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월간 KORSHIP 발행

2016년 개정판

조선 & 해양 총람

Offshore & Shipbuilding Guide

조선&해양 총람 '2016년 개정판' 발행

월간 KORSHIP은 지난 2013년 조선해양 관련업계의 관심과 협조에 힘입어 국내 처음으로 '조선&해양 기업총람(Offshore & Shipbuilding Guide)'을 제작해 발행했습니다.

이번에 월간 KORSHIP은 국내 조선업계의 요구에 따라 '2016년 개정판'을 새롭게 발행하게 되었습니다. 2016년 개정판은 기존 2013년 총람 (1,008개 업체)에 비해 50% 이상 업체가 추가되어 총 1,600여 곳의 조선&해양 업체 정보가 수록되어 있습니다.

발 행 사: 프로콘 (Procon) / 월간 KORSHIP
발 행 일: 2016년 7월 20일
연 락 처: (02) 2168-8896~8899
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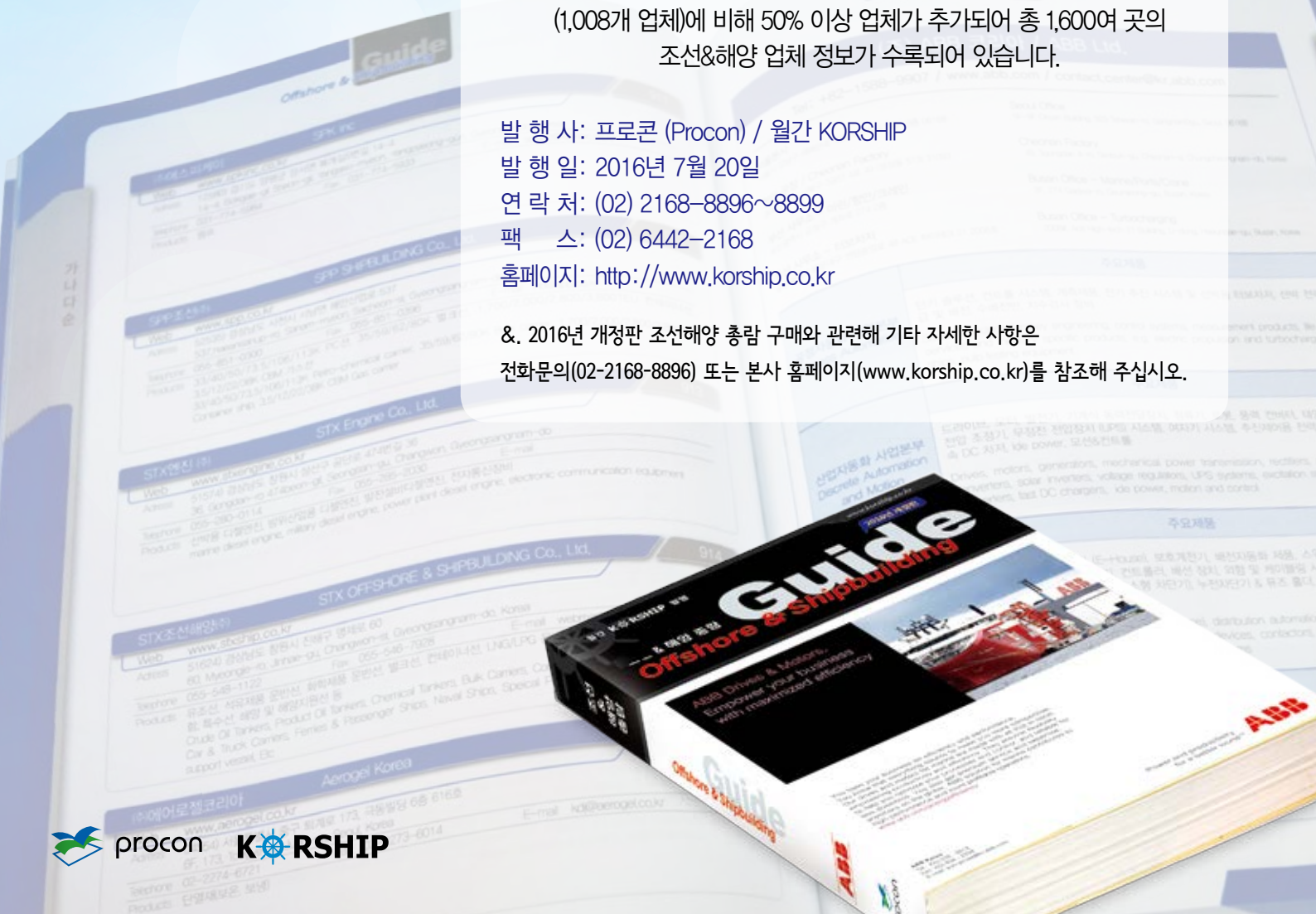

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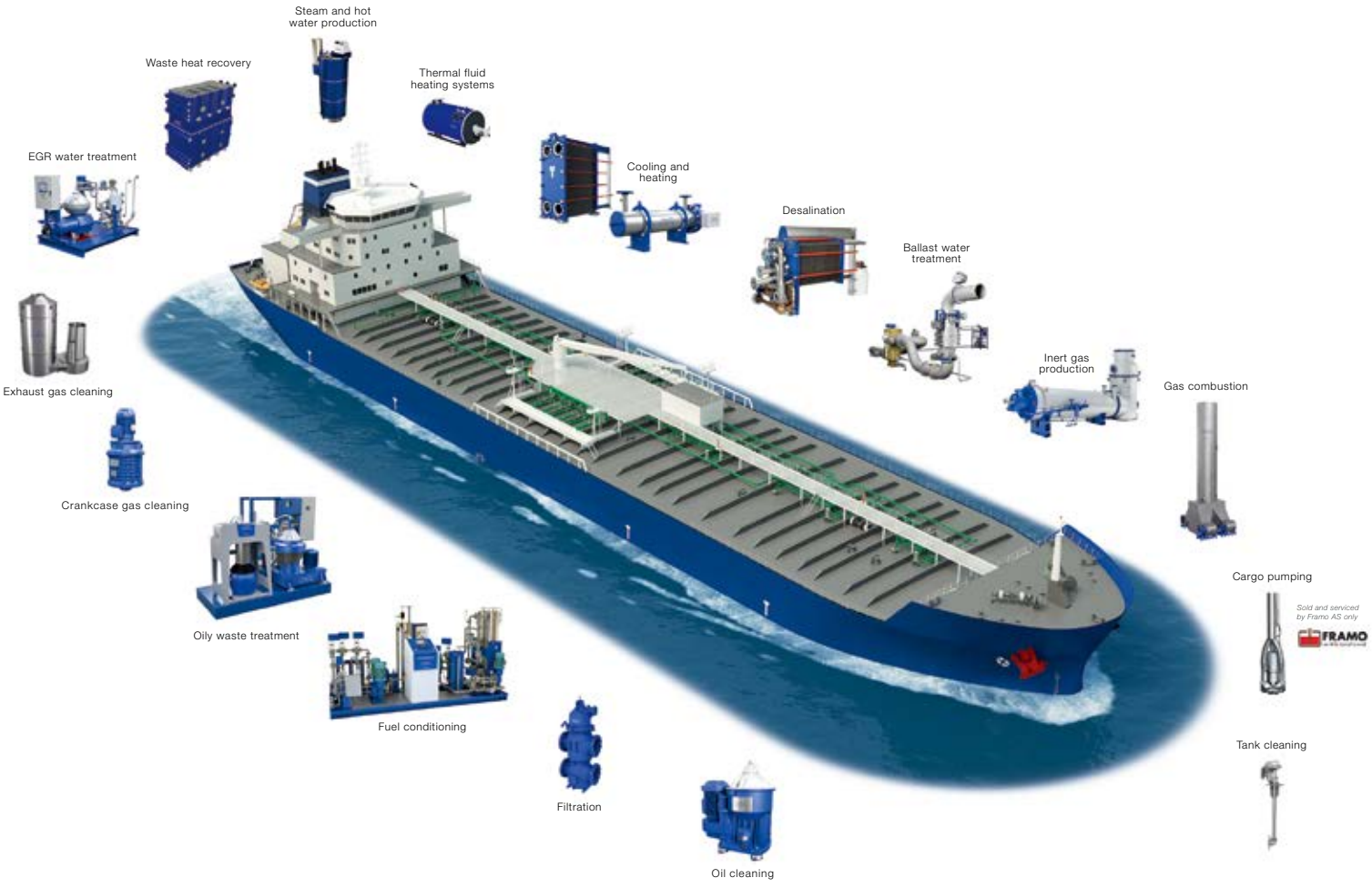

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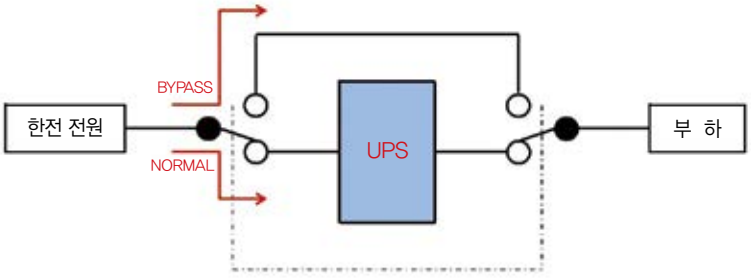

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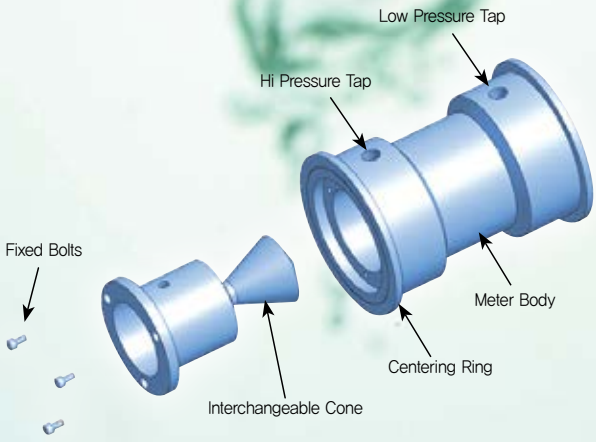

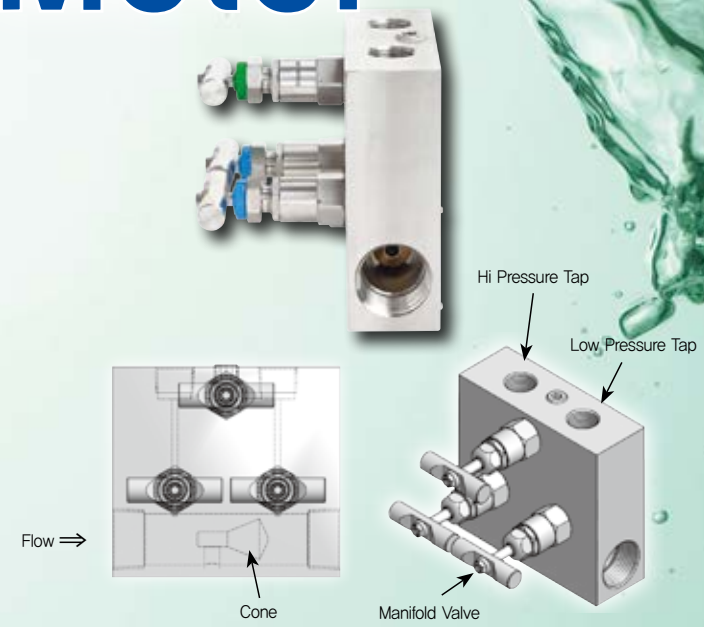

HFV-WM (Wafer type Cone Meter) **IVCM** (Integral Valve Cone Meter)

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 교정시스템**에 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 슬러그 뭉치의 충격으로 인한 Cone의 변형에 쉽게 교체 사용할 수 있는 특징을 가지고 있다. 또한, Wafer형태로 설치가 용이하고 모든 구성품이 정밀 기계가공되어 측정정확도가 우수하며, 용접부가 없어 압력부의 건전성이 확보 되었다.

(특 허 : 제 10-0915088호)

IVCM

IVCM은 차압식 유량계의 필연적 구성품인Manifold Valve를 Meter body와 일체형으로 제작하여 공정시 발생할수 있는 연결부의Leak를 최소화 하고, 설치시 공사 비용 및 시간을 줄이는 장점을 가진다.

(특 허 : 제 10-0915089호)

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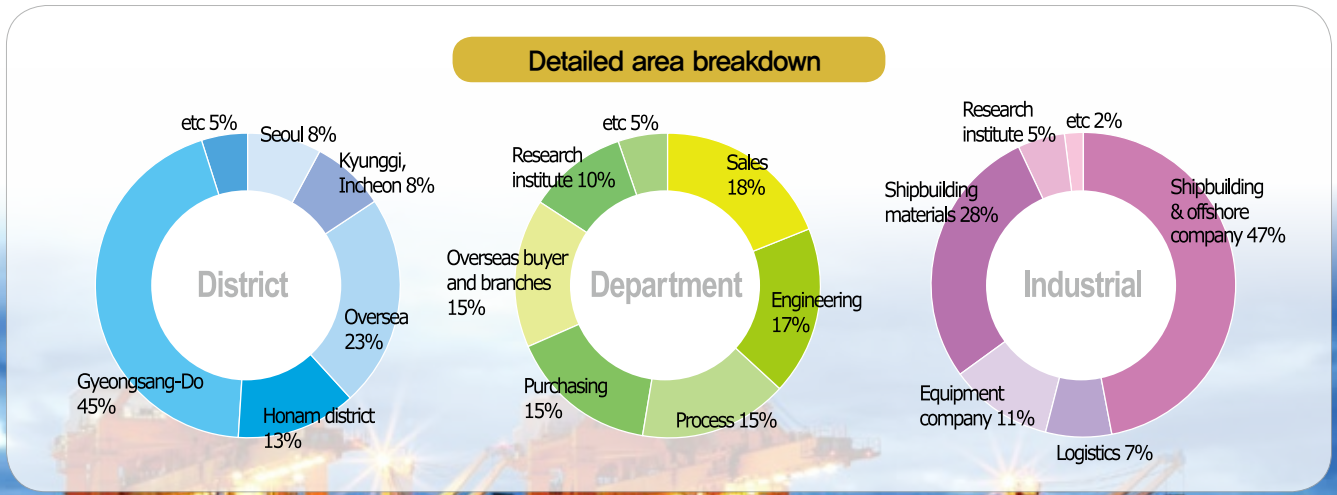

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HHI ushers in Era of 4th Industrial Revolution in Shipbuilding Industry

Hyundai Heavy Industries (HHI) announced it developed Integrated Smart Ship Solution (ISSS), its proprietary ICT technology capable of realizing economical and reliable navigation and management of ships. ISSS is the first of its kind in the global shipbuilding industry.

The solution standardizes ways of navigation varying depending on levels of skills and experiences of navigators, collects and analyzes real-time information on navigations, and thus will play a role in enhancing efficiency and safety of ships. The solution is expected to cut annual operating cost by 6%.

As IMO will introduce e-Navigation, a strategy to bring about increased safety of navigation in commercial shipping through better organization of data on ships by 2019, the demand for smart ships is expected to grow further.

Smart ship technology is a system that helps ships' efficient operation by using ICT and big data. HHI developed the smart ship technology in 2011 for the first time in the world and has applied the system to about 300 ships it delivered so far. Moreover, in May this year HHI signed a memorandum of understanding on establishing a partnership in the smart ship sector with the National Shipping Company of Saudi Arabia (Bahri).

Glovis Challenge, 6,500 PCTC with HHI's Integrated Smart Ship Solution

Lloyd's Register's Luis Benito, Innovation, Strategy and Research Director, Marine and Offshore said, "HHI's technology seeks to align with delivering the key benefits we believe the maritime industry will most benefit from through the adoption of connected, digital and autonomous technologies as the next generation of shipping embraces digitalization. According to Clarkson Research, about 6,500 ships are to be ordered globally for the next five years. Considering the global shipbuilding market share HHI takes up now, ISSS is to be installed on approximately 700 ships for the comparable time period."

ISSS is developed on the back of INTEGRICT which is Hyundai Electric's, a newly spun off company of HHI, intelligence energy management system. ISSS provides a wide range of ship information to operators including optimal navigation routes and navigation speed along with a slope status of the front and back hull of a ship that minimize resistances a ship takes on voyage. The solution allows safer and more efficient management of ships by collecting and analyzing energy data and monitoring status of engines and propellers. The ICT solution already completed field tests as well by being mounted on a 6,500 PCTC and a 250,000 DWT VLOC.

An HHI official said, "As we have always been, we will continue to exert our efforts to lead the global shipbuilding market with differentiated technological edges through the digital innovation."

현대중공업, '통합스마트선박솔루션'으로 4차 산업혁명 선도

현대중공업은 ICT(정보통신) 기술을 활용해 경제적 · 안정적 선박 운항 및 관리를 지원하는 '통합스마트선박솔루션(Integrated Smart Ship Solution)'을 개발했다고 밝혔다. 이 시스템은 항해사의 숙련도와 경험에 따라 달라지는 항해 방법을 표준화하고 운항 정보의 실시간 수집 · 분석을 통해 운항 효율성과 안전성을 높인 것이 특징이다.

이를 통해 현대중공업은 조선업계 선두 주자로서 조선 · 해운업 불황 속에 새로운 시장으로 주목 받고 있는 '스마트 해운' 움직임에 선제적으로 대응할 계획이다. 특히 국제해사기구(IMO)가 2019년부터 선박운항 관리체계를 디지털화하는 '이내비게이션(e-Navigation)'을 도입하기로 하면서, 스마트 선박 수요가 더욱 증가할 것으로 기대된다.

영국 로이드 선급(Lloyd's Register) 선박해양부문 루이스 베니토 이사(Luis Benito, 혁신전략연구담당)는 "현대중공업의 통합스마트선박솔루션은 스마트 시대 해운이 나아가야 할 방향과 부합되는 핵심기술"이라며, "향후 5년 간 발주될 6,500여대 선박 중 현대중공업 그룹의 시장점유율을 고려할 때 약 700척의 선박에 이 시스템이 적용될 수 있을 것"이라고 말했다.

이 시스템은 현대일렉트릭이 ICT 기술로 사용자 편의성을 높이고자 개발한 산업용 플랫폼 '인티그릭(INTEGRICT)'에 기반해 개발됐다. 에너지 데이터의 수집 및 분석과 엔진, 프로펠러 등의 가동 정보 모니터링을 통해 최적의 상태로 선박이 운용될 수 있도록 지원하며, 저항을 최소화하는 선체 전후 기울기 정보 및 최적 운항 속도를 알려줘 안전성을 높일 수 있다. 뿐만 아니라, 전자해도 상에 실시간 날씨 정보를 표시해 효율적인 운항을 돕는다.

이 시스템을 선박에 적용하면 연간 약 6%의 운항비용이 절감될 것으로 예상되며, 이미 6,500대급 자동차운반선과 250,000톤급 초대형 광석운반선에 탑재되어 실증작업을 성공적으로 마무리했다.

지난 5월에는 세계적 해운사인 사우디 바흐리와 스마트 십 공동개발을 위한 양해각서를 체결하면서 업계의 주목을 받기도 했다. 스마트 십 시스템은 2011년 현대중공업이 세계 최초로 개발, 지금까지 300여척의 선박에 탑재했다.

현대중공업 관계자는 "디지털 혁신을 통해 제품을 넘어 솔루션을 제시하는 서비스를 제공함으로써 현대중공업만의 경쟁력을 갖출 것"이라고 말했다.

DSME completed delivery of a drillship

Daewoo Shipbuilding & Marine Engineering (DSME) announced on July 11 that it delivered a drillship worth KRW 620 billion which was ordered by the U.S.-based Transocean in 2012. This drillship, measuring 238m in length and 42m in width, is a DSME-12000 model developed independently by DSME.

It is the largest drillship ever built by DSME and can drill up to 12km at water depths of up to 3.6km. Meanwhile, DSME completed delivery of 3 of the 5 offshore plants scheduled for delivery this year and plans to deliver 2 more units by October. Transocean is a major customer of DSME, which has placed orders at DSME for 12 drillships since it inked its first contract with the shipbuilder in 2006. Including the drillship recently delivered, DSME has successfully handed 11 drillships over to Transocean thus far.

An official from DSME said, "We have overcome difficulties that we have faced over the last 2 years and successfully delivered the offshore facility to reciprocate the trust shown in us by the client. We will ensure timely delivery of the remaining offshore plants to live up to our reputation.

대우조선해양, 트랜스오션 드릴십 1척 인도 완료

대우조선해양은 지난 2012년 미국 트랜스오션으로부터 수주한 6,200억원 규모의 드릴십 1척을 인도했다고 지난 7월 11일 밝혔다.

이번에 인도된 드릴십은 대우조선해양이 자체 개발한 DSME-12000 모델로, 길이 238미터, 폭 42미터 규모다. 이는 대우조선해양이 건조하는 드릴십 중 최대 규모로 최대 수심 3.6 킬로미터의 심해에서 최대 약 12 킬로미터까지 시추가 가능하다. 한편 대우조선해양은 올해 인도예정이었던 5척의 해양플랜트 중 3척을 인도 완료했으며, 오는 10월까지 2척을 추가로 인도할 예정이다.

트랜스오션은 대우조선해양과 2006년 첫 계약을 체결한 이후 총 12척의 드릴십을 발주한 대우조선해양의 주요 고객사다. 이번에 인도된 드릴십을 포함해 대우조선해양은 총 11척의 드릴십을 트랜스오션측에 성공적으로 인도했다.

대우조선해양 관계자는 "지난 2년간 해양플랜트 생산에 어려움이 있었지만, 그 어려움을 이겨내고 성공적으로 설비를 인도해 고객의 신뢰에 부응했다"며 "남은 해양플랜트도 인도 일정을 준수해 기술 대우의 명성을 지켜내겠다"고 말했다.

ABB completes acquisition of B&R

ABB today announced on July 6 that it has completed its acquisition of B&R (Bernecker + Rainer Industrie-Elektronik GmbH), the largest independent provider focused on product- and software-based, open-architecture solutions for machine and factory automation worldwide. The transaction, which was announced on April 4, 2017, is financed in cash and expected to be operationally EPS accretive in the first year.

"I am very pleased to now officially welcome B&R to ABB. This transaction closes ABB's historic gap in machine and factory automation and expands our leadership in industrial automation. Following the acquisition of B&R, we are the only industrial automation provider offering customers in process and discrete industries the entire spectrum of technology and software solutions around measurement, control, actuation, robotics, digitalization and electrification," said ABB CEO Ulrich Spiesshofer.

"This combination will open new global growth opportunities by expanding our offerings to existing clients while also bringing ABB's broad reach, extensive domain knowledge and deep technical expertise to industries and customers that we have not served before. Our commitment to growing the business of B&R is demonstrated by our investment in a new R&D center, which is to be built next to its headquarters in upper Austria."

This transaction marks another important milestone in ABB's Next Level strategy. With the acquisition of B&R, ABB strengthens its position as the second-largest industrial automation player globally. ABB is now uniquely positioned to seize the tremendous growth opportunities created by the Fourth Industrial Revolution. B&R's industry-leading products, software and services in Programmable Logic Controllers (PLC), Industrial PCs and servo motion-based machine and factory automation ideally complement ABB's industrial automation portfolio for utilities, industry and transport & infrastructure providers.

Through the acquisition of B&R, ABB is taking another major step in expanding its digital offering by combining its industry-

leading portfolio of digital solutions, ABB Ability™, with B&R's strong application and software platforms, its large installed base, customer access, and tailored automation solutions.

"There is a strong cultural fit between B&R and ABB, including our shared commitment to customer-centric, open-architecture software and solutions. This will ensure a smooth integration as we combine our strengths and maximize our uniquely comprehensive offering for the benefit of our customers," said Peter Terwiesch, President of ABB's Industrial Automation division.

ABB, B&R 인수 완료

ABB는 B&R(Bernecker + Rainer Industrie-Elektronik GmbH) 인수를 완료했다고 지난 7월 6일 밝혔다. B&R은 세계 최대 독립 공급사로서 전세계 기계 및 공장 자동화와 관련해 제품 및 소프트웨어 기반, 개방형 아키텍쳐 솔루션에 중점을 두고 있다. 지난 2017년 4월 4일 발표된 인수는 현금 거래이며, 첫 해에 운영상 주당순이익 증가가 기대된다.

"이제 ABB로 합류하게 된 B&R을 공식적으로 환영한다. 이번 거래는 기계 및 공장 자동화 분야에서 지속되어 온 차이를 줄이고, 산업 자동화 리더십을 확장시켜줄 것이다. B&R인수에 따라, 우리는 측정, 제어, 구동, 로봇, 디질털화 및 전기화에 대해 프로세스 및 개별 산업 고객에게 기술, 소프트웨어 솔루션의 전체 스펙트럼을 공급하는 유일한 산업 자동화 공급업체가 됐다"고 ABB CEO 울리히 스피스호퍼(Ulrich Spiesshofer)는 밝혔다.

덧붙여 그는 "이번 인수로 기존 고객에게 다양해진 솔루션을 제공하고, ABB의 광범위하고 확장된 전문 지식과 심화된 전문 기술을 기존에 접촉하지 못했던 산업과 고객에게 제공할 수 있게 됐으며, 새로운 글로벌 성장기회를 열게 될 것으로 기대한다. B&R 비즈니스 성장에 대한 공약은 오스트리아 위쪽 본사 옆에 지어진 새로운 R&D센터 투자를 통해 입증될 것"이라고 말했다.

ABB 차세대 전략에서 또 다른 중요한 이정표를 찍었다. B&R을 인수하면서 ABB는 전세계 두 번째 거대 산업 자동화 기업으로서의 입지를 강화했다. ABB는 4차 산업혁명으로 창출되는 거대한 성장 기회를 포착할 수 있는 독보적인 입지를 갖게 되었다. PLC(Programmable Logic Controller), 산업용 PC 및 서보 모션 기반 기계 및 공장 자동화 분야에서 B&R의 업계 선도 제품, 소프트웨어 및 서비스는 유틸리티, 산업 및 운송 및 인프라 공급자를 위한 ABB 산업 자동화 포트폴리오를 이상적으로 보완해 준다.

B&R 인수를 통해 디지털 솔루션 ABB Ability™는 B&R 강력한 어플리케이션 및 소프트웨어 플랫폼, 방대한 설치기반, 고객 접근성 및 맞춤형 자동화 솔루션 등과 결합하면서 ABB는 디지털 제품군을 확장하는 또다른 한걸음을 내딛게 되었다.

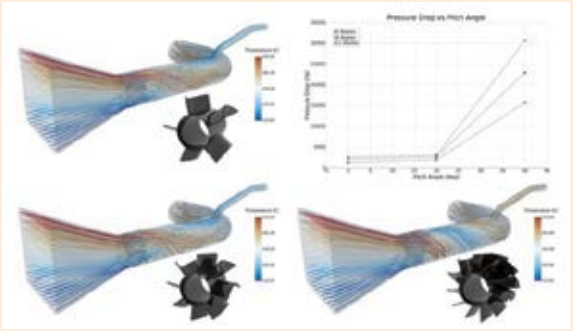
"고객 중심, 개방형 아키텍처 소프트웨어 및 솔루션에 대한 공통적인 약속과 더불어 B&R과 ABB간에는 문화적인 조화로움이 있다. 양사가 서로의 강점을 결합하고 고객 혜택을 위한 독창적인 종합 솔루션을 극대화해 원활하게 통합해 나갈 것이라 확신한다"고, ABB 산업 자동화 사업본부 총괄 대표 피터 터비쉬(Peter Terwiesch)는 말했다.

Siemens' STAR CCM+® software adds fully integrated design exploration and optimization

The latest release of Siemens' STAR CCM+® software for multiphysics computational fluid dynamics (CFD) simulation and analysis includes two new seamlessly integrated features which enable automated product design exploration and optimization.

STAR CCM+ version 12.04 introduces Design Manager, allowing users to easily explore multiple design options within their CFD simulations, and STAR-Innovate™ software, which uses the same proven design optimization technology found in HEEDS™ software - a technology Siemens obtained as part of its 2016 acquisition of CD-adapco. STAR-CCM+ is developed by Siemens' product lifecycle management (PLM) software business, and is part of the company's Simcenter™ portfolio, a robust suite of simulation and test solutions.

"I firmly believe that single-scenario engineering simulations are about to become a thing of the past," said Jean-Claude Ercolanelli, Senior VP of Product Management at Siemens PLM Software. "If you know how to use STAR CCM+ then you will instinctively know how to use Design Manager. This means that every engineer who installs STAR CCM+ v12.04 can now conduct design exploration studies with ease to discover better designs, faster."



Companies are looking for innovative answers to today's challenging engineering problems to differentiate themselves in the market. Using simulation to explore what is feasible drives this innovation. Design Manager enables users to set up and automatically evaluate families of designs directly within STAR CCM+, including process management and performance assessment. It leverages the all-in-one platform, automated meshing, pipelined workflow and accurate physics in STAR CCM+ to overcome the complexities that have historically prevented many from using CFD simulation in this way. Design Manager, which automates the systematic explora-

tion of designs by evaluating variations in geometry and operating conditions, is included with every instance of STAR CCM+ v12.04.

With the addition of the STAR-Innovate add-on, users can take it one step further and perform single and multi-objective optimization studies to intelligently search the design space using the same time-tested and proven technology found in HEEDS. It also provides stochastic analysis to help engineers determine the sensitivity of their simulation predictions to small changes in input parameters, such as manufacturing tolerances on a critical dimension or fluctuations in boundary condition values.

"STAR CCM+ is the only multiphysics CFD offering that seamlessly enables engineers to perform design exploration studies backed by an industrial-strength optimization tool like HEEDS," added Ercolanelli. "As a result, engineers can spend less time setting up and monitoring simulations, and more time assessing the outcomes to determine what makes good designs great. This is a game-changer."

지멘스, 전산 유체 역학 소프트웨어 STAR-CCM+ 최신 버전 출시

지멘스는 시뮬레이션 및 분석에 특화된 다중 물리 CFD(computational fluid dynamics; 전산 유체 역학) 소프트웨어의 최신 버전 STAR-CCM+® v12.04를 출시했다. 이 버전에는 자동화된 제품 설계 탐색과 설계 최적화를 가능하게 하는 2가지 새로운 기능이 통합됐다.

STAR-CCM+ v12.04는 디자인 매니저(Design Manager)를 도입해 CFD 시뮬레이션에서 여러 가지 설계 옵션을 쉽게 탐색할 수 있다. 또한 지멘스가 2016년 인수한 씨디어댑코(CD-adapco)의 검증된 HEEDS™ 소프트웨어의 설계 최적화 기술에 기반한 STAR-Innovate™ 소프트웨어를 추가했다. STAR-CCM+는 지멘스의 PLM 소프트웨어 사업부에서 개발됐으며, 강력한 시뮬레이션 및 테스트 솔루션 제품군인 심센터(Simcenter™) 포트폴리오에 포함된다.

지멘스 PLM 소프트웨어 제품관리부문 부사장인 장 클로드 에콜라넬리(Jean-Claude Ercolanelli)는 "단일 시나리오 엔지니어링 시뮬레이션은 머지않아 구식으로 전락할 것이다. STAR-CCM+ 사용법에 익숙한 사용자라면 디자인 매니저 사용법도 쉽게 익힐 수 있다. STAR-CCM+ v12.04를 설치한 엔지니어는 설계 탐색 연구를 쉽게 수행하고, 우수한 설계를 보다 빨리 발견할 수 있다"고 말했다.

기업들은 시장 내 차별화를 이루기 위해 오늘날 까다로운 엔지니어링 문제에 대한 혁신적인 해답을 찾고 있다. 시뮬레이션을 이용하면 실현 가능성을 탐색할 수 있어 이러한 혁신 달성에 도움을 얻을 수 있다.

디자인 매니저를 통해 STAR-CCM+에서 직접 프로세스 관리 및 성능 평가 등의 설계군을 설정하고 자동으로 평가할 수 있다. 디자인 매니저는 STAR-CCM+의 올인원(all-in-one) 플랫폼, 자동화된 격자, 파이프라인 방식의 워크플로우 및 정확한 물리학을 활용해 기존의 방식으로 CFD 시뮬레이션 사용을 어렵게 했던 복잡성을 극복할 수 있다. STAR-CCM+ v12.04의 모든 인스턴스에는 형상 및 작업 조건의 변화를 검사하여 설계의 체계적인 탐색을 자동화하는 디자인 매니저가 포함되어 있다.

STAR-Innovate 추가모듈을 통해 사용자는 한 단계 더 나아가 HEEDS 소프트웨어에 적용된 검증된 기술을 사용해 설계 공간을 지능적으로 검색하는 단일 및 다중 목적의 최적화된 연구를 수행 할 수 있다. 또한 이 추가 모듈은 확률 분석(stochastic analysis)을 제공함으로써 엔지니어가 임계 치수의 제조 허용 오차 또는 경계 조건 값의 변동과 같은 입력 매개 변수의 작은 변화에 대한 시뮬레이션 예측의 민감도를 결정하는데 도움을 준다.

에콜라넬리 부사장은 "STAR-CCM+는 업계에서는 유일하게 HEEDS와 같은 강력한 최적화 도구에 기반해, 엔지니어가 설계 탐색 연구를 원활하게 수행할 수 있게 돕는 다중 물리 CFD 솔루션이다. 이를 통해 엔지니어는 시뮬레이션 설정 및 모니터링에 더 적은 시간을 할애할 수 있다. 그리고 더 많은 시간을 설계 결과 평가에 할애함으로써, 더 우수한 설계를 만들어 낼 수 있다"고 말했다.

Emerson's new asset management platform honored with IIoT and reliability awards

Emerson's AMS ARES Asset Management Platform received a Connected World IoT Innovations award, recognizing its ability to leverage Internet of Things (IoT) technologies in expanding access to critical asset data organizations can use to improve plant reliability and production.

The 2016 Connected World IoT Innovations award honors cutting-edge Internet of Things (IoT) solutions that are game-changers for their industries, celebrating companies pushing the barriers with uniqueness and technological advancement.

ARES was also recognized by the readers of Plant Engineering in the 2016 Product of the Year awards as being a unique and innovative product among asset management technologies. Readers of Control Engineering also recognized Asset View, the mobile app for AMS ARES, as a leading mobile app for controls, automation, and instrumentation in the 2017 Engineer's Choice awards.

AMS ARES and Asset View are strategic Always Mobile technologies that provide today's worker with critical applications,

tools, and digital intelligence. As a part of Emerson's Plantweb™ digital ecosystem, Always Mobile technologies are specifically designed to help teams increase operational production, reliability, safety, and efficiency—from wherever they work.

에머슨의 새로운 자산 관리 플랫폼, IIoT 및 신뢰성 부문 수상

에머슨의 AMS ARES 자산 관리 플랫폼은 조직이 플랜트 신뢰성과 생산성을 향상하기 위 해 주요 자산 데이터에 접근을 확장하는 사물인터넷(IoT) 기술로 'Connected World IoT Innovations'를 수상했다. 2016 Connected World IoT Innovations 상은 산업의 혁신을 이끌며 기업들의 기술 발전을 이끄는 최신 사물인터넷(IoT) 솔루션을 선정하고 있다.

ARES는 또한 2016 Production of the Year 상에서 Plant Engineering의 독자들로부터 유일무이하며 혁신적인 자산 관리 기술 제품으로 인정받았다. Readers of Control Engineering의 독자들도 2016 Engineer's Choice 상에서 AMS ARES의 모바일 앱인 Asset View를 제어, 자동화 및 계기를 위한 선두적인 모바일 앱으로 꼽았다.

AMS ARES 및 Asset View는 작업자들에게 주요 어플리케이션, 도구 및 디지털 지능을 제공하는 전략적인 Always Mobile 기술이다. 에머슨 Plantweb™ 디지털 에코시스템의 일환으로써 Always Mobile 기술은 어디에서 작업하든 운영상의 생산성, 신뢰성, 안전성 및 효율성을 높일 수 있도록 설계됐다.

HHI group signs MOU with KEPCO for Pet-coke Power Plant Businesses

Hyundai Heavy Industries (HHI) and its oil refining affiliate Hyundai Oilbank signed an MOU with Korea Electric Power Corporation (KEPCO), the state-run utility, to jointly develop overseas pet-coke based power plant businesses.

Pet-coke or petroleum coke is a carbon-rich solid byproduct that derives from oil refining processes. It is an economical energy source but it requires special equipment, CFBC (Circulating Fluidized Bed Combustion), to be used as feedstock for power generation.

HHI has a strong track record of manufacturing CFBC boilers and EPC of various types of power plants while Hyundai Oilbank is one of a few companies with a proven track record of successful management of pet-coke based power plants worldwide. KEPCO has a high reputation in developing power plant projects overseas.

Under the MOU, the three companies will build CFBC power plants adjacent to oil refineries selling pet-cokes, generate power with the pet-cokes, and sell the generated electricity back to the oil refineries. Hyundai Heavy Industries Group aims to generate about KRW 10 trillion from 20 projects for the next 5 years.

The MOU signing ceremony was attended by Chung Ki-sun, Executive Vice President of Corporate Planning Office of HHI; Moon Jong-bak, CEO of Hyundai Oilbank; and Lyu Hyang- reol, Executive Vice President of KEPCO.

Chung Ki-sun said, "We are pleased to enter into independent power plant businesses by teaming up with KEPCO, a global leading player. By creating synergy with HHI's technology and Hyundai Oilbank's project management expertise, we will redouble our efforts for the successful execution of the partnership." Lyu Hyang-reol added, "We see the high potential of pet-coke based power plants as blue ocean businesses thanks to pet-coke's low costs and its abundance."

현대중공업 그룹, 한전과 발전 관련 신사업 진출

현대중공업과 현대오일뱅크, 한국전력은 지난 29일 서울 계동 현대빌딩에서 해외 페트콕(Pet-coke, 석유정제 부산물) 발전 공동개발을 위한 MOU를 체결했다. 이날 체결식에는 현대중공업 정기선 전무, 현대오일뱅크 문종박 사장, 한국전력 유향열 부사장 등이 참석해 향후 페트콕 사업에 대한 3사간 협력 방안을 논의했다.

페트콕은 원유의 정제과정에서 발생되는 부산물로, 연료로 재사용하기 위해선 특수설비와 고도의 운영 기술이 필요해 정유회사 대부분이 외부에 낮은 가격으로 판매해왔다.

3사가 추진중인 페트콕발전은 페트콕을 연료로 CFBC 보일러라는 특수설비를 통해 전력을 생산하는 방식으로, 경제성이 뛰어난 것은 물론 고도의 기술이 필요해 시장진입장벽이 높다는 특징을 갖고 있다.

현대중공업은 다수의 플랜트 공사 실적을 통해 자체 CFBC 보일러 설계, 제작 역량을 갖추고 있으며, 현대오일뱅크는 전 세계적으로 페트콕 발전소 운영 경험을 보유한 몇 안 되는 회사 중 하나이다. 또, 한국전력은 발전설비 운영능력과 해외 발전사업 개발에 탁월한 능력을 갖고 있다. 3사가 갖고 있는 장점을 바탕으로 페트콕을 외부에 판매중인 해외 정유공장 인근에 CFBC 보일러를 건설, 페트콕을 연료로 전력을 생산해 정유공장에 재판매하는 사업을 추진할 계획이다. 현재 페트콕이 생산되는 설비는 전세

계에 약 250기가 있으며, 현대중공업그룹은 5년간 20개 사업을 개발, 매출 10조를 올리는 것을 목표로 하고 있다.

현대중공업 정기선 전무는 "그룹의 사업다각화 차원에서 전력분야의 글로벌 기업인 한국전력과 함께 민자발전사업에 진출하게 돼 기쁘다"며 "현대중공업이 갖고 있는 기술과 현대오일뱅크가 보유한 발전소 운용능력 등 그룹사간 시너지를 바탕으로 성공적인 사업이 될 수 있도록 노력하겠다"고 밝혔다.

Bureau Veritas and Ascenz join forces in ship performance agreement

Bureau Veritas and Singapore based Ascenz have signed a memorandum to provide ship performance and monitoring solutions to shipowners world-wide.

The agreement will enable Bureau Veritas to offer Shipulse, Ascenz's solution for real time ship performance and monitoring. Shipulse captures critical shipboard data to provide insights for better decision making, fuel savings and optimized vessel performance. The data captured covers fuel consumption, bunkering activity, engine, hull and propeller performance.

Bureau Veritas will market Shipulse across its network to offer complementary services and analysis tools based on ship modelling capabilities, data analysis across fleets, and the ability to integrate BV software - such as weather routing and trim optimization - with Shipulse.

Chia Yoong Hui CEO, Ascenz, said "The key value of Shipulse is to bring critical performance information as accurately and seamlessly as possible to shipowners. We are excited that through this co-operation agreement we will be able to enhance our offering and leverage BV's expertise in vessel performance."

Tihomir Kezic, Bureau Veritas' Regulatory Services Director, said "By joining forces with Ascenz we are able to provide solutions to shipowners that connect compliance with performance management to help ensure efficiency and environmental performance as well as safe operations."

CarbonComply enables automated monitoring and reporting of ship CO_2 emissions under EU-MRV regulation requirements. Reporting is a natural output of the Shipulse fuel consumption data and performance analysis. A unique capability of CarbonComply is to register voyages automatically without the need for manual calculations to breakdown fuel consumption or emissions on a per voyage basis. Furthermore, the system is able to detect and classify different voyage stages such as sea passages, maneuvering, drifting and to identify when a ship is either moored or at anchor. This then allows for greater granularity from profiling emissions associated with a sea passage versus that from time spent when anchored.

Ultimately, CarbonComply makes the monitoring and reporting process for EU-MRV compliance more efficient for shipowners and helps shipowners address their risk of non-compliance.

Shell provides OOCL its integrated lubrication solutions for the world's largest container ship

Orient Overseas Container Line (OOCL), one of the world's largest integrated international container transportation, logistics and terminal companies, has appointed Shell Marine to provide its integrated marine solutions, which include lubricants and services for OOCL Hong Kong.

OOCL Hong Kong is the latest vessel to claim the 'world's largest container ship' with a capacity of 21,413 twenty-foot equivalent units (TEUs), measuring 400m in length and 59m in width. The ship is equipped with MAN Diesel & Turbo's (MDT) G-type engines that represent the latest in two-stroke engine technology. The ship is currently plying routes between Asia and Europe.

Protecting, maintaining and optimising marine engine performance at a time when engine technology is fast developing can be challenging and complex, particularly during a period when fuel selection and vessel speed requirements are also up for discussion.

The G-type engine design used in the OOCL Hong Kong requires close oil performance monitoring and technical support and since the containership also needs to optimise its performance by tackling very challenging operating conditions, this means that selecting high quality cylinder oil is of utmost importance.

Drawing on its over 30-year track-record with OOCL, Shell Marine laid out its portfolio of cylinder oil options to match the owner's operating profile and fuel grade expectations as well as to protect the main engine against cold corrosion and optimise feed rates.

"As a supplier, we have considerable experience with MDT's G-type engines. It was crucial that we shared our knowledge with OOCL at the outset, and that they could offer feedback in the dialogue that ultimately led to the optimal product selection," said Jan Toschka, Shell Marine Executive Director.

In addition to Shell Marine's lubricants, Shell LubeMonitor has been deployed onboard OOCL Hong Kong - which includes a cylinder oil condition monitoring service that uses shipboard and laboratory analysis to help optimise engine performance and enable predictive maintenance. The programme includes access to Shell tools and expert advice to help customers strike and maintain an acceptable balance between feed rate related cylinder oil costs and wear-related cylinder maintenance expenses. It is now enhanced with a new software package, Marine Connect, designed to transfer onboard analysis data to the Shell experts easily and securely.

DNV GL releases updated DNV GL NOx TIER III compliance guide

Classification society DNV GL has developed a new brochure to offer a set of best practices for the design of ships subject to NOx Tier III requirements. It also offers guidance on the considerations that should be taken into account at the newbuilding stage.

To ensure the success of any newbuilding plan, shipowners should carefully consider the future operation of their vessels in the newbuilding planning stage, including the implications of the different technological solutions for reducing NOx emissions and how to fulfil the NOx Tier III requirements. In order to fulfil the stricter NOx Tier III emission limits, ship operators have the possibility of choosing from various options. The optimal compliance option will depend upon many factors, including a vessel's individual trading pattern, engine size and speed. The brochure examines selective catalytic reduction (SCR), exhaust gas recirculation (EGR), the use of alternative fuels, internal engine modifications, direct water injection (DWI), fuel-water emulsion (FWE) and intake air humidification.

Wärtsilä launch the first ship with IMO Tier III EIAPP certified engines

The launch of the L'Astrolabe, a 72 metre polar logistics vessel fitted with a complete Wärtsilä propulsion machinery package and Wärtsilä NOR (NOx Reducer) SCR (Selective Catalytic Reduction) exhaust gas cleaning systems for all the main engines, took place on July 12.

The ship was built by PIRIOU (France) for the French Southern and Antarctic Lands Administration. It will be used to transport personnel and supplies to the Dumont d'Urville research station in Antarctica.

The four IMO Tier III certified 8-cylinder Wärtsilä 20 diesel engines are combined with Wärtsilä NOR systems to be fully compliant with the IMO Tier III exhaust emission regulations set out in Annex VI of the MARPOL 73/78 convention. The IMO Tier III EIAPP certification was carried out according to Scheme B based on the requirements of IMO Resolution MEPC.198(62). The Tier III EIAPP certificates were issued by Bureau Veritas.

The full Wärtsilä scope of supply for this

vessel comprises four Wärtsilä 20 main engines, two Wärtsilä controllable pitch propellers and shaft lines including Wärtsilä reduction gears, Wärtsilä NOR systems, and a Wärtsilä tunnel thruster.

"We have been pleased to deliver this combination of engines and SCR systems in the same scope of supply, and take full responsibility for exhaust gas emissions, performance, documentation, statutory approvals and certification. Such packages are convenient for shipyards and ship operators, and triggered by IMO regulations are expected to be specified by an increasing number of shipyards and ship owners. The engine needs to be SCR compatible, and the SCR should be fit for purpose. It has been a pleasure to work with Chantiers Piriou," said Juha Kytölä, Vice President, Environmental Solutions, Wärtsilä Marine Solutions.

The L'Astrolabe will have accommodation for 60 persons, a cargo capacity of 1400 metric tons, and is fitted with a helideck large enough to accommodate two helicopters.

SunRui becomes first Asian manufacturer to win USCG type approval

The Chinese manufacturer SunRui and classification society DNV GL celebrated last week, as Sunrui became the fourth manufacturer of ballast water treatment systems (BWTS) to obtain type approval from the US Coast Guard (USCG). Its BalClor® system treats ballast water in three steps: Filtration, seawater electro-chlorination for disinfection and neutralization. The company is the first Asian manufacturer to be awarded the USCG type approval certificate for BWTS. As one of five independent laboratories accredited by USCG, DNV GL worked with SunRui on the testing of its BWTS.

"We would like to thank DNV GL for its continuous support and assistance. Obtaining the type approval has been a long and rigorous process and we appreciate DNV GL's professionalism and precision during this project," said Mr. Fu Hongtian, General Manager of SunRui.

"After winning the IMO type approval issued by DNV GL and the USCG type approval, we will continue to invest in developing equipment for preventing marine and air pollution, with DNV GL as our classification partner. At the beginning of this year, we already applied for the type approval of a selective catalytic reduction system (SCR) to remove nitrogen oxide emissions (NOx), and we will invite DNV GL to witness emission tests soon. Meanwhile, we are also working on a scrubber to clean sulphur oxide emissions (SOx) from ship emissions and we will apply for DNV GL approval for this project in the near future."

"DNV GL and its associated sub-laboratories DHI Denmark, NIVA (Norway), Golden Bear Facility (USA) and DHI Singapore have been deep into the details of USCG testing for three years and have gained a great deal of experience in what is practical and possible to achieve in complying with the regulation," said Martin Olofsson, Senior Principal Engineer, Environmental Protection at DNV GL – Maritime.

There are now five "Independent Laboratory" accreditations for BWTS. Of 45 BWTS manufacturers who have signed a letter of intent for having their systems approved by the USCG, DNV GL is currently handling 25, making it the largest independent provider of laboratory services.

인터그래프, 새로운 도약 위해 'Hexagon PPM'으로 리브랜딩

인터그래프가 기존 대표 브랜드인 Intergraph® PPM(Process, Power & Marine)를 'Hexagon PPM'으로 리브랜딩한다고 밝혔다. 이번 리브랜딩은 기존 사업영역인 플랜트·발전·해양 산업을 이어가는 동시에 앞으로 어떠한 제한 없이 기존 시장과 산업을 뛰어넘어 도약해 나가고자 하는 의미를 담고 있다.

한편 인터그래프는 기존 Intergraph® PPM 브랜드에 대한 고객사들과의 신뢰성과 그 동안 쌓아온 긍정적인 인식을 고려해 일부 제품의 경우에 한해 계속 유지할 계획이다.

HEXAGON
PPM

1.5 KILOTONS ON THE HOOK – WHILE AFLOAT

Heeling systems from BESI, in Bremen, Germany keep ships stable on the water

WAGO

by Jörg Schomacker

The stability of mobile cranes on land is comparatively easy to ensure; a suitable counterweight is set based on the load, and a few minutes later, hydraulic supports extend several meters out for balance. However, it is commonplace that bulky and especially heavy loads are usually transported via water to their destinations. This raises the question as to how stability is ensured for onboard cranes – water is an unstable surface. Systems made of pumps, valves and ballast tanks hold cargo and commercial ships upright. Often called "heeling pumps," these systems prevent listing of the ship's body in the case of unevenly distributed loads. To control them, the specialists at BESI rely on PFC200 Controllers from WAGO, in combination with the I/O-SYSTEM 750 for Ex and Non-Ex areas.

MPV Heavy Lifters, like the BBC AMBER, are designed to transport bulky and heavy cargo. Heeling systems ensure stability.

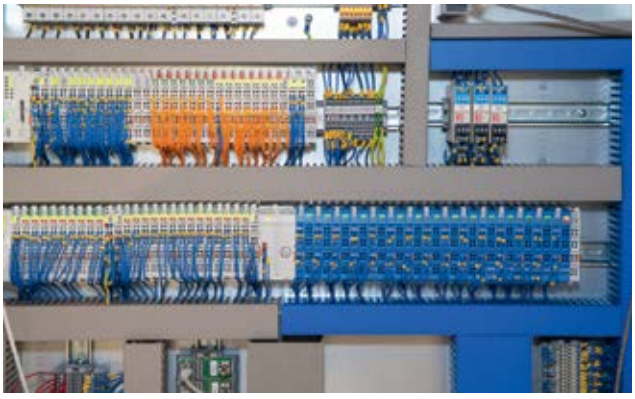
> We can use one system to operate in both areas, and that system is identical in function and programming, making our lives significantly easier.

Vessels which can be identified from afar are called "MPV Heavy Lifters" – as they have at least two large cranes on deck. These multi-purpose vessels are designed specifically for handling bulky and heavy cargo. According the Michael Borchers, Chief Technical Officer at BESI, their cargo has included rocket parts, turbines and even entire trains. In a current new construction project, the two cranes of one "MPV Heavy Lifter" can exceed more than 1,500 tons of lifting capacity. The heeling compensation systems on such ships have to be configured with corresponding abilities.

"The ship has compensation tanks distributed across the entire stern, which our system can quickly and precisely empty or fill with ballast water," explains Borchers. This is the only way for the ship to maintain its balance during loading and unloading. Lifting the cargo and compensation by the pumps is performed in parallel. Consequently, the loading process can only move as fast as the heeling pumps are able to create weight compensation using ballast water – nevertheless, this should function as fast as possible to maintain short logistics times, according to Borchers.

However, the heeling compensation system must function reliably, above all, regardless of the time demands. "If one pump suddenly fails, then an entire ship can turn extremely fast," states Borchers. By this, he means that the boat will capsize, or "turn turtle," as it is colloquially known. "If the heeling system is interrupted, then the crane operator cannot react fast enough to lower the load at the correct time when threading heavy loads onto the deck."

Michael Borchers is the Chief Technical Officer at BESI in Bremen.



Omitting Zener barriers enables a space-saving control cabinet design.

Dropping the load from the hook in an emergency is still possible from the quay, because the ship can use the quay itself as a counter weight; however, this is impossible from the seaside, because the load would crash onto the ship.

Redundant industry standards

This is a scenario that explains why BESI relies on exceptionally reliable technology and equips its systems with sufficient redundancies. To control the "flow management" process, the company from Bremen uses WAGO PFC200 controllers – and in a redundant and spatially distributed function network configuration. BESI groups the heeling system, as well as the measurement, control and monitoring of tank contents under flow management.

Due to the high fuel consumption in large commercial and container ships, fuel and ballast water must be regularly transferred during travel so that the ship retains a stable trim that's optimized for energy efficiency. When ships are in a harbor, the heeling systems can engage automatically on the basis of tilt sensors; at sea, the weight compensation between fuel and ballast water is executed manually.

"No automation system is able to compensate for wave amplitudes 100% of the time," explains Borchers, "because they constantly change and are unpredictable." Automatic operation of an electronic heeling compensation system is therefore forbidden while at sea. This is why cruise ships mechanically stabilize the body of the ship during heavy seas by extending stabilizing fins, which provide more inertia based on their resistance.

One system also includes the Ex areas

Tanks, pipelines, pumps, valve fittings: the flow management components from BESI penetrate cargo and commercial ships like a main artery running from stem to stern. Due to this fine-grained distribution, subsystems may also be installed in areas which fall under explosion protection, so BESI must use intrinsically safe components with Ex-i approvals in their automation.

"Areas are classified depending on what is in the vicinity of the wiring installation, for example, fuel tanks," explains Borchers. Within the I/O-SYSTEM 750, WAGO offers a special variant that is visually distinguished from standard modules thanks to its blue housing. And while these blue Ex-i modules are designed for use in potentially explosive areas, their functionality matches that of the standard modules. This

An Open Path for Networking

Using a combination of WAGO PFC200 Controllers and the I/O-SYSTEM 750, BESI installs an open network structure with distributed intelligence and decentralized I/O nodes in ships. This architecture provides a path for integrating other systems. Integration has already begun: the ventilation and air-conditioning systems have been linked to WAGO's control technology, which then functions as a data collector and ETHERNET gateway to bundle the information and forward it to the control level of the ship via ETHERNET. This means that the necessary control cabinets can be designed to be smaller and more flexible.

means that there is no difference in their programming.
"We can program the control technology in both the Ex and Non-Ex areas with the software environment that we prefer, without having to establish complex links between different systems," according to Borchers.
This means that BESI's engineers do not have to set up secondary or tertiary systems, and can consistently program all modules in one pass – and they can use the standardized languages from IEC 61131-3 (CODESYS) to do it. The advantage of this consistency for BESI is that the software engineers do not have to consider whether components of the heeling system are installed in a hazardous or non-hazardous area.

Visualization of the heeling system which allow ships to be optimally trimmed in the water.

Borchers emphasizes that, "We can use one system to operate in both areas, and that system is identical in function and programming, which makes our lives significantly easier." This is in addition to the fact that the WAGO components that are important for BESI have relevant international approvals for maritime use.

Extra space by omitting Zener barriers

The consistency of the WAGO I/O-SYSTEM 750 also saves time during wiring. Because the intrinsically safe sensors, like level gauges, or the actuators, such as valve relays, can connect directly from hazardous regions to the blue I/O modules, isolation amplifiers – which would otherwise be required – can be omitted. Isolation amplifiers are used in hazardous areas to limit the energy in the electrical circuit, essentially preventing ignition of the explosive atmosphere. Since BESI can omit the Zener barriers, there are not only fewer components in the switch cabinets, they also require less of the valuable onboard space.
The Chief Technical Officer contrasts WAGO automation to a less elegant solution, "If we were to connect, for example, 50 devices from the Ex area to the I/O level, then I would need almost one entire control cabinet just for the isolation amplifiers." Sufficient space is, however, never available – even in new construction – at least for technical equipment. Borchers understands that, even though the level of automation is increasing, space is only grudgingly provided for it. Ultimately, ship designs are optimized to devote as much free space as possible for cargo. "That is why compact automation systems with high degrees of integration are so important."

An ultra-large FPSO sailed off DSME's shipyard

Ichthys FPSO (Floating Production, Storage & Offloading), built by Daewoo Shipbuilding & Marine Engineering (DSME), sailed off on July 20 after delay in delivery.

DSME delivered 2 vessels this month which included a drillship ordered by U.S.-based Transocean in 2012 and an ultra-large FPSO worth USD 2 billion ordered by Japan-based Inpex, signifying a turnaround in its order intake this year. With resumption of offshore plant projects which have been put on hold amid sustained low oil prices, there has been a heightening expectation for a recovery in new orders for offshore plants.

This Ichthys FPSO, built by DSME, successfully completed construction process after 5 years of twists and turns and departed from Okpo shipyard on July 20. As a result, DSME has delivered 4 offshore plants thus far, such as jack-up rig, FPSO, drillship, and CPF (Central Processing Facility), and will complete delivery of offshore plants on schedule this year when it hands a drillship over to a client in October. The production schedule is expected to proceed smoothly.

The Ichthys project in Australia, valued USD 34 billion in all, is led by Japan-based Inpex and France-based Total to develop gas fields and build LNG production/processing facilities in Australia. In 2012, DSME and SHI (Samsung Heavy Industries) were awarded contracts for FPSO and CPF, respectively.

The Ichthys FPSO, delivered recently, measures 336m in length and 59m in width with a weight of approximately 150,000 tons and can store up to 1.2 million barrels of. Furthermore, it can produce up to 80,000 barrels of condensate and 2.6 million cubic meters of natural gas per day.

Ichthys FPSO, built by DSME, sailed off for installation in Ichthys oil field off the coast of Australia.

Including the Ichthys FPSO delivered recently, DSME has successfully built 9 units of FPSO and LNG-FPSO thus far, proving its unmatched technology and competitiveness in global market for offshore plants.

An official from DSME said, "Usually, offshore plant projects involve residual works for installation at local sites even after departure from the port. By contrast, this project completed almost all processes at shipyard, eliminating the need to perform remaining works locally. Our performance is expected to be positively impacted by smooth progress in delivery of offshore plants on schedule without disruption, elimination of risk of delay penalty, a factor of instability, and successful completion of various negotiations on additional constructions."

Ichthys FPSO, which sailed off Okpo shipyard, will arrive at the Ichthys oil field in Browse Basin located 200km north-west of Australia in mid August. After installation and commissioning at the sea, Ichthys FPSO will be deployed for oil and natural gas production in full scale by the end of this year.

SHI built the world's largest FLNG

Prelude FLNG of Shell completed construction and successfully departed from Geoje shipyard on June 29.

Samsung Heavy Industries (SHI) successfully completed the world's largest floating LNG production facility. SHI announced that the Prelude FLNG, the world's largest floating liquefied natural gas (LNG) facility of Royal Dutch Shell, successfully completed construction at Geoje shipyard and departed from the port. SHI won the contract from Royal Dutch Shell for Prelude FLNG in June 2011 through consortium formed with France-based Technip and has proceeded with construction at its Geoje shipyard over the last 5 years since the steel-cutting ceremony in October 2012.

Prelude FLNG, which left Geoje shipyard, will be carried by a tugboat for about a month and moored at the sea adjacent to Prelude Gas Field located approximately 475km north-west of Broome, Australia and then connected with subsea system. Here, Prelude FLNG will produce 3.6 million tons of LNG, 1.3 million tons of natural gas condensate, and 400,000 tons of LPG per year for the next 25 years. Prelude FLNG is the world's largest floating facility measuring 488m in length and 74m in width. It has the size of 4 soccer stadiums arranged in series and a storage tank capacity of 455,000m^3 equal to the capacity of 175 Olympic swimming pools. This storage tank can store LNG equivalent to 3-day domestic consumption. The steel used in this facility weighs 260,000 tons. When storage tank is fully filled, the weight is equal to 600,000 tons which is equivalent to the weight of 6 aircraft carriers.

FLNG is an innovative floating liquefied natural gas (LNG) production facility enabling the LNG to be produced, liquefied, stored and transferred at sea without need for transportation of natural gas to onshore location for liquefaction. Moreover, FLNG can minimize environmental impact by eliminating the need to install additional gas pipelines and enables development of various gas resources ranging from long-distance cluster gas field to large-scale gas field which were previously constrained by production costs.

Park Dae-Young, President of SHI, said, "The successful departure of Prelude FLNG will be an important milestone for Korean shipbuilding and offshore plant industries. With the prospects for an upswing in order placement for LNG-related vessels and offshore plants amid a surge in the demand for LNG, we expect that the success of this project will serve as a springboard for Korean shipbuilding and offshore plant industries, including SHI, to make another giant leap forward."

Paul D'Arcy, President of Shell Korea, said, "Prelude, the first FLNG of Shell, is a meaningful project for global gas industry, as well as Shell. I am delighted that Prelude successfully completed construction in Korea and departed from the port." He went on saying, "Prelude is a symbolic project proving that Shell and Korean companies can grow together. I hope that the FLNG construction experience and safety awareness from this project will serve as a basis for stronger industrial competitiveness."

WinGD X52 diesel FAT and TAT trigger delivery of large order book

Following an extensive test programme in the presence of eight classification societies, the latest development in Winterthur Gas & Diesel's Generation X low-speed diesel engine range, the X52, successfully completed both its Factory Acceptance Test (FAT) and Type Approval Test (TAT).

The newly certified engine is the five-cylinder version of the 52 cm bore X52 diesel from Winterthur Gas & Diesel (WinGD), and completion of the important TAT and FAT signals that the X52 is ready for commercial applications. Testing took place at the Shanghai engine works of WinGD licensee Hudong Heavy Machinery Co., Ltd. (HHM), part of shipping and shipbuilding conglomerate China State Shipbuilding Corporation (CSSC).

The certification processes were carried out on a five-cylinder X52 engine with a contracted output of 6408 kW at 99 rpm and IMO Tier II emissions compliance. With the tests completed, the 5X52 will now be delivered to power a 38,000 DWT bulk carrier under construction at the Guangzhou Wenchong Shipyard (GWS) in Guangzhou, China. GWS is also part of CSSC and the vessel will join the CSSC fleet on completion.

The conclusion of the X52's FAT and TAT is especially significant since this new engine type has already won a considerable advance order book. "The X52 has proven very popular as it is an intelligent engine; its FAT and TAT have been eagerly awaited by both shipyards and their customers," said Alexander Brückl, Senior Project Manager WinGD. "This very rapid market acceptance is based on the reliability and performance

The WinGD 5-X52 diesel undergoing its FAT and TAT at the works of Hudong Heavy Machinery in Shanghai. Testing was witnessed by representatives of the leading Classification Societies: ABS, LR, CCS, BV, DNV-GL, KRS, NK and RINA.

the Generation X diesel and dual-fuel engines have exhibited in service to date. This is also reflected in the fact that we have had the confidence to perform the TAT on the very first engine rather than a later engine, as the Classification Societies allow."

Including the test engine, a total of 14 engines are already on order. Brückl stresses that the major benefits ship owners wish to leverage are the low specific fuel consumption and reduced service costs of the Generation X diesel engines.

The reduced fuel consumption results primarily from the longer stroke configuration of WinGD's Generation X engines, but they also have a relatively light structure and are designed to have low maintenance costs.

"The long stroke design enables higher torques at lower engine speeds compared with earlier WinGD engines. Due to a larger diameter, more efficient propellers can be employed. At the same time, however, our designers were very aware that an engine's stroke dimension has direct effect on engine height which, in turn, has a considerable influence on engine room size and the effective payload of a vessel. We chose a larger bore diameter and, as sales figures have shown, the bore-to-stroke ratio selected by WinGD is proving to be very popular,"

added Brückl.

The X-prefix engines can also be offered with dual ratings which can be accessed via a minimum of modifications to engine and turbocharger components, enabling ship operators to readily employ a fuel-saving slow steaming mode, according to market and contract conditions.

Interestingly, the 38,000 DWT bulk carrier being built at GWS and to be powered by the 5X52 on which FAT and TAT certificates were attained can be qualified as an "intelligent vessel". Anticipating the need for greater system integration, owner CSSC has specified several advanced digital features designed to facilitate maximised vessel efficiency as well as extensive remote monitoring and control of on-board systems for their intelligent vessel.

Of the thirteen engines still on order, all will be six-cylinder 6X52s to be built in Korea. They include both IMO Tier II and Tier III emission compliance, with the Tier III engines featuring both low and high-pressure SCR. Eight of the engines include six 6X52 engine rated 7180 kW at 86.9 rpm and employing high-pressure SCR to achieve IMO Tier III compliance. The Tier III engines will power a series of six 49,000 DWT petroleum products tankers. The other two engines with the same rated output are Tier II compliant and will be installed in two 50,000 DWT product tankers.

Finally, five 6X52s rated 8200 kW at 80 rpm will power a series of five 60,000 DWT open hatch general cargo vessels. These X52 engines will be Tier III compliant thanks to the use of a low-pressure SCR system.

The WinGD 5-X52 diesel undergoing its FAT and TAT at the works of Hudong Heavy Machinery in Shanghai.

Inmarsat's Fleet Xpress honoured in Digital Technology Award win

The Fleet Xpress service from Inmarsat has secured the prestigious Seatrade Award 2017 for Digital Technology, one of the maritime industry's leading honours, which recognises technical innovation.

Inmarsat Maritime Senior Vice President Market Strategy, Drew Brandy, accepted the Award on June 30th. He said "This is a reward for our entire Inmarsat team, recognising the extraordinary work behind the development, launch and delivery to market of Fleet Xpress. Setting a new standard in maritime communications, Fleet Xpress constitutes shipping's real-world digital revolution, bringing unrivalled vessel efficiency and communication benefits to crew, and reinforcing our firm commitment to the future of connectivity at sea. With more than 10,000 ships now committed to Fleet Xpress, this award underpins the success of the service."

Fleet Xpress is the first and only globally-available, high-speed satellite network owned and managed by a single operator. It is the truly innovative service platform that is delivering the benefits of continuous connectivity, big data and 'digital disruption' to shipping.

Fleet Xpress combines Inmarsat's latest Ka-band satellite constellation - Global Xpress - and the proven reliability of Inmarsat's FleetBroadband L-band service providing unlimited back-up for continuous connectivity. This ensures ship owners seamless global mobility, guaranteed performance and controlled costs, within fully-managed support agreements. It is enriched by Inmarsat Gateway, shipping's first service enablement platform that is purpose-designed to bring access to a new generation of value-added applications, services and solutions.

The Inmarsat Gateway opens the way for software developers to offer content-rich applications that drive smarter shipping, perform real-time analysis of data including equipment and fuel consumption monitoring, enable weather forecasting and voyage planning, and bring crew safety/coms gains. The first app to be made available through Fleet Xpress will be Inmarsat's managed Unified Threat Management cyber security solution, developed to bring protection and peace of mind to owners and operators alike.

HHI launches the engine licensing business

Hyundai Heavy Industries (HHI) teams up with Saudi Aramco and Dussur to Set up JV for Marine and Onshore Power Generation Engine Business.

HHI, announced it signed a memorandum of understanding (MOU) with Saudi Aramco and Dussur (Saudi Arabian Industrial Investments Company) to set up a joint venture for marine engine and onshore power generation engine businesses on July 4.

Under the MOU, the joint venture will invest $ 400 million by 2019 to build an engine factory capable of producing about 200 engines per year upon completion at the King Salman Global Maritime Industries Complex at Ras Al-Khair, Saudi Arabia.

From the joint venture business, HHI expects a wide range of revenues in the form of royalty, engine part sales and technical support services. By signing the MOU, HHI begins its first licensing businesses of the proprietary HiMSEN engines. HiMSEN engines are medium speed 4-stroke diesel engines developed in 2000 with 10 years of R&D investment. The eco-friendly HiMSEN engines installed in containerized packaged power plants and diesel power plants have been exported to about 40 countries in Latin America, the Middle East, and Africa. HiMSEN engines are the world's most selling medium speed engines with 22% of global medium speed marine engine markets.

An HHI official said, "The technology of building quality marine engines is crucial in shipbuilding, power generation and other industrial sectors. As we embarked on our HiMSEN engine's first licensing business with the establishment of the joint venture, we will accelerate our efforts to expand the business further as our new growth engine."

(from left) Rasheed Al-Shubaili, CEO of Dussur; Ziad Murshed, Executive Director of New Business Development of Saudi Aramco; and Chang Ki-don, COO of HHI's Engine & Machinery Division

Furthermore on the basis of the JV, HHI plans to advance into the Middle East's engine power plant market that is projected to grow worth $1.54 billion by 2026.

HHI plans to strengthen cooperation with Aramco and tap into its extensive network in the Middle East region and expand its reach into the Middle East market in various fields including production, sales, and after-sales service of HiMSEN engines.

Meanwhile, HHI signed a MOU with Saudi Aramco for strategic cooperation in November 2015 to promote joint ventures in the fields of shipbuilding, engines plants, etc. Moreover, HHI established a shipbuilding joint venture in Saudi Arabia with Aramco, Saudi's state-run shipping company Bahri, etc., last May.

The shipyard under the joint venture will be built on a land covering an area of about 1.5 million pyong in Ras Al-Khair near the Jubail Industrial City on the Kingdom's east coast by 2021 for repair of vessels, as well as construction of ordinary commercial vessels and offshore plants.

ABS Approves New MOSS-type LNG Tank Concept

ABS issues Approval in Principle for KHI's non-spherical shaped MOSS-type LNG tank.

ABS, granted Approval in Principle (AIP) for a new MOSS-type LNG tank design concept developed by Japan's Kawasaki Heavy Industries (KHI).

"We are pleased to issue this AIP that further demonstrates our commitment to technology advancements and safety," said ABS Vice President for Global Gas Solutions Patrick Janssens. "KHI's concept applies the latest technologies, introducing new efficiencies and innovations that promote a safer and more sustainable shipping industry."

Designated as an IMO Type B independent tank, this concept takes a new approach by applying a non-spherical tank design to increase the use of space on board an LNG carrier. According to KHI, the non-spherical design concept allows Panamax-size LNG carriers to expand their total carrying capacity to 180,000m^3, a 25,000m^3 volume increase when compared to using spherical tanks. In issuing its AIP, ABS reviewed the strength and fatigue analysis to support KHI in demonstrating the feasibility of the new concept.

"As the Panama Canal expands and LNG demand increases, owners and operators are looking to gain efficiencies without compromising safety," said KHI Ship & Offshore Company General Manager for the Engineering Division Hideaki Naoi.

This concept takes a new approach by applying a non-spherical tank design to increase the use of space on board an LNG carrier.

"This new concept adds 15% more carrying capacity while maintaining the size of the new Panamax tankers. By working with a proven technology leader like ABS, we were able to prove the feasibility of this innovative design."

Recognizing the changing landscape and increased industry focus on gas, ABS launched its Global Gas Solutions team in 2013 to support industry in developing gas-related projects. The ABS Global Gas Solutions team provides industry leadership, offering guidance in liquefied natural gas (LNG) floating structures and systems, gas fuel systems and equipment, gas carriers, and regulatory and statutory requirements. ABS has extensive experience with the full scope of gas-related assets and is the classification society of choice for some of the most advanced gas carriers in service.

DSME's technological prowess recognized globally

Daewoo Shipbuilding & Marine Engineering (DSME) has gained high recognition for its excellence of technology in LNG carrier sector and received royalty from MAN Diesel & Turbo.

DSME provided MAN Diesel, the world's leading marine engine maker, with the technology required to convert existing LNG carrier diesel engines to natural gas-powered engines. Diesel & Turbo has recently modified the engine of 260,000m^3 ultra-large LNG carrier owned by Qatar Gas Transport, the state-run shipping company of Qatar, into natural gas-powered engine. In that process, the royalty was paid for the unavoidable use of high-pressure natural gas fuel supply system (FGSS), the patented technology of DSME.

FGSS is a core technology of the next-generation natural gas-powered vessels, supplying the highly-pressurized natural gas to the engine. In particular, the FGSS technology of DSME is indispensable for application of ME-GI engine, the natural gas fuel propulsion engine of MAN Diesel & Turbo.

Qatar Gas Transport placed orders at the 3 major domestic shipyards for 53 LNG carriers, including 210,000m^3 class LNG carrier and 45 units of 260,000m^3 class ultra-large LNG carriers, to export to the United States the natural gas produced in Qatar in the mid 2000s. At that time, DSME won orders for 26 LNG carriers which were nearly half of all units ordered.

All ultra-large LNG carriers built then were outfitted with diesel engines operating on bunker-C oil as main fuel. However, those diesel engines were recently converted to ME-GI engines to meet ever more stringent international environmental regulations. ME-GI engine has the advantage of reducing emissions of pollutants, such as carbon dioxide, nitrogen compounds, and sulfur compounds, by over 30%, compared to conventional diesel engines. LNG carriers are expected to be remodeled constantly into natural gas-powered vessels in the period ahead.

FGSS developed independently by DSME

DSME embarked upon development of this technology in 2008 and has successfully applied it since 2013. Particularly, DSME established the industry's first Energy System Experiment Center with an investment of about KRW 200 billion in 2005 in a bid to further strengthen its technological prowess in LNG segment and secure competitive advantage in the market for next-generation high-efficiency and eco-friendly LNG carriers.

An official from DSME said, "The acquisition of this royalty proves that FGSS of DSME is a key technology in the field of LNG carrier remodeling. Recently, a domestic equipment maker also received an order for concerned offshore facilities from overseas client and made a request to DSME for royalty authorization. This shows that a bridgehead has been secured for domestic marine equipment manufacturers to make inroads into this new LNG carrier remodeling segment."

In 2015, DSME provided its patented FGSS technology to domestic marine equipment manufacturers free of charge.

Rolls-Royce, DNV GL, NTNU, and SINTEF Ocean to establish simulation platform for creating future ships

Rolls-Royce, Norwegian University of Technology Science (NTNU), research organisation SINTEF Ocean, and classification society DNV GL have signed a MOU with the aim of creating an open source digital platform for use in the development of new ships.

The platform would allow the creation of so called "digital twins". A digital twin is a digital copy of a real ship, including its systems, that synthesizes the information available about the ship in a digital world. This allows any aspect of an asset to be explored through a digital interface, creating a virtual test bench to assess the safety and performance of a vessel and its systems, both before its construction and through its lifecycle.

Asbjørn Skaro, Director Digital & Systems, Rolls-Royce – Marine said "The platform will enable us to build digital twins of real ships, which in turn will form the basis for novel ways of designing, constructing, verifying and operating new maritime concepts and technology."

Remi Eriksen, Group President and CEO, DNV GL said "We are entering a new era with the accelerated uptake of more IT-technology in shipping. Digitalization of information flows will have a positive impact on safety and environmental performance. By creating ships and ship technology in a virtual environment new ideas and technology can be realized and tested in a shorter time frame. A platform like this could form the basis for future class services."

Hans Petter Hildre, Professor and Chairman, NTNU said "A simulation-based way of working lets us easily test multiple concepts before a final solution is selected. In addition, re-using digital models along the entire value chain will contribute to reducing costs."

Henning Borgen, President, SINTEF Ocean said "This is a very concrete example of how digitalization can contribute in making our most important ocean space industries more efficient. I believe we have the knowledge and data needed to contribute to this industrial revolution and look forward to be part of this."

(back left) Asbjørn Skaro, Director Digital & Systems, (right) Rolls-Royce, Remi Eriksen, Group President and CEO - DNV GL. (Front left) Hans Petter Hildre, Professor and Chairman, (right) NTNU, Henning Borgen, President - Sintef Ocean Ålesund.

The project partners intend to open the platform for use by other parties, with some core aspects built on an open source framework - enabling designers, equipment and system manufacturers, yards, ship owners, operators, research institutes and academia to work together to co-create and innovate together.

The platform is also designed to serve as a model library for different ship concepts, where concepts can be made generally available or kept part of projects with limited access. Following the signing of the MoU, the project partners are now working to form a steering group that will define and govern the development of the core platform system and its deployment.

Baker Hughes & GE Oil & Gas Complete Combination

The world's first and only fullstream Oil and Gas company - uniquely positioned to drive productivity, lower costs and innovate globally for customers

Baker Hughes, a GE company announced on July 3 that the transaction combining GE's oil and gas business with Baker Hughes is complete. The new company is the first and only to bring together industry-leading equipment, services and digital solutions across the entire spectrum of oil and gas development.

BHGE (Baker Hughes GE) will help its customers acquire, transport and refine hydrocarbons more efficiently, productively and safely, with a smaller environmental footprint and at lower cost per barrel. BHGE is focused on:

• Providing a fullstream offering. No other company brings together capabilities across the full value chain of oil and gas activities - from upstream to midstream to downstream. This portfolio positions BHGE to create new sources of value, improving productivity and project economics through integrated equipment and service offerings.

• Combining physical and digital to increase reliability and uptime. Applying digital and advanced technologies to oil and gas could bring approximately five percent productivity improvements across the entire industry. BHGE will use cloud-based software, advanced manufacturing and brilliant factory solutions to help its customers capture some of this opportunity - reducing risk and improving productivity in their operations as well as its own.

• Creating new ways to win. BHGE's leading technology and access to the "GE Store" of knowledge, experience and research mean that it can bring new solutions to market faster.

• Building on heritage to create a world-class culture. BHGE brings together over 125 years of experienced talent in the industry with a mindset of continuous improvement to serve customers in over 120 countries.

Lorenzo Simonelli, president and CEO of Baker Hughes, a GE company said, "Disruptive change is the oil and gas industry's new normal. We created BHGE because oil and gas customers need to withstand volatility, work smarter and bring energy to more people. Our offering is further differentiated from any other in the industry across the value stream and enables and assists our customers in driving productivity, while minimizing costs and risks."

Simonelli continued, "BHGE has proven technologies and experience with the spirit of a startup, and our leadership team looks forward to quickly demonstrating the strengths of the new company. Our focus is on integrating our businesses quickly and seamlessly so we can drive long-term value for all of our stakeholders."

Jeffrey Immelt, chairman and CEO of GE, said, "BHGE can help our customers be more productive in any cycle, especially today's. It's a smart deal for our combined customers, shareholders and employees. Lorenzo and his team are world-class leaders and will focus on accelerating the Company's capability to extend the digital framework in ways oil and gas customers have never seen before. The completion of the transaction marks a new era in the industry, and I am extremely proud of our team's focus, dedication and diligence, which resulted in the completion of this combination in just eight months."

베이커 휴즈와 GE 오일&가스 통합

전세계 최초 풀스트림 석유 가스 회사로 재탄생 – 생산성 향상과 비용 절감 통해 고객사의 글로벌 혁신 제고에 기여할 것으로 기대된다.

베이커휴즈GE는 GE 오일&가스 사업부와 베이커 휴즈(Baker Hughes)의 통합을 완료했다고 지난 7월 3일 밝혔다. 새롭게 출범하는 베이커휴즈GE는 석유와 가스 개발의 전 영역에 걸친(풀스트림) 최첨단 설비, 서비스 및 디지털 솔루션을 보유한 전 세계 최초이자 유일한 기업이 됐다.

베이커휴즈GE는 고객사들이 석유와 천연가스로 대표되는 탄화수소를 더 효율적이고 안전하게 시추, 운송 및 정제 할 수 있도록 돕는다. 이 과정에서 유해물질 배출을 감소하고, 배럴당 비용도 절감할 계획이다.

•풀스트림에 걸친 통합적 서비스 제공: 업스트림부터 미드스트림, 다운스트림에 이르기까지 석유 및 가스의 생산부터 소비에 이르는 밸류체인 전 과정에 통합된 설비와 서비스를 제공해 생산성과 경제성을 향상시킨다.

•산업과 디지털의 결합으로 운영 신뢰도 및 가동시간 증대: 석유 및 가스 산업과 최첨단 디지털 기술의 결합은 산업 전반에서 약 5 %의 생산성을 향상시키는 효과를 가져온다. 베이커휴즈GE는 클라우드 기반의 소프트웨어, 첨단 제조, 브릴리언트 팩토리 솔루션을 통해 고객사들이 리스크를 줄이고, 생산성을 제고할 수 있도록 지원할 예정이다.

•새로운 비즈니스 가치 창출: 베이커휴즈GE의 첨단 기술과 GE의 전사적 지식, 경험, 연구를 공유하는 'GE 스토어'를 활용해 새로운 솔루션을 개발하고 시장에 더 빠르게 내놓을 수 있다. 또한, 장기적 로컬 파트너십, 차별화된 비즈니스 모델, 금융 지원 등을 통해 산업 내 경쟁 우위를 더욱 공고히 할 방침이다.

•세계적 수준의 문화 재정립: 베이커휴즈GE는 125년 이상의 산업 경험을 바탕으로, 120여 개국에 걸친 고객사들이 지속적으로 발전할 수 있도록 서비스를 제공하게 된다.

베이커휴즈GE의 로렌조 시모넬리(Lorenzo Simonelli) 사장은 "파괴적 변화(disruptive change)는 석유 및 가스 산업에 뉴 노말로 자리잡았다. 이번 통합은 고객들이 급격한 변화에 적응함과 동시에 더 많은 사람들에게 에너지를 공급해야 하기 때문에 추진됐다. 베이커휴즈GE의 차별화된 서비스를 통해 고객들이 풀스트림 전반에서 비용과 리스크는 최소화하면서 생산성은 높일 수 있을 것"이라고 밝혔다.

시모넬리 사장은 "베이커휴즈GE는 스타트업 정신을 바탕으로, 뛰어난 기술력과 산업 내 풍부한 경험 또한 보유하고 있다. 새로운 회사로서의 경쟁력을 시장에 빨리 입증할 수 있을 것으로 기대하고 있다"며, "보다 신속하고 완벽한 통합을 통해 이해관계자들을 위한 장기적인 가치 제고에 집중할 것"이라고 덧붙였다.

제프 이멜트(Jeff Immelt) GE 회장은 "베이커휴즈GE는 오늘날 고객들이 어떠한 경제환경에서도 비즈니스 생산성을 향상할 수 있도록 도울 것이다. 이번 합병은 양사의 고객 및 주주, 임직원들에게도 모두 긍정적으로 작용할 것"이라며, "CEO인 로렌조 사장과 그의 팀의 유능한 리더십을 바탕으로, 석유와 가스 산업을 위한 디지털 역량을 전례 없는 수준으로 높일 것이다. 이번 통합은 석유 및 가스 산업의 새로운 시대를 열었으며, 8개월 만에 이러한 일을 성공적으로 이끈 팀의 역할과 헌신, 성실함을 매우 자랑스럽게 생각한다"고 말했다.

초대형 FPSO 대우조선해양을 떠나다

대우조선해양이 지난 7월 20일 그간 공정지연으로 인도가 미뤄졌던 익시스(Ichthys) FPSO(Floating Production, Storage & Offloading Unit하 FPSO)를 출항시키다.

대우조선해양은 이달 들어 지난 2012년 미국 트랜스오션(Transocean)으로부터 수주한 드릴십 1척과 일본 인펙스(Inpex)로부터 수주한 약 20억 달러 규모의 초대형 FPSO 1기를 인도하며, 올해 실적 개선에 청신호가 켜졌다. 더욱이 기존 저유가로 인해 중단됐던 해양플랜트 프로젝트가 재개되면서 그 동안 주춤했던 해양플랜트 발주가 회복세에 들어설 것이라는 기대감마저 높아지고 있다.

대우조선해양이 건조한 '익시스(Ichthys) FPSO'는 지난 7월 20일 5년간의 우여곡절 끝에 건조공정을 성공적으로 마치고 옥포조선소를 떠났다. 이로써 현재까지 잭업리그, FPSO, 드릴십, 고정식 원유생산설비 등 총 4기의 해양플랜트를 성공적으로 인도했으며, 오는 10월 드릴십 1척을 정상적으로 인도하면 올해 해양플랜트 인도를 마무리하게 된다. 향후 생산일정도 원활하게 진행될 것으로 기대된다.

호주 익시스 프로젝트는 일본 인펙스와 프랑스 토탈이 호주 가스전 개발 및 LNG 생산·처리시설을 건설하는 총 340억 달러 규모의 사업으로, 2012년 당시 대우조선해양과 삼성중공업이 각각 FPSO와 CPF를 수주했다.

이번에 인도된 익시스 FPSO는 길이 336m, 폭 59m, 무게는 약 15만톤에 달하며, 최대 120만 배럴의 콘덴세이트(Condensate)를 저장할 수 있다. 또 하루 최대 8만 배럴의 콘덴세이트와 260만㎥의 천연가스 생산이 가능하다.

대우조선해양이 건조한 익시스 FPSO가 호주 익시스 유전으로 출항했다.

대우조선해양은 지금까지 이번 익시스 FPSO를 포함해 총 9기의 FPSO 및 LNG-FPSO를 성공적으로 건조해, 세계 해양플랜트 시장에서 이 분야 최고의 기술력과 경쟁력을 다시 한번 입증했다.

대우조선해양 관계자는 "통상 해양플랜트의 경우 출항 후에도 현지 설치 작업시 미결된 잔여작업을 해야 되는 경우가 대부분이지만, 이번 프로젝트의 경우 거의 모든 작업을 조선소에서 마무리해 현지작업을 제로화 했다"며 "올해 계획된 해양플랜트들의 인도가 차질없이 진행되고 불안요소로 알려진 지체보상금 리스크가 해소되는 한편 각종 추가공사 협상도 성공적으로 마무리됨에 따라 당사 실적개선에 긍정적으로 작용할 것으로 보인다"고 말했다.

한편 옥포조선소를 떠난 익시스 FPSO는 오는 8월 중순 경 호주 북서부 200킬로미터 해역에 위치한 브라우즈 광구내 익시스 유전에 도착할 예정이며, 이후 현지 해상에서 설치작업 및 시운전과정을 거쳐 올연말 본격적인 원유 및 천연가스 채굴에 들어갈 계획이다.

삼성중공업, 세계 최대 FLNG 건조 성공

쉘의 프렐류드 FLNG가 건조를 마치고 지난 6월 29일 거제조선소에서 성공적으로 출항했다.

삼성중공업이 세계 최대 규모의 부유식 LNG 생산설비 건조에 성공했다. 삼성중공업은 로열더치쉘(Royal Dutch Shell)의 세계 최대 부유식 액화천연가스 설비인 프렐류드(Prelude) FLNG가 거제조선소에서의 건조를 모두 마치고 성공적으로 출항했다고 밝혔다.

삼성중공업은 프랑스 테크닙(Technip)과 컨소시엄을 구성해 지난 2011년 6월 쉘로부터 프렐류드 FLNG를 수주했으며, 2012년 10월 강재 절단 이후 약 5년간 거제조선소에서 건조 작업을 진행해 왔다.

프렐류드 FLNG는 거제조선소를 떠나 예인선에 의해 한달 가량 이동해, 호주 북서부 브룸(Broom)에서 약 475km 떨어진 프렐류드 가스전(Prelude Gas Field) 인근 해상에 계류(mooring), 해저시스템과 연결된다. 이곳에서 프렐류드 FLNG는 향후 약 25년 동안 연간 LNG 360만톤, 천연가스 콘덴세이트 130만톤 및 LPG 40만톤을 생산하게 된다.

프렐류드 FLNG는 길이 488m, 폭 74m로 세계 최대 규모의 부유식 설비이다. 이는 축구 경기장 4개를 직렬 배열한 크기와 같고, 저장탱크 용량 455,000㎥으로 올림픽 규격 수영장 175개에 해당하는 규모이다. 이 저장탱크에는 국내 3일치 소비량에 해당하는 LNG를 저장할 수 있다. 설비에 사용된 강재 중량만 26만톤이며, 저장탱크를 모두 채울 경우 중량이 60만톤에 달한다. 이는 항공모함 6척에 해당하는 무게이다.

FLNG는 혁신적인 부유식 액화천연가스(LNG) 생산 기술로, 해상에서 천연가스를 시추한 후 액화를 위해 육상으로 이동하지 않고 액화·저장·해상운송까지 할 수 있는 종합 설비이다. 가스 운송용 파이프라인을 추가 설치할 필요가 없어 환경 영향을 최소화할 수 있으며, 생산비용으로 제약이 따랐던 원거리의 군집형 가스전에서부터 대형 가스전까지 다양한 가스자원 개발이 가능하다.

삼성중공업 박대영 사장은 "프렐류드 FLNG의 성공적 출항은 한국 조선해양플랜트 산업사에 있어서 중요한 이정표가 될 것"이라며 "LNG 수요 증가로 다양한 LNG 관련 선박과 해양설비 발주가 늘어날 것으로 전망되는 만큼, 이번 프로젝트의 성공이 삼성중공업을 비롯한 한국 조선해양플랜트 산업이 재도약하는 발판이 될 것으로 기대한다"고 말했다.

쉘코리아 폴 다아시(Paul D'Arcy) 사장은 "쉘의 첫 FLNG인 프렐류드는 쉘 뿐만 아니라 글로벌 가스 산업에 있어 의미있는 프로젝트이다. 한국에서 성공적으로 건조를 마치고 출항할 수 있게 되어 기쁘게 생각한다"며 "프렐류드는 쉘과 한국 기업이 함께 성장할 수 있는 것을 보여 준 상징적인 프로젝트다. 이번 프로젝트를 통해 얻어진 FLNG 건조 경험과 안전 문화 정착이 산업 경쟁력 강화의 밑거름이 되길 바란다"고 말했다.

현대중공업, 엔진 라이선싱 사업 '출사표'

현대중공업은 사우디 아람코(Saudi Aramco), 두수르(Dussur)와 엔진 합작사 설립을 위한 MOU를 체결했다.

현대중공업은 사우디아라비아 국영 석유회사인 아람코, 산업투자공사인 두수르(Dussur)와 함께 선박 및 육상용 엔진 사업 합작에 관한 MOU를 체결했다고 지난 7월 4일 밝혔다. 사우디 다란(Dhahran) 소재 아람코 본사에서 열린 이 행사에는 장기돈 현대중공업 엔진사업 대표, 지아드 무르쉐드(Ziad Murshed) 아람코 신사업개발팀 총괄임원, 라시드 알 슈바일리(Rasheed Al-Shubaili) 두수르 CEO 등이 참석했다.

이번 MOU에 따라 설립되는 엔진 합작사는 2019년까지 총 4억 달러를 투자, 사우디 동부 라스 알헤어(Ras Al-Khair) 지역의 '킹 살만 조선산업단지(King Salman global maritime complex)'에 연산 200여대 규모의 엔진공장을 설립할 예정이다.

현대중공업은 엔진 합작사 설립을 통해 로열티, 기자재 판매, 기술지원 등을 통해 다양한 부가수익을 창출할 것으로 기대하고 있다. 특히 이번 MOU 체결은 현대중공업이 원천기술을 보유한 '힘센엔진'의 첫 라이선스 사업으로 세계시장에서 그 기술력을 입증 받았다는데 의미가 있다. 힘센엔진은 2000년 8월 현대중공업이 10년의 연구 끝에 국내 최초로 독자 개발한 중형 디젤엔진으로, 주로 선박 추진용이나 발전용으로 사용된다. 현재 중남미, 중동, 아시아 등 40여 개국에 수출되는 힘센엔진은 중형엔진 분야에서 세계시장 점유율 22%로 1위를 차지하고 있다.

현대중공업 관계자는 "엔진 기술은 조선, 발전 등 다양한 산업 분야에서 활용되는 핵심 기술 중 하나"라며, "앞으로 엔진 라이선싱 사업을 적극 확대해 미래성장동력으로 삼을 것"이라고 밝혔다.

(오른쪽부터) 장기돈 현대중공업 엔진사업 대표, 지아드 무르쉐드(Ziad Murshed) 아람코 신사업개발팀 총괄임원, 라시드 알 슈바일리(Rasheed Al-Shubaili) 두수르 CEO

또한 현대중공업은 이번 합작사를 거점으로 삼아 중동 엔진발전시장 개척에 적극 나선다는 계획이다. 글로벌 시장조사업체 테크사이리서치(TechSci Research)에 따르면, 사우디아라비아와 UAE를 중심으로 전력수요가 늘어나며 중동 엔진발전시장 규모는 2026년 1조 7,000억원(15.4억 달러)까지 확대될 것으로 전망된다.

현대중공업은 중동지역 내 강한 네트워크를 구축하고 있는 아람코와 협력을 강화, 향후 힘센엔진의 생산, 판매 및 A/S사업 등 다양한 분야에서 중동지역 시장 확대를 위해 노력한다는 계획이다.

한편, 현대중공업은 지난 2015년 11월 사우디 아람코와 조선, 엔진, 플랜트 등 분야에서 합작을 추진하는 전략적 협력 MOU를 체결했으며, 지난 5월 아람코, 사우디 국영 해운사인 바리(Bahri) 등과 함께 사우디 합작조선소를 설립했다. 사우디 합작조선소는 오는 2021년까지 사우디 동부 주베일항 인근 라스 알 헤어 지역에 일반상선과 해양플랜트 건조는 물론 선박수리까지 가능한 약 150만평 규모로 지어질 예정이다.

세계 무대에서 LNG 기술력 과시

대우조선해양이 LNG선 분야에서의 높은 기술력을 인정받으며, 만디젤&터보(MAN Diesel&Turbo)로부터 로열티를 받는 기염을 토했다.

대우조선해양은 세계적인 선박엔진 메이커인 만디젤로부터 기존 LNG선의 디젤엔진을 천연가스추진용으로 개조하는데 요구되는 기술을 제공했다.

최근 만디젤&터보는 카타르 국영선사인 카타르가스(Qatar Gas Transport Co.)가 보유하고 있는 260,000㎥급 초대형 LNG선의 엔진을 천연가스 연료로 사용할 수 있도록 개조했다. 이 과정에서 필연적으로 대우조선해양이 특허를 보유한 '고압천연가스 연료공급장치(FGSS)'를 사용하게 되었고 그 사용료를 지불한 것이다.

FGSS는 연료인 천연가스를 고압 처리한 뒤 엔진에 공급하는 장치로서 차세대 선박인 '천연가스연료 추진선박'의 핵심 기술이다. 특히 만디젤&터보의 천연가스연료 추진엔진인 ME-GI 엔진을 적용하려면 반드시 대우조선해양의 FGSS 기술을 사용해야만 한다.

카타르가스는 2000년대 중반 카타르에서 생산된 천연가스를 미국으로 수출하기 위해 210,000㎥급과 260,000㎥급 초대형 LNG선 45척을 포함해 총 53척의 LNG선을 국내 조선3사에 발주한 바 있다. 대우조선해양은 당시 절반에 가까운 26척의 LNG선을 수주했다.

당시에 건조된 초대형 LNG선에는 모두 벙커씨유를 주 연료로 하는 디젤엔진이 탑재됐다. 그러나 국제적인 환경규제가 강화되면서 이번 ME-GI 엔진으로 개조하게 된 것이다. ME-GI 엔진을 탑재하면 기존 디젤엔진에 비해 이산화탄소, 질소화합물, 황화합물 등 오염물질 배출량이 약 30% 이상 감소되는 장점이 있어, 향후 추가 선박 개조작업은 지속적으로 이뤄질 것으로 예상된다.

대우조선해양이 독자 개발한 고압천연가스 연료공급장치(FGSS)

대우조선해양은 2008년부터 해당 기술 개발에 착수했고, 2013년부터 실제 건조 선박에 적용하는 등 상용화에 성공했다. 특히 대우조선해양은 LNG 관련 기술력을 지속적으로 확보해 나가기 위해 지난 2015년 약 200억원을 투자해 업계 최초로 구축한 에너지시스템 실험센터를 통해 차세대 고효율·친환경 LNG선 시장에서 우위를 유지한다는 전략이다.

대우조선해양 관계자는 "이번 로열티 획득은 LNG선 개조 분야에서 대우조선해양의 FGSS가 핵심 기술임을 증명하는 것"이며, "최근 국내 한 기자재업체도 해외에서 해당 설비 수주에 성공해 대우조선해양에 로열티 승인을 요청하는 등 향후 국내 조선기자재업체가 LNG선 개조 분야라는 새로운 시장에 진출할 수 있는 교두보가 마련됐다"고 말했다.

대우조선해양은 FGSS 특허에 대해 국내 조선기자재업체에 지난 2015년 사용료를 내지 않아도 사용할 수 있도록 무상으로 이전한 바 있다.

Boil-Off Gas handling onboard LNG fuelled ships

Clean burning natural gas has emerged as an important fuel for ships as the marine industry seeks ways of complying with increasingly stringent environmental regulations. These restrictions limit emissions of sulphur oxides (SOx), nitrogen oxides (NOx) and particulates. The options for compliance are to employ after-treatment systems when using conventional marine fuels, or to use cleaner fuel having fewer harmful emissions, such as natural gas.

Wärtsilä Corporation

By Björn Nygård, Design Engineer, Engineering, Wärtsilä Marine Solutions

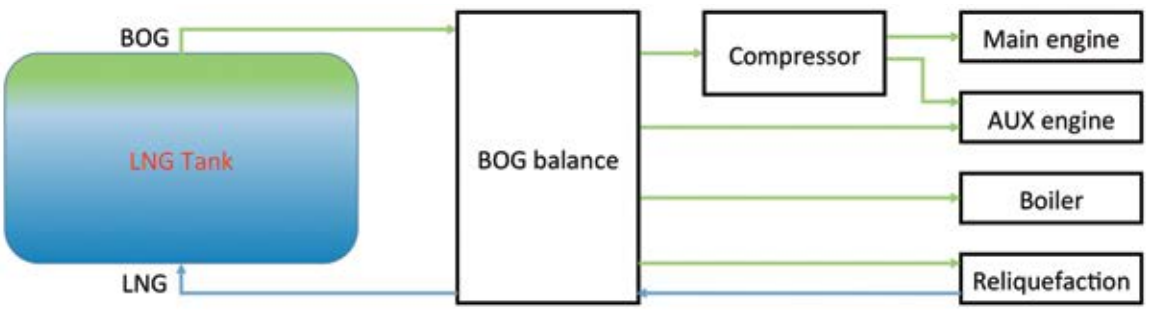


Figure 1. Simplified system layout for BOG handling, when using two-stroke main engines and four-stroke auxiliary engines. Ideally consumption should match BOR, resulting in a BOG balance of zero.

One drawback of natural gas is that it has very low energy density compared to traditional fuels. In order to serve as a convenient energy source, the density needs to be increased. This is done by cooling the gas to cryogenic temperatures, creating liquefied natural gas (LNG). The liquefied gas can be stored in insulated tanks, keeping it in a liquid state for longer periods. However, heat flux from the surroundings will increase the temperature inside the tank, thus causing the liquid to evaporate. The generated gas from this is known as boil-off gas (BOG).

The larger volume of gaseous natural gas created by this BOG will increase the tank pressure. To manage this, pressure vessels are utilised to contain the pressure. For longer storage periods, however, the pressure increases might be too high, which will require alternative solutions to handle the gas pressure.

Wärtsilä, a leading developer of gas and dual-fuel marine engine technologies, has extensively studied the handling of BOG onboard LNG fuelled ships. This article is based on these studies.

Pressure build-up

Pressure build-up depends on several parameters, including the ambient temperature and the amount of LNG in the tank. Another aspect to consider is stratification, which may cause a faster pressure rise. Stratification means that the LNG is divided into layers with the higher density liquid at the bottom and the lower density liquid on top. When the lower layer is heated, it cannot evaporate because of the cover. The densities of the layers are eventually equalised due to boil-off from the top layer and heat transfer. The warmer LNG from the bottom rises to the top and evaporates. This is called rollover and causes a rapid increase in the BOR (boil-off rate), which is difficult to predict.

Thermal stratification can be eliminated by agitating the tank, which occurs naturally on gas-fuelled ships due to the motion of the waves. Agitation of the tank may cause an opposite reaction when warm LNG is mixed with colder LNG, since the temperature at the surface will then decrease and condensate the BOG. The result is a collapse of pressure, which is followed by saturation at a lower pressure.

BOG handling requirements

There are various means of handling the pressure build-up in LNG tanks. One is to contain the pressure for the ambient temperature of the fuel. Other methods include reliquefaction, thermal oxidation, and pressure accumulation. The IGF code – the international safety code for ships using gases or other low flashpoint fuels – also accepts cooling of the fuel in a liquid state. For reliquefaction, a direct system, where the evaporated gas is compressed and condensed before being returned to the tank, is one solution. The other alternative is an indirect system, where the gas is condensed or cooled with an external refrigerant, without being compressed.

Apart from handling the maximal BOR in the tank, the selected method also needs to cope with zero or low BOR's. In the case of failure, the system must provide a redundant system

that can maintain the tank pressure. Venting gas to the atmosphere is not an alternative for pressure control, and is only allowed in emergency situations.

Reliquefaction

Liquefaction is the process where, using a refrigerant cycle, warm gas is cooled and condensed into a liquid. Reliquefaction indicates the process whereby evaporated LNG is cooled and reverted to a liquid state.

Several licensed refrigeration processes are available for the liquefaction of natural gas. These processes use one or more cycles in order to imitate the cooling curve of natural gas. A good match of the curve will give the process high efficiency and thus, low energy consumption. Conversely, a low temperature difference between the refrigerant and the gas will demand a larger heat exchange area. Refrigeration process design is about optimising the number of cycles, the refrigerant composition, and the heat exchange area. The result depends on whether simplicity, efficiency, a compact footprint, or low cost is the key boundary condition. Depending on which refrigeration cycle is used, liquefaction processes can be divided into three categories; cascade cycle, mixed refrigerant and expander cycle.

• Cascade cycle

The cascade process is defined by several cascaded refrigeration cycles, based on the reversed Rankine cycle, using pure two-phase refrigerants. The idea is to reduce entropy production by using several refrigeration cycles for each liquefaction stage. By evaporating the liquid refrigerants, a very high thermodynamic efficiency can be achieved. Conversely the process is complicated and requires a large number of components, meaning the size requirement is large and the capital cost is high. The high efficiency and high investment cost makes it suitable for large land based liquefaction plants.

• Mixed refrigerant

Mixed refrigerant liquefaction is also based on the Rankine cycle. However, contrary to cascade cycles, a blend of refrigerants is used to obtain a close following of the natural gas cooling curve. By mixing refrigerants a temperature glide can be attained, which means the temperature at phase change will not be constant.

This is because the components in the mixture evaporate at different temperatures, causing a change of concentration, which can be adapted to the process gas cooling curve. In

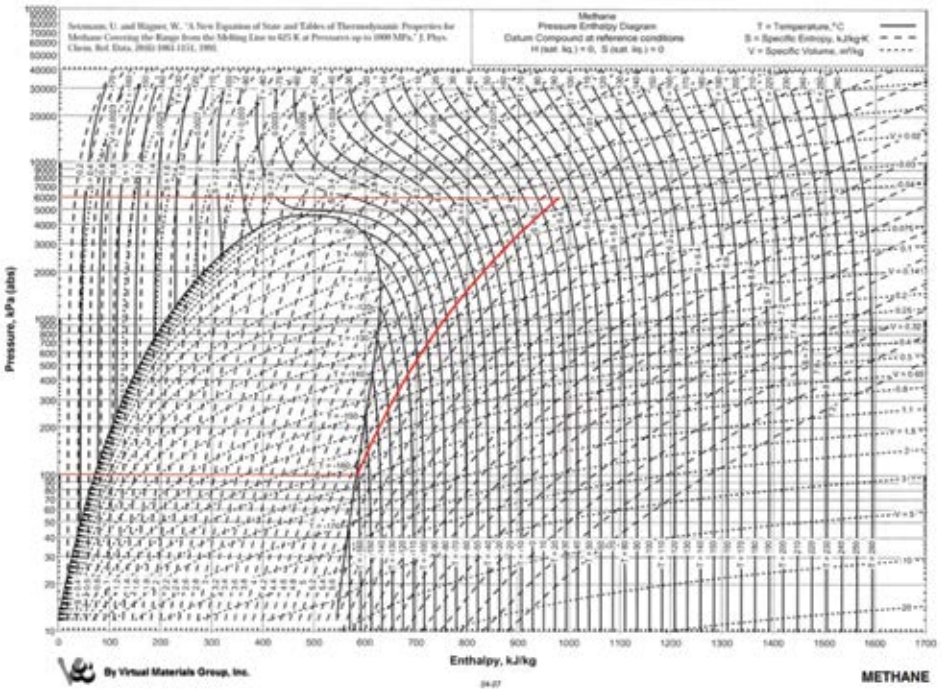


Figure 2. Illustration of an isochoric temperature increase of methane from -162°C at atmospheric pressure to 45°C (upper design temperature for worldwide service). The result is a pressure of around 60 bar.

reality, the mixed refrigerant will cause a curved temperature profile, which will lower the thermodynamic efficiency, compared to the cascade cycle. The mixed refrigerant process is suitable for small-scale liquefaction plants where the low equipment count and simplicity can be a substitute for high efficiency.

• Expander cycle

The expander cycle differs from the other liquefaction cycles by using an expander instead of a J-T valve. The expander is connected to the compressor, and extracts useful power from the compressed gas. The refrigerant used is a pure gas, and is only in gaseous phase, making it insensitive to motion.

This also eliminates issues relating to the distribution of liquid refrigerants in the heat exchangers, thereby allowing rapid start-up. A gaseous phase refrigerant, however, has a limited enthalpy difference, and requires a higher refrigerant flow than two-phase refrigerants, which limits the capacity. The process does not follow the cooling curve of the process gas very well, which results in lower efficiency than with other technologies. This, on the other hand, makes the process more forgiving to variations in the gas composition.

Most expander processes utilise the reversed Brayton cycle, either closed or open loop, to generate cooling. This is done either in a single or dual stage or with precooling. By using an open-loop expander cycle, a fraction of the process gas is utilised as a refrigerant. This eliminates the need for excess refrigerants.

The reversed Stirling cycle is another type of expander process used for liquefaction. The Stirling cycle is a modified Carnotcycle, where heat from the compression stage is utilised in the expansion stage, making it a regenerative cycle.

• Offshore reliquefaction

The selection of liquefaction technology for offshore applications differs from the onshore equivalents. Space on marine vessels is limited, which increases the need for a compact solution.

The use of hazardous hydrocarbons has to be limited for safety reasons. Small-scale offshore reliquefaction is, from a capacity perspective, quite similar to onshore peak-shaving plants. The expander cycle is a proven technology for these small-scale plants and is a viable choice for offshore reliquefaction.

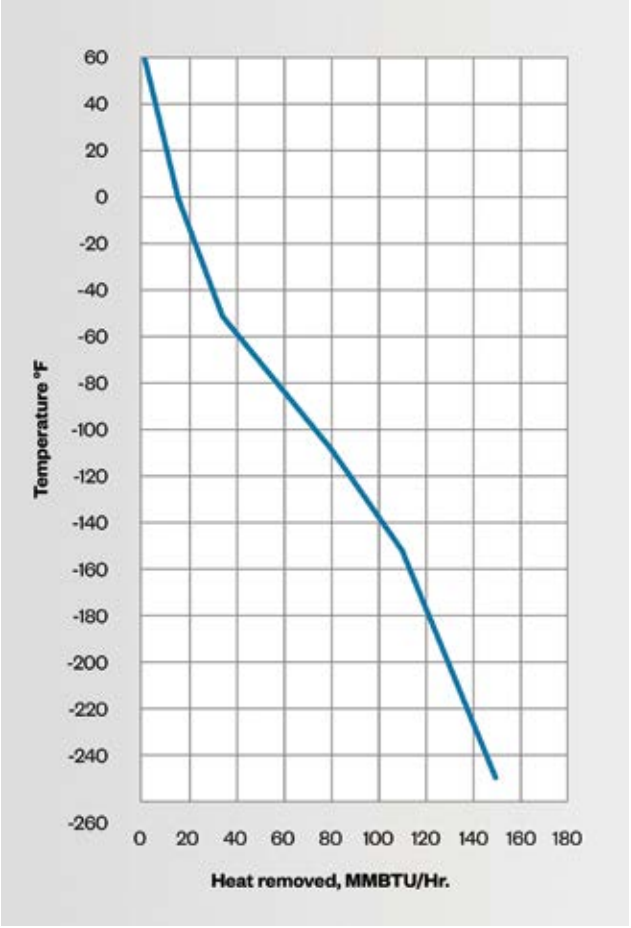


Figure 3. The three-stage cooling curve of natural gas (-161~15°C), with pre-cooling, liquefaction and sub-cooling.

Thermal oxidation

Another method for handling BOG is by thermal oxidation, i.e. combustion. This is primarily done by feeding the excess gas to the consumers, i.e. the ship's engines. Twoand four-stroke internal combustion engines are normally used for propulsion and power generation, while two-stroke engines usually have a high power output and are used for direct propulsion. Four-stroke engines can be used both as main and auxiliary engines, the latter being used while in port as well as when at sea.

Additionally, auxiliary boilers can be used to produce steam or hot water. If the amount of BOG does not correspond to the rate of consumption, the gas can be fed to a gas combustion unit (GCU). The GCU is a burner which combusts the BOG in a controlled manner without the risk of releasing unburned natural gas to the atmosphere. Although a possi-

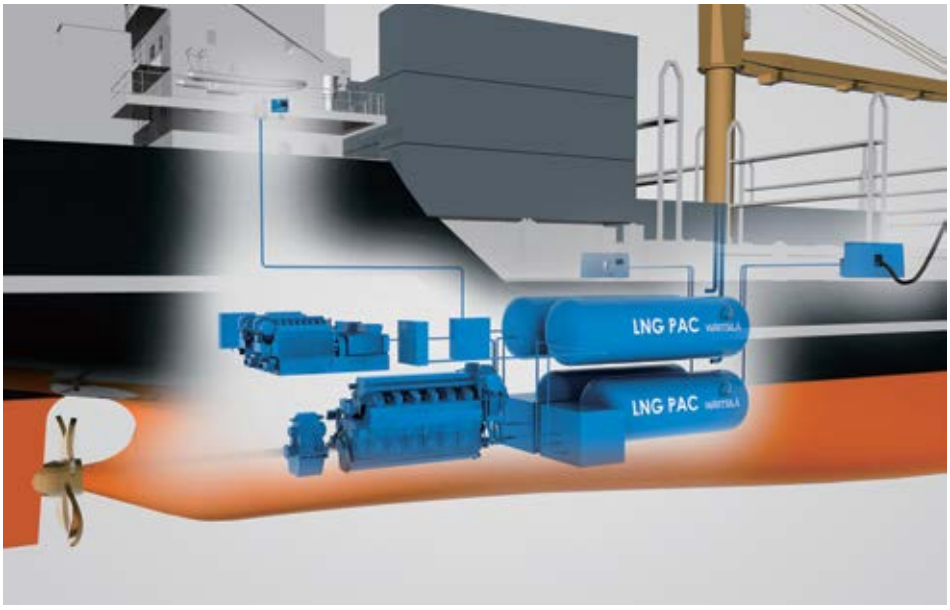


Figure 4. The Wärtsilä LNGPac system allows the safe and convenient utilisation of gas fuel.

ble solution for BOG handling, no useful energy can be recovered from a GCU, which is why it should primarily be recovered by other means.

Compression

Feeding gas to the engines is one way of handling BOG in the tanks. Four-stroke engines usually have a suitable fuel pressure need for type C tanks and can consume the gas at tank pressure. Two-stroke engines, however, demand a higher pressure. Therefore, in order to consume the BOG, the pressure must be increased to that required by the engines.

When choosing the compressor type, pressure ratio and gas flow are the most important aspects that need to be evaluated. For safety reasons when using LNG as feed gas, contamination from lubricants and the risk of gas leaks need to be considered. Either a piston or a rotary screw compressor should be used for gas flows below 1000 m3/h. Piston compressors have a compression ratio suitable for high pressure engines. Screw compressors, with their lower compression ratio, are suitable for low pressure engines.

In oil-free piston compressors, noncontact seals are usually used between the piston and cylinder. To minimise leakage, the contact surfaces are lined with sharp edges, called labyrinth seals. Rotary screw compressors can also be designed to operate without lubricants. These compressors are driven by synchronised gears, making small clearances possible without rotor contact.

Fuel sharing

In order to match BOG generation with engine consumption for a desired load, fuel sharing can be utilised. Dual-fuel engines are capable of running on both diesel and gas, which can be used to even out variations in gas supply or quality. With normal gas operation, around 1-5% of the pilot fuel is needed to ignite the gas. With fuel sharing, the amount of gas can be varied between around 15% and 85%, with the rest being diesel.

Summary

There are basically three suitable BOG handling methods which should be considered, namely boilers, auxiliary engines or reliquefaction units. Auxiliary engines are more suited to gas consumption than main engines. Additionally, the power generated is usually needed - even in port. Reliquefaction units using an expander cycle have rather low efficiency, which means they should be avoided for large BOR. For such cases, thermal oxidation in either a boiler or an auxiliary engine is a better solution.

By comparing the different BOG handling methods, it is clear that there is no universal solution that works for all systems. On the contrary the solution is rather sensitive to tank size and consumer types. This means that the BOG handling solution has to be evaluated on a case by case basis.

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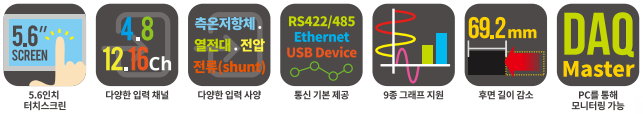
- 콤팩트 설계를 통한 설치 공간 절감 (후면 길이 : 69.2mm)



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Stay afloat using radar technology

The use of tank gauging technology to remotely monitor floating roofs increases safety at terminals.

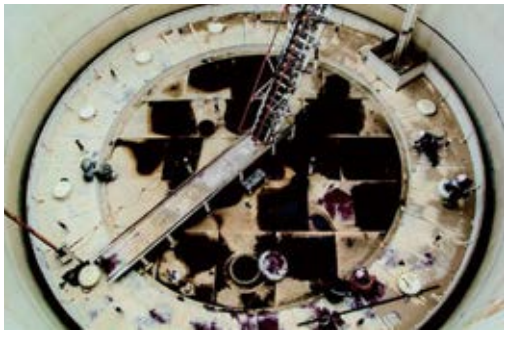
Emerson Automation Solutions

By Ulf Johannesson, Product marketing manager

More than half of the world's larger tanks used for storing common petroleum products have floating roofs, and this proportion is likely to rise due to tightening demands for reduced vapour emissions.

Floating roofs offer environmental and economic benefits over fixed roofs without the need for vapour balancing and recovery. However, issues such as sinking, tilting, leaking and sticking decks can affect the performance of floating roofs - potentially leading to costly structural damage and major environmental and safety risks. Therefore, it is vitally important that any problems can be detected as soon as possible, so that action can be taken to correct issues at an early stage before they can lead to a serious incident.

To successfully meet this challenge, operators need to closely monitor their external floating roofs. Traditionally this would be performed by personnel climbing tanks to carry out visual inspections, but this is a practice that tank farm operators are keen to minimise for the safety of those involved. Therefore, in line with the use of automatic tank gauging for monitoring liquid levels, operators are increasingly favouring a continuous and automated roof monitoring solution that offers greater efficiency and reliability, and keeps personnel out of harm's way as much as possible.



Manual inspections and personnel entering the roof are risky and costly operations

Potential problems with external floating roofs

When rain water or snow accumulates on top of a floating deck it can lead to serious problems. Any excess build-up of this nature is usually removed via overflow drainpipes, but there is a risk that these will become blocked. If the water or snow can't be drained away, it could eventually become heavy enough to cause the roof to float too low, or the weight on top of the roof could become unbalanced, causing the roof to tilt. Strong winds pressing down on the roof can also cause it to tilt, especially in combination with water on the roof, while leaking pontoons or a punctured deck could affect the roof's ability to retain its buoyancy and remain afloat.

Rim seals, also known as peripheral seals, are used between the floating roof and the tank shell to prevent the evaporation of hydrocarbons. These can sometimes be fitted incorrectly or be damaged, and if the seal is not tight enough there is a risk of vapour leaks. A seal that has been fitted too tightly risks causing the roof to stick or move unevenly.

Dual and even triple seals are becoming increasingly popular as a means of minimising vapour emissions, but this increased rim seal friction also increases the danger of the roof sticking. Tank wall abnormalities can also prevent the roof from floating freely, and further problems can arise if the roof access rolling ladders are not moving freely.

Should a floating roof malfunction, it would pose a major environmental and safety risk. A sticking or collapsing roof risks causing significant mechanical damage to the tank, which would not only be extremely costly but would also result in the long-term loss of storage capacity. A sinking, tilting or leaking roof could cause hydrocarbon vapour to be released and the product in the tank to become contaminated. Unexpected vapour release is not only an environmental issue, it would also mean a huge safety risk if it ignites, causing a tank fire and an explosion hazard, potentially putting lives at risk.

A malfunctioning roof drain is a common problem which could lead to severe consequences

Early detection of problems

Given these various issues that can affect floating roofs, it is vital that operators are given an early warning should any abnormal situations occur. It is possible to rely on visual inspections, with personnel climbing to the top of the tank and assessing the roof condition, as well as entering the floating deck to inspect the integrity of the pontoons. However, this approach has several drawbacks.

It risks the safety of the personnel involved, it is a time-consuming and inefficient process, and most importantly it is not failsafe, as it is not always easy for workers to identify a problem. It is not uncommon for manual inspections not to take place, with other tasks being prioritised ahead of them. However, even if these checks are performed daily as part of an inspection round, there is still the risk that a significant amount of time could pass between an inspection taking place and an issue being noticed. An incident is most likely to happen when you are not looking.

Consequently, many operators are keen to minimise visual inspections, and instead favour an automated solution, using a system of intelligent level instruments to monitor the status of their external floating roof tanks. This provides the advantage of continuous surveillance and real-time verification that the floating deck is operating as it should. If there is any deviation from normal operation, such as increased or decreased buoyancy, the roof starting to tilt or the liquid level changing but the roof not moving, automatic systems will issue an instant, actionable alert.

Automated solutions offer a much-improved means of maintaining the integrity of the roof, helping operators adhere to the recognised industry standard API 650, which establishes minimum requirements for storage tank design and inspection.

Automating what was previously a manual task can also help operators meet local health and safety regulations. For example, there are places where it is mandatory to monitor the roofs of tanks larger than 60m (180ft) in diameter. Automated solutions can also support companies' own personnel and process safety policies, as well as their environmental policies.

How an automated solution works

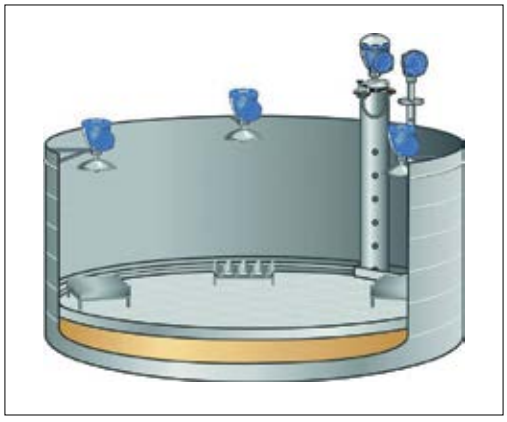
An automated monitoring solution involves level instruments being installed at multiple points. There are two options for where these instruments can be placed – either on top of the tank, or on the floating roof itself.

In the first option, where the devices are placed on top of the tank, typically three non-contacting radars such as Emerson's Rosemount 5400 series or Rosemount 5900 series are installed, mounted at 120 degrees from each other. A reflector plate on the roof enables accurate measurements to be performed without being affected by any protruding objects on the roof surface. The presence of roof tilt can be tracked by comparing the level value from all three radars. This solution tracks how well the roof is floating by comparing the roof readings against an automatic tank gauge, which measures the liquid level through a still pipe.

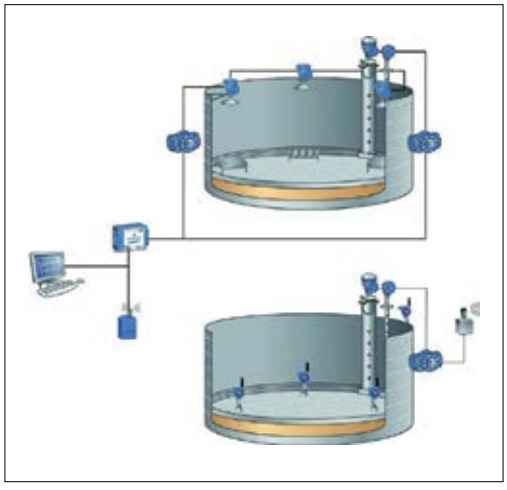
The measurements from the three non-contacting radars are transmitted via wired or wireless communication to the control room, where a console operator can monitor the status of the roof using Emerson's Rosemount TankMaster software package. This solution enables automatic alarms to be generated should issues arise concerning roof tilt, buoyancy and roof sticking, as well as an overfill prevention alarm.

This non-contact solution is highly accurate and reliable. It is suitable for any size of tank, and can be retro-fitted to existing tank gauging systems. Its functionality as overfill protection is a further benefit, along with the redundancy of the level measurement.

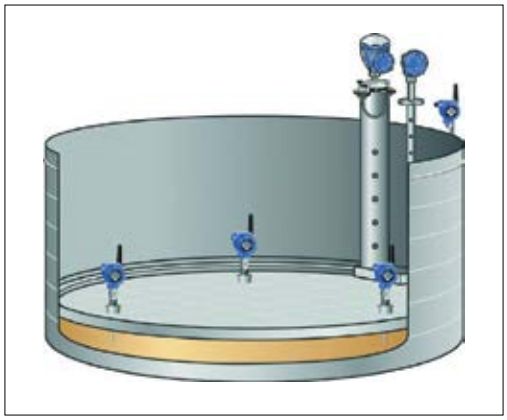
In the second option, where the measurement devices are positioned on the floating roof, wireless and battery-powered guided wave radars (GWR), such as Emerson's Rosemount 3308, are installed in existing noz-



Three non-contacting radars measuring the position of the floating roof



Flexible, scalable and fully automated solution to monitor floating roof tanks from the control room



Three wireless guided wave radars measuring the distance between the floating deck and the liquid surface

zles, with rigid probes penetrating through the roof and into the liquid below. The wireless devices enable installation without the need for flexible wiring that can cope with the movement of the roof.

A wireless repeater mounted at the top of the tanks ensures that when the roof is at a low point the radars can still transmit uninterrupted data back to the control room despite the devices being below the upper edge of the tank shell. When three radars are deployed, they are typically installed at 120 degrees from each other. Potential roof tilt is tracked by comparing the immersion levels of the probes into the liquid product. Using this solution, alarms can be generated for issues with not only tilting, but also buoyancy and roof sticking or sinking.

One major advantage of the rooftop configuration is its ease of installation, configuration and communication. Installation can be done in just two hours and with the tank still in operation. The configuration of the GWR can be performed remotely via wireless on an easy-to-use configuration screen, and the roof tilt data will be available in the TankMaster software in the control room. The three GWR readings are monitored in TankMaster along with the primary radar level gauge, which measures liquid level for inventory purposes. The TankMaster solution also allows for connection to all major distributed control systems (DCS).

As an additional advantage, other sensors can be integrated into an automated solution to further minimise business-critical risks from a floating roof malfunction. The use of wireless communication makes such expansion easy and cost-effective. An example of where this can be used is in monitoring the roof water drain by using a wireless level switch.

The frequency monitoring functionality of the latest wireless vibrating fork switches, such as Emerson's Rosemount 2160, can be used to quickly identify the type of liquid present in the water drain on the tank roof – such as whether it is water or oil. If the switch detects water, it could mean that the drain is blocked or closed, while in the case of hydrocarbons it could mean that either the drainpipe or the roof is leaking. Being able to make this distinction provides major benefits in terms of health and safety, and in preventing product loss and contamination.

Conclusion

An automated monitoring solution provides operators with 24/7 surveillance and real-time verification that a floating roof is operating normally. It also issues automatic alarms in case of any incident or deviation from normal operation, such as increased or decreased buoyancy, the roof starting to tilt, or the liquid level changing but the roof not moving.

Getting an early warning of this kind enables tank farm operators to take appropriate corrective action before the situation worsens and leads to a serious incident. An automated solution helps to meet environmental and health and safety requirements, and provides a significant risk reduction compared to manual inspections, for a relatively low investment.

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탱크 게이징 기술을 통해 플로팅 루프를 원격으로 모니터링함으로써 단자 안전성을 향상시킬 수 있다.

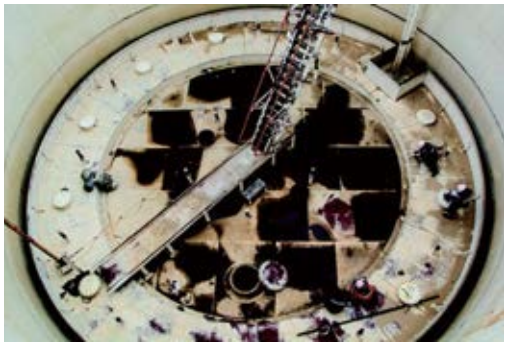
에머슨 오토메이션 솔루션즈

By 울프 요한슨(Ulf Johannesson), 제품 마케팅 매니저

일반적인 석유화학 제품을 저장하는데 사용되는 전 세계 대형 탱크 중 절반 이상이 플로팅 루프를 갖추고 있으며, 이 비율은 증기 배출 감소에 대한 수요 압박으로 인해 증가할 가능성이 높다.

플로팅 루프는 증기 균형이나 회복의 필요성 없이 고정 루프보다 더 나은 환경적 및 경제적 혜택을 제공한다. 그러나 침하하거나, 기울거나, 새거나, 고착된 데크와 같은 문제들은 플로팅 루프의 성능에 영향을 미칠 수 있으며, 잠재적으로는 비용이 많이 들어가는 구조적 손상과 주요 환경 및 안전성 위험으로 이어질 수 있다. 그러므로 최대한 빠르게 문제를 탐지해 심각한 사고로 이어지기 전에 이를 조기에 해결하는 것은 극히 중요하다.

성공적으로 이 문제를 해결하기 위해 오퍼레이터들은 외부 플로팅 루프를 면밀하게 모니터링 할 필요가 있다. 전통적으로 이는 직원이 탱크 위로 올라가 육안 검사를 하는 것으로 수행된다. 그러나 안전상의 이유로 탱크팜 오퍼레이터들이 최소화하고자 노력하는 작업이다. 따라서 액체 레벨을 모니터링하기 위한 자동 탱크 게이징의 사용과 함께 오퍼레이터들은 더욱 뛰어난 효율성과 신뢰성을 제공하고 최대한 직원들을 유해한 것들에 가깝게 가지 않도록 하는 연속적인 자동화 루프 모니터링 솔루션을 선호한다.



수동 점검 및 루프에 접근하는 직원은 위험하고 비용이 많이 드는 작업이다.

외부 플로팅 루프의 잠재적 문제들

빗물이나 눈이 플로팅 덱 위에 쌓이게 되면 심각한 문제로 이어질 수 있다. 과도하게 축적된 이런 자연 요소는 대부분 배수관을 통해 제거되지만, 막힐 위험이 있다. 물이나 눈을 배출하지 못하면 무거워지며 루프가 너무 낮게 뜨거나, 루프 상단의 무게가 균형을 잃어 루프가 기울 수 있다. 또한 루프 위에 가해지는 강력한 바람도 특히 루프 위 물과 합쳐졌을 때 기울임을 유발할 수 있다. 그러는 동안 누출되는 주교나 구멍 난 덱은 루프의 부력을 잃지 않고 계속 떠있을 수 있는 능력에 영향을 미치게 된다.

주변 씰이라고도 알려진 림씰(rim seal)은 플로팅 루프와 탱크 쉘 사이에 사용되어 탄화수소의 증발을 예방한다. 이는 가끔 제대로 맞지 않거나 손상될 수 있으며, 씰이 단단하게 고정되지 않으면 증기가 새어나올 위험이 있다. 씰이 너무 꽉 고정이 되는 경우에는 루프가 고착되거나 불균형하게 움직일 수 있다.

이중 또는 삼중 씰도 증기 배출을 최소화하기 위한 방법으로 많이 사용되고 있으나, 그에 따라 증가된 림 씰 마찰도 루프 고착의 위험을 높일 수 있다. 탱크 벽의 이상도 루프가 자유롭게 떠있지 못하도록 할 수 있으며, 루프 접근 이동 사다리가 자유롭게 움직이지 않을 경우 더 큰 문제가 나타날 수 있다.

플로팅 루프가 고장 났을 때는 중대한 환경 및 안전성 위험이 발생할 수 있다. 고착되거나 가라앉는 루프는 탱크에 심각한 기계적 손상을 야기할 수 있고, 이는 큰 비용을 필요로 할 뿐만 아니라 저장 용량의 장기적 손실로 이어질 수도 있다. 가라앉거나 기울거나 누출되는 탱크는 탄화수소 증기를 배출하고 탱크 내 제품을 오염시킬 수 있다. 예상치 못한 증기 배출은 환경적 문제이며, 또한 점화되었을 경우 탱크 화재 및 폭발과 같은 큰 안전성 문제를 야기하여 생명을 위험에 처하게 할 수 있다.

루프 배수의 고장은 흔한 문제이며 심각한 결과로 이어질 수 있다.

문제 조기 탐지

플로팅 루프에 영향을 미칠 수 있는 이런 다양한 문제들을 고려할 때, 발생하는 비정상 상황에 대한 조기 경고를 오퍼레이터들에게 제공하는 것은 매우 중요하다. 직원이 탱크 위로 올라가 루프 상태를 확인하고 주교의 무결성을 점검하기 위해 플로팅 데크에 입장하는 것도 가능하다. 그러나 이 방법에는 몇 가지 단점이 있다.

관계된 작업자의 안전성을 위협하며, 시간이 많이 소요되는 비효율적인 프로세스이다. 무엇보다도 작업자들이 항상 문제를 쉽게 발견할 수 있는 것이 아니기 때문에 고장안전(failsafe)이라고 할 수 없다. 우선순위로 해결해야 하는 다른 작업들이 있을 때 수동 점검을 하지 않는 것이 드문 일은 아니다. 그러나 이런 점검이 일일 점검의 일환으로 수행된다고 하더라도 점검을 하는 시간과 실제 문제가 발견되는 시간 사이에 큰 차이가 있을 수 있다. 보지 않는 사이에 문제가 일어날 확률이 높기 때문이다.

결과적으로 많은 오퍼레이터들이 육안 점검을 최소화하고자 하며, 지능형 레벨 계기 시스템을 사용해 외부 플로팅 루프 탱크의 상태를 모니터링하는 자동화 솔루션을 선호한다. 이는 플로팅 루프가 제대로 작동하고 있는지에 대한 연속적인 감시와 실시간 확인을 가능하게 한다. 부력 증가 또는 감소, 기울기 시작한 루프, 또는 루프는 움직이지 않으면서 변화한 액체 레벨 등 정상적인 작동에서 벗어난 게 있다면 자동 시스템이 즉각적이고 수행 가능한 경고를 보낸다.

자동화 솔루션은 루프의 무결성을 유지할 수 있는 향상된 방식을 제공하여 오퍼레이터들이 저장 탱크 설계 및 점검을 위한 최소한의 요구사항을 규정하는 업계 표준 API 650를 따를 수 있도록 한다.

수동 작업을 자동화하는 것으로 오퍼레이터들이 지역 보건 및 안전성 규정을 준수하도록 도울 수 있다. 한 예로, 직경 60m(180ft)보다 큰 탱크의 루프는 탱크 루프를 의무적으로 모니터링 하게 하는 곳도 있다. 또한 자동화된 솔루션은 회사의 자체적인 인력과 프로세스 안전 정책 그리고 환경 방침을 지원할 수 있다.

자동화 솔루션이 작동하는 방식

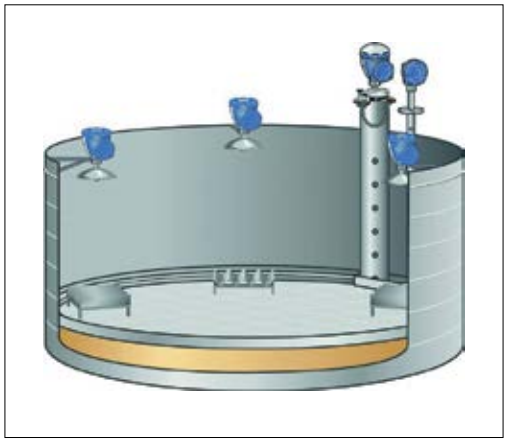
자동화 모니터링 솔루션에서는 레벨 계기가 다수의 지점에 설치됩니다. 이런 계기들이 설치될 위치에는 탱크 상단과 플로팅 루프 이렇게 두 가지 선택권이 있다.

장치가 탱크 상단에 위치하는 첫 번째 옵션의 경우, 보통 에머슨의 Rosemount 5400 시리즈 또는Rosemount 5900 시리즈와 같은 3개의 비접촉 레이더가 서로 120도 각도로 설치된다. 루프의 반사판은 루프 표면에 돌출된 물체의 영향을 받지 않으며 정확한 측정을 가능하게 한다. 루프의 기울어짐은 세 개의 레이더에서 측정한 레벨값을 비교하는 것으로 확인할 수 있다. 이 솔루션은 스틸(still) 파이프를 통해 액체 레벨을 측정하는 자동 탱크 게이지와 루프 측정값을 비교하는 것으로 루프가 얼마나 잘 떠있는지를 추적한다.

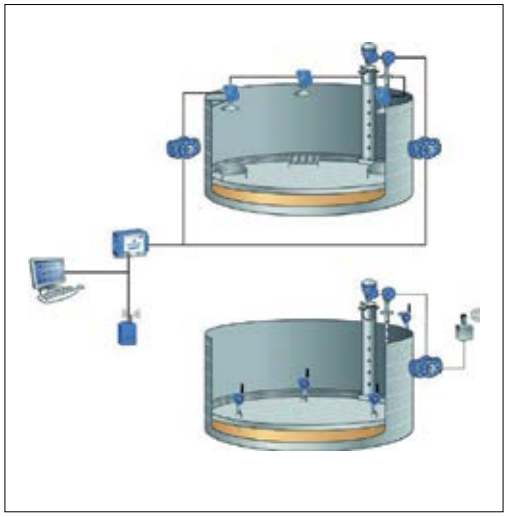
3개의 비접촉 레이더의 측정값은 배선 또는 무선 통신을 통해 제어실로 전송되며, 그곳에서 콘솔 오퍼레이터가 에머슨의 Rosemount TankMaster 소프트웨어 패키지를 사용해 루프의 상태를 모니터링 할 수 있다. 이 솔루션은 루프 기울기, 부력, 루프 고착과 같은 문제가 생겼을 때 자동 알람을 생성하며 또한 과충전 예방 알람도 제공한다.

이 비접촉 솔루션은 매우 정확하고 신뢰할 수 있다. 모든 크기의 탱크에도 적합하며, 기존의 탱크 게이징 시스템에 장착될 수 있다. 과충전 보호로서의 기능성과 레벨 중복 측정도 추가적인 이점이라고 할 수 있다.

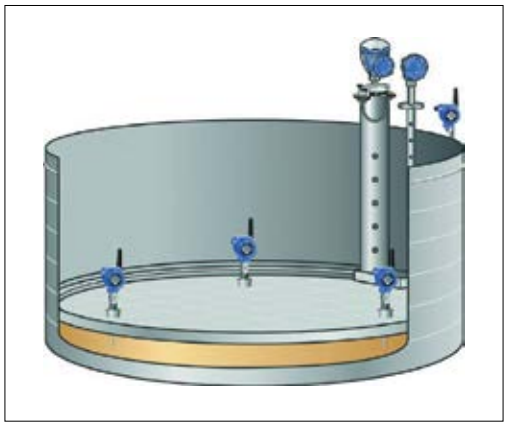
측정 장치가 플로팅 루프에 위치하는 두 번째 옵션의 경우, 에머슨의 Rosemount 3308과 같은 무선 및 배터리 구동 유도파 레이더(GWR)를 루프를 관통해 그 아래 액체에 닿는 단단한 프로브와 함께 기존의 노즐에 설치한



플로팅 루프의 위치를 측정하는 3개의 비접촉 레이더



플로팅 덱 및 액체 표면 사이의 거리를 측정하는 3개의 무선 유도파 레이더



제어실에서 플로팅 루프 탱크를 모니터링하는 유연하고 확장 가능한 전자동 솔루션

다. 무선 장치는 루프의 움직임을 견딜 수 있는 유연한 배선 없이도 설치를 가능하게 한다. 탱크 상부에 장착된 무선 리피터는 루프가 낮은 위치에 있더라도 레이더가 탱크쉘의 상단 끝 아래 위치함에도 불구하고 방해 받지 않은 데이터를 제어실로 전송할 수 있다. 3개의 레이더가 배치될 때 보통 서로 120도 각도에서 설치된다. 잠재적인 루프 기울어짐은 프로브를 액체 제품에 넣었을 때 담금 레벨을 비교하는 것으로 확인할 수 있다. 이 솔루션을 사용하면 기울기 뿐만 아니라 부력 및 루프 고착이나 침하와 관련된 문제들에 대한 경고를 알린다.

루프 상단 설정의 주요 이점 중 하나는 쉬운 설치, 설정 및 통신이다. 탱크가 작동하는 동안 2시간 이내로 설치를 완료할 수 있다. GWR의 설정은 사용하기 쉬운 설정 화면을 통해 무선으로 원격 설정할 수 있으며, 지붕 기울어짐 데이터가 제어실 내 TankMaster 소프트웨어로 전송된다. 3개의 GWR 측정값들은 재고 목적을 위해 액체 레벨을 측정하는 주 레디어 레벨 게이지와 함께 TankMaster에서 모니터링 된다. TankMaster 솔루션은 또한 모든 대부분의 분산제어시스템(DCS)에 연결될 수 있다.

추가적인 혜택은 플로팅 루프 고장과 관련된 비지니스에 영향을 미치는 위험들을 최소화 하기 위해서 다른 센서들을 자동화 솔루션에 통합할 수 있다는 것이다. 무선 통신의 사용으로 쉽고 비용 효율적인 확장이 가능해졌다. 이를 활용할 수 있는 예로는 무선 레벨 스위치를 사용하는 루프 배수를 모니터링 하는 것이 있다.

에머슨 Rosemount 2160과 같은 최신 무선 진동 포크 스위치의 주파수 모니터링 기능을 사용해 탱크 루프의 배수가 물인지 기름인지 그 종류를 파악할 수 있다. 스위치가 물을 탐지하면, 배수가 막히거나 닫혔다는 것을 의미하며, 탄화수소의 경우 배수관 또는 루프가 새고 있다는 것을 의미한다. 이런 차이를 확인하는 것은 보건 및 안전 측면과 제품 손실 및 오염을 예방하는 측면에서 큰 혜택을 제공한다.

결론

자동화 모니터링 솔루션은 플로팅 루프가 정상적으로 작동하는지에 대한 24시간 감시와 실시간 확인을 오퍼레이터들에게 제공한다. 또한, 사건 또는 부력 증가 또는 감소, 기울기 시작한 루프, 또는 루프는 움직이지 않으면서 변화한 액체 레벨 등 정상 작동에서의 이탈이 발생할 때 자동 경보가 내려진다.

이런 조기 경고를 받음으로써 탱크팜 오퍼레이터들은 상황이 심각해져 더 큰 사고로 이어지기 전에 조치를 취할 수 있다. 자동화 솔루션은 비교적 낮은 투자로도 환경적 요구사항과 보건 및 안전성 요구사항들을 만족할 수 있으며, 수동 점검보다 위험도를 훨씬 더 줄일 수 있다.

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A new compact HVDC solution for offshore wind

- HVDC offshore wind compact solution with half the weight and AC platforms eliminated

Every offshore wind installation must endure one of the most demanding environments on the planet: the open sea. In a constant battle with wind, waves and salt water they must stand firm and reliably transmit power back to the mainland, often many kilometers distant. Perhaps most challenging of all is the delivery and commissioning of these behemoths: Weighing sometimes over 20,000 tons they have to be transported and positioned by the world's largest vessels and lifted by the world's most powerful cranes. These are operations that can only be carried out in clement weather. ABB's new offshore wind compact HVDC solution changes all this.

ABB

by Ryan Ladd, ABB Power Grids, Grid Systems HVDC Market Communications, Sweden
Peter Sandeberg, ABB Power Grids, Grid Systems HVDC Marketing and Strategy, Sweden

New designs of offshore platforms reduce weight by half, simplify the electrical concept and allow a modular approach to construction. These new offshore wind compact solutions look quite different from the familiar platform as shown here.

With demand for clean, reliable power increasing, wind turbines are becoming a common sight in many countries. However, on land, wind strength can change at a moment's notice and air flows can be disturbed by the presence of hills, trees and cities. At sea, on the other hand, the wind is much more constant and can usually be relied upon to provide a predictable source of power.

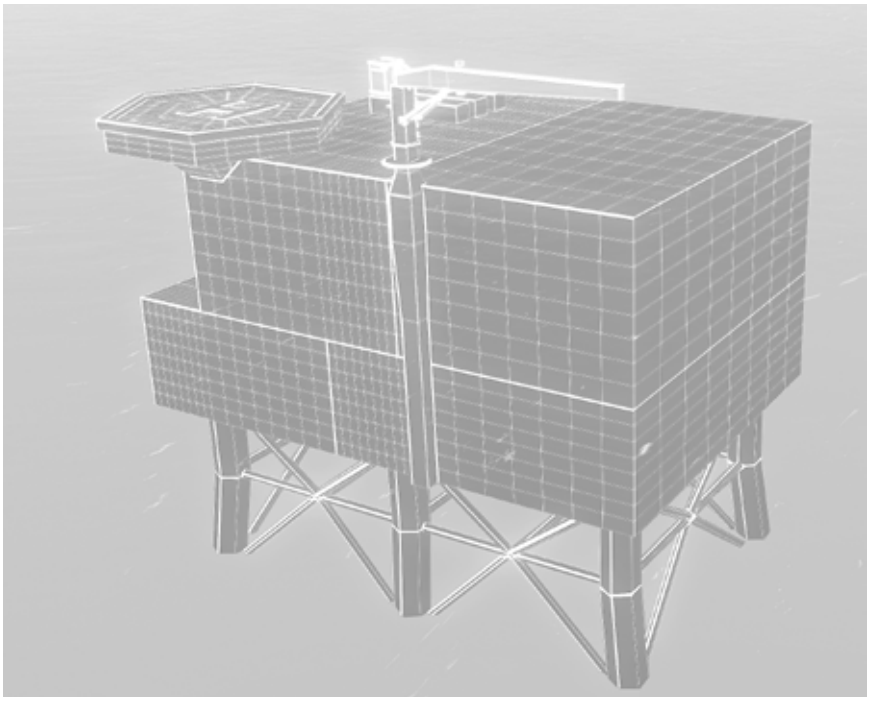
Also, the number of locations on land suitable for wind turbines is limited - for both practical and aesthetic reasons - whereas wind turbines out to sea are less visible and wind yield is significantly greater offshore. For these reasons, offshore wind turbine numbers are rising rapidly.

Offshore power generation and transmission present challenges, of course. The environment is harsh, facilities have to be accessed for maintenance and there are critical technical obstacles involved in transmitting power great distances under the sea. The problem of transmitting power long distances back to shore efficiently has largely been solved by highvoltage direct current (HVDC) technology, which is not prone to the huge losses incurred by traditional alternating current (AC) systems.

HVDC equipment has many other technical advantages, eg, superior controllability, fast response, blackstart capability, etc. These advantages make HVDC the technology of choice for transmitting power to shore in projects around the world.

A new modular HVDC concept for offshore

Although HVDC is an established technology and has been around for over 60 years, its application offshore is relatively recent. The first offshore HVDC wind project was energized in 2009 and every installation since then has differed significantly from its predecessors, a phenomenon common in a rapidly evolving technology.



ABB's new offshore wind compact solution significantly reduces the weight of the platform.

The experience and insight gained from implementing HVDC in offshore situations have enabled ABB to come up with a new offshore wind compact solution - one that reduces the weight and volume of the platform by over 50 percent compared to previous designs.

Also, the new ABB offshore HVDC solution allows the AC substation platforms currently necessary in the wind farm to be eliminated since the wind turbine generators can now be connected directly to the HVDC platform via a 66 kV collection grid. Eliminating the AC substation platform potentially increases the total weight saving further, up to a total of 70 percent compared to a conventional setup and reduces operational costs by removing the long-term maintenance of these stations.

The new HVDC concept is based upon a modular product structure that provides the flexibility to accommodate different customer specifications. The optimized base-level platform contains everything needed for a fully operational HVDC platform but if for example, there is need for living quarters, a helipad, a more powerful crane or other options, the concept allows them to be easily added - without designing and fabricating an entirely new platform from scratch.

Modular design, of course, has other advantages. Each module can be produced individually, in parallel with others and in more diverse and smaller workshops, as opposed to the traditional fabrication of the entire topside platform in a dedicated yard. This greatly increases the number of suitable suppliers, which provides a more competitive environment and significantly reduces the risks inherent in all such megaprojects.

As well as advantages in fabrication, there are also substantial transportation benefits. There are very few vessels capable of transporting and installing the largest platforms but, with half the weight and the flexibility to distribute the modules between cargo carriers, the new concept represents a step change in logistical management.

A solution for the future

The huge savings in weight delivered by the new HVDC concept have been achieved by close collaboration between ABB's top HVDC engineers and researchers. Innovative thinking has allowed a substantial reduction in the HVDC hardware installed on the platform and extensive studies and tests helped point the way to reduce redundancy while maintaining the required high levels of availability in the system. With improvements to layout and the elimination of excess space, this revolutionary new concept truly represents the next generation of offshore wind solutions.

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HHIC wins the bid to build 8 naval ships

The ROK Navy's Leading Next-generation Patrol Boat

Hanjin Heavy Industries & Construction (HHIC)'s Yeongdo Shipyard has strengthened its ground as a special-purpose vessel builder by winning the bid to build 9 naval ships including a next-generation patrol boat ordered by the Defense Acquisition Program Administration (DAPA).

The company announced that it signed a KRW 332.5 billion agreement to build 9 naval ships with the DAPA. They include 4 next-generation patrol boats (PKX-B, No. 5-8, KRW 259.9 billion), 1 multi-purpose training boat (MTB, KRW 40.05 billion) and 3 landing craft utilities (LCU, KRW 32.577 billion).

The Korean shipbuilder also signed a KRW 17.1 billion depot maintenance agreement for the ROK Navy's next-generation landing ship fast (LSF-II). HHIC is the only company having the knowhow and technology to build both LSF-I and next-generation LSF-II in the Republic of Korea. The company proved once again its unrivaled excellence in special-purpose vessels including patrol boats.

The ROK Navy's next-generation patrol boat project is to build 200t next-generation patrol boats which substitute Chamsuri-class patrol vessels which fought in the First and Second Battles of Yeonpyeong. As combat ships with upgraded mark-detection and offense capabilities and air defense system, they are readily operated to defend the NLL and coastline.

This boat is armed with 130mm guided rocket, 76mm cannon, K-6 remotely controlled weapon system (RCWS) and Korean combat system. Reflecting the lessons from the First and Second Battles of Yeonpyeong, it upgraded combat power including weaponry, hit probability and survivability. HANJIN Heavy Industries & Construction was named as the builder of the leading boat in 2014. In 2016 again, the company won the bid to build 3 following ships (No. 2-4).

The MTB is a naval training boat armed with anti-ship, anti-aircraft and anti-submarine and electronic warfare training support systems. This time, the company is ordered to build No. 2 patrol vessel. The South Korean shipbuilding company also won the bid to build the leading boat in 2015.

The LCU is a landing vessel designed to transport, load/unload and bring troops and equipment alongside the quay. It is also used in resupplying munitions and cargoes. With this successful bid, HANJIN Heavy Industries & Construction is able to accelerate its management normalization by putting more emphasis on its two-track strategy which means that Subic Shipyard specializes in the production of large vessels and offshore plants while Yeongdo Dockyard focuses on mid-size and special-purpose vessels.

An official from the company said, "After the successful bid for the leading next-generation patrol boat, we were again named as the builder of the 7 following ships. In other words, we have proven our unrivalled excellence in the construction of naval ships." He continued, "In addition to the following large transport vessels which are now under construction, we are going to get our job (e.g., construction of MTB and LCU, depot maintenance) done perfectly and make a contribution to the reinforcement of the ROK Navy's strength."

한진중공업, 한국 해군 함정 9척 수주

한진중공업은 방위사업청으로부터 해군의 차기고속정(PKX-B) 5~8번함 4척, 다목적 훈련지원정(MTB) 1척, 군수지원정(LCU) 3척 등 총 8척(3,325억원)의 함정 건조계약을 체결했다. 또한, 이와 별도로 해군의 차기 고속상륙정(LSF-II, Landing Ship Fast)의 정비 업무를 수행하는 외주 창정비 사업을 171억원에 계약 체결했다고 전했다.

국내에서 고속상륙정(LSF-I)과 차기 고속상륙정(LSF-II) 건조 기술을 모두 갖고 있는 유일한 방산업체인 한진중공업은 국내 고속함정을 포함, 특수선 분야에서 쌓아온 독보적인 기술력을 다시 한 번 입증했다.

해군의 차기고속정 사업은 제1, 제2 연평해전 승리의 주역으로 알려진 참수리 고속정을 대체하는 200톤급 차기고속정 건조사업이다. 기존 고속정 대비 수상함 표적에 대한 탐지 및 공격능력과 대공방어 능력이 향상된 전투함정으로 NLL 사수, 연안방어 등 현장 즉각 대응전력으로 운용된다.

주요 무장으로는 130mm 유도로켓, 76mm함포, K-6 원격사격 통제체계, 한국형 전투체계 등을 탑재하였으며 제1, 제2 연평해전에서 얻은 교훈을 반영해 화력, 명중률, 생존성 등 전투력을 강화한 함정이다. 한진중공업은 지난 2014년 선도함 건조사로 선정된데 이어 2016년에도 후속함인 2~4번함 3척의 건조사로 선정된 바 있다.

다목적훈련지원정(MTB, Multi-purpose Training Boat)은 대함, 대공, 대잠 및 전자전 훈련 지원체계를 구비한 해군의 실전훈련 지원 함정이다. 한진중공업이 이번에 수주한 함정은 2번함으로 1번함 역시 동사가 지난 2015년 자체 설계를 거쳐 수주한 바 있다. 군수지원정(LCU, Landing Craft Utility)은 부대와 장비의 수송, 접안, 하역 및 철수 시 투입되는 상륙작전용 함정으로 군수, 화물 재보급 작전에도 사용되는 함정이다.

한진중공업은 금번 해군 함정 수주 성과로 수빅조선소를 중대형 상선 위주로, 국내 조선소를 특수목적선 중심으로 운용한다는 투트랙 전략에 한층 힘을 얻으며 경영 정상화에도 박차를 가할 수 있게 됐다.

한진중공업 관계자는 "차기고속정 선도함에 이어 후속함 7척의 건조사로 선정되는 등 함정건조 분야에서 독보적인 경쟁력을 입증했다"고 강조하며, "현재 건조중인 대형수송함 후속함을 비롯해 다목적훈련지원정, 군수지원정, 창정비 업무에 이르기까지 함정 분야에서 국가로부터 위임받은 임무를 완벽히 수행하여 해군 전력 증강에 기여하겠다"고 밝혔다.

DSME won an order for 4 VLCCs

Daewoo Shipbuilding & Marine Engineering (DSME) announced on July 14 that it received an order for 4 units of 318,000-ton VLCCs (Very Large Crude-oil Carriers) from Maran Tankers Management, a subsidiary of Greece's largest shipping company Angelicoussis Group.

These vessels, 336m long and 60m wide, are the next-generation eco-friendly vessels that meet requirements of environmental regulations set forth by the IMO(International Maritime Organization) and incorporate the latest technologies of DSME such as high-efficiency engines and up-to-date fuel-saving technologies. In particular, those 4 VLCCs will be built to specifications same as those of 3 VLCCs ordered last April, which will have a positive impact on productivity improvement with maximization of the effect from series construction of vessels.

Angelicoussis Group is a loyal customer who has constantly placed orders despite the crisis currently facing DSME. Specifically, Angelicoussis Group ordered 5 vessels including 2 LNG carriers, 2 VLCCs, and 1 LNG-FSRU(Floating Storage Regasification Unit) even last year when the self-rescue plan of DSME was unveiled and placed an order for 3 VLCCS last April, apart from recent order for 4 VLCCs.

So far, Angelicoussis Group has placed orders at DSME for 96 vessels since it signed its first shipbuilding contract with DSME in 1994. At present, 17 vessels of Angelicoussis Group are being built at DSME's Okpo Shipyard and Romanian shipyard.

An official from DSME said, "Angelicoussis Group, the largest shipping company of Greece, has shown unlimited trust that our company will be put back on track. As the financing has been smoothly completed

owing to Supreme Court's recent rejection, we have much stronger financial position and anticipate additional orders in the second half of this year."

대우조선해양, 초대형유조선 4척 수주

대우조선해양은 그리스 최대 해운사 안젤리쿠시스 그룹 자회사인 마란 탱커스(Maran Tankers Management)로부터 318,000톤 규모의 초대형유조선(VLCC, Very Large Crude-oil Carrier) 4척을 수주했다고 지난 7월 14일 밝혔다.

이번에 수주한 선박은 길이 336미터, 너비 60미터 규모이며, 국제해사기구(IMO)의 환경규제 기준에 충족하는 차세대 친환경선박으로 고효율 엔진과 최신 연료절감 기술 등 대우조선해양의 최신 기술이 적용된다. 특히

이번 VLCC 4척은 지난 4월 발주된 VLCC 3척과 동일한 사양으로 시리즈 호선 건조 효과의 극대화로 생산성 향상에도 긍정적인 영향을 미칠 것으로 보인다.
안젤리쿠시스 그룹은 대우조선해양의 위기상황에도 불구하고 지속적으로 발주를 해주는 충성고객이다. 대우조선해양의 추가 자구안이 발표될 당시인 지난해에도 LNG선 2척, VLCC 2척, LNG-FSRU 1척 등 총 5척의 선박을 발주했으며, 올해 역시 지난 4월 VLCC 3척 발주에 이어 이번에 4척을 추가 발주했다.
안젤리쿠시스 그룹은 1994년 첫 거래 이후 이번 계약을 포함하여 총 96척의 선박을 대우조선해양에 발주했으며, 현재 총 17척의 안젤리쿠시스 그룹 선박들이 대우조선해양 옥포조선소와 루마니아 조선소에서 건조되고 있다.
대우조선해양 관계자는 "그리스 최대 해운사인 안젤리쿠시스 그룹이 당사의 회생에 무한한 신뢰를 보여주고 있다"며, "최근 대법원의 기각 결정으로 자본확충이 원활히 마무리돼 재무건전성이 크게 좋아진 만큼 하반기 추가 수주도 기대된다"고 말했다.

SSME obtained the RG for 5 crude oil tankers

Sungdong Shipbuilding & Marine Engineering (SSME) announced on July 14 that it obtained the RG (Refund Guarantee) from the Export-Import Bank of Korea (Korea Eximbank) for 5 crude oil tankers contracted with Greece-based Kyklades Maritime Corporation last May.
These vessels, measuring 249.9m in length, 21.5m in height, and 44m in width with a capacity of 115,000 tons, are scheduled from delivery from the second half of 2018 and are SSME's mainstay products in the field of medium-sized tanker which is typically a forte of SSME.
Kyklades Maritime Corporation, the ship owner, is a global tanker operator which has placed orders mostly at major domestic shipyards and has maintained strong business relationship with SSME which dates back to 2014 when it awarded a contract to the shipbuilder for 2 units of 158,000-ton crude oil carrier. The latest order from Kyklades Maritime Corporation was driven by favorable reaction to the vessels delivered to it last year which were distinguished for unmatched quality and selected as the ships of year by Naval Architect, a U.K. magazine specializing in shipbuilding and maritime industries.
In particular, production can start from November this year under this contract, so that, SSME, which has been suffering from thin orderbook despite turnaround last year, can find a way for survival. Moreover, the early production will help ease concern of overseas shipping companies over the issuance of RG, raising the expectation for additional orders.
An official from SSME said, "We have focused on quality of products to overcome recession in industry and are delighted to see that our efforts have paid off. We will deliver the best quality vessels to reciprocate the support that we received from ship owners when we were facing tough times and will make our utmost effort to bring the business back to normal."

성동조선해양, 원유운반선 5척 RG 발급

성동조선해양이 수출입은행으로부터 지난 5월 그리스 키클라데스(Kyklades Maritime Corporation)와 계약한 원유운반선 5척의 선수금환급보증(RG, Refund Guarantee)을 발급받았다고 지난 7월 14일 밝혔다.
2018년 하반기부터 인도예정인 해당 선박들은 길이 249.9m, 높이 21.5m, 폭 44m의 제원을 가지고 있는 115,000톤급 원유운반선으로 성동조선이 강점을 가지고 있는 중형탱커 부문의 주력선종 중 하나이다.

선박을 발주한 키클라데스는 주로 국내 대형 조선소에 선박을 발주해오던 글로벌 탱커 전문선사로 성동조선과는 지난 2014년 158,000톤급 원유운반선 2척의 계약으로 인연을 맺었으며 지난 해 인도받은 선박이 영국 조선해양전문지 네이벌아키텍트(Naval Architect)로부터 최우수 선박에 선정되는 등 품질에 대한 호평이 이어지자 성동조선을 다시 찾은 것으로 알려졌다.
특히 이번 계약은 올해 11월부터 생산활동을 시작할 수 있어 지난 해 흑자전환에도 불구하고 일감부족을 겪고 있는 성동조선으로서는 생존을 위한 활로를 찾을 수 있게 됐다. 뿐만 아니라 RG발급에 대한 해외 선사들의 우려도 불식시킬 수 있어 추가 수주에도 탄력을 받을 것으로 기대된다.
성동조선 관계자는 "품질로 업황 침체를 극복하고자 노력해 왔으며 그간의 노력이 결실을 거두는 것 같아 기쁘다"며 "어려울 때 도와준 선주를 위해 최고 품질의 선박으로 보답하고, 회사의 경영정상화를 위해 최선을 다할 것"이라고 말했다.

Alfa Laval signs major frame agreements for ballast water treatment retrofits

Alfa Laval signed frame agreements with two different shipowners for the supply of Alfa Laval PureBallast systems. The systems will be delivered during a three-year period and retrofitted on tankers and bulk carriers.
The fleet orders were received from a tanker operator in the Middle East and a bulk carrier operator in Europe, who will time the booking of individual PureBallast orders with the scheduled dry docking of their vessels. Alfa Laval will make the first of its PureBallast system deliveries to the shipowners during the latter part of 2017.
"The Ballast Water Management Convention enters into force on 8 September of this year, and these frame agreements are a clear sign that the ballast water treatment market is moving forward," said Kristina Effler, Manager Global Business Management, Alfa Laval PureBallast. "Shipowners are beginning to look beyond individual installations towards long-term solutions that will ensure compliance for their entire fleet."
The framework agreements Alfa Laval has signed for PureBallast cover 45 systems and 8 systems respectively, many of which will handle a significant ballast water flow. The first order includes 22 systems with capacities of 2000 m^3/h or 3000 m^3/h, while the second order comprises four systems of 1500 m^3/h and an additional four of 3000 m^3/h.
"Low power consumption, a small footprint and high installation flexibility make PureBallast competitive for larger flows as well as smaller ones," said Effler. "Flow rates of up to 3000 m^3/h can be handled with a single, easily retrofitted PureBallast system. The signing of major orders involving so many large PureBallast systems shows that PureBallast is attractive across its capacity range."

알파라발, 선박평형수 개조(retrofits)에 대한 기본 계약 체결

알파라발은 선박평형수 처리 장치 개조사업과 관련해 두 곳의 선주사와 기본 계약

을 체결하고, 알파라발의 PureBallast 시스템을 공급하기로 했다. 이 시스템은 유조선 및 벌크선의 개조 용도로 설치되며 향후 3년간 공급될 예정이다.
이번에 계약을 체결한 해운사들은 예정된 선박 수리 일정에 맞추어 개별적인 PureBallast 주문을 진행할 예정이다. 알파라발은 2017년 후반 이들 선주사에게 PureBallast 시스템을 처음 납품하게 된다.
"이번 기본 계약은 선박평형수 처리 시장이 움직이고 있다는 것을 말해준다. 선주들은 개별적인 장비 설치를 넘어 전체 선대의 컴플라이언스를 보장하는 장기적인 솔루션을 찾기 시작했다"고 알파라발 PureBallast 글로벌 비즈니스 매니저인 크리스티나 에플러(Kristina Effler)는 말했다.
이번 계약에 따라, 알파라발은 총 53개의 PureBallast을 공급하며, 이 중 대다수가 대용량의 선박평형수를 처리한다. 첫 주문은 2000m^3/h 또는 3000m^3/h 용량의 22개 시스템이 포함되며, 두 번째 주문은 4개의 1500m^3/h 용량과 추가로 4개

의 3000m³/h 용량의 시스템으로 구성된다.
"낮은 전력 소모, 작은 설치 면적, 높은 설치 유연성 덕분에 PureBallast는 저용량 뿐만 아니라 대용량 장치에도 경쟁력이 있다. 개조 공정에서 용이한 PureBallast은 단일 최고 3000m³/h의 유량을 처리할 수 있다. 대용량 PureBallast 시스템과 관련 한 주요 주문을 체결한 것은 PureBallast가 그 용량 범위에서 매력적인 제품임을 입증한다"고 에플러는 말했다.

LS Cable & System wins first contract to export E.H.V. submarine cables to Southeast Asia

LS Cable & System announced that it had won a contract to export submarine cables worth KRW 62 billion from Singapore PowerGrid (SPPG). This is the first time a Korean cablemaker will export extra-high-voltage (E.H.V.) submarine cables to Southeast Asia.
LS Cable & System will connect a 1.5km offshore section between Woodlands New Town in the northern part of Singapore with Johor Baharu, a resort town in the southern part of Malaysia, using submarine cables. Singapore and Malaysia are now working together to interconnect their power grids so that they will be better able to handle power loads and prevent failures.
This project was initiated to solve the problem of power failure in some sections of the existing submarine cables installed in 1985 as the cables have worn out over the 30+ year period.
"In Southeast Asia, there is a continuous demand for submarine cables to connect insular areas. In particular, demand is increasing in line with industrial development in the region," said Roe-Hyun Myung, President and CEO of LS Cable & System. He emphasized, "Having succeeded in winning the contract by defeating global cablemakers, LS Cable & System secured an advantageous position in the Southeast Asian market following North America, Europe and the Middle East."
The company's active customer support to suggest solutions for construction and delivery issues played a key role in winning the contract, according to the LS Cable & System officials. LS Cable & System has built expertise by working on large-scale submarine cable projects in the U.S., Canada and Qatar as well as an offshore wind power generation complex in Northern Europe.

LS전선, 동남아 초고압 해저케이블 수주

LS전선은 최근 싱가포르 전력청에서 한화 620억원 규모의 해저케이블 프로젝트를 수주했다고 밝혔다. LS전선은 싱가포르 북부 뉴타운 우드랜즈와 말레이시아 남부 휴양도시 조호바루 사이의 바다 1.5km 구간을 해저케이블로 잇는다. 싱가포르와 말레이시아는 전력망을 서로 연계하여 전력 부하 및 고장 등을 대비하고 있다.

이번 프로젝트는 1985년 프랑스 케이블 회사가 매설한 해저케이블이 30여년이 지나면서 노후되어 일부 구간은 이미 단전되는 등 문제가 발생하고 있어 이를 대체하기 위한 것이다.
LS전선 관계자는 "동남아는 도서지역을 연계하는 해저케이블 수요가 지속적으로 생겨나고 있으며, 특히 산업발전에 따라 그 수요가 증가세에 있다"며, "LS전선이 이번에 글로벌 전선업체들을 제치고 수주에 성공함으로써 북미, 유럽, 중동에 이어 동남아에서도 유리한 위치를 차지하게 되었다"고 말했다.
초고압 해저케이블은 전세계적으로 우리나라를 비롯, 유럽과 일본 등의 5개 회사 정도만 공급이 가능하다. 우리나라에서는 LS전선이 국내 유일의 해저케이블 전문 공장을 강원도 동해시에 보유하고 있다.

Nexans secures leading position in subsea market with BP framework agreement

Nexans announced on July 10 that Nexans Norway signed a five-year Global Framework Agreement with BP covering the engineering, procurement and construction of umbilical and Direct Electrical Heating (DEH) systems and ancillary equipment. The agreement also covers the provision of aftermarket services. This new agreement extends and reaffirms the long standing relationship between BP and Nexans that started in 2002.

Nexans secures leading position in subsea market with BP framework agreementThe Agreement provides Nexans a framework for worldwide supply of Umbilical and DEH, and has been specially designed to accommodate supplier-led solutions. The products are developed, tested and manufactured at Nexans' specialised plants in Halden and Rognan, Norway.

Winifred Patricia Johansen, Key Account Manager for BP & Business Development Manager Africa at Nexans said, "This global framework agreement with BP is the result of a long standing, mutually beneficial relationship. Under this contract, we have taken into account current and future market conditions so BP's needs can be met responsively and competitively. Our partnership with BP reinforces our position in the market as the key strategic supplier of subsea systems."

넥상스, BP와 프레임워크 계약으로 해저케이블 시장 선두 자리매김

넥상스 그룹은 넥상스 노르웨이가 BP와 5년간 글로벌 프레임워크 계약을 체결하고, 엄빌리칼 및 직접전기가열(DEH) 시스템 및 보조 장치의 설계, 조달 및 설치를 제공(A/S 포함)한다고 지난 7월 10일 발표했다. 이 새로운 계약으로 넥상스와 BP는 지난 2002년부터 지속되어온 파트너십을 재확인하고, 이를 연장하게 되었다.

이 계약으로 넥상스는 BP사가 수행하는 전세계 프로젝트에 엄빌리칼 및 DEH 프레임워크를 공급하며, 특히 공급업체 주도 솔루션을 수용할 수 있도록 계약됐다. 제품은 넥상스 노르웨이 할덴 및 로그난 전문 공장에서 생산 및 공급될 예정이다.

넥상스 아프리카 사업 개발부 임원이면서 BP 고객 담당자인 위니프레드 패트리시아 요한슨(Winifred Patricia Johansen)은 "이번 글로벌 프레임워크 계약은 BP와 오랜 기간 동안 맺어온 상호 호혜관계의 산물이다. 이 계약에서 BP의 요구사항에 경쟁력 있게 대응할 수 있도록 우리는 현재와 미래 시장 환경을 고려해왔다. BP와의 파트너십으로 해저 시스템 핵심 전략 공급업체로서의 넥상스의 마켓 포지션이 강화됐다"고 말했다.

Rolls-Royce signs new service agreement

Siem Offshore and Subsea 7 have signed a joint three-year service agreement with Rolls-Royce. The agreement covers a total of 74 offshore vessels. This is the first agreement the two Siem-owned companies have signed with the same service provider. Under the agreement, Rolls-Royce will maintain and service all of the equipment it has delivered to the two companies' offshore vessels.

Steinar Sandberg, Siem Group, Head of Group Procurement, said "Naturally, we believe we can save money by jointly entering into this kind of service agreement. We have a modern and technically

advanced fleet that requires good follow-up throughout the vessels' working lives."

Knut Hovland, Rolls-Royce, Director, Marine Services, said "We have delivered equipment to around a quarter of the world's registered fleet. As a result, we also have service assignments and long-term agreements with a large number of ship owners globally. We also have a network of service stations at 34 locations world-wide, so we can be close by whenever equipment needs servicing or repair."

At present, aftermarket services account for roughly 40 per cent of Rolls-Royce Marine's revenues. Long-term agreements account for around a quarter of this. The company is now exploring digital opportunities to provide ship owners with a growing range of new and more effective service solutions. These include new types of services based on surveillance of ships' operations and equipment from control centres located on shore. Rolls-Royce recently signed its first "power-by-the-hour" agreement with the Norwegian logistics and cargo company Nor Lines.

"We are particularly pleased to sign new service agreements in these current times. We have obviously been affected by the fact that many vessels in the offshore market are still laid up, and it will be interesting to see what impact this will have on the service market going forward," said Knut Hovland.

China's largest containerships, powered by ABB turbochargers

ABB turbochargers are powering the main engines and auxiliary engines of the largest containership ever built in China, a 20,000 TEU vessel named COSCO Shipping Taurus, launched in June 2017. This first ship was built by Shanghai Waigaoqiao Shipbuilding (SWS) for delivery to COSCO Shipping Lines Co. Ltd, the world's fourth largest container shipping company. A further ten vessels also for COSCO Shipping Lines will be applied with the same ABB turbocharger configuration. They will add to the company's fleet of 311 containerships with a total capacity of 1.64 million TEU.

Each of the main engines will be equipped with three A180-L units, a two-stroke turbocharger, designed for large, marine diesel engines. To meet the need for optimizing fuel costs across fleets in the container shipping market, these turbochargers increase efficiency and operational flexibility, as well as enabling operators to comply with IMO Tier II emissions regulations with lowest fuel consumptions. Onboard this new ship, and its sister vessels, the four auxiliary engines will each be fitted with a four-stroke TPL67-C turbocharger. To-date, these have been the most in-demand of all ABB turbochargers, with the well-proven reliability that is crucial for the role of auxiliary engines.

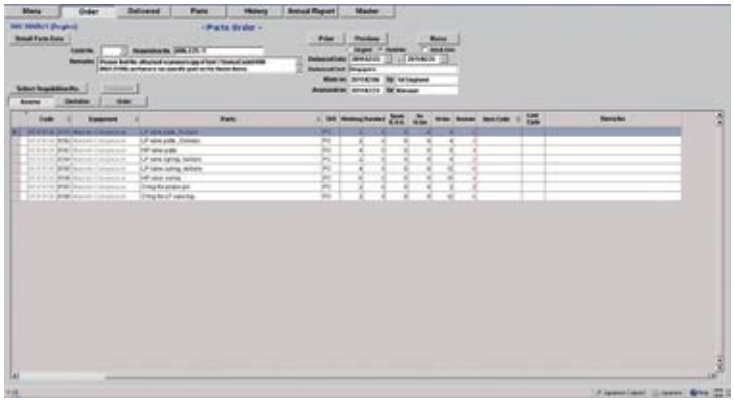
Oliver Riemenschneider, Managing Director, ABB Turbocharging, said "We very much appreciate the strength and duration of our relationship and cooperation with COSCO Shipping Lines over the years. ABB turbochargers have for a long-time been operated onboard its fleets, also the maintenance of more than 300 of these units is managed under ABB service agreements. We look forward to the continuation of this relationship as we deliver our products to power the engines of these new, high capacity ships."

Following the unveiling of the 'Made in China' strategy by the China State Council in 2015, the Ministry of Industry & Information Technology (MIIT) last year published 'The Action Plan for Improving the Marine Equipment Industry's Capability (2016-2020)'. This outlined further the importance and the key tasks for developing China into a shipping and ship building powerhouse. The construction of these eleven new box ships represents continuing progress towards this significant goal.

Allan QingZhou Wang, Head of ABB Turbocharging China, said "This addition in tonnage to the world containership market underlines the high potential to achieve this goal of building China into a great power of shipping and shipbuilding in line with the MIIT ambition. At the same time ABB is recognizing and responding to market demand across Asia, by strengthening our foothold in China."

COSCO Shipping Taurus is 400 meters long, with a width of 58.6 meters, and of the total 20,000 TEU it is equipped for 1,000 TEU of refrigerated capacity. The ship will operate routes from Asia to Europe.

MOL chooses diagnostic monitoring system 'ClassNK CMAXS'



ClassNK's next-generation diagnostic monitoring system "ClassNK CMAXS" has been chosen by Mitsui O.S.K. Lines (MOL) for installation on two more ships operated by the company. The system is now installed on a total of six MOL-operated ships.

The two ships are installed with CMAXS e-GICSX, a system which monitors electrically controlled main engine supplied by Mitsui Engineering & Shipbuilding and CMAXS LC-A for auxiliary engines supplied by DAIHATSU DIESEL MFG. Both CMAXS systems operate simultaneously, gathering information from VDR, data logger and main engine. This information (Big Data) is consolidated on a common platform for analysis and the potential future improvement. The common platform also allows the user to clarify results of machinery diagnostics and troubleshooting using a common interface.

ClassNK CMAXS utilizes sensor data acquired from data logger and VDR among others, and offers diagnoses of onboard machinery and equipment to enable conidition monitoring maintenance and avoid unnecessary downtime. Sensor data acquired by ClassNK CMAXS is integrated into an cloud database, CMAXS Web Service, allowing the information to be shared both on board and on shore. A support service is also available for shipping companies and crew for CMAXS functions and remote monitoring by machinery manufacturers through CMAXS Web Service.

Developed in partnership with DIESEL UNITED, Mitsui Engineering & Shipbuilding, Hitachi Zosen, MAKITA, DAIHATSU DIESEL MFG and Naniwa Pump Mfg, ClassNK CMAXS' revolutionary use of Big Data represents the next step in ship safety and efficiency.

ClassNK Consulting Service continues to support CMAXS LC-A and CMAXS e-GICSX systems to reduce the total lifecycle cost of ships and improve the reliability of machinery with CMAXS partnership machinery manufacturers.

KROHNE

measure

정직한 유량계

the facts

▶ MASS FLOWMETER – OPTIMASS 6400

Entrained Gas Management (EGM) Function

Maintain operation over a wide range of gas fractions, complex flow conditions, and gas & liquid two-phase flow

KORMARINE 2017(국제 조선 및 해양 산업전)

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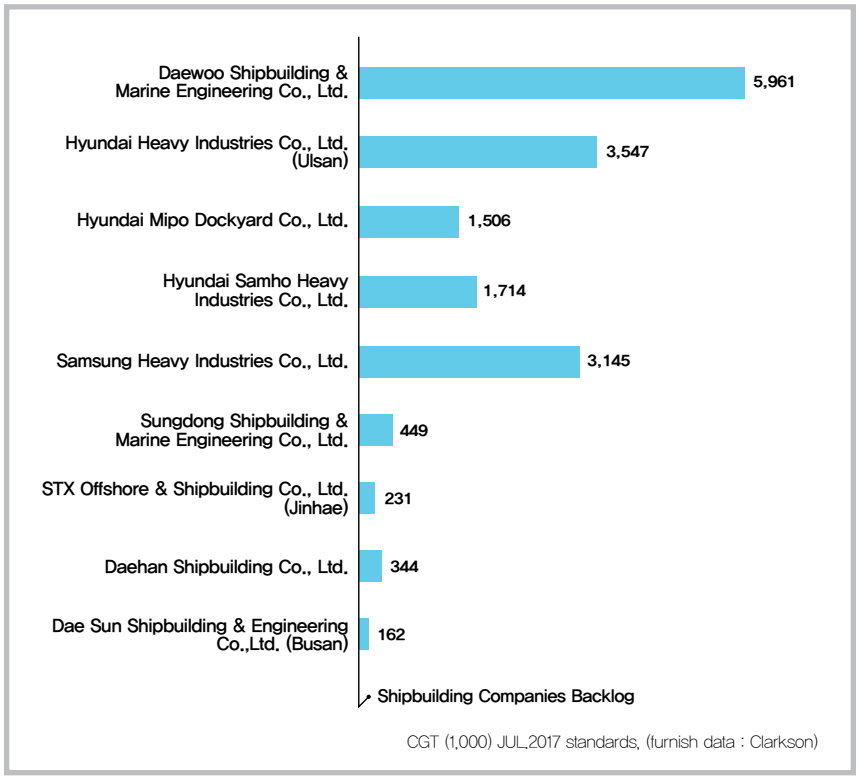
FLUENTA SEIKO

According to Clarkson, global new orders stood at 9.17 million CGT with 321 vessels this year which represents a 30.4% increase from the previous year's level (7.03 million CGT with 304 vessels). By country, Chinese shipyards claimed top spot with 2.90 million CGT with 133 vessels, overtaking Korean shipyards which recorded 2.83 million CGT with 78 vessels. New orders at Japanese shipyards and Italian shipyards amounted to 500,000 CGT (25 vessels) and 740,000 CGT (8 vessels), respectively, trailing behind Korea. Finnish shipyards took the fifth spot with 670,000 CGT (4 vessels).



Although new orders at Chinese shipyards were about twice larger than those at Korean shipyards, the difference was small in terms of CGT, suggesting that more high value-added vessels were ordered to Korean shipyards. Chinese shipyards took top spot in new order quantity as Chinese shipping companies placed orders primarily at Chinese shipyards. Meanwhile, Korean shipyards showed strong performance in LNG carrier and oil tanker markets, wining orders for 8 LNG carriers and 1 offshore facility out of 13 LNG-related vessels and facilities. In particular, Korean shipyards clinched order for 27 VLCCs (Very Large Crude Carriers) this year, dominating the oil tanker market.

Here, we take a close look at the performance of major domestic shipyards, the world's leading players with strong growth in new orders as shown currently in the Clarkson data, such as Hyundai Heavy Industries (HHI), Daewoo Shipbuilding & Marine Engineering (DSME), Samsung Heavy Industries (SHI) and others based on the order backlog data.

Photo: STX Offshore & Shipbuilding Co., Ltd.

Korea Shipbuiling Orders awarded to domestic shipyards in 2015~2017

Data		Type	Number of vessel	Amount	Ship owner	Delivery	Shipyard
2015	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
		319,000 DWT VLCCs	2 vessels	USD 198 million	Maran Tankers Management, Greece	-	Daewoo Shipbuilding & Marine Engineering
	Feb	158,000 tons 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
		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
	Mar	38,000m³ liquefied petroleum gas and ammonia carriers	2 vessels	-	Asian ship owner	-	Hanjin Heavy Industries & Construction
		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
	Apr	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
		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
	May	156,000 tons 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
	Jun	300,000 DWT VLCCs	10 units (5 optional vessels)	USD 1 billion	The National Shipping Company of Saudi Arabia	2017s	Hyundai Samho Heavy Industries
		19,630 TEU container ships	11 vessels	USD 1.1 billion	Maersk Line A/S, Denmark	2018s	Daewoo Shipbuilding & Marine Engineering
		Tankers	2 vessels	-	Arcadia 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
		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
	Jul	173,400m³ LNG Carriers	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
	Aug	Product Carriers	4 vessels	USD 144 million	Scorpio Tankers, U.S.A	The first of 2017	Hyundai Mipo Dockyard
	Sep	84,000m³ LPG Carriers	2 vessels	-	Asia ship owner	2017s	Daewoo Shipbuilding & Marine Engineering
		74,000 tons LR1 tankers	4 units (2 optional vessels)	-	Greece ship owner	The second half of 2017	STX Offshore & Shipbuilding
	Oct	173,400m³ LNG Carriers	2 vessels	USD 400 million	BW Group, Singapore	The first half of 2019	Daewoo Shipbuilding & Marine Engineering
		84,000m³ LPG carriers	2 vessels	-	Asia ship owner	2017s	Daewoo Shipbuilding & Marine Engineering
	Nov	319,000 tons VLCCs	2 vessels	-	Maran Tankers Management, Greece	2017s	Daewoo Shipbuilding & Marine Engineering
	Dec	114,000 tons products carriers	2 vessels	-	Sea Tankers Group	2017. September	Daehan Shipbuilding

2016	Feb	158,000 DWT oil products carriers	2 vessels	-	Ditas Shipping, Turkey	2018s	Hyundai Heavy Industries
	May	40,000 DWT products carriers	2 vessels	-	Greece ship owner	-	Hyundai Mipo Dockyard
		159,000 DWT oil tankers	2 vessels	-	AMPTC, Kuwait	2018s	Hyundai Heavy Industries
	Jun	75,000 tons product carriers	4 vessels	USD 170 million	Tsakos, Greece	The first of 2018	Sungdong Shipbuilding & Marine Engineering
		180,000m³ LNG carriers	2 vessels	USD 400 million	SK E&S, Korea	The first of 2019	Hyundai Heavy Industries
		50,000 tons bulk carrier	1 vessels	-	Ilshin Marine Transport, Korea	The end of 2017	Hyundai Mipo Dockyard
	Jul	31,000 tons Car ferry	1 vessels	-	Weidong Ferry	The end of 2018	Hyundai Mipo Dockyard
	Sep	180,000m³ LNG carriers	2 vessels	USD 367 million	Europe ship owner	-	Samsung Heavy Industries
	Oct	2,800 ton convoy	1 vessel	USD 297 million	Korean Navy	The end of 2020	Daewoo Shipbuilding & Marine Engineering
		2,600 ton frigates	2 vessels	USD 324 million	Department of National Defense, Philippines	2020s	Hyundai Heavy Industries
		Patrol killer medium	3 vessels	USD 173 million	Korean DAPA	2019s	Hanjin Heavy Industries & Construction
		157,000 DWT oil tankers	2 vessels	USD 220 million	Viken, Norway	-	Samsung Heavy Industries
		113,000 DWT oil tankers	2 vessels				
		157,000 DWT oil tankers	3 vessels	USD 170 million	Nordic American Tankers Limited, Norway	-	Samsung Heavy Industries
	Dec	14,500 TEU container ships	4 vessels	USD 700 million	IRISL, Iran	2th quarter 2018	Hyundai Heavy Industries
		49,000 tons products carriers	6 vessels				Hyundai Mipo Dockyard
		LNG Bunkering Vessel	1 vessel	-	Bernhard Schulte, Germany	The end of 2018	Hyundai Mipo Dockyard
2017	Jan	114,000 tons product carriers	2 vessels	-	SFL, France	3th quarter of 2019	Daehan Shipbuilding
		50,000 tons oil tankers	1 vessel	-	Fukujin Kisen, Japan	-	Hyundai Mipo Dockyard
	Feb	RO-RO Ship	2 vessels	USD 117.8 million	CLdN, Luxembourg	The first of 2017	Hyundai Mipo Dockyard
		50,000 DWT product carriers	1 vessel	-	Greece ship owner	-	Hyundai Mipo Dockyard
		300,000 DWT VLCCs	2 vessels	-	Enesel, Greece	The end of 2018	Hyundai Heavy Industries
	Mar	173,400m³ LNG carriers	2 vessels	-	Europe ship owner	The end of 2019	Daewoo Shipbuilding & Marine Engineering
		114,000 tons oil tankers	4 vessels	USD 240 million	Sovcomflot, Russia	3th quarter of 2018	Hyundai Samho Heavy Industries
		21,000m³ LPG carriers	2 vessels	-	Solvang ASA, Norway	2019s	Hyundai Samho Heavy Industries
	Apr	VLCCs	1 vessel	-	Neda Maritime, Greece	2019s	Hyundai Samho Heavy Industries
		318,000 tons VLCCs	3 vessels	USD 250 million	Maran Tankers Management, Greece	2018s	Daewoo Shipbuilding & Marine Engineering
	May	300,000 DWT VLCCs	2 vessels	-	Sentek Marine, Singapore	The first of 2019	Hyundai Samho Heavy Industries
		VLCCs	4 vessels	-	Oceania ship owner	The first of 2019	Samsung Heavy Industries
		11,200 DWT product oil & chemical tanker	3 vessels	-	Korea ship owner	The end of 2018	STX Offshore & Shipbuilding
		7,500m³ LNG carriers	2 vessels	USD 100 million	Korea Line, Korea	The end of 2019	Samsung Heavy Industries
	Jun	114,000 DWT oil tankers	2 vessels	-	Metrostar Management, Greece	The end of 2018	Daehan Shipbuilding
		RO-RO Ship	2 vessels	USD 117.8 million	CLdN, Luxembourg	The end of 2019	Hyundai Mipo Dockyard
	Jul	318,000 tons VLCCs	4 vessels	-	Maran Tankers Management, Greece	-	Daewoo Shipbuilding & Marine Engineering

*Note : Based on the press release and public announcements of each shipyards, internal estimation of Monthly KORSHIP (estimation until Jul 15, 2017)

Offshore plant orders awarded to domestic shipyards in 2011-2017

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
	Sep	Semi-submersible Rig	2 units	USD 1.1 billion	Songa Offshore, Norway	Second hallf 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
	Oct	Fixed Offshore Platform	-	USD 1.4 billion	Chevron, U.S.A	Second half of 2014	Daewoo Shipbuilding & Marine Engineering
		Drillship	1 unit	USD 550 million	Offshore drilling company, Americas	-	Daewoo Shipbuilding & Marine Engineering
		Platform Supply Vessel	1 unit	-	Troms Offshore Supply AS, Norway	First half of 2013	STX OSV
		Offshore Plant Module	2 units	-	-	From 2013 to 2014	STX OSV
		Platform Supply Vessel	4 units	KRW 2 trillion	Island Offshore, Norway	Consecutively from the 3rd quarter	of 2013 to the 1st quarter of 2014
	Nov	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
		Semi-submersible rig	1 unit	USD 620 million	Odfjell, Norway	by mid 2014	Daewoo Shipbuilding & Marine Engineering
	Feb	LNG-FSRU	-	-	Hoegh, Norway	-	Hyundai Heavy Industries
	Mar	Offshore Platform	1 unit	USD 560 million	DONG E&P A/S, 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
	Jun	Semi-submersible drilling rig	1 unit	USD 700 million	Fred Olsen Energy, Norway	March 2015	Hyundai Heavy Industries
		LNG-FPSO	1 unit	-	Petroliam Nasional Berhad, Malaysia	June 2015	Daewoo Shipbuilding & Marine Engineering
	Jul	Drillship	1 vessel	USD 645 million	Ensco plc	-	Samsung Heavy Industries
		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
	Nov	Drillship	1 vessel	USD 700 million	-	2nd half of 2015	STX Offshore & Shipbuilding
	Dec	offshore platform (Top side)	1 unit	USD 1.77 billion	Statoil, Norway	The end of 2016	Daewoo Shipbuilding & Marine Engineering
2013	Jan	Gas Production Platform (topside)	1 unit	USD 1.1 billion	Statoil, Norway	Mar 2016	Hyundai Heavy Industries
		LNG-FSRU	1 vessel	-	BW Maritime, Singapore	2015	Samsung Heavy Industries
	Mar	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
	Jun	Ultra-deepwater Drillship	1 unit	USD 515 million	Ensco, United Kingdom	Third quarter of 2015	Samsung Heavy Industries
		FPSO	1 unit	USD 3.0 billion	Nigeria	Second half of 2017	Samsung Heavy Industries
		Jack-up Rig	2 units	USD 1.3 billion	Statoil, Norway	-	Samsung Heavy Industries
	Jul	Ultra-deepwater Drillship	2 units	USD 600 million	Seadrill, Norway	Second half of 2015	Samsung Heavy Industries
		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
	Sep	Drillship	1 unit	USD 550 million	-	Dec of 2015	Samsung Heavy Industries
		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
	Oct	Drillship	2 vessels	USD 1.24 billion	-	Second half of 2015	Daewoo Shipbuilding & Marine Engineering
		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
2014	Feb	LNG-FPSO	1 unit	USD 1.45 billion	Petroliam 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
	Nov	Fixed Offshore Platform & Submarine Cable	4 units	USD 1.9 billion	ADMA-OPCO	Second half of 2019	Hyundai Heavy Industries
		Offshore Platform	1 unit	USD 700 Million	Royal Dutch Shell	-	Samsung Heavy Industries
		FPU	1 unit		-	-	
2015	Jun	Offshore Platform	2 unit	USD 1.06 billion	Statoil, Norway	The end of 2018	Samsung Heavy Industries
	Jul	FLNG	3 unit	USD 4.7 billion	Royal Dutch-Shell	-	Samsung Heavy Industries
2016	Dec	LNG-FSRU	1 unit	USD 587 million	Maran Gas Maritime, Greece	First half of 2020	Daewoo Shipbuilding & Marine Engineering
2017	Jan	FPU	1 unit	USD 1.27 billion	British Petroreum, United Kingdom	Augst of 2020	Samsung Heavy Industries
		FSRU	1 unit	USD 230 million	Höegh LNG, Norway	May of 2019	Samsung Heavy Industries
		FSRU	1 unit	USD 230 million	Höegh LNG, Norway	4th quarter of 2018	Hyundai Heavy Industries
	Feb	FSRU	1 unit	-	Turkey	-	Hyundai Heavy Industries
	Jun	FLNG	1 unit	USD 2.50 billion	ENI, Italy	-	Samsung Heavy Industries

*Note : Based on the press release and public announcements of each shipyards, internal estimation of Monthly KORSHIP (estimation until Jul 15, 2017)

‘DreamShip’ unfolds the sail!

- Investment resumes in offshore development

Drillship is a high value-added vessel requiring advanced technology and designing capability. It is capable of operating in water depths exceeding 3,000m, which is the greatest competitive edge. Recently, drillship can operate in water depth of 2.2 mile and drill up to 7 miles below sea level. For that reason, drillship is called ‘DreamShip’ in the offshore energy development industry.

Experts agree that the long-term market prospects are not bad despite downturn in offshore plant segment amid sustained low oil prices. Offshore plant industry still remains attractive as future growth engine in case of depletion of onshore resources despite the spotlight recently turned on shale gas that requires low cost of exploitation.


Transocean


MAERSK DRILLING
MAERSK VIKING


NOBLE GLOBETROTTER II
NOBLE


STENA DRILLMAX
Stena


WEST AURIGA
Seadrill
WEST AURIGA


OCEAN RIG
OCEAN RIG CORCOVADO

New Product

DRY and WET Pneumatic Vacuum Cleaner

Cktech Co., Ltd.

Cktech is specialized company of industrial pneumatic equipment. CKAirClean developed to dry and wet type no electric shock / no fire air vacuum cleaner operated by compressed air used in the industrial field (Model: CKAirClean, CK-20/40/70).

Apply the product to the following IMPA CODE, CKAirClean can use at any time without restrictions on weather and place. CKTech's CKAirClrean technology is inhale and remove to wet (moisture / oil), dry (dust / flour / dregs) contaminants at a time. It is very convenient. Also, the technology is can use for facility cleaning of shipyard / onshore plant / offshore plant / chemical plant, general plant.

CKAirClean does not have an electric motor, it works by compressed air, so it is no danger of electric shock and fire and it's can use to outdoors in rain or snow. Because there is no electric parts, it is no need to replace parts due to corrosion or heat generation, and maintenance cost is low due to its strong durability.

An official from CKTech said, "CKAirClean spray water on contaminated place by high pressure washer and it push to another place or inhale to contaminant by vacuum cleaner. It spray water by High pressure and decompose contaminant and it can move to another place but it can't contain contaminants. But CKAirClean is eco-friendly technology that inhale pollutants by compressed air and prevents secondary pollution to the surrounding environment. And it is a safe technology without danger of electric shock and fire."

-TEL: +82-(0)507-1444-1302
-http://cktech.modoo.at

New SIMRAD® AP48 Autopilot Controller

Navico Inc.

Navico announced the new Simrad AP48 Autopilot Controller - a premium dedicated control head for Simrad Continuum autopilot systems, featuring an optically bonded 4.1-inch full colour display and modern glass-helm styling.

The AP48 provides an ultra-wide 170-degree viewing angle and full access to advanced Continuum steering features including Automated Turn Patterns, No Drift steering and Depth Contour Tracking, in addition to a large aluminium rotary control dial and dedicated dodge keys for easy incremental heading adjustment.

The new AP48 offers users the same intuitive interface as the compact AP44, but with a larger rotary control dial, dedicated 'dodge' keys, and other extended keypad controls. The rotary dial provides precise steering control, while dodge keys enable instant heading changes in one-degree or ten-degree increments. Designed for optimal control in all conditions, the AP48's large buttons are ideal for use with wet or gloved hands.

Designed to do much more than keep a vessel on course, the new controller gives users easy access to a range of built-in turn patterns to assist with fishing, diving, or just making a quick and efficient U-turn. For greater control, boaters can customize turn patterns to execute complex spirals, zig-zags, and other useful manoeuvres.

With a compatible echosounder module to enable depth contour tracking, the AP48 can also be set to auto-steer to maintain a constant water depth beneath the vessel – perfect for following depth contours while fishing or cruising, without having to define complex multi-waypoint routes.

Featuring a simple on-screen commissioning process including, dockside configuration and sea trial, the AP48 offers automatic tuning to ensure optimal auto-steering performance. Automatic compass calibration is available with the Simrad Precision-9 solid-state compass, further simplifying autopilot setup, while ensuring heading accuracy.

-TEL: +64-9-925-4500 (Navico Asia Pacific)
-http://www.navico-commercial.com

New Product

Plantweb™ Digital Ecosystem Expansion

Emerson Automation Solutions

Emerson announced a new dual-mode wireless gateway which supports both IEC 62951 WirelessHART and ISA100.11a industrial wireless communications standards.

With more than 31,000 WirelessHART installations worldwide and over 9.1 billion operating hours, Emerson leads the automation industry in wireless networking. Emerson's wireless portfolio helps customers extend their automation ecosystem for improved operating reliability with sensing, monitoring and control technologies such as temperature, pressure, level, corrosion, flow, acoustic, gas and vibration, plus wireless adapters for valve positioners and digital valve controllers.

Serving as the backbone of a wireless infrastructure, wireless gateways and access points increase the amount of real-time information available to automation systems, applications and analytics tools to help organizations improve responsiveness and decision making. Critically, they must possess robust, "always-on" security to limit network vulnerability. When deployed efficiently, they can require the least hardware necessary to keep costs low while operating reliability high. Lastly, customers consistently seek ease-of-deployment as a key consideration.

A future release of Emerson's dual-mode wireless gateway will be integrated into the Cisco 1552WU, a combined WirelessHART and WiFi solution for industrial hardened wireless, and will seamlessly integrate into Emerson's industry-leading security and network management tools, including Emerson's Plantweb Insight applications for Industrial IoT which help industrial facilities improve operations and maintenance by simplifying asset monitoring.

-TEL: +82-2-3438-4600
-http://www.emersonprocess.co.kr

플랜트 운영 고도화 위한 시스템 플랫폼 2017

슈나이더 일렉트릭 소프트웨어 코리아

슈나이더 일렉트릭 소프트웨어 코리아는 전반적인 플랜트 데이터 체계를 고도화해 운영 효율성과 생산성을 제고하는 '시스템 플랫폼 2017'을 출시했다. 원더웨어(Wonderware) 기반의 시스템 플랫폼 2017은 산업용 사물인터넷(IIoT) 기술을 접목시킨 데이터 표준 플랫폼이다. 방대한 양의 공정 데이터를 수집 및 분석하고 이를 시각화해 현장 운영진뿐만 아니라 경영진도 효율적으로 플랜트를 운영하고 최적의 비즈니스 의사결정을 하도록 지원한다.

시스템 플랫폼 2017은 플랜트 모델 기반의 계층 구조 형태로 플랜트의 하위단부터 상위단까지 데이터를 통합적으로 중앙 관리한다. 하위 센서 데이터부터 이기종의 PLC 및 설비 데이터를 통합하고 이 플랫폼 위에 고객의 요구에 따라 스카다(SCADA), 생산관리시스템(MES)과 설비관리 정보시스템(CMMS) 등 다양한 공정 관리 및 제어 시스템을 접목시킨다. 이 기본 정보를 바탕으로 운전자 교육 시스템(OTS)과 프로세스 공정을 최적화하는 확장 솔루션까지 제공한다.

또한 시스템 플랫폼 2017은 데이터를 그래픽 등의 시각화로 간편하게 확인할 수 있고 손쉬운 인터페이스와 스마트한 네비게이션이 가능하다. 게다가 가치 창출 시간(Time-to-value)을 가속화하고 유연한 실행 모델을 선보여 기업이 더욱 빠르게 확장할 수 있으며, IIoT, 클라우드와 모바일 기술과 같은 차세대 기술을 쉽게 플랜트에 접목시킬 수 있다.

한편 시스템 플랫폼 2017은 에코스트럭처 인더스트리(EcoStruxure for Industry)를 비롯한 슈나이더 일렉트릭의 인더스트리 소프트웨어 포트폴리오와 통합된다. 공정 최적화는 물론 에너지 관리를 개선하여 운영 생산성과 에너지 효율성을 함께 제고한다.

-TEL: +82-2-1588-2630
-http://www.schneider-electric.co.kr

KOMEA (Korea Marine Equipment Association)
Member List

AMIR Marine Co., Ltd.
Location : YEONGDO-GU, BUSAN
Website : www.amir.co.kr
Main Products : Piston Ring
TEL : +82 51 413 9600

AMS Co., Ltd.
Location : HAEUNDAE-GU, BUSAN
Website : www.albatros.co.kr
Main Products : Unit Toilet/Wall & Celling Panel, Heat Exchangers (Plate Shell & Tube), etc.
TEL : +82 51 293 1035

A-TECH
Location : GANGSEO-GU, BUSAN
Website : www.atech2004.co.kr
Main Products : Small davit, Air motor, Air winch
TEL : +82 51 832 0723

BC TAECHANG IND. Corp.
Location : JUNG-GU, BUSAN
Website : www.bcinternational.co.kr
Main Products : Ultimate solution for onboard crew maintenance, Deck scaling machine
TEL : +82 51 442 6191

Bethel Engineering Co., Ltd.
Location : NAMYANGJU-SI, GYEONGGI
Website : www.nmg.kr
Main Products : Magic Grating (Steel grating)
TEL : +82 31 593 2712

B-I INDUSTRIAL Co., Ltd.
Location : GANGSEO-GU, BUSAN
Website : www.b-i.co.kr
Main Products : Fire Detection System, Gas Detection System, Navigation Watch Alarm System, Moisture Detection System
TEL : +82 51 441 5670

BIP INDUSTRIES Co., Ltd.
Location : GEUNJEONG-GU, BUSAN
Website : 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

BOGO Co., Ltd.
Location : SAHA-GU, BUSAN
Website : www.bogoco.co.kr
Main Products : Telephone system, Lighting fixture
TEL : +82 51 294 7771

BO MYUNG METAL Co., Ltd.
Location : GANGSEO-GU, BUSAN
Website : www.bmmetal.co.kr
Main Products : Cooper & Cooper-Alloy Pipes & Plates, Fittings, Flanges
TEL : +82 51 266 4101

Bumhan Industries Co., Ltd.
Location : CHANGWON, GYUNGNAM
Website : www.bumhan.com
Main Products : Air compressor, N2 generator, High pressure control valve
TEL : +82 55 251 6070

BY CONTROLS, Inc.
Location : GIMHAE-SI, GYUNGNAM
Website : www.bycontrols.com
Main Products : Watertight door, Pilot door, Hydaulic hatch, etc.
TEL : +82 55 345 6110

BYT Co., Ltd.
Location : GANGSEO-GU, BUSAN
Website : www.byhd.co.kr
Main Products : HARDWARE, OUTFITTING, MARINE OUTFITTING, NEW PRODUCTS
TEL : +82 51 974 5000

CENTURY Corp.
Location : YANGSAN-SI, GYUNGNAM
Website : www.capeind.com
Main Products : Cylinder liner, Man B&W Sulzer (Wartsila) Type www.capeind.com YANGSAN-SI, GYUNGNAM
TEL : +82 55 370 1234

CHK Co., Ltd.
Location : GANGSEO-GU, BUSAN
Website : www.chkj.co.kr
Main Products : Ref. container socket, Juction box
TEL : +82 51 831 9500

ChungSol Marine Co., Ltd.
Location : GANGSEO-GU, BUSAN
Website : 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.
Location : GIMHAE-SI, GYUNGNAM
Website : www.koweld.co.kr
Main Products : Welding auto carriage, LWS, etc.
TEL : +82 55 329 9500

CMR KOREA Co., Ltd.
Location : KUMJUNG-GU, BUSAN
Website : 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.
Location : SAHA-GU, BUSAN
Website : 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.
Location : POCHEON-SI, GYEONGGI
Website : www.cooler.co.kr
Main Products : Heat exchanger
TEL : +82 31 532 9667

DAE KWANG IND Co., Ltd.
Location : GANGSEO-GU, BUSAN
Main Products : SUS PIPE FITTING FLANGE
TEL : +82 51 831 5886

Daechun Industrial Co., Ltd.
Location : GIMHAE-SI, GYUNGNAM
Website : www.daechun.co.kr
Main Products : Multi-core tube, Stainless steel tube
TEL : +82 55 345 2288

DAEHA Co., Ltd.
Location : GANGSEO-GU, BUSAN
Website : www.daehatech.co.kr
Main Products : Hydraulic Pressure Testing Equipment, Cylinder, Pump, Torque Wrench
TEL : +82 51 326 1870

DAEJIN SAT Co., Ltd.
Location : ULJU-GUN, ULSAN
Website : www.daejinsat.com
Main Products : Ceiling panel
TEL : +82 52 225 2361

DAEJUNG Co., Ltd.
Location : SASANG-GU, BUSAN
Website : www.daejung.net
Main Products : Fiber Rope, Pet/PP Mat, Sports Net
TEL : +82 51 304 2511

DAEJUNG VALVE Co., Ltd.
Location : DALSEO-GU, DAEGU
Website : www.djvalves.com
Main Products : Butterfly Valves, Oil Field flow-line components, Control Valves, Actuators, Special Valves
TEL : +82 53 584 2276

Daemmstoff Industrie Korea Ltd.
Location : SAHA-GU, BUSAN
Website : 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.
Location : SAHA-GU, BUSAN
Website : www.daeyang.co.kr
Main Products : Lighting fixtures, Instruments, SAUV, UUV
TEL : +82 51 200 5221

DAEYANG INSTRUMENT. Co., Ltd.
Location : SAHA-GU, BUSAN
Website : http://dic.daeyang.co.kr/08_affiliate/affiliate_01.php
Main Products : Precision instruments - Anemometer, Rudder angle indicator, etc.
TEL : +82 51 200 5212

DaiHan Anchor Chain MFG. Co., Ltd.
Location : NAM-GU, INCHEON
Website : www.dhac.co.kr
Main Products : Anchor chain, Offshore mooring stud, etc.
TEL : +82 32 862 0091

DHMC Co., Ltd.
Location : GIMHAE-SI, GYUNGNAM
Website : www.dhmc-rudder.com
Main Products : Rudder, Block, etc.
TEL : +82 55 346 3663

DECKWIN. Co.
Location : YEONGDO-GU, BUSAN
Website : www.deckwin.com
Main Products : Cable winch, Windlass, Mooring Winch, Capstan etc.
TEL : +82 51 405 7890

DINGJIN MPTECH
Location : GIMHAE-SI, GYUNGNAM
Main Products : Part for Marine Engine, Shaft System
TEL : +82 55 720 7000

DK Tech Corporation
Location : GIMHAE-SI, GYUNGNAM
Website : www.dklok.com
Main Products : Instrumentation fitting & valve
TEL : +82 55 338 0114

DMC Co., Ltd.
Location : GIMHAE-SI, GYUNGNAM
Website : www.dongnam-crane.co.kr
Main Products : Offshore crane, Deck cranes, Floating cranes
TEL : +82 55 720 3000

DNP Co., Ltd.
Location : GANGSEO-GU, BUSAN
Website : www.dnpco.kr
Main Products : Accommodation system
TEL : +82 51 831 4551

Dong Hae M-Tech Co., Ltd.
Location : SEO-GU, INCHEON
Website : www.east-sea.co.kr
Main Products : Grab bucket, Orange grab, Motor grab, Wood grab, etc.
TEL : +82 32 583 8061

Dong Kang M-Tech Co., Ltd.
Location : GANGNAM-GU, SEOUL
Website : www.dkmtech.com

Main Products : Water jet, Night navigator
TEL : +82 2 553 0181

Dong Woo Machinery & Engineering Co., Ltd.
Location : CHANGWON, GYUNGNAM
Main Products : Engine room overhead crane, F.O hose handling davit, etc.
TEL : +82 55 295 3261

Dong-A Valve Ind. Co.
Location : GANGSEO-GU, BUSAN
Website : 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.
Location : GANGSEO-GU, BUSAN
Website : www.dbmarine.co.kr
Main Products : MARINE FIRE DETECTION & ALARM SYSTEM, MARINE FIRE EXTINGUISHING SYSTEM
TEL : +82 51 205 1585

DONGHWA ENTEC
Location : GANGSEO-GU, BUSAN
Website : www.dh.co.kr
Main Products : Heat exchanger, Plate cooler, etc.
TEL : +82 51 970 1000

DongHwa Pneutec Co., Ltd.
Location : GANGSEO-GU, BUSAN
Website : www.dhkomp.co.kr
Main Products : Air/gas compressor
TEL : +82 51 974 4800

D-I Industrial. Co., Ltd.
Location : JINJU-SI, GYEONGNAM
Website : www.d-i.co.kr
Main Products : Marine Transmission, Power Take off, Steering System
TEL : +82 55 760 5500

DooSan Engine Co., Ltd.
Location : CHANGWON, GYUNGNAM
Website : www.doosanengine.com
Main Products : Marine diesel engine, Diesel engines for power generation
TEL : +82 55 260 6000

DRB Holding Co., Ltd.
Location : YEUNGDEUNGPO-GU, SEOUL
Website : www.drbworld.com
Main Products : Marine rubber fender, Industrial rubber sealing & gasket, Industrial rubber track, Rubber damper
TEL : +82 2 2168 9133

ELSCOM Inc.
Location : SASANG-GU, BUSAN
Website : www.elscom.co.kr
Main Products : Explosion-Proof Products, Distribution Board Components, Solar Cable/PV JB
TEL : +82 51 329 8990

Emerson Process Management Korea Ltd.
Location : SEONGNAM-SI, GYEONGGI
Website : www.emersonprocess.co.kr
Main Products : Pressure, Temperature, Level, Analytical & Flow Measurenet, Valves, Tank radar level guaging, etc.
TEL : +82 2 3438 4600

ENTECH (Engineering & Technology Co., Ltd.)
Location : CHANGWON-SI, GYEONGNAM
Website : www.tkhic.com
Main Products : Engine Bed/Frame box, Crane Pedestal, Tubular (SAW Pipe), Air Reservoir, Jacket, Pile, Wind Tower
TEL : +82 70 4628 8844

ESAB SeAH Corp.
Location : CHANGWON, GYUNGNAM
Website : www.esab.co.kr
Main Products : Flux cored wire
TEL : +82 55 289 8111

Flutek, Ltd.
Location : SEONGSAN-GU, GYEONGNAM
Website : 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.
Location : GANGSEO-GU, BUSAN
Website : www.thefriend.co.kr
Main Products : Engine valve spindle, Cable tray
TEL : +82 51 974 7911

GASTRON Co., Ltd.
Location : GUNPO-SI, GYEONGGI
Website : www.gastron.com
Main Products : Installation-Type Detector, Portable Gas Detector, Acid Leak Detecting Paint, Alarm Signalling
TEL : +82 31 490 0800

G.S HIGH-TECHER Co., Ltd.
Location : MIRYANG-SI, GYENGNAM
Website : http://gshightecher.koreasme.com
Main Products : Air vent head, Convex coupling
TEL : +82 51 832 0456

GENERAL MARINE BUSINESS
Location : NAM-GU, INCHEON
Website : www.gmbmarine.com
Main Products : Marine system (ship shore comm. system, emergency shutdown system, etc.), Defense Eng. (Control & monitoring system integration, etc.),Manufacturing & services (new shipbuilding, module production)
TEL : +82 52 270 3500

GESKO Co., Ltd.
Location : GANGSEO-GU, BUSAN
Main Products : CNG Transportation&Refilling, Fire Fighting system, Engineering for Fire fighting system & Ballast treatment system, Annual inspection
TEL : +82 51 973 9913

GS-Hydro Korea Ltd.
Location : GANGSEO-GU, BUSAN
Website : www.gshydro.com
Main Products:Flare flange system, Retaining ring system
TEL : +82 51 266 8221

TECH FLOWER Co., Ltd.
Location : SASANG-GU, BUSAN
Website : www.haean21.com
Main Products : Marine crane, Deck machinery
TEL : +82 51 320 8222

Haewon Ind. Co., Ltd.
Location : SAHA-GU, BUSAN
Website : www.haewon.net
Main Products : Water seal, Inflatable/mating ring
TEL : +82 51 831 4600

Halla Industrial Co., Ltd.
Location : SAHA-GU, BUSAN
Website : www.hallaiq.co.kr
Main Products : Non seal canned motor pump, Gear pump
TEL : +82 51 264 2201

Han Jo Co., Ltd.
Location : YOUNGDO-GU, BUSAN
Website : www.hanjoms.co.kr
Main Products : Lubication oil filter, Fuel oil filter, Filter elements
TEL : +82 51 414 7201

Hankook Flexible Co.
Location : SASANG-GU, BUSAN
Website : www.hkflex.com
Main Products : Metalic flexible hose, Metallic expansion joint, Manufacturing of Metalic flexible hose assemblies
TEL : +82 51 508 6291

HanKuk Miboo Co., Ltd.
Location : GANGSEO-GU, BUSAN
Website : www.hankukmiboo.co.kr
Main Products : Spiral duct, Cold chamber, Deck covering, Level
TEL : +82 51 263 3621

HANLAIMS Co., Ltd.
Location : GANGSEO-GU, BUSAN
Website : www.hanlaims.com
Main Products : Instruments (Level gauge/Level switch) Tank remote sounding system/Cargo monitoring system, valve
TEL : +82 51 601 7016

HANSHIN ELECTRONICS Co., Ltd.
Location : YOUNGDO-GU, BUSAN
Website : www.ehanshin.com
Main Products : Public address sys., Telephone sys.
TEL : +82 51 412 5551

HANSUN ENGINEERING Co., Ltd.
Location : GANGSEO-GU, BUSAN
Website : www.slok.co.kr
Main Products : Instrument Tube Fittings, Instrument Valves, Filters, Condensate Pot
TEL : +82 51 899 6700

HEARTMAN Co., Ltd.
Location : GANGSEO-GU, BUSAN
Website : www.heartman.co.kr
Main Products : Fuel injection nozzle for marine diesel engine, Fuel injection plunger ass'y for marine diesel engine
TEL : +82 51 264 8826

HI AIR KOREA Co., Ltd.
Location : GIMHAE-SI, GYUNGNAM
Website : www.hiairkorea.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

Hi Tech Co., Ltd.
Location : GYUNGJU-SI, GYUNGBUK
Main Products : T-Bar, Gas Protect Plate
TEL : +82 54 776 5310

HOSEUNG ENTERPRISE Co., Ltd.
Location : GANGSEO-GU, BUSAN
Website : www.hosent.co.kr
Main Products : Sewage Treatment System, Plasma Bilge Separator, E/R Package Unit, Tank Package Unit, Ventilator
TEL : +82 51 831 2233

HODU INDUSTRIAL Co.
Location : GANGSEO-GU, BUSAN
Website : 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

Hy-Lok Corporation
Location : GANGSEO-GU, BUSAN
Website : www.hy-lok.com
Main Products : Tube fitting & valve, Double lock & bleed valve, Cryogenic valve
TEL : +82 51 970 0800

HYUNDAI HEAVY INDUSTRIES Co., Ltd.
Location : DONG-GU, ULSAN
Website : www.hhi.co.kr
Main Products : Marine diesel engine & machinery w
TEL : +82 52 202 7291

Hyundai Elevator Co., Ltd.
Location : ICHEON-SI, GYEONGGI
Website : www.hyundaielevator.co.kr
Main Products : Lifts (elevator, escalator, moving walk), Logistics automation system, Parking system (automobiles, bicycles), SOC infrastructure systems (platform screen door, automatic folding canopy, gap zero, etc.)
TEL : +82 31 644 5114

Hyundai Fitting Co., Ltd.
Location : GIJANG-GUN, BUSAN
Website : www.hdfco.co.kr
Main Products : Flange
TEL : +82 51 831 0891

HLB Co., Ltd.
Location : ULJU-GUN, ULSAN
Website : www.hdboat.com
Main Products:Lifeboat , GRP rigid-type rescue boat
TEL : +82 52 240 3500

Hyundai Marine Machinery Co., Ltd.
Location : SEO-GU, INCHEON-SI
Website : www.hmmco.co.kr
Main Products : W.O. incinerator, Aux/blower, F.D fan
TEL : +82 32 583 0671

HYUNDAI WELDING Co., Ltd.
Location : GANGNAM-GU, SEOUL
Website : www.hyundaiwelding.com
Main Products : Covered electrode arc welding consumables, Sub-merged arc welding flux & wire, Soild wire arc welding consumables, Flux cored wire, MIG TIG arc welding consumables, Welding machines
TEL : +82 2 6230 6883

I.M.E. CORPORATION
Location : GIMHAE-SI, GYUNGNAM
Website : www.promarine21.com
Main Products : Engine valve spindle & seat
TEL : +82 55 346 1127

ILJIN AND Co., Ltd.
Location : GIJANG-GUN, BUSAN
Website : 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.
Location : SIHEONG-SI, DYEONGGI
Website : www.ilshineng.com
Main Products : Chemical equipment and Tanks
TEL : +82 31 499 4502

ILSUEUNG Co., Ltd.
Location : GANGSEO-GU, BUSAN
Website : www.ilseung.co.kr
Main Products : Sewage Treatment plant, Fresh water generator, Oil purifier
TEL : +82 51 831 4110

IL-SUNG IND. Co.
Location : SASANG-GU, BUSAN
Website : www.ilsunghs.co.kr
Main Products : Hot water calorifier, Silencer (For M/E, G/E, fan), Mist eliminator, Washable
TEL : +82 51 312 4056

International Machine Tool Co.
Location : SASANG-GU, BUSAN
Website : www.clampimt.com
Main Products : Vertical clamp, Horizontal clamp, etc.
TEL : +82 51 314 2038

INTRA PRECISION MANUFACTURE Co., Ltd.
Location : DONG-GU, BUSAN
Website : www.intraspare.co.kr
Main Products : PISTON CROWN, CYLINDER LINER, CYLINDER COVER, PISTON SKIRT, WATER JACKET
TEL : +82 51 466 4635

JHK Inc.
Location : YANGSAN-SI, GYUNGNAM
Main Products : Container fittings, Lashing fittings
TEL : +82 55 346 2225

JINSEONG LINER & PISTON
Location : DAEDEOK-GU, DAEJEON
Website : www.jinseong.com
Main Products : Cylinder liner, Piston
TEL : +82 42 931 8558

JONGHAP MACHINERY Co.
Location : YANGSAN-SI, GYUNGNAM
Website : http://jonghap.biz
Main Products : Sewage treatment plant, T-bar auto welding machine
TEL : +82 55 370 2600

JUNG GONG IND. Co., Ltd.
Location : SAHA-GU, BUSAN
Website : www.jung-gong.com
Main Products : Marine window, Fire-resistant window, Marine wiper, Clear view screen,
TEL : +82 51 261 2911

JUNG-A MARINE
Location : GANGSEO-GU, BUSAN
Website : www.jung-a.co.kr
Main Products : Accommodation ladder, Pilot slant ladder, Wiper, CVS, Sunscreen davit,
TEL : +82 51 970 6420

JUNGSAN ENTERPRISE Co., Ltd.
Location : ULJU-GUN, ULSAN
Website : www.jungsan.com
Main Products : Marine engine parts
TEL : +82 52 254 3290

K.C. Ltd.
Location : GANGSEO-GU, BUSAN
Website : www.iccp-mgps.com
Main Products : Impressed current cathodic protection (I.C.C.P) system, Anti-fouling system (M.G.P.S), Shaft earthing device
TEL : +82 51 831 7720

Kangrim Heavy Industries Co., Ltd.
Location : CHANGWON, GYUNGNAM
Website : www.kangrim.com
Main Products : Marine boiler, Plant, LPG tank
TEL : +82 55 269 7700

Kangrim Insulation Co., Ltd.
Location : GIJANG-GUN, BUSAN
Website : www.kangrim.com
Main Products : Tank, Pipe insulation, Cold provision store
TEL : +82 51 200 6000

Keonchang Industry Co., Ltd.
Location : SAHA-GU, BUSAN
Website : www.keonchang.co.kr
Main Products : TOP CHARGING EQUIPMENT, HOPPER & CONVEYER, SIDE GUIDE ASS'Y
TEL : +82 51 203 0161

Keum Yong Machinery Co., Ltd.
Location : BUK-GU, DAEGU
Website : www.beumyong.com
Main Products : Exh. valve complete with spindle
TEL : +82 53 382 9044

Key Sung Metal Co., Ltd.
Location : GANGSEO-GU, BUSAN
Website : www.deysungmetal.com
Main Products : Marine valve
TEL : +82 51 831 3391

Keystone Valve (Korea)
Location : ANSEONG-SI, GYEONGGI
Website : www.keystonekorea.com
Main Products : All kinds of valves for offshore and shipbuilding
TEL : +82 51 604 4000

KHAN Co., Ltd.
Location : GEOJE-SI, GYEONGNAM
Website : www.khan-offshore.com
Main Products : Engineering services, Sea-trial & commissioning service, Facility for fabricaton, Modification
TEL : +82 55 639 7600

Kion Printing & Packaging Inc.
Location : GIMHAE-SI, GYUNGNAM
Website : www.kiwon.com
Main Products : Marine equipment & vacuum system
TEL : +82 55 313 9913

KOC ELECTRIC Co., Ltd.
Location : GANGSEO-GU, BUSAN
Website : 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

Kokaco Co., Ltd.
Location : YOUNGDO-GU, BUSAN
Website : www.kokaco.com
Main Products : Exhaust Valve Spindle&Bottom Piece Grinding Machine
TEL : +82 51 403 4114

Komeco Co., Ltd.
Location : GIJANG-GUN, BUSAN
Website : www.komeco.net
Main Products : Tacho sys., Electronic equip.
TEL : +82 51 724 5070

Kongsberg Maritime Korea Ltd.
Location : GIJANG-GUN, BUSAN
Website : www.km.kongsberg.com
Main Products : Alarm monitoring system, Cargo monitoring system, Offshore technology
TEL : +82 51 749 8600

KOREA FILTER Co., Ltd.
Location : GIJANG-GUN, BUSAN
Website : www.korea-filter.co.kr
Main Products : STRAINER, OIL FILTER, AIR FILTER, AUTO STRAINER
TEL : +82 51 727 8360

KOTO Technical Co.
Location : SAHA-GU, BUSAN
Website : http://kotofft.com
Main Products : Maintain & repair items (all hydraulic systems, Adjust alignment, centering)
TEL : +82 51 417 8501

KORVAL Co., Ltd.
Location : SAHA-GU, BUSAN
Website : www.korval.co.kr
Main Products : Control Valves, Regulating Valves, Heat Sensor, Shut-Off Valves
TEL : +82 51 790 9700

KSP Co., Ltd.
Location : GANGSEO-GU, BUSAN
Website : www.kspvalve.com
Main Products : Exhaust valve complete, Exhaust valve spindle
TEL : +82 51 831 6274

KSV (Korea Special Valve) Co., Ltd.
Location : YOUNGDO-GU, BUSAN
Website : www.ksv-valve.co.kr
Main Products : Valve spindle and Valve seat for marine diesel engine
TEL : +82 51 415 4466

KTE Co., Ltd.
Location : GANGSEO-GU, BUSAN
Website : 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.
Location : SAHA-GU, BUSAN
Website : www.kukdongelecom.com
Main Products : Lighting fixture
TEL : +82 51 266 0050

KTMI Co., Ltd.
Location : GANGSEO-GU, BUSAN
Website : www.saejinintech.com
Main Products : Emergency towing system
TEL : +82 51 971 9911

KUKDONG ELECTRIC Co., Ltd.
Location : JINCHEON-GUN, CHUNGBUK
Website : www.nexans.co.kr
Main Products : WIRE All kinds of cables for offshore and shipbuilding including JIS, BS, IEC, DIN, IEEE, etc.
TEL : +82 2 2140 3064

KUMGOKSTEEL INDUSTRY. Co., Ltd.
Location : SEO-GU, INCHEON
Website : www.kgsi.co.kr
Main Products : Steel Gratings, Manhole Covers and Steel Products
TEL : +82 32 564 6759

Kum Kang Precision Co., Ltd.
Location : SAHA-GU, BUSAN
Website : www.kkmarine.co.kr
Main Products : Marine valve, valve for engine, air reservoir tank
TEL : +82 51 262 4894

KANGNAM JEVISCO Co., Ltd.
Location : BUSANJIN-GU, BUSAN
Website : www.jevisco.com
Main Products : Shop primer, Anti-corrosive coatings, Anti-fouling coatings, etc.
TEL : +82 51 892 4221

Kwanglim Marine Tech. Co., Ltd.
Location : GANGSEO-GU, BUSAN
Website : www.klmt.co.kr
Main Products : Steel Door, Hull Apteher Blank, Radar Mast, Hi-Pressure Water Mist Fire Fighting System
TEL : +82 51 313 0055

KWANG SAN Co., Ltd.
Location : GANGSEO-GU, BUSAN
Website : www.kwangsan.com
Main Products : AIR VENT HEAD, EXP. JOINT, HEATING COIL, AIR VENT HEAD, EXP. JOINT, HEATING COIL, PIPE SPOOL, ETC.
TEL : +82 51 974 6316

Kwang Seong Co., Ltd.
Location : GIMHAE-SI, GYUNGNAM
Website : www.ikwangsung.com
Main Products : PIPE CABLE HANGER, SPARE PART SEAT, ETC.
TEL : +82 55 338 2271

Kyung Eun Ceramics Co., Ltd.
Location : GIMHAE-SI, GYUNGNAM
Website : www.ke-ceramics.com
Main Products : Ceramic packing
TEL : +82 55 345 7761

Kyungjin Shipping Co., Ltd.
Location : CHANGWON-SI, GYEONGNAM
Website : www.kyungjinshipping.com
Main Products : Exports & Imports of Marine Equipment, Shipping Agent Service, Shipbroking Service, Trading
TEL : +82 55 224 4383

Kyungsung Industry Co., Ltd.
Location : GANGSEO-GU, BUSAN
Website : www.e-clamp.com
Main Products : LNG carrier sus corner & anchor strips & Pipe clamp, etc.
TEL : +82 51 831 4960

LDC-KOREA Co., Ltd.
Location : HAEUNDAE-GU, BUSAN
Main Products : Traders (Marine Equipment), Ship Repair
TEL : +82 51 266 4037

Leeyoung Industrial Machinery Co., Ltd.
Location : ULJU-GUN, ULSAN
Website : www.leeyoung.co.kr
Main Products : Lashing bridge, T-bulkhead block, Covered-block, Engine casing & funnel, Upper deck & module unit, etc.
TEL : +82 52 231 5800

LHE Co., Ltd.
Location : GIMHAE-SI, GYUNGNAM
Website : www.lhe.co.kr
Main Products : Plate heat exchanger, Fresh water generator
TEL : +82 55 340 0625

LS Cable & System
Location : ANYANG-SI, GYEONGGI
Website : www.lscns.com
Main Products : Power cable, Marine & offshore cable, Telecom cable, SUBMARINE CABLE, WINDSOL, SUPERCONDUCTIVITY
TEL : +82 51 310 6781

LUXCO Co., Ltd.
Location : SAHA-GU, BUSAN
Website : www.luxco.co.kr
Main Products : Electrical equipment for internal combustion engines, Magnetic products, etc.
TEL : +82 51 260 1300

MIN SUNG Co., Ltd.
Location : GANGSEO-GU, BUSAN
Website : 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.
Location : HAMAN-GUN, GYEONGNAM
Website : www.miraewinch.com
Main Products : Winch, Chain Stopper, Capstan
TEL : +82 55 587 8520

MODERN INTECH Co., Ltd.
Location : SASANG-GU, BUSAN
Website : www.mo-dern.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.)
Location : YOUNGDO-GU, BUSAN
Website : www.mrckorea.com
Main Products : Public address system, Auto telephone sys.
TEL : +82 51 414 7891

MSL Compressor Co., Ltd.
Location : POCHEON-SI, GYEONGGI
Website : www.mslcomp.com
Main Products : Breathing air compressor
TEL : +82 31 541 7000

Mt.H Control Valves Co., Ltd.
Location : GANGSEO-GU, BUSAN
Website : www.mth.co.kr
Main Products : Main starting valve, Crankcase relief valve, Cyogenic safety valves & control valve
TEL : +82 51 974 8800

NK Co., Ltd.
Location:SAHA-GU, BUSAN
Website:www.nkcf.com
Main Products:Ballast water treatment sys., CO_2 sys.
TEL:+82 51 200 0152

NOW Co., Ltd.
Location : YANGSAN-SI, GYEONGNAM
Website : http://nowcan.co.kr
Main Products : Duct, Damper, Fitting, Piston, Ring, Cylinder
TEL : +82 55 387 4811

ONNURIPLAN Co., Ltd.
Location : BUCHEON-SI, GYEONGGI
Website : www.onnuriplan.com
Main Products : Dust & Gas Masks, Sanitary Mask Covers, etc.
TEL : +82 32 681 7780

Oriental Precision & Engineering Co., Ltd.
Location : GANGSEO-GU, BUSAN
Website : www.opco.co.kr
Main Products : Crane, Windlass & Mooring Winch, Life Boat Davit
TEL : +82 51 202 0101

OSCG Co., Ltd.
Location : SASANG-GU, BUSAN
Website : www.oscg.net
Main Products : Cable gland and accessories, GRP junction box
TEL : +82 51 305 3910

OTS Co., Ltd.
Location : SUNCHEON-SI, JEONNAM
Website : www.otshi.co.kr
Main Products : Crane, Winch, A-Frame
TEL : +82 61 724 4100

PANASIA Co., Ltd.
Location : GANGSEO-GU, BUSAN
Website : www.worldpanasia.com
Main Products : Ballast water treatment system/level instrument, Seawater coarse filtration/ Emission gas control system, Engineering services
TEL : +82 51 831 1010

Pie Plus Co., Ltd.
Location : GANGSEO-GU, BUSAN
Website : www.piplus.co.kr
Main Products : Crankshaft, Rudder stock, Motor shaft
TEL : +82 51 831 9338

PROSAVE Co., Ltd.
Location : GIMHAE-SI, GYEONGNAM
Website : www.prosave.co.kr
Main Products : Crankcase Explosion Relief Valve, Smart High Velocity Pressure/ Vacuum Relief Valve, Air Release & Vacuum Breaker Valve
TEL : +82 55 313 3511

S&W Co., Ltd.
Location : SAHA-GU, BUSAN
Website : www.snwcorp.com
Main Products : Cam/cam shaft, Valve/seat ring, Engine bolts/ nuts, Bolts
TEL : +82 51 205 7411

S. A. M-Tech
Location : NAMDONG-GU, INCHEO
Website : 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

SG Safety Corp.
Location : PYEONGTAEK-SI, GYEONGGI
Website : www.sgsafety.net
Main Products : Inflatable rubber products, Ship 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.
Location : GANGSEO-GU, BUSAN
Website : www.sam-gong.co.kr
Main Products : Oil purifier, Ship 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

Samin Information System Co., Ltd.
Location : HAEUNDAE-GU, BUSAN
Website : www.saminis.com
Main Products : EcoInspection, Ecoserver Package
TEL : +82 70 7771 2104

SAMKUN CENTURY Co., Ltd.
Location : MIRYANG-SI, GYEONGNAM
Website : www.samkunok.com
Main Products : F.W. supply unit, BWTS, PE coating, Paint
TEL : +82 70 4034 0226

SAMYANG METAL IND. Co., Ltd.
Location : SAHA-GU, BUSAN
Website : www.cuniship.com
Main Products : flanges, fittings
TEL : 82 51 266 6655

Samyoung Machinery Co., Ltd.
Location : GONGJU-SI, CHUNGNAM
Website : www.sym.co.kr
Main Products : Cylinder head, Cylinder liner, Piston & carrier, etc.
TEL : +82 41 840 3000

Samyoung M-TEK Co., Ltd.
Location : HAMAN-GUN, GYEONGNAM
Website : www.symtek.co.kr
Main Products : MBS, Chain wheel, Cylinder cover, etc.
TEL : +82 55 589 7000

SAMYUNG ENC Co., Ltd.
Location : YOUNGDO-GU, BUSAN
Website : www.samyungenc.com
Main Products : AIS/GMDSS radio equip, etc.
TEL : +82 51 601 5555

Sandong Metal Industry Co., Ltd.
Location : GUMI-SI, GYEONGBUK
Website : www.smi-sdhitec.com
Main Products : Manifold, Plug valve, Choke valve, Integral Fittings
TEL : +82 54 472 8311

Saracom Co., Ltd.
Location : YEONGDO-GU, BUSAN
Website : www.saracom.net
Main Products : GMDSS equipment
TEL : +82 51 600 9000

Scana Korea Hydraulic Ltd.
Location : GIMHAE-SI, GYUNGNAM
Website : 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.
Location : CHANGWON, GYUNGNAM
Website : www.sejin89.co.kr
Main Products : Tank top unit, Module unit, Purifier unit, Supply unit, etc.
TEL : +82 55 239 4700

Seobu Electric Ind. Co., Ltd.
Location : SAHA-GU, BUSAN
Main Products : Ground Monitor
TEL : +82 51 264 0670

SEOUL ELECTRIC CABLE Co., Ltd.
Location : UMSUONG-GUN, CHUNGBUK
Website : www.seoulcable.com
Main Products : Offshore & shipboard cables
TEL : +82 43 879 7200

Seun Electric Co., Ltd.
Location : SAHA-GU, BUSAN
Website : www.seunelectric.co.kr
Main Products : Battery charger, Alarm sys.
TEL : +82 51 208 4641

SEWON INDUSTRIES Ltd.
Location : HAMAN-GUN, GYEONGNAM
Website : 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

SHINHAN HEAVY INDUSTRIES Co., Ltd.
Location : ULJU-GUN, ULSAN
Website : www.shinhanheavy.co.kr
Main Products : Deckhouse, Rudder
TEL : +82 52 240 5000

Shin Heung ENG Co.
Location : GANGSEO-GU, BUSAN
Website : www.shinheungeng.co.kr
Main Products : Curtain, Upholstery, Sofa & Chair, Mattress, Carpet, Roller blind
TEL : +82 51 817 6455

Shin Myung Tech Co., Ltd.
Location : YANGSAN-SI, GYUNGNAM
Website : www.smdavit.com
Main Products : Air motor, Winch, Davit, Crane, Reel, Capstan, Pump, etc.
TEL : +82 55 363 7091

Shin Sung eng Co., Ltd.
Location : GANGSEO-GU, SEOUL
Website : www.ishinsung.com
Main Products : Air Con. Plant, Ref. Plant
TEL : +82 2 2600 9602

Shin Yeong Co., Ltd.
Location : GIMHAE-SI, GYUNGNAM
Website : www.sy-ind.com
Main Products : Manhole, Access hatch
TEL : +82 55 346 0034

Shin-A Co., Ltd.
Location : SAHA-GU, BUSAN
Website : www.shina-ent.com
Main Products : Navigational/communication equip.
TEL : +82 51 204 6221

Shin-A Metal Tech Co., Ltd.
Location : BUK-GU, ULSAN
Website : 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.
Location : YEOUNGDO-GU, BUSAN
Website : www.shindong.com
Main Products : Navigation & communication, Internal communication equipment
TEL : +82 51 461 5141

Shinshin Machinery Co., Ltd.
Location : GIJANG-GUN, BUSAN
Website : 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.
Location : GANGSEO-GU, BUSAN
Website : www.sillametal.com
Main Products : Fixed pitch propeller (FPP), Controllable pitch propeller (CPP, Shafting, Stern equipment)
TEL : +82 51 831 5991

Simulation Tech Inc.
Location : GEUMCHEON-GO, SEOUL
Website : www.simulationtech.co.kr
Main Products : Voyage data recorder
TEL : +82 2 3281 0960

SKMARINTEC Co., Ltd.
Location : GIMHAE-SI, GYUNGNAM
Website : www.skmarintec.co.kr
Main Products : Electrolytic Sewage Processing Eqiupment
TEL : +82 55 314 4620

SMECO Co., Ltd.
Location : YEONGI-GUN, CHUNGNAM
Website : www.smecopiston.com
Main Products : Piston, Piston liner
TEL : +82 44 864 3030

SMS Co., Ltd.
Location : SAHA-GU, BUSAN
Website : www.sms-marinesystem.com
Main Products : Hatch cover, Lashing bridge, Ro-Ro equipment, Hydro door
TEL : +82 51 290 1000

CAPE INDUSTRY Ltd.
Location : YANGSAN-SI, GYUNGNAM
Website : www.capeind.com
Main Products : Cylinder Liner
TEL : +82 55 370 1234

SPECS Corporation
Location : BUNDANG-GU, SEONGNAM
Website : www.specs.co.kr
Main Products : Oil Mist Detection System for Engine Room (AOMD), Oil Mist Detection System for Diesel Engine (COMD), Shaft Torque Power RPM Meter (TPM), etc.
TEL : +82 31 706 5211

STACO Co., Ltd.
Location : GANGSEO-GU, BUSAN
Website : www.staco.co.kr
Main Products : Wall & ceiling panel, Unit toilet
TEL : +82 51 831 7000

STACO CHALMERS Co., Ltd.
Location : GANGSEO-GU, BUSAN
Website : www.staco.co.kr
Main Products : Unit Cabin, Unit Toilet, Marine Door
TEL : +82 51 831 7000

STX Engine Co., Ltd.
Location : CHANGWON, GYUNGNAM
Website : 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.
Location : CHANGWON, GYUNGNAM
Website : www.stxhi.co.kr
Main Products : Turbocharger, Diesel engine parts, Industrial components, Shipuilding machinery, Cargo pump system, Casting parts
TEL : +82 55 280 0700

Suh Han Ind. Co., Ltd.
Location : SAHA-GU, BUSAN
Website : wwww.suhhani.co.kr
Main Products : Cable tray and duct, Hot dip galvanizing, Ship window
TEL : +82 51 204 1920

SUNBO INDUSTRIES Co., Ltd.
Location : SAHA-GU, BUSAN
Website : 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.
Location : GANGSEO-GU, BUSAN
Website : www.sgtkor.com
Main Products : Ship block, Fin tube, Header pipe
TEL : +82 52 228 5801

Sung Kwang Bend Co., Ltd.
Location : GANGSEO-GU, BUSAN
Website : www.skbend.com
Main Products : Butt welding pipe fittings
TEL : +82 51 330 0200

Sung Mi Co., Ltd.
Location : GIMHAE-SI, GYUNGNAM
Website : 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.
Location : GYEONGJU-SI, GYEONGBUK
Website : http://sungsin.koreasme.com
Main Products : Hatch coaming, T-Block, Water mist catcher, Water separator, Louver
TEL : +82 54 776 6441

Sungil SIM Co., Ltd.
Locatio : GANGSEO-GU, BUSAN
Website : www.sungilsim.com
Main Products : Pipe bending, Pipe spool, Marine Engine, Gas turbine
TEL : +82 51 831 8800

Suro Propeller & Machinery Co.
Location : YOUNGDO-GU, BUSAN
Website : www.suropump.co.kr
Main Products : Propeller, Propeller shaft
TEL : +82 51 415 0445

T.K. Corporation Co., Ltd.
Location : GANGSEO-GU, BUSAN
Website : www.tkbend.co.kr
Main Products : Butt-welding fittings, Forged fittings, Flanges
TEL : +82 51 831 6600

TAE KWANG Co., Ltd.
Location : GANGSEO-GU, BUSAN
Website : www.tkbend.co.kr
Main Products : Pipe Fittings, Fitting & Valve
TEL : +82 51 831 6550

TAE YOUNG TRADING Ltd.
Location : NOWON-GU, SEOUL
Website : www.marine-matarial.com
Main Products : Receptacles & wire accessories, Flood light, Deck light, Reflector lamps, HRF mercury lamps, Sodium lamps, Marine electrical equipment
TEL : +82 2 2272 1960

Taekyung Heavy Industries Co., Ltd.
Location : CHANGWON-SI, GYUNGNAM
Website : www.tkhic.com
Main Products : Engine Bed/Frame Box, Air Receiver/Gas ReceiverSteel Outfittings, Tubular(SAW Pipe), etc.
TEL : +82 70 4628 8844

TANKTECH Co., Ltd.
Location : SAHA-GU, BUSAN
Website : 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

TechMarine S/W Co., Ltd.
Location : DONG-GU, BUSAN
Website : www.techmarine.net
Main Products : Loading computer program, CAOS, Stowage program, LOFOS, LMS
TEL : +82 51 467 7003

Techcross Inc.
Location : GANGSEO-GU, BUSAN
Website : www.techcross.com
Main Products : Ballast water management system
TEL : +82 51 603 3500

TETRADYNE
Location : GURO-GU, SEOUL
Website : www.tetradyne.co.kr
Main Products : Marine Monitor, Marine Panel PC
TEL : +82 2 323 4972

TMC Co., Ltd.
Location : CHEONAN-SI, CHUNGNAM
Website : www.tmc-cable.com
Main Products : Marine cables, Oil & rig cables, Onshore cables, Special cables, Optical fiber cables
TEL : +82 41 589 6500

TOPSAFE Co., Ltd.
Location : GIMHAE-SI, GYUNGNAM
Website : www.topsafe.co.kr
Main Products : High-velocity pressure vacuum valve, Breather valve, Flame arrestor, Emergency vent cover, Detonation flame arrestor
TEL : +82 55 338 9986

TTS INTERNATIONAL Corp.
Location : GANGSEO-GU, BUSAN
Website : www.ttsi.co.kr
Main Products : Cuni Pipe, Cuni Flange, Cuni Fitting
TEL : +82 51 832 9977

VISER Co., Ltd.
Location : GIMHAE-SI, GYUNGNAM
Website : www.viser.co.kr
Main Products : PHE GASKET, Valve seat, Dust packing, etc.
TEL : +82 55 346 5575

WARTSILA ACCOMMODATION SYSTEMS KOREA, Inc.
Location : GOSEONG-GUN, GYEONGNAM
Website : www.waskorea.co.kr
Main Products : Unit toilet, Unit cabin, Wall panel, Ceiling panel
TEL : +82 55 673 7315

WhaYoung Co., Ltd.
Location : MIRYANG-SI, GYUNGNAM
Website : www.whayoung.co.kr
Main Products : Fuel pump ass'y for ship engine
TEL : +82 55 359 1100

WONIL Co., Ltd.
Location : MASAN-SI, GYEONGNAM
Website : 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.
Location : GIMHAE-SI, GYUNGNAM
Main Products : Weather-tight steel door, Louver vent, Steel window box, Mooring fitting
TEL : +82 55 337 1651

WOOJOO M & E Co., Ltd.
Location : SAHA-GU, BUSAN
Website : www.wjme.com
Main Products : Exp. junction box, Warning alarm, etc.
TEL : +82 51 264 9130

Yoo Won Industry Ltd.
Location : SAHA-GU, BUSAN
Website : www.yoowonind.com
Main Products : Steering gear, Filter, Deck M/C
TEL : +82 51 205 8541

You Jeon Industry Co., Ltd.
Location : CHANGWON, GYUNGNAM
Main Products : Marine engine parts, Engine bed
TEL : +82 55 297 2121

YoungkWang Machine Co., Ltd.
Location : GYEONGJU-SI, GYEONGBUK
Website : www.ykmc.com
Main Products : Skid unit, Pressure vessel, Heat exchanger
TEL : +82 54 776 6456

Younglim Timber Co., Ltd.
Location : NAMDONG-GU, INCHEON
Website : www.younglim.com
Main Products : Wood Fire Retardant, Flooring Board, Furniture, Wood for Interiors
TEL : +82 32 811 9051

YOUNGIL PRECISION Co., Ltd.
Location : HAMAN-GUN, GYEONGNAM
Website : http://youngilco.kr
Main Products : Valvetrain components for all kinds of 4-Stroke Diesel Engine's
TEL : +82 55 585 2915

DAEWOO SHIPBUILDING & MARINE ENGINEERING CO., LTD.

• Address : 85, Da-dong, Jung-gu, Seoul, Korea • Tel : +82-2-2129-0114 • Fax : +82-2-2129-0077~8 • http://www.dsme.co.kr

• 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, FPUs, Drill Ships, Semi-Submersible Drilling Rigs, Fixed Platforms, Submarines, Submarine Rescue Vessels AUVs, Destroyers, Battle Ships*

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• 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 Handing Equipment*

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• http://www.hshi.co.kr

• Products : *Tankers, VLCCs, Product Carriers, Chemical Tankers, Containerships, LNG Carriers, LPG Carriers, Pure Car Carriers, Bulk Carriers, Other Vessels*

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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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• Tel : +82-55-647-7435/7415 • Fax : +82-55-647-5065 • http://www.isungdong.com

• Products : *Crude Oil Tankers, Product Carriers, Chemical Tankers, Shuttle Tankers, Container Carriers, Bulk Carriers, FSO*

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• Products : *Container Carriers, Product/Chemical/Crude Oil Tankers, LNG/LPG Carriers, Cable Ships, Supply Boats, Semi-Submersible Drilling Rigs, Dredgers, Navel Ships, Special Purpose Ships, Bulk Carriers*

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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*

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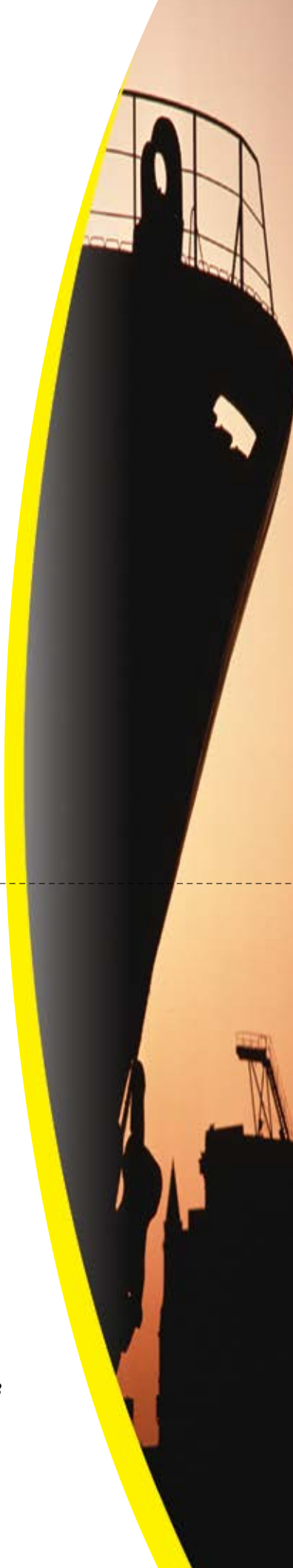

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