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월간 KORSHIP 발행

2016년 개정판

조선 & 해양 총람

Guide

Offshore & Shipbuilding

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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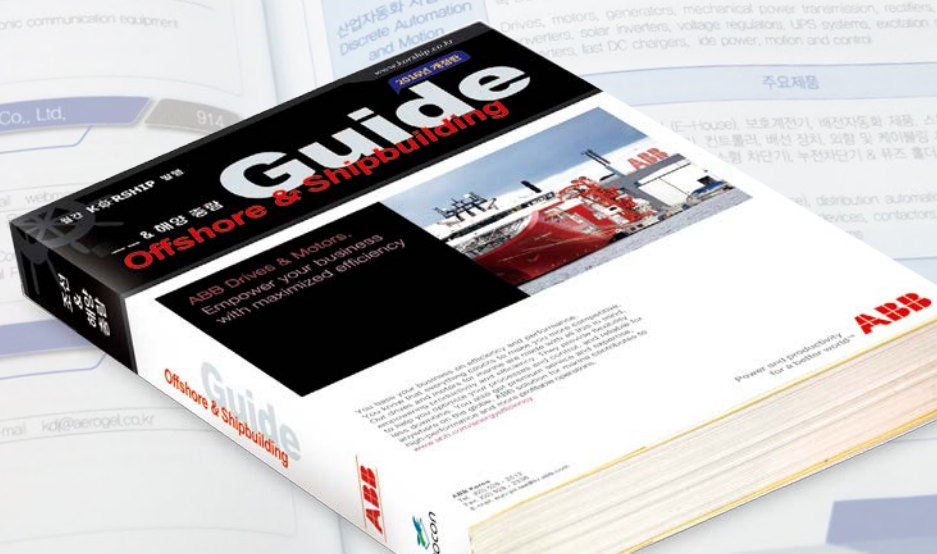
&. 2016년 개정판 조선해양 총람 구매와 관련해 기타 자세한 사항은 전화문의(02-2168-8896) 또는 본사 홈페이지(www.korship.co.kr)를 참조해 주십시오.



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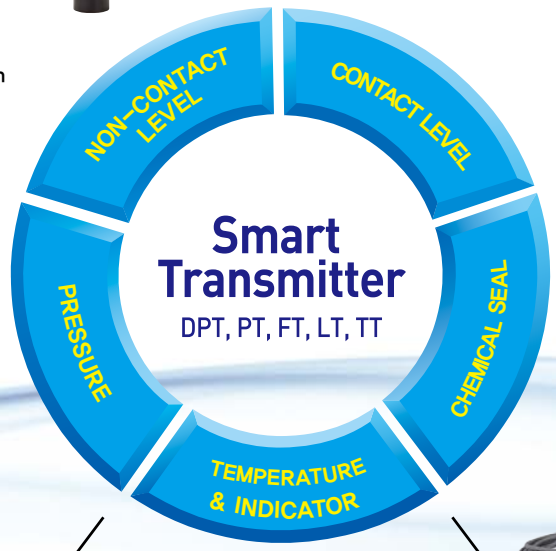

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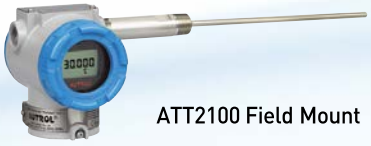

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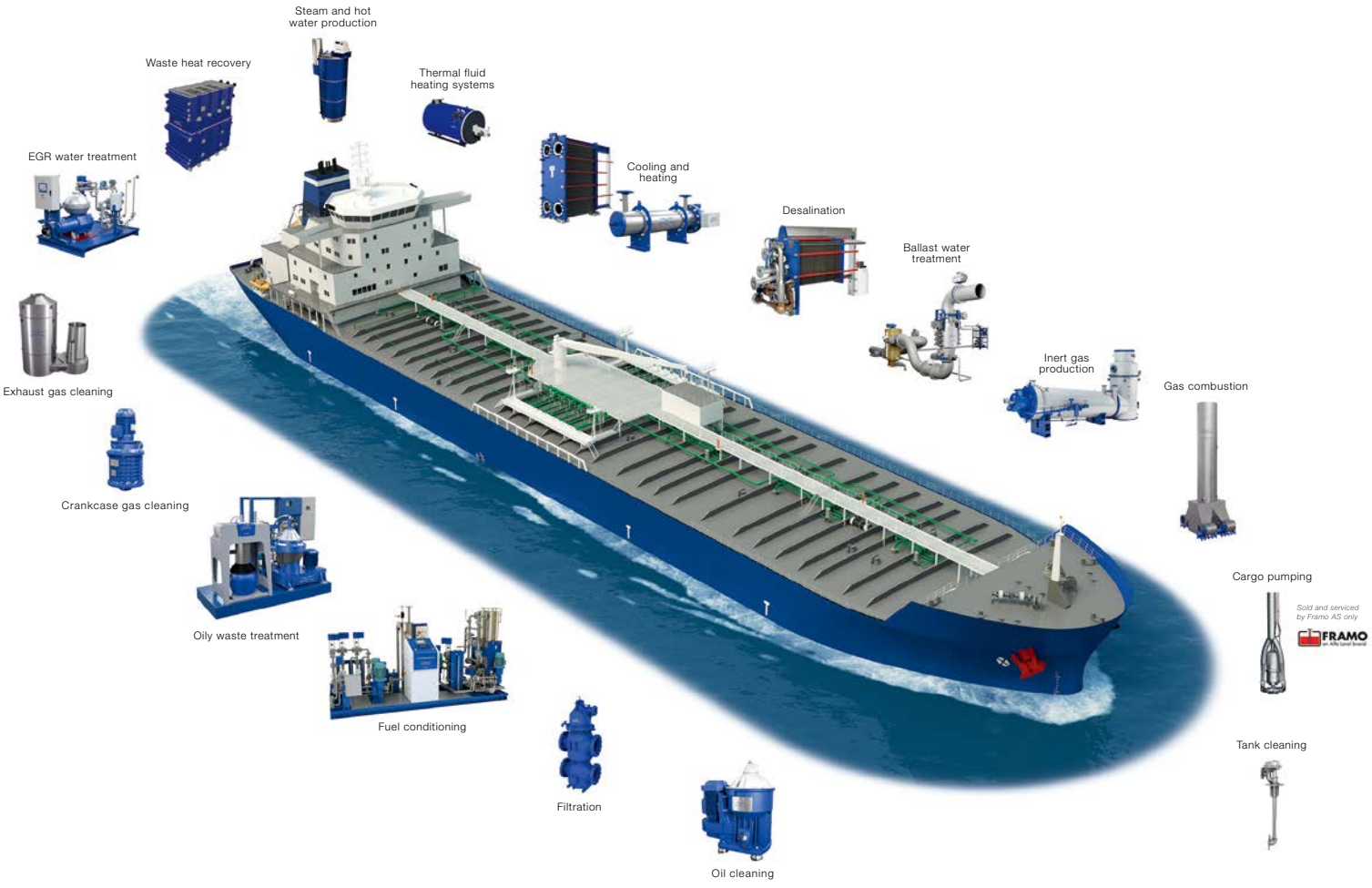

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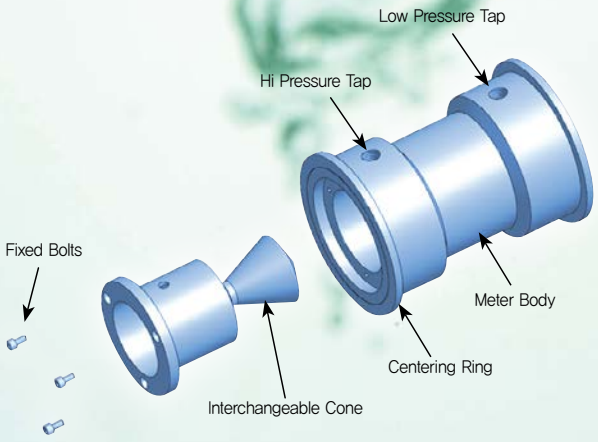

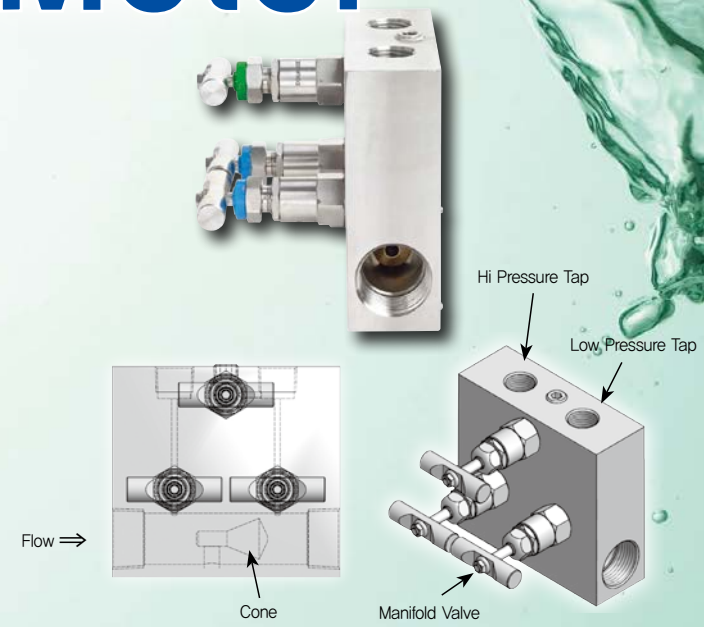

HFV-WM (Wafer type Cone Meter) **IVCM** (Integral Valve Cone Meter)

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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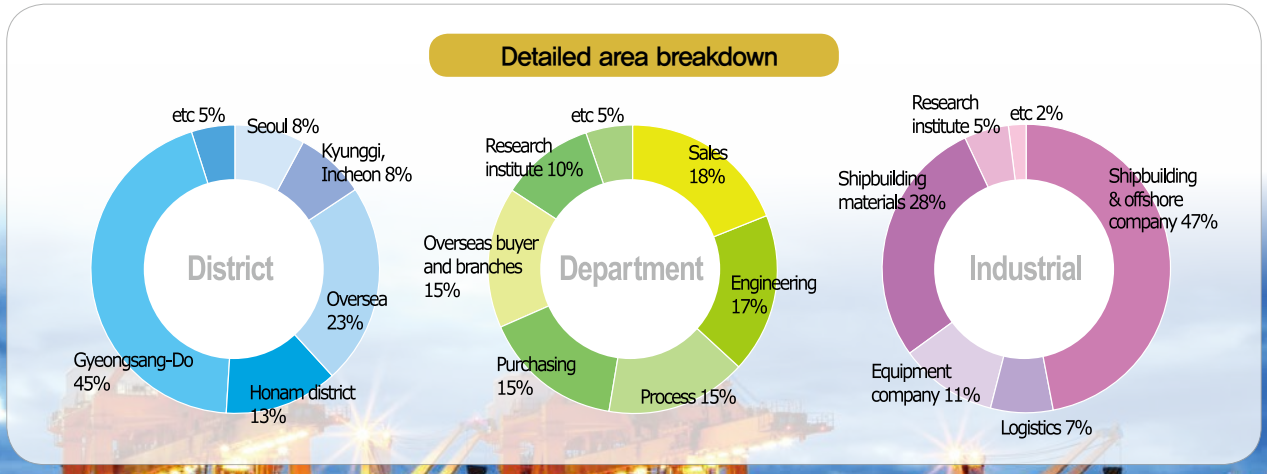

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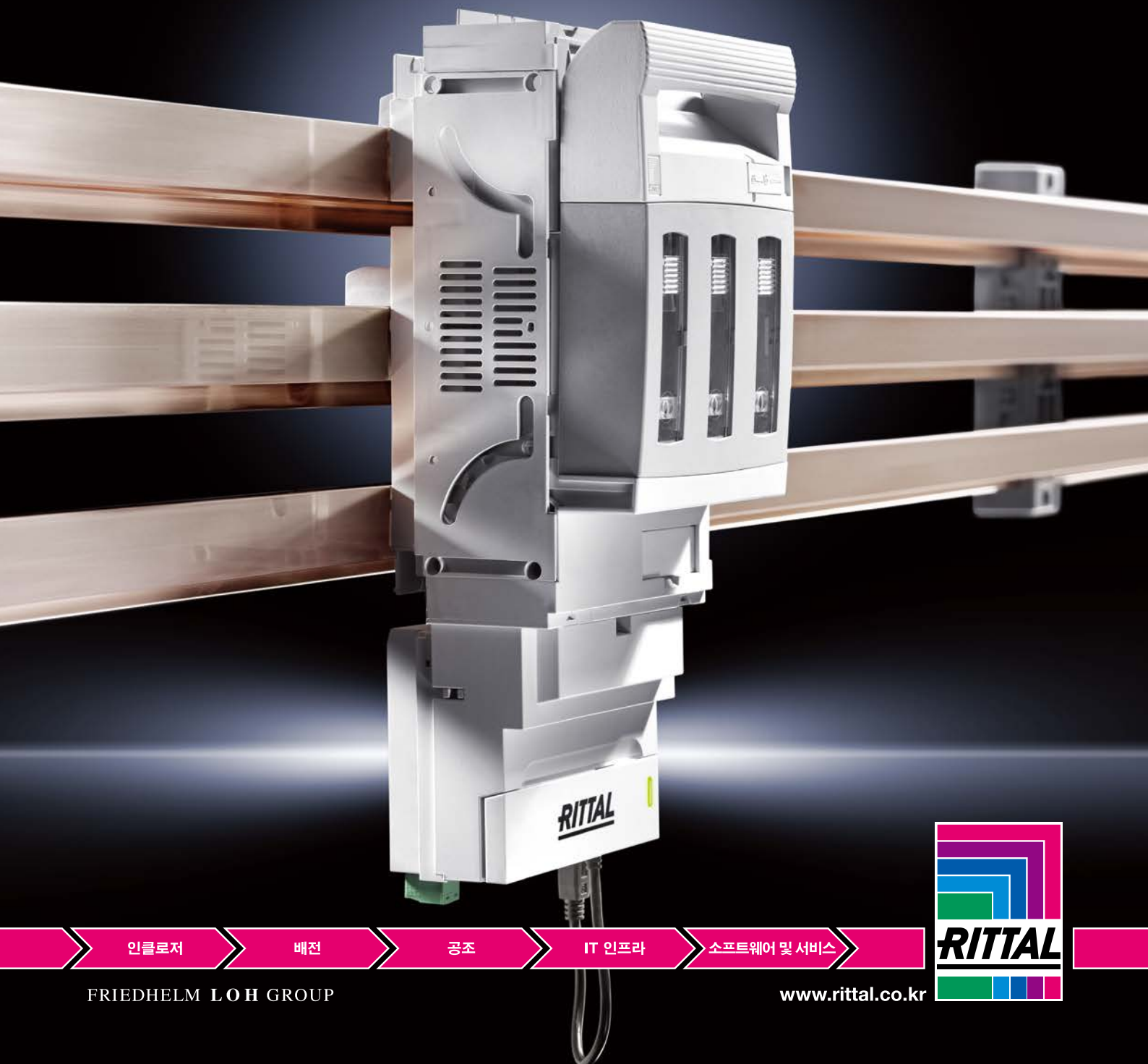

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KR signed a MOU with Meta Vista for joint research on liquefied hydrogen technology

The Korea Register of Shipping (KR) announced that it signed a MOU(Memorandum of Understanding) with Meta Vista for joint research and development (R&D) in the field of liquefied hydrogen carriers and hydrogen technology at the head office of the KR on August 8.

The MOU represents an agreement on technology exchange and joint R&D between KR and Meta Vista specializing in hydrogen energy technology development. Under this MOU, both companies will work closely in the development of technology for transporting liquefied hydrogen using ship, technology for development of liquefied hydrogen as marine fuel, development of hydrogen safety evaluation technology, etc.

This agreement was initiated with both companies' recognition of the need for joint technological actions to utilize hydrogen energy in maritime sector in line with the government's policy aiming to expand the supply of renewable energies and promote new energy industries.

An official from the KR said, "Hydrogen is eco-friendly clean energy that emits almost no pollutants. Research has already been making progress in Japan and Europe to use hydrogen as marine fuel. The joint research between KR and Meta Vista is expected to further strengthen domestic technological competitiveness related to liquefied hydrogen in marine industry."

한국선급-메타비스타, 액화수소기술 공동연구를 위한 MOU 체결

한국선급(KR)은 지난 8월 8일 한국선급 본사에서 메타비스타와 액화수소운송선과 수소 기술 분야의 공동 연구개발을 위한 MOU를 체결했다고 밝혔다.

이번 MOU는 한국선급과 수소에너지 기술개발 기업인 ㈜메타비스타 간 기술교류 및 공동 연구개발 등에 대한 협약으로 선박을 이용한 액화수소의 운송기술 개발과 선박 연료로서 액화수소 활용기술 개발, 그리고 수소의 안전성 평가기술 개발 등에 상호 적극 협력하기로 합의했다.

이번 협약은 정부의 '신재생에너지 보급 확대 및 에너지신산업 육성' 정책에 발맞춰 수소에너지를 해사분야 활용하기 위한 기술적 공동 대응의 필요성을 양사가 공감하면서 시작되었다.

한국선급 관계자는 "수소는 오염물질을 거의 배출하지 않는 친환경 청정에너지로서 일본 및 유럽에서는 이미 선박 연료로서 수소를 활용하는 연구들이 진행되고 있다"며, "이번 한국선급과 메타비스타 간의 공동연구를 통해서 해사산업분야에서 액화수소 관련 국내 기술 경쟁력이 한층 더 강화될 것으로 예상된다"고 말했다.

HHI Group secures KRW 1 trillion through management improvement plan

Hyundai Heavy Industries (HHI) Group announced on July 26 that it secured KRW 1 trillion to date this year as a part of the KRW 3.5 trillion management improvement plan it has been implementing since June 2016 in an effort to rebuild trust in the market and improve its balance sheet.

HHI Group sold its 100% shares in Hotel Hyundai for 200 billion won to Hahn & Company, Korea's leading private equity investment group managing 4 trillion won worth asset. In June this year, Hyundai Samho Heavy Industries (HSHI) also raised 400 billion won from IMM Private Equity via pre-IPO and Hyundai Mipo Dockyard (HMD) secured 350 billion won by offloading its shares in Hyundai Robotics, a holding company of Hyundai Heavy Industries Group.

In April this year, HHI disaffiliated its construction equipment and electro electric systems divisions as Hyundai Construction Equipment and Hyundai Electric & Energy System respectively, both independent corporates now. With all of these comprehensive measures HHI has implemented since June 2016, HHI has lowered debt-to-equity ratio to around 90% from 134% as of the end of the first quarter of 2016.

In the second half of this year, HHI Group continues to accelerate focusing on core businesses by liquidating poor performing overseas offices and incorporate firms including Hyundai Cummins (construction equipment engine) and Jake (wind power gear box), and selling non-core assets including Hi Investment & Securities.

An HHI official said, "With the sell-off of shares of Hotel Hyundai today, we have secured more than 3 trillion won to date this year and achieved about 90% of the 3.5 trillion management improvement plan."

현대중공업 그룹, 올해 경영개선 계획 이행으로 1조원 확보해

현대중공업 그룹이 연달아 비핵심자산 매각에 성공하며 경영개선계획 이행에 박차를 가하고 있다.

현대중공업은 자회사인 호텔현대 지분을 국내 사모투자 전문회사인 한앤컴퍼니(Hahn & Company)에 전량 매각하기로 했다고 지난 7월 26일 밝혔다. 매각금액은 2,000억원이며, 고용승계를 보장한다는 조건이다.

현대중공업 그룹은 앞서 진행한 현대삼호중공업 프리IPO(4,000억원), 현대미포조선의 현대로보틱스 지분 매각(3,500억원) 등을 포함, 올해에만 총 1조원의 유동성을 확보하며 경영개선계획의 조기달성 가능성을 높이고 있다.

현대중공업 그룹은 지난해 6월 비핵심자산 매각, 사업조정, 경영합리화 등 총 3.5조원 규모의 경영개선계획을 발표, 이를 적극 이행해오고 있다. 지난해 현대차, KCC, 포스코 등 투자주식과 유휴부동산 등을 매각했고, 추가적으로 현대종합상사, 현대기업금융, 현대기술투자, 현대자원개발의 계열분리를 완료한 바 있다.

올해에도 지난 4월 사업경쟁력 강화 및 재무건전성 확보를 위한 선제적 조치로 사업분할을 실시하며 경영개선에 속도를 내고 있다. 이에 따라 현대중공업은 부채비율(별도 기준)을 경영개선계획 실행 전인 2016년 1분기 말 134%에서 현재 90% 중반까지 줄여 업계 최고 재무건전성을 확보하게 됐다.

현대중공업은 하반기에도 비핵심자산을 과감히 매각, 핵심 사업에 역량을 집중할 계획이다. 우선 금융업 철수 방침에 따라 하이투자증권의 매각을 추진중이며, 현대커민스, 독일 야케법인, 중국 태안법인, 미국 현대아이디얼전기 등 비핵심사업 정리도 마무리 단계에 있다.

현대중공업그룹 관계자는 "이번 호텔현대 매각을 포함해 지금까지 3조원 이상의 경영개선계획을 집행, 목표인 3.5조의 90% 가까이 달성했다"며, "앞으로도 경영개선계획을 적극 이행하는 한편, 비핵심자산의 추가 매각을 통해 핵심사업 위주의 사업재편과 무차입경영 실현을 위해 최선을 다할 것"이라고 밝혔다.

한편 한앤컴퍼니는 지난 2010년 설립돼 현재 운영자산이 4조에 달하는 국내 최대 규모의 사모투자 전문회사로, 중장기적 관점에서 기업가치를 제고하는 투자전략으로 시장 입지를 견고히 하고 있다.

DSME's operating income turned to black in the first half of this year

Daewoo Shipbuilding & Marine Engineering (DSME) published a report on consolidated turnover which showed a turnaround in its operating income in the first half of 2017. Thus DSME kept the balance in the black for two consecutive quarters. In addition, the audit firm, which had stated limited opinions due to uncertainties such as absence of new funding support plan at the end of 2016 and weak internal control, presented an unqualified opinion on the financial statement of the first half of this year, reflecting an improvement in financial structure through debt restructuring.

DSME registered KRW 6 trillion and 188.1 billion in sales, KRW 880 billion in operating income, and KRW 1 trillion and 488.3 billion in current net income in the first quarter of 2017. Specifically, DSME saw its sales sliding about 13% year-on-year and a turnaround in both operating income and current net income. In addition, DSME saw a drastic improvement in financial structure as its debt-to-equity ratio decreased sharply from 1,557% at the end of the first quarter to 248% at the end of the first half of 2017.

According to DSME, the surplus was attributed primarily to receipt of additional payment for construction of offshore plants delivered in the first quarter through negotiation with clients and to successful adjustment of delay penalty. Particularly, DSME which incurred massive losses from offshore plant sector has delivered most of offshore plants without disruption, thus eliminating factors of earnings deterioration and creating stable revenue generation opportunities.

An official from DSME said, "Profitability is expected to continue to improve as more than 20 highly profitable commercial vessels are scheduled for delivery in the second half of this year. Along with that, we will proceed with self-rescue plan even more thoroughly to bring business back to normal expeditiously and make effort to reciprocate the favors of creditor banks, corporate bond and CP investors, and shareholders who participated in debt rescheduling."

대우조선해양, 올해 상반기 영업이익 흑자 달성

대우조선해양은 연결기준 실적 공시를 통해 2017년 상반기 영업이익 흑자로 2분기 연속 흑자를 달성했다고 밝혔다. 또한 2016년말 신규자금지원계획 등의 미확정과 내부통제 취약 등의 사유로 '한정' 의견을 제시한 감사법인은 채무조정을 통한 재무구조 개선 등을 반영한 금년 상반기 재무제표에 대해 '적정' 검토의견을 제시했다.

대우조선해양의 2017년 상반기 매출액은 6조 1,881억원, 영업이익은 8,880억원, 당기순이익은 1조 4,883억원이다. 전년 동기 대비 매출은 약 13% 감소했고, 영업이익과 당기순이익은 흑자전환했다. 아울러 재무구조도 1분기말 부채비율 1,557%에서 상반기말 248%로 대폭 개선됐다.

대우조선해양에 따르면 상반기 인도된 해양플랜트와 관련하여 주문주 측과의 협상을 통해 공사대금을 추가 확보하고 인도지연 지체보상금 조정에 성공한 것이 흑자달성에 크게 기여했다고 밝혔다. 특히 과거 거액손실의 원천이었던 해양플랜트가 정상적으로 대부분 인도됨에 따라 손익악화 요인이 사라져 안정적인 수익창출이 가능해졌다.

대우조선해양 관계자는 "수익성이 높은 20여척의 상선 인도가 하반기에 계획돼 있어 수익성은 지속적으로 개선될 전망"이라며, "이와 함께 자구계획안도 좀더 철저하게 이행하여 조기 경영정상화를 달성하고 채무조정에 동참해 준 채권은행, 회사채, CP 투자자 및 주주에게 보답하도록 노력하겠다"고 말했다.

MOF moves ahead with construction of LNG-fuelled vessels

The Ministry of Oceans and Fisheries (MOF) announced that it set a plan to introduce 150-ton LNG-fuelled clean-up vessel to be deployed at Ulsan Port by the end of 2018 on a pilot scheme in a bid to stimulate industries related to LNG-fuelled vessel and would start designing work from the following month.

As the International Maritime Organization (IMO) decided to strengthen regulations curbing greenhouse gas emissions from ship(in October, 2016), the MOF set up a task force dedicated to promoting industries related to LNG-fuelled vessels in January this year and has pressed ahead with policies related to LNG-fuelled vessels in anticipation of a surge in the demand for vessels powered by LNG, a clean fuel.

As a result, the MOF will begin with introduction of LNG-fuelled clean-up vessel on a pilot scheme in 2018 to create demand in public sector. Moreover, it has mapped a plan to build 1-2 units of LNG-fuelled clean-up vessels every year over the next 5 years and has strived to secure related budget. The revised supplementary budget for this year includes KRW 520 million necessary to design 4 units of public ship in order to revitalize shipbuilding industry and spur an increase in orderbooks, out of which KRW 200 million will be used for contracting out the design of LNG-fuelled vessel.

An official from the MOF said, "The adoption of LNG-fuelled vessels has gathered pace globally as we are seeing constant placement of orders for LNG-fuelled vessels worldwide. We will introduce LNG-fuelled vessels proactively in public sector and promote related industries actively."

해양수산부, LNG 추진선 건조 추진

해양수산부는 LNG 추진선박 연관산업 활성화를 위해 2018년말까지 울산항에 배치할 예정인 150톤급 청항선을 LNG 추진선박으로 시범 도입하는 계획을 확정하고, 내달부터 설계를 시작할 계획이라고 밝혔다.

해양수산부는 국제해사기구(IMO)의 선박배출가스 규제 강화 결정(2016.10)에 따라 청정 연료인 LNG를 사용하는 선박 수요가 급증할 것으로 예상하고, 올해 1월 'LNG 추진선박 연관 산업 육성단'을 결성해 LNG 추진선박과 관련된 정책을 지속적으로 추진해 왔다.

이에 따라, 해양수산부는 공공부문 수요 창출을 위해 2018년 시범도입을 시작으로 향후 5년간 매년 1~2척의 청항선을 LNG 추진선박으로 건조하는 계획을 수립했으며, 그 동안 관련 예산 확보에 노력해 왔다. 올해 추가경정 예산에 조선산업 활성화와 일감확보를 위한 관공선 4척의 설계비 5억 2,000만원을 반영했으며, 그 중 2억원을 LNG 추진선박 설계 발주에 활용할 예정이다.

해양수산부 관계자는 "세계 각국에서 LNG 추진선박에 대한 발주가 이어지는 등 전 세계적으로 LNG 추진선박 도입추세가 가속화 되고 있다"며, "앞으로 공공부문에서부터 선제적으로 LNG 추진선박을 도입하고 관련 산업을 적극적으로 육성해 나갈 예정"이라고 말했다.

HHI turned to profit for 6 consecutive quarters

On August 1, 2008, Hyundai Heavy Industries Group announced the consolidated sales and operating income of Hyundai Heavy Industries (HHI), Hyundai Construction Equipment, Hyundai Electric & Energy Systems ("Hyundai Electric"), and Hyundai Robotics for the second quarter of 2017.

HHI recorded KRW 4.6292 trillion in sales and KRW 151.7 billion in operating income, thus keeping its balance in the black for 6 consecutive quarters since it successfully turned a profit in the first quarter of 2016. The shipbuilding division posted KRW 2.7016 trillion in sales, down 6.9% QOQ (Quarter On Quarter) amid a decline in volumes of vessels built. However, the shipbuilding division posted KRW 145.6 billion in operating income, an increase by 14.6% QOQ, bolstered by the effort to raise productivity and cut costs. Moreover, offshore and plant divisions continued to be in the black due to completion of major construction projects and stabilization of processes. Meanwhile, engine division saw the sales jumping about 33% QOQ on the back of rising sales amid the rebound in shipbuilding market.

Hyundai Construction Equipment reported KRW 683.2 billion in sales and KRW 35.8 billion in operating income, underpinned by recovery of global market, improvement of sales network, strengthened strategic alliance, etc. Hyundai Electric reported KRW 491.2 billion in sales and KRW 30.6 billion in operating income. Hyundai Robotics recorded KRW 4.1975 trillion in sales and KRW 251.1 billion in operating income, driven by expansion of global investment in LCD sector, upturn in the sales of clean-up robots, and operation of Hyundai Chemical.

Business restructuring and financial soundness based on management improvement plan led to strengthened competitiveness in winning new orders. The 3 shipbuilding affiliates of Hyundai Heavy Industries Group won orders for 81 vessels worth USD 4.5 billion thus far, which is more than five-fold increase compared to the corresponding period of the previous year (16 vessels worth USD 1.7 billion).

An official from HHI said, "We will press

ahead with aggressive sales strategy based on our strengthened competitiveness amid gradual recovery of market despite our concern about a decline in sales due to thin orderbook. We will exert our best efforts to transform our company into a global leader with differentiated competitiveness in each field through constant management rationalization and technology-oriented management innovation."

현대중공업, 6분기 연속 흑자

현대중공업 그룹은 현대중공업과 현대건설기계, 현대일렉트릭앤에너지시스템(이하 '현대일렉트릭'), 현대로보틱스 등 총 4개사의 2017년도 2분기 연결기준 매출과 영업이익을 지난 8월 1일 발표했다.

현대중공업은 매출 4조 6,292억원, 영업이익 1,517억원으로, 2016년 1분기 흑자전환에 성공한 이후 6분기 째 흑자를 이어갔다. 조선 부문은 건조물량 감소로 매출이 전 분기 대비 6.9% 줄어든 2조 7,016억원에 머물렀으나, 생산성 향상과 원가절감 노력에 힘입어 영업이익은 14.6% 늘어난 1,456억원을 기록했다. 또한 해양 · 플랜트 부문의 경우 주요 공사의 마무리, 공정 안정화에 따라 흑자 기조를 이어갔으며, 엔진 부문은 조선 시황 회복세에 따른 판매량 증가로 매출이 전분기 대비 33% 가량 큰 폭으로 올랐다.

현대건설기계는 글로벌 시황 회복과 영업망 정비, 전략적 제휴 강화 등에 따라 매출 6,832억원과 영업이익 358억원을 기록했으며, 현대일렉트릭 역시 매출 4,912억원, 영업이익 306억원을 기록했다. 현대로보틱스는 LCD 부문 글로벌 투자 확대에 따른 클린룸 로봇 판매량 증가와 현대케미칼 가동으로 매출 4조 1,975억원, 영업이익 2,511억원을 기록했다.

경영개선계획에 따라 실행된 사업재편과 재무건전성은 수주경쟁력 강화로 이어져, 현대중공업 그룹 조선 3사는 지금까지 81척, 총 45억 달러의 수주계약을 체결, 지난해 같은 기간대비(16척, 17억 달러) 척수로 5배 이상 늘어난 실적을 기록했다.

현대중공업 관계자는 "일감부족에 따른 매출감소가 우려되는 상황이나, 지난해 대비 시황이 점차 나아지고 있는 만큼 강화된 수주경쟁력을 바탕으로 적극적인 영업전략을 펼쳐 나가겠다"며, "지속적인 경영합리화 노력과 기술 중심의 경영혁신을 통해 각 분야에서 차별적 경쟁력을 갖춘 글로벌 선도기업이 될 수 있도록 최선의 노력을 다할 것"이라고 말했다.

ABB's DEGO IV software delivers on fuel saving promise for Stena Line vessel

A significantly upgraded vessel control software package from ABB is delivering the measurable operational efficiency gains promised to Stena Line for the freight ferry Stena Scotia within a month of commissioning. The 'DEGO IV' advanced speed governor and actuation system onboard has been enhanced so that control over the vessel's propulsion system minimizes roll and rudder movements, delivering a new way of saving fuel while also improving crew comfort.

The fourth generation DEGO software collates data from sensors monitoring 60 shipboard parameters in real time, including engine performance (rpms, scavenge air pressure, fuel use, etc.), propeller performance (pitch, slip, torque and power), rudder/vessel centre of gravity torque and navigational information. In an advance on previous versions, DEGO IV uses this data to model a control strategy to minimize ship roll, adjusting to changing sea or ship conditions by simulating the next two roll periods to optimize roll damping against fuel consumption on a predictive basis.

The 120-trailer capacity, twin-propeller Stena Scotia is deployed in daily Ro-Ro services between Rotterdam and Killingholme in the UK.

Dick van der Ent, Energy Efficiency Manager at Stena Line BV, says "For us it is important to minimize the daily fuel consumption and related emissions. ABB guaranteed us a minimal saving potential of 3% when utilizing the latest generation of the DEGO system."

Part of a broad range of energy optimization tools offered to the maritime industry by ABB, the efficiency gains available using the DEGO system depend on ship type, sea conditions and the type of autopilot used. First installations of DEGO IV, made across 10 vessels, indicate fuel saving potential in the range of 5-7%, with roll reduction between 20-40% and rudder reduction of 15-60%.

"The latest generation of our DEGO system is an excellent example of the way our integrated solutions help to optimize the energy efficiency of ships, ranging from newbuildings to vessels with years in service such as Stena Scotia," said Juha Koskela, Managing Director of ABB's Marine and Ports Business. "In a society that demands shipping becomes more sustainable, and rules and regulations on green shipping are becoming more stringent, we as ABB put great effort into helping our customers meet their needs."

ABB's Marine Software portfolio is designed to offer ship owners and operators the ability to visualize data, for exploitation by crew onboard ships or for sharing with the ship's shore-side support team.

DNV GL carries out its first offshore drone survey

DNV GL surveyors have carried out the classification society's first offshore drone survey on the semisubmersible vessel Safe Scandinavia in the North Sea. This 25,383 GT tender support vessel (TSV) is owned and operated by Prosafe, supporting Statoil's drilling operations off the coast of Norway. Using camera-equipped drones, DNV GL's drone pilots checked the TSV's fairleads and their connection with the vessel's two columns as part of the intermediate survey.

"Innovation is one of Prosafe's core values. We are very pleased that we chose to try the drone survey, as it helped us optimize our survey requirements and allowed us to save significant amounts of time and money. Normally, this kind of operation would cause disruption to our client for several days. The drone survey took only a few hours and was just as effective," said Ian Young, Chief Operating Officer at Prosafe.

"This was a great opportunity for us to demonstrate our drones' abilities to check the condition of remote external components in challenging offshore conditions. The inspection only required the semi-submersible to de-ballast, then we flew the drone approximately 25 metres below the main deck to check the condition of the fairleads and their connections to the columns that hold up the TSV. With wind speeds of approximately 15 knots, this went very well and the survey showed that the fairleads and their connections were in a good condition," explained Cezary Galinski, Project Manager Classification Poland at DNV GL.

The classification society has carried out multiple drone surveys on both ships and offshore units, inspecting many areas on board, ranging from tanks and cargo holds to external structures such as jack-up legs. The inspection of such spaces can be both costly and time consuming, and even in some instances potentially dangerous. Using drones to visually check the condition of remote structural components can significantly reduce survey times and staging costs, while at the same time improving surveyor safety.

LR joins project to build world's biggest sailing cargo ship

Lloyd's Register has joined the Quadriga sustainable shipping project – an initiative from Hamburg-based Sailing Cargo, which aims to build the world's biggest sailing cargo ship.

The project outlines a plan to build a 170-meter car carrier, capable of carrying between 1,700 and 2,000 cars, which will be equipped with four DynaRig masts and will operate on hybrid propulsion with sails and diesel-electric engines, and an optional battery system for peak loads. The vessel will be capable of sailing at 10-12 knots with the aim of reaching 14-16 knots in the next few years through combined expertise.

Wind-assisted propulsion offers a realistic option for introducing renewable power into shipping. LR's Low Carbon Pathways 2050 study found that low carbon ships will need to enter the fleet by 2030 in order for shipping to reduce its emissions in line with the Paris Agreement and this means significant changes in the industry are required.

The big question is whether the technology will be available on the scale needed to achieve the level of reduction required. The consensus is that engineering advances alone and the associated efficiency gains will simply not be enough to achieve this. Fuels will have to change and the Quadriga project provides one of the potential viable alternative solutions.

Uwe Köhler, founder of the Quadriga project, said "We must do the right thing for the future of our industry; the Quadriga project combines traditionally proven systems with

cutting edge technology and aims to provide a solution to reduce CO_2 emissions. We are delighted to be working with Lloyd's Register on this project."

LR's Nico Dettmann, Marketing and Sales Manager for Central and Eastern Europe,

Marine & Offshore, said "It's a very exciting initiative to be involved in. It's always motivating for us to be involved from the concept stage of any project, especially those that involve innovative technology and new ways of doing things. We have a long history of working with and supporting our clients to bring their new and novel concepts, safely and robustly from inception to operational reality."

Through consultancy during the design and specification stage followed by onsite new construction supervision, LR will help to ensure compliance with the highest technical, safety and environmental standards upon realisation of the project. LR will also verify whether the predicted performance parameters have been achieved.

ClassNK issues EU MRV Monitoring Plan approval to Iino Marine Service

ClassNK has issued approval certification to Iino Marine Service Co., Ltd. on successful assessment of an EU MRV Monitoring Plan for its chemical tanker "CHEMROAD WING" as an EU MRV verifier on 28 July. The issuance of this approval certification is a first for ClassNK.

EU MRV is an EU regulation on the monitoring, reporting, and verification of carbon dioxide (CO_2) emissions from vessels. This regulation lays down rules for developing Monitoring Plans to the verifiers accredited by a national accreditation body in the EU by 31 August 2017 for ships above 5,000 gross tons which arrive at or depart from ports under the jurisdiction of an EU member state. EU MRV also outlines requirements for collecting data and submitting Emission Reports from 1 January 2018 (Monitoring Process).

ClassNK acquired approval from UK-based national accreditation body UKAS in March 2017 as EU MRV verifier. ClassNK issued approval certification to Iino Marine Service for their vessel "CHEMROAD WING" for fulfilling the necessary criteria stipulated in EU MRV regulations. The Monitoring Plan submitted states data collection methods for fuel consumption, distance travelled, time spent at sea, amount of cargo carried, as well as methods to be used to treat data gaps.

(from left) Mr. Akira Hoshi (Director & General Manager of Engineering Department, Iino Marine Service Co., Ltd.), Mr. Toshio Koiwa (Director of Assurance Operations Division, ClassNK).

ABS Joins Industry Partners to Advance Autonomous Shipping

ABS joined the Unmanned Cargo Ship Development Alliance to work with industry partners, including class organizations, shipyards, equipment manufacturers and designers to advance autonomous shipping. The design will integrate features of independent decision-making, autonomous navigation, environmental perception and remote control.

"Increased digitization, advanced technologies and new levels of connectivity are changing the way the maritime industry operates," said ABS Greater China Division President Eric Kleess. "In the coming years, we will see significant changes in the way ships are designed and built, with a strong drive to develop autonomous vessels especially in China. As a key member of this alliance, ABS is aligned closely with industry to support safer and more sustainable maritime operations."

The Unmanned Cargo Ship Development

Alliance, chaired by HNA Technology Group Co, Ltd., was formed with nine members, including ABS, CCS, China Ship Research & Development Institute, Shanghai Marine Diesel Engine Research Institute, Ltd, Hudong-Zhonghua Shipbuilding (Group) Co., Ltd, Marine Design Research Institute of China (MARIC), Rolls-Royce, and Wartsila. The alliance officially launched at the end of June and expects to deliver the unmanned cargo ship by October 2021.
"Through this collaborative effort, we will apply the latest technologies to develop a new autonomous ship concept," said HNA Technology Group Vice Chairman Li Weijian. "The newly formed alliance is advancing new innovations in ship design and operations, and also working to promote the safe adoption of these assets in the market."

Briese Schiffahrt appoints KR to deliver EU MRV verification services

Korean Register (KR) has announced that it has been appointed to provide EU (European Union) Monitoring, Reporting and Verification (EU-MRV) services to Briese Schiffahrt, a global leader in the management of general cargo, multipurpose and heavy lift vessels, which is headquartered in Leer, Germany.
KR and Briese Schiffahrts GmbH & Co. KG signed the agreement which covers verification services including assessment of monitoring plans and verification of carbon emission reports in compliance with ISO 14065 standard and regulation 757/2015.
As a leading classification society, KR offers a wide range of services through its rules and standards to shipping, ship building and industrial clients in Germany and around the world. KR opened it's branch office in Hamburg in 1997 and opened a new site office in Frankfurt earlier this year.
Michael Suhr, Technical / Commercial Director KR, said "We are pleased that Briese Schiffahrt has chosen KR to be its partner for EU-MRV verification. This appointment demonstrates KR's growing status in the German market and is a clear endorsement of our technical abilities. We remain committed to providing prompt, efficient technical and specialist services to all of our valued customers in Germany and look forward to supporting Briese Schiffahrt in this important work."
KR was authorized by Germany's National Accreditation Body (DAkkS) to act as a verification body for EU MRV (Monitoring, Reporting, Verification) on 2 March 2017. KR will continue to support its customers applying for Monitoring Plan Assesment. The official deadline for this service is 31 August 2017 and from 1 January 2018, KR will report the results to the EU accordingly.

USAID and Inmarsat Partner for Legal, Traceable and Sustainable Fishing

The United States Agency for International Development's Oceans and Fisheries Partnership (USAID Oceans) and Inmarsat Global Limited (Inmarsat) have announced a new partnership to help commercial fishing crews promote sustainable fishing in Southeast Asia.
By making use of enhanced communication technology, the partnership will advance catch documentation and traceability (CDT) to promote legal, reported and regulated fishing. USAID Regional Development Mission for Asia's Regional Environment Office Director, Angela Hogg, and Chief Sales Officer for Inmarsat Maritime, Gerbrand Schalkwijk attended a signing ceremony for the partnership.
"USAID Oceans is very pleased to be partnering with Inmarsat on developing solutions and services that will support sustainable fishing and, at the same time, improve the welfare and livelihood of those working at sea," said Angela Hogg.
Through this partnership, USAID Oceans will leverage Inmarsat's expertise to improve communica-

(From left) Geronimo Silvestre, Chief of Party, USAID Oceans, Gerbrand Schalkwijk, Chief Sales Officer, Inmarsat Maritime and Angela Hogg, USAID Regional Development Mission for Asia's Regional Environment Office Director at the signing ceremony for the partnership.

tions for fishing vessels in the region. Crew members on medium and large vessels will integrate existing monitoring systems and CDT data with Inmarsat's Fleet One and IsatData Pro technology, a global two-way messaging service for tracking and monitoring ports and vessels. USAID Oceans will pilot this technology in Bitung, Indonesia, and Songkhla, Thailand, where the project has undertaken CDT system development and testing. Successful pilot tests demonstrating effective communications between vessels and ports will enable further CDT system development in the region.

In Indonesia, Inmarsat will equip fishing vessels from participating companies with onboard satellite systems for real-time electronic voice and data exchange while at sea, consistent with Indonesia's Ministry of Marine Affairs and Fisheries reporting requirements. Enhanced connectivity will help reduce illegal fishing and support fishers to monitor and share fish stocks. This technology will help fishing fleets to locate fish faster, improve voyage planning and reduce operational costs. Better ship-to-shore communication will enable captains to instantly track weather forecasts, thereby ensuring safer sailing and quality of life at sea.

In Thailand, Inmarsat, in partnership with seafood producer, Thai Union, is providing a satellite communications to help crews maintain at-sea connectivity for quicker and easier digital catch reporting, communication and fleet management. Activities in Indonesia and Thailand will support expansion to other countries in the Asia-Pacific region to use similar systems.

Roxtec invests in new fire lab

Cable and pipe transit manufacturer Roxtec is growing in several different industries. In order to meet the increasing demand for product testing and pave the way for continuous growth, the company is building a new fire test lab in Karlskrona, Sweden. It will be ready in 2018.

The Roxtec sealing system is used all over the world to protect life and secure operations. Owners and contractors within everything from shipbuilding and construction to renewable energy rely on the seals that are tested and certified to protect against multiple risk factors, including fire.

"We see a lot of opportunities for our cable and pipe transits," said CEO Mikael Helmerson. "We are growing in many sectors at the same time and keep on adding safety solutions for use in new applications. This intensive development makes us perform more fire protection tests than ever before. With the new fire lab, we increase our capacity and prepare ourselves for further growth."

Roxtec provides safety seals for projects requiring quality and reliability, and the 540-squaremeter two-floor fire lab will reflect this in all aspects. It will be built at the Roxtec global headquarters close to the material test lab and the product development and production facilities. It will help ensure an efficient work flow, a good working environment and a sustainable testing procedure.

The lab will enable Roxtec to set up tests according to most national and international standards. "We perform fire tests in order to develop our transits and ensure quality, but also to be able to invite customers and certifying authorities to witness tests with specific products for specific applications," said Ulf Hildingsson, manager technical and commercial support at Roxtec.

MacGregor invests in software to drive RoRo vessels' operations efficiency

MacGregor has acquired the rights for a ships efficiency software from Lekven AS to increase RoRo vessels operations efficiency and to drive port call optimisation. The contract was signed in June 2017.

According to the contract, MacGregor acquires the rights for an operational efficiency software for ships, ports and adjacent activities. This software will be further developed and launched to the market during 2017.

"MacGregor is very well known and a

respected player in the RoRo business. They have a long experience and have pioneered many new services and solutions to the market over the years. I am very happy to join MacGregor and share my expertise from the shipping company side where I have built the software based on improving ship owner and port businesses by utilising business information," said Endre Lekven, who developed the software.

"MacGregor continues to shape the marine industry with value adding services and solutions. This collaboration is an ideal fit to MacGregor offering as part of our strategy is to support RoRo ship owners and operators to improve their existing and future fleet efficiency by eliminating inefficiencies for smarter cargo handling," said Magnus Sjöberg, Vice President, RoRo Division, MacGregor. "We are now first focusing on improving logistics efficiency of PCTCs and minimising their waiting time."

"According to our strategy, we focus on widening our digital offering portfolio, and ships efficiency software is a natural addition to it. This business intelligence software is first of its kind in the market. It is easy to operate and has clear interfaces and reports," said Alexander Nürnberg, Senior Vice President, R&D and Technology, MacGregor. "The software has had a 15 months trial with a global PCTC ship owner/operator in European ports, showing very positive results."

삼성중공업, 안전 실천 마스터플랜 발표

삼성중공업은 지난 8월 3일 안전경영을 위한 전략을 논의하는 '안전전략회의'를 개최해 안전한 작업장 구현을 위한 마스터플랜을 확정했다.

삼성중공업은 마스터플랜 수립에 앞서 전 작업장 추가 특별 안전진단, 크레인 사고 재발방지와 작업장 위험요소 제거를 위한 자체 TF 활동, 고객사 VOC 청취 및 글로벌 선진사 벤치마킹 등을 실시했다.

삼성중공업은 안전 최우선 경영을 실천하기 위해 '안전경영위원회'를 신설하고, 안전관리 조직을 '안전경영본부'로 격상시켜 위상과 권한을 강화했으며, 크레인 충돌사고 재발을 막기 위해 새로운 개념의 위치·형상 기반의 충돌방지 시스템을 개발해 2018년까지 단계별로 적용할 계획이다. 뿐만 아니라, 자체 TF 활동을 통해 위험 요소를 추가로 발굴하고 선제적 사고예방 조치를 진행할 계획이다.

삼성중공업 관계자는 "사고 원인에 대한 철저한 분석과 반성, 자체 TF 활동, 외부 전문가들의 조언과 벤치마킹 결과 등을 바탕으로 2018년까지 안전한 작업장을 구현하기 위한 마스터플랜을 수립했다"면서 "안전이 경영의 제 1원칙이라는 철저한 안전 의식을 바탕으로 마스터플랜을 적극 실천해 나갈 것"이라고 말했다.

부산시와 KRISO, 미래 선박해양 기술개발 협력 MOU 체결

부산시와 선박해양플랜트연구소(KRISO)는 국제해사기구(IMO)의 안전과 환경규제, 4차 산업혁명에 대응해 미래 고부가가치 선박해양산업의 발전을 선도하기 위해 업무협약을 체결했다. 이번 협약식은 지난 8월 23일 김영환 부산시 경제부시장, 서상현 선박해양플랜트연구소장 등이 참석한 가운데 개최됐다.

부산시는 조선산업의 수주불황과 침체에도 불구하고 미래 스마트선박 시장에 대한 세계 각국의 치열한 경쟁과 IoT, 빅데이터, AI, 스마트 센서 등 4차 산업혁명 핵심기술의 확대에 따른 조선 및 해운의 스마트 서비스 기술 선점이 필요하다는 판단에 따라 선도적 미래 선박해양 기술개발을 통해 지역 기업들이 시장을 선점할 수 있도록 지원하겠다는 전략이다.

이번 협약에 따라, 선박해양플랜트연구소는 부산지역 산업체가 미래 선박해양 분야로 진출할 수 있도록 기술개발 참여확대 및 지원을 노력하고, 부산시는 이를 위해 선박해양플랜트연구소에 적극 지원할 계획이다.

부산시 관계자는 "최근 글로벌 조선경기 불황으로 지역 조선기자재업체가 많은 어려움을 겪고 있지만 이럴수록 세계 산업환경에 낙오되지 않고 또 최근과 같이 4차 산업혁명으로 산업기술이 급변하는 시기에 무엇보다 선도적인 기술개발이 중요하다며 부산시는 이번 협약을 계기로 선박해양플랜트연구소와 협력하여 지역 기업체의 기술개발에 적극 지원해 나가겠다"고 말했다.

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MR Tanker segment bottoms out and sails smoothly

- Newbuilding price index rebounding in 3 years

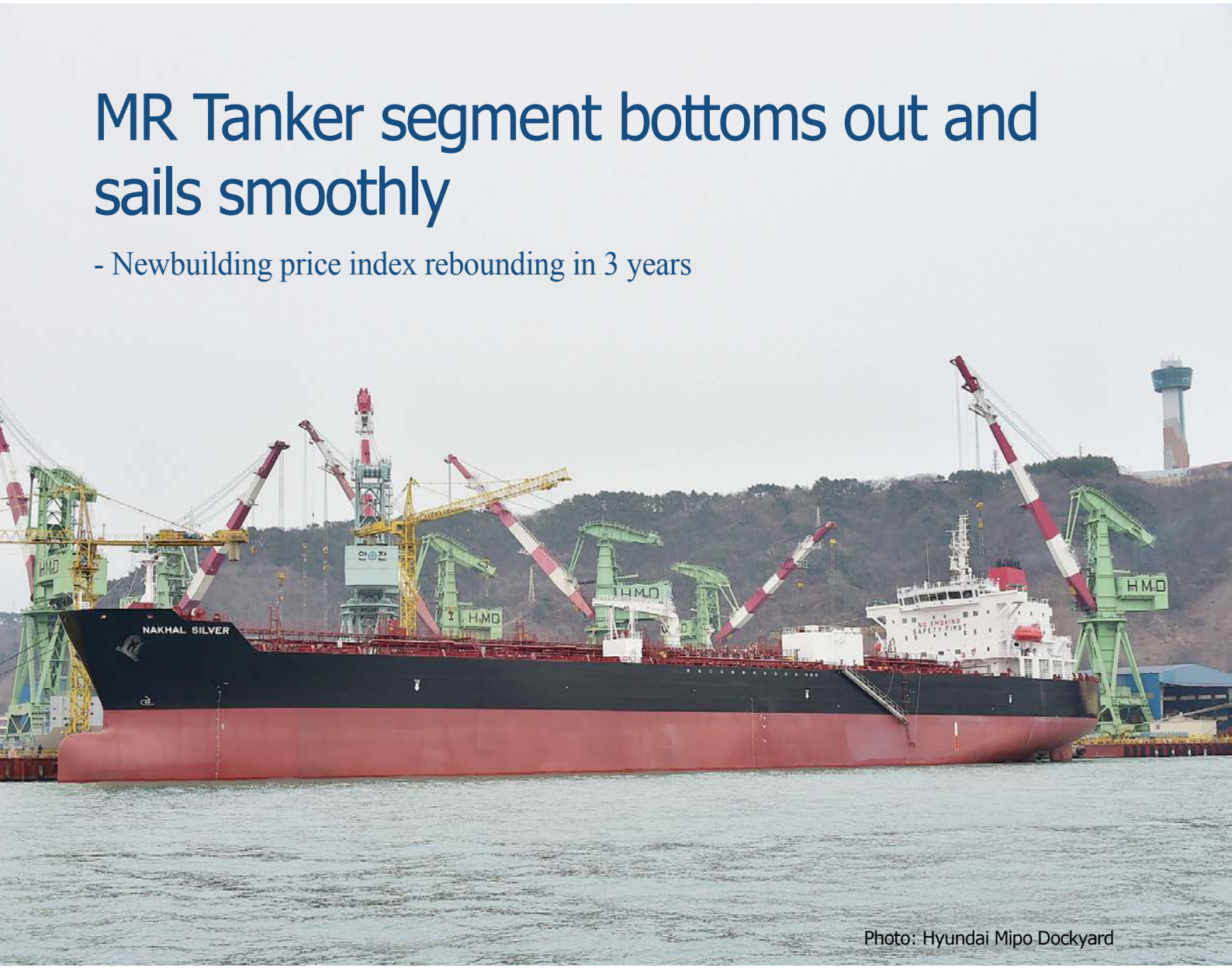

Photo: Hyundai Mipo Dockyard

It is widely believed that global shipbuilding industry hit the bottom. At the end of the long tunnel of recession, newbuilding price index and pre-owned vessel price index are showing signs of recovery this year which raises expectation for a turn-around in industry.

According to Clarkson, newbuilding price index reached 123 points in July. Newbuilding price index hit 123 points in December last year and dipped to 121 points in March this year but remained stationary since then. However, recent increase in price index for Panamax bulk carrier and MR tanker has pushed the newbuilding price index upward. Pre-owned vessel price index is also pushed upward by tanker and containership segments.

The prospect for a turnaround in new orders in the second half of this year also supports the view that shipbuilding market will bottom out amid robust growth of global cargo traffic volumes and enforcement of more rigorous environmental regulations in 2020. According to shipbuilding industry, cargo traffic vol-

umes is expected to reach 11.4 billion tons this year, an increase by 310 million tons compared to the previous year, underpinned by global economic growth. Replacement of old vessels is expected to gather pace due to SOx (Sulfur Oxides) regulations in 2020. This year, the demand for new vessels stands at 51.41 million DWT amid the rise in cargo traffic while the demand for ship replacement due to scrapping amounts to 36.11 million DWT. Thus, global new order placement is expected to reach about 87.52 million DWT, an increase by 206.4% from the previous year.

Particularly, newbuilding price of MR tanker is rebounding in 3 years after persistently downward trend since 2014, bolstering the recovery in new orders. This trend is attributed to the fact that cargo traffic volume of petrochemical products has increased at an annual rate of more than 4% due to low oil prices while the order backlog of MR tankers is diminishing. In other words, vessel prices have risen as a result of decline in vessel supply in comparison to the growth of cargo traffic volume. In addition, rapid increase in the quantity of old vessels aged more than 15 years has also affected the price increase of MR tankers.

Global shipbuilding market witnessed a slight recovery in newbuilding orders in the first half of this year, while volumes of vessels built declined due to diminishing order intake persistent for several years. Cruise ship orders have continued upward trend since last year, comprising 26% of shipbuilding orders, the highest, in the same period. The share of orders for bulk carriers decreased while that of order for tankers increased.

Tanker market saw a slide in new orders for VLCCs which had been on the increase since 2015 amid sustained low oil prices. However, new orders for MR tanker, a medium-sized oil tanker, have increased to accommodate the rise in transportation of crude oil and petroleum products, creating a momentum to shipbuilding industry that has remained in doldrums.

MR tanker is a medium-sized vessel with a capacity of 40,000 to 60,000 DWT, which transports petroleum products such as gasoline, diesel, and kerosene which are byproducts resulting from the refining process of crude oil. Price of newbuild MR tanker has recently risen to USD 33 million apiece.

According to shipbuilding industry, the rebound in the price of MR tanker is driven by drastic increase in old MR tankers aged more than 15 years in comparison to the increase in marine cargo traffic volume. Another factor is the increase in the demand for refining among oil-producing countries due to the glut of oil supply.

Meanwhile, Korean shipbuilding industry is still mired in recession across the types of vessels. However, the share of oil tanker and PC (Product Carrier) rose to 60% in the first half of this year, which suggests a turnaround led by tanker segment.

A signal for recovery in shipbuilding market

In tanker market, freight rate for oil tanker declined while freight rate for PC (Product Carrier) edged upward. New order placement for tankers has been on the rise amid low oil prices that have stayed persistently low since the second half of 2014. However, tanker order placement has begun to fall this year as a consequence of excessive orders placed thus far. The capacity in tanker market is expected to exceed the growth rate of cargo traffic volume this year.

VLCC freight rate on the route between Ras Tanura in Saudi Arabia and Rotterdam in the Netherlands dropped 10.9% year-on-year until last March based on WS average. In the meantime, VLCC freight rate on the route between Bonny Island terminal off Nigeria and Ningbo in China slid 3.2% while Suezemax-class freight rate on the route between Saudi Arabia and Trieste in Italy fell 16.1%.

The supply growth rate of PCs (Product Carriers) is expected to surpass the demand growth rate by 1-2%. However, the freight rate index and charter rate for PCs increased due to the increase in cargo traffic volume. Freight rate index for MR tankers on route between West India and Singapore rose 15.4% year-on-year while freight rate index for LR tanker on route between Skikda in Algeria and Houston rose 13.6% year-on-year. Freight rate index for MR tanker on Houston-Rio de Janeiro route increased 7.2% year-on-year while freight rate for MR tanker on Houston-Amsterdam route increased 7.5% year-on-year. In particular, charter rates for 74K LR-class PCs

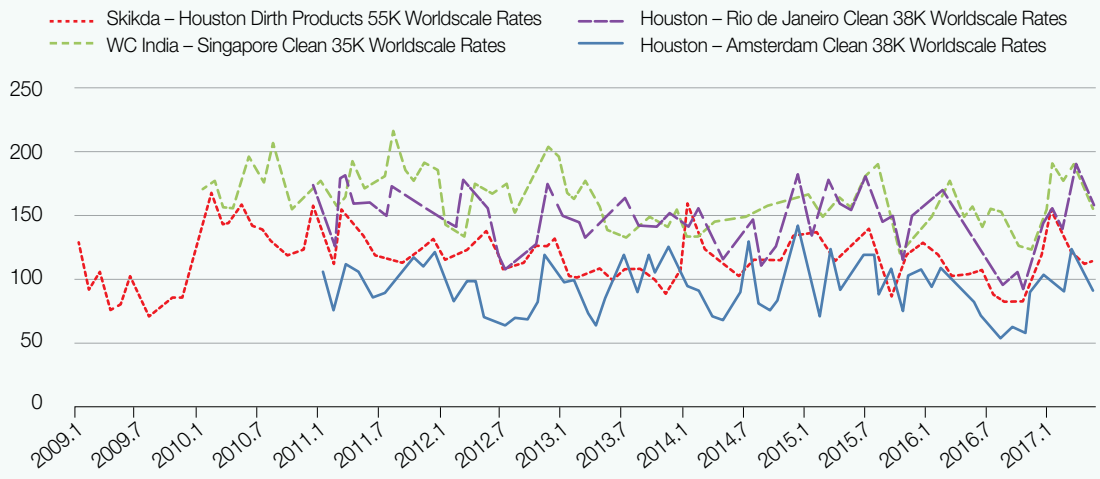

Figure 1. Trends of freight rate for PCs (Source: Clarkson)

(Product Carriers) increased by 4.9% to USD 13,375/day and that for 47K-class PCs rose by 11.8% to USD 13,281/day in the same period. Meanwhile, charter rates for 37K MR-class PCs decreased by 4.3% to USD 11,250/day.

According to related industries, freight rate for PCs (Product Carriers) increased and charter rate for some vessel types also rose, compared to the same period of the previous year.

However, such rise in freight rates is considered an adjustment for excessive decline or is limited for the upswing in the demand for specific sea routes. For the PCs, trade volume of petroleum products has slowed down and growth rate of capacity is expected to exceed that of demand by about 1%p as a result of the supply of capacity.

Aframax-class tanker is divided into crude oil carrier, product carrier, and shuttle tanker carrying the oil to onshore locations from FPSO (Floating Production Storage and Offloading) unit, depending on purposes. Recently, no order has been placed for shuttle tanker in the aftermath of order drought in offshore plant sector. However, new orders have been placed continuously for crude oil carriers operating on routes from Africa to Europe and Asia based on Libya, which is bolstered by the increase in crude oil production in Libya. Moreover, the demand for MR to LR2 tankers has been increasing amid the surge in production and exports of petroleum products, spurred by the Shale Gas Revolution, in the United States.

Upturn in new orders for MR tankers

The vessels used to transport petroleum products include MR tankers and LR1/LR2-class tankers. MR tanker is a versatile multi-functional vessel with a capacity of 25-55K which can transport chemicals, animal oil/vegetable oil such as palm oil, and some chemical products, as well as petroleum products.

38K-class Pure Chemical Tanker can transport up to 56 high-risk chemical products altogether at a time. The vessel size is limited by the IMO (International Maritime Organization) to less than 40K DWT due to the risk of explosion caused by mixing of chemicals as a result of mistaken coating on the inner wall of stand-alone tank.

For global capacity, there are 1,927 MR tankers worldwide. Usually, vessels are dismantled when they are aged 22 years or older. According to Clarkson, the number of pre-owned MR tankers aged over 15 years has exceeded about 350 units last year. There are about 140 vessels aged more than 22 years. About 90 vessels are scheduled for delivery in 2017. And about 30 vessels are scheduled for delivery in 2018. Approximately 30 vessels are scheduled for delivery after 2019.

An average of 81 vessels had been delivered from 2000 to 2006, while an average of 98 had been delivered between 2000 and 2016. An increase in dismantling of old vessels is expected, along with rising demand for replacement, as a result of rise in steel plate prices, lack of room amid intensi-

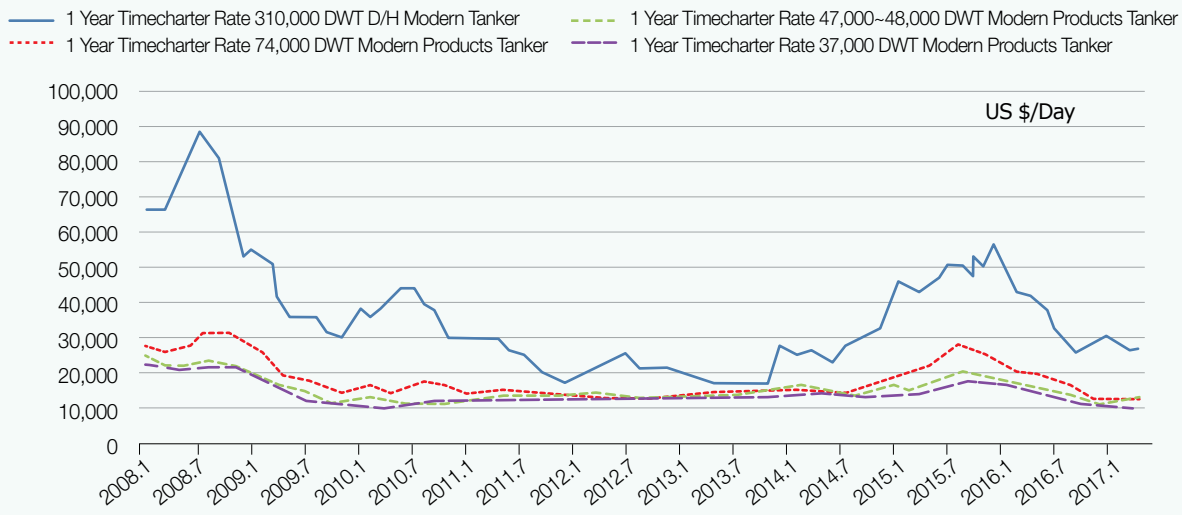

Figure 2. Trends of charter rate (Source: Clarkson)

fied retrenchment of small-and medium-sized shipyards, and ship prices falling precipitously. Orders placed right now at domestic shipyard will be delivered in 2019. Therefore, order placement is expected to increase in 2017.

MR tankers have been recently built in compliance with rigorous Tier III emission standard set forth by the IMO (International Maritime Organization). Orders for MR tankers have been placed by Norway-based DSD Shipping and U.K.-based Union Maritime, etc., as well as France-based Socatra which placed an order in 6 years.

New orders for Aframax-class oil tankers on upward trend

According to Clarkson, 35 Aframax-class oil tankers, including LR2 tankers, were ordered this year. That is almost six-fold increase, compared to the previous year (6 vessels). New orders for MR tankers are also on the increase. The quantity of MR tankers ordered in the first half of this year stands at 30 which is similar to the previous year's order quantity. Particularly, Hyundai Mipo Dockyard (HMD), major player in global market for PCs, won orders for 31 MR tankers among 41 units ordered to it in the first half of this year.

According to foreign press, 38 VLCCs were ordered in the first half of this year. Last year, only 13 vessels were ordered. This year, the quantity of VLCCs ordered in the first half of this year was almost 3 times the quantity ordered throughout the previous year. Along with VLCCs, new orders for Aframax-class oil tanker have continued upward trend this year. 8 units of LR2 (Long Range2) tankers were ordered to Daehan Shipbuilding by BW Group. Subsequently, 4 units of LR2 tankers (including 2 optional vessels) were ordered to Hanjin Heavy Industries & Construction (HHIC) by Central Shipping Monaco.

Outlook for growth in new orders for PC (Product Carrier)

As low oil prices are prolonged, investment in oil refining facilities is expanding globally. The construction of oil refining facilities is already in full swing, mainly in the Middle East. The oil refining facilities to be completed by 2021 will have the refining capacity of 6.7 million barrels per day (330 million tons per year). Assuming that about 230 million tons of oil (about 70% of 330 million tons) are transported by tanker by sea, quite a little growth of cargo traffic volume is expected, considering that global maritime cargo traffic volume of petrochemicals amounts to roughly 1.38 billion tons.

About 650 PC tankers are expected to be ordered by 2021. As the cargo traffic increases to 230 million tons, 215 vessels are demanded newly. Moreover, about 400 old vessels aged more than 15 years need to be replaced. New orders for MR tankers, which comprise more than 70% of PC tankers, are expected to rise sharply soon.

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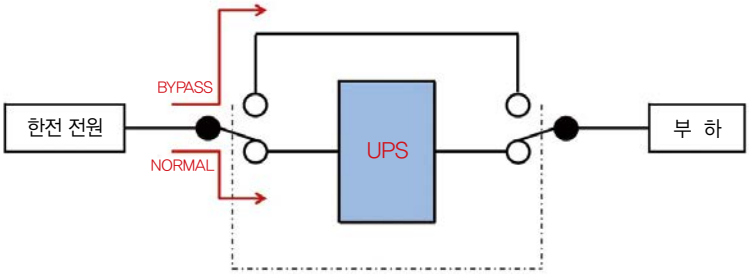

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2017년 하반기 국내 신조선 시장 '성장세' 주목

한국수출입은행에서 발표한 '2017년 하반기 조선시황 전망'을 살펴보면 하반기 중 신조선 시장의 흐름이 상반기와 큰 차이는 없을 것으로 예상되며, 시장에서의 불확실성은 해소되기 어려울 것으로 전망하고 있다. 이러한 이유로는 하반기에 세계 신조선 시장에 뚜렷한 변화요인을 기대하기 어렵기 때문으로 분석하고 있다. 이러한 세계 시장의 흐름이 하반기 중에도 부진할 전망이라 국내 수주 역시 큰 폭으로 호전되기는 어려울 것으로 전망하기도 했다.

다만, 2020년 규제 실행이 다가오고 있고, 신조선 가격의 완만한 상승 흐름이 나타나면서 저가에 발주하고자 하는 선주들이 조금씩 움직임에 따라 연말을 전후해 소폭의 수주증가가 전망되어 2017년 국내 총 수주량은 전년대비 126% 증가한 500만 CGT 내외가 될 것으로 예상되며, 수주액은 271% 증가한 170억 달러 내외가 될 것으로 내다봤다. 또한, 현재 선주들의 관망세로 신조선 발주가 미루어 지고는 있으나 오래 지속되지는 않을 것으로 예상하고 있다.

올해부터 시행되는 평형수처리장치 규제에 의한 개조투자 여부결정, 2020년부터 실행되는 SOx 규제에 대한 개조 또는 신조투자 결정 등 어려운 결정해야 할 시기가 다가오고 있고, 여기에 IMO 규제 이외에 EU, 미국 등 주요국 정부들의 단독 규제까지 향후에도 각종 규제강화가 추가로 논의되거나 검토되고 있어 선주들의 친환경, 고효율 선박은 생존을 위한 필수요건이 되고 있고, LNG의 가격 하락 속도에 따라서 LNG 연료 추진선박의 신조선 수요가 급격히 몰릴 가능성도 있다. 이처럼 선복량 과잉시황에서도 환경규제 강화에 의한 신조선 수요는 잠재되어 있으며 2018년부터 이들 수요가 점차 발주로 이어질 것으로 예상된다.

국내 조선산업 신조선 추정 수주 현황

세계 조선소, 선주사, 리서치기관, Shipbrokers 및 국내외 언론의 보도자료 등을 종합한 국내 조선산업의 2017년 7월 31일 기준 신조선 추정 수주 현황을 보면 옵션을 포함해 총 210척 중 Gas Carrier 15척(1,449,300 CBM), Tanker Carrier 175척(26,521,400 DWT), Bulker

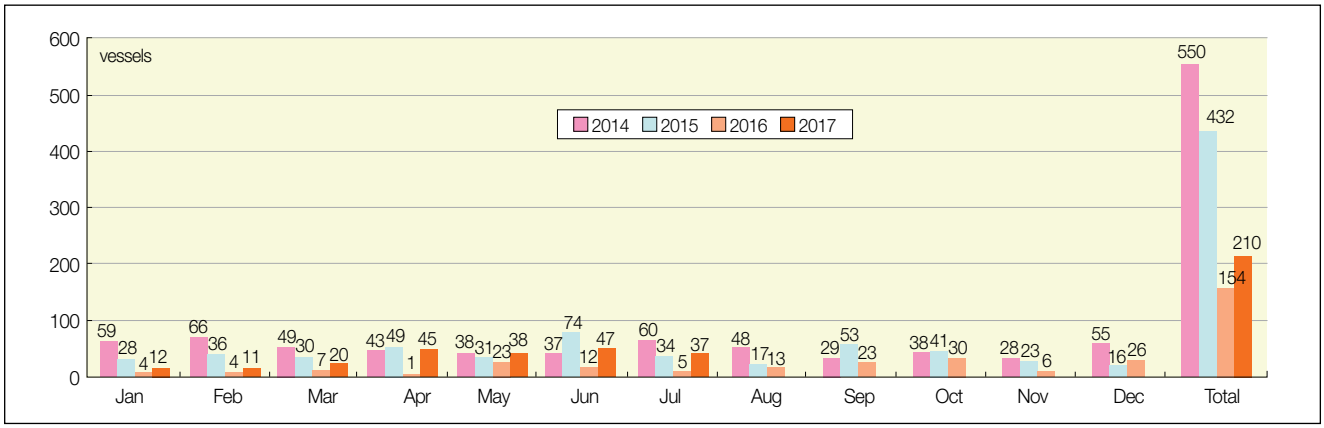

그림 1. 국내 조선소 2014–2016년 대비 2017년 추정 수주현황 추이 (옵션 포함)

Carrier 3척(975,000 DWT), Other vessels 17척을 수주한 것으로 나타났다. 아울러 해양플랜트(Offshore Rig) 6기와 옵션 11기를 포함해 총 17기를 수주한 것으로 나타나고 있으나 Container Ship의 수주는 전무한 상태이다.(그림 1 참조)

월별 수주 현황을 보면 1월은 Tanker Carrier 12척(1,394,000 DWT) 수주, 2월은 11척 중 Gas Carrier 4척(84,000 CBM), Tanker Carrier 5척(750,000 DWT), 18,000 DWT Ro-Ro vessels 2척 수주, 3월은 20척 중 Gas Carrier 8척(994,300 CBM), Tanker Carrier 14척(2,795,700 DWT) 수주, 4월은 45척 중 Gas Carrier 2척(15,000 CBM), Tanker Carrier 42척(7,960,300 DWT), Other vessels 1척 수주, 5월은 38척 중 Gas Carrier 1척(38,000 CBM), Tanker Carrier 37척(6,855,000 DWT) 수주, 6월은 47척 중 Gas Carrier 2척(360,000 CBM), Tanker Carrier 28척(2,726,000 DWT), Bulker Carrier 3척(975,000 DWT), Other vessels 14척 수주, 7월은 Tanker Carrier 37척(4,040,400 DWT)을 수주 한 것으로 나타나고 있다.(표 1~2 참조)

2017년 7월 31일 추정 수주금액을 보면 1월 US$ 545.7 Million, 2월 US$ 533 Million, 3월 US$ 2,013.3 Million, 4월 US$ 2,449 Million, 5월 US$ 2,138.9 Million, 6월 US$ 2,563.8 Million, 7월 US$ 1,560 Million으로 총 US$ 11,723.7 Million 중 Gas Carrier US$ 1,790.8 Million, Tanker Carrier US$ 8,912.1 Million, Bulker Carrier US$ 225 Million, Other vessels US$ 795.8 Million으로 집계됐다.(표 3 참조)

2017년 7월 국내 신조선 추정 수주 현황

국내 조선 업체별 2017년 7월 신조선 추정 수주 현황을 보면 대우조선해양이 그리스의 Maran Tankers에서 318,000 DWT Tanker Carrier 4척을, 삼성중공업은 Bermuda 소재 Teekay Offshore로부터 154,000 DWT Tanker Carrier 4척(2+2option)을, 한진중공업은 Monaco의 Central Shipping으로부터 115,000 DWT LR2 Tanker Carrier 4척(2+2option)을 수주했다.

현대미포조선은 Greece의 Sea Pioneer로부터 50,000 DWT Tanker Carrier 2척과 Norway의 DSD shipping로부터 50,000 DWT Tanker Carrier 4척(2+2option)을 수주했고, 현대미포조선 Vinashin 조선소는 일본의 Matsumoto shipping로부터 50,000 DWT Tanker Carrier 2척과 일본의 Fukujin Kisen으로부터 50,000 DWT Tanker Carrier 2척, Hisamoto Kisen KK로부터 50,000 DWT Tanker Carrier 1척을 수주했다.

Division	Gas	Tanker	Bulker	Container	Other	Monthly Total
January		12				12
February	4	5			2	11
March	6	14				20
April	2	42			1	45
May	1	37				38
June	2	28	3		14	47
July		37				37
Total	15	175	3	0	17	210

표 1. 국내 조선소 선종별 수주현황 (옵션 포함 – 2017년 7월 31일 기준)

Division	Gas (CBM/m³)	Tank (DWT)	Bulk (DWT)	Container (TEU)
January		1,394,000		
February	84,000	750,000		
March	952,300	2,795,700		
April	15,000	7,960,300		
May	38,000	6,855,000		
June	360,000	2,726,000	975,000	
July		4,040,400		
Total	1,449,300	26,521,400	975,000	0

표 2. 국내 조선소 선종별 수주량 추이 (옵션 포함 – 2017년 7월 31일 기준)

Division	Gas	Tanker	Bulker	Container	Other	Monthly Total
January	–	545.70	–	–	–	545.70
February	160.00	254.00	–	–	119.00	533.00
March	1,105.30	828.00	–	–	–	1,933.30
April	80.00	2,339.00	–	–	30.00	2,449.00
May	45.50	2,093.40	–	–	–	2,138.90
June	400.00	1,292.00	225.00	–	646.80	2,563.80
July	–	1,560.00	–	–	–	1,560.00
Total	1,790.80	8,912.10	225.00	0.00	795.80	11,723.70

표 3. 국내 조선소 2017년 월별 추정 수주금액 (옵션 포함 / Unit: US$-Million)

Division	Gas Carrier	Tanker Carrier	Bulker Carrier	Container Ships	Other vessels	Shipyard Total
HHI	5	28	3			36
DSME	4	19				23
SHI	2	18				20
HMD	4	43			4	51
HSHI		16				16
STX O&S		16				16
Sungdong		7				7
HHIC		10			12	22
DaeHan		16				16
DaeSun		2				2
Other Yard					1	1
Ships Total	15	175	3	0	17	210

표 4. 국내 조선업체 선종별 수주현황 (신조선 옵션포함 – 2017년 7월 31일 기준)

NO	Shipyard	Date	Client	Country	Class of Order	Q'TY	Delivery
1	HMD	Jan	Pleiades Shipping	Greece	50,000 DWT Tanker Carrier (2+2option)	4	2018
2	HMD	Jan	Sangji Shipping	Korea	50,000 DWT Tanker Carrier	1	2018
3	HMD	Jan	Gs Caltex	USA	50,000 DWT Tanker Carrier	1	2018
4	Daehan	Jan	Ship Finance International	Norway	114,000 DWT Tanker Carrier (2+2option)	4	2018
5	HHI	Jan	DHT Holdings	Bermuda	319,000 DWT VLCC Tanker Carrier	2	2018
6	HMD	Feb	Fukujin Kisen	Japan	50,000 DWT Tanker Carrier (1+1option)	2	2018
7	HMD	Feb	CLdN Ro-Ro Shipping	UK	18,000 DWT Ro-Ro	2	2018
8	HMD	Feb	Solvang	Norway	21,000 cbm Gas Carrier (2+2option)	4	2019
9	HMD Vinashin	Feb	Central Mare	Greece	50,000 DWT Tanker Carrier	1	2018
10	HHI	Feb	Enesel	Greece	300,000 DWT Tanker Carrier	2	2018
11	DSME	Mar	FLEX LNG	Norway	173,400 cbm LNG carrier (2+2option)		2019
12	DSME	Mar	Angelicoussis Group	Greece	318,900 DWT Tanker Carrier	4	2019
13	HHI	Mar	Knutsen OAS Shipping	Norway	180,000 cbm LNG Carrier	3	N/A
14	HHI	Mar	DRYSHIPS	Greece	78,700 cbm LNG Carrier – Option Declared	1	2017
15	HSHI	Mar	SCF Group	Russia	114,000 DWT Tanker Carrier	1	2018
16	HHIC-Subic	Mar	TMS Tanker	Phillipine	320,000 DWT Tanker Carrier	4	2019
17	HMD	Mar	Undisclosed	Greece	50,000 DWT Tanker Carrier (1+1option)	4	2018-19
18	DaeSun	Mar	Shokuyu Tanker	Japan	3,000 DWT Tanker Carrier	2	2018
19	DSME	Apr	Hyundai Merchant Marine	Korea	318,900 DWT Tanker Carrier LOI (5+5option)	10	N/A
20	DSME	Apr	Metrostar Management	Greece	114,000 DWT Tanker Carrier	2	2018
21	HHI	Apr	FRONTLINE	Norway	300,000 DWT Tanker Carrier (2+2option)	4	2019
22	SHI	Apr	Korea Line Corp	Korea	7,500cbm LNG carrier	2	2019
23	HHIC-Subic	Apr	Eastern Pacific	Singapore	115,000 DWT Tanker Carrier	2	2019
24	HSHI	Apr	Neda Maritime	Greece	319,000 DWT Tanker Carrier LOI (1+1option)	2	2019
25	HSHI	Apr	Sentek Marine & Trading	Singapore	300,000 DWT Tanker Carrier (2+2option)	4	2019
26	HMD	Apr	Undisclosed	Greece	50,000 DWT Tanker Carrier (2+2option)	4	2018
27	Daehan	Apr	Clients of Metrostar	Greece	114,000 DWT Tanker Carrier – TIER II	2	2018
28	Sungdong	Apr	Clients of Kyklades	Greece	115,000 DWT Tanker Carrier (5+2option)	7	2018-19
29	Daesun	Apr	GS-CALTEX CORP	Korea	6,500 DWT Chemical Tankers IMO II	1	2018
30	STX	Apr	Sambong Corporation	Korea	11,200 DWT Tanker Carrier (1+1option) -eco	2	2018-19
31	STX	Apr	Woolim Shipping	Korea	11,200 DWT Tanker Carrier – eco	2	2018-19
32	Dongsung	Apr	Bougainville	Islands	Passengership/car ferry	1	N/A
33	SHI	May	Capital Maritime and Trading	Greece	320,000 DWT Tanker Carrierr (4+4option)	8	2019-21
34	SHI	May	BW Group	Singapore	320,000 DWT Tanker Carrier	4	2019-20
35	HMD Vinashin	May	D'AMICO	Italy	51,000 DWT Tanker Carrier (6+6option)	12	2018
36	HMD Vinashin	May	Central Shipping	Greece	51,000 DWT Tanker Carrier	1	2018
37	HMD Vinashin	May	Union Maritime	UK	50,000 DWT Tanker Carrier (2+2option)	4	2018
38	HSHI	May	Frontline	Norway	300,000 DWT Tanker Carrier (2+2option)	4	2019-20
39	HSHI	May	Euronav	Belgium	157,000 DWT Tanker Carrier	2	2018
40	HHI	May	TAI CHONG CHEANG(TCC)	Taiwan	319,000 DWT Tanker Carrier	2	2019
41	HHI	May	Exmar	Belgian	38,000 cbm LPG carrier	1	2018
42	SHI	Jun	AET TANKER	Malaysia	125,000 DWT Shuttle tankers	2	2019
43	HMD	Jun	CLdN COBELFRET N.V.	Luxembourg	18,000 DWT Ro-Ro	2	2019
44	HHI	Jun	BoCom FL	China	46,000 DWT Tanker Carrier (4+4option)	8	2018-19
45	HHI	Jun	BoCom FL	China	158,000 DWT Tanker Carrier (8+2option)	10	2018-19

NO	Shipyard	Date	Client	Country	Class of Order	Q'TY	Delivery
46	HHI	Jun	Polaris Shipping	Korea	325,000 DWT Bulker Carrier (VLOC)	3	2018–19
47	HHI	Jun	KNUTSEN OAS	Japan	180,000 cbm Gas Carrier (1+1option)	2	2019
48	Daehan	Jun	Clients of Metrostar	Greece	114,000 DWT Tanker Carrier – TIER II	2	2019
49	HHIC	Jun	Defense Acquisition Program	Korea	Patrol killer	4	N/A
50	HHIC	Jun	Defense Acquisition Program	Korea	235ton Logistics Support Ship	3	N/A
51	HHIC	Jun	Defense Acquisition Program	Korea	Patrol killer/Multi–purpose training boat	5	N/A
52	STX	Jun	Ocean Gold Tankers	Greece	50,000 DWT Tanker Carrier – Tier II	2	2019
53	STX	Jun	Golden Energy	Greece	50,000 DWT Tanker Carrier – Tier II	4	2019
54	HMD	Jul	Sea Pioneer	Greece	50,000 DWT Tanker Carrier	2	2018–19
55	HMD	Jul	DSD Shipping	Norway	50,000 DWT Tanker Carrier(2+2option)	4	2019
56	HMD Vinashin	Jul	Matsumoto shipping	Japan	50,000 DWT Tanker Carrier	2	2018–19
57	HMD Vinashin	Jul	Fukujin Kisen	Japan	50,000 DWT Tanker Carrier	2	2018–19
58	HMD Vinashin	Jul	Hisamoto Kisen KK	Japan	50,000 DWT Tanker Carrier	1	2018–19
59	Daehan	Jul	BW Group	Singapore	115,000 DWT LR2 Tanker Carrier (6+2option)	8	2019
60	HHIC	Jul	Central Shipping	Monaco	115,000 DWT LR2 Tanker Carrier (2+2option)	4	2019
61	STX	Jul	Socatra	Frence	50,000 DWT Tanker Carrier (2+2option) – LOI	4	2019
62	STX	Jul	Woolim Shipping	Korea	11,200 DWT Tanker Carrier (1+1option)	2	2019
63	DSME	Jul	Maran Tankers	Greece	318,000 DWT Tanker Carrier	4	2019
64	SHI	Jul	Teekay Offshore	Bermuda	154,000 DWT Tanker Carrier (2+2option)	4	2019–20
Total By Volume of 2017						210 ships	

표 5. 2017년 한국 주요 조선소 추정 신조선 수주현황 (신조선 옵션포함 – 2017년 7월 31일 기준)

STX조선해양은 Frence의 Socatra으로부터 50,000 DWT Tanker Carrier 4척(2+2option)에 대하여 LOI을 체결했으며 국내 선사인 Woolim Shipping으로부터 11,200 DWT Tanker Carrier 2척(1+1option)을 수주했다. 대한조선은 Singapore 소재 BW Group으로부터 115,000 DWT LR2 Tanker Carrier 8척(6+2option)을 수주했다.(표 4~5)

2017년 국내 조선소 해양플랜트 추정 수주 현황

2017년 7월 31일 기준 해양플랜트(Offshore Rig) 추정 수주현황을 보면 2016년 1월에는 수주소식이 전무하였으나 2017년 1월에는 6기(3+3option), 2월 10기(2+8option), 6월 1기 수주로 총 17기(5+11option)를 수주한 것으로 나타나고 있다.

업체별 해양플랜트 추정 수주 내용을 보면 삼성중공업은 총 6기(2+3option) 중 오일메이저 BP가 발주하는 매드독(Mad Dog)II 프로젝트의 부유식 해양 생산설비(FPU, Floating Production Unit)를 약 1조 5,000억원(약 12.7억 달러)에 수주하여 국내 조선업계 새해 첫 수주를 기록했으며, 6월 Italia의 ENI으로부터 210,000ton FLNG 해양플랜트 1기를 25억 달러에 수주했다. 이어 노르웨이 호그(Hoegh) LNG로부터 170,000㎥ FSRU 1척을 약 2,700억원(약 2.3억 달러)에 수주했으며, 이 계약에는 FSRU 3척의 옵션도 포함돼 있는 것으로 전해졌다.

NO	Shipyard	Date	Client	Country	Class of Order	Q'TY	Delivery
1	SHI	Jan	BP	UK	FPU (Floating Production Unit)	1	2020
2	SHI	Jan	Hoegh LNG	Norway	170,000㎥ FSRU (1+3option)	4	2019–Q2
3	HHI	Jan	Hoegh LNG	Norway	170,000㎥ FSRU (options exercised)	1	2018Q4
4	HHI	Feb	Kolin Construction	TURKEY	170,000㎥ FSRU (1+1option)	2	2019
5	DSME	Feb	Excelerate Energy	USA	170,000㎥ FSRU (1+7option)	8	2019–20
6	SHI	Jun	ENI	Italia	210,000ton FLNG	1	2022
Total By Offshore Rig						17 Rig	

표 6. 2017년 국내 조선소 해양플랜트(Offshore Rig) 추정 수주 현황

현대중공업은 총 3기(2+1option) 중 노르웨이 호그 LNG로부터 170,000㎥ FSRU Options exercised 1척에 대한 계약을 체결과 TURKEY의 Kolin Construction–Kalyon Group에서 170,000㎥ FSRU 2기(1+1option)를 수주했다.

대우조선해양은 미국의 Excelerate Energy로부터 170,000㎥ FSRU 8기(1+7option)에 대한 건조의향서(LOI)를 체결했다.(표 6 참조)

세계 조선산업 2017년 신조선 추정 수주 현황

세계 조선소, 선주사, 리서치기관, Shipbrokers 및 국내외 언론의 보도 자료 등을 종합한 2017년 7월 31일 기준 세계 신조선 추정 수주 현황을 보면 총 686척 Gas Carrier 39척(4,652,000 CBM), Tanker Carrier 322척(65,827,200 DWT), Bulker Carrier 168척(18,797,450 DWT), Container Ship 31척(58,770 TEU), Other vessels 126척을 수주한 것으로 나타났다.

2017년 7월 31일 기준 월별 추정 신조선 수주 현황을 보면 1월은 66척 중 Gas Carrier 8척(512,000 cbm) Tanker Carrier 41척(2,806,800 DWT), Bulker Carrier 2척(21,450 DWT), Container Ships 7척(12,400 TEU), Other vessels 8척을 수주했다.

2월은 75척 중 Gas Carrier 4척(84,000 CBM), Tanker Carrier 31척(2,916,800 DWT), Bulker Carrier 9척(551,000 DWT), Container Ship 25척(12,900 TEU), Other vessels(Ferry, Cruise, car carriers, RoPax, etc.) 25척을 수주했다.

3월은 93척 중 Gas Carrier 7척(959,800 CBM), Tanker Carrier 25척(3,274,700 DWT), Bulker Carrier 26척(2,806,000 DWT), Container Ship 8척(8,050 TEU), Other vessels(Ferry, Cruise, car carriers, RoPax, etc.) 27척을 수주한 것으로 나타나고 있다.

Division	Gas	Tanker	Bulker	Container	Other	Monthly Total
January	8	41	2	7	8	66
February	4	31	9	6	25	75
March	7	25	26	8	27	93
April	2	62	22	2	7	95
May	6	63	14	4	20	107
June	8	56	29	4	34	131
July	4	44	66	0	5	119
Total	39	322	168	31	126	686

표 7. 세계 조선소 2016년 선종별 수주 비교 (옵션 포함 – 2017년 7월 31일 기준)

Division	Gas(CBM/m³)	Tank(DWT)	Bulk(DWT)	Container (TEU)
January	512,000	2,838,300	31,450	12,400
February	84,000	2,885,300	541,000	12,900
March	959,800	3,274,700	2,806,000	8,050
April	15,000	11,627,500	3,212,000	920
May	75,500	12,195,000	806,000	10,100
June	860,400	5,961,000	4,068,000	14,400
July	2,145,300	27,045,400	7,333,000	0
Total	4,652,000	65,827,200	18,797,450	58,770

표 8. 세계 조선소 선종별 수주량 추이 (옵션 포함 – 2017년 7월 31일 기준)

4월은 95척 중 Gas Carrier 2척(15,000 CBM), Tanker Carrier 62척(11,627,500 DWT), Bulker Carrier 22척(3,212,000 DWT), Container Ship 2척(920 TEU), Other vessels(Ferry, Cruise, car carriers, RoPax, etc.) 7척을 수주했다.

5월은 107척 중 Gas Carrier 6척(75,500 CBM), Tanker Carrier 63척

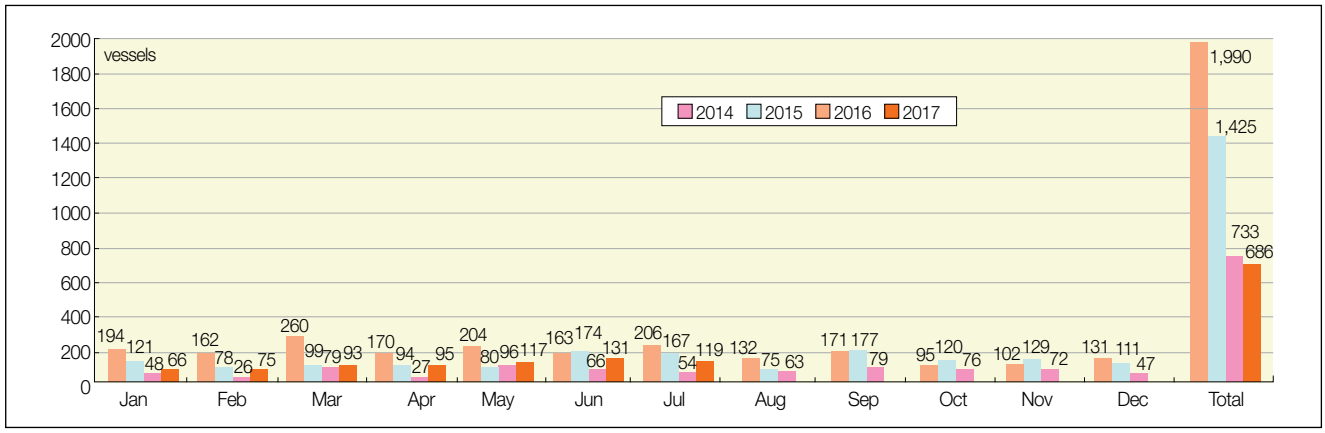

그림 2. 세계 조선소 2014~2016년 대비 2017년 추정 수주현황 추이

Division	Gas Carrier	Tanker Carrier	Bulker Carrier	Container Ships	Other vessels	Country Total
Korea	15	175	3	0	17	210
China	16	134	140	23	41	354
Japan	3	9	19	0	5	36
Other	5	4	6	8	63	86
Ships Total	39	322	168	31	126	686

표 9. 국가별 2017년 선종별 수주현황
(Other vessels: Ferry, Cruise, Car carriers, RoPax, MPP, etc. – 2017년 7월 31일 기준)

Division	Gas(CBM/m³)	Tank(DWT)	Bulk(DWT)	Container (TEU)
Korea	2,898,600	49,002,400	1,950,000	0
China	1,544,000	15,741,500	14,261,450	34,270
Japan	171,900	1,051,800	1,744,000	0
Other	37,500	31,500	842,000	24,500
Ships Total	4,652,000	65,827,200	18,797,450	58,770

표10. 국가별 2017년 선종별 수주량 추이
(옵션 포함 – 2017년 7월 31일 기준)

(12,195,000 DWT), Bulker Carrier 14척(806,000 DWT), Container Ship 4척(10,100 TEU), Other vessels(Ferry, Cruise, car carriers, RoPax, etc.) 20척을 수주했다.

6월은 131척 중 Gas Carrier 8척(860,400 CBM), Tanker Carrier 56척(5,961,000 DWT), Bulker Carrier 29척(4,068,000 DWT), Container Ship 4척(14,400 TEU), Other vessels(Ferry, Cruise, car carriers, RoPax, etc.) 34척을 수주했다.

7월은 119척 중 Gas Carrier 4척(2,145,300 CBM), Tanker Carrier 44척(27,045,400 DWT), Bulker Carrier 66척(7,333,000 DWT), Other vessels (Ferry, Cruise, car carriers, RoPax, etc.) 5척을 수주했다.(그림 2, 표 7~8 참조)

국가별 2017년 신조선 추정 수주 현황

2017년 7월 31일 기준 국가별 추정 신조선 수주현황을 보면 한국은 총 210척 중 Gas Carrier 15척(1,449,300 CBM), Tanker Carrier 175척(26,521,400 DWT), Bulker Carrier 3척(975,000 DWT), Other vessels 17척을 수주한 것으로 나타났다.

중국은 총 354척 중 Gas Carrier 16척(1,544,000 CBM), Tanker Carrier 134척(15,741,500 DWT), Bulker Carrier 140척(14,261,450 DWT), Container Ships 23척(34,270 TEU), Other vessels 41척을 수주했다.

일본은 총 36척 중 Gas Carrier 3척(171,900 CBM), Tanker Carrier 9척

(1,051,800 DWT), Bulker Carrie 19척(1,744,000 DWT), Other vessels 5척을 수주했으며, 기타 국가의 경우 총 86척 중 Gas Carrier 5척(37,500 CBM), Tanker Carrier 4척(31,500 DWT), Bulker Carrier 6척(842,000 DWT), Container Ships 8척(24,500 TEU), Other vessels(Cruises, RoPax, MPP, etc) 63척을 수주했다.(표 9~10 참조)

2017년 7월 31일 기준 한.중.일 신조선 추정 수주금액(옵션 포함)을 보면 한국은 총 US$ 11,723.7 Million 중 1월 US$ 545.7 Million, 2월 US$ 533 Million, 3월 US$ 2,013.3 Million, 4월 US$ 2,449.00 Million, 5월 US$ 2,138.90 Million, 6월 US$ 2,563.8 Million, 7월 US$ 1,560 Million으로 집계됐다. 중국은 총 US$ 14,156 Million 중 1월 US$ 1,627 Million, 2월 US$ 945 Million, 3월 US$ 3,186.4 Million, 4월 US$ 2,343.70 Million, 5월 US$ 1,380.90 Million, 6월 US$ 1,860 Million, 7월 US$ 2,813 Million으로 집계됐다. 일본은 총 US$ 1,018.5 Million 중 1월 US$ 34 Million, 2월 US$ 181.5 Million, 3월 US$ 141 Million, 4월 US$ 50 Million, 5월 US$ 61 Million, 6월 US$ 495 Million, 7월 US$ 56 Million으로 집계됐다.(표 11 참조)

Division	Korea	China	Japan	Monthly Total
January	545.70	1,627.00	34.00	2,206.70
February	533.00	945.00	181.50	1,659.50
March	1,933.30	3,186.40	141.00	5,260.70
April	2,449.00	2,343.70	50.00	4,842.70
May	2,138.90	1,380.90	61.00	3,580.80
June	2,563.80	1,860.00	495.00	4,918.80
July	1,560.00	2,813.00	56.00	4,429.00
Total	11,723.70	14,156.00	1,018.50	26,898.20

표 11. 2017년 월별 한.중.일 신조선 추정 수주금액 (옵션 포함–Unit: US$-Million)

본 자료는 세계 조선소, 선주사, 리서치기관, Shipbrokers 및 해외 언론의 보도 자료 등을 근거로 작성된 것으로, 타 자료와는 상이할 수 있습니다.

DSME delivered a submarine to the Indonesian Navy

Daewoo Shipbuilding & Marine Engineering (DSME) successfully completed construction of a submarine ordered from overseas client for the first time nationwide, writing a new chapter in the history of Korean submarines.

DSME held a hand-over ceremony at Okpo shipyard on Geoje island on August 2 for the first of 3 units of 14,000-ton submarines ordered by the Indonesian Ministry of National Defense in 2011.

The ceremony was attended by about 80 officials and guests from home and abroad, including Indonesian Minister of National Defense Ryamizard Ryacudu and DSME President Jung Sung-rip. Particularly, the Chief of Staff of the Indonesian Navy Admiral Ade Supandi, who would operate the submarine, and Korean naval officers participated in the ceremony to endorse cooperation between the navies of both countries.

This submarine named 'NAGAPASA' is Korea's first export-type submarine developed by DSME in 1988 with technology transferred from Germany and measures 61m in length with a weight of 1,400 tons. In particular, this submarine can accommodate 40 crews and move 10,000 nautical miles (18,520km), covering the round-trip distance between Busan Port and L.A. Port of the United States, without stopping which proves its excellent deep sea operational capability.

This submarine is an attack-type submarine armed with 8 launching tubes capable of launching weapons such as torpedoes and mines and an advanced weapon system. The contract on the 3 submarines was valued at approximately 1.1 billion (KRW 1.3 trillion), the largest single defense contract ever awarded to a domestic company.

The 1,400-ton submarine built by DSME

DSME has maintained long-standing cooperative relationship with the Indonesian Navy based on its technologies accumulated from successful implementation of submarine overhaul projects for Indonesia in 2003 and 2009, respectively.

An official from DSME said, "We wrote a new chapter in history with successful delivery of the nation's first-ever export-type submarine, proving strong technological competitiveness of DSME in global market for submarines. Based on excellence of our technology, we will maintain continuing partnership with Indonesian Navy in line with its underwater prowess improvement plan while playing a part in building up Korea's naval power."

DSME has become the nation's first-ever warship exporter as it built the LSVs (Logistics Support Vessels) for the U.K. Navy and Norwegian Navy and naval combat ships for Thailand and Malaysia, including the submarine to be delivered to Indonesia this time. Thus, DSME is expected to be better placed in winning various overseas projects based on its unique defense-related technologies.

The 2nd submarine ordered by the Indonesian Navy is currently under construction at DSME's Okpo shipyard for delivery within this year. The 3rd submarine will be constructed in the form of blocks at Okpo shipyard and assembled finally at the Indonesia's state-run PT.PAL Shipyard with technical support of DSME before delivery on a staggered basis by 2018. The 3 submarines will carry out missions of maritime security maintenance and territorial defense in Indonesia and engaged in Indonesian naval operations for at least 30 years.

Eco-friendly solution for fuel saving

ABB's Onboard DC Grid enables integration of energy storage on specialized hybrid wind farm vessel.

ABB will optimize the safety and environmental credentials of a new Louis Dreyfus Armateurs wind farm Service Operation Vessel (SOV) by installing Onboard DC Grid power distribution to enable the cost-efficient integration of batteries. As an integral part of the power system, the Power and Energy Management System (PEMS) will ensure safe and efficient operation of the vessel. The hybrid system enables lean operation with fewer running generators without compromising on safety, meaning less maintenance and better fuel consumption over the long-term.

The Onboard DC Grid has been installed on a wide range of vessels including ferries, OSVs and a cable layer.

"Shipping is waking up to the many advantages of energy storage," said Juha Koskela, Managing Director of ABB's marine and ports business. "With the industry starting to use batteries more and more, and fuel cells becoming a viable option, we fully expect the Onboard DC Grid to gain further traction."

The Onboard DC Grid will integrate two sets of batteries used primarily for spinning reserve and peak shaving. Power peaks during operation can be covered by the battery rather than starting another engine. Again, battery power can act as backup for running generators, reducing the need to run spare generator capacity. In addition to ship efficiency gains, the mode of operation has long-term benefits for ship engines, as it increases efficiency through higher engine load and reduces running hours overall.

"This project shows how energy storage is a cost-effective solution that maximize energy efficiency and safety," said John Olav Lindtjørn, Global Product Manager for Onboard DC Grid at ABB Marine & Ports. "Energy storage can be used for many purposes onboard; sometimes it serves as the sole energy source but for this windfarm vessel it is being deployed as an effective supporting element for the main engine."

The whole power system is controlled by integrated PEMS, enabling the generators to run at variable speeds and charge the batteries in the optimal way while at the same time maximizing safety and efficiency. This contrasts with traditional AC systems, where generators run at fixed maximum speed irrespective of the power demand onboard, leading to excessive engine wear and poor fuel efficiency at lower loads. The ship's crew of up to ninety will also benefit of the reduced vibrations.

The Louis Dreyfus Armateurs ship will be built by Cemre Shipyard in Turkey. The vessel design is a SOV vessel by Salt Ship Design. The SOV will operate on four wind farms off the German coast, enabling the maintenance of the turbines by wind farm technicians.

DNV GL & Siemens lead the way in asset PLM for oil & gas industry

In collaboration with Siemens, DNV GL is combining deep technical domain knowledge from oil and gas projects and operations with Teamcenter PLM technology into a powerful digital asset model.

DNV GL has chosen Siemens' Teamcenter® portfolio, the world's most widely used digital lifecycle management software, to help its customers manage the safety and performance of all information over the asset lifecycle. Taking the next step in efficient and information-driven asset lifecycle management, the two companies will combine DNV GL's deep technical domain knowledge from oil and gas projects and operations, with Siemens' PLM software technology, to create a powerful digital asset model.

The collaboration between Siemens and DNV GL will support the oil and gas industry's increasing focus on its digital transformation. Research conducted by DNV GL1 reveals that nearly half (49 percent) of senior oil and gas executives believe digitalization is necessary to boost profitability. Thirty-nine percent believe spending on digitalization will increase in 2017.

The asset information lifecycle, from feasibility stage through end of life, currently suffers from disparity of information formats and no single source of essential asset information among owners, operators, designers, yards and manufacturers. This, in turn, leads to cost, quality and safety issues both in engineering as well as during operations and asset modifications. DNV GL is tackling these challenges by combining unique domain knowledge with the breadth and depth of Siemens' Teamcenter portfolio.

"DNV GL's deep technical expertise is involved in all stages of the asset lifecycle, supporting customers in optimising their performance, and ensuring safe and reliable operations," said Elisabeth Tørstad, CEO, DNV GL - Oil & Gas. "By working with Siemens and its Teamcenter software, our customers will be able to save time in reviewing critical asset lifecycle information and work more collaboratively with industry partners. Users will have access to an online, self-service portal that offers automated compliance-checking, benchmarking and data mining capabilities."

As part of the implementation, DNV GL will take advantage of Active Workspace for Teamcenter® software, which provides a streamlined and intuitive user experience across operating systems and computing devices to facilitate smarter decision-making.

"With the rise of digitalization, improved collaboration will enable the industry to transform to meet the demands of the new era and become profitable," said Joe Bohman, Senior Vice President of Lifecycle Collaboration Software for Siemens PLM Software. "The backbone of Siemens' Teamcenter software is Product Lifecycle Management, the ability to manage large volumes of complex information integrated with engineering tools over the lifecycle from cradle to grave. Solutions that allow users to master new challenges collaboratively, and therefore quickly and simply, will help companies meet these future needs. We are proud that DNV GL decided in favor of Siemens PLM Software to boost its group-wide digitalization strategy using Teamcenter."

Production procesing automation trend outlook

Emerson announces global exchange conferences for users, by users – driving digital transformation.

The worldwide user community at the heart of the industrial digital transformation will host two Emerson Global Users Exchange conferences to collaborate, network and solve the challenges in achieving Top Quartile performance – representing the top 25 percent of peer companies in operations and capital performance. Professionals from industries who provide the backbone of everyday life including oil and gas, power generation, water and wastewater, life sciences, refining and chemical share better performance solutions that can improve earnings up to 15 percent.

Emerson Global Users Exchange: The Americas

Registration is open for the Americas annual conference in Minneapolis, Minnesota, Oct. 2-6, 2017. The event theme is "Powering Collaboration" and will include keynotes, technical paper presentations, industry forums, workshops, technology roundtables, "Meet the Experts" sessions, exhibits, awards and Emerson technology roadmaps. The event also features a keynote presentation by world champion adventure racer Robyn Benincasa and an address by Mike Train, executive president, Emerson Automation Solutions, as well as an evening networking event at US Bank Stadium – the future site of Super Bowl LII.

Emerson Global Users Exchange: Europe, Middle East and Africa

The Europe, Middle East and Africa biennial conference will be at The Hague, The Netherlands, March 7-9, 2018. The Hague conference theme is "Connect, Communicate, Create" and will build upon the increasing success of its predecessors, allowing delegates an even greater opportunity to network with peers and explore new industry opportunities to expand digital intelligence to the entire manufacturing enterprise.

For Users, By Users

The Emerson Global Users Exchange is a user community committed to extracting the most from their automation investments and enables global industry to achieve Top Quartile performance in the areas of safety, reliability, production and energy management. Shaped by users, for users, the event is managed by an Emerson customer board of directors, comprising users from a range of industries who formulate the conference content and guide the direction of the users group at large. Presentations from both events will provide delegates peer-to-peer best practices to extract the greatest value from technology investments, solve engineering challenges, drive improved performance, dramatically enhance safety and compliance; reduce capital and engineering costs; increase profitability through effective energy management; and create successful system migration and lifecycle management paths.

GE Innovation Forum 2017 opening

'Digital Innovation' of Korea's manufacturing sector in the era of the Fourth Industrial Revolution

GE announced that it has recently hosted 'GE Innovation Forum 2017 LIVE' under the theme of 'Industrial Productivity Growth through Digital Transformation in Korea' at Grand Hyatt Incheon on August 25 (Fri) 2017.

At this year's forum which was live streamed via various official online channels, Bill Ruh, Chief Digital Officer of GE & President and CEO of GE Digital and Chaisung Lim, Chairman of Korea Industry 4.0 Association and Prof. Konkuk Business School shared their insights on the importance of becoming digital industrial by pinpointing on how far digital transformation has been done in Korea's manufacturing industry, key hurdles to solve and next steps to take in the era of the Fourth Industrial Revolution.

During his keynote speech, GE Digital CEO Bill Ruh emphasized that it is critical to have a purpose-built software platform, the 'System of Assets' to maximize productivity growth by moving away from traditional business computing platforms including Systems of Record and Systems of Engagement. He introduced GE's Predix platform as the one representing the System of Assets and also presented Predix-backed technologies and relevant cases to make the platform to work in a real business world.

Emphasizing the needs for a shift from IT (Information Technology) to DT (Digital Technology), Mr. Ruh introduced the idea of 'GE for GE,' which is to build new applications around the products to deliver greater efficiency internally - CDO and CIO are collaborating to bring better ideas and solutions together inside and outside of the company, and ultimately unlocking domain knowledge for the customers and the world.

Following Mr. Bill Ruh's keynote speech, Prof. Chaisung Lim presented some of key challenges that Korean companies have been facing in the era of the Fourth Industrial Revolution, while highlighted the importance of tying up with global companies such as GE to build a digital industrial ecosystem. According to Mr. Lim, Korea was able to gain competitive foothold in various industries including steel, shipbuilding and semiconductors - however, it has been struggling to enhance its manufacturing competitiveness due to the declining exports for the past two years. For sustainable growth of the companies, he pointed out that in a business-wide perspective, there needs to be a shift in thought from hardware-oriented to platform-oriented. Also, he said in the transition time for 'Hyper-connected Society', advanced Industrial Internet platform - linking between physical and cyberspace - that helps to effectively collect, analyze and manage an immense amount of data is necessary.

Mr. Chaisung Lim said, "A number of Korean companies including POSCO, spreading best practices of smart factory and Hanwha Techwin, which is also using industrial IoT platform for its aircraft engine manufacturing, have been pushing their digital transformation initiative." He added, "However, many companies are still facing challenges in achieving digital transformation since there are limitations in the flow of data throughout the divisions."

At the fireside chat, Mr. Ruh and Mr. Lim continued in-depth conversations about how to build an innovative organizational culture that is necessary for the digital age. Based on his experience of building a digital team to become a major business unit, GE Digital, he pointed out the followings: 1) the importance of a learning culture within the organization, 2) leadership

and HR team that have understandings of software businesses that need different talents and capabilities, and 3) finally, breaking down existing silos within the business units and setting mutual goals and objectives. He introduced GE's 'FastWorks' program as an example, and emphasized building a horizontal organizational system and implementing innovative ideas in terms of speed and scale are the ways to achieve digital transformation in a data-intensive environment.

Mr. Bill Ruh commented, "On top of GE, there are companies such as Airbnb and Uber that are currently taking asset, making it more efficient and driving productivity growth. This is the key to become 'digital' not only for companies in consumer world but for companies in industrial world," adding, "Korean market is moving fast, and many industrial companies - especially that are working with GE - are the early adopters. This also means there are a lot of potentials in industrial companies in Korea, and some of them are already seeking new opportunities globally through the partnership with GE".

'GE Innovation Forum' is a knowledge-sharing forum designed and hosted by GE to explore new ideas and insights with Korean partners, contributing to sustainable growth and competitiveness enhancement of Korean industries. Since 2015, a number of influential global business, industry, academic leaders including Jeff Immelt, the 9th Chairman of GE, Wonsik Choi, Managing Director at McKinsey & Company, Byungtae Lee, a professor of Information Systems in the College of Business at KAIST, were invited to share insightful thoughts on industry's latest trends and innovation agendas. The 2017 forum was live-streamed for the first time, which allowed anyone can join watching the event via official online channels.

Prelude officially enters into Lloyd's Register class

Shell's floating liquefied natural gas (FLNG) facility "Prelude" has officially entered into Lloyd's Register class. At 488 metres long, 74 metres wide and displacing about 600,000 tonnes of water, Prelude is the largest floating offshore facility in the world.

Last month Prelude arrived at its operating location in the Browse Basin, offshore northwest Australia. It will be moored at a depth of 250 metres and will not be dry-docked for the first 25 years of its expected 50-year operational life. The facility required around 260,000 tonnes of steel to build and its turret is the largest ever built. It has been designed to withstand category five cyclones and its technology has generated over 150 patents.

LR has been actively involved with the project from the start, helping to ensure it will operate safely by applying FLNG expertise through classification, equipment certification, validation and verification against performance standards.

Prelude's substructure and turret have been designed and constructed in accordance with LR's Rules for Floating Offshore Installations at a Fixed Location and its topsides certified to an agreed set of industry codes and standards. LR also confirmed compliance of the facility with Shell's design and engineering practices, where applicable, and the performance standards specified by Prelude's safety case.

The intended risk based classification scheme is expected to benefit from use of the latest in remote inspection technologies to gather accurate and repeatable survey data to allow a predictive and focused approach. The LR team in Perth will be welcoming colleagues from LR's Geoje office in the coming months to assist in the transition from the yard through offshore commissioning to the operations phase.

MAN's subsea compressors reach field proven status

Both subsea compression trains at Statoil's Åsgard field have achieved more than 25,000 operation hours with an availability close to 100%. The world's first subsea gas compression facility features two MAN Diesel & Turbo HOFIM™ motor-compressor units.

The Åsgard subsea compression system has officially reached the highest Technology Readiness Level (TRL) 7 with both trains surpassing 10'000 operating hours. The subsea facility demonstrated an availability close to 100 % - the very few interruptions were caused by failure of the power supply from the vessel.

"MAN Diesel & Turbo's persistence in driving technology solutions forward leads to this ground-breaking success for the entire oil & gas industry – the world's first subsea compression system is now field-proven technology", said Uwe Lauber, CEO of MAN Diesel & Turbo SE. "This important achievement proves that MAN's subsea compression technology is mature and ready to be applied by the industry."

MAN's HOFIM™ motor-compressors were supplied to Statoil's contractor Aker Solutions. The units help to extend the reservoirs' productive life on the Åsgard field for another 15 years. Overall, 306 million barrels of oil equivalent will be added.

The team behind the Åsgard subsea compressor technology has received the UTF (Underwater Technology Foundation) Subsea Award in June 2017. Key individuals within Statoil Norway and MAN Diesel & Turbo in Zurich have been awarded for their dedicated work during the joint development project and for today's results which add proven value to the oil & gas industry.

"The close development work with Statoil has always been very open and fruitful, which is essential to be successful", said Patrik Meli, MAN's head of engineering compressors and Åsgard project director. "Our HOFIM™ motor-compressor units have been in operation with practically no stops or interruptions since production start in September 2015."

Compared to conventional upstream facilities on platforms or FPSOs (Floating Production, Storage and Offloading), the subsea technology works more cost-effectively, safely and with a smaller environmental footprint.

MAN Diesel & Turbo has worked with Statoil on a joint subsea compressor qualification program. The project required an extremely robust motor-compressor design in order to withstand the harsh conditions of subsea environments. The adapted subsea HOFIM™ features a tailored motor design, casings designed for 220 bar pressure, a 7-axes active magnetic bearing system and a special cooling gas extraction.

Compressors are used to maintain output as reservoir pressure at gas-producing fields drops over time. They are typically installed on platforms above sea level. The two 11.5 MW HOFIM™ motor-compressor-units at Åsgard are the world's first compressors in operation 300 meters below sea level.

USCG Type Approval Tests Complete For Evoqua SeaCURE® System

Evoqua anticipates receiving USCG BWMS Type Approval before the end of the calendar year.

SeaCURE® Ballast Water Management System (BWMS), the electrochlorination based solution pioneered by Evoqua Water Technologies, has successfully completed all biological efficacy US Coast Guard Type-Approval tests.

Tests were carried out under the supervision of classification society Lloyd's Register and the independent laboratory NSF International will now compile test data for submission to the USCG for imminent approval.

"We are delighted that the SeaCURE system has successfully completed and exceeded all testing requirements and protocols for USCG certification. It has been a lengthy process but the importance of these tests and USCG Type Approval cannot be undervalued," said Matt Granitto, Business Manager, Ballast Water. "The testing regime we opted for was the most stringent because it uses natural organisms in natural environments over those that are manufactured. By using real organisms, it takes a lot longer as nature doesn't always have sufficiently high organism counts."

All testing was carried out by NSF International. The first five tests in brackish waters took place in Baltimore harbour in the summer of 2015 by NSF partner Maritime Environmental Resource Centre (MERC). Another partner laboratory, Great Ships Initiative (GSI), then carried out five freshwater tests in the summer of 2016, with the final set of land based tests (marine water) completed by Holland's MEA-NL, working in conjunction with classification society Lloyd's Register, on 27th July 2017. Shipboard testing was conducted in various locations around the globe with scientists from MERC.

NSF International was the first independent laboratory to be certified by the USCG for BWMS testing and is widely regarded as the most stringent testing regime there is for a ballast water management system.

"We deliberately selected an independent laboratory that would challenge the SeaCURE system as part of the whole approval process. The testing NSF partners carry out is extensive and places considerable demands on the system in real-life, operational conditions. Testing uses real organisms, in different salinities, different water temperatures and different local environments, taking into account organism regrowth," said Ian Stentiford, Evoqua's Global Vice President, Electrochlorination.

The Evoqua SeaCURE system has now successfully completed all USCG Type Approval tests.

"It is very stringent; but we knew that if the SeaCURE system could pass these tests, then shipowners will be confident that the system they have invested in is very robust and it can actually do what it has been designed for in all at-sea operating conditions encountered."

The SeaCURE system is one of the smallest electrochlorination-based ballast water treatment systems to have completed USCG testing, with one unit capable of treating up to 6,000m^3/h from an easy-to-install skid of just 2m×1.5m.

대우조선해양, 인도네시아 해군에 잠수함 인도

대우조선해양이 국내 최초로 해외에서 수주한 인도네시아 잠수함 건조에 성공하며 대한민국 잠수함 역사를 새로 썼다.

대우조선해양은 지난 2011년 인도네시아 국방부로부터 수주한 1,400톤급 잠수함 3척 가운데 초도함 인도식을 지난 8월 2일 거제 옥포조선소에서 가졌다.

이날 인도식에는 리아미잘드 리아꾸두(Ryamizard Ryacudu) 인도네시아 국방부 장관과 대우조선해양 정성립 사장 등 내외빈 80여명이 참석했다. 특히 잠수함을 운용하게 될 인도네시아 해군 아데 수빤디(Ade Supandi) 참모총장과 대한민국 해군 관계자도 행사에 참석해 양국 해군 간 상호협력에도 의미를 더했다.

'나가파사(NAGAPASA)'함으로 명명된 잠수함은 1988년 독일로부터 기술을 이전받아 대우조선해양이 독자 개발한 대한민국 최초 수출형 잠수함으로, 전장 61m, 1,400톤급 규모다. 특히 40명의 승조원을 태우고 10,000해리(1만8520Km)거리인 부산항에서 미국 LA항까지 중간기항 없이 왕복 운항할 수 있어 잠수함의 생명인 뛰어난 수중 작전능력을 갖췄다.

이 잠수함은 어뢰, 기뢰 등 무기를 발사할 수 있는 8개의 발사관과 최신 무기체계로 무장한 공격형 잠수함으로 계약 당시 잠수함 3척의 수주 금액은 약 11억 달러(한화 약 1조 3,000억원)에 달해 국내 방산수출 사상 최대 규모로 기록됐다.

대우조선해양은 이미 지난 2003년과 2009년 두 차례에 걸친 인도네시아 잠수함 창정비 사업을 성공리에 수행하며 쌓은 기술력과 신뢰도를 기반으로 인도네시아 해군과 오랜 상호 협력관계를 이어오고 있다.

대우조선해양이 건조한 1,400톤급 잠수함

대우조선해양 관계자는 "대한민국 최초 수출 잠수함을 성공리에 인도해 새로운 역사를 기록함과 동시에 전 세계에 대우조선해양의 잠수함 분야 기술 경쟁력을 입증하게 됐다"며, "이러한 기술력을 바탕으로 우리나라 해군력 강화에 기여함은 물론 인도네시아 해군의 수중전력 증강계획에 발맞춰 지속적인 파트너십을 이어가길 기대한다"고 말했다.

대우조선해양은 영국·노르웨이 해군의 군수지원함과 태국·말레이시아 수상전투함을 비롯해 이번 인도네시아 잠수함까지 건조하며 함정 분야를 총망라한 국내 유일의 방산 수출업체가 됐다. 이로써 대우조선해양은 향후 독보적인 방산 기술력으로 각종 해외 프로젝트 수주경쟁에서 우위를 선점할 것으로 기대된다.

한편 인도네시아 잠수함 2번함은 연내 인도를 목표로 대우조선해양 옥포조선소에서 건조 중에 있으며, 3번함은 옥포조선소에서 블록형태로 건조후 대우조선해양의 기술지원 아래 인도네시아 국영조선소인 PT.PAL 조선소에서 최종 조립해 2018년까지 순차적으로 인도될 예정이다. 향후 3척의 잠수함은 인도네시아 해상안보 및 영해수호 임무를 수행하며 최소 30년간 인도네시아 해군 작전에 투입된다.

생산 공정 자동화 트렌드 조망

에머슨은 2017 글로벌 유저 익스체인지 컨퍼런스를 개최한다.

산업 디지털 변화의 중심에 있는 전세계 사용자 커뮤니티가 '최고 성과(Top Quartile: 운영 및 자본 실적에서 동종업계 상위 25%를 차지하는 기업)' 달성을 위해 협력, 네트워킹 및 각종 도전 과제의 해결을 토대로 하는 에머슨 글로벌 유저 익스체인지 컨퍼런스를 두 차례 걸쳐 개최한다. 석유 및 가스, 발전, 수처리, 생활과학, 정제 및 화학 등의 업계 전문가들이 모여 최대 15%까지 수익을 향상할 수 있는 성능 솔루션을 공유한다.

에머슨 글로벌 유저 익스체인지 컨퍼런스: 아메리카

미네소타 미네아폴리스에서 열리는 아메리카 연례 컨퍼런스는 2017년 10월 2일부터 6일까지 등록 가능하다. 행사 주제는 "협력 강화"로 키노트, 기술 문서 프레젠테이션 및 회의, 산업 포럼, 워크숍, "전문가와의 만남(Meet the Experts)" 세션, 전시, 수상 및 에머슨 기술 로드맵을 포함할 예정이다. 또한, 세계적인 챔피언 모험 레이서인 로빈 베닌카사(Robyn Benincasa)에 의한 키노트 프레젠테이션뿐만 아니라 에머슨 오토메이션 솔루션즈 수석 사장인 마이크 트레인(Mike Train)의 연설은 물론, 수퍼볼(Super Bowl) LII의 확장 기지인 US 뱅크 스타디움(Bank Stadium)에서의 네트워킹 이벤트도 있다.

에머슨 글로벌 유저 익스체인지 컨퍼런스: 유럽, 중동, 아프리카

유럽, 중동 및 아프리카에서 2년마다 개최되는 컨퍼런스는 오는 2018년 3월 7일부터 9일까지 네덜란드 헤이그에서 열린다. 헤이그 컨퍼런스 주제는 "연결, 소통, 창조"로 전임자들의 성공을 기반으로 한다. 동료와 네트워킹을 형성하고 디지털 인텔리전스를 제조 기업 전체로 확산하며 새로운 기회를 모색할 수 있는 장이 될 예정이다.

사용자를 위한, 사용자에 의한

'에머슨 글로벌 유저 익스체인지'는 자동화 투자에서 최대한을 얻어내고 글로벌 산업이 안전성, 신뢰성, 생산 및 에너지 관리 분야에서 최고 성과를 낼 수 있도록 전념하는 사용자 커뮤니티이다. 사용자에 의해, 그리고 사용자를 위해 마련되는 이번 행사는 컨텐츠 구성부터 사용자 그룹의 방향성을 지도하는 다양한 산업 분야의 사용자들로 구성된 에머슨 고객 이사회에 의해 관리된다.

두 가지 행사에서 선보일 프레젠테이션은 모두 기술 투자를 통한 최고 가치 창출, 엔지니어링 과제 해결, 성과 향상, 안전성 및 규제 준수를 극적으로 개선하는 P2P(peer-to-peer) 차원의 사례를 제공한다. 이를 통해 자본 및 엔지니어링 비용 절감, 효과적인 에너지 관리를 통한 수익성 향상 및 성공적인 시스템 이전과 생애주기 관리 경로를 생성하는 토대가 될 것이다.

GE 이노베이션 포럼 2017 라이브 개최

4차 산업혁명 물결 속 한국 제조업의 '디지털 혁신'을 논의하다.

GE 코리아는 지난 8월 25일 그랜드 하얏트 인천에서 '디지털 트랜스포메이션(Digital Transformation)을 통한 한국제조업 생산성 혁신'을 주제로, 'GE 이노베이션 포럼 2017 라이브'를 개최했다고 밝혔다.

공식 온라인 채널을 통해 실시간 생중계로 진행된 이번 포럼에는 빌 루(Bill Ruh) GE 최고디지털책임자(CDO) 겸 GE 디지털 사장과 국내 산업혁신 전문가로 불리는 임채성 한국 인더스트리4.0 협회장 겸 건국대 경영대학 기술경영학과 교수를 특별 초청해, 4차 산업혁명 시대에 국내 제조업의 디지털 혁신 현황을 짚어보고 앞으로의 도전과제와 나아가야 할 방향에 대해 집중 조명했다.

이 날 기조연설을 맡은 빌 루(Bill Ruh) 사장은 과거 전통적으로 데이터를 기록 및 보관하거나 클라우드와 같이 사용자와 상호작용하고 데이터를 응용하는 시스템을 넘어, 이제는 물리적 자산과 가상의 자산을 관리하고, 이를 통해 생산성을 극대화할 수 있는 '자산관리 플랫폼'이 필요함을 강조했다. 그는 GE의 산업인터넷 플랫폼인 '프레딕스(Predix)'를 이러한 시스템으로 소개하며, 자산성과관리(APM, Asset Performance Management) 솔루션, 디지털 트윈 (Digital Twin) 등 해당 플랫폼을 구현하기 위한 첨단 기술 및 사례 또한 공유했다.

빌 루 사장은 이제 기업들은 IT에서 DT (Digital Technology)로 생각의 전환이 필요하다고 강조하며, 전사적 차원에서 산업 환경의 최적화를 이끄는 'GE를 위한 GE' 개념에 대해 소개했다. 최고디지털책임자인 CDO와 최고정보책임자인 CIO가 협업하여 더 나은 아이디어와 솔루션을 고안하고, 이러한 방향을 고객사들에게도 전달해 결국 전 세계까지 범위를 확대하는 것이 GE의 목표라고 전했다.

이어서 발표를 진행한 임채성 한국 인더스트리4.0 협회장은 4차 산업혁명 시대를 맞은 국내 기업들의 도전과제를 제시하며, 앞으로 GE와 같은 글로벌 기업들과의 협업을 통해 '산업인터넷 생태계'를 구축해 나가는 것이 중요하다고 강조했다. 그는 그동안 철강, 조선, 반도체와 같은 산업군에서 글로벌 선도기업과 같은 경쟁력을 확보한 한국이 최근 2년간 이어지고 있는 수출 부진 등 제조업의 경쟁력 강화에 어려움을 겪고 있는 점을 언급하며, 기업들의 지속가능한 성장을 위해서는 무엇보다 하드웨어 중심에서 플랫폼 중심으로 사고의 전환을 해야 한다고 지적했다. 이는 모든 것이 연결되는 '초연결 사회'에서 방대한 양의 데이터를 효과적으로 수집, 분석, 관리할 수 있는 플랫폼, 즉 사이버와 물리적 공간의 연결고리가 필요하다고 덧붙였다.

임채성 협회장은 "현재 스마트팩토리 구축을 확대하고 있는 포스코, 항공엔진에 산업 사물인터넷(IIoT)을 도입한 한화테크윈 등 국내 기업들도 디지털 트랜스포메이션을 실현하기 위한 노력을 적극 실천하고 있다"며, "하지만 아직도 많은 기업들 내에 데이터가 원활하게 흐르지 않는 한계가 있고, 이 때문에 디지털 트랜스포메이션까지 이어지지 않고 있다"고 설명했다.

마지막으로 진행된 대담에서 두 연자는 디지털 시대에 필요한 혁신적인 조직문화를 어떻게 구축할 것인가에 대한 심도 있는 대화를 이어나갔다. 빌 루 사장은 과거 소규모의 디지털 팀을 GE디지털이라는 사업부로 성장시킨 경험을 바탕으로 1) 끊임없이 학습해 나가는 문화의 중요성과 2) 각 분야별로 다른 유형의 인재가 필요한 소프트웨어 사업을 이해하고, 이에 맞는 다양한 인재를 확보하는 HR 측면에서의 리더십, 마지막으로 3) 조직내 사일로(Silos)를 없애고 하나의 공통된 목표를 향해 나아가는 것이 무엇보다 중요함을 언급했다. 대표적인 예로 GE의 전사 혁신 프로그램인 '패트스웍스(FastWorks)'를 소개하며, 데이터 집약적인 환경에서 이러한 자산을 빠르게 공유하고 대응하는 수평적 조직 시스템을 구축하고 이를 통해 데이터로부터 얻는 통찰력을 규모있게 실현해야만 진정한 디지털 트랜스포메이션을 이룰 수 있다고 강조했다.

빌 루 사장은 "GE뿐만 아니라 에어비앤비, 우버는 기존 자산에 디지털 역량을 접목시켜 효율성을 높인 대표적인 기업이며, 이러한 방향은 소비재기업 뿐만 아니라 산업기

업이 실현해 나가야 하는 디지털 측면의 목표"라며, "한국 시장은 빠르게 움직이고, GE와 함께 일하고 있는 파트너사를 포함한 많은 기업들이 얼리어답터(Early Adopter)이기 때문에 제조업을 비롯한 국내 산업기업들은 높은 잠재력을 갖고 있다. 이미 다수의 한국기업들이 GE와의 파트너십을 통해 글로벌로 나아갈 수 있는 길을 모색하고 있다"고 덧붙였다.

한편, 'GE 이노베이션 포럼'은 GE가 한국 산업과 기업의 성장 및 경쟁력 향상에 기여하고자 기획한 지식 포럼으로, 국내에서 2015년 처음 개최되었다. 과거 포럼에서는 제프 이멜트(Jeff Immelt) 전 GE 회장을 포함해 최원식 맥킨지 한국사무소 대표, 이병태 카이스트 경영대 교수 등 영향력 있는 산업계 및 학계 리더들이 참석하여 미래 산업 트렌드와 혁신방안에 대한 인사이트를 공유했으며, 올해에는 처음으로 온라인상에서 참여 가능한 실시간 생중계로 진행됐다.

Record breaker

- ABB to provide power, propulsion and automation for the world's most advanced port icebreaker

To make sure the maximum amount of power possible can be derived from marine engines such as those used in icebreakers, they are fitted with turbochargers. ABB has a wide range of turbocharger solutions for marine craft and are now to supply the new Power 2 800-M turbocharger for the most advanced port icebreaker ever built, which is currently in planning for construction by the Vyborg Shipyard in Russia.

ABB

When John Franklin searched for the North-West Passage in the mid-1800s, he could scarcely have imagined by just how much polar sea ice would retreat in the following 150 years.

Now, large ocean-going ships regularly ply sea routes along the north of Canada and Russia. These shipping lanes almost halve the time it takes to voyage between the Atlantic and the Pacific oceans and the routes are remaining ice free for everlonger periods, thus lengthening the shipping season.

With this increased shipping presence comes the increased need for icebreakers. Due to the nature of the job they do, icebreakers have to be of solid construction: Thick ice is not often broken by ramming it, but by lifting the ship above the ice and breaking it from above. Lifting an icebreaker is no easy matter as icebreakers have very heavy and robust strengthening cross-members to protect the vessel against the pressure of pack ice.

Further, an icebreaker's hull differs from a normal hull in thickness, shape and material: The bow, stern and waterline are reinforced with thick steel specially chosen for its low-temperature performance and the hull's shape is designed to assist the ship to rise above the ice before falling and breaking through it. All these additional features mean that an icebreaker is much heavier than a normal ocean-going ship of similar size.

> "The main engine will be fitted with Power2 800-M, the most advanced two-stage turbocharging system in the industry."

ABB's Power2 turbocharging solution provides the power icebreakers need.

Icebreakers have to have powerful engines and be of a robust construction.

> “Power2 800-M is the most compact turbocharger of its kind.”

Moreover, due to the immense strength and often unpredictable nature of ice, icebreakers are equipped to deal with a plethora of potential dangers. For example, pressurized air and heated water jets may be forced out of the ship under the ice to help break it or ballast water may be pumped rapidly around the vessel to rock it a further assisting ice breaking.
Clearly, icebreakers have to have powerful engines.
To make sure the maximum amount of power possible can be derived from the marine engines such as those used in icebreakers, they are fitted with turbochargers. ABB has a wide range of turbocharger solutions for marine craft and are now to supply turbochargers for the most advanced port icebreaker ever built, which is currently in planning for construction by the Vyborg Shipyard in Russia. ABB will also provide the power and automation capabilities for the vessel.
The main engine will be fitted with Power2 800-M, the most advanced two-stage turbocharging system in the industry, enabling highest efficiency turbocharging performance.

Power2 800-M

Power2 is ABB’s dedicated two-stage turbocharging system. Power2 800-M, the second generation of Power2, is the most compact turbocharger solution of its kind. Space is at a premium in a ship’s engine room and with this in mind, ABB designed the turbocharging system to take up minimal space: This two-stage turbocharging system is 20 percent more compact than conventional two-stage turbocharging solutions. Space saving is especially critical in an icebreaker as the extremely strong hull construction of the vessel leaves less internal space than would be available on an equivalent, regular ship.
The Power2 800-M’s extractable cartridge enables service to be completed in just two steps instead of the previous six, making maintenance easy and reducing downtime and service costs.
On the icebreaker’s engine, the Power2 800-M will enhance fuel efficiency and flexibility of operations. With up to 60 percent less NOx emissions, the Power2 800-M also substantially cuts discharges to the atmosphere – an important aspect for operation in the pure Arctic environment.
With a low-pressure and high-pressure stage, the Power2 800-M provides higher air pressure ratios – up to 12 from eight in the previous generation. A single-stage turbocharger can operate at around 65 to 70 percent efficiency; Power2 800-M exceeds 75 percent efficiency and is the only system currently available across the large-engine industry with this capability.
The Power2 800-M responds to the need for new marine engine technology to offer consistency of performance across conventional and newer marine fuel options. This application will demonstrate the advances in efficiency and power density now available for four-stroke engines that operate over a wide range of load profiles and that face added demands from various bodies who regulate emissions. Once the icebreaker is constructed, commissioned and operating in iced-up port waters, the capabilities of the Power2 800-M will prove to be invaluable in providing the power to keep waters ice-free for shipping.

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USING OFF - THE SHELF PRODUCTS

- Why standardized industrial technology offers so many advantages to the maritime sector

While general cargo and container ships can easily count and add up the loads connected to their cargos for effective load management, precise level measuring devices are required for tankers. Krohne Marine from Norway is considered one of the global experts in this field, with more than 50 years of experience in designing load-monitoring and management systems for tankers. Krohne is using standardized control technology from WAGO in their new generation of "Cargomaster" systems, and replacing their proprietary electronics.

WAGO

by Stian Karlsen

By using “Cargomaster,” ships’ crews constantly have the level of their tanks at their fingertips. The complete solution from Krohne Marine includes the entire monitoring system, from alarms, to isualization and connection to higher-level control systems, in addition to straight level measurement systems.

Krohne uses their OPTIWAVE 8300 C Level Radar for the actual measurements at the load level. In addition to level measuring, the system – designed in Brevik, Norway – can also monitor pumps, conduits and the ship’s draught. Until recently, the Norwegians developed most of the necessary electronics themselves – primarily with the assumption that this would maximize precision and uptime. Their innovation is reflected in an abundance of patents, among other things.

Standardized instead of proprietary

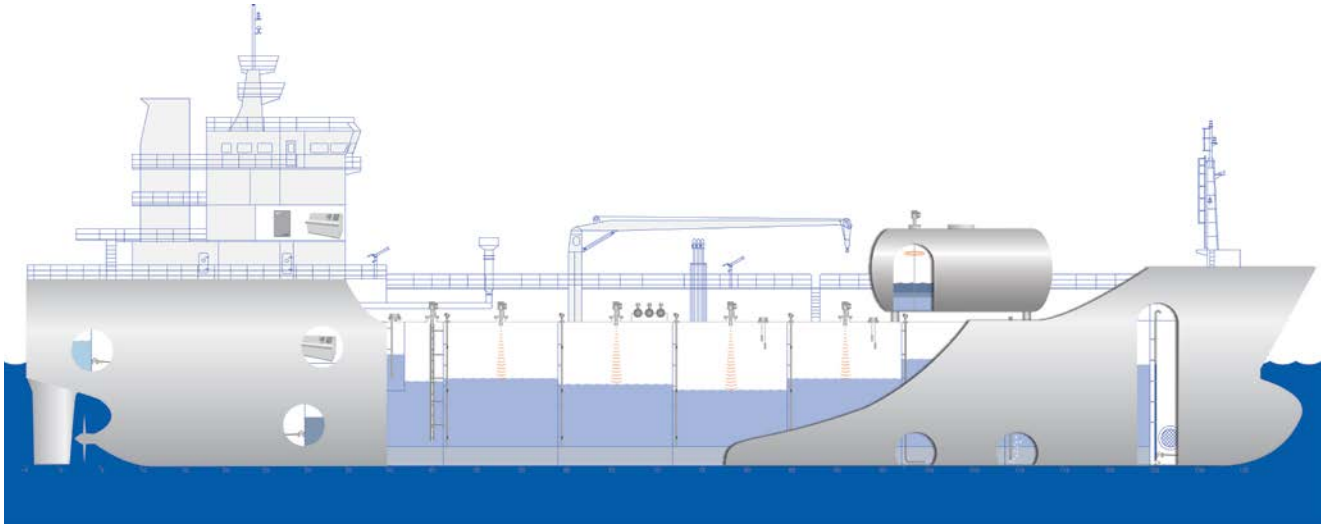
Krohne Marine is symbolic of proprietary systems, which function excellently; however, against a ackground of long operating times during freight travel, they also raise costs for product updating, replacement part inventory and service. These outcomes are typical for proprietary developments, particularly in control hardware.

Therefore, within the context of upgrading “Cargomaster,” Krohne went looking for a partner in industrial control technology, with whom they could perform maritime tasks with off-the-shelf products. The use of standardized components was possible because the Norwegians’ expertise lies in the design and implementation of software, rather than the hardware, as the Director of Research and Development at Krohne Marine, Svein Henriksen explains. “Using off-theshelf products currently allows us to reduce costs, primarily in development and production,” adds Henriksen.

Optimal – in terms of price, performance and uptime

Prior to making the strategic decision to rely on WAGO’s industry-proven, standardized control technology in their tank management systems, the Norwegian company compared diverse solutions rom leading manufacturers. “We were looking for a supplier with products that could accommodate our requirements without long adaptation times – even in areas with extremely high demands, like explosion protection. In addition, the products that we use must have the corresponding approvals from the classification agencies,” explains Henriksen, who manages the Service Department at Krohne.

From a functional perspective, the new hardware had to provide high performance – especially in communication capabilities. These criteria ultimately led to the decision to use the WAGOI/O-SYSTEM 750. “With WAGO, we found a vendor that meets our needs,” states Jon Anders Eriksen, the man in charge of process control technology at Krohne Marine. The collaboration functioned extremely well from the start – including intensive support in software engineering and training.



By using cargo-monitoring systems like the “Cargomaster,” crews always have the fill level of their onboard tanks at their fingertips.

Unforetold options

The partnership ultimately led to a system in which the software was not merely implemented in the new control hardware, but instead was highly adapted for optimal interplay between software and hardware. This in turn led to a significant increase in performance compared to previous generations.

By deciding to stop developing their own hardware, and to begin using standardized modules, Krohne Marine was also able to tap into advantages for applications in the Ex areas. Background: The I/O-SYSTEM 750 includes modules for Ex and non-Ex areas. Functionally, these modules are not different; they are distinguished by their design and external color. Within the WAGO system, blue is the color for explosive areas.

This consistency in the product portfolio offers the Norwegians an advantage: they no longer need to consider whether a wiring installation falls under Ex-protection or not. From the perspective of the software engineers, only the functions are relevant because there are no longer any spatial restrictions.

In addition, the blue I/O modules eliminate additional components because Zener barriers are no longer necessary in the control cabinet. This detail not only saves space, it also makes the installation easier, as there are fewer components to be wired. This, in turn, increases operating safety due to the lowered risk of mismating or component failure.

More time for core competencies

For Krohne Marine, these points were exactly what drove their decision to use standardized industrial technology. Due to their large series production, which includes sophisticated production monitoring routines, Krohne Marine also benefited from reduced failure rates in the components used. The spring clamping technology in the WAGO-I/OSYSTEM also contributed to reliability, as the high vibrations board a ship demonstrate the system's high performance.

Using off-the-shelf products pays off – even in the maritime sector. WAGO's standardized control technology also functions reliably in the harsh environmental conditions at sea. "We have not had a single complaint," emphasizes Henriksen.

The cost reductions connected to the standardized products are visible in many areas at Krohne: fewer components and less inventory are needed, faster configuration and assembly, better availability of replacement parts and service around the world. "During development, we can now concentrate more on improving the functionality and user-friendliness of our systems," concludes Henriksen. The R&D Manager sees sustainable advantages that will significantly sharpen his company's competitive edge.

Because the WAGO-I/O-SYSTEM can connect applications in both normal and Ex areas using the same system, Svein Henriksen (left) and Øystein Johansen (right) can concentrate on their core competencies when designing their tank management systems.

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A 'tool chain' for hydrodynamic analysis workflow

Hydrodynamic analysis is an evolutionary process that requires inter-related tools to strike the ideal balance between facility and precision, explains HydroComp's Don McPherson.

HydroComp, Inc.

Ship design is largely an 'evolutionary' workflow process, with design updates reflecting knowledge gained during loops around the design spiral. Each discipline (major dimensions, hull form, weights, powering and arrangement, to name just a few) will influence the others. In early stage design, knowledge is formational and about big decisions. Knowledge becomes more specific as the design matures and is constrained by the earlier design decisions.

Hydrodynamic analysis – whether that is for hull form, propulsor, or the integration of the two – follows these same evolutionary design stages. Workflow effectiveness benefits from tools that are appropriately matched to the task at hand. This article describes the rationale and organisation of a 'tool chain' for hydrodynamic analysis, from parametric studies through full CFD. Each stage sets the table for the next, with increasing precision and benchmarking for confident outcomes. This article will touch only on hull form resistance prediction, but the concepts and conclusions are equally valid for propulsor design.

An appreciation of order

To many, 'order' is the neatness of things (my mother would fit into this category). To scientists and engineers, order is a characterisation of complexity. Equation forms can help explain this. A line is of a lower order: Y = AX+B. With every additional exponent component in a polynomial, the order is raised: Y = AX3+BX2+CX+D. Each equation form is a model describing the output for a given input. Most would say that the higher order model better captures the outcome – but this is only true when the data is sufficiently refined. If you do

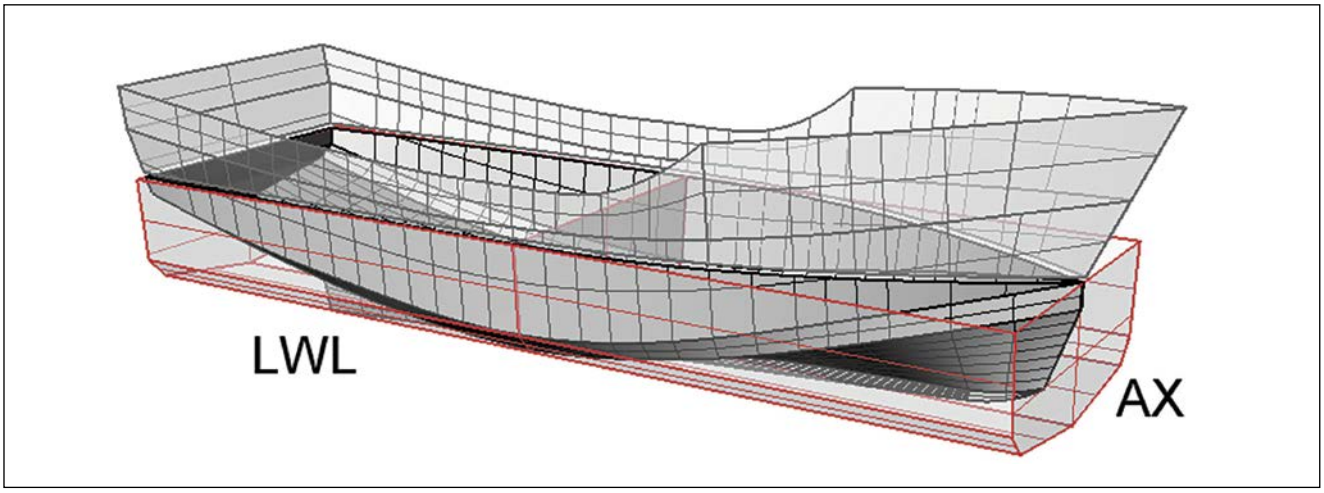


Figure 1. Data models of hull form shape

not know the principal input data with certainty, a higher order model provides no more knowledge or usefulness than a simpler model.

Computational models are numerical predictors of an attribute for the given data, and they are the tools of marine design and optimisation. In the context of hydrodynamic analysis, we have a wide variety of tools to manage our models for prediction of resistance and powering, from quick and simple charts that use just a few parameters, to full RANSE (Reynoldsaveraged Navier-Stokes equations) CFD codes that require a complete description of the surfaces that are wetted. So which tool should we use?

Design is an evolutionary process from lower to higher precision. All naval architects will be familiar with the design spiral, and this offers some insight into the value of having a connected hydrodynamic analysis tool chain from lower to higher order that gives the best 'value' for the 'cost'. In short, we need inter-related tools that hit the 'sweet spot' between facility and precision.

Data and prediction models

When we talk about models we must consider both sides of the coin: data and prediction. Hull form data models for hydrodynamic analysis represent the 'hole in the water'. Prediction models interrogate the data and forecast an outcome. Hull form data, such as would be needed for resistance prediction, can be described in a variety of ways. The order of the data can be described in dimensional terms: [1D], [2D], or [3D]. Figure 1 illustrates the order of hull form data:

- Immersed parameter [1D]. These are significant parameters made up of one-dimensional values, such as length/beam ratio (the aspect ratio of the waterplane bounding box) or prismatic coefficient (the ratio of the immersed volume to the red extruded prism of maximum sectional area).
- Immersed volume [2D]. This is typically the longitudinal distribution of shape, such as waterplane cuts, sectional area curve, or the waterplane distribution.
- Immersed surface [3D]. The full 3D envelope is captured via the wetted surface itself.

Prediction models

This is where the strengths and weaknesses of the various hydrodynamic analysis software tools are exposed. They all generally employ one or more of the data models described above, but their capacity to predict performance can be quite different. We will consider a 'tool chain' that connects the workflow from [1D] through [3D] using HydroComp NavCad to illustrate the [1D] and [2D] links in the chain.

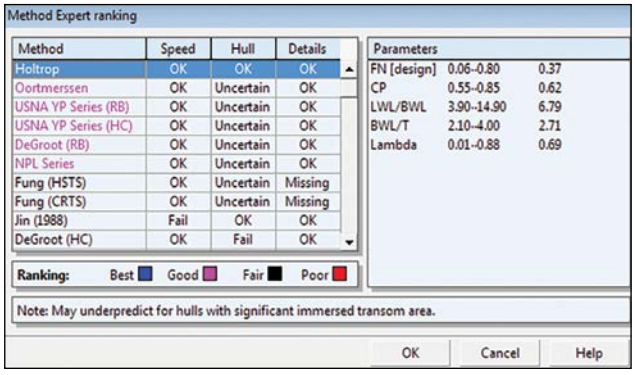


Figure 2. HydroComp NavCad's 'Method Expert'

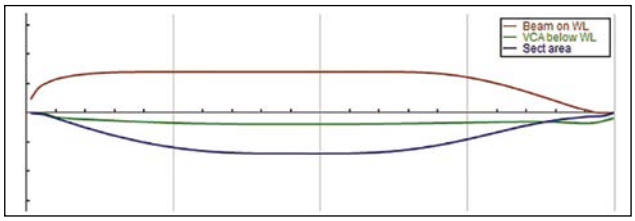


Figure 3. Longitudinal distribution of volume and waterplane characteristics (Duisburg Test Case)

• Parameter-based empirical prediction [1D]

These methods are largely derived from a statistical regression of historical data. In other words, they use what has already gone before to predict what may come ahead. One might therefore think that they are not very good at projecting or extrapolating beyond their own scope, but this is not always the case. If the method uses a framework that gives a qualitative structure – such as a curve shape that reflects the physics of ship resistance – then methods can extrapolate somewhat beyond their data limits.

Perhaps the most well-known parametric ship resistance method is the Holtrop method. This has wide application for non-planing monohull forms, but it still has its limitations. A comprehensive library of methods, is necessary to ensure that you have a method which satisfies the scope of the parameters and speed range. The Method Expert utility on HydroComp NavCad provides ranking and guidance to the user on the proper selection of a method for a [1D] parametric analysis.

Parametric-empirical methods can also be enhanced using

a correlation technique that 'aligns' a prediction to a specific ship. Since many designs are derivative of earlier work, it is immensely valuable to be able to leverage the knowledge invested in model testing and/or sea trials to achieve the highest fidelity prediction for the new design. The 'Aligned Prediction' utility in NavCad provides such a capability.

At the conclusion of these parametricfriendly loops through the design spiral, the naval architect will have answers to those first-order questions of a ship's size, general shape, and powering requirements. They in turn provide the stepping-off point for the next refinement of the design.

• Volume-based semiempirical prediction [2D]

The shape descriptors employed in the parameter-based empirical calculations can now be extended to include a greater refinement of the longitudinal distribution of shape. For example, Figure 3 shows the longitudinal distribution of sectional area, waterplane (beam), and centre of immersed sectional area for a post-Panamax container ship with a bulbous bow. (This is the 'Duisburg Test Case', which is used as a validation benchmark for computational prediction models.)

This hull can be described parametrically as: 7.0 L/B, 3.5 B/T, 6.4 CVOL (fineness), 0.67 CP, 1% aft LCB. Of course, there are an unlimited number of shapes that can fit into that description. The longitudinal distribution gives us a more complete picture of the immersed volume.

This data distribution is used for resistance prediction by the Analytical Distributed Volume Method (ADVM) in the Premium Edition of HydroComp NavCad. It is a [2D] analytical wave-making code that also predicts the viscous properties at scale. It is suitable for monohulls and catamarans, and its prediction of resistance is independent of any statistical underpinning, making it useful as a prediction option for a very broad range of vessel types. The 'semi-empirical' aspect of the method is that certain diverging and transverse wave energy characteristics are constrained based on studies of many different hull types.

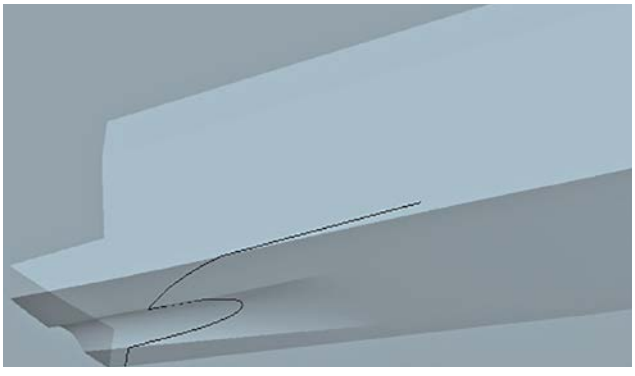


Figure 4. Irregular waterline offsets through a propeller pocket

The foundation of the NavCad ADVM is an analytical wave-making prediction method similar to slender – and thin – ship codes, such as Michell Integral methods. It differs from these codes, however, in two key ways. First, the ADVM is not limited to thin or slender ships, and allows for successful prediction for wide (high B/T) ships such as the Duisburg Test Case illustrated in Figure 3. That being said, it does tend to somewhat over-predict wave-making for hulls with substantial buttock flow, such as barges and very shallow sailboats.

Second, and more importantly, the method does not use a waterplane cut technique (as is the case for a Michell-based method). Such methods are ill-behaved when they encounter irregular changes in waterplane geometry, such as through tunnel thrusters or propeller pockets. Figure 4 shows how a waterplane cut through a propeller pocket produces a discontinuous flow line. A simplification of the geometry would be required to achieve an outcome with a waterplane cut method. Of course, the local effect of such details is above the order of the [2D] design loop, and will be exposed in the higher-order [3D] CFD link in the tool chain. Instead of waterplane cuts, the NavCad ADVM employs sectional area curve and waterplane distributions which allow for a more well-behaved analysis with no loss of fidelity for the [2D] design and analysis objectives.

The wave energy component of ship resistance can also be communicated via its influence on wave pattern elevations. Figure 5 an example of a wave pattern calculated by this method.

The computational cost of a complete resistance curve and wave pattern plot is just a few minutes on a typical business-grade computer. This [2D] link in the tool chain is a very time and cost-effective option – especially when proceeding to the use of full CFD [3D].

• Preparation for [3D] CFD analysis

One key to successful [3D] CFD analysis is to first complete the [1D] and [2D] studies for the project at hand. Why? Since [3D] analysis is of the highest order, why should we not go directly to CFD?

The reasons for first conducting the [1D] and [2D] steps in

the workflow will depend on the purpose of the [3D] computation. Mature and validated CFD is a complex model for predicting characteristics of fluid flow that allows observation of flow (unlike [1D] and [2D] analyses for the most part), works in a ship's native scale (without extrapolation from model scale), and can be used for design optimisation of local shape (such as the propeller pocket described above).
Some compelling reasons for using lower order analyses prior to [3D] CFD are:
- *For better analysis.* Analysis is all about accurately predicting attributes for prescribed data. It is the user's responsibility to make sure that both the data and prediction models are properly established. However, confidence in outcomes requires a benchmark. The lower order analyses provide these benchmarks, along with increased confidence, improved efficiency, and decreased risk.
- *For design.* Design is the application of analysis to investigate the influence of changes in data on outcome. It is typically an iterative process of 'test-and-move'. Test one condition, gain knowledge, compare to other condition, and move to a new and better condition. Repeat until the study converges to an acceptable definition of what is 'sufficient' or 'optimum'. Lower order analysis can very quickly and inexpensively conduct design studies suitable to pare down the set of 'all-possible-designs' to a manageable few that will meet the objectives and justify higher order study.

Rapid design space optimisation

The advent of more affordable and accessible CFD offers exciting possibilities for ship design. To insure that overall [3D] computational efficiency and cost-effectiveness is as high as possible, it is necessary to first make use of [1D] and [2D] rapid design space optimisation. With the introduction of the Premium edition, NavCad is able to provide integrated support for design optimisation, and naval architects can make CFD studies more effective by using NavCad Premium to 'set the table' for it.
A preparatory design space study establishes a starting geometry for CFD that is substantially closer to the final outcome, which greatly increases the success of analysed designs and the value of CFD. In addition to quickly narrowing the design space, NavCad Premium can also be used to assign confidence and validate the CFD model. Its predictions are quantitatively very reliable and robust, allowing follow-on CFD prediction values such as resistance or propulsor thrust, to be judged against those generated by NavCad Premium during its design space investigation.

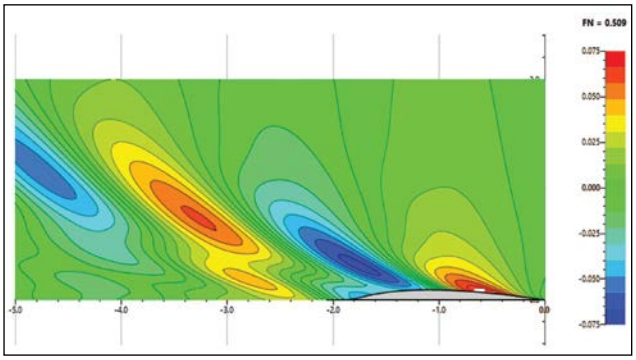


Figure 5. Wave pattern elevation calculation (Wigley hull)

What order of tool is needed?

We have described a tool chain for hydrodynamic analysis workflow by naval architects and designers. It is important, however, to remember that not all three links are necessarily needed for each project or task. It is fair to say that [3D] needs the preparatory steps of [1D] and [2D], and that [2D] builds upon [1D] analysis. That being said, when is a lower-order calculation sufficient? When is value gained by going to a higher order? NA

• Tasks appropriate for [1D] analysis

1. Prediction of speed and required engine power. Parametric methods can typically offer reliable prediction of speed and power for most ships and boats. However, selection of the right empirical-based method is critical, as is proper modeling of propulsors. NavCad's Method Expert, for example, offers this important user guidance. This is further enhanced with alignment to model tests or sea trials of similar vessels.
2. Selection of propeller parameters. Propeller sizing (also called enginepropeller matching) can use [1D] methods to select the critical propeller and driveline design characteristics – propeller diameter and blade area, blade count, and even reduction gear ratio. Even if the design of the final propeller is to be off-loaded to a supplier, it is the responsibility of the designer to select the proper gear ratio (for shaft RPM) and principal parameters as they relate to the hull-propeller-engine system.
3. Initial design guidance. The ship design process is not limited to hydrodynamic analysis. Designers are responsible for many other objectives – capacities, stability, structure, and

more. At early design stages, naval architects do not need 'optimum' hull characteristics; rather they need guidance on general design 'trends' to reduce resistance and power. Parametric [1D] calculations are perfect to advise designers on how principal characteristics – maximum section area, LCB, transom immersion, bulb area – will influence resistance.

4. Benchmarking for [2D] analysis. It is always beneficial to run a lower order calculation as a benchmark for the next higher order calculation. The [1D] parametric-empirical predictions can serve as checks of [2D] outcomes to make sure that the [2D] data model is correct.

5. When to proceed to higher-order analysis. The parametric-empirical [1D] calculations as found in HydroComp NavCad will be sufficient if your objective is the quantitative prediction of speed and power for the purposes of determining maximum ship speed, selecting propulsion components, or investigating operational fuel consumption, for example. It is also suitable for forensic studies of existing performance. Running higher order calculations is justified if a qualitative optimisation of the immersed volume is needed, if the vessel does not well match the data set of a parametric method in the library, or for investigations of local characteristics of flow.

• Tasks appropriate for [2D] analysis

1. Prediction of ship resistance. The ADVM computation in NavCad Premium edition is not built from a regression data set, so its resistance predictions are independent of any particular hull type. This makes it an ideal companion to [1D] calculations as an additional confidence check. Like the [1D] calculation, these can also be enhanced with alignment to existing model tests.

2. Investigation of the influence of distributed shape changes on resistance. When the principal parameters of a design (L/B, B/T) have been established, a [2D] computation can be used to investigate resistance based on the distribution of the immersed volume. This capability can be used to optimise and design hydrodynamically-significant features such as 'shoulders' in the sectional area curve, immersed transom area, length of entrance or run, or characteristics of bulbous bow geometry, for example.

3. Narrow the design space for [3D] CFD. While computers are increasing in power and [3D] codes are becoming more efficient, the [3D] CFD computational requirements in time, skill, and resources are still considerable. Anything that reduces the number of iterations to find a [3D] solution makes the analysis more efficient and the entire project more profitable. The [2D] ADVM calculation – particularly if driven as a simulation solver by an optimising code – will 'set the table' for CFD by narrowing the design space for investigation.

4. Benchmarking for [3D] analysis. As was the case for [1D] benchmarking of [2D] calculations, it is absolutely critical for the success of [3D] resistance predictions to have the knowledge derived from the [2D] link in the tool chain. Differences in outcome can point to potential errors in the [3D] data model (such as incorrect gridding) or in CFD settings (turbulence models or convergence). While many CFD codes have a proven track record, user mistakes happen. Without the appropriate benchmarks from the lower order [2D] distributed volume calculation, it is often difficult to have sufficient confidence in the results of the [3D] CFD calculations.

5. When to proceed to higher-order analysis. The distributed-volume [2D] calculations from the Premium edition of NavCad serve as an additional resistance prediction method that allows for a better understanding of the influence of volume changes. It can be used for design optimisation of shape characteristics, or on a broader level for narrowing the design space and making [3D] CFD studies more cost-effective and time-efficient with better outcomes. Full CFD studies are called for if localized optimisation is needed, if flow is to be observed, or as a final validation stage of the design spiral.

Summary

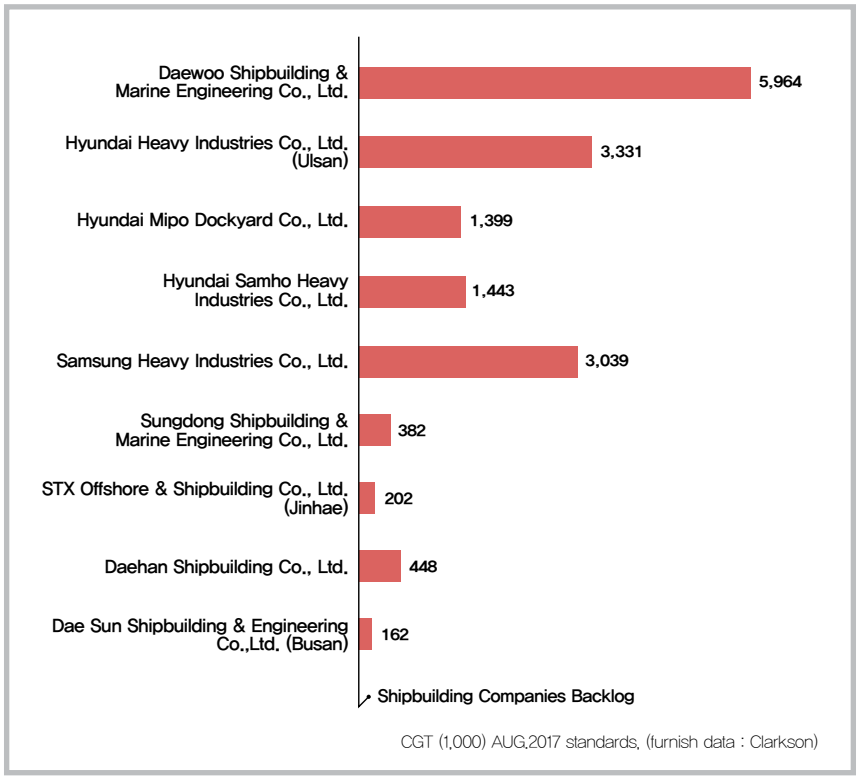
The evolutionary nature of ship design calls for a multi-order 'tool chain' for hydrodynamic analysis.

Workflow from [1D] parametric analysis through [3D] CFD requires computational models and tools that are appropriately matched to the task. An interactive suite of tools that hits the 'sweet spot' between facility and precision is critical for successful and cost-effective hydrodynamic outcomes. Fortunately, such tools are easily accessible and appropriate for any naval architectural office.

About the author

Donald MacPherson is an internationally-recognised specialist in applied hydrodynamics with particular emphasis on the design of propulsors. In addition to being the co-founder VP technical director of HydroComp, he is also an instructor of naval architecture at the University of New Hampshire.

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: Hyundai Samho Heavy Industries Co., Ltd.

DSME inked a contract to supply key equipment for 3,000-ton submarine

Daewoo Shipbuilding & Marine Engineering (DSME) announced on August 25 that it recently signed a contract worth KRW 215 billion with Hyundai Heavy Industries (HHI) to supply 3 types of equipment to be installed on board the 3,000-ton submarine, the third vessel built in Jangbogo-III project.

DSME will supply the 3 types of equipment which it has placed successfully in production line for the first time nationwide after research on key technologies and R&D contracted out to third party. The equipment will be outfitted first to the 3,000-ton no. 1 and no. 2 submarines built by DSME. Under this contract, the equipment will be delivered by the end of 2021 to be out fitted to the third submarine constructed in the first phase of Jangbogo-III project which was awarded to HHI last year.

The Jangbogo-III project aims to build 3,000-ton submarines providing key military capability for ROK Navy with pure domestic technologies and to localize not only basic design and detail design but also core equipment.

DSME is currently building 2 submarines in the first phase of Jangbogu-III project worth about KRW 1.7 trillion which it was awarded in 2012 and is proceeding with basic design in the second development project awarded to it to build submarines with underwater operational capability, detection capability, and weapon system which outstrips those of the first submarine. In particular, DSME has pressed ahead with R&D in collaboration with many domestic companies to localize about 40 types of major equipments such as fuel cell and propulsion motor, as well as combat system and sonar system mounted on submarines.

An official from DSME said, "DSME has successfully localized major equipment and become the fifth company worldwide to export submarines, underpinned by DSME's submarine construction expertise accumulated over the last 3 decades. We will continue to develop technologies to solidify our unrivalled leading position in technology."

DSME has won orders for 13 vessels worth USD 1.33 billion, including 2 LNG carriers, 8 VLCCs, 2 special purpose vessels, so far this year.

대우조선해양, 3,000톤급 잠수함 핵심장비 공급사업 계약 체결

대우조선해양은 최근 현대중공업과 '3,000톤급 잠수함 장보고-Ⅲ 1차 사업 3번함'에 설치될 2,150억원 규모의 3종 장비에 대한 공급계약을 체결했다고 지난 8월 25일 밝혔다.

이번에 대우조선해양이 공급할 장비는 핵심기술연구개발 및 도급연구개발을 통해 국내 최초로 생산에 성공한 3종 장비로 대우조선해양이 건조하는 '3,000톤급 잠수함' 1번 함과 2번 함에 먼저 탑재될 예정이다. 이번 계약에 따라 이 장비들은 2021년 말까지 인도되어 현대중공업이 지난해 수주한 장보고-Ⅲ 1차사업 3번 잠수함에 설치된다.

장보고-Ⅲ 사업은 대한민국 해군의 차기 주력 전력인 3천톤급 잠수함을 순수 국내 기술로 건조하는 사업으로, 기본설계와 상세설계는 물론 핵심장비까지 국산화한다는 계획이다.

대우조선해양은 2012년 약 1조 7천억원 규모의 장보고-Ⅲ 1차 사업을 수주해 2척의 잠수함을 건조 중에 있으며, 지난해에는 1차 잠수함보다 수중 작전능력 · 탐지능력 · 무장 등이 향상된 2차 개발 사업을 수주해 현재 기본설계가 진행 중이다. 특히 잠수함에 탑재되는 전투체계 및 소나 체계는 물론 연료전지, 추진전동기 등 주요 장비 약 40여종에 대한 국산화를 위해 국내 여러 업체들과 지속적으로 연구개발을 추진해 왔다.

대우조선해양 관계자는 "지난 30년간 축적된 대우조선해양의 잠수함 건조능력이 주요장비의 국산화 성공과 세계에서 다섯 번째로 잠수함을 수출하는 국가가 되는 원동력이 됐다"며 "향후에도 지속적인 기술개발로 최고의 기술경쟁력을 유지하겠다"고 말했다.

대우조선해양은 올해 LNG선 2척, VLCC 9척, 특수선 2척 등 총 13척 13.3억 달러를 수주했다.

Nexans supplies 320 kV cables for “DolWin6” offshore DC link to TenneT

Transmission system operator TenneT awarded Nexans the contract to supply and install the cables for the DolWin6 direct-current link. These cables will transport the electricity from the offshore wind farms of North Sea Cluster 3 from the DolWin Kappa HVDC converter station to the Emden/Ost onshore HVDC converter and transformer station.

Two parallel, XLPE-insulated 320 kV DC cables, each measuring 90 km in length, will be able to carry a maximum output of 900 MW. The Nexans contract, worth around 100 million euros, comprises the cables, accessories and installation. In addition to the DC cables, Nexans will be installing a fibre-optic cable for data transfer. The project – Nexans Deutschland’s biggest to date – is scheduled for completion in 2023.

The geographical location of the offshore wind farm to be connected means that the offshore grid connections runvia the ecologically sensitive Wadden Sea. This is also the case with the DolWin6. On the way from the DolWin Kappa converter station, where the three-phase current generated at sea is converted to direct current, to Hilgenriedersiel on the mainland, around 45 kilometres away, the cables will cross the island of Norderney. To help protect the Wadden Sea and the flora and fauna on Norderney, horizontal drilling will enable the cables to pass under the island.

TenneT is beginning work on this part of the project this year, as in order for the dykes and natural features to be protected, it can be carried out only between mid-July and the end of September Nexans will also install the cables carefully and within suitable time frames. The submarine cables, manufactured in Norway, are scheduled for delivery and installation in summer 2020 and 2021. Installation of the land cables, produced in Belgium, between Hilgenriedersiel and Emden – a distance of roughly 45 kilometres – is planned to take place from 2020 as well.

Dr Dirk Steinbrink, Managing Director of Nexans Deutschland and Senior Executive Vice-President of the Nexans Group, said “I am delighted that TenneT has awarded us the contract for this important link. With DolWin6, we are responsible for all stages of the project relating to the cable system, including design, manufacture, logistics and installation, and after previous projects such as Beatrice, Italy-Montenegro and NordLink, we once again have the chance to demonstrate our expertise in high-voltage direct-current transmission.”

Low-loss high-voltage and ultra-high-voltage cables from Nexans enable grid operators to expand their grids in a way that achieves the best possible results in terms of efficiency and conservation of resources, and thereby to lay the groundwork for the energy supply of the future.

넥상스, 돌윈6(DolWin6) 오프쇼어 DC 링크를 위한 케이블 공급 계약 체결

송전시스템 운영업체인 테넷(TenneT)는 돌윈6 (DolWin6) DC (직류) 링크에 사용될 케이블의 설치 및 공급업체로 넥상스를 선택했다. 넥상스 케이블은 북해 클러스터3 오프쇼어 풍력발전단지에서 만들어진 에너지를 돌윈 카파 HVDC 변전소에서 엠덴(Emden)/오스트(Ost) 온쇼어 HVDC 변전소로 전력를 송전한다.

두 회선의 XLPE 절연 320kV 직류 케이블은 각 길이가

90km로 최대 900MW의 전류를 송전할 수 있다. 넥상스 계약 금액은 약 1억 유로 상당으로, 케이블, 악세사리 공급 및 설치를 포함한다. 넥상스는 DC 케이블 뿐 아니라 데이터 전송에 필요한 광섬유 케이블도 함께 공급 및 설치한다. 넥상스 독일이 수주한 역대 최대 규모인 이번 프로젝트는 2023년에 완료된다.

오프쇼어 풍력발전단지가 서로 연결되어야 한다는 것은 오프쇼어 그리드 연결이 생태적으로 민감한 바덴 해를 거치게 되어 있다는 것을 의미한다. 이는 돌윈6의 경우와도 같다. 바다에서 발전한 삼상 전류를 직류로 변환하는 돌윈 카파 변전소에서부터 45km 정도 떨어져 있는 본토의 힐겐리에데르시엘(Hilgenriedersiel)까지 이어지는 케이블은 노르더나이 섬을 가로지르게 된다. 바덴 해와 노르더나이의 플로라, 파우나 지역을 보호하는데 도움을 주기 위해서, 수평 드릴링으로 케이블을 섬 아래로 지나가도록 할 예정이다.

테넷는 올해부터 이 프로젝트에 착수하였고, 제방과 자연 풍토 보호를 위해 프로젝트 수행은 7월 중순부터 9월 말까지로 제한됐다. 넥상스는 이 기한에 맞춰 신중하게 케이블을 설치할 예정이다. 노르웨이에서 제조되는 해저 케이블은 2020–2021년 여름에 납품 및 설치될 예정이다. 벨기에에서 제조된 힐겐리에데르시엘(Hilgenriedersiel)과 엠덴(Emden)을 잇는 약 45km 길이의 육상케이블 설치 또한 2020년에 이루어질 예정이다.

넥상스 그룹의 초고압 사업 부분 총괄 사장인 더크 스테인브링크(Dirk Steinbrink) 박사는 "테넷으로부터 이렇게 주요 대형 링크 계약을 수주하게 되어 매우 기쁘게 생각한다. 돌윈6와 함께 우리는 프로젝트에서 설계, 제조, 운송, 설치 등 케이블 시스템에 관한 모든 부분을 책임지고 수행할 것이다. 우리는 베아트리스, 이탈리아–몬테네그로, 노드링크 프로젝트에 이어 다시 한번 대형 프로젝트를 수주해 초고압 직류 송전에 관한 넥상스의 전문지식을 증명할 기회를 얻게 됐다"고 말했다.

넥상스의 저손실 초고압 및 초초고압 케이블은 그리드 운영 업체가 효율성과 자원 절약에 있어 최선의 결과를 도출할 수 있도록 그리드 확장 사업을 통해 미래 에너지 공급의 토대를 마련할 것이다.

HHI won an order for 2 LPG carriers

Hyundai Heavy Industries (HHI) has bagged an order from global energy company Vitol to build two very large liquefied petroleum gas (LPG) carriers. This contract would be valued at USD 600 million for up to 8 vessels if all options are exercised. These LPG carriers will be built at Ulsan headquarters and delivered to ship owner by the first half of 2019 on a staggered basis.

HHI will be built using green technologies such as a ballast water treatment system and scrubber for limiting sulfur oxides that will enable the ship to save fuel and protect water environment. VITOL, a global energy company, has chartered and operated about 250 vessels and it is the first time for VITOL to place its own order for any ultra-large LPG carrier. Previously, VITOL used the chartered vessels for transportation of LPG. With the latest order for LPG carriers, VITOL plans to transport the LPG directly.

HHI, which is also the world's largest shipbuilder, is renowned for building top-notch very large LPG and liquefied natural gas (LNG) carriers and has delivered about 200 LPG and LNG vessels until now.

An official from HHI said, "We are grateful to VITOL for the latest order which is the result of its trust in HHI's technology. We will make our utmost effort to ensure timely delivery of high quality vessels applying eco-friendly technology."

HHI group have clinched orders to build total 81 vessels, worth $ 4.5 billion, so far this year, raising expectations that the shipbuilding industry might have turned around after a prolonged slump for the last few years.

현대중공업, 초대형 LPG운반선 2척 수주

현대중공업은 최근 VITOL와 84,000m³ 초대형 LPG운반선 2척의 수주계약을 체결했다고 밝혔다. 이번 수주 규모는 옵션분까지 최대 8척으로 총 6억 달러에 달한다. 이들 LPG운반선은 울산 본사에서 건조해 오는 2019년 상반기까지 차례로 선주사에 인도할 예정이다.

특히 이 LPG운반선은 연료를 절감할 수 있는 최신형 선형과 평형수 처리장치, 황산화물 규제에 대응할 수 있는 스크러버(SCRUBBER) 등의 기술이 접목된 친환경 선박으로 건조된다.

VITOL는 세계적인 에너지기업으로 250척에 달하는 선박을 용선해 운영중에 있지만 자체적으로 초대형 LPG운반선을 발주하기는 이번이 처음이다. 그간 용선한 선박을 이용해 LPG를 운반했지만, 이번 발주를 통해 직접 LPG를 운송할 계획인 것으로 알려졌다.

현대중공업은 LPG운반선, LNG운반선 등 초대형 가스선 분야의 뛰어난 기술력을 바탕으로 지금까지 200여척에 달하는 초대형 가스선을 건조해 다양한 선주사에 성공적으로 인도한 바 있다. 현대중공업 그룹은 가스선 분야에서 LNG 운반선 12척, LNG FSRU 2척, LPG운반선 8척 등 총 22척(32억 달러)의 옵션과 건조의 향서를 체결했다.

현대중공업 관계자는 "현대중공업의 기술력을 믿고 발주를 결정해 준 VITOL에 감사하다"며 "친환경 기술 적용 등 고품질의 선박을 적기에 인도할 수 있도록 최선의 노력을 다하겠다"고 밝혔다.

한편, 현대중공업 그룹 조선3사는 이번 계약으로 지금까지 81척, 총 45억 달러 의 수주계약을 체결, 지난해 같은 기간대비(16척, 17억 달러) 척수로 5배 이상 늘어난 실적을 기록 중에 있다.

Rolls-Royce & Mystic Cruises combine to launch eco-friendly expeditionary cruise ship

Rolls-Royce has signed a deal with WestSea Yard, part of Martifer Group, to equip an expeditionary oceanic cruise ship for Portuguese based cruise company Mystic Cruises.

The vessel, to be called the MS World Explorer, will be the company's first expeditionary oceanic cruise ship. The MS World Explorer will offer expeditionary cruise itineraries in Antarctica from November to March and this new vessel's inaugural Antarctic season is already fully chartered to, and being distributed globally by, Polar Cruise Company Quark Expeditions. For the rest of the season it will visit small and distinct ports around the world normally not accessible to larger cruise ships and will be distributed worldwide by the German Company Nicko Cruises.

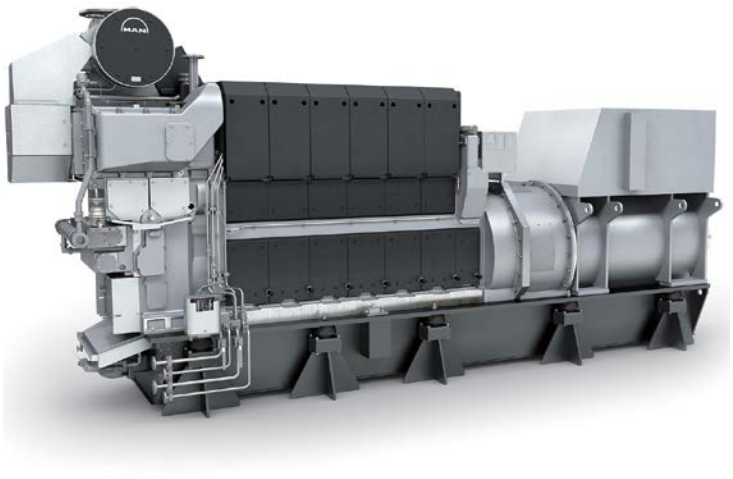
Equipped with environmentally sustainable and top of the line technology developed by Rolls- Royce, the MS World Explorer is the first of several ships to be built by the Portuguese company for its expeditionary cruise line. The design is the result of several years of study and development to create the perfect balance between luxury, comfort, efficiency and environmental friendly operation.

Mário Ferreira, Mystic Cruises, CEO said "These are very exciting times for us, this project is something that we've been working on for some time, crafting it to perfection to meet our clients' and the market's needs. The MS World Explorer will be the first of our expeditionary cruise ships. She will offer passengers a once in a lifetime experience of exclusivity and personalised service visiting the vast frozen landscapes of Antarctica and small, exclusive ports around the world."

Rolls-Royce has supplied two Bergen, C25:33L8P main engines and a Bergen C25:33L6P auxiliary dual generator. These connect to a Low Voltage AFE "SAVeCUBE" Power Electric System which allows the engines to operate at variable speeds maximising their efficiency for the required power. Rolls-Royce is also providing the automation and control system, and the complete Promas propulsion system with two CPP propellers integrated with two flap rudders, also steering gears and tunnel thrusters.

John Roger Nesje, Rolls-Royce, Vice President, Power Electric Systems – Marine said "Our experience of all aspects of ship design and construction, has allowed us to help Mystic Cruises, carefully consider the MS World Explorer's operational profile and identify the optimum combination of technologies to use in order to reduce emissions and achieve improved performance and fuel economy."

MAN Diesel & Turbo wins diesel-electric propulsion package



MAN Diesel & Turbo and AKA have received an order in connection with the building of a multi-purpose supply vessel for a federal Russian agency.
Delivery is scheduled for March 2018. Petersburg and marks the first successful collaboration between the two partners since MAN Diesel & Turbo bought a 40% share in AKA – the electric-and-hybrid-systems company – in June 2017. The order comprises 4 × MAN 7L21/31 GenSets, including alternators, with AKA's scope of supply for the order covering:

- complete 690V main switchboard
- 690V-to-400V transformers
- electric motors for main props and thrusters
- frequency converters for electric motors
- the drive control and power-management systems.

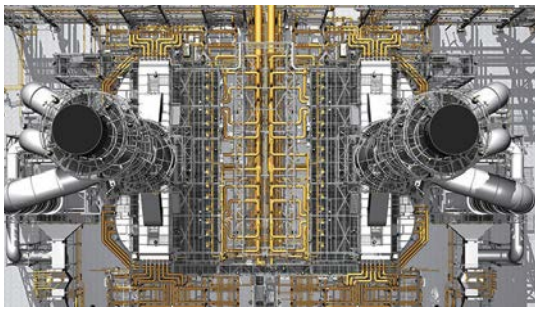
Wayne Jones, Chief Sales Officer – MAN Diesel & Turbo, said "This specialist vessel, with its unique operational demands, showcases MAN Diesel & Turbo's competence as a solution provider and the broader capability we now possess with AKA's energy-management expertise. Encouragingly for our new partnership, the previous vessel in this series was equipped with an identical propulsion package, but from a different supplier."
AKA's CEO, Jason Aspin, said "We are excited to deliver on this first order together with our new partner, MAN Diesel & Turbo. Our expertise in energy management, and electrical-system integration, combined with MAN's vast experience in power-train solutions, allows us to deliver a completely integrated power and propulsion system for this vessel, making it a WIN-WIN-WIN between our partnership and this client".

Samsung Engineering Selects SmartPlant® Foundation to Build Engineering Data Warehouse

Samsung Engineering has selected SmartPlant® Foundation to build an engineering data warehouse, which will house the critical engineering information related to its active projects across Central America, the Middle East and Asia.

SmartPlant Foundation is Hexagon PPM's complete asset information management solution, ensuring secure access to engineering designs, equipment and instrument lists, vendor data, purchase orders, requests for quotation, specification sheets and all ancillary documents. As the basis of Samsung Engineering's engineering data warehouse, the solution will provide numerous time- and cost-saving benefits.

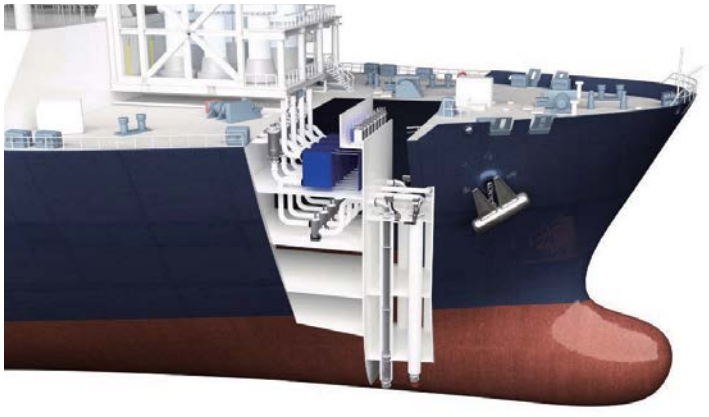
"The best way to improve design quality is to share information in a timely manner, and SmartPlant Foundation is clearly the best solution on the market to help us realize that," said Won Hee Cho, Plant Technology Center team leader at Samsung Engineering. "We expect to benefit from features such as real-time change management and enhanced



collaboration, as well as the ability to reuse reference engineering data for future projects."

Mattias Stenberg, president of Hexagon PPM, said, "We are pleased Samsung Engineering continues its adoption of our technology solutions and is seeing the benefits of keeping engineering information current and synchronized in a smart digital asset."

Framo wins contract to deliver pump systems to GasLog



FSRU Framo pumping system illustration

Framo has won the contract to deliver pump systems (Sea Water Lift Pumps) for a potential Floating Storage Regasification Unit (FSRU) for the shipowner GasLog at Samsung Heavy Industries.

The order was placed shortly after Framo signed a supply agreement for similar pump systems for an FSRUs under construction at the same Korean yard for shipowner Høegh LNG.

"This represents acknowledgement of our ultra-compact pump concept that is now gaining a solid position on the FSRU market," said Thorbjørn Vågenes, Director Oil and Gas pumping systems in Framo.

The pump systems are based on thoroughly tested and recognized Framo technology. In comparison with conventional pump systems, Framo's pumps provide significant savings on space and eliminate the need for a separate pump room onboard the ship. Delivery is scheduled for August 2018.

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
	Aug	84,000m³ LPG carriers	2 vessels	-	Vitol	The first of 2019	Hyundai Heavy Industries

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

Upturn in demand amid rising LNG cargo traffic volume

- LNG oversupply likely to stay persistent until 2020

The use of LNG as a low carbon energy source is expanding to meet the requirements of global environment regulation. In addition, the increase in shale gas production based on business feasibility of shale gas also has a far-reaching influence on expansion of LNG market.

As three major LNG exporters, such as Qatar, Australia, and the United States, are recently scrambling to expand LNG exports, LNG prices are likely to fall further. Qatar, the world's largest LNG producer accounting for one-third of the world's LNG production, has an annual LNG output of 77 million tons. Not long ago, Qatar announced that it would increase its LNG production by 30%. This move aims to widen the gap in market share with Australia trailing closely behind and to keep the United States in check which has an increasing confidence in the wake of Shale Revolution.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New Product

Next Generation FaroArm®

FARO Technologies, Inc.

FARO® introduced the new FARO® QuantumS FaroArm®. This introduction extends FARO leadership in value and performance in the manufacturing inspection process through best in class performance and durability, enhanced ergonomics and extreme portability.

The QuantumS is certified to ISO 10360 -12:2016, the most rigorous international measurement quality standard in existence. This global standard, unlike the various regional standards such as VDI/VDE 2617, establishes the consistent, critical testing procedures that enable objective performance comparisons across any and all Articulated Arm Coordinate Measuring devices.

Also, the QuantumS sets a new standard for ruggedness as it tests to the International Electrical Commission (IEC 60068 -2) standards for shock, vibration and temperature stress relief. Next, with the addition of the FAROBluTM Laser Line Probe HD, the QuantumS continues the FARO tradition of delivering maximum measurement consistency for both direct-to-parts contact and non-contact requirements in every working environment. Finally, FARO extends its leadership in improving end user productivity by enabling users to capture more, richer detail faster than any other comparable product on the market.

The advanced man-machine interface and enhanced ergonomics make the FARO QuantumS a virtual extension of the human arm and enables up to 15% less effort and fatigue for the operator with direct, contact only units. This dramatic increase in both comfort and portability increases operator productivity by facilitating continuous use over extended periods during the workday.

QuantumS advances the concept of true portability and ensures additional floor reach by up to 40%. Advanced wireless capability ensures that the reliability of cable-free scanning and probing is comparable to scanning and probing with a cable attachment. Furthermore, the availability of dual, hot swappable batteries supports continuous operation anywhere on the factory floor without the need for external power.

-TEL: +82-51-662-3412
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Ballast Water Monitoring Kits

Aqua-tools

30 Rapid ATP ballast water monitoring kits will be supplied to SGS Group, which has been contracted to monitor treated ballast water by several countries.

Aqua-tools has delivered the first in series of 30 state-of-the-art Rapid ATP Ballast Water Monitoring Systems to SGS Group.

The Geneva-based testing and certification body has agreements in place with several countries to inspect and monitor the treated ballast waters of vessels entering their ports, the latest of which is The Kingdom of Saudi Arabia. Vessels discharging ballast water in Saudi Aramco ports will be required to present a ballast water report and sample from 16 August 2017.

Dr. Vladimiro Bonamin, Vice-President, Global Business Development Manager, SGS Groups, said "With the entry into force of the Ballast Water Management Convention next month, ballast water monitoring will become an important aspect of the port state control function, as inspectors test treated water for compliance. aqua-tools, in collaboration with SGS Group (Switzerland) and LuminUltra (Canada), has developed a Rapid ATP technology designed to be the most reliable and effective ballast water monitoring solution on the market."

According to Bonamin, existing bioluminescence methodologies used to monitor Adenosine Tri-phosphates (ATP), a molecular structure, like DNA, that is found in all living organisms, "are ineffective in high salinity waters and while an accepted method for testing surface waters, these rudimentary solutions do not provide a reliable tool with which to test the efficacy of ballast water treatment systems".

Marc Raymond, Managing Director, aqua-tools, said "Our test protocol is based on the bioluminescence principle, whereby the proportion of light correlates exactly with the number of Adenosine Tri-phosphates found in ballast water. Other luminometers measure the light but these use a very rudimentary measurement 'pen' to take a small sample of the water. This is ineffective since the reagent required to extract the ATP from the organism is heavily diluted and does not provide an accurate measurement from which to assess efficacy across the entire spectrum specified in the IMO D2 parameters list.

Aqua-tools' ATP 2G technology can be used onboard vessels and by enforcement agencies to rapidly analyse treated waters onboard vessel during the deballasting process, providing results in less than 40 minutes.

SGS Group now has agreements in place to implement ballast water compliance verification tests and certification in seven countries, with the service available in USA, Canada, South Africa, Germany, Italy, Spain, Belgium, the Netherlands, Finland, UAE, India, China, South Korea, Australia, Thailand and Taiwan.

The 30 Rapid ATP Ballast Water test kits will now be distributed to SGS Group offices in all those countries by which it has been contracted to carry out ballast water verification tests.

-TEL: +33-(0)139-750-220
-http://www.aqua-tools.com

New Product

새로운 One-type-fit 액추에이터

알파라발

알파라발은 표준 다이어프램 밸브 제품군 전체와 호환되는 새로운 Unique DV-ST UltraPure 액추에이터를 개발했다. 이 제품은 재고 관리를 단순화하고 프로세스를 빠르고, 쉽고 안전하게 만들어 준다. 프로세스 또는 어플리케이션 종류와 상관없이 이 액추에이터는 주조, 단조 또는 블록 및 오토 클레이브 작업에 사용되는 Unique DV-ST UltraPure Diaphragm Valve의 예비 부품으로 구입 가능하다

Unique DV-ST UltraPure 액추에이터는 살균시 고온에서도 견딜 수 있으며, 최대 작동 압력 10 bar(6 bar PTFE/EPDM)에서 작동한다. 기존의 많은 액추에이터와는 달리, 0% 압력 강하의 동일한 작동 압력에서 밸브를 닫을 수 있다. 작동 압력이 10 bar(6 bar PTFE/EPDM) 이하로 유지되는 한 안정적이고 고장 없는 성능이 보장된다. 액추에이터의 크기 또는 구성을 변경할 필요가 없으며, 공정 라인의 변경이 발생할 경우 역시 마찬가지다.

알파라발의 감지 및 제어 장치는 Unique DV-ST UltraPure 액추에이터와 쉽게 통합되어 우수한 밸브 자동화 솔루션을 최대로 활용할 수 있도록 돕는다. 이 감지 및 제어 장치는 엄격한 허용 오차 대역을 통해 간단한 설치로 최대의 프로세스 안전성과 설치 후 추가 관리를 필요로 하지 않는 노터치 센서를 제공한다. 이를 통해 인적 오류를 최소화하고 안전하고 효율적인 생산을 촉진함으로써 가동 시간을 연장할 수 있다.

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DCIM 쿨링 옵티마이즈 솔루션

슈나이더 일렉트릭 코리아

데이터 보유량이 기업의 경쟁력을 결정짓는 시대가 됨에 따라 대용량 데이터를 수집 및 분석, 저장하는 데이터센터의 중요성이 높아지고 있다. 에너지 관리 및 자동화 분야의 세계적인 전문 기업인 슈나이더 일렉트릭 코리아는 데이터센터의 공기흐름 개선하여 핫스팟을 제거하고 전력비용 절감과 이산화탄소 발생량을 줄이는 솔루션을 제공한다.

DCIM 쿨링 옵티마이즈(DCIM for Cooling Optimize)는 데이터센터의 공기 흐름을 조절하여 평균 온도를 유지하는데 도움을 주는 솔루션이다. 데이터센터의 각 요소에 부착된 센서를 통해 다양한 데이터를 수집하고, 이를 분석하여 최적화된 상태로 제어하는 소프트웨어로 냉각장치 운영에 따른 전력 소모를 크게 낮춰 비용 절감 효과를 기대할 수 있다.

쿨링 옵티마이즈 소프트웨어는 모든 냉각 장치가 전 랙에 미치는 영향을 지속적으로 학습한 다음 해당 정보를 사용해 냉각 장치 설정 및 공기 흐름을 자동으로 조정해 모든 랙에 적절한 냉각량을 제공한다. 이를 통해 98%까지 핫 스팟이 제거되고 냉각 전력 소비가 크게 감소하는 효과를 누릴 수 있다. 또한, 데이터센터 상면의 평균 온도를 유지하는 것은 설계된 IT부하의 용량을 충분히 사용할 수 있다는 큰 장점이 있다.

데이터센터 전체 사용 전력 중 약 40%를 차지하는 쿨링에서 IoT와 인공지능을 활용하여 최상의 절감 솔루션을 제공하는 쿨링 옵티마이즈(Cooling Optimize)는 장비 이동, 업그레이드 또는 IT 부하 스윙과 같은 온도에 영향을 주는 모든 요소들을 실시간으로 볼 수 있는 기능을 제공하고, 관리자는 데이터센터 상면의 온도환경을 보다 잘 이해하고 신뢰성과 효율성을 향상시킬 수 있도록 돕는다.

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Member List

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Head Office : Gangseo-gu Busan
Homepage Add. : www.answerclear.com
Main Products : CO2 Extinguishing Sys. External Fire Fighting Sys.
TEL : +82-51-831-3691

BANDO MARINE.
Head Office : Gangseo-gu Busan
Homepage Add. : www.bando.info
Main Products : Life Boat
TEL : +82-51-831-1950

BERM YOUNG VALVE.
Head Office : Gangseo-gu Busan
Homepage Add. : www.byvalve.com
Main Products : Quick Closing Valve, Ball Valve, Bellows, Beal Valve
TEL : +82-51-311-2511

B-I INDUSTRIAL CO., LTD.
Head Office : Gangseo-gu, Busan
Homepage Add : www.b-i.co.kr
Main Products : Fire & gas detection system, smoke, heat & flame detector.
TEL : +82-51-441-5670

BMT CO., LTD.
Head Office : Yangsan Gyeongsangnam-do
Homepage Add. : www.superlok.com/
Main Products : Fitting & Valve, Vacuum Clamp
TEL : +82-55-783-1000

BO KYOUNG IND., CO.
Head Office : Gangseo-gu Busan
Homepage Add. :
Main Products : O-ring, Sealing, Gasket
TEL : +82-51-831-4615

BOKYUNGTL CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. :
Main Products : Rudder Body, Winch, Crane
TEL : +82-51-832-0801

BO MYUNG METAL CO., LTD.
Head Office : Saha-gu Busan
Homepage Add. :
Main Products : Copper Tube & Pipe, Cupro-Nikel Pipe, Copper Fitting
TEL : +82-51-266-4101

BOYANG HARDWARE CO., LTD.
Head Office : Kimhae Gyeongsangnam-do
Homepage Add. : www.byhd.co.kr
Main Products : Stairway Body, Ladder, Hardware
TEL : +82-55-345-1951

BUSAN INDUSTRY CO.
Head Office : Gangseo-gu Busan
Homepage Add. :
Main Products : Powder Coating
TEL : +82-51-831-4810

BUSUNG PLANT CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. :
Main Products : Cargo Reducer Piece
TEL : +82-51-831-1784

CEPHAS PIPELINES CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. :
Main Products : Butterfly Valve
TEL : +82-51-263-3661

CHK CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. : www.chkj.co.kr
Main Products : Telephone Booth, Work Shop, Cable Box, Spare Box
TEL : +82-51-831-9500

CHWANG HYEOP INSTRUMENTS.
Head Office : Gangseo-gu Busan
Homepage Add. : www.chkj.co.kr
Main Products : Telephone Booth, Work Shop, Cable Box, Spare Box
TEL : +82-51-831-3607

CHANG WON ENVIRONMENT IND CO., LTD.
Head Office : Kimhae Gyeongsangnam-do
Homepage Add. : www.seaclean.kr
Main Products : Sewage Tredtment Plant
TEL : +82-55-342-5545

CMR KOREA CO., LTD.
Head Office : Kumjung-gu Busan
Homepage Add. : www.cmkkorea.com
Main Products : Temperature & Press Sensor, Alarm Monitoring Sys.
TEL : +82-51-521-2883

DAECHANG METAL CO., LTD.
Head Office : Saha-gu Busan
Homepage Add. :
Main Products : Main Bearing support, Chain Wheel, Gear Wheel
TEL : +82-51-264-0831

DAE-DONG ENTEC CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. : www.ddentec.com/
Main Products : Air Cooler, Oil Cooler, Oil Tank, Air Tank, Oil Heater
TEL : +82-51-832-1123

DAE HAN HEAT ELECTRIC MACHINERY IND.,CO.
Head Office : Kijang-kun Busan
Homepage Add. :
Main Products : CO_2 Welder, DC Tig, Welder, AC ARC Welder
TEL : +82-51-724-6777

DAEHEUNG IND. CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. : www.daeheungind.kr/kr/
Main Products : Forged Flanges, Nozzel & Forged Neck, Forged Items for ship
TEL : +82-51-831-6635

AQ TECK CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. :
Main Products : Flower Meter, Viscometer, Control Valve
TEL : +82-51-831-3720

DAEHWA TECHNICAL CO., LTD.
Head Office : Kimhae Gyeongsangnam-do
Homepage Add. :
Main Products : Shot & Blast, Painting, Painting's Manufacture
TEL : +82-55-329-5705

DAEJUNG SPECIAL STEEL CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. :
Main Products : Winch, Shaft, Gear Cluch
TEL : +82-51-831-1133

DAEKYUNG CO., LTD.
Head Office : Saha-gu Busan
Homepage Add. : www.dkhoist.com
Main Products : Chain Block, Lever Block Trelley
TEL : +82-51-264-6611

DAERIM MACHINERY CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. : www.dae-rim.kr
Main Products : Head, Air Receiver Tank, Pressure Vessel, Reactor
TEL : +82-51-831-1456

DAESAN ENGINEERING CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. : www.daesan-eng.com
Main Products : E/R Package unit, Pipe Group Unit
TEL : +82-51-831-0090

DAE SEONG MARINE TEC CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. : www.ds-frp.com/
Main Products : Pipe Insulation System, FRP Weather Door
TEL : +82-51-832-2071

DAESUNG IND CO.
Head Office : Gangseo-gu Busan
Homepage Add. :
Main Products : VENT SYS, OIL TANK, Out Fitting
TEL : +82-51-831-7427

DAE WON HEAVY INDUSTRIES CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. : www.daewonindustry.co.kr/
Main Products : Deck Machinery, Deck Equipments, OffShore
TEL : +82-51-831-5215

DAEWON METAL IND. CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. : www.galvanizing.co.kr/
Main Products : Hot Dip Galvanizing, Pipe for Shipbuilding
TEL : +82-51-831-2541

DAEYANG ELECTRIC CO., LTD.
Head Office : Saha-gu Busan
Homepage Add. : www.daeyang.co.kr
Main Products : Precision Instrument
TEL : +82-51-200-5331

DAEYANG INSTRUMENT CO., LTD.
Head Office : Saha-gu Busan
Homepage Add. : www.daeyang.co.kr
Main Products : Precision Instrument
TEL : +82-51-200-5331

DAEYANG SP CO., LTD.
Head Office : Yangsan Gyeongsangnam-do
Homepage Add. :
Main Products : Welding machine
TEL : +82-55-388-3800

DA HEUNG ENG. CO., LTD.
Head Office : Sasang-gu Busan
Homepage Add. :
Main Products : Marine valves
TEL : +82-51-311-1882

DAOM METAL.
Head Office : Sasang-gu Busan
Homepage Add. :
Main Products : Sus plate, Flange, Pipe sleeve
TEL : +82-51-315-1347

DEAIL MACHINERY.
Head Office : Gangseo-gu Busan
Homepage Add. :
Main Products : Piston Rod, Cross headpin, Propeller Shaft
TEL : +82-51-832-1119

DECKWIN CO., LTD.
Head Office : Youngdo-gu Busan
Homepage Add. : www.deckwin.com
Main Products : Winch
TEL : +82-51-413-1193

DH-M CO., LTD.
Head Office : Seo-gu Incheon
Homepage Add. : www.dhm.co.kr
Main Products : High Pressure Blower, High Pressure Washer
TEL : +82-32-527-5782

DHP ENGINEERING CO., LTD.
Head Office : Dongnae-gu Busan
Homepage Add. : www.dhpeng.com
Main Products : Plate Type heat Exchanger, Disk & Shell type heat Exchanger
TEL : +82-51-556-4200

DINES CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. :
Main Products : Provision Crane, Tilting Radar Post
TEL : +82-51-971-0972

DK INDUSTRIAL CO., LTD.
Head Office : Saha-gu Busan
Homepage Add. : www.dk-ind.com/
Main Products : Silencer, Fire Damper, Lashing Bridge, Rudder
TEL : +82-51-832-1436

DK TECH CORPORATION CO., LTD.
Head Office : Kimhae Gyeongsangnam-do
Homepage Add. : www.dklok.com
Main Products : Instrument TuBe Fitting, Instrument Valve
TEL : +82-55-338-0114

DNP CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. : www.dnpco.kr
Main Products : Fire & Gas Damper, Galley Equipment, AL, Steel Furniture
TEL : +82-51-831-4551

DOLIM PRECISION.
Head Office : Gangseo-gu Busan
Homepage Add. :
Main Products : Cross Head Pin, Main Journal, Crank Shaft
TEL : +82-51-831-8861

DONG-A VALVE IND.
Head Office : Gangseo-gu Busan
Homepage Add. :
Main Products : Marine Offshore valve, Strainer
TEL : _+82-51-831-1500

DONGBANG SHIP MACHINERY CO., LTD.
Head Office : Jinhae Gyeongsangnam-do
Homepage Add. : www.dongbangsm.co.kr
Main Products : General Steel Poping, Framo & Hydro Piping, Module Unit
TEL : +82-55-545-0882

DONGHAE INTEC CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. : www.dhintec.co.kr
Main Products : Sleeve, Scupper, Suction Bell Mouth
TEL : +82-51-831-2565

DONG HUN ENTERPRISE CO.
Head Office : Sasang-gu Busan
Homepage Add. :
Main Products : Ball Valve
TEL : +82-51-314-2610

DONGHWA ENTEC CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. : www.dh.co.kr
Main Products : E/R Heater & Cooler, Copt, Condenser, Plate Heat Exchanger
TEL : +82-51-970-1000

DONGHWA M&E CO., LTD.
Head Office : Gangseo-gu, Busan
Homepage Add. : www.donghwame.com
Main Products : Heat Exchanger
TEL : +82-51-971-3455

DONGHWA PNEUTEC CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. :
Main Products : Air Comfressor, Cylinder, Cylinder, Head, Piston
TEL : +82-51-974-4800

DONGIL SHIPYARD CO., LTD.
Head Office : Saha-gu Busan
Homepage Add. :www.dongilshipyard.co.kr
Main Products : Rescue Boat Davit & Winch, Assembly, Line Hauler
TEL : +82-51-200-1211

DONGKYUNG INDUSTRY CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. : www.dki21.co.kr
Main Products : Reducer, Gear
TEL : +82-51-832-1602

DONG NAM ENGINEERING CO., LTD.
Head Office : Saha-gu Busan
Homepage Add. : www.dongnam-eng.com
Main Products : Electric Control Panel
TEL : +82-51-204-3984

DONGNAM PRECISION IND. CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. :
Main Products : Multi Core Tube, Sus Cable Tray & Cover, LNG Line Out Fitting
TEL : +82-51-831-3500

DONG SUNG HIGHTECH.
Head Office : Gangseo-gu Busan
Homepage Add. : www.dshitech.com
Main Products : Shutter Grill, P-Chamber, Diffuser, Frie Damper, Volume Damper
TEL : +82-51-831-9561

DONGYANG G.T.S.
Head Office : Gangseo-gu Busan
Homepage Add. :
Main Products : Compresed Centellen Board, Metal Inserting Gasket
TEL : +82-51-831-6505

DONGYANG HYDTEC CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. : www.dongyang-hyd.com
Main Products : Rudder & propeller Truck, Block lifter, Gripper Jack System
TEL : +82-51-831-6185

DONGYANG METAL CO., LTD.
Head Office : Sasang-gu Busan
Homepage Add. : www.dy-metal.co.kr
Main Products : Swing bolt a' ssy, Fittings
TEL : +82-51-814-5157

DONGYOUNG ELECTRIC CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. : www.dyelectric.com
Main Products : Main Switchboard, Emergency Switchboard
TEL : +82-51-261-9800

DSB ENGINEERING CO., LTD.
Head Office : Youngdo-gu Busan
Homepage Add. : www.dseng.com
Main Products : Totally Enclosed, Lifeboat, Herged Qrarity Davit
TEL : +82-51-412-5937

DSE BEARING CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. : www.dsebearing.com
Main Products : Metal Bearing
TEL : +82-51-831-2046

DSK CO., LTD.
Head Office : Youngdo-gu Busan
Homepage Add. : www.dskworld.com
Main Products : Piston Crown
TEL : +82-51-417-7800

DUYOUNG INDUSTRIAL MACHINES CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. :
Main Products : Plate-Baffle
TEL : +82-51-831-2477

EM SYSTEC CO., LTD.
Head Office : Sasang-gu Busan
Homepage Add. : www.emsystec.com
Main Products : Marine Switch Board, Control Console
TEL : +82-51-302-8761

FRIEND CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. : www.thefriend.co.kr
Main Products : Marine Cable Tray, Mud Box, Strainer
TEL : +82-51-831-9456

GEO MAEK SHOT&PAINT CO.,LTD.
Head Office : Saha-gu Busan
Homepage Add. :
Main Products : Deck Machinery Part, Hose Handling Crane
TEL : +82-51-264-3315

GEORIM ENGINEERING CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. : www.kangrim.com
Main Products : Marine Indutrial Boiler, Exhaust Gas Boiler
TEL : +82-51-831-2929

GISUNG ENGINEERING CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. :
Main Products : Air Reserovir, Heat Exchanger
TEL : +82-51-831-4475

G. M. TEC CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. : www.igmtec.com
Main Products : Duct Equip't Seat Support
TEL : +82-51-831-5851

G.S HIGH-TECHER CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. : www.gshightecher.koreasme.com
Main Products : Air Vent Head, Pipe Coupling
TEL : +82-51-832-0456

G&S PRECISION IND CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. :
Main Products : Cable Tray, Vent, Hull Outffittings
TEL : +82-51-831-0849

HAE DONG METAL CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. : www.hdanode.com
Main Products : Zinc Anode, Al Anode
TEL : +82-51-831-3751

HAE DUK RUDDER & R.STOCK CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. : www.rudders.co.kr
Main Products : Rudder & R.Stock, Rudder Horn, Rudder Carrier
TEL : +82-51-831-0101

HAE SUNG INDUSTRIAL.
Head Office : Saha-gu Busan
Homepage Add. : www.hsjs.co.kr/
Main Products : Cable Tray, Cable Way Fitting, Cable Coaming
TEL : +82-51-264-8103

HAEWON INDUSTRIES CO.
Head Office : Gangseo-gu Busan
Homepage Add. :
Main Products : P/Crown, P/Skirt
TEL : +82-51-831-4600

HAEWON IND. CO., LTD.
Head Office : Sasang-gu Busan
Homepage Add. : www.heawon.net
Main Products : Copper, Copper-Nickel, Monel Fitting & Flanges
TEL : +82-51-312-2161

HAEYANG FAMILY CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. :
Main Products : F.P Propeller, C.P Propeller, Propeller Shaft
TEL : +82-51-831-3550

HAEYANG METAL CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. :
Main Products : F.P Propeller, C.P Propeller, Propeller Shaft
TEL : +82-51-831-4591

HAEYANG PROPELLER CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. :
Main Products : Marine Propeller
TEL : +82-51-831-4599

HANCHANG TRANS CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. : www.hctr.co.kr
Main Products : Pole Mounted Transformer, Pad Mounted Transformer
TEL : +82-51-831-3470

HANJULEVEL.
Head Office : Sasang-gu Busan
Homepage Add. : www.hanjulevel.co.kr
Main Products : Level instrument Etc, Vapour Emision Control Sys.
TEL : +82-51-303-0537

HANLA IMS CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. : www.hanlalevel.co.kr
Main Products : Cargo Tank Monitoring Sys. Tank Remote Sounding Sys.
TEL : +82-51-601-3019

HANLA IND CO., LTD.
Head Office : Saha-gu Busan
Homepage Add. :
Main Products : Oil Filter unit, Gas Blower
TEL : +82-51-264-2201

HANMAUM KI-GONG CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. : www.hankg.co.kr
Main Products : Air Cooler Housing, Oil Cooler Housing
TEL : +82-51-831-5211

HEARTMAN CO., LTD.
Head Office : Saha-gu Busan
Homepage Add. : www.heartman.co.kr
Main Products : Nozzle Tip, Plunger Ass'y, Fuel Injection V/V
TEL : +82-51-262-8869

H.M.E.
Head Office : Kijang-kun Busan
Homepage Add. : www.hyomyungeng.com
Main Products : Battery Charger, Light Signal Column
TEL : +82-51-709-9000

HOSEUNG ENTERPRISE CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add.: 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

HWAJIN ENTERPRISE CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. : www.hwa-jin.com
Main Products : Control Box, Gauge Board System
TEL : +82-512-831-9447

HWAJIN PF CO., LTD.
Head Office : Saha-gu Busan
Homepage Add. : www.hwajinpf.com
Main Products : Butt-Welding Pipe, Fittings Carbon Steel
TEL : +82-51-204-3001

HWA SHIN PRECISION CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. :
Main Products : Life Boat Winch
TEL : +82-51-831-9839

HYOSUNG STEEL TECHNOLOGIES CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. :
Main Products : Steel plute cutting, Hy Auto or Manual
TEL : +82-51-831-5093

HYUNDAI HYCRAULIC CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. : www.hhmc.co.kr
Main Products : TURNING ROLLER, BLOCK LIFT
TEL : +82-51-831-8611

HYUNDAI ZINC METAL CO., LTD.
Head Office : Saha-gu Busan
Homepage Add. : www.hdz.co.kr
Main Products : Sacrificial Anode, Hot Dip Galvanizing, Ship Manufacture
TEL : +82-51-266-4788

HYUNJIN MATERIALS CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. : www.hjmco.co.kr
Main Products : Cross Head, Connecting Rod, Piston Rod
TEL : +82-51-602-7700

ILDO MACHINE ELECT CO., LTD.
Head Office : Saha-gu Busan
Homepage Add. :
Main Products : Heavy Electric Parts
TEL : +82-51-266-6066

IL - SUNG INDUSTRY CO.
Head Office : Sasang-gu Busan
Homepage Add. :
Main Products : Silencer, Water Air Filter, Air Intet Trunk
TEL : +82-51-312-4056

IN SUNG INDUSTRY CO.
Head Office : Saha-gu Busan
Homepage Add. :
Main Products : Profile, Steel Coalming Insulation
TEL : +82-51-293-7550

JAESEUNG ENGINEERING CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. :
Main Products : Steel Pipe Spool, Sus Pipe Spool, CuNi Pipe Spool
TEL : +82-51-831-8838

JEILSANKI CO.
Head Office : Gangseo-gu Busan
Homepage Add. :
Main Products :
TEL : +82-51-831-5398

JEONG-AM SAFETY GLASS CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. : www.jeong-am.co.kr
Main Products : Tempered Glass, Laminated Glass
TEL : +82-51-831-6161

JEONG HWA ACCOMMODATION SYSTEM CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. : www.jeonghwa21.com
Main Products : Wooden Furniture
TEL : +82-51-974-8000

JEONG WOO COUPLING CO., LTD.
Head Office : Kimhae Gyeongsangnam-do
Homepage Add. : www.jwcjoint.co.kr
Main Products : Pipe Coupling, Pipe Repair Clamp
TEL : +82-55-339-7666

JIN GU ENGINEERING.
Head Office : Kimhae Gyeongsangnam-do
Homepage Add. :
Main Products : Rudder Stock, Stern Tube, Stern Roller, Winch
TEL : +82-55-343-3414

JIN IL BEND CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. :
Main Products :
TEL : +82-51-832-1919

JINKWANG ELECTRIC CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. :
Main Products : Pull Card Switch, Belt Sway Switch, Belt Speed Switch
TEL : +82-51-831-2571

JINYOUNG METAL CO., LTD.
Head Office : Sasang-gu Busan
Homepage Add. : www.jymct.co.kr
Main Products : Multi Core Tube, Welded Stainless, Steel Tube
TEL : +82-51-313-4001

JMC HYDRAULICS.
Head Office : Saha-gu Busan
Homepage Add. :
Main Products : Hydraulic Motor For Marine, Hydraulic Control Valve
TEL : +82-51-204-4046

JNC HI-TECHNOLOGIES.
Head Office : Gangseo-gu Busan
Homepage Add. : www.jnchitec.com
Main Products : Junction Box, Elect panel bard, Tel Booth
TEL : +82-51-974-9500

JOKWANG I.L.I CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. :
Main Products :
TEL : +82-51-602-0200

JONGHAP POLESTAR ENGINEERING CO., LTD.
Head Office : Youngdo-gu Busan
Homepage Add. :
Main Products : Diesel Engine Piston, Cylinder, Valve
TEL : +82-51-403-5514

JUNG GONG IND. CO., LTD.
Head Office : Saha-gu Busan
Homepage Add. : www.jung-gong.com
Main Products : Ordinary Window Side, Scuttle, Heated Window
TEL : +82-51-261-2911

JUNG - WOO MACHINERY CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. :
Main Products : Carrier Housing, Split Bearing,Stock, Up.Lower Sleeve
TEL : +82-51-831-5394

KANG BACK INDUSTRY CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. :
Main Products : Electric Control Box, Valve & Similar , Equipment
TEL : +82-51-831-9025

KANGIL CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. :
Main Products : Pressure Vessel, Deaerator, Heat Exchanger
TEL : +82-51-972-5672

KANGRIM HEAVY INDUSTRIES CO., LTD.
Head Office : Changwon Gyeongsangnam-do
Homepage Add. : www.kangrim.com/
Main Products : Marine Indutrial Boiler, Exhaust Gas Boiler
TEL : +82-55-269-7701

K.C. LTD.
Head Office : Gangseo-gu Busan
Homepage Add. : www.iccp-mgps.com
Main Products : I.C.C.P. System, M.G.P.S, Shaft Earthing Device
TEL : +82-51-831-7720

KEO HUNG MACHINERY.
Head Office : Gangseo-gu Busan
Homepage Add. :
Main Products : Deck Crane, Provision Crane, Hose Handling Crane
TEL : +82-51-831-6296

KEYSUNG METAL CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. : www.keysungmetal.com
Main Products : Valve(Cryogenic, Ball), Strainer
TEL : +82-51-831-3391

KOC ELECTRIC CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. :
Main Products : Cast Resin Transformer, Dry Resin Transformer
TEL : +82-51-832-0550

KOREA HYDRAULIC CO.
Head Office : Gangseo-gu Busan
Homepage Add. : www.enpos21.com
Main Products : Electtric Motor Pump, Hand Pump, Single/ Double Acting Ram
TEL : +82-51-832-1100

KOREA PHE CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. : www.kphe.co.kr
Main Products : Plate Heat Exchanger, Tank Cleaning Heater
TEL : +82-51-261-2664

KOREA STEEL SHAPES CO., LTD.
Head Office : Sasang-gu Busan
Homepage Add. : www.ekosco.com
Main Products : Flat Bars, Equal Angles, Unequal Angles
TEL : +82-51-323-2611

KOREA TRADING & INDUSTRIES CO., LTD.
Head Office : Saha-gu Busan
Homepage Add. : www.kticopper.co.kr
Main Products : Copper alloy coil, Plate
TEL : +82-51-293-4423

KORINOX CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. : www.korinox21.com
Main Products : Cold Mill Stainless, Steel Coil
TEL : +82-51-832-0031

KORVAL CO., LTD.
Head Office : Saha-gu Busan
Homepage Add. : www.korval.co.kr
Main Products : Crank Case Relief Valve, Main Starting Valve, Rotary Valve
TEL : +82-51-790-9700

KSP CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. :
Main Products : Ship Engine Valve Spindle, Flange, Ring Gear
TEL : +82-51-831-6274

KSV
Head Office : Youngdo-gu Busan
Homepage Add. : www.ksv-valve.co.kr
Main Products : Valve Spindle, Seat-Ring for marine Engine
TEL : +82-51-415-4466

KTE CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. : www.kte.co.kr
Main Products : Electrical Equipment (Switchboard & Console)
TEL : +82-51-265-0255

KUKDONG ELECOM CO., LTD.
Head Office : Saha-gu Busan
Homepage Add. : www.kukdongelecom.com
Main Products : Naviagtion/Signal LT, EX-Plosion Proof LT, Fluorescent LT
TEL : +82-51-266-0050

KUKDONG INDUSTRIAL ENGINEERING.
Head Office : Sasang-gu Busan
Homepage Add. : www.kdie.co.kr
Main Products : Exhaust Gas Pipe With Insulation, Fuel Injection Pipe and Bloc
TEL : +82-51-303-6900

KUKJE METAL CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. : www.kjmetal.co.kr
Main Products : Manhole Cover, Portable Tank, EXH. Gas Pipe
TEL : +82-51-831-1541

KUM HAW PRECISION CO.
Head Office : Gangseo-gu Busan
Homepage Add. :
Main Products : Coupling Flange, Bellows Flange
TEL : +82-51-831-5685

KUMKANG ENGINEERING.
Head Office : Gangseo-gu Busan
Homepage Add. :
Main Products : Hand Rail, Storm Rail, Platform, Inc. Ladder
TEL : +82-51-831-0091

KUMKANG PRECISION.
Head Office : Saha-gu Busan
Homepage Add. : www.kkmarine.co.kr
Main Products : Engine Parts, (Air Reservoir) & Valve
TEL : +82-51-262-4893

KWANGIL CORP.,
Head Office : Sasang-gu Busan
Homepage Add. : www.k-i.co.kr
Main Products : Stainless Steel, HR Coil
TEL : +82-51-324-0006

KWANG JIN E.N.G CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. :
Main Products : Pipe Piece, Pipe Spool
TEL : +82-51-831-1435

KWANG JIN IND. CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. :
Main Products : Part of Heat Exchanger
TEL : +82-51-831-4131

KWANG JIN TECH.
Head Office : Gangseo-gu Busan
Homepage Add. :
Main Products : Non Asbestos, Teflon, Rubber
TEL : +82-51-973-5566

KWANG LIM MARINE TECH. CO.,LTD.
Head Office : Sasang-gu Busan
Homepage Add. :
Main Products : Window Box, (STEEL, AL, SUS) Vent Hole
TEL : +82-51-313-0055

KWANG SAN CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. : www.kwangsan.com
Main Products : Heating Coil unit, Expansion joint
TEL : +82-51-974-6301

KWANGWOON CO.,LTD.
Head Office : Youngdo-gu Busan
Homepage Add. : www.kwang-woon.com
Main Products : Square Window, Side Scuttle, Door, Hatch, Window Wiper
TEL : +82-51-414-9494

KYEONG SIN FIBER CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. : www.ksfiber.co.kr
Main Products : Rudder Bearing Bush, Insulation
TEL : +82-51-831-0268

KYOUNGWON BENDING CO.
Head Office : Kimhae Gyeongsangnam-do
Homepage Add. : www.bending4u.com
Main Products : Hwase Pipe, Chain, Locker
TEL : +82-55-313-1277

KYUNGIL METAL CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. :
Main Products : Marine Equipment Plating, Head Rest Pipe Plating
TEL : +82-51-831-1677

KYUNGSUNG INDUSTRY CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. : www.e-clamp.com
Main Products : Svs Corner & Anchor, Strip, Clamp
TEL : +82-51-831-4960

LHE CO., LTD.
Head Office : Kimhae Gyeongsangnam-do
Homepage Add. : www.lhe.co.kr
Main Products : Heat Exchanger
TEL : +82-55-340-0624

MANZU INDUSTRY. CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. :
Main Products : Phosphate Coat, Pipe & Structure Painting, Special Painting
TEL : +82-51-832-0944

MARINE RADIO CO., LTD.
Head Office : Youngdo-gu Busan
Homepage Add. : www.mrckorea.co.kr
Main Products : Public Addressor Sys, Common Aerial Sys.
TEL : +82-51-414-7891

MARINE TECHNICAL ENGINEERING CO., LTD.
Head Office : Sasang-gu Busan
Homepage Add. :
Main Products : Oily Water Seperator, Bilge Alarm, Air Dryer
TEL : +82-51-831-1118

MARSEN CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. : www.marsen.co.kr
Main Products : Cargo Tank Monitoring System, Tank High/ Overfill Alarm System
TEL : +82-51-831-2108

MAX TECH.
Head Office : Kimhae Gyeongsangnam-do
Homepage Add. : www.maxtech21c.com
Main Products : Engine, Shock Absorper, Gasket
TEL : +82-55-327-9652

MCM CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. : www.mcm21.co.kr
Main Products : Valve, Junction Box, Switch Cover
TEL : +82-51-832-0505

MI JIN PRECISION.
Head Office : Sasang-gu Busan
Homepage Add. :
Main Products : Valve, Tube, Vend, Pipe for ship
TEL : +82-51-315-3143

MIJOO INDUSTRY CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. :
Main Products :
TEL : +82-51-831-1588

MIRAE ENGINEERING CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. : www.miraeship.co.kr
Main Products : Hull Block, Steel Outfitting, Pipe Spool/Unit
TEL : +82-51-790-5800

MJ TSR CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. : www.mjtsr.com
Main Products : Rubber Sheets & Hats, All Types of Parts for Shipbuilding & Industries
TEL : +82-51-832-0002

MODERN INTECH CO., LTD.
Head Office : Sasang-gu Busan
Homepage Add. :
Main Products : Curtain, Carpet, Upholstery, Mattress for Marine
TEL : +82-51-325-0260

MT.H CONTROL VALVES CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. :
Main Products :
TEL : 82-51-974-8831

MYTEC CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. : www.imytec.com
Main Products : Heat Exchanger, Pressure Vassel
TEL : +82-51-831-7474

NAMSUNG SHIPBUILDING CO., LTD.
Head Office : Saha-gu Busan
Homepage Add. :
Main Products : Rescue Boat Davit & Winch, Assembly, Line Hauler
TEL : +82-51-200-1277

NAMYANG METAL.
Head Office : Gangseo-gu Busan
Homepage Add. :
Main Products : Stair Way Body, Bulk Head Hnlon, Galley Hood
TEL : +82-51-832-1721

NARA CORPORATION CO., LTD.
Head Office : Saha-gu Busan
Homepage Add. :
Main Products :
TEL : +82-51-790-7505

NAVUTEC.
Head Office : Kijang-kun Busan
Homepage Add. : www.navutec.com
Main Products : Fire fighting & Safety, equipment for marine & Offshore
TEL : +82-51-728-5055

NEW-OHSEUNG CO., LTD.
Head Office : Saha-gu Busan
Homepage Add. :
Main Products : Manifold, Spool piece, Chain compressor
TEL : +82-51-266-5724

NK CO., LTD.
Head Office : Saha-gu Busan
Homepage Add. :
Main Products : Ballast Water Treatment System, Co2 System
TEL : +82-51-204-2211

NOKSAN FLANGE CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. :
Main Products : Flange for ship
TEL : +82-51-831-7956

OBOK ELECTRIC CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. :
Main Products : Transformer
TEL : +82-51-832-1751

OK KWANG ENG CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. : www.okv.co.kr
Main Products : Marine valves, Strainers
TEL : +82-51-326-7741

OK KWANG METAL CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. : www.okkwang.com
Main Products : Std Flange, Tube Sheet, Forging Material
TEL : +82-51-831-9885

ORIENTAL PRECISION & ENGINEERING CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. : www.opco.co.kr
Main Products : Deck house, Engine room Casing, Life Boat
TEL : +82-51-202-0101

ORIENTAL PRECISION MACHINERY CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. : www.opco.co.kr
Main Products : Crane Component
TEL : +82-51-831-0202

O.S.C.G CO., LTD.
Head Office : Sasang-gu Busan
Homepage Add. : www.oscg.net
Main Products : Cable grand, Junction box
TEL : +82-51-305-3910

PACO HITEC CO., LTD.
Head Office : Saha-gu Busan
Homepage Add. : www.pacohitec.com
Main Products : Hydraulic hose, Fitting
TEL : +82-51-266-6994

PAL MI METAL IND CO., LTD.
Head Office : Jinhae Gyeongsangnam-do
Homepage Add. :
Main Products : Valve, Yoke, Fork, Knuckle, Carrier
TEL : +82-55-552-3840

PANASIA CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. : www.worldpanasia.com
Main Products : Hi-level Alarm Sys. Tank level Gauge
TEL : +82-51-831-1010

PI PLUS CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. : www.pharmaidsolutions.com
Main Products : Rudder stock, Pintle, Intermediate Shaft
TEL : +82-51-831-9338

POONG JIN METAL CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. :
Main Products : Emergency Shut-Off Valve, Veneral Bronze Casting Valve
TEL : +82-51-831-8510

PSM CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. : www.psminc.co.kr
Main Products : Ring Flange, Shaft, Nozzle
TEL : +82-51-970-3000

SAEJIN INTECH CO., LTD.
Head Office : Kimhae Gyeongsangnam-do
Homepage Add. : www.saejinintech.com
Main Products : Emergency Towing, Arrangement, Universal Swivel Fairlead
TEL : +82-55-328-1458

SAMBOO METAL CO,, LTD.
Head Office : Gangseo-gu Busan
Homepage Add. : www.samboometal.com
Main Products : Wheel, Shaft, Hyd-Net, Hyd Coupling Bolt, Flange
TEL : +82-51-831-1478

SAMGONG CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. : www.sam-gong.co.kr
Main Products : Oil Purifiers, Ship' Accommodation, Ladders
TEL : +82-51-200-3040

SAMJOO ENG. CO., LTD.
Head Office : Saha-gu Busan
Homepage Add. : www.sam-joo.co.kr
Main Products : Catering Furniture, Galley Hood, Laundry Equipment
TEL : +82-51-264-6677

SAMJUNG MACHINERY.
Head Office : Gangseo-gu Busan
Homepage Add. :
Main Products : Piston Rod, Cross Head, Inter Shaft
TEL : +82-51-832-0190

SAM KWANG HI-TEC CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. :
Main Products : Rectangle Windows
TEL : +82-51-832-0177

SAMSUNG NONFERROUS METAL CO., LTD.
Head Office : Kimhae Gyeongsangnam-do
Homepage Add. : www.metalsamsung.co.kr
Main Products : Bushing, Liner, Sleeve, Pintle Bush
TEL : +82-55-329-1067

SAMYANG METAL IND. CO., LTD.
Head Office : Saha-gu Busan
Homepage Add. : www.cuniship.com
Main Products : W-NT 90/10 Flange, Elbow, Tee
TEL : +82-51-266-6655

SAMYOUNG FITTING.
Head Office : Gangseo-gu Busan
Homepage Add. :
Main Products : Elbow, Tee, Coupling
TEL : +82-51-832-0211

SDK CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. :
Main Products : Winch, Hatch
TEL : +82-51-832-1882

SEAPLUS CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. : www.sea-plus.co.kr
Main Products : Low Pressure CO2, Fire Extinguishing Sys
TEL : +82-51-831-0119

SEBO METAL CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. : www.sebometal.co.kr
Main Products : Pump Tower for LNG, Vent Mast
TEL : +82-51-970-0200

SEBO TECH CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. :
Main Products : Windwall, Heat Shield, Manual Hatch
TEL : +82-51-831-4171

SEIL SERES CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. : www.seilseres.com
Main Products : VRC system, ODME
TEL : +82-51-831-1858

SEJIN BOLT CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. :
Main Products : Bolt, Nut & Be, Double Nut, Chard Nut, Hinge Bog
TEL : +82-51-831-9832

SEUNG JIN E.N.G.
Head Office : Gangseo-gu Busan
Homepage Add. :
Main Products : Pipe Spool (Steel)
TEL : +82-51-831-9050

SEUN STEEL CO., LTD.
Head Office : Jin-gu Busan
Homepage Add. : www.seunsteel.co.kr
Main Products : CR, HGL, CGL, EGL
TEL : +82-51-639-3200

SEWOONG PRECISION MACHINERY CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. :
Main Products :
TEL : +82-51-831-0595

SEYANG HIGH-TECH
Head Office : Gangseo-gu Busan
Homepage Add. :
Main Products : Water & Oil Strainer, Condensate Chlorination Tank
TEL : +82-51-831-9125

SHILLA E&T CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. :
Main Products : Spot Cooler, Heat Exchanger, Pressure Yeses
TEL : +82-51-831-7705

SHINDONG DIGITECH CO., LTD.
Head Office : Dong-gu Busan
Homepage Add. : www.shindong.com
Main Products : Navigation Communication, Satellite Communication
TEL : +82-51-461-5000

SHINHWA INTERIOR & TECHNOLOGY CO., LTD.
Head Office : Saha-gu Busan
Homepage Add. :
Main Products : Marine Furniture
TEL : +82-51-441-1294

SHINKWANG ACE ELECTRIC CO., LTD.
Head Office : Kimhae Gyeongsangnam-do
Homepage Add. : www.skace.com
Main Products : Cable Tray, Accessories
TEL : +82-55-332-3315

SHINMYUNG INDUSTRIAL CO., LTD.
Head Office : Gangseo-gu Busan

Homepage Add. :
Main Products : Cable Tray Joint, Hanger
TEL : +82-51-831-5061

SHIN SHIN HEAVY INDUSTRIES CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. :
Main Products : Deck Machinery, Hydraulic system, Serface Treatment
TEL : +82-51-832-0734

SHIN SHIN MACHINERY CO., LTD.
Head Office : Kijang-kun Busan
Homepage Add. : www.sspump.com
Main Products : Centrifugal Pumps, Gear Pumps, Screw Pumps
TEL : +82-51-727-5300

SHINWOO METAL CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. : www.shinwoometal.net
Main Products : Flange, Forging
TEL : +82-51-831-2830

SHIN YOUNG AIR CLUTCH.
Head Office : Gangseo-gu Busan
Homepage Add. : www.airclutch.co.kr
Main Products : SY-CB Type, SY-VC Type, SY-E Type
TEL : +82-51-831-7072

SILLA METAL CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. : www.sillametal.com
Main Products : PROPELLER(F.P.P), C.PPROPELLER Blade & Hub
TEL : +82-51-831-5991

SIN HUENG FLANGE CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. :
Main Products : Flange for ship
TEL : +82-51-831-6167

SINWEOL GRATING CO., LTD.
Head Office : Sasang-gu Busan
Homepage Add. : www.steelgrating.net
Main Products : Steel Grating for Ship
TEL : +82-51-323-7000

SMS CO., LTD.
head office : Saha Gu Busan
homepage add : www.sms-marinesystem.com
main products : hatch-pontoon type, folding type, side rolling type, etc. lashing equipment-2/3tier
TEL : +82 51-290-1000

SM POWER TEC CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. : www.smpt.co.kr
Main Products : Vacuum Pump for Shipping Bldc, AC,DC Motor & Generator
TEL : +82-51-973-0267

SNP CO., LTD.
Head Office : Saha-gu Busan
Homepage Add. :
Main Products : Galley Equipment, Cold Chamber, Catering Furniture
TEL : +82-51-261-7711

STACO CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. : www.staco.co.kr
Main Products : Wall Panel, Celing Panel, Unit Toilet, Marin Door
TEL : +82-51-831-7000

STA-JH CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. :
Main Products : Welding Fittings (Butt Welding)
TEL : +82-51-831-1274

STASB CO., LTD.
Head Office : Jinhae Gyeongsangnam-do
Homepage Add. :
Main Products : Marine Furniture, Door
TEL : +82-55-544-8070

STAUFF KOREA LTD.
Head Office : Saha-gu Busan
Homepage Add. : www.stauff.co.kr
Main Products : Hyd' System & Engineering, Hyd' Clamp & Test
TEL : +82-51-266-6666

STBEND CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. : www.stbend.co.kr
Main Products : SUS Pipe Fitting, SUS Bend
TEL : +82-51-831-5131

STEEL KOREA CO., LTD.
Head Office : Jinhae Gyeongsangnam-do
Homepage Add. :
Main Products :
TEL : +82-55-541-2212

SUHHEUNG ENGINEERING CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. : www.shge.co.kr
Main Products : Steel Grating
TEL : +82-51-831-1811

SUNBO IND CO., LTD.
Head Office : Saha-gu Busan
Homepage Add. : www.sunboind.co.kr
Main Products : Tank Top Unit, Engine Room unit, Sater Strainer Silenser
TEL : +82-51-261-3454

SUNG CHANG CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. :
Main Products : Non-Asbestos Gasket, Spiral Wound Gasket, P.T.F.E Gasket
TEL : +82-51-316-6300

SEOUNG HYUP MACHINERY.
Head Office : Sasang-gu Busan
Homepage Add. :
Main Products : White Metal, Piston Lo
TEL : +82-51-303-4112

SUNG IL CO., LTD.(SIM)
Head Office : Gangseo-gu Busan
Homepage Add. : www.sungilsim.com
Main Products : Pipe Spool Pre-Fabrication, Induction Pipe Bending
TEL : 82-51-831-8800

SUNG KWANG M/C.
Head Office : Gangseo-gu Busan
Homepage Add. :
Main Products : Oil Press, Pipe Vending, Pipe Fitting Unit
TEL : +82-51-831-0620

SUNGWON ELECTRIC CO.
Head Office : Gangseo-gu Busan
Homepage Add. :
Main Products : Cable Tray, Starter, Panel, Cable Way
TEL : +82-51-831-9230

SUNG WON ENTERPRISE. CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. : www.sungwonent.co.kr
Main Products : V-Flow Swing Check, Valves, Manifold Unit
TEL : +82-51-831-2140

SUNIL INSTRUMENT CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. : www.suniltech.co.kr
Main Products : Tank Level System, Viscosity System
TEL : +82-51-831-1994

SUN KWANG P.S.P INC. CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. :
Main Products : Cargo Line, Ballasst Line, Engine Room, I.G Line
TEL : +82-51-831-3777

S&W CO., LTD.
Head Office : Saha-gu Busan
Homepage Add. : www.snwcorp.com
Main Products : Com Shaft, Valve, Seat, Piston Pin, Bolt, Nut
TEL : +82-51-205-7411

TAE HWA INDUSTRY CO.,LTD (THI)
Head Office : Seocho-gu Seoul
Homepage Add. : www.thi.co.kr
Main Products : Reciprocating & Screw, Compressor Unit, Brine/ Water Chiller Unit
TEL : +82-2-598-1126

TAEHWA KALPA SEAL.
Head Office : Gangseo-gu Busan
Homepage Add. : www.taehwa1.com
Main Products : TH3000, TH3000W
TEL : +82-51-831-9944

TAE KWANG INDUSTRIES.
Head Office : Gangseo-gu Busan
Homepage Add. : www.tkic.co.kr
Main Products : Boiler, Oil Cooler / Heater, Shell & Tube Heat, Exchanger
TEL : +82-51-831-1801

TAESHIN G & W CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. : www.taeshin.co.kr
Main Products : Co2 / Mag, Mig Arc Welding, Machine, Air Gouging
TEL : +82-51-831-1100

TAESUNG MACHINERY CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. : www.taesungmc.co.kr
Main Products : Manufacture of Structures, for Shipbuilding(LNG,LPG) and plant
TEL : +82-51-971-4006

TAEWON CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. : www.twubc.kr
Main Products : Flange, Strainer, Pressure
TEL : +82-51-831-0310

TAEWOONG CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. : www.taewoong.com
Main Products : Piston Rod/ Crown/ Head, Cross Head Pin
TEL : +82-51-329-5000

TAEWOONG TECH CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. :
Main Products : Main Shaft, Connecting Rod, Inter Shaft, Propeller Shaft
TEL : +82-51-831-6685

TANKTECH CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. : www.tanktech.co.kr
Main Products : High velocity valve
TEL : +82-51-979-1600

TK CORPORATION CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. : www.tkbend.co.kr
Main Products : Fittings (Elbow, Tee, Reducer, Cap)
TEL : +82-51-970-6600

TMC CO., LTD.
Head Office : Kimhae Gyeongsangnam-do
Homepage Add. : www.besttmc.com
Main Products : Membrane Sheets, Heavy Steel Corner, Anchor Strip
TEL : +82-55-340-3000

TYCO MARINE SERVICES KOREA CO., LTD.
Head Office : Sasang-gu Busan
Homepage Add. : www.dbefire.com
Main Products : Fire Fighting System & Equipment
TEL : +82-51-633-9100

U-YOUNG PRECISION IND. CO., LTD.
Head Office : Kimhae Gyeongsangnam-do
Homepage Add. : u-nex.com/
Main Products : Elec/Hyd. Windless, Elec/Hyd, Winch, Steering Gear
TEL : +82-55-326-9691

U-YOUNG & TECH.
Head Office : Kimhae Gyeongsangnam-do
Homepage Add. : u-nex.com/
Main Products : Elec/Hyd. Windless, Elec/Hyd, Winch, Steering Gear
TEL : +82-55-326-9691

WON KWANG VALVE CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. : www.wonkwangvalve.com
Main Products : Marine Globe Valve, Marine Angle Valve, Marine Gate Valve
TEL : +82-51-831-9932

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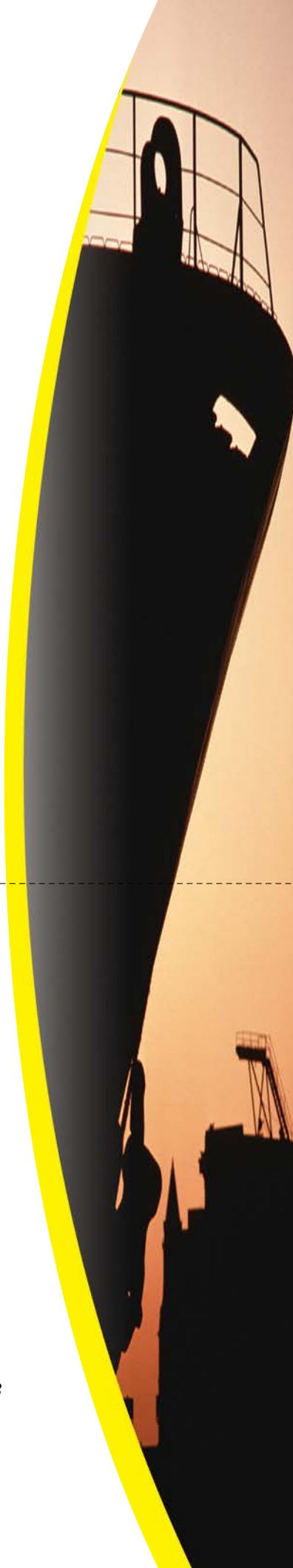

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