottom panel and control board with A-60 class.

Korea providing major shipyard customers the advantage of just-in-time delivery. Remitite's oversea branch, Remitite Singapore Pte. Ltd., has been setup in order to meet international customer's needs and expedite delivery service.

New OptiSIS Solution for Safety Instrumented Systems

Rockwell Automation

In KORMAINE 2015, Rockwell Automation showcase new OptiSIS solution, giving industrial operators a pre-engineered safety instrumented system that can help ease deployment and reduce lead times for small and midsized process applications.

The OptiSIS solution is ideal for oil and gas, chemical and petrochemical producers with aging process-safety systems that are either noncompliant or can no longer be maintained.

"Replacing or upgrading a process-safety system using a custom-engineered approach can be costly and time-consuming," said Mark Eldredge, Packaged Solutions program manager for Rockwell Automation. "The OptiSIS solution can reduce lead time by more than 30 percent, leading to faster and more cost-effective safety instrumented system deployments."

The OptiSIS solution is designed for safety instrumented system



applications of 50 or 100 I/O points, including emergency shutdown (ESD) systems, burner-management systems (BMS) and high-integrity pressure protection systems (HIPPS). The version for applications of up to 100 I/O points will be available in the fourth quarter of 2015.

The pre-engineered OptiSIS solution is delivered ready to install, wire and configure, shortening the overall engineering time and eliminating the need for any programming. Users need only enter their logic scenarios into the system's cause-and-effect graphical interface. The configurations are tested and can then be stored for verification against original safety function requirements – or used at a later date to restore the system to a known state.

Flexible inputs and outputs help confirm that the system accommodates a varying mix of digital and analog I/O types. Additionally, simplex I/O and fault-tolerant (dual) I/O versions are available to address different redundancy needs.

The system meets requirements up to Safety Integrity Level 3 (SIL



3) and is compliant with IEC 61511/ISA 84.00.01.

It uses ready-to-install, TUV-certified hardware and validated application software.

Supplying Superior Copper, Copper-Nickel Pipe Fittings and Flanges

SAMYANG METAL

Founded in 1981, Samyang Metal has been recognized widely ever since as a leading manufacturer of copper and copper-nickel pipe fittings and flanges. It was ISO 9001 and ISO 14001, OHSAS 18001 certified in 1998 and 2012, respectively, and has received approval certificates from ABS, DNV, LR, and BV. As an approved vendor, Samyang Metal has worked side by side with major heavy industries in Korea in offshore, onshore, and shipbuilding projects all over the world.

Samyang Metal's copper-nickel alloys products are widely used in shipbuilding and offshore projects as well as other marine applications due to their resistance to seawater corrosion, erosion and bio-fouling.

Samyang Metal produces seamless butt weld fittings from seamless tubes and pipes either by hot or cold extrusion, forming, forging, machining, or by a combination of two or more of these operations. Its seam-welded butt weld fittings are produced from hot or cold rolled, annealed or pickled sheet or plate, formed into half shells or segments and longitudinally seam-welded.

The company forms its composite weld-neck and composite slip-on flanges from components, an inner flange (welding collar) in



Cu-Ni 90/10 or Cu-Ni 70/30 and an outer flange in carbon steel. Composite blind flanges are produced from a carbon steel blind flange welded with a machined disc in Cu-Ni 90/10 or Cu-Ni 70/30.

Its solid flanges in Cu-Ni 90/10 or Cu-Ni 70/30 are produced from bar or plate by hot forging and machining. The use of solid silver brazing flanges in integral silver brazing alloy rings means that under normal circumstances there is generally no need for socket feed with additional brazing alloy.

Samyang Metal has continued to pursue excellence, as shown by its superior quality products, highly skilled staff, and on-time delivery service.

Incomparable Quality, Innovative Production, Double Wall Gas Pipes

SUNGMOON

As the importance of globally tightened environment regulation and fuel efficiency has been emphasized, a focus of the marine engine industry is concentrated on eco-friendly and high efficiency fuel gas. Consequently, SUNGMOON, a specialized manufacturer of fuel gas supply pipes, is preparing for its leap into the world markets.

SUNGMOON has been delivering Double Wall Gas Pipes manufactured by its own developed extruding method for Wärtsilä 50DF engines over the years. Recently, SUNGMOON has also achieved developing Chain and Helix high-pressure fuel gas pipes for the ME-GI engine of MAN Diesel & Turbo, and invented bending machine for manufacturing the Chain and Helix Pipes. It will be a revolutionary technology which facilitates the standardized mass production, and currently, the patent application was completed. Recognized as having its independent technical expertise, SUNGMOON has been producing and delivering the Double Wall Gas Pipes for HIMSSEN engines to HHI-EMD and the fuel gas supply pipes connecting to LNG engine from the FGSS to Hyundai Shipyard as well as for MAN 28/32 DF engines to the STX engine.

Those pipes are not all of SUNGMOON's business areas. To keep pace with the increase of global demand for LNG and the rise of LNG's importance, SUNGMOON started developing the regasification System for LNG FSRU. In addition, SUNGMOON launched a brand named 'MODU' as part of the marine environment management project, and developed a marine waste crusher by its own as the first product.

According to a completely revised IMO MARPOL ANNEX V (Prevention

of pollution by garbage from ships), the discharge of marine waste from ships is completely prohibited except in some conditions. Consequently, as it is inevitable to unload generated waste, additional problems occur such as lack of waste loading space and unloading cost. It is SUNGMOON's 'MODU' marine waste crusher that can solve those problems all at once.

As this product was designed by taking into account the voltage tailored to the ship environment, crushable materials, size, etc., the volume of various wastes generated from ships can be effectively reduced. As of now, SUNGMOON completed the supply contracts of this crusher with major shipbuilding companies and marine companies at home and abroad, and will also release the additional marine environment related product lines.

As SUNGMOON entered even the marine environment management market, the company is no longer the firm limited to the business of marine engine parts. We expect carefully that SUNGMOON, which aims for the global enterprise leading the trend through various business lines, can impact greatly on the shipbuilding & offshore plant industry market.



LNG plus 'one-stop-shopping' can help South Korean shipyards survive slump

Wärtsilä

The shipbuilding industry continues to suffer from the dual impact of vessel overcapacity and the fall in oil prices, which has brought offshore investments to a virtual standstill. The latter has been particularly painful for South Korean yards, with the result that losses and lay-offs have been felt by even the bigger yards. This, in turn, is having a 'knock-on' effect on providers of marine solutions.

Wärtsilä, the leading supplier of products, solutions and services to the marine sector, is one such company being affected. However, according to Hans Laheij, Area Sales Director – Wärtsilä Marine Solutions,



Wärtsilä 31 engine



there is a silver lining to the current cloud hanging over the industry. "It is vitally important for South Korea to have a strong shipbuilding sector, and I see two developments that can help yards survive the current situation and return to good profitability," he says. "The first is the accelerating switch to gas fuel propulsion. This is creating a strong demand for LNG carriers, and is likely to lead to the need for other merchant ship newbuilds with dual-fuel capability. The second factor that can help yards speed up project completions, reduce risks and most importantly, save costs, is the fact that 'one-stop-shopping' is now more than ever before possible. Wärtsilä offers everything from Ship Design to propulsion machinery, electrical and automation systems, pumps and valves, environmental solutions, and total integrated system packages".

Gas is the fuel of the future

There can be little doubt the movement to gas fuel is a tide that won't

be turned back. This progression of merchant shipping into the gas age is, to a large extent, being driven by increasingly stringent environmental regulations that are having an impact on the industry. Here again, Wärtsilä has a strong edge over its competition since it has developed an unmatched offering in both gas propulsion, storage, and supply systems, as well as in environmental solutions.

Wärtsilä 50DF dual-fuel engines were fitted to the first LNG carriers in 2006. Today, more than 65 percent of all such vessels are fitted with Wärtsilä DF engines. South Korean yards have some 80 percent of the current order book for LNG carriers, and the Wärtsilä Hyundai Engine Company (WHEC) joint venture has played a key role in cooperating with yards to develop the use of dual-fuel technology. At the same time, the Wärtsilä 34DF dual-fuel engine has become established as the industry standard for auxiliary applications in the LNG Carrier segment with a market share exceeding 70 percent.

A Grand Announcement of DNV Type Approved Offshore Container Lifting Shackles

YOKE Industrial

In KORMAINE 2015, YOKE Industrial, a market leading designer and manufacturer of lifting components for the oil and gas industry, is excited to announce the launch of its new range of DNV Type Approved Grade 6 and Grade 8 lifting shackles. The bolt, nut and cotter shackles meet DNV Standard 2.7-1 Offshore Containers Specifications and DNV 2.7-3 Portable Offshore Units and come complete with certification.

The new range of DA™ (DNV Approved) Shackles meets the demanding requirements of the offshore industry, including impact strength of 42J @-40C (DA808). The shackle range DA838 (Grade 6) and DA808 (Grade 8) are closed die forgings, ensuring you receive the performance characteristics and clear embossed markings demanded, for ease of identification for years to come. These markings have become the Riggers choice, and offer you the assurance you need from a forged shackle. YOKE DA™ Shackles also comply with the European Standard (EN13889), USA Federal Specifications (RR-C-271F Type IVA Grade A, Class 3) and other international and national standards. YOKE DA™ Shackles can also be used in your other day to day lifting applications, giving you the confidence for each and every lift.

There is no longer a need for you to carry dual stocks of different shackles; DA808 and DA838 give you the solution to all your needs.

YOKE DA™ Shackles also offer the highest design factors in the industry, up to 8:1 (DA808), ensuring that you have confidence in every lifting

application, even in the harshest environments. Each shackle is supplied with certification as required by DNV. Traceability from the raw material, through the production process to the finished product. YOKE DA™ Shackles are clearly

embossed with the YOKE brand, WLL, size, traceability code, grade and CE mark. The bolts are also clearly embossed with the YOKE logo, traceability code and grade. Each shackle is hot dipped galvanized to ensure performance in the harshest conditions. Riggers in the industry have long recognized the benefits of the strength, ductility and impact properties of a closed die forged shackle. Embossed markings ensure easy and clear identification for years to come, and traceability against your DNV Offshore Container certificates reduces overall rigging cost.

YOKE continues to develop its range of lifting products for critical lifting applications, be it for energy, cold temperature environments, construction, manufacturing, ship building and other demanding industries who continue to call upon YOKE to work with them to provide a safe lifting solution. "Safety is our first priority"





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Speeding up the future of engineering automation solution: Era of 3xE has arrived!

Intergraph, which spearheads modernization of shipbuilding and offshore industries, held Intergraph PP&M Korea 2015 Conference in Seoul on September 3. This event attracted about 450 domestic engineers and officials. MONTHLY KORSHIP had an interview with Franz Kufner Executive Vice President, Melanie L. Eakes Executive Vice President at the event site.

Intergraph PP&M (Process, Power & Marine), world's leading supplier of engineering automation solutions, has developed innovative technologies finding wide-ranging applications in various industries including shipbuilding, offshore, petrochemical, power generation industries.

Intergraph PP&M Korea 2015 Conference, an annual event, has provided unique platform to provide engineers with latest information and success cases related to engineering automation, helping

them keep their fingers on the pulse of industrial trends, new technologies, etc. The event began with presentation themed '3xE Era: Future of global energy projects' by Franz Kufner Executive Vice President/Intergraph Asia-Pacific, the keynote speaker. He said, "We are at a watershed moment for industrial ecosystem shaping our industry. We are seeing an integration of discrete solutions and its ramification to all of us including owner/operators, EPC, shipbuilding and offshore industries. This event will provide a new window into what kind of values have been delivered to customers leveraging the capabilities provided by an array of technologies and solutions that Intergraph has developed."

Q: What are strategies of Intergraph to accommodate trends of global oil & gas market?

A: (Franz Kufner) Growth has slowed down in oil & gas market, compared to last year, as a result of curtailed investment in offshore development due to low oil prices. Oil segment has seen deepwater drilling cost overruns resulting in weak investment. International major oil companies will postpone investment until oil price rebounds back to about USD 80 per barrel range from

current level of \$40 per barrel. That does not show the interest in offshore development tapered off. We are just seeing different investors and different nature of investment. Intergraph is providing breakthrough solutions, such as new technologies and engineering methods required in oil & gas industry, responding flexibly to changes in market by working closely with customers and partners.

(Melanie Eakes) As the industry is pushing boundaries of innovation, customers or corporate owners want to keep costs to a minimum through streamlined operation, maintenance, and repair of oil & gas production facilities. Number or data tell a clearer story. This has been the focus of Intergraph in pushing forward solution development and technical support.

Q: This year, major Korean shipyards also ran into huge deficits in offshore plant sector. What are fundamental problems, uncovered by media, from the perspective of Intergraph?

A: (Franz Kufner) Intergraph is putting an emphasis on 'Processing Influent' to find a way out of current crisis. For that, we are focusing on technical support that can help Korean customers



Franz Kufner Executive Vice President/Intergraph Asia-Pacific PP&M

achieve even better quality and higher productivity. Intergraph's innovative solutions, including Smart3D, SPP&ID, PDS, etc., provide capabilities for managing the data from overall offshore projects (data comparison and analysis). If whole processes ranging from Front-End Engineering Design (FEED) to handover are seamlessly linked, I think that problems in offshore plant segment can be resolved easily.

(Melanie Eakes) The integrated solutions of Intergraph enable omni-directional data integration, ensuring data consistency. That will result in higher engineering efficiency and better quality, ultimately driving costs down. For instance, P&ID data can be converted to 3D data through SPF (SmartPlant Foundation) to increase ease of comparison and analysis, making it easy to figure out problems.

Q: How strong is Intergraph's momentum of growth in shipbuilding/offshore markets?

A: (Franz Kufner) Intergraph is expected to continue on double-digit growth path this year, riding the momentum created last year. We are seeing a steady upturn in number of customers looking for our solutions, and have maintained stronger relationship with partners every year. That has been the growth engine for Intergraph. In global market, more sales have been generated from shipbuilding market, spurred by robust sales in LNG carrier, cruise ship, warship segments, etc., than from offshore market. Investment also seems to have taken a dive in offshore market. Regionally, Korea remains very important market for Intergraph. Clearly, Asia is the largest

sales market. Besides, sales growth has picked up in Asian market, such as Japan and Vietnam.

Q: What project stands out among projects driven forward by Intergraph this year?

A: (Franz Kufner) Intergraph has been geared towards integrated operations with partners. Specifically, Intergraph is putting primary focus on 3 areas: precise forecast, swift production plan, and technological improvement. Particularly, Intergraph is expanding its reach into EPC (Engineering, Procurement, Construction) market. Intergraph has been involved in offshore project led by INPEX, Australia's resource developer. We have been proceeding with global energy development projects of various scales, including a project in South Africa, since early this year.

Q: What is key driver for Intergraph's robust growth in shipbuilding/offshore markets? What makes Intergraph set itself apart from others?

A: (Franz Kufner) A growing number of ship owners and EPC contractors have been flocking to Intergraph's solutions applicable to shipbuilding and offshore markets which are quite challenging markets. That is because there are only a few companies that recognize importance of data and provide solution-based technical support as extensively as we do.

(Melanie Eakes) Additionally, Intergraph provides an array of solutions integrated into single package increasing ease of use, adding appeal to Intergraph's solutions. As mentioned before, there are myriads of advantages provided

by integrated solutions. In particular, one-stop solutions are very likely to gain ground in the market, considering the time and cost of building vessels or offshore facilities.

Q: You stressed 3xE model in the keynote speech. What is the meaning of that model?

A: (Franz Kufner) In Intergraph PP&M Korea 2015 Conference, we wanted to send a message that our focus was beyond technology development. 3E models mean E1 (Ecosystem, the infrastructure or environment to deliver a seamless experience to our customers), E2 (Expertise, all the knowledge that we bring to our partnership with each customer), and E3 (Engagement, ongoing partnership with our customers).

In the 3xE model, we work together with our customers to deliver outcomes that benefit them, rather than the traditional B2B approach of selling products



Melanie L. Eakes Executive Vice President/Intergraph Global Support & QA/Smart 3D Solutions Development PP&M



3E Model

and services. To provide what is of most value to them, we must be much, much closer to our customers and truly understand their businesses and circumstances. In today's economic climate we have to do more than deliver

products or solutions and leave the responsibility to achieve the required results solely to the customer. 3xE is not a new product or solution. It is a new customer engagement model.

One of successes built on 3E is eVision which provides special applications such as LOTO (Lock-out/Tag-out), O&M space. That reflects huge importance of lifecycle data management when interoperability is required among safe operation solutions, e.g., SmartPlant Fusion, SmartPlant for Owner Operators (SPO), and eVision. Only in that way, reliability of technical data can be assured in day-to-day operation. Those complementary solutions have brought benefits to cus-

tomers of both eVision and Intergraph.

Q: What are Intergraph's plans for the future?

A: (Franz Kufner) Communication with customers will be the most valuable in the future. Our primary goal is to add momentum to our co-growth with acquired companies or partners through synergic effects, rather than simply seeking profits. Moreover, lifespan of vessels or plant facilities has taken on an added importance from standpoint of technology development. So, we will move ahead with deployment of workforce and resources needed to place more focus on maintenance and repair. ⚓

The Maritime CIO Forum at Kormarine, 22 October 2015

Following a successful series of events in Rotterdam, The Netherlands and Oslo, Norway, this highly targeted one day conference will take place on 22 October, during Kormarine 2015 at BEXCO in Busan, the biggest International Marine, Shipbuilding, and Offshore show in Korea.

The Maritime CIO Forum series of one-day events have been developed to address the issues and trends that technology leaders face in an increasingly changing and continuously developing business environment. CIOs in the maritime sector are expected to deliver strategies capable of both driving revenue and reducing costs for their organisations. Now that their role is taking on an ever more strategic focus, CIOs need to strengthen their leadership skills while remaining at the forefront of technological breakthroughs and contributing to the business – all the while making smart decisions about maritime technology and satellite communications selection, investment and implementation.

As well as a focus on satellite communications and technical developments, this one-day forum will also address strategic and practical challenges that all companies are facing at present - such as:

- How is innovation in maritime communications driving the future of shipping?
- The Digital Age - maximizing efficiencies with next generation solutions for the maritime market

- The future of unmanned vessels
- Innovating and investing in the industrial Internet of Things (IIoT)
- Big data and analytics to drive innovation, competitiveness and growth
- Putting information security onto the boardroom agenda
- Can the cloud lift global trade?
- Future-proofing your IT infrastructure
- Harnessing disruptive innovation in the maritime sector
- And more



Highly targeted, the Digital Ship Maritime CIO Forum @ Kormarine will consider the future of shipping and how the CIO's role can influence sustainability and competitiveness in a fast paced and ever changing maritime environment. It will provide an opportunity for some of the industry's leading technology experts and business heads to discuss and debate the on-going role of IT and communications in the shipping industry and help to solve the technology, leadership and business challenges ahead.

The role of RS has become increasingly enlarged



Russian Maritime Register of Shipping (RS) is one of the leading international classification societies established back in 1913 and authorized by 70 maritime administrations of flag states.

Currently about 6 billion USD value of Russian new building projects are progressing at Korean major shipyards. Last year, RS signed a class agreement with Samsung Heavy Industries for 6 units of 42,000 dwt Arctic shuttle tankers. As more arctic vessels are operating in cold environment, RS plays an important role in connection with the regulations of ice-class vessels, cryogenic thick plates and so on. Also, Daewoo Shipbuilding & Marine Engineering won 15 units of ice-breaking 172K cubic meters LNG carriers for Russian Yamal project. Korean steel makers had fierce competitions to supply cryogenic thick plates for the tankers with certifications awarded from RS. Moreover, 1 unit of ice class LNG FSRU at HHI is scheduled for delivery by 2020 and more new building projects such as ice class oil tankers and condensate oil/gas carriers will follow. All these projects are constructed under the RS supervision and certification.

Considering the increasing trend of global gas demands, Russia is expected to be more active in offshore energy development. Russia government has long term plan to develop onshore and offshore oil and gas fields in Russia and it requires massive new building fleets and facilities with high technology and efficiency. Thus, the role of RS is anticipated to be



greater as demands for offshore facilities and vessels are increasingly growing for oil and gas development in Russian arctic region.

Regarding Far Eastern Shipbuilding and Ship Repair Center (FESC) being constructed at Far East region of Russia, Russian President Vladimir Putin reiterated that the shipbuilding cluster in the Far East is expected to become a major production center for building and servicing vessels of various classes. Most of ships and facilities to be operated in Russia require ice class or Arctic class measures including winterization of the vessel.

Meanwhile, in order to increase the work activities of RS Korea, a new Korean Business Development Manager joined

recently and he will work for introducing of RS activities and marketing to contribute the exports of Korean equipment to Russia and also successful construction of Russian vessels through providing more convenient classification services and smooth cooperation with Korean clients.

RS Korea will open a booth located at 5H17 of 5 Hall in Bexco Exhibition Center during KORMARIN 2015. With providing active customer services, RS Korea will also hold a seminar to introduce the future direction of Russian shipbuilding industry, the outline of projects by 2030, the activities of RS Korea, the approval procedure of plan and equipment at Centum Hotel on the 22nd October (Thursday afternoon). ⚓

World Ocean Forum 2015, "Footprint 70 years and Forecast 30 years of Maritime History"

Commemorating the 70th anniversary of the liberation of Korea from Japanese colonial rule, the 9th World Ocean Forum 2015 recalls the trajectory of Korean maritime affairs and foresees the coming 30 years of the clean ocean era.

The 9th World Ocean Forum, the largest ocean and maritime issue-related forum in Korea-will open at the BEXCO in Busan, Korea, from 20 to 22 October. Celebrating the 70th anniversary of the liberation of Korea, the WOF 2015 will explore the post-independence and post-World War II Korea's maritime affairs that will enable and encourage greater awareness in climate change and environmental crisis as well as future strategy for next three-decades of the clean ocean era.

More than 2,000 people, representing global maritime business, international agency and expert group are enrolled to take part in the event, which has the theme "Footprint 70 years and Forecast 30 years of Maritime History". This year's event is co-hosted by the Ministry of Oceans and Fisheries, Busan Metropolitan City and Busan Ilbo, and organized by the KAMI (Korea Association of Marine Industry).

Alongside the WOF 2015, the Marine Week-one of the three global shipbuilding & marine industry exhibitions-and the Kormarine Conference- shipbuilding industry and marine equipment show-also will open at BEXCO and they will provide an opportunity to share

knowledge and to build a business network among participants.

Following the Opening Ceremony on October 20, the Secretary General-elect Lim Ki-Tack of the IMO will deliver a keynote speech, "IMO's Role for Sustainable Development and Use of Ocean". IMO, as a special agency of the United Nations, is the international standard-setting authority for the maritime governance, environmental protection and transportation policy, and Mr. Lim is the first Korean to run for the office.

- *Energy & Resources*
- *Assessing Ocean Policies of China, Japan and Korea for 21st Century*
- *Environment-Climate and Ocean Science*
- *Fisheries Management*
- *ICAV International Conference on Arctic Vision 2015*
- *Green Technology, Green Opportunity*



Also, the participants are scheduled to attend a series of six sessions that includes four key sessions for marine industry (Energy & Resources; Ocean Policy & Ocean Strategy; Environment-Climate & Ocean Science; and Sustainable Green Fisheries & Aquaculture), and "International Conference on Arctic Vision 2015" and "Kormarine Conference 2015".

Furthermore, the special sessions under the "Re-architecting Marine Policy under the UN Post-2015 Regime" and "Port Repositioning for Value Creation" will be hosted by KMI (Korea Maritime Institute) until 22 October. ⚓



선박엔진 온실가스 및 배출가스 (NOx, PM) 저감 기술

연료 첨가제 국산화에 성공한 테크노바이오가 기존 제품과 비교한 성능 테스트에서 합격점을 받았다.

1995년 설립된 연료 첨가제 전문업체인 테크노 바이오는 끊임없는 연구개발을 통해 우수한 연료첨가제 제품을 생산하고 있다. 테크노 바이오의 연료 첨가제는 유용성 유기칼슘화합물을 기본으로 한 제품으로 타사의 제품에 비해 연료 절약 및 오염물질 저감능력이 우수하며 환경친화적인 제품이다. 그 동안 영국 Innospec, 미국 Drew, 일본 Nippon Yuka, 미국 Nalco Fuel Tec에서 각 종류별 연료 첨가제(Fuel additive)를 생산해 전세계에 보급해왔다.

테크노 바이오는 중소기업청 기술개발사업(구매조건부 신제품개발사업)을 진행해 수요처 한진해운과 위탁연구기관 한국선급이 참여한 가운데 신제품 개발사업을 최근 완료했다. 이 연료 첨가제 Power-Z는 다양한 성능 테스트에서 해외 유수의 제품과 비교해 결코 성능이 떨어지지 않으며, 오히려 뛰어나다는 평가를 받았다.

사실 연료 첨가제의 대한 조성과 연소 촉진성, 분산성 연구에 대한 대외 발표 자료는 흔치 않으며, 선박엔진에서 표준화된 측정장비와 계측장비로 PM 및 NOx 저감효과를 객관적으로 검증한 보고서도 없다. 특히 연료 소모율을 ISO3046 기준 성능시험을 수행한 사례는 전무하다.

테크노 바이오는 이 신제품 개발사업을 통해 ISO3046 CODE 기준을 적용해 국내 최

평가항목	평가방법	인증기준	평가 결과	
			테크노바이오	해외 제품
PM(DUST)	대기오염공정시험기준(mg/m³)	평균감소율	-58.8%	-39.9%
NOx	대기오염공정시험기준(PPM)	평균감소율	-27.34%	-17.85%
연료소비율	ISO:3046 시험성적서(g/kWh)	평균감소율	-2,157%	-1,147%

■ 내연2호기 소기실 상태 비교(Power-Z 사용 전/후)



Power-Z 사용 전(NO.5 실린더)
사진 : 2014.3.12 오전 10시 촬영



Power-Z 600시간 사용 후 사진

■ 내연2호기 피스톤 상태 비교(Power-Z 사용 전/후)



Power-Z 사용 전(NO.5 실린더)
사진: 2014.3.12 오전 9시 56분 촬영



Power-Z 600시간 사용 후 사진

초로 성능 시험을 시행했고, 제주도 화력발전소의 내연 2호기(중유 40,000kWh/day 160톤 소모)를 실험설비로 기존 해외 제품과 비교 테스트를 하여 더 우수한 성능 결과를 얻었다. 또한, 뛰어난 기술력과 기술개

발에 대한 열정으로 국책사업을 성공적으로 수행하여 (주)한국중부발전으로부터 동반성장우수상을 수상했다. 🚢



The winch application lab in Helsinki lets customers test winch drive requirements and performance with a real motor load.

Today's electrical deck winch control solutions deserve a deeper look

Next-generation electric winches are rapidly being adopted on marine vessels, replacing the older hydraulic and early electric units. Imagine electric anchor/mooring winches with no hydraulics, motor encoders, gearbox load cell sensors or external controllers. ABB has them today, certified for marine use and speaking deck machinery language.

ABB

Deck machinery winches for anchoring and mooring are fundamental equipment on all marine vessels, with hydraulic-oil-driven winches traditionally being used. Winching operations are very challenging since a slack mooring or anchor line with almost zero tension at the start has to, in just a few seconds, deal with torque rapidly racing to extreme levels. To properly maneuver and secure high-mass marine vessels moving on the water surface, it is vital to have precise and 100 % reliable control of the

huge torque forces at work.

Hydraulic oil still dominant, until now

Electrical three-speed winch motors with contactors have existed already for many years, as have electrical VSD (variable speed drive) solutions with basic functionality. Although these



Figure 1. The winch drives were developed from a combination of several winch manufacturer's needs and requirements.

first-generation electrically-driven winches offered improved control and positive environmental benefits, they were not widely accepted. The DOL (Direct on Line) motors with 3 motor windings for low-middle-high speeds had limited success, as did the early VSD design which included a PLC with winch application, motors with encoders and tension control via load sensors.

Drawbacks of this first generation included costly motors with three windings, a high starting current, high noise, and the requirement for electrical cabinets with contactors for each set of windings in the motor. In addition, external control via old control cards raised questions about support, maintenance and spare parts. On the early VSD winches, external PLCs, encoders and load sensors made the systems complicated and sometimes unreliable.

The result, until recently, has been that older hydraulic systems have so far been maintained by approximately 70 % of the worldwide marine vessels. This is understandable considering the fact that winch builders, and of course ship owners, are extremely careful with their multimillion dollar vessels and cargoes. This clearly is not a place where new things are tested before they are first well-proven with years of experience on both the hardware and software. To create a smart, secure, drives-based solution for deck machinery, ABB decided to take a different approach.

Smart, fully-integrated electric winch control

"To successfully break into the electrically-driven winch sector, and displace the older hydraulic technology, we realized we needed to offer more than basic products like drives and motors," explains Mikael

Holmberg, ABB's marketing manager for marine winches. "To really gain the confidence of the deck machinery builders and ship owners, deep application experience and expertise was required."

To win that confidence, ABB has been developing a new integrated drive-motor-control approach for anchoring, mooring and other deck winches since 2007. Working side-by-side with many of the biggest winch manufacturers on the deck machinery market, ABB gained considerable insight into ways to use its own world-leading expertise in drives and motor control.

The result has been a new winch concept, much different from the previous electrical attempts. Based on ABB's direct torque control (DTC) platform, precise motor control and operation is achieved without any encoder or load cells, at full torque, over the whole speed range.

Marine certified, speaking marine language

"On top of the motor control, we created a specific winch control application in cooperation with the leading OEMs. So we studied real market requirements and implemented them in the drive, tailoring both the hardware and software to maritime vessel operations, speaking a very understandable marine winch language," continues Mikael.

"In addition, ABB drives and motors have marine certification which has been critical role in gaining acceptance of new maritime machinery and technology."

This is good news for vessel operators since the driving force to move away from hydraulic piping, namely high maintenance and environmental damage due to oil leakages, is still there. With the newest generation of electrical winch systems greatly simplifying control and clean operation, the marine market is clearly taking a second look at electrical solutions, specifically the ABB DTC platform.



Total winch control built in the drive

Clear user benefits come from all key features being built directly into the new ABB winch drive. “By putting the winch application inside the AC drive and eliminating the external devices,” continues Mikael, “we simplify the system enormously. This achieves precise VSD motor control and auto mooring/tension operations internally, without costly and troublesome encoders, load cells or external controllers. This, in a nutshell, is why we are now rapidly gaining market share from the old hydraulic methods and having more and more customer success stories with ABB electric winches.”

Of course it's not that simple, as a lot of work and experience has been devoted to the new technology. For decades, ABB has been a world leader in AC drives and AC motors, and its deep technical expertise in frequency converters has allowed it to come up with these novel solutions. Adding assurances to the maritime market is the marine certification and the presence of ABB service people in the world's most important harbors.

Benefits from the simplicity

The winch drives for marine and offshore environments give the following benefits to users:

- Full torque at low or zero speed, enabling winch start/stop without jerk-

ing.

- Reduced noise via stepless speed and torque control.
- Synchronized control for mechanical disc brake in starting-stopping of the winch.
- Control software with tailor-made parameters for anchoring, automooring and handmooring.
- Available in low harmonic and regenerative variants.

The marine drives started with ACS800 platform, followed by ABB marine motors in the offering, and now the new ACS880 platform is also tailored for winches. Moving forward, ABB will be optimizing the DC grid supply onboard ships and the direct DC supply to the AC drives.

Robust and cost-effective electrical winching

In summary, higher levels of operational reliability and more precise regulation of lower motor speeds with high torque levels are today achievable. This is accomplished via the combination of direct torque control (DTC) with a specific but flexible winch control program. This unique ABB solution eliminates the need for motor shaft encoders and gearbox load cell sensors, while also eliminating the environmental risk posed by oil leaks.

To act to get these benefits from the latest generation of reliable and environmentally friendly winch control, go to www.abb.com/drives/winches

About ABB

ABB (www.abb.com) is a leader in power and automation technologies that enable utility, industry, and transport and infrastructure customers to improve their performance while lowering environmental impact. The ABB Group of companies operates in roughly 100 countries and employs about 140,000 people. ⚓

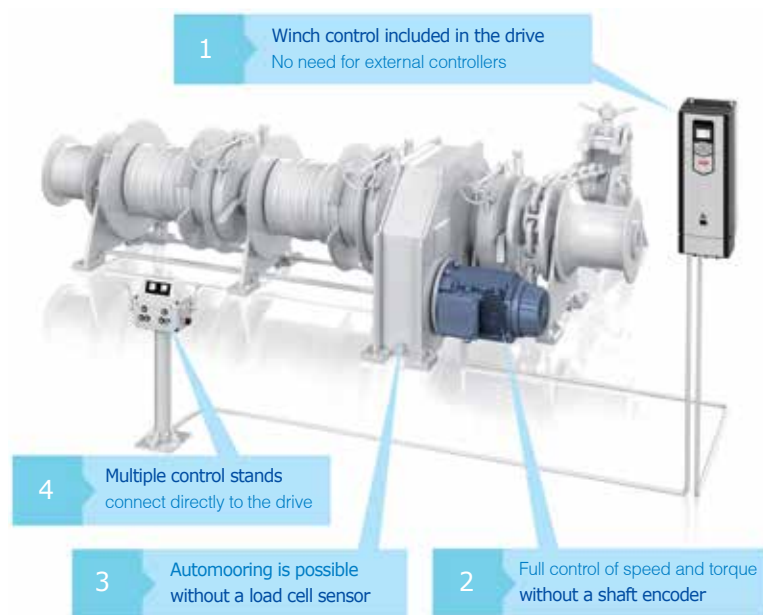


Figure 2. ABB's winch drives help simplify winch control and reduce part count.



헬싱키에 위치한 윈치 어플리케이션 실험실에서는 실제 모터로드로 사용자의 용도에 맞게 직접 테스트가 가능하다.

차세대 전동식 윈치 제어 솔루션

기존의 유압 윈치와 구형 전동식 윈치를 대체하는 차세대 전동식 윈치는 빠른 속도로 선박에 적용되고 있다. 유압 설비, 모터용 엔코더, 기어 박스에 장착되는 로드셀과 같은 외부의 별도 제어 장치가 없는 간편한 앵커링 & 무어링 윈치를 상상해보자. ABB는 오늘날 이 모든 것을 구현할 수 있으며, 선박 용어로 프로그램 되어있는 선급 인증된 제품을 보유하고 있다.

ABB

선박에 필수적인 앵커링과 무어링 윈치는 전통적으로 유압식으로 사용되어 왔다. 윈치 운용은 가히 도전적이라 말할 수 있다. 왜냐하면 느슨해져 있는 무어링 로프나 앵커는 최초에 거의 0의 장력에서 시작해 불과 수초 이내에 극도로 높은 토크를 요구하기 때문이다. 해면에서 요동치는 육중한 선박을 안전하고 적절하게 기동하기 위해서는 큰 토크를 제어하는 정밀성과 100% 신뢰할 수 있는 제어는 윈치 운용에 있어 필수적인 요소이다.

기존 유압식 기동

VSD(variable speed drive)를 통한 윈치 제어 시스템의 기초가 되는 3-speed 윈치용 전기 모터는 지난 수 년 동안 존재해 왔다. 이와 같은 1세대 전기 구동형 윈치는 제어성능이 개선되었고 환경문제에 도움이 되었지만 널리 사용되지 못했다.



Figure 1. 원치 드라이브는 원치 제조사의 요구사항들을 수렴해 개발됐다.

저-중-고속을 위한 3개의 와인딩으로 구성된 직입 기동형 모터는 제한적으로 성공했으며, 이는 PLC, 모터 엔코더, 로드셀과 함께 사용되었던 초기 VSD 구동형 원치 시스템과 비슷한 결과를 낳았다.

이러한 초기 세대의 전기식 원치 구동의 단점은 다음과 같다. 3개의 와인딩을 사용하는 값비싼 모터와 높은 기동 전류 및 소음 그리고 와인딩의 갯수만큼 전기 판넬에 컨택터를 설치해야 하는 번거로움이다. 게다가 구형의 컨트롤 보드를 사용하는 외장형 제어기는 유지 보수 비용 및 스페어 파트 구비 등의 어려운 점이 많다. 초기 VSD 구동형 원치는 외장형 PLC, 엔코더, 로드셀로 시스템을 구성하므로 복잡하며 종종 신뢰도의 문제가 있다.

현재까지 운용되는 전세계의 선박 중 약 70%에는 여전히 오래된 유압 원치 시스템이 오랫동안 잔존하고 있다. 천문학적 비용이 요구되는 선박에 선주와 원치 제조사는 이와 같은 요소들을 충분히 검토해야 한다. 수 년간의 경험으로 충분히 증명되기 전에 하드웨어와 소프트웨어 모두를 새로 적용하기에는 어려움이 따를 것이다. 안전하고 스마트한 VSD 솔루션을 제공하기 위해서 ABB는 다른 방법으로 접근했다.

스마트한 통합적인 전동식 원치 제어

ABB의 선박용 원치 마케팅 매니저인 미카엘 홀름베르그(Mikael Holmberg)은 “기존의 구형 유압 제어를 타파하고 전동식 원치 분야의 성공적인 시작을 열기 위해서는, 흔히 알고 있는 모터와 드라이브의 기동 방식 그 이상의 무언가를 제공해야 함을 깨달았다”라고 말했다. 덧붙여 그는 “원치 제조사와 선주에게 확신을 줄 수 있도

록 ABB는 보다 깊은 경험과 전문적인 지식을 갖추어야 했다”고 설명했다.

이러한 확신을 위해 ABB는 2007부터 앵커링과 무어링 및 기타 원치에 적용될 새로운 통합적 드라이브와 모터 제어방식을 개발해왔다. 갑판 기계 분야의 저명한 원치 제조사들과 협업함으로써, ABB는 우리가 가진 드라이브와 모터제어의 세계적인 전문 기술을 어떻게 적용할지에 대한 식견을 넓혀갔다. 그 결과 기존 시도들과 전혀 다른 새로운 원치 구동 개념을 얻어낼 수 있었다. ABB의 DTC(Direct Torque Control) 기술은 모터를 엔코더와 로드셀 없이 정밀하게 모든 속도영역에서 최대 토크까지 제어할 수 있다.

선급인증, 선박용으로 말하다

미카엘은 “모터 제어뿐만 아니라, 우리는 주요 OEM들과 원치용 프로그램도 개발했다. 우리는 실제 시장에서 요구하는 것들은 연구했고, 이를 드라이브에 탑재했다. 드라이브의 하드웨어 및 소프트웨어는 모두 선박 운용에 적합하며 사용자가 이해하기 쉽도록 선박용 원치 언어를 사용한다”라고 말했다. 또한 “ABB의 선급인증된 드라이브와 모터는 새로운 선박 기계 기술 분야에서의 요구하는 중대한 역할들을 수행 할 수 있다”고 덧붙였다.

유압 배관을 없앨 수 있다는 것은 선박 운전자들에게 희소식이다. 다시 말해, 유지 보수작업이 많고 오일 누출 등으로 환경 오염을 시킬 수 있는 유압 배관이 여전히 사용되고 있다는 의미다. 최신 기술의 전동식 원치 시스템은 제어 방식을 간소화하고 청결한 운용을 가능하게 한다. ABB의 DTC 제어를 사용한 차세대 전기식 솔루션은 조선업계에서 주목할 만한 대상인 것은 명백하다.

드라이브에 내장된 모든 원치 제어 기술

ABB의 새로운 원치 드라이브에 내장되어 있는 모든 주요 기능들은 사용자에게 커다란 이점을 가져다 준다. 미카엘은 “AC 드라이브에 원치 프로그램을 내장함으로써 외부의 추가 장치가 필요 없게 되었다. 우리는 시스템을 간소화 시킬 수 있다. 이는 유지 비용이 들며

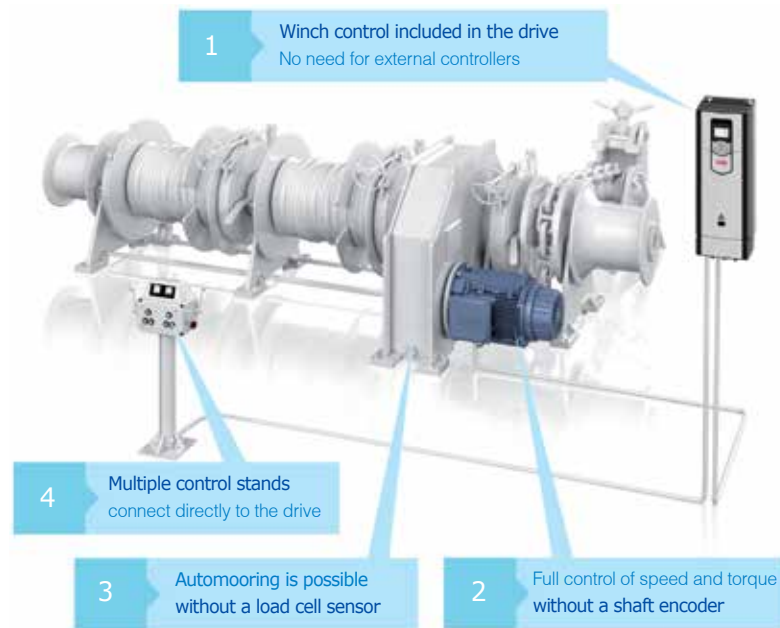


Figure 2. ABB의 윈치 드라이브는 부품과 윈치 제어가 간편화되었다.

찾은 고장을 일으키는 엔코더와 로드셀과 같은 외부 제어 장치가 불필요하게 됨으로써, 드라이브 자체적으로 정밀한 VSD 모터 제어와 오토머어링 및 장력 운용을 할 수 있게 한다. 이것이 바로 ABB가 구형의 유압 방식으로부터 빠르게 시장 점유율을 늘리고, ABB를 사용하여 성공하는 고객수가 점점 더 늘어나는 이유"라고 말했다.

새로운 기술 개발은 많은 경험과 노력들이 수반 되어야 하기 때문에 간단한 문제는 아니다. 하지만 ABB는 수십 년 동안 AC모터와 AC드라이브 시장을 주도해왔으며, 주파수 변환기(Frequency converter) 분야에서의 전문 기술과 지식은 이러한 새로운 해결책 모색을 가능하게 했다. 선급 인증된 제품과 ABB의 서비스 엔지니어가 세계 중요 항구에 존재하는 한, 조선업 시장의 신뢰성은 더욱 높아질 것이다.

간편화 이점

조선 해양 분야에 윈치 드라이브는 다음과 같은 이점을 사용자에게 제공한다:

- 저속 또는 0 속도에서의 최대 토크는 윈치 기동/정지시에 급동작 방지
- 무단 속도 제어 및 토크 제어를 통하여 소음감소
- 윈치 기동/정지시에 Magnetic brake와 동기 제어 가능
- 앵커링, 오토머어링, 핸드머어링 전용 파라미터 탑재한 소프트웨어
- 저하모닝, 회생형 제품 공급 가능

ABB의 선박 전용 드라이브는 ACS800 시리즈로 제공되어 왔으며, 현재 새로운

ACS880 제품도 이용이 가능하다.

견고하고 비용 효율적인 윈치 솔루션

요약해 보면, ABB의 윈치 솔루션은 운용상의 신뢰도와 저속에서의 높은 토크 값을 정확하게 제어하는 것이 가능하다. 이는 DTC(Direct Torque Control)와 윈치 전용 프로그램의 조합으로 구현된다. ABB의 특별한 솔루션은 모터 엔코더, 기어박스의 로드셀의 설치가 필요하지 않으며, 오일 누출 등의 환경 위험 요소들을 없앨 수 있다. 추가 상세 정보는 www.abb.com/drives/winches에서 확인 가능하다.

About ABB

전력 및 자동화 기술 선두기업 ABB(www.abb.co.kr)는 유틸리티, 산업, 운송 및 인프라 고객의 생산성을 향상시키고, 환경으로의 영향을 최소화한다. ABB그룹은 전 세계 100여개 국에서 14만여 명이 근무 중이다. ⚓



Cape Vessel: Project Magnet has enabled a significant increase to Arrium Mining's export capability. Cape vessels can now be loaded and reach a run-rate of 12mtpa.

Project Magnet extends the life of Whyalla Steelworks

To deliver a completely integrated pit to port solution to extend the life of the Whyalla Steelworks, Arrium Mining called on the process control and domain expertise of LogiCamms and Rockwell Automation.

Rockwell Automation

Arrium Mining is a leading Australian resources company, currently exporting at a run rate of 12 million tonnes of hematite ore to China per annum from its Middleback Ranges and Peculiar Knob mining operations in South Australia. The company has three key businesses: Mining, Mining Consumables, and Steel & Recycling.

A significant milestone in the company's history occurred in 2005 when Arrium decided to diversify into the resources sector through Project Magnet which would convert the Whyalla Steelworks to magnetite iron ore feed, creating a new revenue stream for the company by making available hematite iron ore for export sales.

Challenge

To develop a completely integrated control system across the pit to port operations of Whyalla steelworks within a tight timeframe.

A project of this magnitude would require a completely integrated control system, enabling visibility for any operator station across the pit to port operations. To achieve this, Arrium Mining called on the combined expertise of LogiCamms and Rockwell Automation® to deliver an innovative solution that would not only extend the life of the Whyalla Steelworks but also reduce the cost of steelmaking while also incorporating environmental improvements.

Full integraton from the pit to port

Rockwell Automation and LogiCamms, a leading engineering, project delivery and asset management company, have a longstanding history of delivering fully integrated solutions and Project Magnet is no exception. According to Greg Schultz, executive account manager - mining, Rockwell Automation, "This project highlights a complete pit to port operation from a control point of view."

With the mine site located approximately 60 kilometres from the Whyalla Steelworks, a slurry pipeline was built to allow magnetite to be transported through the pipe to Whyalla. Concurrently, hematite ore continued to be transported by rail to the port for shipping.

The three main areas of the operation that required complete control system integration were the materials handling area, which involves the handling and storage of hematite for export; the filter/flux area which receives magnetite from the slurry pipeline and prepares it for feeding to the existing pellet plant, and the mine concentrator area.

A challenging aspect of this project was the distance involved in connecting the concentration plant which was near the mine site to the filter/flux which is located at the steel works more than 60 kilometres away.

"This was addressed by utilizing Ethernet across a large fibre optic network. FactoryTalk® View provided visibility at any operator station across the whole of the pit to port operation," said Schultz. "It was a complex installation that utilised a number of redundant HMI servers across the expansive network," he continued.



Aerial view of Pelletising Plant after Project Magnet



The Magnetic Separator - a close up view of the part of the Concentrator Plant

To provide reliable and secure control system integration based on the ControlLogix® platform, multiple control systems were utilised that were completely redundant by the controllers and the HMI servers. Low and Medium Voltage drives were also provided for the pumping and crushing equipment and safety components including Guardmaster safety relays were incorporated into the motor control centre design.

LogiCamms realised project development time saving benefits through the Integrated Architecture solution of Rockwell Automation, with the use of direct-referenced tags and User Defined Tag structures. The project wide SCADA solution with FactoryTalk® View SE, provided client screens that could view any graphic from anywhere in the application, with minimal extra configuration. Maintenance of the entire application is possible from engineering workstations in any area.

"This application was one of the largest FactoryTalk View applications to be completed at the time and high level support from the Software Business Unit of Rockwell Automation was invaluable in the success of the solution," said Andrew Thompson, senior engineer – control systems for LogiCamms.

According to Jonathon Deluao, principal control systems engineer, Arrium Mining, "The solution has provided full integration and a high level of



Aerial view of the Concentrator and Crusher Plant

process control which gives us the ability to control and modify the system according to the production needs.” He added “We now have a fully automated plant that is flexible enough to cater to our needs both production wise and process wise.”

From dry to wet

The transition of the Whyalla Steelworks from hematite to magnetite feed has changed the iron ore pellet process from a dry to a wet process. As the magnetite ore is pumped via a slurry pipeline from the mine to the steelworks, the level of fugitive dust emissions are reduced which greatly benefits the Whyalla community.

Project Magnet has also fostered the use of covered facilities for loading iron ore and the relocation of the crushing and screening area to the mine site, which has resulted in further improvements in environmental conditions for Whyalla.

Under Project Magnet, a transshipping service has been introduced to avoid major dredging of the Whyalla Port and a new fleet of high-sided wagons has been put into service. The benefits from Project Magnet play an important part in enhancing the sustainable competitiveness of the Whyalla Steelworks.

A new lease on life

The successful implementation of Project Magnet has essentially provided a new lease on life for the Whyalla steelworks by extending the lifes-

pan from the expected 2020 constraint imposed by hematite ore reserves, to at least 2027.

Using magnetite ore in a concentrated form of feed has resulted in freeing the hematite ore reserve for accelerated sale and export - increasing annual sales from one million tonnes up to six million tonnes, with the Whyalla Port Expansion Project now enabling Arrium Mining to reach a run rate of 12 million tonnes.

Based on the success of Project Magnet, Arrium Mining has opened another mine using a complete solution from Rockwell Automation. “We have migrated to a completely integrated Ethernet network with advanced segregation and security components,” said Deluao.

Through combining leading technology with high level domain expertise, Project Magnet has resulted in a completely integrated pit to port solution that continues to provide many benefits to the Whyalla and South Australian communities. 

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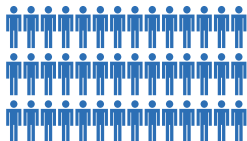
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Automation of a watergate in the port of Zeebrugge Smooth Shipping Traffic

Watergates are needed in Zeebrugge, Belgium, in order to allow container ships to enter and leave the inner port area. Signaling lights and automation technology from Phoenix Contact make sure that the gating process runs smoothly for everyone.

Phoenix Contact

By Arno Martin Fast, Control Technology, Product Marketing, Phoenix Contact Electronics GmbH, Bad Pyrmont

Zeebrugge, located in the Belgian province of West Flanders, is the site of one of the largest and most important European ports. In addition to a multitude of various goods, passenger cars built in Belgium and neighboring countries by a variety of manufacturers are shipped worldwide from here, making the port of Zeebrugge the second largest and most modern maritime trade hub in Belgium after Antwerp.

Its advantages lie not only in its geographical location on the North Sea, but also the excellent links to highways and the rail network it has.

Located on the Strait of Dover at a narrow part of the English Channel with great water depth, the port of Zeebrugge can be accessed by even the largest container ships. They transport 2.2 million cars per year around the world, making

the Belgian city the largest passenger car hub globally. Zeebrugge is also the most important European port for roll-on/roll-off traffic.

The Pierre Van Damme watergate, inaugurated in 1984, and a second watergate enable container ships to reach the two large docks in the inner port. (Figure 1)

The watergate is designed for a maximum of two ships, each up to 250 m long and with a maximum draft of twelve meters. The water level must be raised or lowered to compensate for a difference of maximum four meters without pumps only using gravity. In addition to the two gates, the Pierre Van Damme watergate includes four lift bridges, which allow trucks and other vehicles pass through during gating.



Figure 1. The Pierre Van Damme watergate connects the inner port of Zeebrugge with the North Sea.

Highly available, diagnosable signaling lights

Due to increased safety requirements, the port master in Zeebrugge demanded reliable and diagnosable signaling on the watergate. For this purpose, Phoenix Contact developed fieldbus-enabled signaling lights and worked together with a system integrator to install them in the watergate. (Figure 2)

The signaling lights from the CSD-SL product line, available in the fluorescent red, green, yellow, and white, comply with the requirements of IALA E200-1 and EN 12699. On top of the exceptional illumination range, they also feature a redundant voltage supply and a redundant fieldbus system. Two power supply units and two isolated fieldbus modules thus ensure high availability and provide diagnostic capabilities. The housing of the signaling lights and the connection technology are also designed for the rough maritime environ-



Figure 2. At all times, the signaling lights communicate to the captain the most important commands.

ment.

In addition, Phoenix Contact controllers are used in the watergate, transmitting the data from the signaling lights to an upstream control system via the real-time Ethernet protocol Profinet. In this way, employees in the control room can read information from the signaling system, such as current luminosity, the current and voltage of each of the up to 66 LEDs, the status of the LEDs, as well as the luminous intensity acting on the lights.

In addition to performing diagnostic checks on signaling lights, each individual LED can be controlled. If requested, the Phoenix Contact controller can write the diagnosed data directly to an SQL database. The port authority can thus securely archive the information concerning which signals on the watergate were active at which point in time. Therefore, if an incident occurs, the relevant data of the signal systems are available at all times.

Profinet-based, redundant control technology

As described above, the watergate of the port of Zeebrugge also includes four lift bridges and their safety technology in addition to the gates and signaling facilities. Numerous Phoenix Contact components and systems are also used for the automation of these installations. (Figure 3)

These include the tried and tested terminal blocks, as well as relays, controllers, I/O modules, signal convertors, and safety-related components. The signaling lights are controlled by the control room through a fiber optic connection via a Profinet protocol. The control commands are then communicated via switches to the Profinet-enabled ILC 171 ETH 2TX



Figure 3. The control cabinets for the watergate contain numerous Phoenix Contact components.

compact controller.

Due to the increased availability requirements of the gateway, the transmission paths are configured and implemented redundantly. Therefore two ILC 171 ETH 2TX units with an accompanying fieldbus master belong to each of the 8-meter long masts on which the signaling lights are installed. (Figure 4)

If one of the communication links fails, the other controller immediately takes over the tasks of the isolated PLC and also signals to the control room that it has failed.

In addition to the failure of the second compact controller, the active ILC 171 ETH 2TX transmits many types of information from the signaling light to the control room. As mentioned above, these include the status, current, and voltage of each individual LED, the temperature within the signaling lights, as well as the incident luminous intensity. Subsequently, the Inline controller can write the data directly to an SQL database, where they are stored for evaluation and documenta-

tion purposes. Safety-related components are used to control and monitor the four lift bridges and the corresponding gate systems. They also meet the high safety requirements of the port authority. (Figure 5)

Efficient process

How does the gate process work? If a ship wishes to enter or leave the inner port, the gates on the respective watergate side are first closed. As soon as this is completed safely, the lift bridges are raised and the gate opens. The captain is informed via signal lights that the ship can enter the lock. (Figure 6)

In order to make the process as efficient as possible, there is room for up to two ships with a maximum length of 250 meters in the Pierre Van Damme Watergate. (Figure 7)

Once the opened gate has closed again, the lift bridges are

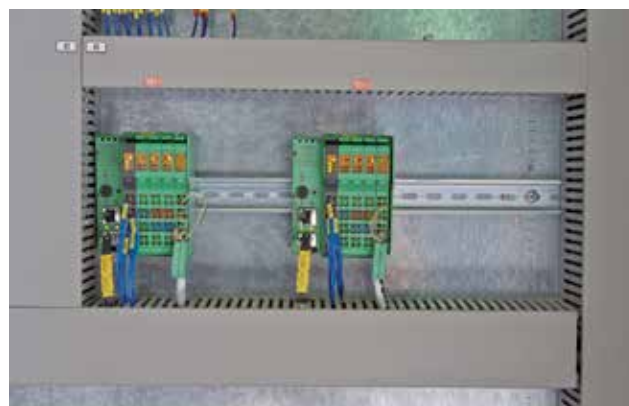


Figure 4. Two Inline controllers are used for communication with the signaling lights.



Figure 5. As part of the Inline station, the safety-oriented modules are used to control and monitor the four lift bridges and the corresponding gate systems.



Figure 6. The Phoenix Contact automation technology ensures safe passage into the watergate.

lowered and re-opened to vehicle traffic. The level of water in the watergate must be raised or lowered to compensate for the difference in water levels between the inner harbor and the North Sea. For this purpose, the watergate keeper opens the valve flaps built into the watergate walls, so that the water levels are equalized with the help of gravity.

Once the water inside and outside the watergate is at the same level, the gates on the exit side are closed, the lift bridges are raised, and the gate is opened. The captain receives important commands via the signaling lights throughout the process. The components, systems, and solutions from Phoenix Contact enable safe passage through the Pierre Van Damme watergate and hence a smooth and fast exchange of goods.

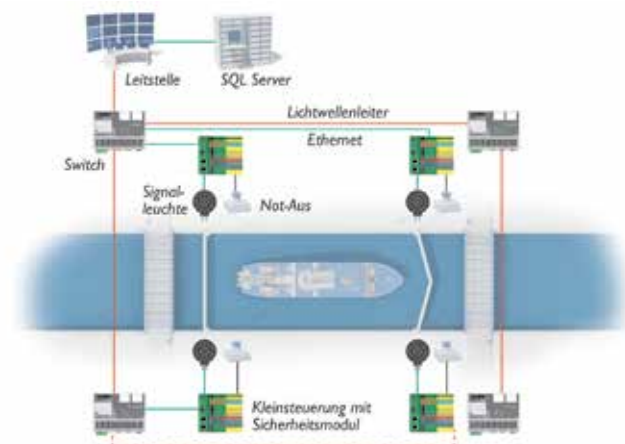


Figure 7. Simplified view of the watergate in Zeebrugge.

Future-proof solution for rough environmental conditions

Increased safety requirements for watergates require new components and automation concepts. With highly communicative control technology and the redundant signaling lights, Phoenix Contact offers a future-proof solution that is able to meet changing requirements. At the core of the solution is the Inline controller ILC 171 ETH 2TX. It offers:

- Support for numerous protocols, including HTTP, FTP, SNMP, SMTP, SQL, and MySQL.
- Free engineering according to IEC 61131 using the PC Wox Express software tool
- The Profinet device functionality
- An integrated Web server for visualization with the WebVisit tool
- An integrated FTP server
- The flash file system.

On top of the very good illumination range, the signaling lights also feature a redundant voltage supply and a redundant fieldbus system. Two power supply units and two isolated fieldbus modules ensure high availability and provide comprehensive diagnostic capabilities. The housing of the signaling lights and the connection technology are also designed for the rough maritime environment.

About Phoenix Contact

Phoenix Contact is a world leader for electronic components, systems and solutions in the field of electrical engineering, electronics and automation. The company currently employs 14,000 people worldwide and achieved a total revenue of 1.77 billion euro in 2014. The headquarters are in Blomberg, Germany. The Phoenix Contact Group consists of nine companies and 50 sales companies. The worldwide presence is also supported by 30 agencies in Europe and overseas. Phoenix Contact operates manufacturing facilities in nine countries around the world with a high level of vertical integration. Not only screws, plastic and metal parts, but also highly automated machines are manufactured. The product range includes components and system solutions for energy supply, including wind and solar, device, machine tools and control cabinets.

Phoenix Contact Korea, one of the company's 50 international subsidiaries, is located in Seongnam. Learn more at www.phoenixcontact.co.kr.



Coriolis Flowmeters for Gas Measurement

-Advanced features serve the needs of a complex measurement

Emerson Process Management

By Tonya Wyatt, Process Gas Marketing Manager at Micro Motion, Inc., a Business Unit of Emerson Process Management

When thinking of flow measurement, water is the first fluid that typically comes to mind. However, most flow applications are a bit more challenging than measuring clean water. Gas flow measurement, for example, is considerably more difficult due to the compressible nature of gas. Although changing pressure has little effect on the density of a non-compressible fluid like a liquid, pressure changes in a gas flow stream result in density changes as well. In addition, as the gas flows through the pipeline, the pressure naturally changes, resulting in different density values along the pipeline (Figure 1). This means that a cubic foot of gas at one

point in the pipeline with a given set of temperature and pressure conditions doesn't have the same number of molecules or same energy content as a cubic foot at some other set.

Reference Standards

As a result, standard or reference conditions were developed. This allowed for an "apples-to-apples" comparison of volumetric flowrates of gas at different conditions by correcting the volumetric reading from actual volume at the actual temperature and pressure conditions to a set of standard temperature and pressure conditions. However, there are multiple working definitions for these standard conditions, so it is still important to reference which set of "standard" conditions are being used.

For example, the International Union of Pure and Applied Chemistry (IUPAC) established standard temperature and pressure as 273.15 K (0 C, 32 F) and 100 kPa-a (14.504 psia, 0.986 atm-a, 1 bar-a)¹, while the Society of Petroleum Engineers (SPE) uses a reference temperature of 15 C and reference pressure of 100 kPa-a², and the National Institute of Science and Technology (NIST) uses a reference temperature of 293.15 K (20 C, 68 F), and 101.325 kPa-a (1 atm-a)³ for gas.

Most gas flow measurements used today measure either the volume of the gas, velocity of the gas (and knowing the geometry of the flowmeter can readily output volume flow), or differential pressure as gas moves through a known reduced diameter (and, using Bernoulli's equation, calculate the

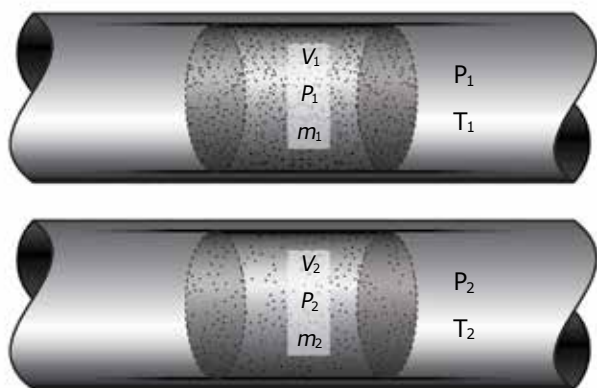


Figure 1. At two different pipeline conditions, the same volume of gas ($V_1=V_2$) can contain a different number of molecules. For example, when the pressure is higher and/or the temperature is lower ($P_1>P_2$ and/or $T_1<T_2$), there is a higher density of gas in the same volume and the mass is higher ($\rho_1>\rho_2$ and $m_1>m_2$).

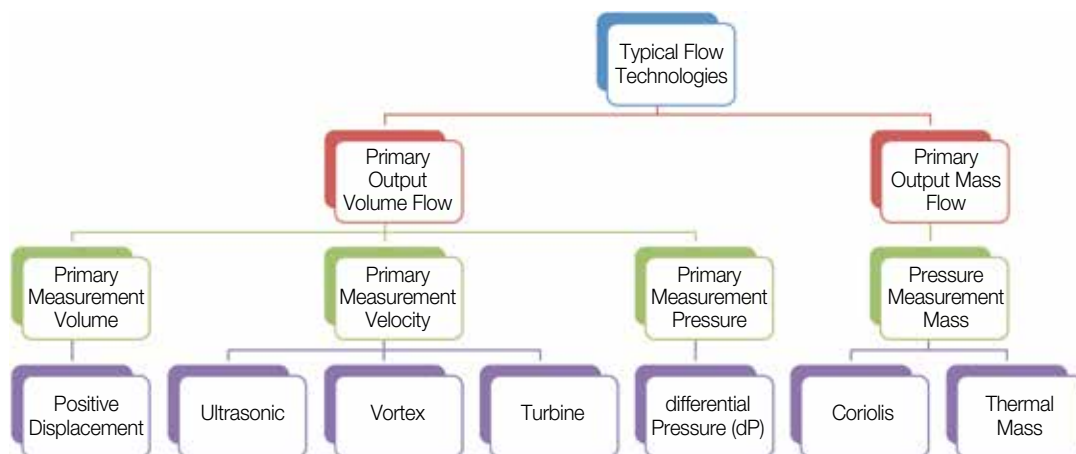


Figure 2. Listing of some typical flowmeters with their primary output variable and the primary variable being measured.

velocity of the gas, which is then output as volume flow using the known geometry). (Figure 2)

These are all very common methods of measurement and are widely accepted in industry. Most of these technologies are then combined with pressure and temperature compensation (e.g. PVTz corrections) in order to convert the actual volumetric flowrate to a standard volumetric flowrate (Figure 3). In some cases, the volumetric flowrate is combined with either a measured or calculated density (based on gas composition, pressure and temperature) and used to output mass flowrate of the gas.

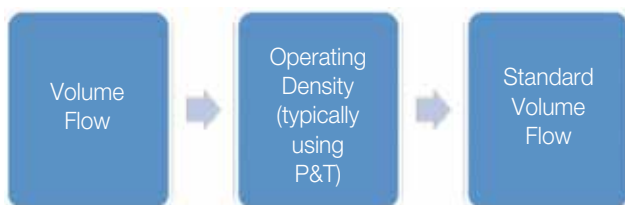


Figure 3. Volumetric flowmeters require the knowledge of the operating density (which will depend on gas composition, pressure and temperature) in order to output standard or normal volume flow. For constant composition gases, this typically requires pressure and temperature measurement. For changing composition gases, this typically requires a gas chromatograph and pressure and temperature measurement, or a gas density meter.

Coriolis for Gas Flow

Although Coriolis flowmeters have been used very successfully in a wide variety of gas flow measurement applications



Figure 4. A typical curved tube Coriolis flowmeter has two parallel tubes that are vibrated at their natural frequency. All flow is split and flows through the bent tubes.

for the past 20-plus years, and the American Gas Association (AGA) published the first Coriolis standard for custody transfer of natural gas approximately 10 years ago, this technology is oft overlooked for gas flow measurement applications. In fact, some of the properties mentioned earlier in this article that make gas flow measurement more complicated than liquid measurement for other technologies, have no effect on a Coriolis flowmeter.

A Coriolis mass flowmeter generally has one or two tubes (straight or bent) that are vibrated at their natural frequency (Figure 4). When there is no fluid flowing through the tube(s), the inlet and the outlet of the tube(s) are moving at the same time (Figure 5a). Sensing coils located on the inlet and outlet

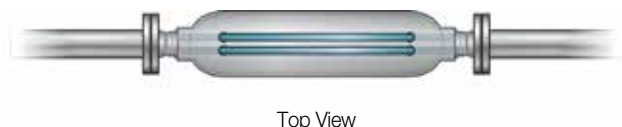


Figure 5a. Looking at the Coriolis flowmeter from the top during no flow, the tubes are parallel to each other and the right and left sides move in unison.

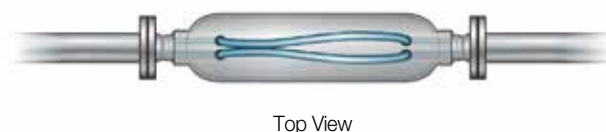


Figure 6a. Looking at the Coriolis meter from the top while the fluid is flowing, there will be a twist in the tubes (shown exaggerated).

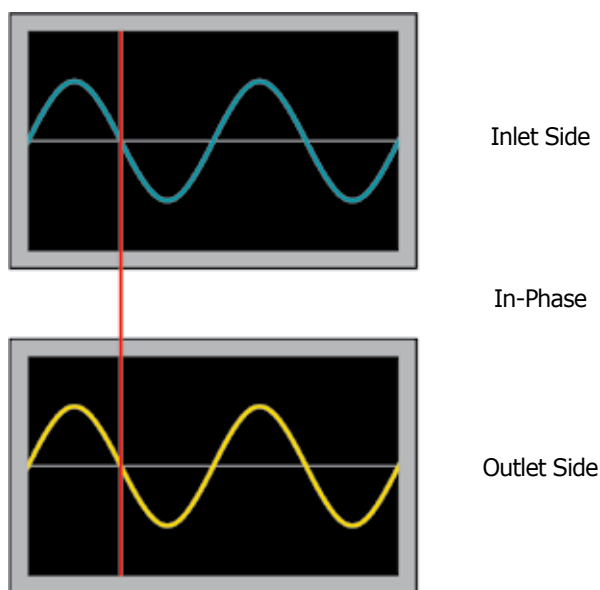


Figure 5b. During no flow, the inlet and the outlet side of the tube are moving together or in-phase.

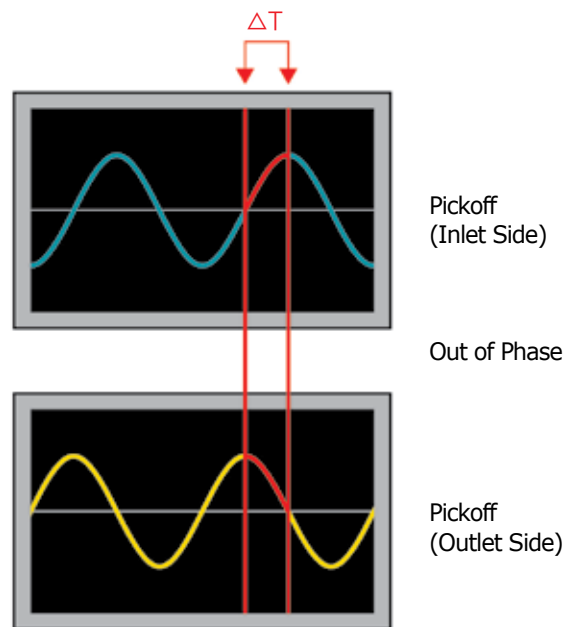


Figure 6b. During flow, the inlet and outlet side of the tube will be out of phase. The time shift between the inlet and outlet is proportional to the mass flowrate.

sections of the tube(s) oscillate and produce a sinusoidal electrical wave as the coil passes through a magnetic field. (Figure 5b)

When there is flow through the tube(s), because of the Coriolis effect, the gas causes the tube to twist (Figure 6a). The inlet of the tube and the outlet of the tube will no longer be moving at the same time. The time difference between the inlet and the outlet of the tube is proportional to the mass flow of the gas. (Figure 6b)

This is true for compressible and non-compressible fluids. Therefore, a Coriolis meter can measure mass flowrate for a gas application without needing to compensate for changes in the density resulting from pressure and temperature changes. Unlike thermal mass flowmeters, the Coriolis meter can measure the mass of a gas even if the composition is changing.

Coriolis Performance Advantages

There are a few advantages associated with eliminating the need for pressure and temperature compensation for fluid properties. The first is that eliminating external temperature and pressure reduces installation complexity in most cases (although some newer DP devices have these measurements fully integrated). In addition, reducing the number of measurement devices required reduces the potential leak points and potential maintenance issues. Finally, each measurement device will add to the overall uncertainty of the system and reduce overall accuracy.

Because the Coriolis flowmeter is not measuring velocity, a fully conditioned flow profile is not required. This further reduces the cost and complexity of installation and allows you to install the meter where it is most convenient.

Many users choose Coriolis meters for gas flow measurement where measurement accuracy is highly valued. Coriolis flowmeters are available on the market today with accuracies as good as +/-0.35 percent. Higher gas supply pressures help to maintain that high accuracy over a wider turndown than lower pressure applications. The best practice for installing Coriolis flowmeters for gas applications is to put the sensor upstream of any pressure regulator.

In addition, some Coriolis meters have meter verification capabilities that allow the user to check the calibration of the meter, as well as the health of the electronics. Results from the meter verification procedures can be used, according to AGA Report No. 11, to determine if and when field or laboratory flow tests should be completed. This can be a significant benefit for users since field flow tests can be difficult and expensive for gas applications.

Limitations of Coriolis

The initial capital cost of Coriolis meters is typically higher than other technologies and escalates rapidly with the size of the meter. When low value gases are being measured, the user may wish to consider less expensive measurement technology. However, it is important to not only consider the initial purchase price, but the overall cost of ownership. Even though Coriolis meters can be more expensive initially, other pieces of equipment are often eliminated (such as pressure and temperature measurement and flow computers for non-natural gas custody transfer). Installation costs and maintenance costs are also typically lower, which makes the overall cost of ownership less expensive than other technologies in many cases.

Coriolis meters are limited in line sizes to typically less than 16-inch lines. In the larger sizes, Coriolis meters can weigh over 1,000 pounds. Pressure loss through a Coriolis meter can be medium to high. Coriolis meters are physically larger than most other technologies, making installation difficult. This is especially true as the line size increases.

While Coriolis mass flowmeters work well for gas applications, typically other technologies such as DP flowmeters and Vortex flowmeters should be used for steam applications. Coriolis meters are also widely used for density measurement in liquid applications, but they typically should not be used for gas density measurement due to lack of resolution of the density measurement. Consequently, they should not be used for actual volumetric flow output. However, they can be used to output standard or normal volumetric flow

using the following equation:

$$Q_{\text{StdVol}} = Q_{\text{mass}} / P_{\text{ref}}$$

Where:

Q_{StdVol} is Standard Volumetric Flowrate (e.g. SCFM or Nm³/h)

Q_{mass} is Mass Flow rate (measured by the Coriolis meter) (e.g. lb/min or kg/hr)

P_{ref} is density of the gas at reference temperature and pressure (independent of operating pressure and temperature).

Note that for a gas with a constant composition, the density of the gas at reference temperature and pressure (P_{ref}) can be easily determined and entered into the Coriolis flowmeter as a constant. (Figure 7) If the gas composition is changing, just like with any other flowmeter, additional measurement will be required.

Other Gas Measurement Technologies

Many other technologies are being used today for gas flow measurement, including differential pressure, turbine meters, and ultrasonic meters. Differential-pressure (DP) meters, such as orifice plates, annubars, Venturi tubes, and nozzles, have been used for over 100 years. AGA Report No. 3 provides guidelines for using DP meters for natural gas measurement.

Advantages of DP meters include:

- ▶ Simple to use
- ▶ No moving parts
- ▶ Capital cost can be low to medium
- ▶ Broad gas industry acceptance
- ▶ Not limited by line size

Disadvantages of DP meters include:

- ▶ Low accuracy and turndown compared to other meters
- ▶ Flow profile sensitive (requires straight runs and/or flow conditioners)
- ▶ Medium to high pressure loss
- ▶ Requires pressure and temperature compensation

Turbine meters are covered in AGA Report No. 7, and like DP meters have been around for well over 100 years.

Advantages of turbine meters include:

- ▶ Medium to high accuracy with medium turndown



Figure 7. Mass flowmeters require the knowledge of the density of the gas at reference conditions in order to output standard or normal volume flow. For constant composition gases, this will be a constant number. For changing composition gases, this number will vary and additional equipment (like a gas chromatograph or specific gravity meter) may be required.

- ▶ High tolerance to valve noise
- ▶ Capital costs are mid-range (typically more than DP, but less than others)

Disadvantages of turbine meters include:

- ▶ Moving parts that can wear over time and can be damaged with high flow rates
- ▶ Flow profile sensitive (requires straight runs and/or flow conditioners)
- ▶ Medium-to-high pressure loss
- ▶ Requires pressure and temperature compensation

Because the Coriolis flowmeter is not measuring velocity, a fully conditioned flow profile is not required. This further reduces the cost and complexity of installation and allows you to install the meter where it is most convenient.

Ultrasonic meters are also used for measuring gas flow. AGA Report No. 9 provides guidelines for using ultrasonic meters for natural gas applications.

Advantages of ultrasonic meters include:


- ▶ High accuracy and turndown
- ▶ Low pressure loss (although flow conditioners used with ultrasonic meters may increase this to medium pressure loss values)
- ▶ No moving parts
- ▶ No damage with high flow rates
- ▶ Multiple health diagnostics

- ▶ Available as clamp-on device (although accuracy degrades with this option)

Disadvantages of ultrasonic meters include:

- ▶ Medium to high capital cost
- ▶ Typically not available in very small line sizes
- ▶ Flow profile sensitive (requires straight runs and/or flow conditioners)
- ▶ Requires pressure and temperature compensation

A Good Fit for Gas Measurement

With no moving parts, gas mass flow accuracies as good as ± 0.25 percent of rate (more typically ± 0.35 percent to 0.5 percent), bi-directional flow capabilities, no need for gas calibration (manufacturer dependent), and no need for flow conditioning, Coriolis flowmeters are a good choice for many gas applications. Coriolis flowmeters can also typically handle dirty gases, as well as wet gases. And for a gas with known composition, the mass flow can easily be converted to standard or normal volumetric flowrate units to provide more familiar units. There are approximately 100,000 Coriolis flowmeters installed on gas applications globally, ranging from custody transfer of gases such as hydrogen, ethylene, and natural gas to check meters to critical process feeds to gas phase reactors to combustion control. 

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3. Johnson, Aaron, and Wright, John D., NIST Measurement Services: Gas Flowmeter Calibrations with the 26 m³ PVTt Standard, NIST Special Publication 1046, 2004.

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HIGH SEAS, HIGH DEMANDS

Load and ballast management, energy supply, drive control, and monitoring systems: the control and monitoring tasks on board a ship are as complex as they are numerous.

Certified from the bridge to the engine room: the WAGO-I/O-SYSTEM 750 has been a fixed component in maritime technology and offshore industry for years.

WAGO

by Marc-Andree Paul, WAGO

On yachts and tankers, on container and cruise ships, WAGO controllers and industrial PCs take on almost every automation task. The newest controller generation is ready to take up the torch: the PFC200 is especially suitable for the high demands of the high seas with its multiple interfaces, performance, and compact dimensions.

Load and ballast management, energy supply, drive control, and monitoring systems: the control and monitoring tasks on board a ship are as complex as they are numerous. Ship automation has therefore followed a trend for several years, in that conventional, centralized automation systems are increasing giving way to intelligent networks of decentralized solutions. In this way, central control computers can be done away with altogether. Due to the constant expansion of decentralized structures and the increased displacement of tasks further afield, the demands placed on distributed, autonomous controllers have also grown.

Increase in Automation and Communication Tasks

A multi-client-server-network architecture of this type, which demands a higher communication capability from the components used, also necessitates the implementation of more sophisticated processes in strict real time. Corresponding data and incidents are stored on site in text files or databases. In addition, loading so-called "recipes" of comprehensive parameter lists for load and ballast management requires a high level of computing power. In parallel to this, users should also always have secure remote access, including visualization and the possibility to intervene in the configuration. However, process control and ETHERNET communication haven't represented the only challenges for a long time; it is also necessary to synchronously operate a multiplicity of serial communication gateways for generator sets, electrical devices, and navigation equipment. WAGO's PFC200 fulfills this highly-demanded combination of performance and diversity of applications in real supplements the 750-88x



According to the configuration level, the PFC200 is equipped with onboard interfaces – RS-232/RS-485, CAN, CANopen, or PROFIBUS-DP-Slave – in addition to the two standard ETHERNET connections.

ETHERNET controller family in the highend power segment with an almost identical shape.

Programming and Engineering

The PFC200 with Cortex-A8 processor architecture, based on a real time capable Linux® operating system, is compatible with all controllers and modules within the WAGO-I/O-SYSTEM 750. Due to the new controller's complete compatibility with a selection of more than 400 I/O modules, customized nodes in scalable outputs can be configured. This also includes diverse special technical functions, such as condition monitoring, energy measurement modules, and relevant standards for maritime technology and the offshore industries like SIL and Ex i.

The opportunity to migrate existing CODESYS projects, without limitations, creates an unchanged “look & feel” during development work and contributes to long term investment security. The decision to use the Linux® platform provides users with maximum configuration freedom during programming. Due to the open access, existing source codes and algorithms, for example C routines, can still be used without the necessity of translation into a PLC language.

NOTICE

- *Powerful and reliable: The PFC200 is predestined for use on the high seas.*
- *In addition to two ETHERNET ports, the PFC200 directs additional interfaces.*
- *Always fitting: The PFC200 offers different configuration options.*

Safe and Diverse Connections

According to the configuration level, the PFC200 is equipped with onboard interfaces – RS-232/RS-485, CAN, CANopen, or PROFIBUS-DPSlave – in addition to the two standard ETHERNET connections. The CODESYS configuration tools, a WAGO-specific Modbus-RTU/TCP/ UDP configurator, and numerous function libraries, available free of charge, also provide a multiplicity of protocols. This means that some of the most important connections can be realized directly via the controller, without the need for additional bus modules. Diverse equipment aggregates can be linked using the CAN interface via protocols like J1939 or NMEA2000, for example. The RS-232/RS-485 interface can be freely parameterized to communicate with voyage data recorders, higher-level control systems, or navigation devices. These interfaces include Modbus RTU (Master/Slave), NMEA0183, RK512, 3964R, and many other protocols.

For data exchange on board using a ship network, as well as for remote access via LAN/WAN, the PFC200 also supports all relevant protocols in the TCP/IP family: DHCP, DNS, SNTP, FTP, TELNET, HTTP, and Modbus TCP/UDP. In order to guarantee the security and integrity of information during web access and data transfer, SSH and SSL/TLS security protocols for establishing secure HTTPS and FTPS connections are integrated as standard.

Optimal Start Up, Robust Operation

WAGO's PFC200 can be configured either via embedded web server (Web-based Management), CODESYS programming environment (IEC 61131-3), or the configuration



dialog (Linux® console). No specific operating system knowledge is required. Featuring SDHC memory, the fan-less and battery-free controller is maintenance-free and extremely robust. In addition to faster read/write access to user data, such as recipes and log files that are stored as CSV files, the integrated SD card memory enables a complete system backup & recovery – including programming, visualization, and configuration data. This also facilitates the respective startup of system “clones”, which is relevant for global use on the high seas.

The WAGO-I/O-SYSTEM fulfills the highest quality demands and therefore has received all maritime certificates, including GL, DNV, ABS, BV, and BSH.

The PFC200 will follow in this tradition, and can be used everywhere on the ship – from the machine room to the bridge – due to extremely low interference emissions, and high resistance to interference, temperature, vibration, and



The WAGO-I/O-SYSTEM fulfills the highest quality demands and therefore has received all maritime certificates, including GL, DNV, ABS, BV, and BSH.

shock. In these fields of application, maintenance free operation is guaranteed for years. ⚓

EPSITRON® CLASSIC POWER – REDESIGN

- With its redesign of the EPSITRON® CLASSIC Power family, WAGO delivers even more versatile, compact power supply units.

Slimmer, more communicative, more attractive. The second generation of the EPSITRON® CLASSIC Power supply units save even more space in the control cabinet. Thanks to their wide input range (85 to 264 VAC) and UL and GL approvals, the new 787 Series power supply units can be used throughout the world in the most varied power supply systems and applications. The total of 14 power supply units with an ambient temperature range of -25 to +70°C can be used for supplying power to industrial electric and electronic equipment in IT and automation engineering, in systems engineering, building automation, and process and control technology. The units can also be employed near residential areas thanks to their DIN EN 60335-1 conformity.

Using their newly integrated TopBoost function, these units, with a nominal rating of ≥ 120 W, supply a brief power surge in the event of a secondary short circuit. This provides reasonably priced secondary protection using standard circuit breakers. The new 787-16xx power supply units are available with nominal output voltages of 12, 24, and 48 VDC, and outputs of 25 to 480 W. LEDs and an active DC OK signal or a floating DC OK contact (depending on the type of unit), indicate to the user what the operating status of the unit is at all times.



In a compact metal or plastic housing: The new EPSITRON® CLASSIC Power supply units are ideal for a wide range of applications thanks to their lean design, additional functions, such as TopBoost, pluggable connection technology, and signaling contacts.

Digital Ship

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22 OCTOBER 2015

BEXCO, BUSAN

The Maritime CIO Forum series of one-day events have been developed to address the issues and trends that technology leaders face in an increasingly changing and continuously developing business environment. CIOs in the maritime sector are expected to deliver strategies capable of both driving revenue and reducing costs for their organisations. Now that their role is taking on a more strategic focus, CIOs need to strengthen their leadership skills while remaining at the forefront of technological breakthroughs and contributing to the business – all the while making smart decisions about maritime technology and satellite communications selection, investment and implementation.

This one day conference at Kormarine 2015 will address the strategic and practical challenges which all companies are facing at present, such as:

- How to drive business value in the form of growth as well as increased efficiency and productivity?
- How to build a business case to demonstrate the value of IT
- How to foster innovation?

Who should attend:

- Chief Information Officers (CIOs)
- Chief Technology Officers (CTOs)
- Chief Operating Officers (COOs)
- Senior business and technical executives in:
 - Technology
 - Communications
 - Information Management
 - Operations
 - Finance Functions
- Suppliers providing:
 - Ship Shore Communications
 - Software I Data Services
 - Shipboard Electronics I Safety I Navigation Systems
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Propel your profits with maximum uptime and efficiency with Danfoss Drives



With a total of nine marine certifications, Danfoss Drives provide all the advantages that ship builders, owners and crew expect from their equipment. Our drives are certified by the world's leading class authorities, including DNV, Lloyds Register, ABS and Bureau Veritas, and provide advantages all over the vessel.

Vacon is now part of Danfoss Group

Optimise control and energy efficiency at sea

Using drives for controlling motors aboard a vessel gives many benefits. A frequency converter reduces the startup current peak. The need for auxiliary generators for startup is thus eliminated, especially where you have large motors for thrusters and propulsion. Different types of pumps, i.e sea water, mud and cargo pumps, are typical systems where a drive is installed.

Engine room ventilation systems, air conditioning systems for crew and passenger accommodation areas and air conditioning systems are also applications where installing Danfoss drives can provide multiple benefits. Danfoss drives fully comply with the rules of the marine



approval societies.

Success story

Client	STX Offshore and Shipbuilding Co. Ltd., a world leading shipbuilding company in offshore and shipbuilding industries
Task	A solution with low level of noise and vibration in propulsion application to be fulfilled to DNV Silence A class and flexible dimensioning of drive layout.
Application	Propulsion and thruster
Solution provided	690 V Liquid cooled AFE 2x2.5 MW propulsion drives 1.35 MW and 2.33 MW thruster drives

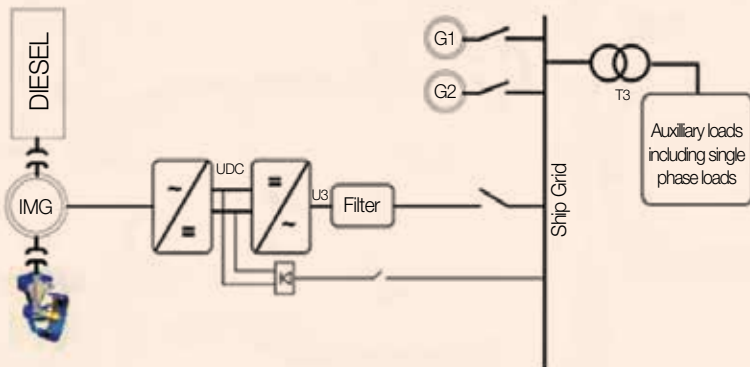
During the design phase Vacon proposed 690AFE liquid cooled drive solution to reduce the harmonics and noise in consideration of requirements of typical research vessels.

VACON (Danfoss Drives) NXP liquid cooled drives are the ultimate in space-saving, high power density AC drives. They are well suited for locations where air-cooling is difficult, expensive or impractical, such as onboard ships or where installation space is at a premium. As no air ducts are required, liquid cooled drives are extremely compact and suitable for a wide variety of heavy industries with harsh operating conditions such as marine & offshore.

Normally, the size of panels is already fixed but our drives are flexible on dimensioning of drive layout according to the requirement of the project. Also from maintenance point of view, the local operator in Korea will have more flexibility. It will reduce the maintenance cost as main electrical

Simulated system

During Kormarine Exhibition the demonstration for Grid converter will be displayed and simulated to show how PTI and PTO function operated with normal induction motors and Vacon Grid converter as per below diagram.



Application Areas

1. Separator

VLT® drives increase the performance of the separator. The drive makes the separator tolerant against load surges. It can catch the separator on the fly and bring it to standstill without the need of resistors.

2. Pump

Pump dedicated features like built-in PID controllers, dry pump detection, flying start, sleep mode, cascade controller, end of curve and flow compensation save energy, protect the pump.

3. Thruster

VLT® control of thrusters eliminates the need for pitch control. This saves energy, reduces noise and minimizes maintenance. The preheat function eliminates anti-condensation heaters.

4. Steering gear

Accurate positioning of the rudder enables precise steering of the ship. The hydraulic pumps only run when the vessel is changing course, which saves energy.

5. Fan

Load dependent capacity control and Automatic Energy Optimization save energy. Skip resonance monitoring reduces noise and protects the system. Motor pre-heat prevents damage and eliminates the need for anti-condensation heating.

6. Winch

Fast reaction to torque variations enables reliable operation of mooring and anchoring winches, as well as heavy duty work winches. Built-in, advanced mechanical brake control eases mechanical stress on both gear and brake.



7. Compressor

A VLT® drive increases the efficiency of both air compressors and refrigeration compressors. Speed control ensures that the capacity at any time meets the actual demand.

8. Crane and hoist

High torque and advanced mechanical brake control ensures smooth operation in rough load conditions and perfect control of the load at all times. The hoist digiPot function allows easy control with typical hand held crane controllers.

equipment like switchgears, motors were made locally in Korea.

About Danfoss and Vacon

United by a passion for perfection, Danfoss and Vacon have teamed up to offer you more.

Danfoss and Vacon have merged together to open a new chapter of success. Vacon is now a part of the Danfoss group and together we have become the world's largest independent drives provider.

By coming together, we are now bigger, better and stronger. We can now offer you the best variable speed drives in the market and create AC drives that are more competitive, innovative and attractive! Through this merger we have not just increased our strength but also expanded our product offerings, support and market reach. Our aim though remains the same, i.e. to offer you the same superior quality products and services like always. ⚓





Return Of Investment – Guaranteed

Either we deliver on high performance or we return the additional investment in SeaQuantum X200. That's confidence!

Jotun

In a market characterised by fierce competition, fluctuating bunker prices and new and pending emissions control legislation, hull performance has become business critical.

A Hull Performance Solution from Jotun can be expected to deliver a 8.5 % fuel cost and GHG emission saving as compared to a market average alternative. The pay-back period is usually less than 1 year. The inclusion of reliable performance measurement and performance guarantees results in investment risk being limited.

While investment in hull performance solutions is typically very attractive, the expected return on investment will vary based on a broad range of factors including vessel type, trade, activity level, voyage policies, current level of hull performance, current main engine bunker consumption, expect-

ed cost per ton of bunker, etc.

In addition to the direct financial return on an investment in a Hull Performance Solution from Jotun, there are also typically considerable indirect and non-financial benefits such as improving the ship's environmental footprint, extending the ship's commercial lifespan (delaying obsolescence) and increasing the ship's second hand value.

To help support investment decisions by owners, the HPS team at Jotun is working with a growing list of customers to develop detailed and comprehensive business cases for investments in hull performance. Jotun provides assistance in extracting and analyzing historic hull performance as well as other case data for the fleet in question and can also provide input on relevant industry benchmarks.



On Feb 19th, Jotun announced that Mediterranean Shipping Company (MSC) will apply Jotun's Hull Performance Solutions (HPS) on a number of existing and new vessels.

The solution component

Jotun's Hull Performance Solutions combine state-of-the-art antifouling and application technologies with reliable measurability and performance guarantees.

• The best coating technology available

SeaQuantum X200 is our first antifouling purpose designed to maximise initial performance (low friction properties) as well lifetime performance (antifouling properties) with no limitations in terms of formulation cost.

It is the culmination of more than 10 years of experience, 15,000 trial formulations and more than 6,000 full applications with the original SeaQuantum technology.

SeaQuantum X200 comes in three different versions optimised for different combinations of speed and trade – each delivering a substantial improvement in hull performance compared to any other antifouling technology available on the market today.

• Jotun High Performance Application Procedures for Dry Dock

Paint by itself is a semi-finished product, and hull performance is greatly influenced also by the quality of pre-treat-

ment and application.

As a part of our Hull Performance Solutions we have developed Jotun High Performance Application Procedures for Dry Dock based on a combination of best practice and new development. In NB tailored High Performance Application procedures are now being developed for the major yards. Every application is supported by an HPS certified project manager and an expanded team consisting of our best coating advisors. Our High Performance Application Procedures have been optimised for delivering the smoothest possible hull surface and include a comprehensive regime for measuring and documenting the solutions contribution to reducing average hull roughness.

• Reliable measurement methodology

Jotun's Hull Performance Measurement Method (JHPMM) isolates the impact of a ship's underwater surfaces on its energy efficiency by tracking relative changes in the relationship between the power delivered to the propeller and speed through water over time.

Significant sources of random and systematic error are managed by collecting data with a very high frequency, by using a set of pre-defined data filters and normalisation proce-



dures, as well as a quality assurance protocol that includes monitoring of the correlation between different sensors.

JHPMM has been the starting point for work on the ISO 19030 standard, and a number of leading ship owners have judged it sufficiently reliable so as to be used in performance based contracts.

• Jotun High Performance Guarantee

Jotun has developed a set-up for performance based contracting where Jotun either documents that high performance has been delivered or returns the additional investment in the hull performance solution.

Customers are in effect paying for delivered high performance – not for paint with the promise of high performance. Our High Performance Guarantees have been designed to offer our customers unrivalled flexibility in terms of operation. As a part of a High Performance Guarantee, Jotun will regularly report on performance based on an agreed upon reporting schedule.

• Draft International Standards approved by ISO Marine Environment sub committee

On the 19th of March 2015 draft international standards of ISO 19030, measurement of changes in hull and propeller performance was approved by participating members of the ISO Marine Environment Protection Sub-Committee (ISO TC8 SC2).

The aim of the standard is to recommend practical methods for measuring changes in ship specific hull and propeller performance, to the industry for use on a voluntary basis.

• Broad stakeholder involvement

The Committee Drafts are the culmination of 3 years of work following a submission to IMO's Marine Environment Protection Committee (MEPC) February 2012 (MEPC63-4-8), where Bellona Foundation as a part of the Clean Shipping Coalition, called for a transparent standard for accurate and reliable measurement of changes in hull and propeller performance, and where Jotun made its Hull Performance Measurement Method (JHPMM) available as a starting point for work on such a standard.

Work on the drafts was initiated June 2013. Geir Axel Oftedahl from Jotun was appointed Project Manager and Svend Søyland from Bellona Foundation was elected the Convener of the working group.

More than 50 experts and observers, representing ship owners, shipping associations, new build yards, coatings manufacturers, performance monitoring companies, academic institutions, class societies and NGOs participated in the ISO working group.

"The quality of the Draft International Standards reflect the expertise and dedication of the individual working group members who in total have contributed more than 10,000 hours towards development and review of the drafts," says Geir Axel Oftedahl.

• If you can measure it, you can manage it

In the initial submission to IMO it was estimated that the potential for fuel savings and GHG emissions reductions related to improvements in hull and propeller performance was between 7 and 10 percent across the world fleet. This translates into around 0.3 percent of all manmade carbon emissions and 30 billion USD in fuel savings.

ISO 19030 will contribute towards the realization of this potential by making it possible to accurately determine the impact of hull and propeller related maintenance, repair and retrofit activities on the fuel efficiency of the ship in question. The standard will also make it possible for buyers and suppliers of technologies and solutions aimed at improving hull and propeller performance to enter into performance based contracts based on a contractually acceptable measurement methodology. ⚓



The Power to change

Driven to make a choice on future fuels by regulation, yet reined in by plummeting HFO bunker prices, ship owners would be wise to invest in propulsion solutions able to meet a variety of challenges at the same time says ABB Turbocharging, the developer of Power2®.

ABB

While air pollution legislation continues to force ship owners towards lower emission strategies, sustained lower heavy fuel oil prices have caused them second thoughts on the timing of fuel selection decisions.

Inside Emissions Control Areas (ECAs), fuel sulphur content is now limited to 0.1 %, with a 0.5 % restriction proposed for implementation globally by 2020. However, HFO prices settling one third down on 2014 levels have seemingly put the race for gas fuel on pause, giving a welcome shot in the arm to suppliers of the abatement technology (exhaust gas scrubbers) that will support the continuing use of HFO.

Few analysts predicted the oil price collapse of late 2014, with subsequent forecasts in early 2015 seemingly based on best guessing. In looking for some insight into future trends it is therefore worth reflecting that, whatever the bunkering market looks like in terms of future fuel selection by market share, some technical advances developed with one set of cost

assumptions in mind are equally capable of supporting another set.

One such enabling technology is proving to be Power2 from ABB Turbocharging. The two-stage turbocharging solution has been integral in enabling the higher engine power density targeted for the new generation diesel and dual fuel marine engines designed to reduce fuel consumption, and thus cut emissions. As engine builders have brought modified new generation main power units to market running on diesel and liquefied natural gas, ABB Turbocharging has been a key development partner, demonstrating that Power2 has the flexibility to cater for a range of fuels in the future.

An example is the brand new medium speed Wärtsilä 31 engine launched to the market at one of the marine industry's leading events, NorShipping held in Norway in June 2015. It is the first of a new generation of medium speed engines designed to set a new benchmark in efficiency

and overall emissions performance. The multi-fuel capabilities that the Wärtsilä 31 engine bring to the market extend the possibilities for operators to use different qualities of fuel. The technical developments of this latest generation of Power2, have enabled the first application in the marine industry of the two-stage turbocharging solution, on this new engine.

Two part story

Two-stage turbocharging achieves a step change in turbocharging efficiency levels and pressure ratio capabilities. The process effectively allows the pressure ratio to be doubled, without increasing the mechanical load within a profile that is only 20 percent larger than state-of-the-art single-stage turbocharging solutions. The latest Power2 800-M increases turbocharging efficiency beyond 75 percent and increases pressure ratio capabilities up to 12, that's as good as it gets in the industry.

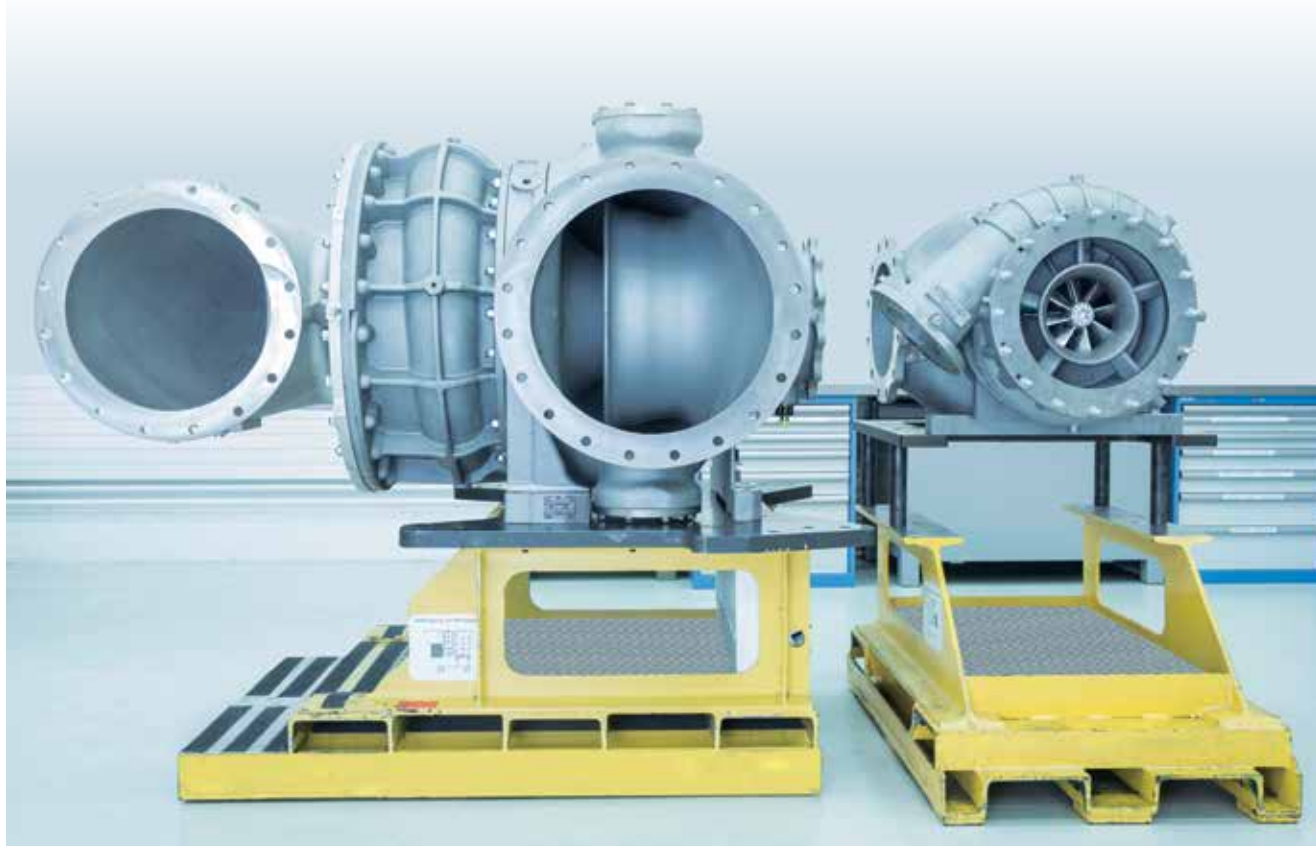
Power2 is operational in power plant applications, and similar interest is expected in the marine industry. Offshore vessels, for example, are expected to benefit from the high engine power density enabled by Power2, leading to low power-to-

weight-and-size ratio as well as excellent transient capabilities. Uptake is also expected in the cruise and ferry market, where optimizing fuel efficiency of four-stroke engines at high loads over extended periods is commonplace. In terms of the engine overall, enhanced performance converts to a significant efficiency gain compared with single-stage turbocharging.

Experience to date leads ABB Turbocharging to highlight that, for a 10MW engine running on HFO, the annual savings would exceed US \$ 100,000. Just as significantly, as new fuels enter mainstream shipping, the company's most compelling contention is that savings are available whatever the fuel choice.

"Nowadays reciprocating engines are asked to cope with various emission requirements, with vessels in different operating profiles and using different fuels, while still delivering constant high performance," commented Paolo Tremuli, General Manager, New Engine Technology, ABB Turbocharging.

"This new generation Power2 800-M enables engines to surpass industry standards in power output, fuel savings and emission reduction. It is applicable to engines burning all marine fuel types," added Christoph Rofka, Senior General





Manager - Products, ABB Turbocharging.

In fact, ABB Turbocharging has been one of the key industry partners contributing to the development of new marine engine models that will be available for use as diesel or dual fuel, in the mainstream marine and offshore markets from 2015. Distinguished by higher performance, better space utilization and being easier to service, the latest Power2 800-M solution is lower cost than solutions available to date, with high expectations that it will therefore be widely applied across the marine industry.

The new version of Power2 is also 20 % more compact than conventional two-stage solutions, and specifically enhanced with high availability in mind. "Our new four-stroke serviceability solution allows service from the cold side without touching any connection to the engine. Access to rotating components can be accomplished without disconnection." This allows a completely new service concept for Power2: a unique removable cartridge reducing downtime and increasing ease of servicing through cutting six steps down to two.

"We have worked on this new generation Power2 in collaboration with a major OEM, which has been pivotal in the evolution of a solution that we anticipate will have a major impact; it also responds to the very real demand from customers for turbocharger flexibility to meet operational challenges," said Rofka. "The enhancements to ease of servicing are a crucial part of this evolution."

Power2 plus gas

Bringing Power2 to marine customers represents a mile-

stone, said Rofka, and offers an opportunity to "look beyond this for dual fuel and gas fuel engines. We also see potential in this market for our Valve Control Management (VCM®) technology with regard to transient operating flexibility and further enhanced fuel efficiency."

In combination Power2 and VCM also confer additional operating robustness, in line with the necessarily strong but controlled Miller timing. For engines running on LNG, this last attribute is critical, said Rofka, because gas and dual-fuel engines need to be capable of "diesel-like" performance.

The potential flexibility will surely be welcome. While formerly predicated on high bunker fuel prices, the industry's obsession with ship efficiency has sustained, despite the recent oil price low. The consequent suspension of exploration work by many of the world's oil majors has been reflected by falling order books in the offshore support sector, in turn stimulating owners to sweat existing assets harder. The focus of efficiency has very much turned to asset availability, rather than the promise of future cost savings offered by new technology.

"It's fair to say that there were few analysts predicting the slide in oil prices that hit this market in the latter part of 2014," Rofka continued. "We remain focused on anticipating real and coming situations, to provide customers with reliable technical solutions that are also flexible enough to meet changing circumstances. We are confident, for example, that Power2 anticipates a market requirement based on technological arguments that remain unchanged." ⚓

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Low Pressure Water Mist Systems: Fighting Fires Effectively and Efficiently

Water mist is a proven fire-fighting solution onboard ships, and owners are increasingly aware of the advantages of low pressure systems.

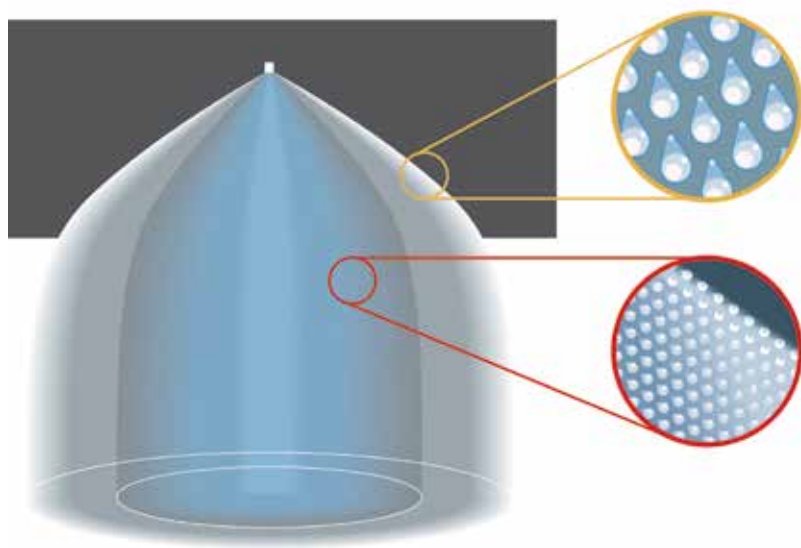
Wilhelmsen Technical Solutions

By Stein Lovskar, Commercial Development Manager

For a fire to survive, it must rely on the presence of the three elements of the 'fire triangle': oxygen, heat and combustible material. The removal of any one of these elements is enough to suppress or extinguish a fire.

While traditional water sprinkler systems remove only the heat element of the triangle, water mist systems remove both the heat and oxygen elements by dispersing water through specially-designed nozzles.

The smaller the water droplet sizes are, the larger the surface area becomes per litre of water and thus the more effective the system is in rapidly reducing the temperature of a fire. To put it another way, when water is converted to steam – which is what happens to the water droplets in water mist – then a large amount of energy is taken from the fire, which results in rapid cooling.



XFlow® - the unique combination of fine and very fine droplets

Low pressure vs. High pressure

As a result of their proven effectiveness in fighting fires, water mist systems have become increasingly popular in shipboard applications.

First to the market were high pressure water mist solutions, but low pressure systems are increasingly preferred by owners and yards. The key reasons for this are their easier and less costly installation and maintenance.

In addition, low pressure systems have simpler piping requirements and less risk of clogging. Using a common pump unit and control system, makes it easier to operate and maintain. Furthermore, low pressure systems have lower power requirements than high pressure ones, providing a further potential saving in emergency generator costs.

All water mist systems must pass the same performance-based tests according to International Maritime Organization (IMO) requirements. As a result, there can be no difference in the extinguishing efficiency between low pressure and high pressure systems.

However, there remains a misperception that low pressure water mist systems use more water than high pressure systems. But approval data published in DNV EXCHANGE



XFlow® low pressure nozzle

demonstrates that there is very small difference between the systems and that low pressure systems can even use less water on occasions.

Fire-fighting in sensitive spaces

Owners naturally have concerns when it comes to the combination of water and electrical equipment. However, a review by Liu and Kim¹ of water mist fire suppression cites several studies showing that water mist is effective in electronic equipment applications and does not cause short circuits or other damage.

Water mist may in fact have some advantages over gas based fire suppressants due to its heat removal mechanism, which may help to prevent melting of wire insulation and other materials, and due to its non-toxic quality, which may allow uninterrupted human occupation of the compartment.

Water mist can be used in a room where equipment with an Ingress Protection (IP) rating better than IP22 is located.

Another misperception is that low pressure systems can cause more damage to electric and electronic equipment than high pressure systems. In fact, cabinets and cables may be better cooled by the larger water mist droplets.

Unitor XFlow® water mist system - the ultimate low pressure solution

Since 2012, Wilhelmsen Technical Solutions has supplied the Unitor XFlow® water mist fire-fighting system alongside its other solutions. Unitor XFlow® is a state-of-the-art, low pressure water mist system with a combination of very fine and larger droplets.

Using the patented XFlow® nozzle technology, this low pressure system can provide protection volume up to 5,000 m³ – a volume which traditionally has required a high pressure system.

The system is performance-based, meaning that its operation is verified at an independent test facility to an IMO performance standard. In addition to machinery spaces, water mist fire-fighting systems can be specified for accommodation and balcony areas in the cruise and leisure yacht markets.

Unitor XFlow® water mist system is tested according to multiple IMO standards. For Local Application: IMO MSC/Circ. 1387, Total Flooding: IMO MSC/Circ. 1165 (with scaling according to circ. 1385) and Accommodation: IMO Res. MSC. 265(84), replacing IMO Res. A.800 (19).

More and more leading companies have specified Unitor XFlow® water mist system particularly those building high specification tonnage. For these applications, owners selected a low pressure system for its reliability, ease of operation and maintenance, low power consumption and cost effectiveness. The low power consumption in particular reduces the prioritised load requirement from the generators and lowers the capacity drain from the emergency generator.

Supported by the dedicated Wilhelmsen Technical Solutions technical and operational team, Unitor XFlow® water mist system provides a proven option for owners and yards seeking a highly efficient and cost effective fire-fighting solution. ⚓

References

1. A Review of water mist fire suppression technology: Part II - Application studies Liu, Z.G.; Kim, A.K. Journal of Fire Protection Engineering, v. 11, no. 1, Feb. 2001, pp. 16-42.



ADVANCED WATER TECHNOLOGY



Fresh Water Generator

Innovative technology without chemicals

New technology from Enwa contributes to reducing chemical use on board and a better environment

Enwa Group

The Norwegian company Enwa are proud to be able to present a “self-cleaning” evaporator – water production entirely without the use of chemicals. This product has been developed by Danish maritime specialists, with attention concentrated on chemical-free water output, small footprint and minimum need for space in connection with maintenance and service. “Chemicals have traditionally been used, and the crew has had to wear both gloves and eye protection when handling these,” explains Peter Eriksson, Business Development Director at Enwa Water Technology AB.

“That’s no longer necessary. The Enwa Fresh Water Generator (FWG) with Scale-Guard technology eliminates

the need to inject anti-scaling products and substantially reduces maintenance requirements. We can now offer our customers produced water at a lower cost than conventional FWGs.” He also emphasises that the company is very pleased to be able to present the latest addition to its product portfolio, which is better for the environment, cuts work for the crew and reduces time and cost.

“Three methods are available for securing fresh water on a vessel – bunkering from shore, a freshwater generator on board or a water maker using a reverse osmosis (RO) process,” Eriksson explains. “We have long experience of designing and building RO solutions at our Swedish factory.”

Enwa's patented EnwaMatic® technology, developed in-house, is winning ever more admirers, and almost 5,000 installations can be found on ships and offshore installations and in buildings. Put simply, this involves filtering the water and treating it with processed minerals. Particles are removed and water properties balanced to make it non-corrosive and avoid deposition and bacteria. Appropriate and chemical-free water treatment gives better energy transfer, lower power consumption and reduced maintenance costs. Enwa is a turnkey supplier of systems and products for water treatment on land and at sea. Demand for more and cleaner water is growing. "We're working continuously to meet this requirement and ensure that our solutions create real value for our clients," reports Eriksson, before noting that more information is available on the company website at www.enwa.com.

About Enwa Group

The Enwa group comprises a number of companies with water as their core business. Water Technology is one of three divisions, serving the offshore and marine markets as well as land-based industry and property.

Through continuous development and by concentrating attention on value creation at customers, Enwa is constantly enhancing its services and has moved in recent years from being a product supplier to become a provider of system

and service solutions. New technology from Enwa contributes to reducing chemical use on board and a better environment. ⚓



The more information

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ADVANCED WATER TECHNOLOGY



Fresh Water Generator

화학제품 없는 혁신적인 기술

선내의 화학제품 사용을 줄인 친환경적인 Enwa의 신기술

Enwa 그룹

노르웨이에 본사를 둔 Enwa는 화학제품을 전혀 사용하지 않고 담수를 생산하는 '자동 세척' 증발식 조수기를 발표했다. 이 제품은 화학제품을 사용하지 않고 담수를 생산하고 유지와 서비스를 위한 최소한의 공간을 차지하는 것에 전념한 덴마크의 해양 전문가에 의해 개발되었다.

Enwa Water Technology AB의 사업개발 부서장인 Peter Eriksson은 "화학제품은 통상적으로 사용되어왔다. 선원들은 화학제품들을 다룰 때 장갑과 눈 보호용 제품을 착용해야만 했지만, 이제는 더 이상은 필요하지 않다"라고 설명했다. "Scale-Guard가 설치된

Enwa의 조수기는 Scale 방지 제품의 사용이 불필요하며, 유지에 필요한 요건을 상당히 줄여준다. 우리는 통상적인 조수기보다 적은 비용으로 담수를 생산하는 조수기를 공급할 수 있게 되었다. 특히 친환경적이고 선원들의 일을 단축시켜주며, 시간과 비용을 절감할 수 있는 이 제품에 대한 포트폴리오의 최신 버전을 선보이게 되어 기쁘다"고 그는 강조했다.

"선박에서 담수를 확보하는 방법에는 세가지가 있는데, 해안에서 공급받거나 선내의 조수기 혹은 RO를 이용하는 것이다. 우리는 스웨덴 공장에서 RO를 이용해 설계 및 설치하는데 오랜 경험을

가지고 있다”고 Eriksson은 설명했다.

특허 받은 Enwa의 EnwaMatic® 기술은 높은 평가를 받고 있다. 현재 약 5,000여개의 제품이 선박 및 연안, 건물들에 설치되었다. 단순히 물을 투입하면 여과되어 미네랄 과정을 거쳐 처리된다. 입자들이 제거되고 물은 부식성이 없어지고, 침전물과 박테리아를 막아 균형을 이루게 된다. 특히 화학제품 사용이 없는 수처리는 더 나은 에너지 전환과 적은 전력소비로 유지비용을 절감할 수 있다. Enwa는 육지와 해양에서 수처리를 위한 시스템 및 제품을 터키로 공급하고 있다. 더 많은 양과 더 깨끗한 물에 대한 요구는 지속적으로 증가하고 있다. “우리는 이러한 요구에 부합하기 위해 지속적으로 노력하고 있으며, 고객들에게 실제적인 가치를 창출할 것이라고 확신한다”고 Eriksson은 말했다.

About Enwa Group

Enwa 그룹은 핵심사업이 물인 여러 회사로 구성되어 있다. Water Technology는 세가지 분야 중 하나이며, 육상 산업뿐만 아니라 오프쇼어(Offshore)와 해양 시장에 공급하고 있다.

고객가치창출을 위해 거듭 발전하고 집중함으로써 Enwa는 지속적으로 서비스를 강화하고 있다. 최근에는 제품 공급자에서 시스템과 서비스 솔루션 공급자로 영역을 확대했다. Enwa의 신기술은 선박의 화학제품 사용을 줄이고 친환경에 기여하고 있다. ⚓



The more information

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아즈빌이 제안하는 LNG선 통합제어시스템

— LNG선의 안전한 항해를 지원하는 통합제어시스템 선박용 DCS

아즈빌은 '인간을 중심으로 한 오토메이션으로 인간의 안심·쾌적·성취감을 실현함과 동시에 지구 환경에 공헌한다'는 기업이념을 바탕으로, 산업계에 제품과 솔루션을 폭넓게 제공하고 있다. Advanced Automation 사업에서는 공장이나 플랜트를 비롯해 필드기기부터 감시제어 시스템에 이르기까지 다양한 현장에 오토메이션과 관련된 종합적인 솔루션과 서비스를 제공하고 있다. 해운 및 조선 분야에서는 LNG선의 기간 시스템인 분산제어시스템과 필드기기를 제조 및 판매하고 있다. 또한 도크(Dock)에서의 서비스 메인テナンス를 제공해 LNG선의 라이프 사이클에 있어서 폭넓은 비즈니스를 전개하고 있다. 여기서는 LNG선의 효율적인 항해를 지원하는 IAS(Integrated Automation System)를 소개하며, 아즈빌의 LNG선 IAS의 특징에 대해 설명한다.

아즈빌(주)

By 오타 야스히코(Ota Yasuhiko) 어시스턴트 매니저, 글로벌 마린 오토메이션 영업본부

LNG선의 IAS를 둘러싼 배경

북미에서의 본격적인 셰일가스 채굴 및 동일본대지진 발생후의 에너지 전환을 배경으로, 상사, 전력회사, 가스회사가 경쟁적으로 천연가스 수입 프로젝트 개시를 결정하고 있다. 이러한 배경으로 인해, 해운 관련 주요 업체에서는 LNG선에 대한 투자를 적극적으로 강화할 방침을 표명하고 있다.

Figure 1은 천연가스의 서플라이 체인을 나타낸다. 아즈빌은 천연가스 서플라이 체인을 상류에서 하류까지 지원하는 제품군과 각종 솔루션을 제공하고 있다. 천연가스 서플라이 체인 가운데, LNG선은 해상운송 분야에서 중요한 역할을 담당하고 있다. LNG선은 탑재된 기기 개별의 성능뿐만 아니라, 시스템 전체적으로 최적의 기능과 성능이 요구된다. LNG선이 개발된 지 약 50년이 경과했는데, 아즈빌은 도입 초창기부터 LNG선 제어에 종사했으며, 현재는 최신 선박용 DCS가 LNG선 전체를 제어하는 IAS로써 안전한 항해에 기여하고 있다. 아즈빌은 기관 시스템 및 하역 제어 시스템을 분산 제어 시스템(DCS: Distributed Control System)으로 통합해, IAS로서 LNG선의 효율적인 운항에 기여하고 다양한 기능을 실현하고 있다.

선박용 DCS의 특징

선박용 DCS는 차세대형 오픈 오토메이션 시스템이다. 윈도우 단말, 제어·정보 네트워크에 Ethernet 등 오픈·표준화된 기술을 시스템 기반으로 채용해, 정보공유화에 있어서 유연성을 대폭 향상시켰다. 컨트롤러간 필드 네트워크로는 업계 표준인 필드버스(Fieldbus) 협회 사양에 대응한다. 관리 소프트웨어간 데이터인터페이스를 DCOM(Distributed

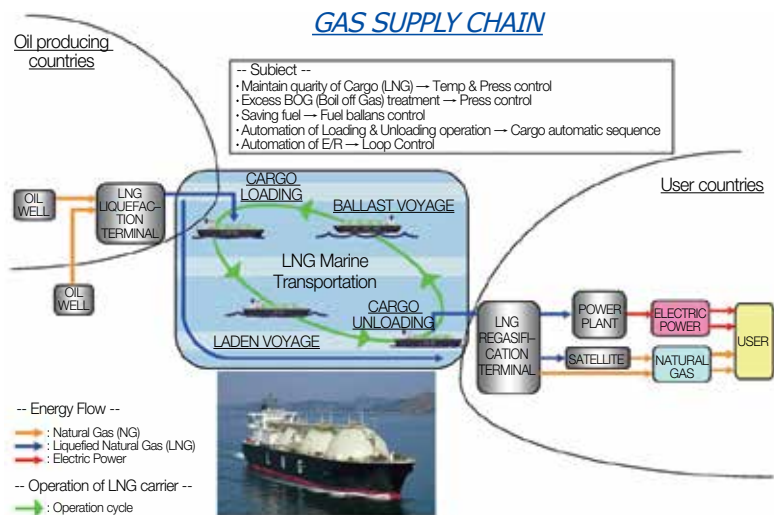


Figure 1. 천연가스 서플라이 체인

Component Object Model/ActiveX, OPC(OLE for Process Control)로 하여, 범용 소프트웨어와의 제휴를 강화해 정보를 공유하고 있다. 이와 같은 오픈·표준화 기술을 채용 후에, LNG선의 제어 전반에 요구되는 신뢰성, 2중화 성능을 확보했다. 이것이 콘셉트 "Dependable Open"이다.

선박용 DCS의 특징은 다음과 같다:

— 선내 시간 관리

Marine-DEO는 선내 시간과 시스템 시간 등 2개의 시간을 관리하는 기능이 있다. Figure 2와 같이 선내 시간은 조작 화면에 항상 표시되

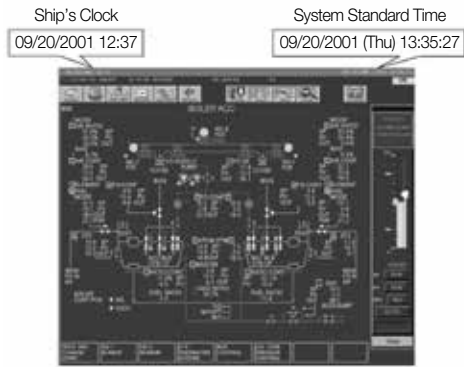


Figure 2. 선내 시간 관리

며, 이벤트 발생시간과 알람 발생 시간은 선내 시간을 기준으로 기록되어 있다. 선내 시계에서 시간 동기 신호가 송신되어 선박용 DCS와 선내 시간이 동기되어 있다.

- 통합 엔지니어링 환경

Figure 3과 같이 시스템의 기본 설정뿐만 아니라, Function Block의 Configuration을 사용할 수 있다. 복수의 가상 컨트롤러는 소프트웨어 시뮬레이터에 접속할 수 있어, 실제 디바이스를 접속하지 않고 디버그 환경이 제공된다.

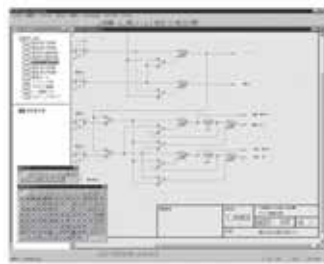


Figure 3. 통합 엔지니어링 환경

- 견고하고 신뢰성 높은 제어

선박용 DCS는 강력하고 견고하며 실적이 있는 DCS이며, 다양한 Process 중에서 중요한 어플리케이션에 활용되는 컨트롤러를 채용해,

고도의 통신과 제어 기능 및 자기진단 기능과 2중화 기능을 실현했다.

- Automation Suite

아즈빌은 오토메이션 시스템 전문업체로서 'Automation Suite'로 불리는 올인원 패키지 솔루션군을 전개하고 있다. Automation Suite는 휴먼 인터페이스 엔진, 히스토리 엔진, 제어 엔진, 어플리케이션 구축 엔진으로 구성되며, LNG선의 감시제어에 필요한 솔루션 및 소프트웨어를 제공하고 있다.

- 리모트 알람

Marine-DEO가 알람을 검출하면, Figure 4와 같이 알람 신호는 실시간으로 익스텐션 알람 패널 등의 외부 시스템으로 송신된다. 알람 신호는 컨트롤러인 프로세스 제어 컨트롤러를 경유하여, Supervisory Station

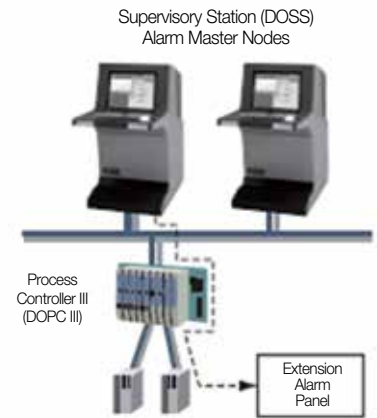


Figure 4. 리모트 알람 개요

DOSS에 표시된다. 이러한 알람 신호는 캐빈, 그 외의 익스텐션 알람 패널로 송신할 수 있다.

- 선급 대응

선박용 DCS의 하드웨어는 해상의 열악한 환경에서 사용하는 것을 전제로 진동성, 환경성을 고려해 설계됐다. 또한, 선박용 DCS는 ABS, BV, LR, NK, CCS 등의 주요 선급협회의 형식 승인을 취득했다. 또한 LR선급협회로부터 소프트웨어의 품질관리 규정인 Software

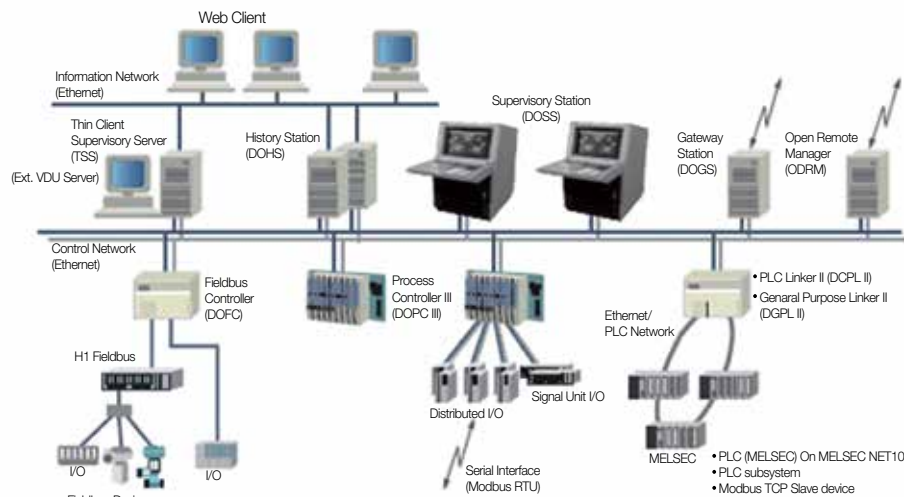


Figure 5. Marine-DEO 시스템의 구성



Conformity Assessment의 인증을 취득해, 하드웨어와 소프트웨어 모든 면에서 제3자인 선급협회로부터 품질, 기능, 능력을 증명받았다.

선박용 DCS의 시스템 구성

선박용 DCS의 일반적인 시스템 구성은 Figure 5와 같다. 선박용 DCS는 시스템 감시 조작용 휴먼 머신 인터페이스(HMI)와 2중화 가능한 고신뢰성 제어 컨트롤러로 구성되며, 이것은 2중화된 제어 LAN(Ethernet)에 접속된다.

HMI는 기본 OS로 윈도우를 채용해, 쾌적한 감시 조작 환경과 개방적인 데이터 처리 환경을 제공한다. 또한 LNG선에 최적의 제어 시스템을 구축하는데 필요한 현장 오퍼레이션 모듈, 리모트 감시 모듈, 히스토리 해석 모듈, 통신 게이트웨이 모듈, 비정상 운전 지원 모듈, 알람 해석 모듈 등의 어플리케이션 모듈을 구비했다. 주요 시스템 구성 기기는 다음과 같다.

– DEO Open Supervisory Station (DOSS)

DOSS는 시스템 구축(엔지니어링 기능) 및 프로세스 조작/감시 등의 HMI 기능을 제공 한다. 콘솔 타입의 DOSS는 Figure 6과 같다.



Figure 6. DOSS(콘솔)

• 시스템 엔지니어링 기능

Marine-DEO에서는 시스템 설계부터 각종 제어 기능 설계, 필드버스(fieldbus) 엔지니어링 기능, 그래픽 화면 설계, 디버그나 문서 관리까지의 토털 엔지니어링을 통합 엔지니어링 환경에서 실시한다. 엔지니어링 머신에서 베타컬 컨트롤러로서 기능하는 소프트웨어 시뮬레이터를 통해, 시스템 설계부터 각종 제어 기능 설계와 디버그까지의 토털 엔지니어링을 머신 1대로 할 수 있다. 설계와 디버그 환경이 수시로 전환됨과 동시에, 다수가 작업하는 엔지니어링을 실현해, 효율적인 엔지니어링이 가능하다. 소프트웨어 시뮬레이터는 필요에 따라 여러 대를 동시에 실행할 수 있다.

화면 표시는 프로세스 오퍼레이션 디스플레이, 알람·이벤트 모니터링 디스플레이, 시스템 모니터링 디스플레이 등 3개로 분류된다.

1. 프로세스 오퍼레이션 디스플레이

그래픽 화면: 유저 고유의 프로세스 플로우 화면, 프로세스 조작 감

시 화면이다.

그룹 화면: 최대 8개의 페이스 플레이트로 조작 감시하기 위한 프로세스 조작 감시 화면이다. 온라인으로 그룹명 등록 및 페이스 플레이트 할당이 가능하다.

트렌드 화면: Figure 7과 같이 History Station이 수집한 트렌드 데이터를 표시한다.

상세 화면: 제어 포인트 등의 파라미터 정의 정보를 표시하고 파라미터를 튜닝하는 화면이다. 조절 제어 포인트에서는 튜닝 트렌드가 표시된다.



Figure 7. DOSS 화면

2. 알람·이벤트 모니터링 디스플레이

알람 개요 화면: Figure 7과 같이 구역 내에서 발생한 Process 알람을 발생 시간 순서, 우선도 순서로 표시한다. 알람마다 온라인 매뉴얼을 정의할 수 있다.

메시지 개요 화면: 구역 내의 시퀀스 메시지를 발생시간 순으로 표시한다. 컨펌이 있는 메시지에 대해서는 컨펌하여 공정 보진(공정순차처리)시킬 수 있다.

시퀀스 이벤트 메시지 화면: 구역 내의 시퀀스 이벤트를 발생 시간 순서, 우선도 순서로 표시해, 시퀀스의 진행 상황을 표시한다.

3. 시스템 모니터링 디스플레이

시스템 스테이터스 화면: Figure 7과 같이 각 노드의 가동상태 알람을 나타내는 화면이다.

컨트롤러 스테이터스 화면: 컨트롤러 상태의 상세 정보를 표시한다.

– DEO Open History Station

History Station은 선박용 DCS 시스템의 트렌드 데이터베이스, 이벤트 데이터베이스, 장표 데이터베이스로서의 역할을 담당한다. History Station에는 SQL Server가 탑재되어 프로세스데이터, 이벤트데이터 등을 장기간 저장한다.

– DEO Process Controller

프로세스 컨트롤러는, 선박용 DCS의 프로세스 입출력 관리부터 루프 제어, 로직 제어, 시퀀스 제어를 실현하는 다기능 프로세스 제어용 컨트롤러이다. 프로세스 제어 컨트롤러의 특징은 다음과 같다.

1. 고성능 컨트롤러

- 3중화 CPU를 표준 채용, CPU 1대라도 지속 제어 가능
- 3중화 CPU 병렬 2중화 방식에 의한 무순단(Auto Return) 전환
- 2 out of 3 2중화 아키텍처에 의한 출력 데이터가 높은 신뢰성
- 통신 퍼포먼스 증대로 인한 내부화 성능 향상

2. 대용량

- 최대 640루프의 처리 능력
- 최대 120대의 I/O모듈 접속

3. 고기능

- 최대 10,000파라미터/초의 통신 능력
- 최고 속도 100ms의 연산처리
- 1ms에서의 접점상태 기록 기능(시퀀스 오브 이벤트(SOE))

4. 용이한 리뉴얼 및 증설

- 기존 I/O(X-Bus I/O)의 통합화
- 기존 컨트롤러와 컨트롤러간 통신

5. 통합 엔지니어링

환경동일 환경에서 프로세스에 적절한 설계부품 선택 또는 혼재 장착 가능 소프트웨어 시뮬레이터의 도입으로, 컨트롤러가 필요 없는 시뮬레이션과 디버그 실현

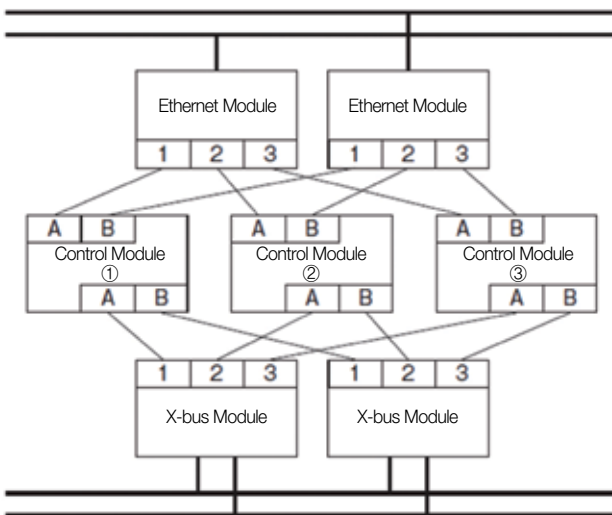


Figure 8. 2 out of 3용장 아키텍처 개념도

그럼 컨트롤러 특징 중 하나인 2 out of 3 2중화 아키텍처에 대해 알아보자. Figure 8과 같이 프로세스 제어 컨트롤러의 컨트롤-모듈은 3중화로 구성되어 있으며, 각 컨트롤-모듈이 항상 동기화하면서 동일 연산 기능을 실행하며, 그 결과를 각각의 메모리 진단 후에 출력한다. 상위 네트워크에 입출력하는 이더넷-모듈과 I/O 네트워크에 입출력하는 X-Bus-모듈은 이 3개의 출력을 항상 비교해 2 out of 3의 다수결

판정 논리로 데이터를 외부에 출력한다. 즉, 3개의 컨트롤-모듈이 출력하는 값 중에 1개가 비정상인 값을 나타내는 경우라도, 나머지 2개의 정상적인 값을 채용하므로 반드시 정확한 값을 출력할 수 있다. 또한 기타 장점으로서 기존 대기 2중화 방식에서는 피할 수 없었던 실행측에서 대기측으로 백업 전환을 처리시에 시간이 전혀 소요되지 않아, 완전한 무순단(Auto Return)으로 변환처리를 할 수 있다는 점이 있다.

- I/O 서브시스템

분산형 I/O와 시그널 유닛 I/O에 대해 소개한다. 분산형 I/O는 I/O모듈 베이스와 I/O모듈로 구성되며 DIN 레일에 설치된다. I/O모듈 베이스는 각 I/O모듈에 대응한 전용이 준비되어 있으며, 필드 배선은 I/O모듈 베이스의 출력 단자에 직접 접속된다.

시그널 유닛 I/O는 시그널 유닛, 베이스 유닛, FX-Bus 통신 모듈로 구성된다. 시그널 유닛 I/O에는 입력(또는 출력)/전원 간/유닛 간 개별적으로 절연된 아날로그 I/O(절연 내압 AC500V)와 32점 Photocoupler 절연 입력, 32점 반도체 출력의 디지털 I/O가 구비되어 있다.

- Open PLC Linker

MELSECNET/10(또는 MELSECNET/H)을 통해 미쓰비시전기의 MELSEC를 통합 제어하기 위한 다기능 컨트롤러(2중화 가능)이다. MELSECNET의 링크 디바이스를 I/O로 취급해, 프로세스 제어 컨트롤러와 같이 루프 제어, 로직 제어, 시퀀스 제어가 가능하다. 프로세스 제어 컨트롤러와 공통화된 제어 데이터베이스를 사용한다.

- 멀티 벤더 통합 게이트웨이

멀티 벤더 통합 게이트웨이(DEO General Purpose Linker)는 선박용 DCS 서브시스템의 통합 감시제어를 실현하는 게이트웨이이다. 다양한 서브시스템의 통신 프로토콜에 대응하고 있으며, PLC 등의 서브시스템과 연동시킨 고도의 설비 자동화를 실현할 수 있다.

- Thin Client Supervisory Server (TSS)

리모트 환경에 설치된 클라이언트 PC에 DCS 오퍼레이션 환경을 제공하는 서버 노드이다. 클라이언트에서 DOSS와 동일한 조작이 가능하다. 화면 어플리케이션은 DOSS와 공통화되어 있다.

TSS는 선박용 DCS 시스템에서 아즈빌이 새로운 오퍼레이션 스타일 콘셉트를 실현하는 HMI 솔루션으로 자리매김하고 있다. Web 베이스의 HMI 환경을 실현해 Web 단말로 로케이션 프리인 Full DCS Operation이 가능해진다.



TSS는 TSS 서버나 TSS 클라이언트로 불리는 서버와 클라이언트로 구성된다. TSS 클라이언트는 네트워크를 통해 TSS 서버에 접속해 TSS 서버 내 DCS 어플리케이션을 이용할 수 있다. 따라서, TSS 클라이언트 내부는 전용 DCS 어플리케이션이 없는 심플한 클라이언트 구조로 되어 있다. TSS에서는 기존 DCS가 취약한 현장 조작 환경(현장 오퍼레이션 환경)을 전용 단말 TSS 클라이언트로 제공할 수 있다.

Web 클라이언트 (Ext. VDU 클라이언트) - 네트워크에 접속된 PC를 Web 클라이언트로 사용할 수 있다. Web 브라우저로 IAS의 감시 내용을 실시간으로 조작할 수 있으며, 알람 발생시에는 알람 내용이 Web 클라이언트의 음성으로 통지된다. 또한 PC로 다른 작업 중이어도 모니터링이 가능하다.

LNG선의 오퍼레이션 사이클

LNG선은 선적항에서 LNG를 탱크 용량의 전량을 싣고, 양하항에서 LNG의 전량을 양하하는(짐을 내리는) 운항 형태가 일반적이다. LNG를 선적한 항해를 'Laden Voyage', LNG를 선적하지 않은 항해를 'Ballast Voyage'라고 한다. 선적 항해 중에는 LNG 온도와 탱크 압력을 관리한다. 한편 빈 화물의 항해 중에는 선체의 안정성 유지 및 선체의 요동을 줄이기 위해 벨라스트 탱크에 해수를 싣는다.

빈 탱크에 LNG를 선적하면 선적한 LNG 온도보다 탱크 온도가 높으므로, 기체인 액화천연가스가 대량으로 증발해 증기상태가 된다. 액화천연가스의 부피는, 액체 LNG에 비해, 600배가 되어 탱크압력이 상승하게 된다. 따라서 증기가 탱크 내에 축적된 채로 선적하면, 탱크압력이 계속 상승해 탱크에 설치된 안전밸브의 설정압력까지 도달하여 안전밸브에서 증기가 분출된다. 이것을 막기 위해 선적시에는 탱크 내에서 발생한 증기를 선적 기지로 송출해, 압력을 일정 이하로 유지하는 제어가 필요하다.

한편 선적과는 반대로 양하시에는 카고의 LNG가 감소함에 따라 탱크압력도 내려간다. 그대로 양하할 경우, 탱크가 변형되지 않게 설정된 안전밸브의 설정압력까지 도달해 탱크 내에 공기가 들어가게 된다. 이를 막기 위해 양하시에는 수입기지에서 증기를 일정량 송출하여 탱크압력을 일정하게 유지할 수 있도록 제어하고 있다. LNG선의 오퍼레이션 사이클 각 과정에서 IAS에는 이하의 다양한 기능이 요구된다. LNG선 IAS가 실현하는 기능의 화면 예를 Figure 9와 Figure 10에서 볼 수 있다.

1. Cargo Control (카고 제어)
2. Gas Management (가스 매니지먼트)
3. Ballast Control (발라스트 제어)
4. Automatic Sequence Control for Cargo Operation (하역 작업용 자동 시퀀스)

5. Machinery Control (기관 제어)

6. Power Management (파워 매니지먼트)

Control Function of IAS

1. Cargo Control

- Cargo tank press control
- Cargo pump control
- Spray header press control
- Spray pump control
- Fuel gas pump control
- Fuel gas header press control
- Barrier space press control
- Cofferdam temp control
- Glycol heater control
- ESD/tank protection control



Figure 9. IAS 기능 예(Cargo Control)

Control Function of IAS

2. Gas Management

- Forcing Vaporizer control
- LNG Vaporizer control
- BOG heater control
- H/D compressor control
- L/D compressor control
- Gas combustion unit control
- BOG vent control

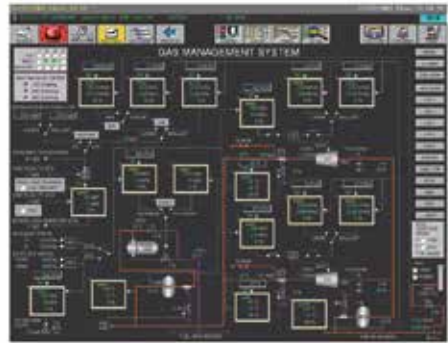


Figure 10. IAS 기능 예(Gas Management)

결론

지금까지 LNG선에서 채용되고 있는 선박용 DCS의 특징을 중심으로 설명했다. 향후, LNG 연료 엔진 등 새로운 추진기관의 채용, 복잡화된 국제 룰에 적용, 안전 운항 강화나 에너지절감, 환경대책, 유지보수 비용절감 등 이를 둘러싼 사업 환경의 변화가 예상된다. 아즈빌은 고도의 계측 및 제어 기술을 핵심으로, 선박시장에 요구되는 솔루션을 제공해왔다. 앞으로도 '인간을 중심으로 한다는' 발상으로, 컨설팅부터 납입 후의 유지, 보수 서비스까지 고객과 함께 현장에서 가치를 창조해 나가고자 한다. ⚓

* Ethernet은 후지제록스(주)의 상표다.

* Windows는 미국 Microsoft Corporation의 미국 또는 기타 지역에 등록된 상표다.

* MELSEC, MELSECNET은 미쓰비시전기(주)의 상표다.

Korea Shipbuilding Orders awarded to domestic shipyards in 2015

Data	Type	Number of vessel	Amount	Ship owner	Delivery	Shipyard
Jan	174,000m³ LNG carriers	2 vessels	USD 400 million	Korea Line Corporation, Korea	The end of 2017	Daewoo Shipbuilding & Marine Engineering
	174,000m³ LNG carriers	2 vessels	USD 400 million	Hyundai LNG Shipping, Korea	The end of 2017	Daewoo Shipbuilding & Marine Engineering
	19,200 TEU container ships	3 vessels	USD 450 million	Scorpio Group, Monaco	-	Samsung Heavy Industries
	LNG carriers	2 vessels	USD 416 million	SK shipping, Korea	The end of 2017	Samsung Heavy Industries
Feb	319,000 DWT VLCCs	2 vessels	USD 198 million	Maran Tankers Management, Greece	-	Daewoo Shipbuilding & Marine Engineering
	158,000 ton oil tankers	5 units (2 optional vessels)	USD 330 million	-	2017s	Sungdong Shipbuilding & Marine Engineering
	174,000m³ LNG carriers	1 vessel	USD 200 million	-	-	Daewoo Shipbuilding & Marine Engineering
	74,000 DWT oil products carriers	2 units (1 optional vessels)	USD 46 million	Valles Steamship, Hong Kong	-	STX Offshore & Shipbuilding
Mar	300,000 DWT VLCCs	2 vessels	USD 192 million	Metrostar Management, Greece	The end of 2016	Hyundai Heavy Industries
	1,800 TEU container ships	4 units (2 optional vessels)	-	Cosmoship Management S.A. Greece	-	Dae Sun Shipbuilding & Engineering
	180,000m³ LNG carriers	1 vessel	-	Mitsui O.S.K Lines, Japan	2018s	Daewoo Shipbuilding & Marine Engineering
	38,000m³ liquefied petroleum gas and ammonia carriers	2 vessels	-	Asian ship owner	-	Hanjin Heavy Industries & Construction
Apr	20,100TEU container ships	4 vessels	USD 619.57 million	Mitsui O.S.K Lines, Japan	2017. August	Samsung Heavy Industries
	LR1 tankers	2 vessels	KRW 320 billion	BW, Singapore	2016 ~ 2017	STX Offshore & Shipbuilding
	319,000 DWT VLCCs	2 vessels	USD 198 million	Maran Tankers Management, Greece	The end of 2016	Daewoo Shipbuilding & Marine Engineering
	20,600 TEU container ships	3 vessels	-	CMA CGM, France	The end of 2017	Hanjin Heavy Industries & Construction (HHIC)-Phil's Subic Shipyard
May	21,100 TEU container ships	6 vessels	USD 950 million	OOCL, Hong Kong	The end of 2017	Samsung Heavy Industries
	10,500 TEU container ships	5 vessels	-	Hapag-Lloyd, Germany	-	Hyundai Samho Heavy Industries
	Pure Car/Truck Carriers	2 vessels	USD 130 million	Norwegian Car Carriers, Norway	The end of 2016	Hyundai Samho Heavy Industries
	11,000 TEU container ships	6 vessels	-	Asian and European ship owners	2016 ~ 2017	HHIC-Phil's Subic Shipyard
Jun	156,000 ton oil tankers	2 vessels	-	Maran Tankers Management, Greece	-	Daewoo Shipbuilding & Marine Engineering
	5,200 ton training vessel	1 vessel	-	-	-	Hanjin Heavy Industries & Construction
	74,000 tons LR1 tankers	8 units (4 optional vessels)	USD 375 million	Marshall Islands-based ship owners	The end of 2016	STX Offshore & Shipbuilding
	300,000 DWT VLCCs	10 units (5 optional vessels)	USD 1 billion	The National Shipping Company of Saudi Arabia	2017s	Hyundai Samho Heavy Industries
Jul	19,630 TEU container ships	11 vessels	USD 1.1 billion	Maersk Line A/S, Denmark	2018s	Daewoo Shipbuilding & Marine Engineering
	Tankers	2 vessels	-	Acadia Shipmanagement, Greece	-	Hyundai Heavy Industries
	300,000 DWT VLCCs	6 units (4 optional vessels)	USD 540 million	John Fredriksen	-	STX Offshore & Shipbuilding
	174,000 CBM LNG carriers	3 units (1 optional vessels)	-	Teekay LNG Partners, Canada	First quarter of 2019	Hyundai Samho Heavy Industries
Aug	155,000 DWT tankers	3 vessels	USD 330 million	-	2018. February	Samsung Heavy Industries
	84,000m³ VLGCs	4 vessels	USD 320 million	China Peace, China	-	Daewoo Shipbuilding & Marine Engineering
	173,400m³	1 vessel	USD 195 million	Chandris, Greece	The end of 2018	Daewoo Shipbuilding & Marine Engineering
	14,000 TEU container ships	9 vessels	USD 1.1 billion	Maersk Line A/S, Denmark	2017	Hyundai Heavy Industries
Sep	Product Carriers	4 vessels	USD 144 million	Scorpio Tankers, U.S.A	The first of 2017	Hyundai Mipo Dockyard
	84,000m³ LPG Carriers	2 vessels	-	Asia ship owner	2017s	Daewoo Shipbuilding & Marine Engineering

*Note : Based on the press release and public announcements of each shipyards, internal estimation of Monthly KORSHIP (estimation until Sep 15, 2015)

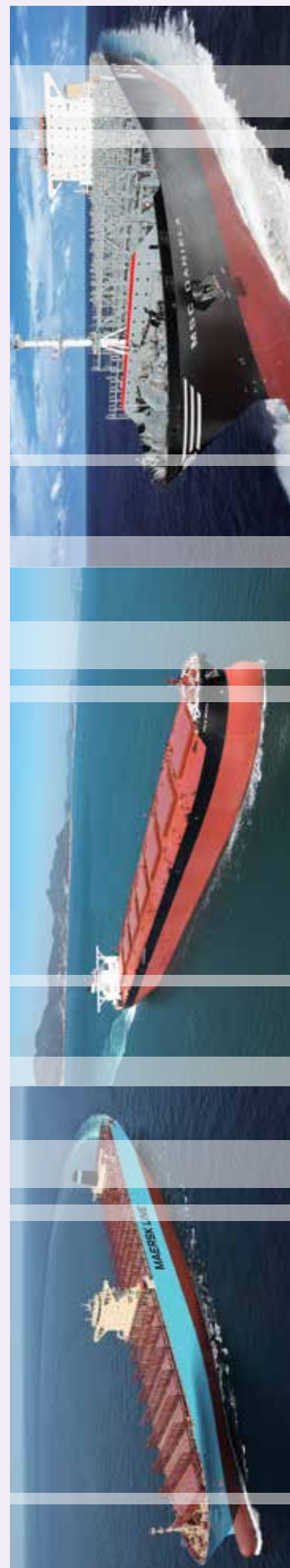




ABB to optimize routes of giant Maersk Line container ships

ABB is working with Meteo Group to equip 140 container ships from Maersk Line with advisory software to optimize routes, boost maritime safety and protect precious cargo based on factors including the hull design and the weather; helping them avoid conditions that could be harmful to the ship, its crew or its cargo.

The deal will see ABB combine its Octopus motion-monitoring, forecasting and decision-support software, which improves vessel availability and safety, with Meteo Group's SPOS Seekeeping plug-in. Once fitted on Maersk Line ships, this will enable captains to define on-board loading conditions, and more accurately determine areas of the ocean where their ship's motion is likely to exceed threshold values. Routes can then be optimized automatically to skirt adverse conditions, ensuring cargo arrives safely and on-time at its destination port.

"Both Meteo Group and ABB take great pride in the fact that we are delivering an onboard advisory tool for the world's biggest container shipping company," said Heikki Soljama, managing director of ABB's Marine and Ports business unit. "This will enable Maersk to execute cargo transportation across the world in a safe and efficient manner."

This innovative software solution reflects ABB's focus on the Internet of Things, Services and People in helping marine customers leverage vast amounts of previously untapped data about their ships to boost the efficiency and safety of their operations while cutting costs. Innovation has always been a key source of competitive advantage for ABB and is a key element of the company's Next Level strategy.

ABB's Octopus advisory suite, which is also deployed aboard liquefied natural gas tankers and the world's biggest cruise ships, includes a three-dimensional hydrodynamic database for each individual hull type. This means ABB's software, together with Meteo Group's plug-in, produces very accurate calculations about how a ship will respond to dynamic weather and ocean conditions. The resulting routing advice is far more precise and tailored to the individual vessel because it takes into account not only environmental conditions such as wind, currents and swell but also the effect these changing conditions may have on the ship's behavior.

ABB offers the widest portfolio of marine advisory and optimization systems to the maritime market. Its performance management solution consists of the Octopus advisory suite and the 'Emma' advisory suite, a decision support toolkit to minimize the overall fuel and energy costs for a whole fleet.

ABB, 머스크 컨테이너선에 항로 최적화 소프트웨어 공급

ABB와 네덜란드 기상예보 전문 Meteo 그룹은 머스크의 140척 컨테이너 선박에 항



로 최적화, 해양안전 향상 및 화물보호 기능을 탑재한 소프트웨어 프로그램 공급계약을 수주했다.

Meteo 그룹의 SPOS SEAKEEPING 프로그램과 함께 선박운 동성 감시, 예측 및 의사결정 지원 프로그램인 ABB 'Octopus'가 통합되어 선박에 설치된다. 이를 통해 선장이 Loading 조건을 결정하고, 대양의 어느 지역에서 선박 Motion이 한계를 초과할 것인지에 대한 정보를 정확히 제공한다.

ABB 마린 및 항만 사업부 헤이키 솔자마(Heikki Soljama) 대 표는 "Meteo 그룹과 ABB, 양사는 세계 최대 컨테이너 선사 에 선내 자문시스템을 납품하게 되어 자부심을 느낀다"라고 전했다. 덧붙여 "이 시스템을 통해 머스크는 안전하고 효율 적인 화물 운송이 가능해질 것"이라고 말했다.

Meteo 그룹에 제공되는 소프트웨어는 ABB가 주력 중인 IoTSP(Internet of Things, Services and People)가 반영된 혁신 적인 솔루션이다. 높은 활용도가 있으나 기술한계로 사용되 지 못했던 선박관련 방대한 데이터를 활용해 조선 및 해양 고객사는 비용 절감과 더불어 운영 효율성 및 안전 증진 효 과를 기대할 수 있다. 혁신은 ABB 경쟁력의 원천이며 차세 대 전략의 핵심 요소이기도 하다.

LNG선박과 세계에서 가장 큰 유람선에도 설치된 ABB의 'Octopus advisory suite'는 각각의 선형을 위한 3차원 유체 역 학정보를 포함하며, ABB와 Meteo 그룹의 소프트웨어 통합으 로 변화무쌍한 날씨와 해양 환경에 따라 선박이 어떻게 반 응할 것인지에 대해 매우 정확히 계산한다. 이 항로자문 시 스템은 바람, 해류, 너울과 같은 환경적인 조건뿐 아니라 이 변수들이 선박에 미치는 영향까지 고려하기 때문에 훨씬 정 확하다. 각각 선박의 운항특성에 따른 맞춤정보도 제공한다. ABB는 선박 자문/최적화 시스템(marine advisory and optimization systems)에 관한 폭넓은 포트폴리오를 제공하며, Octopus advisory suite와 전체 선단의 연료와 에너지 비용을 최소화하는 의사결정 지원도구인 'Emma' advisory suite로 구 성되어 있다.

Nexans win subsea cables for Abu Dhabi's Nasr oil field

The new super complex at the heart of the future development of the Nasr oil field, offshore from Abu Dhabi in the UAE, will be powered by Nexans' subsea cables. This follows the award of a contract worth around Euro 90 million by the EPC contractor, Hyundai Heavy Industries (HHI), for Nexans to supply high voltage power cables and infield cables. The Nasr oil field is located approximately 130 km northwest of Abu Dhabi City in UAE, the world's seventh largest oil producing country.

HHI is undertaking engineering, procurement, construction, installation and commissioning work for a new super complex serving the Nasr field. The project will comprise a gas treatment platform, a separation platform, an accommodation platform; installation of subsea power and infield cables; modifying an existing manifold tower and two wellhead towers and work for power distribution facilities from the existing Das Island in the Persian Gulf.

For the Nasr project, Nexans is supplying HHI with 132 kV XLPE insulated three-core subsea power cable incorporating three fibre optic elements, together with 11 kV XLPE insulated three-core infield cables, also incorporating three fibre optic elements.

Dirk Steinbrink, Nexans Senior Executive Vice President High Voltage & Underwater Cables, said, "Winning this very significant order for the Nasr project continues our current growth in subseas power cable projects. It also demonstrates the broad scope of our offering for the oil and gas industry with high technology power cables and umbilicals."

The Nasr cables will be manufactured at Nexans' specialized facility in Halden Norway.

넥상스, 아부다비 나스르 프로젝트의 해저케이블 수주

UAE 아부다비에 위치한 나스르 해상 유전개발 프로젝트는 넥상스의 해저케이블로 작동 될 예정이다. 넥상스는 2단계 프로젝트에서 EPC를 맡은 현대중공업과 약 9,000

만 유로 상당의 초고압 전력 및 인필드 케이블 공급 계약을 체결했다.

나스르 유전은 세계 7대 오일 생산국인 UAE 아부다비에서 북서쪽으로 약 130km 떨어진 지점에 위치해 있다.

현대중공업은 나스르 유전 개발에 필요한 대규모 해상 복합단지의 설계, 구매 건설 및 시운전을 담당하며, 이 프로젝트에는 원유분

리설비, 가스처리시설, 기초구조물, 거주구, 전력 공급용 해저 케이블 설치와 기존 매니폴드 타워와 두 개의 수원 타워 수리 및 페르시아만 다스섬의 기존 배전 설비 작업이 포함되어 있다.

넥상스는 나스르 프로젝트에서 3개 회선의 광통신이 포함된 132kV XLPE 절연 삼상 해저 케이블과 11kV XLPE 절연 삼상 인필드 케이블을 현대중공업을 통해 공급한다.

넥상스 초고압 및 해저케이블 사업부 더크 스테인브링크 부사장은 "우리는 나스르 프로젝트와 같은 대규모 계약을 수주함으로써 해저 전력 케이블 분야에서 지속적인 성장을 거듭하고 있다. 또한 오일&가스 산업에서 전력 케이블과 엄빌리칼로 폭 넓은 서비스를 제공할 수 있다는 것도 재증명됐다"고 말했다.

나스르 프로젝트에 사용 될 케이블은 노르웨이 할덴에 있는 넥상스 초고압 케이블 전문 공장에서 제조된다.



Schneider Electric announces Global Software Agreement with Shell for SimSci Spiral Suite

Schneider Electric announced that Shell has signed a global agreement for Spiral Suite that includes planning, scheduling and supply and distribution optimization modules.

Spiral Suite is the industry's only unified planning and scheduling environment designed from the ground up. It fully supports all supply chain work processes across large and small refineries, bringing together enterprise crude knowledge management, planning, scheduling and

envelope optimization activities in a single software application. The result is a solution that better explores opportunities, reduces operational risk and shrinks the gap between planned and actual results. All activities are supported within a single application, with a single user interface and a single source of data with version and data management control.



Spiral Suite enables information to be shared easily between users, improving understanding and collaboration between traders, planners and schedulers and replacing potentially disjointed point solutions.

"We are pleased to collaborate with Shell on this project. Spiral Suite promises to enhance the refinery business environment where diverse business groups can collaborate to understand how their decisions impact others and then cooperate to collectively unlock the maximum value of their economic forecasts," said Ravi Gopinath, Ph.D., Executive Vice President, Schneider Electric Software.

"It increases transparency and collaboration across different business groups, enabling our customers to make the best overall decisions for safety and profitability while taking better advantage of new opportunities presented by the market."

슈나이더 일렉트릭, 셸에 시뮬레이션 소프트웨어 '스파이럴 스위트' 공급

슈나이더 일렉트릭이 셸(Shell)과 소프트웨어 공급 협약을 맺고, 플래닝, 스케줄링, 공급 및 유통 최적화 모듈이 포함된 심사이 스파이럴 스위트(SimSci Spiral Suite)를

루션을 공급했다고 밝혔다.

심사이 스파이럴 스위트는 업계 유일의 통합 플래닝 및 스케줄링 솔루션으로, 정유 공정 전체에 걸쳐 원유 정보 관리, 플래닝, 스케줄링 및 최적화 활동을 하나의 소프트웨어 애플리케이션으로 관리할 수 있도록 해준다.

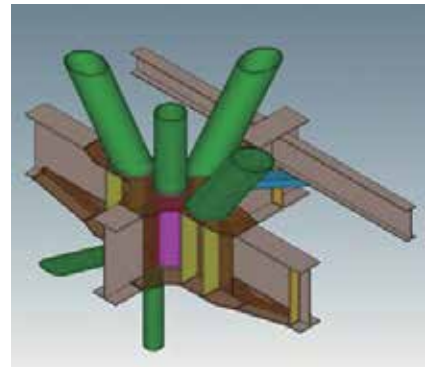
이 애플리케이션은 하나의 사용자 인터페이스와 데이터 소스를 기반으로 운영되어, 버전 관리, 데이터 관리 제어 등 모든 활동을 한꺼번에 처리할 수 있다. 또한, 다양한 사용자 간의 정보 공유가 용이해, 영업 담당자와 플래닝 담당자, 스케줄링 담당자 사이의 협업을 강화시켜준다.

슈나이더 일렉트릭의 소프트웨어 사업부 수석 부사장 라비 고피나스(Ravi Gopinath)는 "셸과 이번 프로젝트를 위해 협력하게 되어 기쁘다. 스파이럴 스위트는 다양한 사업부가 협력하여 서로의 결정이 어떤 영향을 미치는지 이해하고 협업을 통해 최대의 수익을 낼 수 있도록 사업 환경을 개선해준다. 여러 사업부 간의 투명성과 협업성 강화로 고객이 새로운 사업 기회를 포착하고, 동시에 현명한 의사결정을 통해 안전과 수익성을 높일 수 있도록 돕겠다"고 말했다.

Kværner Verdal AS selects AVEVA Bocad

AVEVA announced that, following a rigorous competitive evaluation, Kværner Verdal AS has selected AVEVA Bocad Steel™ and AVEVA Bocad Offshore™ for use at its design and fabrication yard in Verdal, Norway. Kværner required a specialised structural steel design solution that provided out-of-the box functionality and powerful integration. Through the use of AVEVA Bocad Offshore, Kværner benefits from software that is specifically created for the design, detailing and fabrication of all forms of offshore steel structures. When integrated with Kværner's AVEVA PDMS™ deployment, these structural steel solutions provide an efficient and complete 3D engineering solution that will enable the company to execute larger, more complex structural projects with reduced risk, cost and delivery time.

"Kværner will benefit from an unrivalled combination of tight project control and high quality design and fabrication on projects where being on time and budget are business-critical", said Helmut Schuller, EVP Sales, AVEVA. "AVEVA Bocad is easy to adopt, enabling clients to use it immediately on new projects with no dip in productivity. All improvements in engineering and fabrication processes have a direct benefit to the bottom line of a business. AVEVA Bocad will enable clients to increase their competitiveness by delivering better quality projects to their customers. A key element to this win has been AVEVA's ability to build and sustain long-standing customer relationships."



Dave Wheeldon, CTO, AVEVA, added, "Accurate and detailed design leads to efficient and error-free construction. This is essential for businesses like Kværner when designing and building complex offshore installations. AVEVA Bocad Offshore extends the productivity of AVEVA Bocad Steel with special features for the unique needs of this challenging industry sector. The Future of Steel Fabrication has never been so exciting, and the AVEVA Bocad solution is driving this future, creating new capabilities that will transform the structural steel industry."

Offshore plant orders awarded to domestic shipyards in 2011-2015

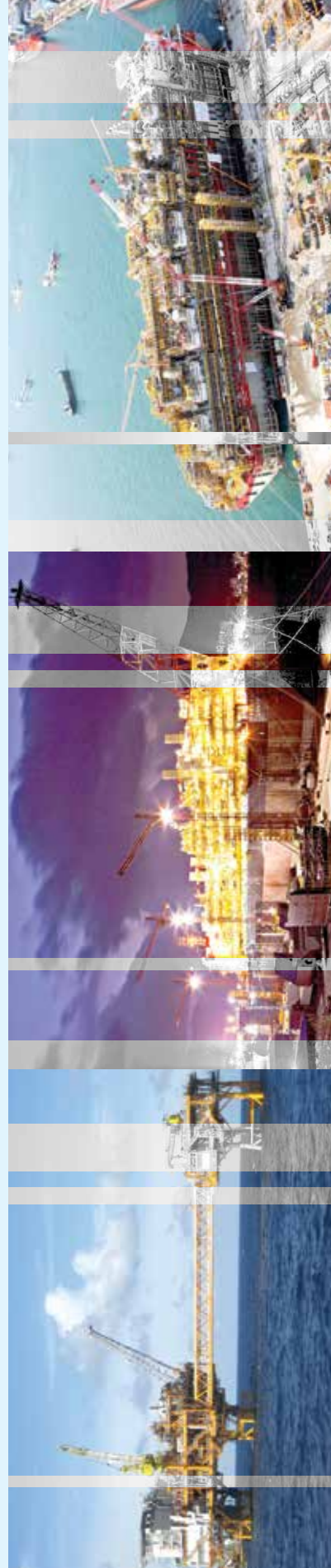


Offshore Plant Orders

Data	Type	Number of vessel	Amount	Ship owner	Delivery	Shipyard	
2011	Jul	Drillship	2 vessels	USD 1.1225 billion	Maersk, Denmark	July 2014	Samsung Heavy Industries
	Aug	LNG-FSRU	1 vessel	USD 280 million	Excelerate Energy, U.S.A	First quarter of 2014	Daewoo Shipbuilding & Marine Engineering
		Semi-submersible Rig	2 units	USD 1.1 billion	Songa Offshore, Norway	Second half of 2014	Daewoo Shipbuilding & Marine Engineering
		Well Intervention Vessel	2 vessels	USD 420 million	Eide Marine Services AS, Norway	2013	STX Finland
		Drillship	1 vessel	KRW 600 billion	Noble Drilling, U.S.A	Second half of 2014	Hyundai Heavy Industries
		Fixed Offshore Platform	-	USD 1.4 billion	Chevron, U.S.A	Second half of 2014	Daewoo Shipbuilding & Marine Engineering
	Oct	Drillship	1 unit	USD 550 million	Offshore drilling company, Americas	-	Daewoo Shipbuilding & Marine Engineering
		Platform Supply Vessel	1 unit	-	Toms Offshore Supply AS, Norway	First half of 2013	STX OSV
		Offshore Plant Module	2 units	-	-	From 2013 to 2014	STX OSV
	Nov	Platform Supply Vessel	4 units	KRW 2 trillion	Island Offshore, Norway	Consecutively from the 3rd quarter	of 2013 to the 1st quarter of 2014
		Pipe Laying Support Vessel	2 units	USD 500 million	Odebrecht, Brazil	August of 2014	Daewoo Shipbuilding & Marine Engineering
	Dec	Offshore facilities (Gas platform and various facilities)	-	USD 900 million	Major multinational oil companies	2nd half of 2014	Hyundai Heavy Industries
2012	Jan	CPF (Central Processing Facility)	-	KRW 2.6 trillion	INPEX, Australia	4th quarter of 2015	Samsung Heavy Industries
	Feb	Semi-submersible rig	1 unit	USD 620 million	Odjfell, Norway	by mid 2014	Daewoo Shipbuilding & Marine Engineering
		LNG-FSRU	-	-	Hoegh, Norway	-	Hyundai Heavy Industries
	Mar	Offshore Platform	1 unit	USD 560 million	DONG E&P AS, Danish	April 2015	Daewoo Shipbuilding & Marine Engineering
		FPSO	1 unit	USD 2.0 billion	INPEX, Australia	April 2016	Daewoo Shipbuilding & Marine Engineering
	Apr	Drillship	1 vessel	USD 645 million	Ensco plc	Third quarter 2014	Samsung Heavy Industries
	May	Semi-submersible Drilling Rig	2 units	USD 1.1 billion	Songa Offshore, Norway	Mid 2015	Daewoo Shipbuilding & Marine Engineering
		Drillship	1 vessel	USD 600 million	Seadrill, Norway	Second half of 2014	Samsung Heavy Industries
		Drillship	1 vessel	USD 655 million	Diamond Offshore Drilling Limited., U.S.A	4th quarter of 2014	Hyundai Heavy Industries
		Semi-submersible drilling rig	1 unit	USD 700 million	Fred Olsen Energy, Norway	March 2015	Hyundai Heavy Industries
	Jun	LNG-FPSO	1 unit	-	Petroliaam Nasional Berhad, Malaysia	June 2015	Daewoo Shipbuilding & Marine Engineering
	2013	Jul	Drillship	1 vessel	USD 645 million	Ensco plc	-
Gas Compression Platform			1 unit	USD 420 million	(Letter of Award)	Second half of 2015	Hyundai Heavy Industries
Aug		LNG-FSRU	8 vessels	-	Excelerate, U.S.A	Between early 2015~2017	Daewoo Shipbuilding & Marine Engineering
Sep		Drillship	1 vessel	USD 620 million	Rowan, U.S.A	First half of 2015	Hyundai Heavy Industries
		Drillship	1 vessel	USD 623 million	-	-	Samsung Heavy Industries
Oct		Drillship	4 vessels	USD 2.06 billion	Transocean, U.S.A	One-by-one from mid 2015	Daewoo Shipbuilding & Marine Engineering
		Drillship	1 vessel	USD 560 million	Atwood Oceanics, U.S.A	-	Daewoo Shipbuilding & Marine Engineering
		LNG-FSRU	1 vessel	USD 270 million	Hoegh LNG, Norway	First half of 2015	Hyundai Heavy Industries
		Drillship	1 vessel	USD 700 million	-	2nd half of 2015	STX Offshore & Shipbuilding
Dec		offshore platform (Top side)	1 unit	USD 1.77 billion	Statoli, Norway	The end of 2016	Daewoo Shipbuilding & Marine Engineering
Jan		Gas Production Platform (topside)	1 unit	USD 1.1 billion	Statoli, Norway	Mar 2016	Hyundai Heavy Industries
Mar		LNG-FSRU	1 vessel	-	BW Maritime, Singapore	2015	Samsung Heavy Industries
	Floating Production Unit (FPU)	1 unit	USD 1.3 billion	Total, France	First half of 2016	Hyundai Heavy Industries	
	Tension Leg Platform (TLP)	1 unit	USD 700 million	Total, France	First half of 2015	Hyundai Heavy Industries	

	Apr	FPSO	1 unit	USD 1.9 billion	Chevron, U.S.A	-	Hyundai Heavy Industries
	May	Semi-Submersible Drilling Rig	1 unit	USD 750 million	Diamond Offshore, U.S.A	Nov of 2015	Hyundai Heavy Industries
		Ultra-deepwater Drillship	1 unit	USD 515 million	Enasco, United Kingdom	Third quarter of 2015	Samsung Heavy Industries
	Jun	FPSO	1 unit	USD 3.0 billion	Nigeria	Second half of 2017	Samsung Heavy Industries
		Jack-up Rig	2 units	USD 1.3 billion	Statoli, Norway	-	Samsung Heavy Industries
		Ultra-deepwater Drillship	2 units	USD 600 million	Seadrill, Norway	Second half of 2015	Samsung Heavy Industries
	Jul	Semi-Submersible Rig	1 vessel	USD 718 million	Stena, Sweden	First half of 2016	Samsung Heavy Industries
		Ultra-deepwater Drillship	1 unit	USD 570 million	Atwood Oceanics, U.S.A	The end of 2015	Daewoo Shipbuilding & Marine Engineering
		Drillship	1 unit	USD 550 million	-	Dec of 2015	Samsung Heavy Industries
	Sep	Ultra-deepwater Drillship	1 unit	USD 600 million	Ocean Rig, Greece	Dec of 2015	Samsung Heavy Industries
		Jack-up Rig	1 unit	USD 530 million	Maersk Drilling, Denmark	The middle of 2016	Daewoo Shipbuilding & Marine Engineering
		Drillship	2 vessels	USD 1.24 billion	-	Second half of 2015	Daewoo Shipbuilding & Marine Engineering
	Oct	Drillship	1 vessel	USD 520 million	Transocean, U.S.A	The middle of 2016	Daewoo Shipbuilding & Marine Engineering
		LNG-FSRU	1 unit	-	Gas Sayago (Joint venture)	Sep of 2016	Daewoo Shipbuilding & Marine Engineering
	Dec	LNG-FSRU	1 unit	-	BW Maritime, Singapore	Early 2016	Samsung Heavy Industries
		LNG-FSRU	1 unit	-	Mitsui OSK Line, Japan	The middle of 2016	Daewoo Shipbuilding & Marine Engineering
	Feb	LNG-FPSO	1 unit	USD 1.45 billion	Petrolim Nasional Berhad, Malaysia	2018	Samsung Heavy Industries
	Apr	Drillship	2 vessels	USD 1.29 billion	Oceania	First half of 2017	Samsung Heavy Industries
	Jul	Central Processing Platform	2 units	USD 700 million	Hess E&P Malaysia, Malaysia	The end of 2016	Hyundai Heavy Industries
		Fixed offshore platform	4 units	USD 1.94 billion	ADMA-OPCO, UAE	The end of 2019	Hyundai Heavy Industries
		Fixed Offshore Platform & Submarine Cable	4 units	USD 1.9 billion	ADMA-OPCO	Second half of 2019	Hyundai Heavy Industries
	Nov	Offshore Platform	1 unit	USD 700 Million	Royal Dutch Shell	-	Samsung Heavy Industries
		FPU	1 unit		-	-	
	Jun	Offshore Platform	2 unit	USD 1.06 billion	Statoli, Norway	The end of 2018	Samsung Heavy Industries
2015	Jul	FLNG	3 unit	USD 4.7 billion	Royal Dutch-Shell	-	Samsung Heavy Industries

* Note : Based on the press release and public announcements of each shipyards, internal estimation of Monthly KORSHIP (estimation until Sep 15, 2015)



Offshore wind power emerges as key growth engine for future

As Europe is dominating global offshore wind power market, total installed offshore wind power capacity is expected to reach 10 GW on annual average in Europe by 2020. Meanwhile, the enthusiasm for offshore wind power has been withered away in Asia, including Korea, China, and Japan. However, industry experts agree that offshore wind power has the greatest growth potential among renewable energy industry of the future and has the far-reaching ripple effect on economy.

For example, many manufacturers are needed to produce various parts such as blade, turbine, nusselt, etc., along with special vessels for transport and assembly of

structures and port facilities.

Countries in Europe or North America have speeded up expansion of offshore wind energy and already started to see tangible results in terms of job creation and economic growth.

According to European Wind Energy Association (EWEA), Europe connected grids fully to 584 commercial offshore wind turbines in the first half of this year, bringing total combined capacity to 2,342.9 MW. 15 commercial wind farms are currently under construction. Once the construction is completed, total installed capacity is expected to reach 4,268.5 MW. ⚓





Power over Ethernet to wireless Gateway

Emerson Process Management



Power over Ethernet (PoE) allows the Smart Wireless Gateway to easily integrate with compatible infrastructure without the need for extra wiring

Emerson Process Management has added Power over Ethernet (PoE) to the Smart Wireless Gateway 1420, making it possible to power the gateway and compatible devices using a standard Ethernet cable. PoE allows easy, economical installation of wireless Gateways without requiring extra power wiring infrastructure.

The PoE Gateway provides infrastructure flexibility in places where there is limited access to power. By using an Ethernet cable connection, a new PoE Gateway can be easily installed and powered by an existing wireless access point. Alternately, PoE allows the Gateway to power any Ethernet-enabled instrument. Taking advantage of existing power infrastructure results in a significant cost savings compared to running new wiring.

-TEL: +82-2-3438-4600

-<http://www.emersonprocess.co.kr>

New
Product

High-performance, intrinsically-safe radio control

HBC-radiomatic KOREA



Version with LCD display, joystick, Z-axis switch, enabling switch and many other operating elements.

The latest HBC technology offering a wide range of options and features in an intrinsically-safe Design. (That is our new radio transmitter, the spectrum Ex.) This high-performance innovation with approvals for ATEX, IECEx, NEC® and CEC, now provides you with greater coverage and flexibility for operation machinery and equipment in potentially explosive atmospheres.

Spectrum Ex – Advantages at a glance:

- Choice of 2 housing sizes : Ideal adaptation to your requirements
- Up to 3 Joysticks or 8 linear levers version
- radiomatic® iLOG : Service without downtimes
- Robust plastic housing, protection class IP 65
- 2.4 GHz technology : Automatic frequency management
- Version with split-screen display for feedback and status data
- radiomatic® report (optional): HBC user identification and data logging
- Enabling switch
- 2 rechargeable NiMH exchange batteries, approx.. 9 hrs of continuous operating time.
- Weight: approx.. 2kg(4.4 lbs.) including battery
- And much more

LCD feedback - The display allows for the clear indication of diverse crane and machine data, warnings and error notifications - a considerable increase in safety.

radiomatic® report (optional) - This feature protects



Version with large housing, 3 joysticks and many other operating elements.

the control from unauthorized use. It enables the blocking of safety-relevant functions for nonauthorized users as well as the storage of useful operational data.

radiomatic® iLOG - The intelligent electronic key enables the quick activation of a spare transmitter in case the transmitter is damaged. This results in easy service without expensive downtime.

Frequency management (optional) - The fully automated 2.4 GHz technology ensures interruption-free radio operation without frequency conflicts in areas with many radio users.

Safety features (optional) - In emergencies, radiomatic® shock-off/zero-g can trigger an automatic shutdown of the control and thus ensure additional safety.

Approvals:

Area	Approval according to:
Underground	ATEX / IECEx
Ex zone 1	ATEX / IECEx
Ex zone 2	ATEX / IECEx
Ex zone 21	ATEX / IECEx
Ex zone 22	ATEX / IECEx
Class I, Division 1, Groups C and D T4/ Class I, Zone 0, Group IIB, T4	NEC® / CEC

-TEL: +82-51-780-8330~2
www.hbc-korea.co.kr

New Handheld 3D Laser Scanner

FARO Technologies, Inc.



FARO announced the release of the new FARO Scanner Freestyle3D X Handheld Laser Scanner, a 3D Laser Scanner designed to transform the way the Architecture, Engineering and Construction (AEC), Law Enforcement, and other industries document 3D data through easy to use, intuitive data acquisition. With the release of the Freestyle3D X, FARO's portfolio now contains two handheld scanners designed to help customers increase productivity, save time and make effective, data-driven decisions.

The new Freestyle3D X incorporates state-of-the-art scanning technology that delivers enhanced scanning accuracy of 1 millimeter at 1-meter range. The Freestyle3D X is available with a U.S. National Institute of Standards and Technology (NIST) traceable calibration accessory to provide users with verifiable data accuracy – which is critical for forensic scanning and other highly regulated industries. On-site calibration data is exportable to PDF format allowing information to be easily shared with other team members.

The Freestyle3D X also incorporates an automatic flash mode enabling users to scan objects in a variety of lighting conditions. New software tools deliver an intensely detailed visualization of the created 3D point cloud, and an integrated best-point filter enhances the quality of the scan data by reducing noise up to 35 %. Finally, post-processing functions have also been improved, offering up to 5x faster data saving speed to further improve productivity on the job site.

The Freestyle3D X can be employed as a standalone device or used in concert with FARO Laser Scanner Focus3D X Series Laser Scanners. Point cloud data from all devices can be integrated seamlessly – even in grey scale.

With the introduction of the Freestyle3D X to its portfolio, FARO continues its role as a technology innovator for customers – helping them work faster, more effectively and save money in the process. FARO is dedicated to offering a full range of innovative and user-friendly handheld scanners to allow customers to implement and leverage 3D scanning to their business advantage.

-TEL: +82-51-662-3412

-<http://www.faro.com>

New
Product

HYUNDAI HEAVY INDUSTRIES CO., LTD. (HHI)

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- Products : Bulk Carriers, Containerships, Tankers, VLCCs, Product Carriers, Multi-purpose Cargo Ships, OBO Carriers, Pure Car Carriers, LPG Carriers, Ro-Ro Ships, Chemical Tankers, Offshore Rigs/Barges, LNG Carriers, Passenger Ships, Drill Ships, Special & Naval Ships, FPSO, FSO, Semi-submersible Drilling Rig, Other Vessels

DAEWOO SHIPBUILDING & MARINE ENGINEERING CO., LTD. (DSME)

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- Products : LNG Carriers, LNG-RVs, LNG-FPSOs/FSRUs, LPG Carriers, LPG-FPSOs, ULCCs, VLCCs, Suezmax/Aframax/Panamax Tankers, Shuttle/Chemical Tankers, Product Carriers, Containerships, Capesize/ Kamsarmax/ Supramax Bulk Carriers, Ore Carriers, VLOCs, Ro-Ro Ships, PCTCs, Passenger Car Ferries, FPSOs, FSOs, FPU's, Drill Ships, Semi-Submersible Drilling Rigs, Fixed Platforms, Submarines, Submarine Rescue Vessels AUVs, Destroyers, Battle Ships

SAMSUNG HEAVY INDUSTRIES CO., LTD. (SHI)

- Address : 1321-15, Seocho-Dong, Seocho-Gu, Seoul, Korea • Tel : +82-2-3458-7312 • Fax : +82-2-3458-7319
- <http://www.shi.samsung.co.kr>
- Products : Arctic Shuttle Tankers, VCLLs, Crude Oil Tankers, Container Vessels, LNG/LPG Carriers, FPSO, FSO, Drillships, etc., LNG FPSO, Offshore Platforms, TLP, SEMI, Cruise Ships & Ferries, Steel Structures, Bridges & Building, Cargo & Material Handling Equipment

HYUNDAI SAMHO HEAVY INDUSTRIES CO., LTD. (HSHI)

- Address : 1700, Yongdong-ri, Samho-eup, Yeongam-gun, Jeollanam-do, Korea • Tel : +82-61-460-2114 • Fax : +82-61-460-3701
- <http://www.hshi.co.kr>
- Products : Tankers, VLCCs, Product Carriers, Chemical Tankers, Containerships, LNG Carriers, LPG Carriers, Pure Car Carriers, Bulk Carriers, Other Vessels

STX OFFSHORE & SHIPBUILDING CO., LTD.

- Address : 100 Wonpo-dong, Jinhae, Gyeongnam, Korea • Tel : +82-55-548-1122 • Fax : +82-55-546-7928 • <http://www.stxship.co.kr>
- Products : Crude Oil Tankers, Product Oil Tankers, Chemical Tankers, Bulk Carriers, Container Ships, LNG/LPG Carriers, Pure Car & Truck Carriers, Ferries & Passenger Ships, Naval Ships, Special Purpose Ships, Offshore and offshore support vessel, Etc

HYUNDAI MIPO DOCKYARD CO., LTD. (HMD)

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- Products : Product/Chemical Tankers, Containerships, Self-Unloading Bulk Carriers, Multipurpose Cargo Carriers, Drillships, Cable Layers, Pipe Layers, FPSOs, Car Ferry & Passenger Ships, LPG Carriers, Pure Car / Truck Carriers, General Cargo Carriers, Ro-Ro Vessels

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- Products : Container Ships, Bulk Carriers, Tankers, MPC & General Cargo Ships, Gas Carriers, Ro/Ro ships, Tug Boats, Fishing Boats/Vessels, Special Purpose Vessels



KOMEA (Korea Marine Equipment Association)

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Head office : GANGSEO-GU, BUSAN
Homepage add : www.atech2004.co.kr
Main products : Small davit, Air motor, Air winch
TEL : +82 51 832 0723

BC TAECHANG CO., LTD.

Head office : JUNG-GU, BUSAN
Homepage add : www.bcinternational.co.kr
Main products : Ultimate Solution for Onboard crew maintenance, Deck Scaling Machine
TEL : +82 51 442 6191

Bethel Engineering CO., LTD.

Head office : NAMYANGJU-SI, GYEONGGI
Homepage add : www.magicgrating.com
Main products : Magic Grating(Steel Grating)
TEL : +82 31 593 2712

BIP INDUSTRIES CO., LTD.

Head office : GEUNJEONG-GU, BUSAN
Homepage add : www.bn-bip.com
Main products : Wall panel, Ceiling panel, Bathroom unit, Cabin unit, Floating floor, TLQ, Marine furniture, Marine door etc
TEL : +82 51 519 2000

Bumhan Industries CO., LTD.

Head office : CHANGWON, GYUNGNAM
Homepage add : www.bumhan.com
Main products : Air Compressor, N2 Generator, High Pressure Control Valve
TEL : +82 55 251 6070

BY CONTROLS, INC.

Head office : GIMHAE-SI, GYUNGNAM
Homepage add : www.bycontrols.com
Main products : Watertight Door, Pilot Door, Hydraulic Hatch etc
TEL : +82 55 345 6110

BYT CO., LTD.

Head office : JINRAE-MYUN, GIMHAE
Homepage add : www.byhd.co.kr
Main products : HARDWARE, OUTFITTING, MARINE OUTFITTING, NEW PRODUCTS
TEL : +82 55 345 1951

CAPE INDUSTRIES LTD.

Head office : YANGSAN-SI, GYUNGNAM
Homepage add : www.capeind.com
Main products : Cylinder Liner
TEL : +82 55 370 1234

CENTURY CORPORATION

Head office : YANGSAN-SI, GYUNGNAM
Homepage add : www.capeind.com
Main products : Cylinder Liner, Man b&w sulzer(wartsila)type
TEL : +82 55 370 1234

CHK CO., LTD.

Head office : GANGSEO-GU, BUSAN
Homepage add : www.chkj.co.kr
Main products : Ref. Container Socket, Junction Box
TEL : +82 51 831 9500

ChungSol Marine CO., LTD.

Head office : GANGSEO-GU, BUSAN
Homepage add : www.chungsolmarine.co.kr
Main products : Window Wiper, Straight Line Type, Clear View Screen, Window, Door, Hatch
TEL : +82 51 832 2226

ChungSong Industry CO., LTD.

Head office : GIMHAE-SI, GYUNGNAM
Homepage add : www.koweld.co.kr
Main products : Welding Auto Carriage, LWS etc
TEL : +82 55 329 9500

CMR KOREA CO., LTD.

Head office : KUMJUNG-GU, BUSAN
Homepage add : www.cmrkorea.com
Main products : Marine Telephone System, Public Address System, Communal Aerial System, Marine CCTV System, Marine Clock System, Anemometer System, Rudder Angle Indicator System, Temperature Sensor, Pressure Sensor
TEL : +82 51 521 2883

Dae Chang Metal CO., LTD.

Head office : SAHA-GU, BUSAN
Homepage add : www.dcm.co.kr
Main products : Propeller boss, Chain Wheel cam, Dummy ring, Valve body etc
TEL : +82 51 264 0831

Dae Heung Cooler CO., LTD.

Head office : POCHON-SI, GYEONGGI
Homepage add : www.cooler.co.kr
Main products : Heat Exchanger
TEL : +82 31 532 9667

Daechun Industrial CO., LTD.

Head office : KIMHAE-SI, KYUNGNAM
Homepage add : www.daechun.co.kr
Main products : Multi Core Tube, Stainless Steel Tube
TEL : +82 55 345 2288

DaeJin Dampha CO., LTD.

Head office : ULJU-GUN, ULSAN
Homepage add : www.dampha.co.kr
Main products : Ceiling Panel
TEL : +82 52 225 2361

Daemmstoff Industrie Korea LTD.

Head office : SAHA-GU, BUSAN
Homepage add : www.daemmstoff.com
Main products : KVM SEALING COMPOUND, MANGANA TETAINING COMPOUND(PUTTY, FIRE STOP, PANDA-90 etc
TEL : +82 51 261 7073

Daeyang Electric CO., LTD.

Head office : SAHA-GU, BUSAN
Homepage add : www.daeyang.co.kr
Main products : Lighting Fixtures, Instruments, SAUV, UVU
TEL : +82 51 200 5221

DAEYANG INSTRUMENT. CO., LTD.

Head office : SAHA-GU, BUSAN
Homepage add : http://dic.daeyang.co.kr/08_affiliate/affiliate_01.php
Main products : precision instrument-anemometer rudder angle indicator etc
TEL : +82 51 200 5212

DaiHan Anchor Chain MFG. CO., LTD.

Head office : NAM-GU, INCHEON
Homepage add : www.dhac.co.kr
Main products : Anchor Chain, Offshore Mooring Stud etc
TEL : +82 32 862 0091

DHMC CO., LTD.

Head office : KIMHAE-SI, KYUNGNAM
Homepage add : www.dhmc-rudder.com
Main products : Rudder, Block etc
TEL : +82 55 346 3663

DK Tech Corporation

Head office : GIMHAE-SI, GYUNGNAM
Homepage add : www.dklok.com
Main products : Instrumentation fitting&valve
TEL : +82 55 338 0114

DMC CO., LTD.

Head office : GIMHAE-SI, GYUNGNAM
Homepage add : www.dongnam-crane.co.kr
Main products : Offshore Crane, Deck Cranes, Floating Cranes
TEL : +82 55 720 3000

DNP CO., LTD.

Head office : GANGSEO-GU, BUSAN
Homepage add : www.dnpco.kr
Main products : Accommodation System
TEL : +82 51 831 4551

Dong Hae Machinery Co.,Ltd

Head office : SEO-GU, INCHEON
Homepage add : www.east-sea.co.kr
Main products : Grab Bucket, Orange Grab, Motor Grab, Wood etc
TEL : +82 32 583 8061

Dong Kang M-Tech CO., LTD.

Head office : GANGNAM-GU, SEOUL
Homepage add : www.dkmtech.com
Main products : Water Jet, Night Navigator
TEL : +82 2 553 0181

Dong Woo Machinery&Engineering CO., LTD.

Head office : CHANGWON, GYUNGNAM
Homepage add :
Main products : Engine room over head crane, F.O hose handling Davit etc
TEL : +82 55 295 3261

Dong-A Valve Ind. CO.

Head office : GANGSEO-GU, BUSAN
Homepage add : www.donga-valve.com
Main products : Manufactured low&high pressure valves, Flap Check(duo-check) valve etc
TEL : +82 51 831 1500

Dongbang Marine CO., LTD.

Head office : GANGSEO-GU, BUSAN
Homepage add : www.dbmarine.co.kr
Main products : MARINE FIRE DETECTION & ALARM SYSTEM, MARINE FIRE EXTINGUISHING SYSTEM
TEL : +82 51 205 1585

DONGHWA ENTEC

Head office : GANGSEO-GU, BUSAN
Homepage add : www.dh.co.kr
Main products : Heat Exchanger, Plate Cooler etc
TEL : +82 51 970 1000

DongHwa Pneutec CO., LTD.

Head office : GANGSEO-GU, BUSAN
Homepage add : www.dhkomp.co.kr
Main products : Air/Gas Compressor
TEL : +82 51 974 4800

Dong-I Industrial CO., LTD.

Head office : JINJU-SI, GYEONGNAM
Homepage add : www.dongico.co.kr
Main products : Marine Transmission, Steering system, P.T.O
TEL : +82 55 755 9928

DooSan Engine CO., LTD.

Head office : CHANGWON, GYUNGNAM
Homepage add : www.doosanengine.com
Main products : Marine Diesel Engine, Diesel Engines for Power Generation
TEL : +82 55 260 6000

DRB Holding CO., LTD.

Head office : YEUNGDEUNGPO-GU, SEOUL
Homepage add : www.drworld.com
Main products : Marine rubber fender, Industrial rubber sealing & gasket, Industrial rubber track, Rubber damper
TEL : +82 2 2168 9133

Emerson Process Management Korea LTD.

Head office : SEONGNAM-SI, GYEONGGI
 Homepage add : www.emersonprocess.co.kr
 Main products : Pressure, Temperature, Level, Analytical&Flow
 Measurenet, Valves, Tank radar level guaging etc
 TEL : +82 2 3438 4600

ESAB SeAH Corp.

Head office : CHANGWON, GYUNGNAM
 Homepage add : www.esab.co.kr
 Main products : Flux Cored Wire
 TEL : +82 55 289 8111

Flutek, LTD.

Head office : SEONGSAN-GU, GYEONGNAM
 Homepage add : www.flutek.co.kr
 Main products : Axial Piston pumps, Axial piston
 motors&reduction gear, Electro-hydraulic steering gear, Deck
 machinery, Staffa motor, ECO servo
 TEL : +82 55 570 5800

FRIEND CO., LTD.

Head office : GANGSEO-GU, BUSAN
 Homepage add : www.thefriend.co.kr
 Main products : Engine Valve Spindle, Cable Tray
 TEL : +82 51 974 7911

G.S HIGH-TECHER CO., LTD.

Head office : GANGSEO-GU, BUSAN
 Homepage add : www.gshightecher.koreasme.com
 Main products : Air vent head, Convex coupling
 TEL : +82 51 832 4666

GENERAL MARINE BUSINESS INC.

Head office : NAM-GU, INCHEON
 Homepage add : www.gmbmarine.com
 Main products : Marine system(ship shore comm.system,
 emergency shut down system etc), Defense Eng.
 (Control&monitoring system integration etc), Manufacturing
 &services(new shipbuilding, module production)
 TEL : +82 52 270 3500

GS-Hydro Korea Ltd.

Head office : GANGSEO-GU, BUSAN
 Homepage add : www.gshydro.com
 Main products : Flare Flange system, Retain ring system
 TEL : +82 51 266 8221

H.K.E CO., LTD.

Head office : YOUNGDO-GU, BUSAN
 Homepage add : www.hk-eng.kr
 Main products : Expansion Joint, Fuel Injection Pipe, Air Filter,
 L.O Filter, F.O Filter
 TEL : +82 51 415 2494

Haeon Machinery Ind. CO., LTD.

Head office : GIMHAE-SI, GYUNGNAM
 Homepage add : www.haeon21.com
 Main products : Marine Crane, Deck Machinery
 TEL : +82 55 345 2024

Haewon Ind. CO., LTD.

Head office : GANGSEO-GU, BUSAN
 Homepage add : www.haewon.net
 Main products : Water Seal, Inflatable/Mating Ring
 TEL : +82 51 831 4600

Hal La Industrial CO., LTD.

Head office : SAHA-GU, BUSAN
 Homepage add : www.hallaiq.co.kr
 Main products : Non Seal Canned Motor Pump, Gear Pump
 TEL : +82 51 264 2201

Han Jo CO., LTD.

Head office : YOUNGDO-GU, BUSAN
 Homepage add : www.hanjoms.co.kr
 Main products : Lubication Oil Filter, Fuel Oil Filter, Filter
 Elements
 TEL : +82 51 414 7201

HanKuk Miboo CO., LTD.

Head office : SAHA-GU, BUSAN
 Homepage add : www.hankukmiboo.co.kr
 Main products : Spiral Duct, Cold Chamber, Deck Covering, Level
 TEL : +82 51 263 3621

HANLAIMS CO., LTD.

Head office : GANGSEO-GU, BUSAN
 Homepage add : www.hanlaims.com
 Main products : Instruments(Level gauge/Level Switch) Tank
 Remote Sounding System/Cargo monitoring system valve Re
 TEL : +82 51 601 7016

HANSHIN ELECTRONICS CO., LTD

Head office : YOUNGDO-GU, BUSAN
 Homepage add : www.ehanshin.com
 Main products : Public Address Sys., Telephone Sys.
 TEL : +82 51 412 5551

HEARTMAN CO.,LTD.

Head office : GANGSEO-GU, BUSAN
 Homepage add : www.heartman.co.kr
 Main products : The fuel injection nozzle for marine diesel
 engine, The fuel injection plunger ass'y for marine diesel engine
 TEL : +82 51 264 8826

HI AIR KOREA CO., LTD.

Head office : GIMHAE-SI, GYUNGNAM
 Homepage add : www.hiarkorea.co.kr
 Main products : Air Handling Unit, Spot Cooler, Refrigeration
 condensing unit, Fire damper, Provision refrigeration plant, MGO
 cooling system, Packaged air conditioner, Ventilation fan, Spiral duct
 TEL : +82 55 340 5000

Ho Seung Enterprise CO., LTD.

Head office : GANGSEO-GU, BUSAN
 Homepage add : www.hosent.co.kr
 Main products : Package Unit for Engine Room
 TEL : +82 51 831 2233

HODU INDUSTRIAL CO.

Head office : GANGSEO-GU, BUSAN
 Homepage add : www.hoducompany.com
 Main products : Catering Furniture, Galley Hood W/Fire
 Fighting, Galley E/Q(Deep Fat Fryer/Cooking Range etc.)
 TEL : +82 51 271 3342

HWASEUNG R&A

Head office : YANGSAN-SI, GYUNGNAM
 Homepage add : www.hsma.com
 Main products : Stern Tube Seal, Hatch Cover Seal, GRE pipe,
 Cathodic Protection Equipment(I.C.C.P/M.G.P.S)
 TEL : +82 55 370 3331

Hy-Lok Corporation

Head office : GANGSEO-GU, BUSAN
 Homepage add : www.hy-lok.com
 Main products : Tube Fitting&Valve, Double lock&Bleed Valve,
 Crygenic valve
 TEL : +82 51 970 0800

HYUNDAI EHEAVY INDUSTRIES CO., LTD.

Head office : DONG-GU, ULSAN
 Homepage add : www.hhi.co.kr
 Main products : Marine Diesel Engine & Machinery
 TEL : +82 52 202 7291

Hyundai Elevator CO., LTD.

Head office : INCHEON-SI, GYEONGGI
 Homepage add : www.hyundaielevator.co.kr
 Main products : Elevators, Escalators & Moving Walks, Material
 Handling Systems, Parking Systems, SOC Infra Systems
 TEL : +82 31 644 5114

Hyundai Fitting CO., LTD.

Head office : GANGSEO-GU, BUSAN
 Homepage add : www.hdfco.co.kr
 Main products : Flange
 TEL : +82 51 831 0891

HYUNDAI LIFEBOATS CO., LTD.

Head office : ULJU-GUN, ULSAN
 Homepage add : www.hdboat.com
 Main products : Life Boat , GRP Rigid Type Rescue Boat
 TEL : +82 52 240 3500

Hyundai Marine Machinery CO., LTD.

Head office : INCHEON-SI, GYEONGGI
 Homepage add : www.hmmco.co.kr
 Main products : W.O. Incinerator, Aux/Blower, F.D FAN
 TEL : +82 32 583 0671

HYUNDAI WELDING CO., LTD.

Head office : GANGNAM-GU, SEOUL
 Homepage add : www.hyundaiwelding.com
 Main products : Covered electrode arc welding consumables,
 Submerged arc welding flux&wire, Solid wire arc welding
 consumables, Flux cored wire, MIG TIG arc welding
 consumables, Welding machines
 TEL : +82 2 6230 6883

I.M.E. CORPORATION

Head office : GIMHAE-SI, GYUNGNAM
 Homepage add : www.promarine21.com
 Main products : Engine Valve Spindle&Seat
 TEL : +82 55 346 1127

ILJIN AND CO., LTD.

Head office : GUJANG-GUN, BUSAN
 Homepage add : www.iljinamst.co.kr
 Main products : Fire detection system, Gas detection
 system, emission monitoring system, Water spray&cargo
 spray system etc
 TEL : +82 51 755 6191

ILSHIN ENGINEERING CO., LTD.

Head office : SIHEONG-SI, DYEONGGI
 Homepage add : www.ishineng.com
 Main products : Chemical Equipment, Storage Tank
 TEL : +82 31 499 4502

ILSUEUNG CO., LTD

Head office : GANGSEO-GU, BUSAN
 Homepage add : www.ilsueung.co.kr
 Main products : Sewage tTretment Plant, Fresh Water
 Generator, Oil Purifier
 TEL : +82 51 831 4110

IL-SUNG IND. CO.

Head office : SASANG-GU, BUSAN
 Homepage add : www.ilsunghs.co.kr
 Main products : Hot Water Calorifier, Silencer (For M/E, G/E,
 Fan), Mist Eliminator, Washable Air Filter, Pneu. Fire Damper
 (For Funnel, Em'cy G/E Room)
 TEL : +82 51 312 4056

International Machine Tool CO.

Head office : SASANG-GU, BUSAN
 Homepage add : www.clampimt.com
 Main products : Vertical Clamp, Horizontal Clamp etc
 TEL : +82 51 314 2038

INTRA PRECISION MANUFACTURE CO., LTD

Head office : DONG-GU, BUSAN
 Homepage add : www.intrapare.co.kr
 Main products : PISTON CROWN, CYLINDER LINER,
 CYLINDER COVER, PISTON SKIRT, WATER JACKET
 TEL : +82 51 466 4635

JHK INC.

Head office : YANGSAN-SI, GYUNGNAM
 Homepage add : www.jonghap.biz
 Main products : Container Fittings, Lashing Fittings
 TEL : +82 55 370 2600

JINSEONG LINER&PISTON

Head office : DAEJEON-GU, DAEJEON
 Homepage add : www.jinseong.com
 Main products : Sylinder liner, Piston
 TEL : +82 42 931 8558

JONGHAP MACHINERY CO., LTD

Head office : YANGSAN-SI, GYUNGNAM
 Homepage add : http://jonghap.biz
 Main products : Sewage Treatment Plant, T-bar auto welding
 machine
 TEL : +82 55 370 2600

JS CABLE CO., LTD.

Head office : CHEONAN-SI, SHUNGNAM
 Homepage add : www.jsable.co.kr
 Main products : Shipboard Cable
 TEL : +82 41 559 4800

JUNG GONG IND. CO., LTD.

Head office : SAHA-GU, BUSAN
 Homepage add : www.jung-gong.com

Main products : Marine window, Fire resistant window, Marine wiper, Clear view scree, Anti-glare sunscreen
TEL : +82 51 261 2911

JUNG-A MARINE

Head office : GANGSEO-GU, BUSAN
Homepage add : www.jung-a.co.kr
Main products : Accommodation Ladder, Pilot slant ladder, Wiper, CVS, Sunscreen davit, Cpastan, AI structure, Hatch, Helideck, Special product
TEL : +82 51 970 6420

JUNGSAN ENTERPRISE CO., LTD.

Head office : ULJU-GUN, ULSAN
Homepage add : www.jungsan.com
Main products : Marine Engine Part
TEL : +82 52 254 3290

K.C. LTD.

Head office : GANGSEO-GU, BUSAN
Homepage add : www.iccp-mgps.com
Main products : I.C.C.P. System, M.G.P.S, Shaft Earthing Device
TEL : +82 51 831 7720

Kangrim Heavy Industries CO., LTD.

Head office : CHANGWON, GYUNGNAM
Homepage add : www.kangrim.com
Main products : Marine Boiler, Plant, LTG Tank
TEL : +82 55 269 7700

Kangrim Insulation CO., LTD.

Head office : SAHA-GU, BUSAN
Homepage add : www.kangrim.com
Main products : Tank, Pipe Insulation, Cold Provision Store
TEL : +82 51 200 6000

Keonchang Industry CO., LTD.

Head office : SAHA-GU, BUSAN
Homepage add : www.keonchang.co.kr
Main products : TOP CHARGING EQUIPMENT, HOPPER&CONVEYER, SIDE GUIDE ASSY
TEL : +82 51 203 0161

Keum Yong Machinery CO., LTD.

Head office : BUK-GU, DAEGU
Homepage add : www.beumyong.com
Main products : Exh. Valve Complete with Spindle
TEL : +82 53 382 9044

Key Sung Metal CO., LTD.

Head office : GANGSEO-GU, BUSAN
Homepage add : www.deysungmetal.com
Main products : Marine Valve
TEL : +82 51 831 3391

Keystone Valve(Korea)

Head office : ANSEONG-SI, GYEONGGI
Homepage add : www.keystonekorea.com
Main products : All kind of valves apply to offshore and shipbuilding
TEL : +82 51 604 4000

KHAN CO., LTD.

Head office : GEOJE-SI, GYEONGNAM
Homepage add : www.khan-offshore.com
Main products : Engineering Service, Sea-trian&Commissioning service, Facility for Fabricaton, Modification
TEL : +82 55 639 7600

Kion Printing&Packaging Inc.

Head office : GIMHAE-SI, GYUNGNAM
Homepage add : www.kiwon.com
Main products : Marine Equipment & Vacuum System
TEL : +82 55 313 9913

KOC ELECTRIC CO., LTD.

Head office : GANGSEO-GU, BUSAN
Homepage add : www.kocelec.com
Main products : H/V Transformer(ATEX, WATER COOLED TYPE), UPS(Uninterruptible Power Supply), Bus way/Bus Duct
TEL : +82 51 970 6302

Kokako CO., LTD.

Head office : YEOUNGDO-GU, BUSAN
Homepage add :

Main products : Exhaust Valve Spindle&Bottom Piece Grinding Machine
TEL : +82 51 403 4114

Komeco CO., LTD.

Head office : GIJANG-GUN, BUSAN
Homepage add : www.komeco.net
Main products : Tacho Sys., Electronic Equip.
TEL : +82 51 724 5070

Kongsberg Maritime Korea Ltd.

Head office : GIJANG-GUN, BUSAN
Homepage add : www.km.kongsberg.com
Main products : Alarm monitoring system, Cargo monitoring system, Offshore technology
TEL : +82 51 749 8600

KOREA FILTER CO., LTD.

Head office : GIJANG-GUN, BUSAN
Homepage add : www.korea-filter.co.kr
Main products : STRAINER, OIL FILTER, AIR FILTER, AUTO STRAINER
TEL : +82 51 727 8360

Korea Flexible CO.

Head office : KUMJUNG-GU, BUSAN
Homepage add : www.hkflex.com
Main products : Metallic Flexible Hose, Metallic Expansion Joint, Manufacturing of Matalic Flexible hose Assemblies
TEL : +82 51 508 6291

KOTO Technical CO.

Head office : SAHA-GU, BUSAN
Homepage add :
Main products : Maintain&repair item(all hydraulic system, Adjust alignment(centering)
TEL : +82 51 417 8501

KSP CO., LTD.

Head office : GANGSEO-GU, BUSAN
Homepage add : www.kspvalve.com
Main products : Exhaust Valve Complete, Exhaust Valve Spindle
TEL : +82 51 831 6274

KSV(Korea Special Valve) CO., LTD.

Head office : YOUNGDO-GU, BUSAN
Homepage add : www.ksv-valve.co.kr
Main products : Valve spindle and Valve seat, for marine diesel engine
TEL : +82 51 415 4466

KTE CO., LTD.

Head office : GANGSEO-GU, BUSAN
Homepage add : www.kte.co.kr
Main products : High Voltage Swichboard, Side Thruster, Low voltage swichboard, Side thruster Control system, Group Starter Panel, Alarm Monitoring system, electric equipment etc
TEL : +82 51 265 0255

Kuk Dong Elecom CO., LTD.

Head office : SAHA-GU, BUSAN
Homepage add : www.kukdongelecom.com
Main products : Lighting Fixture
TEL : +82 51 266 0050

KUKDONG ELECTRIC WIRE CO., LTD.

Head office : JINCHEON-GUN, CHUNGBUK
Homepage add : www.nexans.co.kr
Main products : All kind of cable for Offshore and Shipbuilding including JIS, BS, IEC, DIN, IEEE etc
TEL : +82 2 2140 3064

Kum Kang Precision CO., LTD.

Head office : SAHA-GU, BUSAN
Homepage add : www.kkmarine.co.kr
Main products : marine valve, valve for engine, air reservoir tank
TEL : +82 51 262 4894

KUNSUL CHEMICAL IND. CO., LTD.

Head office : BUSANJIN-GU, BUSAN
Homepage add : <http://jebi.co.kr/>
Main products : Main products : Shop Primer, Anti-Corrosive Coatings, Anti-Fouling Coatings etc
TEL : +82 51 892 4221

KWANG SAN CO., LTD.

Head office : GANGSEO-GU, BUSAN
Homepage add : www.kwangsan.com
Main products : AIR VENT HEAD, EXP.JOINT, HEATING COIL, PIPE SPOOL etc
TEL : +82 51 974 6316

Kwang Seong CO., LTD.

Head office : GIMHAE-SI, GYUNGNAM
Homepage add : www.ikwangsung.com
Main products : PIPE CABLE HANGER, SPARE PART SEAT ETC
TEL : +82 55 338 2271

Kyung Eun ceramics CO., LTD.

Head office : GIMHAE-SI, GYUNGNAM
Homepage add : www.ke-ceramics.com
Main products : Ceramic Packing
TEL : +82 55 345 7761

Kyungsung Industry CO., LTD.

Head office : GANGSEO-GU, BUSAN
Homepage add : www.e-clamp.com
Main products : LNG carrier, sus corner & Anchor Strips&Pipe clamp etc
TEL : +82 51 831 4960

Leeyoung Industrial Machinery CO., LTD.

Head office : ULJU-GUN, ULSAN
Homepage add : www.leeyoung.co.kr
Main products : Lashing bridge, T-bulk head block, Covered-block, Engine casing&funnel, Upper deck&module unit etc
TEL : +82 52 231 5800

LHE CO., LTD.

Head office : GIMHAE-SI, GYUNGNAM
Homepage add : www.lhe.co.kr
Main products : Plate Heat Exchanger, Fresh Water Generator
TEL : +82 55 340 0625

LS Cable &System

Head office : ANYANG-SI, KYEONGGI
Homepage add : www.lscns.com
Main products : Power Cable, Marine&Offshore Cable, Telecom Cable, SUBMARINE CABLE, WINDSOL, SUPERCONDUCTIVITY
TEL : +82 51 310 6781

LUXCO CO., LTD

Head office : SAHA-GU, BUSAN
Homepage add : www.luxco.co.kr
Main products : Electrical Equipment for Internal Combustion Engines, Magnet Products etc
TEL : +82 51 260 1300

MIN SUNG CO., LTD.

Head office : GANGSEO-GU, BUSAN
Homepage add : www.minsung.co.kr
Main products : Steel Outfitting, Access Hatch, Swing away hatch, Cable tray, Electric cable box etc
TEL : +82 51 305 8862

Mirae Industries CO., LTD.

Head office : HAMAN-GUN, GYEONGNAM
Homepage add : www.miraewinch.com
Main products : Winch, Chain Stopper, Capstan
TEL : +82 55 587 8520

MODERN INTECH CO., LTD.

Head office : SASANG-GU, BUSAN
Homepage add : www.mo-dem.com
Main products : Fire retardant curtain, mattress, upholstery furniture, fire retardant fabric, carpet, rubber flooring
TEL : +82 51 325 0260

MRC(Marine radio CO., LTD.)

Head office : YOUNGDO-GU, BUSAN
Homepage add : www.mrckorea.com
Main products : Public Address System, Auto telephone sys
TEL : +82 51 414 7891

MSL Compressor CO., LTD.

Head office : POCHON-SI, GYEONGGI
Homepage add : www.mslcomp.com
Main products : Breathing Air Compressor
TEL : +82 31 541 7000

Mt.H Control Valves CO., LTD.

Head office : GANGSEO-GU, BUSAN
 Homepage add : www.mth.co.kr
 Main products : Main Starting Valve, Crank Case Relief Valve, Cyogenic Safety Valves&Control Valve
 TEL : +82 51 974 8800

NK CO., LTD.

Head office : SAHA-GU, BUSAN
 Homepage add : www.nkcf.com
 Main products : Ballast Water Treatment Sys., Co2 Sys.
 TEL : +82 51 200 0152

Oriental Precision&Engineering CO., LTD.

Head office : GANGSEO-GU, BUSAN
 Homepage add : www.opco.co.kr
 Main products : Deck House, Funnel & Engine Casing
 TEL : +82 51 202 0101

OSCG CO., LTD.

Head office : SASANG-GU, BUSAN
 Homepage add : www.oscg.net
 Main products : Cable gland and accessories, GRP junction box
 TEL : +82 51 305 3910

PANASIA CO., LTD.

Head office : GANGSEO-GU, BUSAN
 Homepage add : www.worldpanasia.com
 Main products : Ballast water treatment system/level instrument, seawater coarse filtration/emission gas control system, engineering service
 TEL : +82 51 831 1010

Pie Plus CO., LTD.

Head office : GANGSEO-GU, BUSAN
 Homepage add : www.piplus.co.kr
 Main products : Crank Shaft, Rudder Stock, Motor Shaft
 TEL : +82 51 831 9338

S&W CO., LTD.

Head office : SAHA-GU, BUSAN
 Homepage add : www.snwcorp.com
 Main products : Cam/Cam Shaft, Valve/Seat ring, Engine Bolts/ Nuts, Bolts
 TEL : +82 51 205 7411

S. A. M-Tech

Head office : INCHEON-SI, GYEONGGI
 Homepage add : www.samartkr.com
 Main products : Engine control lever, Engine control cable, Hydraulic steering system, Stern drive, Helm pump, Cylinder etc
 TEL : +82 32 815 3614

SAE JIN INTECH CO., LTD.

Head office : GANGSEO-GU, BUSAN
 Homepage add : www.saejinintech.com
 Main products : Emergency Towing System
 TEL : +82 51 971 9911

Sam Gong Industrial CO., LTD.

Head office : PYEONGTAEK-SI, GYEONGGI
 Homepage add : www.samgongkorea.co.kr
 Main products : Inflatable rubber products, Ship's ballast water treatment system, Life rafts, Speed boats, River boats, Fishing boats, Water tanks, High speed boats
 TEL : +82 31 651 3012

SAMGONG CO., LTD.

Head office : GANGSEO-GU, BUSAN
 Homepage add : www.sam-gong.co.kr
 Main products : Oil Purifier, Ship's Window, Ship Accommodation ladder, Cathodic protection system, Elevator type tower gangway, Ship ballast water treatment system, Quick Release mooring hook&road monitoring system
 TEL : +82 51 200 3040

SAMKUN CENTURY CO., LTD.

Head office : GIMHAE-SI, GYUNGNAM
 Homepage add : www.samkunok.com
 Main products : F.W.supply unit, BWTS, PE coating, Plant
 TEL : +82 70 4034 0226

Samyang Ind. CO., LTD.

Head office : SAHA-GU, BUSAN
 Homepage add :

Main products :
 TEL : +82 51 263 4460

Samyoung Machinery CO., LTD.

Head office : GONGJU-SI, CHUNGNAM
 Homepage add : www.sym.co.kr
 Main products : Cylinder Head, Cylinder Liner, Piston&Carrier etc
 TEL : +82 41 840 3000

Samyoung M-TEK CO., LTD.

Head office : HAMAN-GUN, GYEONGNAM
 Homepage add : www.symtek.co.kr
 Main products : MBS, Chain Wheel, Cylinder Cover etc
 TEL : +82 55 589 7000

SAMYUNG ENC CO., LTD.

Head office : YOUNGDO-GU, BUSAN
 Homepage add : www.samyungenc.com
 Main products : AIS/GMDSS Radio Equip etc
 TEL : +82 51 601 5555

Saracom CO., LTD.

Head office : GANGNAM-GU, SEOUL
 Homepage add : www.saracom.net
 Main products : GMDSS Equipment
 TEL : +82 2 566 4248

Scana Korea Hydraulic LTD.

Head office : GIMHAE-SI, GYUNGNAM
 Homepage add : www.scana.co.kr
 Main products : Actuators, HPU and Local Control Panel, Offloading systems/winches and mooring system/turret/swivel etc
 TEL : +82 55 343 9007

SEJIN IND CO., LTD.

Head office : CHANGWON, GYUNGNAM
 Homepage add : www.sejin89.co.kr
 Main products : Tank top unit, module unit, purifier unit, supply unit
 TEL : +82 55 239 4700

SEOUL ELECTRIC CABLE CO., LTD.

Head office : UMSUONG-GUN, CHOONGBUK
 Homepage add : www.seoulcable.com
 Main products : Offshore & Shipboard Cables
 TEL : +82 43 879 7200

Seun Electric CO., LTD.

Head office : SAHA-GU, BUSAN
 Homepage add : www.seunelectric.co.kr
 Main products : Battery Charger, Alarm Sys.
 TEL : +82 51 208 4641

SEWON INDUSTRIES., LTD.

Head office : HAMAN-GUN, GYEONGNAM
 Homepage add : www.sewon-ind.com
 Main products : High velocity P/V valve, Air Vent Head, Expansion Joint, Flame Arrester / Breather Valve
 TEL : +82 55 580 7200

Shin Han Machinery CO., LTD.

Head office : ULJU-GUN, ULSAN
 Homepage add : www.shinerpia.com
 Main products : Deck House, Rudder
 TEL : +82 52 240 5000

Shin Heung ENG. CO.

Head office : GANGSEO-GU, BUSAN
 Homepage add : www.shinheungeng.co.kr
 Main products : Curtain, Upholstery, Sofa&Chair, Mattress, Carpet, Roller Blind
 TEL : +82 51 817 6455

Shin Myung Tech CO., LTD.

Head office : YANGSAN-SI, GYUNGNAM
 Homepage add : www.smdavit.com
 Main products : Air motor, Winch, Davit, Crane, Reel, Capstan, Pump etc
 TEL : +82 55 363 7091

Shin Yeong CO., LTD.

Head office : GIMHAE-SI, GYUNGNAM
 Homepage add : www.sy-ind.com
 Main products : Man-hole, Access Hatch
 TEL : +82 55 346 0034

Shin-A CO., LTD.

Head office : SAHA-GU, BUSAN
 Homepage add : www.shina-ent.com
 Main products : Navigational/Communication Equip.
 TEL : +82 51 204 6221

Shin-A Metal Tech CO., LTD.

Head office : BUK-GU, ULSAN
 Homepage add : www.shinametal.com
 Main products : Engine Metal Bearing, Bearings for medium&small engines, Main Bearing Shells, Segment&Segment Holder, Guide Shoe, Top&Bottom end bearing, Mesta Bearing
 TEL : +82 52 298 2100

Shindong Digitech CO., LTD.

Head office : YEOUNGDO-GU, BUSAN
 Homepage add : www.shindong.com
 Main products : Navigation&communication, Internal communication equipment
 TEL : +82 51 461 5141

Shinshin Machinery CO., LTD.

Head office : GIJANG-GUN, BUSAN
 Homepage add : www.sspump.com
 Main products : VID(Cooling F.W&S.W Pump), EHC(Volute Casting Centrifugal Pump), NLG(External Gear Pump)
 TEL : +82 51 713 0000

Silla Metal CO., LTD.

Head office : GANGSEO-GU, BUSAN
 Homepage add : www.sillametal.com
 Main products : Fixed Pitch Propeller(FPP), Controllable Pitch Propeller(CPP, Shafting, Stern Equipment
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Simulation Tech Inc.

Head office : GEUMCHEON-GO, SEOUL
 Homepage add : www.simulationtech.co.kr
 Main products : Voyage Data Recorder
 TEL : +82 2 3281 0960

SMECO CO., LTD.

Head office : YEONGI-GUN, CHUNGNAM
 Homepage add : www.smecopiston.com
 Main products : Piston, Piston Liner
 TEL : +82 44 864 3030

SMS CO., LTD.

Head office : SAHA-GU, BUSAN
 Homepage add : www.sms-marinesystem.com
 Main products : Hatch Cover, Lashing Bridge, Ro Ro Equipment, Hydro Door
 TEL : +82 51 290 1000

SPECS Corporation

Head office : BUNDANG-GU, SEONGNAM
 Homepage add : www.specs.co.kr
 Main products : Oil Mist Detector
 TEL : +82 31 706 5211

STACO CO., LTD.

Head office : GANGSEO-GU, BUSAN
 Homepage add : www.staco.co.kr
 Main products : Wall & Ceiling Panel, Unit Toilet
 TEL : +82 51 831 7000

STX Engine CO., LTD.

Head office : CHANGWON, GYUNGNAM
 Homepage add : www.stxengine.co.kr
 Main products : Marine diesel engine, Military diesel engine, power plant diesel engine, electronic communication equipment
 TEL : +82 55 280 0114

STX Heavy Industries CO., LTD.

Head office : CHANGWON, GYUNGNAM
 Homepage add : www.stxhi.co.kr
 Main products : Turbocharger, Diesel engine parts, Industrial componests, Shipbuilding machinery, Cargo pump system, Casting parts
 TEL : +82 55 280 0700

Suh Han Ind. CO., LTD.

Head office : SAHA-GU, BUSAN
 Homepage add :

Main products : Cable Try and Duct, Hot Dip Galvanizing, Ship's Window
TEL : +82 51 204 1920

SUNBO INDUSTRIES CO., LTD

Head office : SAHA-GU, BUSAN
Homepage add : www.sunboind.co.kr
Main products : Package module unit, Tank top unit, E/R Block etc
TEL : +82 51 260 5551

Sung Jin Geotec CO., LTD.

Head office : GANGSEO-GU, BUSAN
Homepage add : www.sgtkor.com
Main products : Ship Block, Fin Tube, Header Pipe
TEL : +82 52 228 5801

Sung Kwang Bend CO., LTD.

Head office : GANGSEO-GU, BUSAN
Homepage add : www.skbend.com
Main products : Butt Welding Pipe Fittings
TEL : +82 51 330 0200

Sung Mi CO., LTD.

Head office : GIMHAE-SI, GYUNGNAM
Homepage add : www.sung-mi.co.kr
Main products : Door Frame, Wall Panel, Ceiling Panel, Door Hardware, Unit Toilet
TEL : +82 55 329 1117

SUNG SIN INDUSTRIES CO., LTD.

Head office : GYEONGJU-SI, GYEONGBUK
Homepage add : <http://sungsin.koreasme.com>
Main products : hatch Coaming, T-Block, Water Mist Catcher, Water Separator, Ltuver
TEL : +82 54 776 6441

Sungil SIM CO., LTD.

Head office : GANGSEO-GU, BUSAN
Homepage add : www.sungilsim.com
Main products : Pipe bending, Pipe spool, Marine Engine, Gas Turbine
TEL : +82 51 831 8800

Suro Profeller & Machinery CO.

Head office : YOUNGDO-GU, BUSAN
Homepage add : www.suropump.co.kr
Main products : Propeller, Propeller Shaft
TEL : +82 51 415 0445

T.K. Corporation CO., LTD.

Head office : GANGSEO-GU, BUSAN
Homepage add : www.tkbend.co.kr

Main products : Butt-Welding Fittings, Forged Fittings, Flanges
TEL : +82 51 831 6600

TAE YOUNG TRADING LTD.

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Homepage add : www.marine-material.com
Main products : Receptacles & Wire Accessories, Flood Light, Deck Light, Reflected Lamps, HRF Mercury Lamps, Sodium Lamps, Marine Electrical Equipment
TEL : +82 2 2272 1960

TANKTECH CO., LTD.

Head office : SAHA-GU, BUSAN
Homepage add : www.tanktech.co.kr
Main products : Water-mist fire fighting system for engine room and accommodation, LNG fuel tank system, Offshore steel structure
TEL : +82 51 979 1600

Techcross Inc.

Head office : JUNG-GU, BUSAN
Homepage add : www.techcross.com
Main products : Ballast Water Management System
TEL : +82 51 603 3500

TechMarine S/W CO., LTD.

Head office : DONG-GU, BUSAN
Homepage add : www.techmarine.net
Main products : Loading Computer program, CAOS, Stowage Program, LOFOS, LMS
TEL : +82 51 467 7003

TMC CO., LTD.

Head office : CHEONAN-SI, SHUNGNAM
Homepage add : www.tmc-cable.com
Main products : Marine Cables, Oil&Rig Cables, Onshore Cables, Seecial Cables, Optical Fiber Cables
TEL : +82 41 589 6500

TOPSAFE CO., LTD.

Head office : GIMHAE-SI, GYUNGNAM
Homepage add : www.topsafe.co.kr
High Velocity Pressure Vacuum Valve, Breather Valve, Falme
Main products : Arrester, Emergency Vent Cover, Detonation Flame Arrester
TEL : +82 55 338 9986

VISER CO., LTD.

Head office : GIMHAE-SI, GYUNGNAM
Homepage add : www.viser.co.kr
Main products : PHE GASKET, Valve Seat, Dust Packing etc
TEL : +82 55 346 5575

WARTSILA ACCOMMODATION SYSTEMS KOREA, INC.

Head office : GOSEONG-GUN, GYEONGNAM
Homepage add : www.waskorea.co.kr
Main products : Unit Toilet, Unit Cabin, Wall Panel, Ceiling Panel
TEL : +82 55 673 7315

WhaYoung CO., LTD.

Head office : MIRYANG-SI, GYUNGNAM
Homepage add : www.whayoung.co.kr
Main products : Fuel Pump Ass'y for Ship's Engine
TEL : +82 55 359 1100

WONIL CO., LTD.

Head office : MASAN-SI, GYEONGNAM
Homepage add : www.ms-wonil.com
Main products : Cylinder Cover, Common Rail Unit, Silencer, Spraying Plate, Rotor Shaft
TEL : +82 55 253 1500

Woo Chang Ind. CO., LTD.

Head office : GIMHAE-SI, GYUNGNAM
Homepage add :
Main products : Weather Tight Steel Door, Louver Vent, Steel Window Box, Morning fitting
TEL : +82 55 337 1651

WOOJOO M & E CO., LTD.

Head office : SAHA-GU, BUSAN
Homepage add : www.wjme.com
Main products : Exp.Junction box, Warning Alarm etc
TEL : +82 51 264 9130

Yoo Won Industry LTD.

Head office : SAHA-GU, BUSAN
Homepage add : www.yoowonind.com
Main products : Steering Gear, Filter, Deck M/C
TEL : +82 51 205 8541

You Jeon Industry CO., LTD.

Head office : CHANGWON, GYUNGNAM
Homepage add :
Main products : Marine engine parts, Engine bed
TEL : +82 55 297 2121

YoungkWang Machine CO., LTD.

Head office : GYEONGJU-SI, GYEONGBUK
Homepage add : www.ykmc.com
Main products : Skid Unit, Pressure Vessel, Heat Exchanger
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