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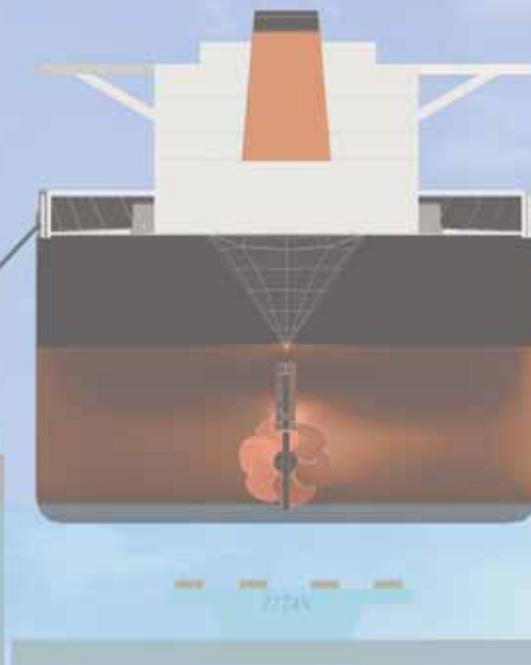
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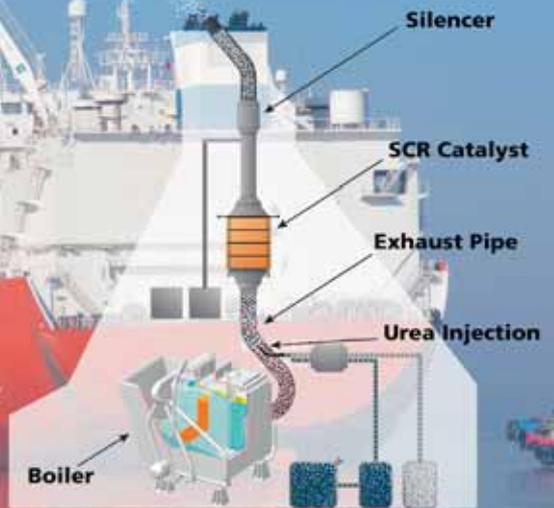
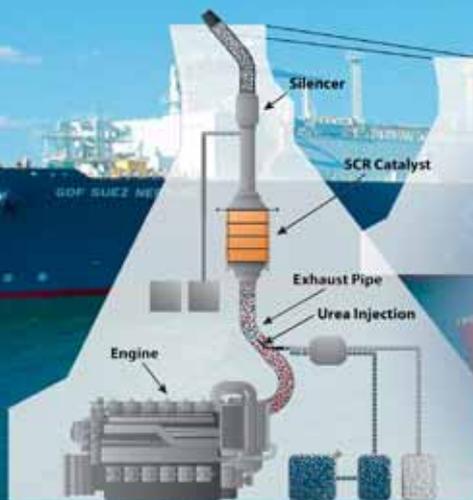
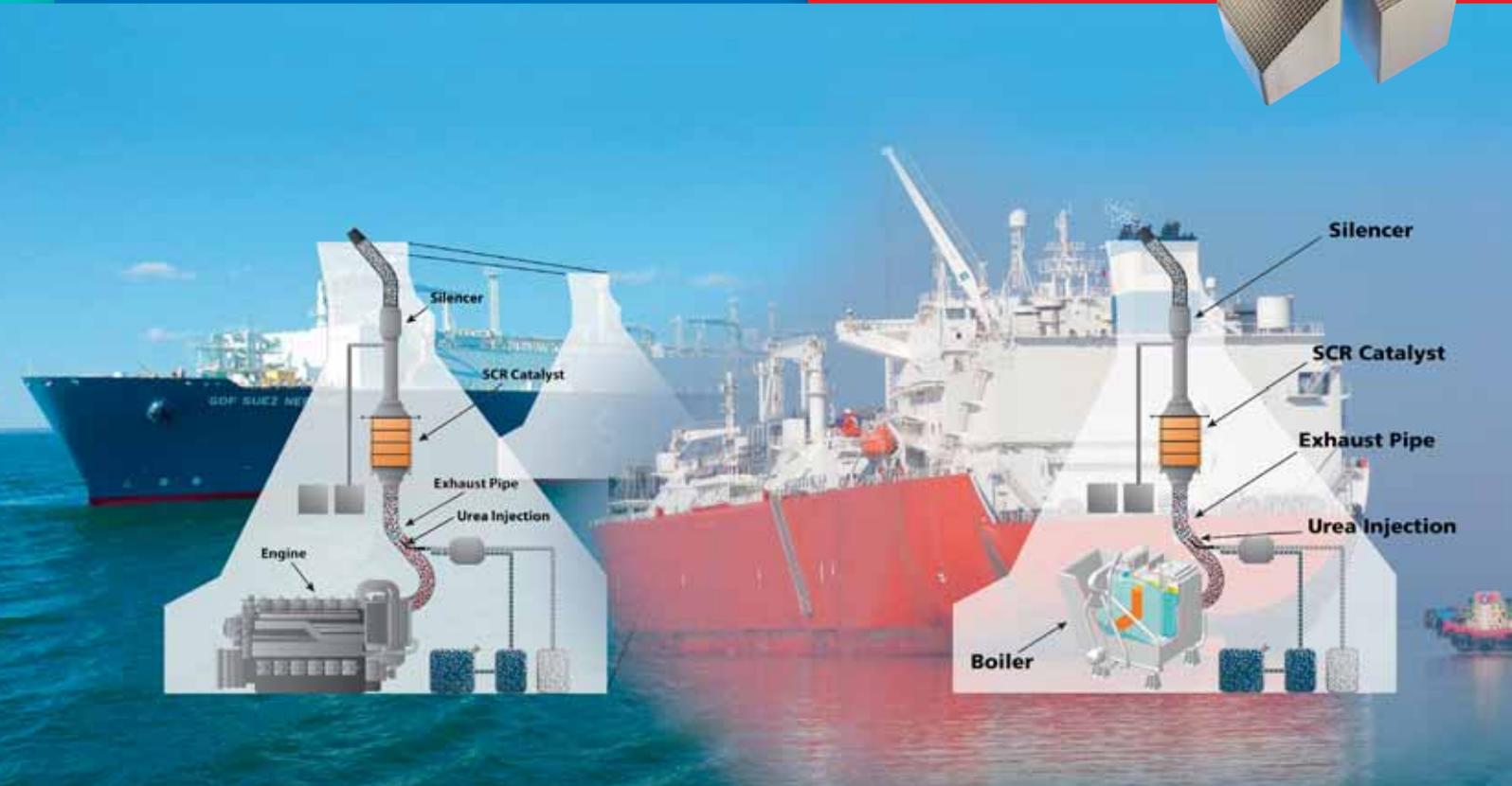
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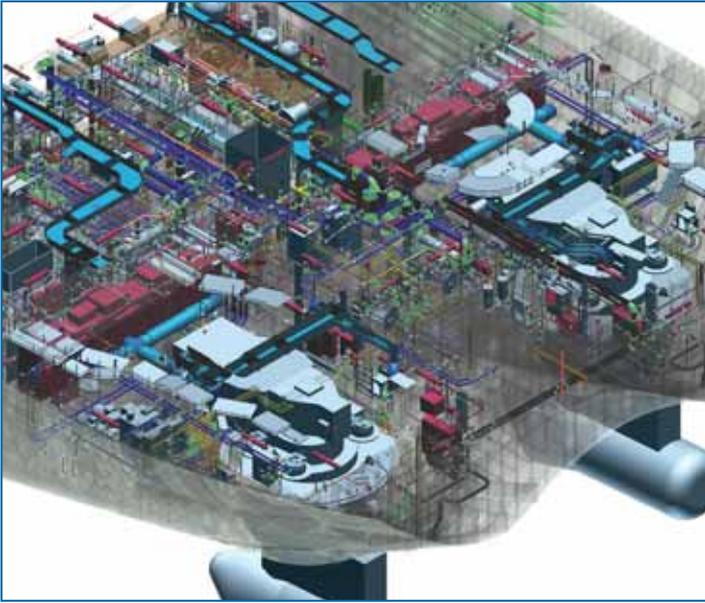


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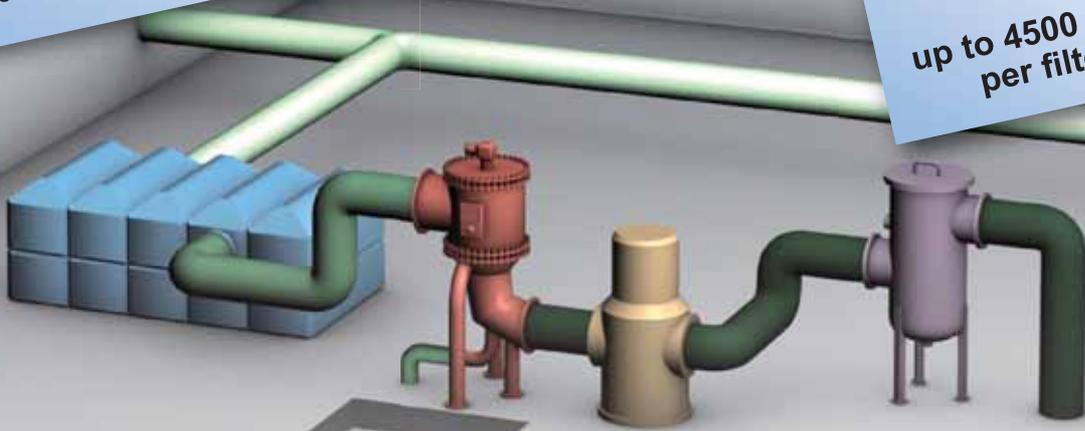
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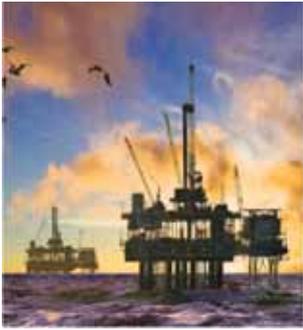
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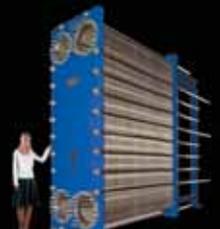
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# Mission Statement

Korship helps not only to share informations and technologies of shipbuilding industry between users and potential suppliers but also introduce subscribers up-to-date shipbuilding related technologies and informations to become a shipbuilding industry technical journal.

Korship puts advertising domestic companies in touch with abroad buyers and tries to contribute development and growth of domestic shipbuilding industries by introducing world's new technologies, news, companies and products to superintendents, engineers, Korea branch of abroad companies, domestic shipbuilding companies and all related companies.

## Technology

World's up-to-date indispensable informations of shipbuilding companies, products and system technology described to help people who engage in the industry.

## Special Focus

Provide articles deeply focusing on latest shipbuilding industry technologies, logistics and port etc.

## Company & Comments

Introduce latest tendency and related news of industry through company interview.

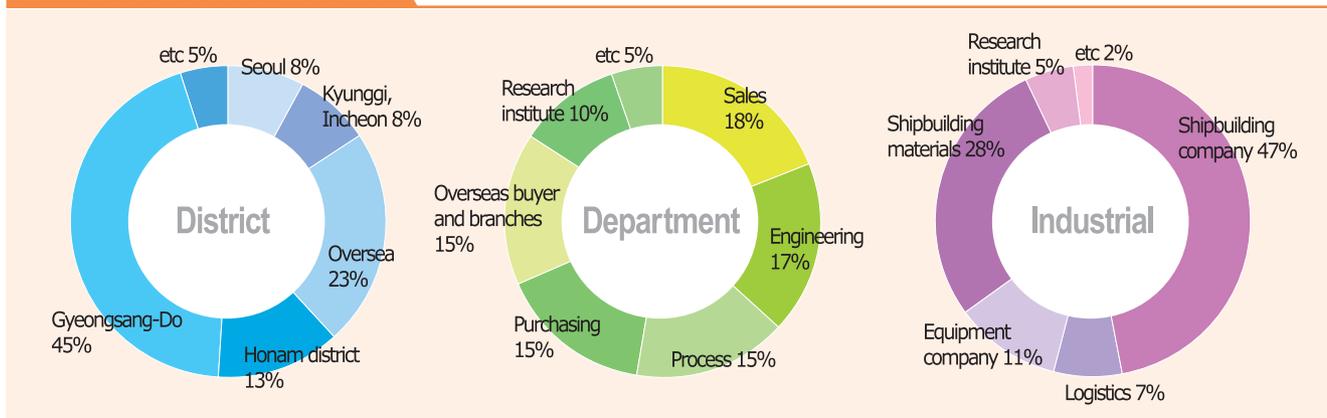
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New shipbuilding industry products overview

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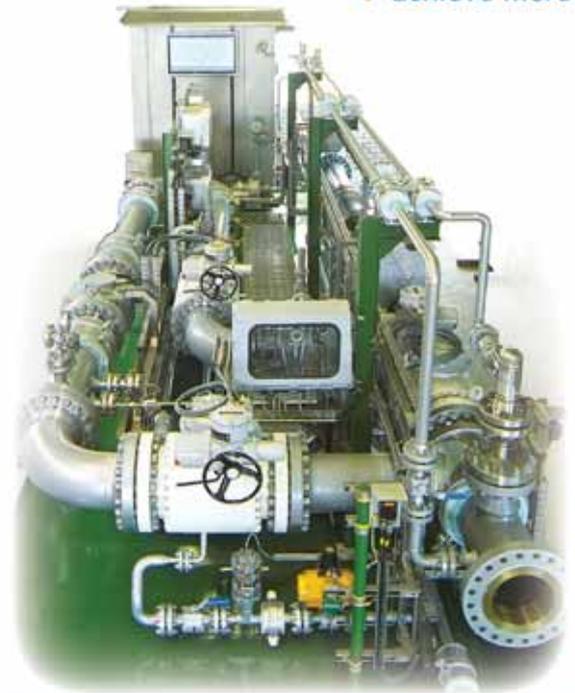
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## HHI launched HiMSEN engine in the drillship market

Marine engines developed purely with domestic technology will be installed in drillships (deepwater drillships) which have been shot into limelight as high value-added offshore facilities.

Hyundai Heavy Industries (HHI) announced on August 31 that it was awarded orders worth a total of USD 150 million for 98 units of 'HiMSEN' engines for drillships from global offshore drilling companies, such as U.S.-based Diamond Offshore Drilling, Noble Drilling Holding, etc, so far this year.

HiMSEN engine, unveiled by HHI in 2000, is the nation's first and only engine developed independently. By installing the wholly domestically-developed HiMSEN engines on board drillships, HHI is making a full-scale foray into the drillship engine market which has been dominated by global companies such as MDT of Germany, Wartsila of Finland, and Caterpillar of the U.S., etc. These HiMSEN engines will be installed consecutively in a total of 15 drillships, including the 9 vessels which will be built by HHI from the first half of 2012.

The engines which will be installed in drillships are the essential equipments providing electric power to the thruster which con-

trols the position of drillship and thrusts the ship. Usually, 6 to 8 generating engines are installed in 1 unit of drillship.

Particularly, drillship engines were required to stand up to unfavorable weather conditions at the sea and thus had to meet more rigorous quality standards compared to general merchant vessels. Therefore, foreign products have been used in the conservative engine markets.

HHI embarked on full-fledged production of HiMSEN engines in 2001 and reached a production milestone of 5,000 units in February 2011 a decade after the start of the production. HiMSEN engine has gained ground in the global market, capturing 35% share of the market for medium-sized marine engines in a short period of time.

Additionally, HiMSEN engine was selected as among '10 New Technologies of Korea' in 2002 and named as 'World-Top Class



HiMSEN engine of HHI

Product' in 2004. Besides, HiMSEN engine was awarded prizes consecutively in 'iF Design Award' and 'Red Dot Design Award'.

An official from HHI remarked, "About 6,700 units of HiMSEN engines have been shipped to around 40 countries worldwide so far, which attests to the excellence of our technology. This drillship engine order is meaningful very much in that HiMSEN engine, developed purely with domestic technology, is expanding its application to high value-added offshore facilities beyond the applications for ships and onshore power generation."

## DSME develops excellent graduating high school students

Dawoo Shipbuilding & Marine Engineering (DSME) will operate the tentatively named 'Heavy Industries Academy', a workforce readiness training programs for high school graduates.

DSME announced an innovative recruitment plan called 'Recruitment & Training Program for the Excellent Graduating High Students' in a press conference on August 29.

Along with that, DSME unveiled the detailed plan for developing talented manpower while posting job openings in media.

DSME will accept the applications from September 21 to October 7 to recruit excellent graduating high school students. The applications can be submitted on the website of DSME ([www.dsme.co.kr](http://www.dsme.co.kr)) and the

shortlist will be announced on October 19. The shortlisted candidates will go through an interview screening and adaptitude test in mid November. Finally, the names of the successful candidates will be announced in Mid December and they will start working from January 1, 2012.

This Heavy Industries Academy will become an in-house training institute for



developing talented manpower into experts in heavy industries, just like the cadets receive 4 years of military education to prepare them for leadership as officers. The Heavy Industries Academy will provide basic education and on-site training in the first year and appoint dedicated mentors to help trainees build practical work experience at related departments during the subsequent 3 years after they finish military service. In addition, intensive language courses will be offered.

This open recruiting process of DSME is meaningful very much, considering that it provides new career opportunities for the high school students who cannot afford to go to general universities despite excellent academic achievements or those who seek professional careers rather than continuing academic pursuit.

The centerpiece of the recruitment plan is to hire excellent graduating high school students as regular employees. After employment, they will carry out certain works and the period of military service will be considered as the period worked.

Those who complete the internal/external in-house training program of DSME will have the work experience equal to or superior to that of university graduates or new employees in the same age group and be treated accordingly.

Nam Sang-tae, CEO & President of DSME, remarked, "These series of courses offered Heavy Industry Academy will be vital in equipping the trainees with advanced knowledge and experience related to heavy industries including the shipbuilding and offshore sectors and helping them achieve competency at a level equal to or

superior to that of university graduates in the same age group. Talented people who aspire to make their own career path and take up new challenges are invited to DSME."

The Recruitment & Training Program for the Excellent Graduating High Students launched by DSME this time, is expected to become an epoch-making and practical example for addressing 3 major problems (admission to universities, military service, and employment) facing the graduating high school students. Additionally, the program is expected to stimulate the shift from the academic background-oriented society towards competency-oriented society, thus having a tremendous impact across industries.

## First oil production in Angola on the world's largest FPSO built by DSME

Pazflor FPSO (Floating Production Storage & Offloading Unit) successfully pumped the first oil from the Pazflor deepwater field in

Angola. This FPSO project was undertaken for the French oil and gas giant Total by Daewoo Shipbuilding & Marine Engineering

(DSME) on a turnkey basis including the installation.

Pazflor FPSO sailed out of DSME's Okpo shipyard in Geojedo island upon the naming ceremony in January and arrived on site off the coast of

Angola on

April 12 after a voyage of 84 days. Pazflor FPSO succeeded in the production of oil from the deepwater oil field in 4 months after the installation of the offshore oil production facility and preparation works in the rough sea.

The first oil production on the FPSO - which came after the containment of marine contamination, completion of facility connection operations, and first trial production - means that full-scale commercial production will begin soon.

With the strict management of works and production process by DSME, Pazflor FPSO start-up was brought forward ahead of initial schedule by 1 month. By achieving the first oil earlier than initial plan, DSME cemented its position as a world's leader



Pazflor FPSO which received first oil flow in Angola



with unmatched technology prowess and competitiveness in the production of high value-added offshore facilities. In particular, DSME completed construction without a single incident although the works involved very difficult installations.

Meanwhile, Pazflor FPSO carries the highest price tag and is the world's largest FPSO, measuring 325m in length, 61m in width, 32m in height and weighs 120,000 tons.

Moreover, Pazflor FPSO can produce up to 220,000 barrels of crude oil and 4.4 million m<sup>3</sup> of natural gas per day and has the storage capacity of up to 1.9 million barrels (approximately 260,000 tons) of crude oil which is equivalent to the daily oil consumption in Korea. Besides, it is capable of producing oil from 2 wells at the same time. Pazflor FPSO, completed in 36 months from contract award in December 2007, will be delivered to the Total in November this year after finalizing the remaining installations and trial operation in Angola.

## Executives of STX signed a contract to support low income multicultural families

Executives of STX Group held a donation contract-signing ceremony to assist low income multicultural families.

The ceremony which occurred at the Community Chest of Korea (CCK) in Seoul on August 31 was attended by related officials such as Chu Seong-yup, President of STX Group, Kang In-gwon, Secretary of External Relations of STX Group, Lee Yeon-bae, Chairman of the Seoul branch of CCK, Choi Chan-gyu, Secretary-General, Kim Yong-hee, Secretary-General of Gyeongnam branch of CCK, and others.



STX held a donation contract-signing ceremony on August 31 to assist low income multicultural families. The photo shows Kang In-gwon, Secretary of External Relations of STX Group, Chu Seong-yup, President of STX Group, Lee Yeon-bae, Chairman of the Seoul branch of Community Chest of Korea (CCK), Kim Yong-hee, and Secretary-General of Gyeongnam branch of CCK (from the left).

144 executives of STX Group who signed the aforesaid contract will donate KRW 9.1 million monthly (KRW 192 million yearly). The executives who signed up to be donors will establish ties with low income multicultural families, make a 1 year commitment and offer KRW 100,000 in monthly donation to 91 multicultural families.

STX Group set up a donation fund in 2009 with the executives of STX and STX Pan Ocean playing a leading role. The donation drive has gathered momentum. 6 affiliates in Gyeongin region, the Seoul-Incheon corridor, joined the donation efforts last year and even the executives of the affiliates in Gyeongnam region began to make contributions to the fund this year which is earmarked to assist multicultural families.

An official from STX Group said, "Executives will voluntarily donate a portion of their income, and this kind of donation is expected to set an example for the grassroots donation culture. We will fulfill our corporate responsibility toward the society by providing practical assistance to the disadvantaged people across the society."

## SIMTOS 2012 will be held on unprecedented large scale

SIMTOS (Seoul International Machine Tool Show) 2012 will be held for 6 days in KINTEX from April 17, 2012 on an unprecedented scale occupying a total area of 100,000m<sup>2</sup> which is twice larger than that of previous show, which is the largest nationwide.

Recently, machine tool exhibitions in neighboring countries, such as CIMT of China, TIMTOS of Taiwan, etc, are expanding in size. Against this backdrop, Korea Machine Tool Manufacturer's Association (KOMMA) decided to make SIMTOS 2012 a larger, more international, and more specialized exhibition dedicated to production and manufacturing technologies in an endeavor to increase the attraction of foreign buyers and actively make inroads into the market amid fierce global competition.

An official from KOMMA said, "With up to 100,000m<sup>2</sup> of area, an increase by 45% from the previous show, 5,000 booths, and 100,000 visitors, the coming SIMTOS 2012 will be the largest and best exhibition in Korea which will help build up global competitiveness of domestic machine tool industry and related industries. Particularly, SIMTOS will become the world's 4th largest machine tool exhibition, even larger than JIMTOF of Japan."

Meanwhile, SIMTOS 2012 is expected to help lay the cornerstone for Korea - the world's 5th largest producer, 6th largest exporter, and 4th largest consumer of machine tools - to increase brand recognition of Korean machine tools and join the ranks of advanced machine tool manufacturing countries.



## SKIL Power Tools rolls out 6-inch Bench Grinder 3000

SKIL Power Tools announced Bench Grinder 3000 recently.

This new product, fitted with powerful 370W motor, adopted the grinding disc treated with aluminum oxide and silicon carbide for fast grinding works.

The die-cast housing protects the motor from dust and particles and the robust and sturdy die-cast base provides extra robustness which ensures stability in work and long life. Large/adjustable spark shields and adjustable work piece support,

designed for easy handling while grinding or sharpening, increase convenience of user and help avoid distraction caused by hot flying sparks.

An official from SKIL Power Tools stressed, "The steel safety cover and dust-proof on-off switch add reliability and stability. It is a powerful and reliable product suited for rough works."

Currently, SKIL Power Tools provides free exchange for registered products showing any problem within 6 months after pur-



Bench Grinder 3000

chase until the end of this year. For details, visit the website of SKIL Power Tools at [www.skiltools.co.kr](http://www.skiltools.co.kr).

## Parker Korea Marine Service Center provide not only products but also extensive services

Parker Korea Marine Service Center has been performing active and extensive performance in marine & offshore industry/market since established, 2009. Marine Service Center offers Prefabrication, On site supervision, Installation, Modification, Flushing, Testing, Piping Turn Key Package, Breadman, Kitting, Tech Service, Hose assemblies, Multi Group products and services.

Especially Parker offers unique customer value added services to customer like Breadman, Kitting, Tech Service, Parker on-site Container Service, PTS (Parker

Tracking System) and so on. Breadman is logistics and delivery system. Parker products and kits are direct delivery to customer's assembly line, work station or warehouse. PTS is designed to help customers reduce their downtime through increases the speed, timing and accuracy of necessary products. These services make innovative logistics system at ship-building business.

Parker Marine Service Center provides many profitable services to marine and offshore customers with on Parker's own

technology and product. And Parker has been supplying hydraulic products to NOV (National Oilwell Varco) during 3 years. NOV is the world famous drillship equipment company. Recently Parker Korea Marine Service Center set up Parker on-site Container Service for support to NOV at Sam Sung Heavy Industry Shipyard. Parker on-site Container Service can operate crimping, bending, tube forming and cutting. Therefore, it can quick respond to on-site requirement more efficiently. The Parker on-site Container Service will significantly reduce the time it takes to obtain critical spares or fabricate replacement hose assemblies. Equipment and labor downtime are greatly reduced, keeping your operations up and running longer. Parker Marine Service Center main task is focus on marine & offshore business. Also, it has powerful value added services can offer optimized management stock, reduce stocks and no obsolete items and increase productivity to customer.



Parker Marine Service Center provides many profitable services to marine and offshore customers with on Parker's own technology and product.



## Your Dependable Class Partner Anytime, Anywhere

As a member of International Association of Classification Societies (IACS), KOREAN REGISTER (KR) has been providing top quality classification services for ships and offshore installations. With exclusive survey offices at major ports around the world, KR endeavors to safeguard life, property and the environment.



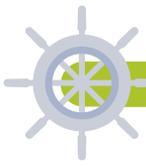


# KORMARINE 2011 brings together offshore industries

KORMARINE 2011 will be held at BEXCO (Busan Exhibition & Convention Center) in Busan from October 26 to 29. KORMARINE is the world's foremost event for the development of shipbuilding and marine especially offshore resources in the fields of drilling, exploration, production, and environmental protection.

During KORMARINE 2011, over 1,100 companies from 45 nations will be showcasing their latest development and products from all sectors of the maritime industry. The leading trade fair for the global shipbuilding industry expects over 35,000 trade visitors from 83 countries.





International Shipbuilding & Marine Equipment show is the world's foremost event for the development of shipbuilding and marine especially offshore resources in the fields of drilling, exploration, production, and environmental protection. KORMARINE is held biannually at BEXCO in Busan.

Exhibitors at the world's leading trade show for the shipbuilding & marine industry present environmentally friendly and smart device & contents innovations KORMARINE 2011 - 18th international shipbuilding & marine Equipment show from 26 to 29 October.

### Expansion into offshore field

Even though KORMARINE has improved to be one of the major exhibitions for the Korean industry, it has been troubled with spatial issues. However, BEXCO is expanding the pavilion in 2012 and KORMARINE is preparing to make a leap forward to achieve further goals.

There has already been number of offshore related companies participating the fair but with a purpose of an official expansion for offshore plants sector, Shipbuilding Association and other all KORMARINE 2011 sponsors made an agreement on co-hosting all the events of the fair.

### Promotion of new products and technologies

Environmental and climate protection and offshore technolo-

gy are the major leaders of innovation in the maritime sector without a question. Re-emerging business activities create competition between shipbuilders and shipbuilding supplier; however, despite of the fact, it challenges companies to come up with even more creative ideas and improves themselves further more. This will clearly be apparent at KORMARINE 2011 which will be held at BEXCO from October 26th through 28th, 2011. Over 1,100 exhibitors from 45 countries will be presenting a plethora of new products and technologies. The exhibitors will also have time to explain their innovative strength to more than 35,000 visitors travelling from every corner of the globe.

As mentioned above, we believe as shipbuilding industries support and develop technologies with environmental protection, it also offers shipyards and shipbuilding sectors to increase their capabilities and improvement in their efficiency. At the KORMARINE 2011, every exhibitors of shipbuilding companies will report outcome of their business performance and what strategies they pursue such as how to reduce frictional resistance by channeling air along the outside of the hull. The offshore sector will also challenge the shipbuilders. The engine and drive component manufacturers are skilled with techniques that are environmental-friendly. In the field of ship management systems and automation, the leading providers will demonstrate new and enhanced products -



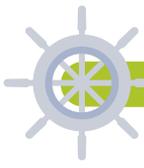
### Special Events

Event	Date/Time	Venue	Organizer
ISMT 2011 (International Symposium Marine Engineering 2011)	25 (Tue.) -28 (Fri.), 10:00-17:00	Convention Hall Rm.301-302	The Korean Society of Marine Engineering
Opening Ceremony	26 (Wed.), 11:00-12:00	Hall T Entrance and Exhibition Hall	Busan Metropolitan City
Congratulatory Luncheon	26 (Wed.), 12:00-13:00	Convention Hall Rm.103-105	Korea International Trade Association
Congratulatory Reception	26 (Wed.), 17:30-20:00	Haeundae Centum Hotel	Busan Metropolitan City
International Shipbuilding and Marine Seminar	26 (Wed.)-28 (Fri.), 10:00-17:00	Conference Hall	K.Fairs Ltd.
World Ocean Forum	26 (Wed.)-28 (Fri.), 10:00-17:00	Conference room 107-110, 201-208	Korea Association of Marine Industry
Welcome Reception I Germany, U.K, Netherlands, Denmark	26 (Thu.)-28 (Fri.), 18:00-20:00	Not confirmed	Organizer of National pavilion
The Export Meeting (China, Vietnam & Korea)	27 (Thu.)-28 (Fri.), 10:00 -17:00	Convention Hall & Exhibition Hall	K.Fairs Ltd.
KOMERI Technical Seminar	27 (Thu.), 13:00-15:45	Convention Hall Rm.107/108	Korea Marine Equipment Reaserch Institute
KOMEA Forum	28 (Fri.), 09:45-17:15	Convention Hall Rm.107/108	Korea Marine Equipment Association
DIGITALSHIP IT Technical Seminar	28 (Fri.), 09:45-17:15	Convention Hall Rm.101/102	DIGITALSHIP

including communication, navigation systems, sensors and energy distribution systems etc. Moreover, KORMARINE 2011 will clearly be demonstrating that new materials such as ceramics and composites are gaining ground in shipbuilding. Composites are no longer purely used for superstructures and internal finishing, but are now being used for technical function components where steel dominated previously. During KORMARINE 2011, over 1,100 companies from 45 nations will be showcasing their latest development and products from all sectors of the maritime industry. The leading trade fair for the global shipbuilding industry expects over 35,000 trade visitors from 83 countries.

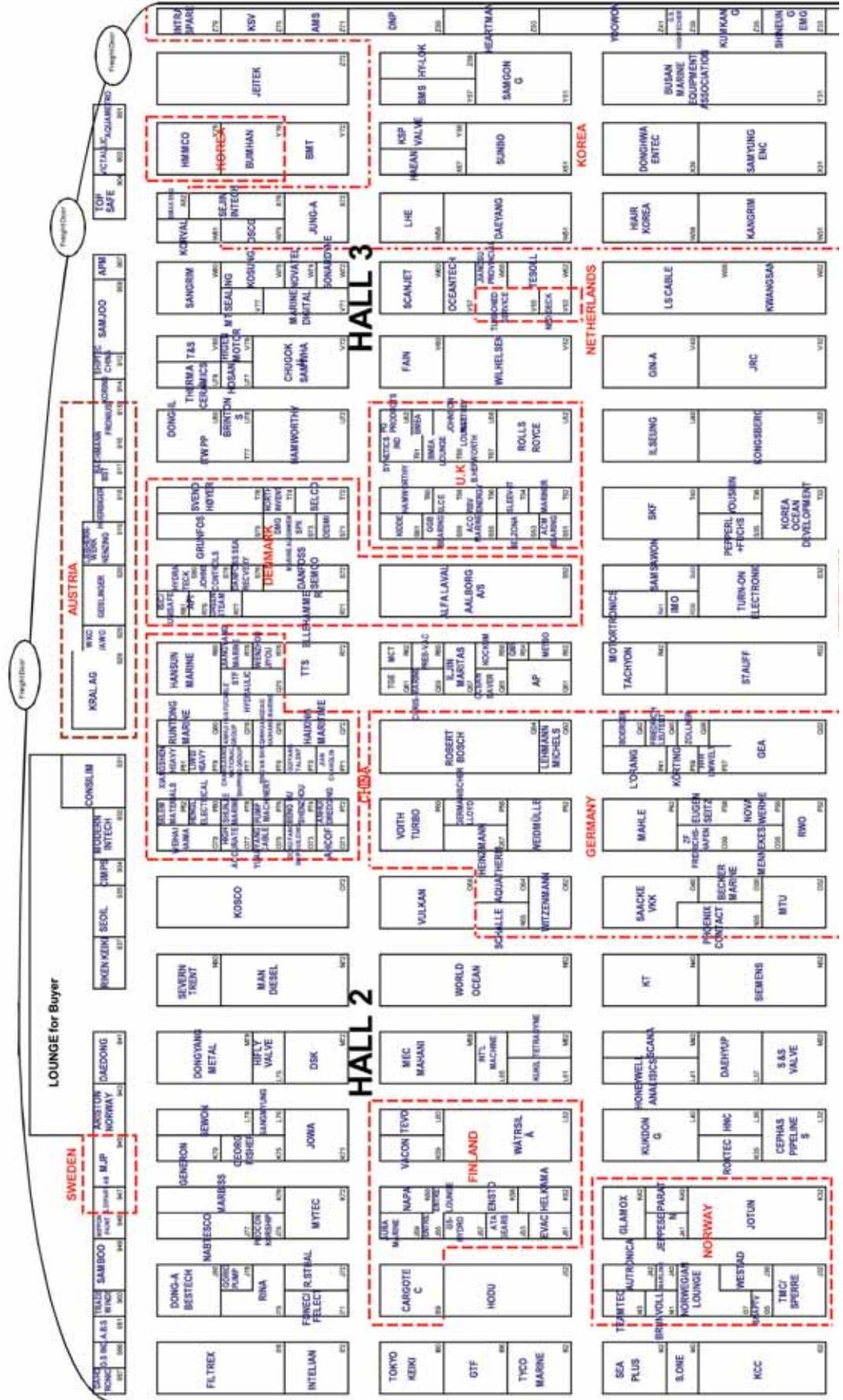
### Various seminars and events

On the occasion of KORMARINE 2011, the first global emerging SMART ocean industries (World Ocean Forum) also will be held. This respected congress with over 80 prominent representatives from the realms of industry, politics, science, and intelligent will give speeches on how 'smart work' develops and provides specific solutions for ecological and sustainable shipping. ([www.wof.kr](http://www.wof.kr))



# KORMAINE 2011

26 - 29 Oct. 2011 BEXCO, Busan, Korea







## Hyundai Heavy Industries, world's best shipyard

Now, HHI's Ulsan shipyard spreads over 1,000 acres of production area and 800 acres of residential and recreation areas. In this vast area, workshops and facilities are arranged to realize maximum efficiency in shipyard operations. By far the most prominent features of the shipyard, the Goliath cranes with a wide range of capacity service eleven dry docks, including a drydock specifically built for FPSO and other offshore facilities. The dry dock sizes are so varied that any type or size of vessel can be built in the appropriate dry dock. Since its groundbreaking in 1972, HHI has had remarkable success in shipbuilding, but has also expanded its business activities in other heavy industry fields. Today, HHI has established itself as an integrated heavy industries company with seven business divisions: Shipbuilding, Offshore & Engineering, Industrial Plant & Engineering, Engine & Machinery, Electro Electric Systems, Green Energy, and Construction Equipment. Acquired by HHI in 2002, Hyundai



View of the shipyard

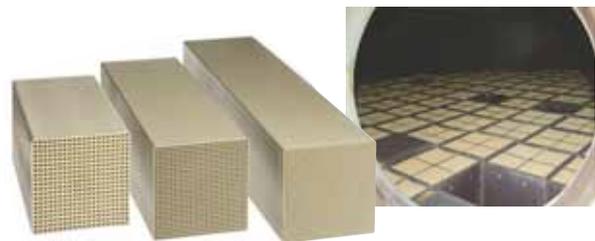
Samho Heavy Industries (HSHI) is the fourth largest shipbuilder in the world. The shipyard's business scope includes shipbuilding, offshore facilities, and industrial plants & cranes. HSHI recently implemented the Total Engineering System that synergizes the entire construction process; design, fabrication, transportation, installation, and commissioning, to provide facilities tailored to client needs. Hyundai Mipo Dockyard (HMD) has achieved global recognition for its medium-sized conventional ships and specialized vessels such as medium-

ranged product/chemical tankers and sub-Panamax containerships with optimized specifications and unchallenged quality. These accolades could not have been achieved without HMD's innovative design staff and a workforce dedicated to producing the best quality products. HMD has continued to evolve into a shipyard producing high-value-added ships, not just over half of the world's P/C carrier and containership market. Anticipating market changes, HMD entered the LPG carrier, PCTC, Ro-Ro vessel markets.

## Johnson Matthey - SINOx emissions control

Johnson Matthey is a global leader in the development and manufacture of catalysts and engineered systems to control air pollution from mobile and stationary sources. Since the mid 1990s, Johnson Matthey's SINOx range of products for the selective catalytic reduction (SCR) of oxides of nitrogen (NOx) has been successfully applied to a variety of marine exhaust applications. SINOx technology is capable of meet-

ing the requirements of IMO Tier III. As well as providing DENOx solutions for ship propulsion and gensets, Johnson Matthey has developed a range of SCR systems for liquid natural gas re-gasification vessels (LNGRV). With several LNGRV already commissioned and fully operational with



Shape of catalyst (left) and the installed appearance (right)

Johnson Matthey SINOx SCR systems - enabling the customers to meet the most stringent marine environmental standards.

# new level of expertise



**Honeywell Marine is a global partner providing a complete solution for any vessel type.**

Our comprehensive and local project and engineering capabilities help ship owners, operators, shipyards, OEMs, panel builders and integrators reduce capital investment risk. We are dedicated to providing the most reliable technology for marine operations, including compliance with international certifications and regulations.

**Honeywell**

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## HIGEN MOTORS, the emerging pioneer of Korean electric motor industry

The legacy of HIGEN dates back to, 1963, 48 years ago, when Gold Star, now renamed LG Electronics, started motor manufacturing business for import substitution and later in 1999, LG Electronics went joint venture with OTIS Elevator, a U.S. based elevator company.

In 2008, HIGEN MOTORS was spun off as an independent corporation specializing in motors and energy transfer solutions.

HIGEN MOTORS specializes in motors and energy transfer solutions such as low voltage motors, high voltage motors, electric vehicle motors, servo drives and servo motors, inverter motors, permanent magnet motors, inverter built-in motors, spindle motors, and related products of industrial grade with power rating of 0.4kW to 1,500kW.

HIGEN MOTORS provides motors to the major players in the shipbuilding industries such as Hyundai Mipo Dockyard (HMD), Samsung Heavy Industries (SHI), STX Offshore & Shipbuilding (STXOS), Daewoo Shipbuilding & Marine Engineering (DSME), etc. for various applications such as Boat Davit, Engine Room Crane, Electric Provision Crane, Monorail Hoist, Steering Gear, and others.

In particular, HIGEN MOTORS' technological capabilities showcased in a rescue mission to lift the ill-fated, Korean Navy battle ship, Cheonan, sunken during the North and South Korean military conflicts of March 2010 in the Yellow Sea. The rescue ship, Samho 2200, an ultra large floating crane, was outfitted with 16 units of 200HP hydraulic pump motors manufactured by HIGEN



Samho 2200, a floating crane of Samho I&D which hoisted the sunken naval patrol ship Cheonan in 2010, is outfitted with 16 units of HIGEN MOTORS' 200HP hydraulic pump motors.

MOTORS.

Here is the product range of HIGEN MOTORS' covering wide industrial application:

### •Explosion proof motors

- Explosion proof symbol: Ex d
- Group symbol: II B, IIC
- Maximum surface temperature: T4 (T1-T4)
- Envelope and fixing structure: Totally enclosed (TEFC, TEAO, TENV), horizontal (B3), vertical (B5, V1), B3B5
- Ambient conditions: Refrigerant temperature -20-50°C, humidity below 80%
- Hazardous location: Type 1 location, type 2 location
- Indication: Ex d IIB/C T4 certified by ATEX

### •High voltage motors

- 3 Phase, 60Hz, 4Pole, 3,300V or 6,600V

- Ins. class F (Temp. rise B class), (Vacuum pressure impregnated with epoxy resin varnish)
- Duty: continuous

### •Servo motors & servo drives

- High speed (32 bit) DSP technology
- Rapid position & speed control
- Low noise by IGBT-IPM
- Feed-forward compensation function
- Application:
  - \*Low inertia: Robot, chip mount, factory automation
  - \*High inertia: CNC system, transfer machine

### •Spindle motors

- Frameless type
- Wide range of rated output (standard 8,000rpm, special 12,000rpm)
- High response & speed control
- High torque, low inertia
- Low noise & vibration (V5)

## SPX, total solution & business partner for marine industry

SPX Corporation is a global Fortune 500 multi-industry manufacturing leader with nearly USD 5 billion in annual revenue, operations in more than 35 countries and approximately 15,500 employees. The company's high-specialized, engineered products and technologies serve customers in three primary strategic markets: infrastructure, process solutions and diagnostic systems. Many of SPX's innovative solutions are playing a role in helping to meet the rising global demand, particularly in emerging markets, for marine, electricity, processed foods and beverages, and vehicle services.

SPX Corporation manufactures equipment for marine and shipbuilding applications including ship bunkering, bilge and ballast, sea water intake, main engine cooling and many more. The company's dedicated team of experienced engineers utilizes in-depth processes, plus application and design skills to provide quality solutions to meet customers' needs based on the company's decades of experience in the marine industry.

### •Plate heat exchanger

Drawing on 100 years of successful history, SPX's APV brand is a major suppli-

er of high-performance plate heat exchanger solutions for cooling, heating and water desalination to the marine and shipbuilding industries all over the world.

The company's product portfolio includes a comprehensive range of plate heat exchanger technologies and solutions ranging from standard units to custom designs, from high capacity heavy-duty models to those that are small and compact.

Plate Heat Exchanger is committed to achieving this by combining proven and new technologies with design expertise, application knowledge, and project experience that are able to meet nearly every heat transfer challenge in marine industry.

### •Chemical injection package

SPX's Bran+Luebbe is the world's leading supplier of chemical dosing pumps and systems to aid in the recovery of oil and gas, both offshore and onshore. With over 30 years' experience in the supply, installation and maintenance of these systems, the company can offer a level of expertise unrivalled within today's worldwide industry.

Requirements for Chemical Injection Packages are very diverse - depending



Plate heat exchanger

on the application, location, number of chemicals, multi-point injection, and increases in production output and changes in production conditions. With unmatched experience and expertise, the company is capable of designing, manufacturing, testing and certifying chemical injection systems to meet growing customer and industry needs. The company's extensive line of metering pumps, process pumps, process systems, chemical injection systems and analyzers are designed to exceed customers' expectations when it comes to efficient metering, processing and analyzing.

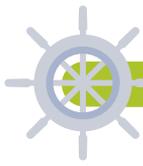
## ABB Turbocharging - Innovative slow steaming configuration

Leading manufacturer ABB Turbocharging has devised a turbocharger configuration for low speed 2-stroke engines which promotes rapid adaptation of combustion air delivery on engines requiring dual ratings. The concept is based on the wide compressor maps of ABB's A100-L range of single stage

turbochargers for low speed engines and responds to demands for engines having a high power output matched to normal cruising speeds and a lower rating matched to a slower, fuel saving speed - i.e. "slow steaming".

The concept was developed to meet the dual rating engine specifications of

a series of 10 container ship newbuildings contracted by Singapore-based operator NOL. It is made possible by the uniquely wide compressor maps of the A100-turbocharger and involves changing only the number of turbochargers in the engines' exhaust gas stream rather than exchanging their



internal components or using techniques like variable turbine geometry to adjust air delivery characteristics.

The system devised by ABB Turbocharging is designed to allow the ten, 12 cylinder 98cm. bore low speed two-stroke diesels aboard the NOL container vessels to achieve ratings of just over 72MW at 104rpm for normal cruising or just over 54MW at 97rpm for slow steaming. The solution comprises four A190-L turbochargers, one of which can be cut-off from the exhaust gas stream. This is achieved via either a motorized valve or insertion of a simple blanking plate. In spite of the reduced level of energy in the engine exhaust gases due to the lower engine power rating, the A190-L's wide compressor maps allow the three turbochargers still in the exhaust gas flow to efficiently produce charge air at the pressures and volumes needed for the slow steaming rating.

"Substantially modifying the compressor map of a turbocharger can involve the exchange of many of its internal components," notes Arie Smits, ABB's head of global turbocharger sales for the low speed engine segment. "In the extreme case this can mean the turbine and compressor wheels as well as the

nozzle rings and diffusers. In any event, the turbocharger has to be opened, parts removed, new parts fitted and reassembled. But with the A100-L's excellent compressor maps it was possible to achieve dual ratings with optimized fuel consumption by, essentially, only reducing the number of the turbochargers supplying combustion air to the engines."

The compressor map is an important measure of turbocharger performance, reflecting how effectively and flexibly energy in the engine exhaust gases driving the turbocharger turbine can be converted into compressed air by the compressor wheel. The efficiency and pressure ratio levels of the turbocharger are vital factors in determining the "width" of its compressor map. In the case of ABB Turbocharging's A190-L, both are market leading values: in final testing of the A190-L, ABB technicians



ABB Turbocharging's A100-L turbocharger for 2-stroke low speed engines features pressure ratios of up to 4.7 and recently achieved a record level of efficiency.

measured its peak efficiency at 75.8%, the highest level ever recorded. Moreover it was measured at a considerably higher pressure ratio than on the previous record-setting product - turbochargers of ABB Turbocharging's A100-L series for low speed engines feature a maximum pressure ratio of 4.7.

Since its market launch, several hundred A100 turbochargers have been sold for high, medium and slow speed engines. They are particularly successful at minimizing fuel consumption on diesel engines designed to comply with IMO Tier II limits on emissions of oxides of nitrogen (NOx).

## Siemens offers advanced systems and solutions

Siemens is a global leader providing automation solutions to all industries such as automotive, chemical, semiconductor, steel, wastewater treatment, shipbuilding, machinery industries, etc, with the largest share of the world's market. The advanced systems and solutions of Siemens allow customers to maximize productivity, flexibility, and

efficiency. In addition, Siemens offers stable hardware, innovative software and integrated industrial solutions.

Siemens Industry Solutions Division of Korea, headquartered in Seoul, is operating divisions in Ansan, Daegu, Ulsan, Changwon, etc, and specialize in the technology, system, and solution for the production and process automation.

Major products of Siemens is as follows:

### •SINAMICS GM150

The SINAMICS GM150 converter in IGBT version can be optimally combined with converter motors from Siemens. In this case, a sine-wave filter is not required. This results in an especially favorably-priced, compact and



## Together, we can build better hydraulic and propulsion systems to keep profits afloat.

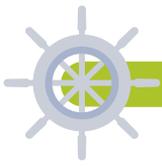
When you're out on the high (and sometimes very rough) seas, repairing important ship machinery usually isn't an option. Which is why it's nice to have a partner like Parker, to help efficiently and cost-effectively build machinery that can handle heavy loads and harsh environments. From cranes, winches, and capstans, to engines, gearboxes, and hydraulics, we've helped engineer durable and reliable **systems and components** for bulk carriers, oil tankers, supply boats, and everything in between. For more information, go to [parker.com/profitsafloat](http://parker.com/profitsafloat). And see how Parker can help keep your business sailing forward.

aerospace  
climate control  
electromechanical  
filtration  
fluid & gas handling  
hydraulics  
pneumatics  
process control  
sealing & shielding



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[www.parker.com/profitsafloat](http://www.parker.com/profitsafloat) (02) 559 0400



SINAMICS GM150

efficient drive solution.

For operating standard motors (motors designed to be connected to the line supply), the converter offers the best prerequisites available in the market when used together with the optional sine-wave filter. They are the optimum choice when retrofitting existing plants and systems from fixed-speed drives to variable-speed drives.

SINAMICS GM150 converters in IGBT version offer economic drive solutions that can be matched to customers' specific requirements by choosing from the wide range of available compo-

nents and options.

SINAMICS GM150 converters in IGBT version are available with a 12-pulse or 24-pulse Basic Line Module. The 12-pulse version is standard for the lower output power ratings at voltages 2.3kV, 3.3kV and 4.16kV. For higher output power ratings, two Basic Line Modules and two Motor Modules are connected in parallel with a common DC link or two line modules in series (24-pulse Basic Line Modules). Converters with voltages > 4.16kV are available on request. For the lower output power ratings at voltages 2.3kV, 3.3kV and 4.16kV, the 24-pulse Basic Line Module is optionally available. HV-IGBT power semiconductors are used in Motor Modules - They are mounted on plug-in Powercards that are simple to replace. The line supply and motor can either be connected from the top or from the bottom. The converter cabinet comprises a section for the Basic Line Module, a section for the Motor Module, as well as the control section.

### •H-compact PLUS

Highest power rating, reliability, efficien-

cy and modular cooling system: This distinguishes the three-phase high-voltage motors of the H-compact PLUS series.

These motors are available in shaft heights 450, 500, 560 mm with a gray cast iron enclosure, as well as 630 and 710 mm with a steel enclosure in degree of protection IP55 or IP23 - air or water cooled. The insulation and bearing system guarantees the highest degree of reliability. The MICALASTIC insulation system with VPI impregnation offers high switching and reversing strength and has proven itself worldwide even under the toughest of application conditions: In extreme cold, heat, humid and aggressive environments.

The lifecycle costs are extremely important - and these make the H-compact PLUS motor so attractive. H-compact PLUS motors save energy, require little maintenance and operate reliably over their long motor lifetime. An investment that pays back in a short time. H-compact PLUS motors are environmentally-friendly and can be recycled up to approx. 98%.

## Pepperl + Fuchs - Protection through intrinsic safety

DART stands for Dynamic Arc Recognition and Termination. DART Technology detects a spark during its onset and switches off before the spark becomes incandive. With DART Technology, more power is available to instrumentation and control equipment than has so far been possible with intrinsically safe devices.

Pepperl+Fuchs specialists place high value on interoperability, including between the various manufacturers, and especially on straightforward appli-

cation in practice.

PROFIBUS PA and FOUNDATION Fieldbus H1 are two very popular process automation fieldbuses. They facilitate communication between the control technology and field instrumentation and are particularly suitable for hazardous areas. With the FieldConnex DART Fieldbus series the company applied DART Technology in practical products for the first time. These products are certified by the PTB to the international standard IEC 60079-11

and can thus be used throughout the world.

The application of DART Fieldbus is subject to the same rules as in non-Ex requirements - with long cable runs and large numbers of devices connected simultaneously. And the best thing is that this safest of fieldbus infrastructures can be used in both new systems and upgrades, as your chosen or existing intrinsically safe field instrumentation can be connected.

FISCO, the Fieldbus Intrinsically Safe

Concept, provided the inspiration for DART Fieldbus, paving the way to simplicity in practice. DART Fieldbus was designed with a comparable level of simplicity for general planning and validation of intrinsic safety. Only three rules must be observed by your colleagues responsible for instrumentation and automation, and these rules practically run in their blood in any case.

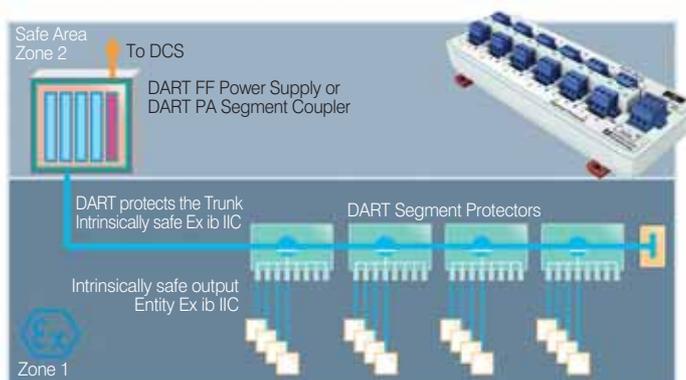
*-The maximum permitted length of the trunk is 1,000m; this is probably longer than required by your system.*

*-Only cable type 'A' should be used. This cable type is a shielded twisted pair cable, very suitable for fieldbus.*

*-Only those DART components listed on the certificate can be connected to the trunk.*

Pepperl+Fuchs is a leading developer and manufacturer of electronic sensors and components for the global automation market. For more than 60 years, the company's continuous inno-

vation, high quality products, and steady growth has guaranteed the company continued success.



Completely intrinsically safe fieldbus with high power on the trunk and spurs. Connection for all intrinsically safe instrumentation.

## ProSep KOLON provides the process solutions for upstream oil and gas industries

ProSep is a technology-based process solutions provider to the upstream oil and gas industry. The company designs, develops, manufactures and commercializes technologies to separate oil, gas and water generated by oil and gas production. ProSep has installed over USD 200 million of process equipment both for onshore and offshore installations for national and international oil and gas companies including BP, Chevron, ENI Agip, Kuwait oil company, Occidental Petroleum, Petronas, Pan American Energy, Pemex, Ecopetrol, ExxonMobil, Saudi Aramco, Total, ConocoPhillips and Statoil.

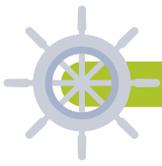
Meanwhile, ProSep together with Kolon Group, a large joined hands to commercialize ProSep's process solutions to the growing Korean and Chinese oil and gas supply industries. The Joint Venture Agreement concluded late in 2010, operates under the name of ProSep Kolon Company Limited ("ProSep Kolon").

ProSep's process solutions are designed to reduce energy and chemical consumption while lowering overall equipment footprint, an ideal offering for offshore installations. The company's engineers have developed a complete line of produced water treatment solutions including best-in-class water polishing systems allowing for removal of polluting hydrocarbons and corrosive and other undesired contaminants from large quantities of produced water. Its flagship CTour and TORRTM produced water treatment systems together treat significant volumes of produced water for discharge or re-injection in the Norwegian Continental Shelf and Middle-East, down to less than 5ppm of oil in water.



TGT-produced water treatment: Hydrocyclones and Induced Gas Flotation /Bumi Armada)

ProSep's crude treatment experts designed and delivered systems including primary separation, dehydration and desalting equipment in North America, Gulf of Mexico, offshore Brazil and the Middle-East. The company's gas experts have also designed highly efficient solutions for gas conditioning, dehydration, and sweetening for installations of all sizes, onshore and off-



shore, in North America, South America and Far East Asia.

ProSep operates with a flexible fabrication model that combines the advantages of controlling its own facility and the flexibility of an extensive network of local fabrication partners in the most important oil and gas centers around the world.

ProSep' 56,000 square foot state-of-the-art facility, located in Houston (Texas, USA) can fabricate and assemble skids and complete packages with dimensions up to 20 (W) x 19 (H) x 70 (L) and weights up to 125 tonnes, ensuring the best in project execution,

fabrication management and quality assurance.

ProSep oversees its product development activities from a modern laboratory located in Norway where both dry and underwater installations allow engineers to recreate operating environments and conditions. To optimize its development activities, the company entered into strategic joint industry partnerships with Statoil, Total, Conocco Phillips and Saudi Aramco. These collaboration agreements not only provide instant market validation for new products but it also provides access to the end-users' facilities for field testing and

performance validation.

Many of ProSep's proprietary step-change technologies such as ProSalt and ProDry have been developed using such collaboration models. These systems respectively improve crude desalting and gas dehydration in high pressure environments while reducing consumption of chemicals, water and energy in the production process, key performance factors for producers looking to improve capacity while reducing costs. The company's innovative offering was recognized with three Spotlight on New Technology Awards from the annual Offshore Technology Conference.

## HKC, specialist in actuator and accessory for valve automation

HKC established in 1991 is the special maker of actuator and accessory for valve automation.

HKC has en effort to invest continue technique development and maximize product function efficiency.

By making a equipment efficiency, all products are competitive rank in high 5% not only domestic market but also world market. All these have application to heavy and chemical plant and meet that customer wish quick and closer service from Plan, Test working and A/S with best engineer.

HKC products export to 40 country in the world and expect the territory upper 50% every year through the local keen competition as a result HKC aces with top brand. So the company builds a strong position from sale market and makes a success of location with the super actuator, Field Bus and a digital signal system.

Major products of HKC include Quarter-turn electric actuator, Linear electric

actuator, Multi-turn electric actuator (Under development), Aluminum body pneumatic actuator, Heavy duty pneumatic actuator, Valve position monitor, Declutchable gear operator, Package valve (MOV, AOV), and others.

Specifically, electric actuator, the flagship product of HKC is the best solution for limited space application and has the following characteristics:

- Visual indicator & LED lamps
- Push button type manual lever
- Multi-voltages with lead wire cable
- Higher output torque but compact
- Light, Compact, Robust
- Enclosure: IP67

Pneumatic actuator's features are as follows:

- Rack & pinion, scotch yoke
- Double acting, single acting



Electric actuator (LCU-C & HQ-Series)

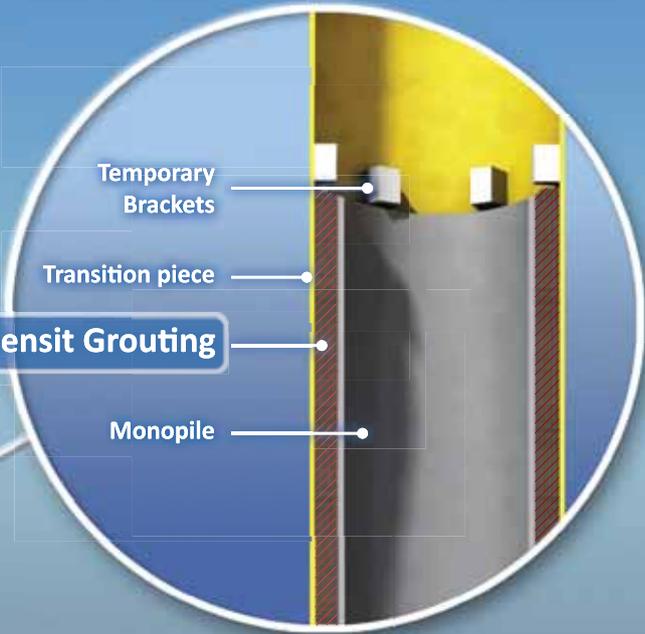
- Light & robust, special coating
- Precise machining
- Top/side: VDI/VDE 3845 NAMUR
- Bottom: ISO 5211 standard
- Fast delivery & economical cost



Pneumatic actuator (HP-Series)



**ITW Densit Grouting**



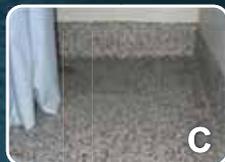
**APPLICATION STRENGTH IN NUMBERS**

Densit is the leading provider of Engineered UHPC (Ultra High Performance Concrete) solutions as chosen by the worldwide Offshore Wind and Upstream Oil & Gas Industries



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## Honeywell Analytics - Sensepoint XCD gas detector

Honeywell Analytics recently announced the latest addition to the Honeywell Analytics range of gas detectors, the Sensepoint XCD (Exceed).

The Sensepoint XCD has been developed for the detection of toxic gases, flammable gases and oxygen in a three-wire 4-20mA format.

This configuration is ideal for retrofitting other older generations of Honeywell Analytics gas detectors including the Sieger 1050 series, Sieger Flammable Series 2000, the Zareba Sensepoint Pro and many other makes and models.

With a flameproof hazardous area approval and rugged weatherproof industrial design, the Sensepoint XCD is ideally suited for a wide range of industrial applications. In addition to the industry standard 4 to 20 mA analogue output signal, three configurable relays provide outputs for local or remote

actuation of alarm and fault status, while other options include a MODBUS digital signal. Magnetic switches permit configuration and calibration without the need to open the enclosure or obtain a hot work permit.

The Sensepoint XCD uses Surecell electrochemical sensing technology, and for CH<sub>4</sub> and CO<sub>2</sub> uses infrared sensing technology which is supplied pre-configured. Intelligence in the transmitter detects the type and range of sensor fitted.

Onboard diagnostics provides valuable information during operation and fault finding routines.

Patented Reflex toxic sensor test algorithms ensure sensing elements are fitted and operational at all times. Sensepoint XCD is certified for use in hazardous areas by ATEX (European), UL and CSA, KTL (Korea) and GB/PA/CCCF. Also, Sensepoint XCD is



Sensepoint XCD gas detector

certified for use in vessel by MED.

Detectable gases include Flammable (infrared), Flammable (catalytic), Oxygen, Hydrogen Sulphide, Carbon Monoxide, Hydrogen and Sulphur Dioxide, Ammonia, Chlorine, Nitrogen Monoxide, Nitrogen Dioxide and Carbon Dioxide (infrared).

## Rolls-Royce, a global company providing power on land, sea, and air

Rolls-Royce provides a range of capabilities and expertise for - merchant vessels, naval surface ships, submarines and offshore vessels. The company's primary focus is on power, propulsion and motion-control solutions, serving over 2,000 customers and equipment installed on over 30,000 vessels globally. Rolls-Royce has a history in Korea which dates back to over 40 years ago. Over the years, Rolls-Royce has presence in the aviation, defense, and ship-building industries in Korea. The Marine Business Division of Rolls-Royce in Busan is a leader in designing, developing, and supplying products and

integrated systems as well as relevant services to merchant ship companies and the navy forces all over the world. It consists of around 100 employees. It operates a marine equipment plant that is in charge of manufacturing equipment, such as deck machinery, as well as assembly, test marketing, and maintenance services. Products manufactured here are released in the Korean market and also exported to Japan.

Rolls-Royce plans to expand collaboration opportunities with renowned Korean companies, academic institutes, as well as research organizations to provide aircraft and vessel power

systems that are needed by the Korean Armed Forces and airlines in Korea and other related industries, all of which are growing into global players.

Display items & their key features which will be showcased during the exhibition are as follows:

### •MT30

The MT30 brings today's aero gas turbine technology to the marine market and gives operators of gas turbine-powered vessels efficiency and reliability improvements, with a highly competitive power-to-weight ratio and reduced operating and through-life costs.

Designed with 50 to 60 percent fewer

parts than other aero-derivative gas turbines in its class, the MT30 has two ratings; ABS type approved at 36MW flat rated to 38° C and MT30A flat rated at 40MW at 38° C. It is Lloyds approved and DNV design assessed. It maintains operating efficiency down to 25MW. The MT30 can be configured for either mechanical or electrical drive.

The MT30 is a twin-spool, high-pressure ratio gas turbine that can be configured with an axial intake plenum (for funnel installations) or compact rotatable radial intake for machinery space installation. Compact and lightweight, the MT30 features an eight-stage variable geometry intermediate pressure compressor and a six-stage high-pressure compressor. The four-stage free power turbine is derived from the Industrial Trent and Trent 800 and is supported on a robust bearing structure for optimum reliability.

**•UT-788 ship model**

Rolls-Royce offers a range of ship designs for the offshore sector from its well known UT-Design family, launched in the mid 1970s. The range includes -

platform supply vessels, anchor handling/tug/supply vessels, multipurpose service vessels and other specialised vessels such as coastal patrol vessels and FPSO/FSOs for sub-sea service, well intervention, drilling, storage and production.

**•Roro-ship model**

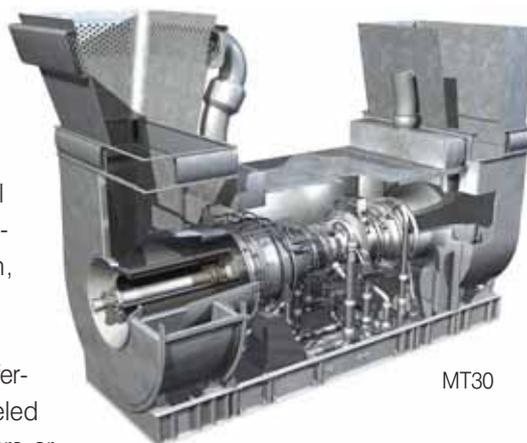
Roll-on/roll-off (Ro-Ro) ships are ferries designed to transport wheeled cargo such as cars, trucks, trailers or railroad cars and have built-in ramps allowing cargo to be efficiently “rolled on” and “rolled off” the vessel when in port. The ramps and doors may be stern-only, or bow and stern for quick loading/unloading.

The company’s ability to deliver complete and competitive ship systems for cargo vessels ensures equipment compatibility with minimal design and engineering costs.

Delivery, installation, and support are also more efficient thanks to the company’s extensive global network.

**•Promas model**

Promas is an integrated propeller rudder



MT30

der system that offers increased propulsive efficiency without any loss in manoeuvrability. The propeller and the rudder are considered as one propulsion unit and are designed together for optimum propulsive efficiency.

Promas comprises of a twisted full-spade rudder with bulb that is smoothly connected to the propeller hub by a hubcap, and is adapted and optimised to the propeller design.

A well-designed twist adapts the rudder to the rotation of the propeller slipstream and reduces the local angle of attack on the rudders leading edge.

## Hodu Industrial supplies accommodation equipment and electric equipment

Hodu Industrial has been supplying various accommodation equipment and electric equipment as well as HSMS in fields of marine and offshore industries since its establishment since its establishment in 2001.

Hodu Industrial has been supplying specialized and exclusive products and engineering with the highest level of customer service. In addition, the company has been developing domestic products and upgrading products’ quality to meet customer’s satisfaction.

Hodu Industrial supplies a wide range of products, including laboratory system, workshop equipment, galley & laundry equipment, galley hood & fire ext. system, catering furniture, medical equipment, sauna unit, entertainment & cinema, gymnasium equipment, and others.

Additionally, it is working closely with Vimar, Alufarm, Nobel Fire System,



Electric range with oven



Electric deep fat fryer

KARCHER, Skyline, GMT, BMT, MMC, etc.



ISO 9001: 2000



## Power Lifting Magnet



With an extensive track record worldwide, as well as in Korea, the world's largest shipbuilder and undisputed No. 1 leader in offshore plant sector, Geumgang Magnet and Geumgang Cable Reel will fulfill all your needs. We dramatically enhance your productivity.



☞ Cable reel for container cranes



☞ Cable reel installed in Hanjin Heavy Industries & Construction



☞ Cable reel installed in Hyundai Hysco



☞ Cable reel for export to Saudi Arabia

### Lifting Magnet for

- Still Plate
- Scrap
- Section BAR
- Billets

### Cable Reel for

- Gantry Crane
- Harbor Crane
- RTGC
- RMGC

## Geum Gang Power Technique

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TEL: 032-872-8530 Fax: 032-872-8510

Web: <http://www.ggttec.co.kr>

E-mail: [magreel@chol.com](mailto:magreel@chol.com)

# Ready, Steady, Go!



## Introducing Sensepoint XCD

XCD's unique tri-colour visual display allows the device's status to be seen at a glance - even from a distance! Using an instantly recognizable 'traffic light' system, the unit features three visual settings; steady green for normal operation, flashing yellow for a fault or warning and flashing red for an alarm.



Optimised for the detection of flammable, toxic and Oxygen hazards in potentially hazardous areas, XCD offers ease of operation and a low cost of ownership. Simple one man operation permits non intrusive configuration of the device, helping to reduce ongoing maintenance requirements.



## Honeywell Analytics - Experts in Gas Detection

### Made in Korea!



MED approval  
(MED-B-6360)

### Fixed Gas Detection

Our fixed range of gas detection products is suited to all types of applications and industries; from high functionality devices to low-cost systems ideal for the compliance market.

### Toxic Gas Detection

Our toxic gas detection systems offer unrivalled sensitivity combined with flexible functionality to support a comprehensive array of gases including exotics.

### Technical Services

From calibration work and maintenance to full end-to-end support, our technical services and additional support options provide expert assistance to ensure maximum up-time of your equipment.

# Honeywell



# Emerson, the leading expert in automation of offshore facilities

Emerson Process Management, established in 1890, is a global leader in process control and automation in various industries. Particularly, Emerson Process Management has extensive experience with LNG carrier and FPSO projects in the shipbuilding/offshore sectors and is continuing strong performance in these sectors recently, like signing a contract for the world's largest FLNG (Floating Liquefied Natural Gas) project being developed by the U.S.-based Royal Dutch Shell.

Riding high on such strong performance, Emerson Process Management Korea is poised to turn itself into a leader in this field by reinforcing the supply of total solutions for process control and automation and engineering services and securing contracts from the shipbuilding/offshore sectors.

## *Emerson Process Management Korea*



Patrick Deruytter, General Manager of Emerson Process Management Korea

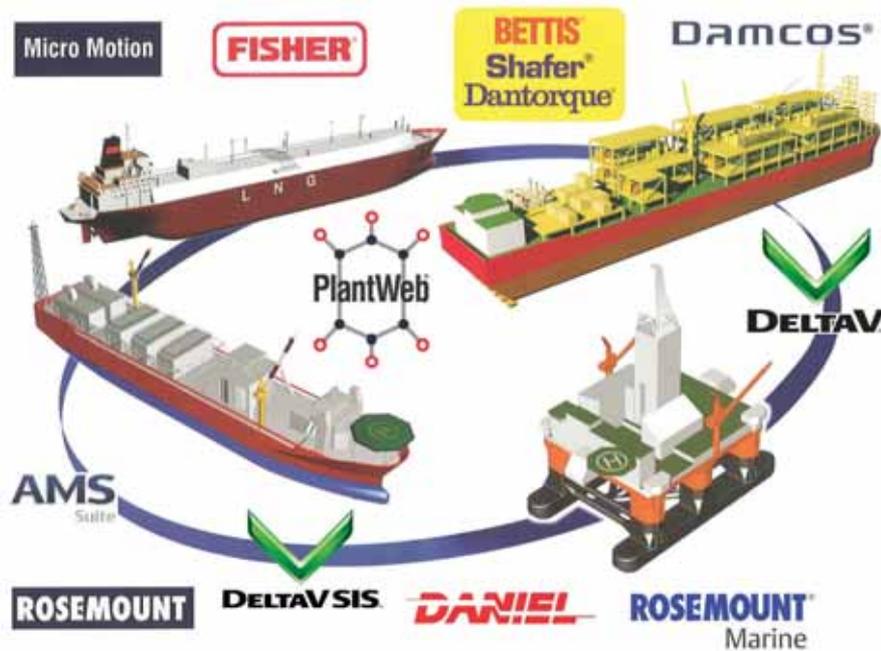
Emerson Process Management (hereinafter referred to as "Emerson") headquartered in the United States is a global leader specializing in the process automation for the production, processing, distribution in the chemical, oil, gas, refining, pulp, power, wastewater treatment, food and beverage, pharmaceutical and other industries since its establishment which dates back to 1890. Emerson has the network of manufacturing and sales network straddling over 150 countries worldwide and employs about 128,000 people.

Emerson achieved USD 21.0 billion in total revenue in 2010, among which the process management comprised 28%, the highest proportion followed by the network power (27%) and industrial automation (20%).

Emerson offers a complete line of products categorized into the system & solution, valve & regulator, and measurement. The brand names and products based on product range are as follows:

- System & solution: DeltaV, OVATION, AMS Suite, PlantWeb
- Valve & regulator, actuator: Fisher, Bettis, Hytork, Topworx, Tescom, EL-O-Matic, Shafer
- Precision measurement: Bristol (Flow measurement), Daniel (Fiscal metering), Micro Motion (Mass flow), Mobrey (Level, density, & viscosity), Rosemount (Pressure, temperature, flow & level), Rosemount Analytical (Gas & liquid analysis), Rosemount Tank Radar (Radar level), Roxar (Multiphase metering)

Particularly, Emerson's Intelligent control systems, software, etc, help pro-



Total solution of Emerson Process Management for marine & offshore production unit

process industries better manage customers' plants. In addition, Emerson is prepared to constantly keep abreast of global trends, the dramatic shift in the world's dependence on secure reliable data as the foundation for a global economic system.

### Emerson's brilliant performance in the shipbuilding & offshore sectors

Emerson has extensive experience and know-how in LNG carriers and FPSO projects, on the basis of which it has achieved a plethora of success thus far.

For instance, Emerson was selected as the preferred supplier of digital automation solutions for oil, gas and liquefied natural gas (LNG) facilities and is undertaking the engineering, project management, installation, commissioning, and provides support on the automation solutions. Additionally, Emerson applied the PlantWeb digital plant architecture to the process control, power management, safety instrumented systems on the Golar Freeze, a floating storage and regasification unit (FSRU). Emerson participated in the world's largest 'Yuum K'ak Naab' FPSO project and incorporated the module concept into the automation system for the first time worldwide. Furthermore, Emerson integrated the safety system and the system controlling the vessel topside,

hull, subsea and radar tank gauging on Akpo FPSO of the French-based Total. Besides, Emerson took part in the project for the automation of the FPSO used for U.K.-based BP's oil field exploitation in deepwater off Angola.

Emerson Process Management Korea has attained remarkable achievement in the Korean shipbuilding and offshore market on the back of the growth in the orderbook of large domestic shipyards amid strong demand for LNG carriers and offshore facilities recently.

Patrick Deruytter, General Manager of Emerson Process Management Korea (hereinafter referred to as "Emerson Korea") who has led the company since 2008, said "Emerson Korea has accomplished splendid

and satisfactory results in 2011 compared to previous years. Recently, the market has gained strength amid the swelling orderbook of Korean shipyards for LNG carriers or offshore facilities such as FLNG, FPSO which have gained spotlight in the shipbuilding and offshore markets, and we have cemented our leading position built upon the worldwide recognition of our extensive experience and technology amassed through many years of works in the maritime field. Currently, we are proceeding ahead with 6 to 7 projects."

Including the project developed by Royal Dutch Shell which signed contracts with Samsung Heavy Industries (SHI)/Technip consortium for FLNG facility, Emerson is participating in the gas field project awarded to Hyundai Heavy Industries (HHI) to develop the SHWE gas field in Myanmar and the LNG-FSRU project awarded by Petrobras to the U.S.-based Excelebrate Energy which then selected Daewoo Shipbuilding & Marine Engineering (DSME) to build the vessel, and other projects.

For Emerson Korea, Royal Dutch Shell's project to build the FPSO off the coast of Australia is the most important among aforesaid projects. This project, the world's largest FLNG facility capable of pumping 11,000 barrels of gas per day from under water wells, has stimulated growth in new orders for FLNG and thus is expected to have wide-ranging spillover



Akpo FPSO in which Emerson successfully installed automation system

effect in the period ahead. Emerson which has practical experience with FLNG projects will be better positioned in winning new orders.

Patrick Deruytter, General Manager of Emerson Korea, remarked, "I am delighted very much that we received the order for the world's largest FLNG project. The main driver to the success in winning this contract is our effort for innovative process control and automation technology that we have demonstrated so far at sea. We will exert our best effort to provide the best solutions that can fully satisfy every customer."

He added, "Before I came onboard with Emerson Korea, Emerson partook in a project to build a LNG production facility, the world's largest, in Qatar. We have fully leveraged the experience and expertise that we gained from that project to increase our orderbook and provide engineering and management services, etc, in the Korean market."

The recent performance of Emerson Korea may be somewhat surprisingly remarkable. Although Emerson Korea does not enjoy wide name recognition in the Korean market, it has long been a player in shipbuilding and offshore markets and accumulated extensive experience and expertise. He said, "Sharing the information and technologies via our global network straddling 150 countries, we have maintained and further strengthened our leading position."

Meanwhile, Emerson Korea anticipates even stronger performance in the fields of LNG and offshore facility sectors which are expected to be dominated by Korean shipyards in the second half of this year and onwards.

Patrick Deruytter, General Manager of Emerson Korea said, "We anticipate more new orders as large shipyards of Korea are expected to keep dominating the LNG-related facility sector for LNG carriers, FLNG, LNG-FSRU, and if so, Emerson Korea will have more business and can win more deals, which is a very encouraging prospect."

Currently, Emerson Korea generates approximately 30% of its total revenues from the shipbuilding and offshore sectors.

### Strength of Emerson

He indicated that the key contributor to the Emerson Korea's growth in new order bookings in projects is its seamless supply of integrated solutions for process control and automation that fulfill customers' requirements.

The integrated solution which Emerson supplies is called 'Point Solution'. It enables the bunkering, measurement and analysis of flow, temperature, pressure, level, etc, and system and engineering services offered in one package.

Emerson can offer this complete line of services because it has a wide range of products and solutions such as control valves & valve actuators, measurement, tank radar gauging, coriolis flow & density meters, ultrasonic meters, orifice fittings & plates, gas chromatographs & analyzers, flow conditioners, IAS/ICSS system, SIS/ESD/F&G system, asset management system, fiscal metering system, etc, and is equipped with the engineering capability for proper and efficient control.

Patrick Deruytter, General Manager of Emerson Korea, stressed, "Integration is the core of Emerson's technology. We have integrated all products and systems by working closely with customers, and by doing so, we have offered the keys to resolving problems and adversity facing customers."

Particularly, Emerson has explored and even sought solutions to the problems that could not be resolved by other process companies, and as a result, has created a slew of innovative technologies. Some of these examples include the electric marshalling, point solution, modular system related to the shipbuilding and offshore industries. Emerson's introduction of wireless technology for the first time worldwide 2 years ago is consistent with these efforts. Although the wireless technology has yet to be fully applied, it provides numerous benefits such as reduction in time and cost and freedom of movement in relation to the operation of machine and therefore has great potential for extensive application.

Patrick Deruytter, General Manager of Emerson Korea, said, "Applying a new technology is a challenging and daunting



Crane platform of StatoilHydro into which Emerson incorporated wireless technology for the first time in the industry

task. We are focusing on making success with application and further developing it as we stand firm in our belief that more emphasis should be put on the validation of new technology than its development." He went on saying, "We will develop new technologies in line with the future trend that may be oriented towards larger size, higher density and accuracy."

### Another issue in the offshore market

Another primary focus of Emerson Korea is to supply the system that ensures high fuel efficiency, sustainability, and spill-proof capability of reducing fuel spills which are features highlighted by the offshore industry.

Fuel efficiency systems are deemed to have great prospect for growth, considering that high fuel efficiency will be required for all existing or new ships.

In relation to that, Emerson's Micro Motion certified marine bunker measurement solution is installed on AP Moller Maersk vessels.

This solution complies with the international standard for custody transfer and enables accurate, transparent, and traceable heavy fuel oil (HFO) measurements which are accepted by the fuel suppliers of Mearsk. It provides HFO bunker measurements that enhance operational efficiency, minimize disputes, and provide automated electronic Bunker Delivery Tickets.

Emerson is currently developing the measurement solutions and boiler solutions. Patrick Deruytter, General Manager of Emerson Korea, said, "To realize these solutions and systems, how an item will be applied upon its development is more important. We will focus on making success with application to the sites."

### Plans of Emerson Korea

Emerson Process Management Korea is targeting a two-fold growth in sales in 2012 as the market is flourishing recently.

Patrick Deruytter, General Manager of Emerson Korea, explained, "There will be 3 key drivers in attempting to reach this goal.

The first one is the booming automation. The second one is the spurred export in the construction sector via EPC (Engineering, Procurement and Construction) companies. The third one is the addition of momentum to the modernization projects in connection with domestic consumption. Here, modernization means expanding the size of existing petrochemical facilities or replacing old facilities."

He remarked, "Growth simply in terms of number is not meaningful very much. Rather, it is more important to garner more share of markets. We will focus on building basic systems in offshore facilities or LNG carriers, etc, expanding supply of integrated solutions at a global level, and adapting new technologies to new projects."



Emerson's Micro Motion certified marine bunker measurement solution supplied to AP Moller Mearsk

Emerson Korea plans to take necessary measures as Korean shipyards recently move beyond the shipbuilding and offshore facility sectors into renewable energy sector such as wind power and vigorously develop offshore wind power systems.

Patrick Deruytter, General Manager of Emerson Korea, said, Emerson pays close attention to the changes in the market and industries and do everything possible to develop solutions or technologies that can meet the requirements of future market. Also, we are interested in the energy and sustainability which have emerged as crucial issues for all industries and offer new opportunities for the upcoming period."

Specifically, Emerson already has the products and solutions targeting the wind power market, including the offshore wind power market, into which Korean shipyards have made inroads, although it is somewhat premature to talk about that.

Patrick Deruytter, General Manager of Emerson Korea, remarked, "We see the changes of Korean shipyards as a positive development and wait until the wind power market



Demo room of Emerson Process Management Korea



Emerson Process Management headquartered in the United States

which is still in its incipient stage grows a little bit more. In the meantime, we will build up more experience in engineering services such as application or maintenance and repair."

He added, "Currently, Chinese market is the largest worldwide, but Korean market is the world's best and has an enormous influence on the global market in light of market size or order intake. We set up a separate organization dedicated to the shipbuilding and offshore sectors 5 years ago and have made forays into the Korean market with full support of the head office and achieved exciting results. Korea where our efforts have paid off is a very attractive and innovative market."

Patrick Deruytter, General Manager of Emerson Korea, said, "Our objective is to help ensure success in customers' projects and maintain them in the best conditions. We place the greatest emphasis and highest value on the cooperative, trustworthy and sustainable relationship with customers, not merely supplying products. That is also the vision held dear in our heart."

He remarked, "Along with that, we will make multifaceted investment to enable all employees of Emerson to attain such objective and vision, which will surely help boost their pride and morale." 

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# ABB, a global leader in automation and power technology for offshore industry

ABB with its foundation dating back to the 18th century is a global company providing a vast line of products and solutions for power products, power system, discrete automation and motion, process automation, and low voltage products. ABB Korea has seen its orderbook rising amid strong performance of shipbuilding and offshore industries in 2011 and is expected to continuously tread on the growth path. Accordingly, ABB Korea plans to focus on supplying the products and solutions that optimize efficiency in shipbuilding and offshore industries.

## ABB

ABB headquartered in Switzerland is a global company with operation in around 100 countries, employing approximately 130,000 people world-

wide. Specifically, ABB has a very long history and unmatched expertise related to various industries. Furthermore, ABB has an innovation and technology heritage dating back over 120 years.

ABB's business area is classified into 5 categories such as power products, electric system, industrial automation process automation and low voltage products, and offer a wide range products in related fields.

Currently, ABB has wide portfolio, e.g. control system, switchgear, transformer, motor, inverter, converter, instrument & analytical system, low voltage product, in power generation, distribution, metal, oil, gas and petrochemical, pulp and paper, cement including shipbuilding and marine. Strength of ABB is supplying solution including engineering as system package and satisfied all customers' requirement.

Han Yun-sok, CEO of ABB Korea, stressed, "The greatest strength of ABB resides in its ability to supply an array of system solutions optimized to each industry, as well as the focus on products."

### ABB in Korea since 1950s

ABB Group with a legacy dating back to the 18th century made entry into the Korean market in 1950s. The Swedish Asea and Swiss Brown Boveri combined their assets to form a new company, 'ABB', in 1988.

In Korea, ABB Korea headquarter with sales and marketing is located in Samsung dong. We are manufacturing dry type transformer, low and medium voltage switchgear, low voltage drive in Cheonan factory with system engineering. For close and easy approach, ABB Korea has two Busan offices of Marine system and turbocharging. In addition, there is Incheon service station. 650 professional employees are working in ABB Korea.

ABB is offering global solutions worldwide via its global R&D network for



Han Yun-sok, CEO of ABB Korea



Cheonan plant of ABB Korea and inside view

technologies. Besides, ABB has established identical service systems in respective countries to ensure same service support for products and technologies anywhere worldwide, ranging from product upgrade/exchange to the extension of product value life cycle.

### ABB with outstanding performance in various industries

ABB has a broad range of portfolio that covers various sectors. Particularly, ABB has a well-balanced product group that can minimize the impact from sluggish economy.

For example, power products and power system required long term period for order. Discrete Automation and Motion of driver, motor, power electronics and robot, low voltage, instrumentation, analytics are divided into short term product reflecting fast adapting business condition.

Thus, ABB has cushioned the impact of economic slowdown

with its well-balanced line of products and has achieved a growing orderbook for EPC even when shipbuilding industry suffered from order drought.

Recently, shipbuilding and offshore industries are flourishing. Particularly, ABB is showing strong sales performance compared to previous year, as well as its systems that provide integrated engineering solutions to large domestic shipyards. As the offshore facility sector is expected to show faster growth than the shipbuilding sector, ABB anticipates remarkable growth over the long-term. Accordingly, ABB is moving to put primary focus on supplying the products and solutions designed to raise efficiency and optimize operations in shipbuilding and offshore sectors.

ABB is also expected to be firmly on a steady growth path even in the renewable energy sector amid more rigorous regulations imposed to mitigate CO<sub>2</sub> emissions. ABB is already carving out significant share of market for wind power. The



Opening ceremony for ABB's Customer Center set up in Cheonan plant last year



Year-end celebration of ABB Korea, held last year

company has been awarded contracts to supply for large-scale wind farm projects worldwide in recognition of its unparalleled technology, and ABB considers the wind power sector as one of key drivers for its growth in the period ahead. In particular, ABB is moving beyond the power sector into the wave power, photovoltaic, and solar power sectors and expected to generate more revenue from renewable energy sector.

To keep pace with increasing orders, ABB Korea completed its second plant in Cheonan to dramatically strengthen its manufacturing, assembly, and engineering capacity. Currently, ABB's first plant, completed in 1998, is manufacturing, assembling and engineering the switchgears, drives, control systems, low voltage products, instrumentation, industrial robots and others, and its second plant is manufacturing mold transfers.

Besides, ABB Korea established the Customer Center inside its Cheonan plant late last year to help customers have better understanding of its product range. Products of ABB's entire divisions are displayed in this Customer Center which also presents demonstrations to help customers and ordinary citizens easily learn more about ABB's products. Han Yun-sok, CEO of ABB Korea, stressed, "This Customer Center provides a quick glance into ABB's products and offers a unique opportunity to have access to the vast range of products of ABB's entire divisions worldwide."

### Brilliant performance in the shipbuilding/offshore sectors in 2011

The orderbooks of domestic shipyards, which fell to USD 5.8

billion in 2009, began to recover from 2010 and soared this year compared to previous year. Particularly, the offshore plant contracts awarded to major domestic shipyards mostly relates to the construction of large-scale deepwater offshore plants such as FPSO (Floating, Production, Storage, and Offloading) or deepwater drillship projects.

Electrical propulsion of ABB recorded significant performance in this year. ABB established over 50% market share in drillship and LNG. Comparing with other suppliers, outstanding strength is ABB system consists of over 98% in-house ABB products. ABB products have satisfied customer with continuous reliability and productivity improvement in various industry. ABB has supplied reliable and stable system and solution based on certified ABB products in marine industry.

Han Yun-sok, CEO of ABB Korea, said, "The greatest strength of ABB in the shipbuilding and offshore industries stems from its engineering technology that enables flexible fulfillment of customers' various requirements with its products and systems."

ABB is strictly proceeding ahead with the project management to vigorously reflect customers' requirements using its technology amassed through many years of work in related fields. Although ABB's products are available as individual units as well as packages, they can create bigger synergies if these products' excellent performance is combined with engineering technology. This unique strength has been the key contributor to ABB's remarkably strong performance this year. As Front Runner, ABB proved again global leader posi-



Field instrument & Device

tion with 70% market share in drillship and 57% market share in LNG”.

Also, wider and more diverse customer base is ABB’s another achievement this year. ABB is currently expanding the application of the building automation system - which did not use the products of secondary vendors or ABB’s products previously - to shipbuilding sector.

### ABB’s focus on energy efficiency improvement

Korean shipyards are facing stiff competition from Chinese rivals and need to actively cope with the requirements of IMO Tier 2 & Tier 3 which will come into force soon. Besides, IMO is scheduled to adopt regulations imposing mandatory limits on energy efficiency (EEDI, EEOI, SEMP) by the middle of next year, which will require new ships to meet a minimum level of energy efficiency.

In addition to these mandatory requirements, the sustained high oil prices and increasing prices of marine diesel engine fuels are putting extra strain on ship owners. ABB Turbocharging developed high efficiency new-generation turbocharger which can enhance fuel efficiency of marine diesel engine, thus playing a role of market leader. Last year, ABB completed the field test of A100 series product which can increase fuel efficiency by over 5% compared to existing model TPL. In late

August this year, ABB inked a contract to supply over 350 units for 2 stroke engines.

ABB has already completed development of new-concept Power 2 (2 stage Turbocharger) and VCM (Valve Control Management) to cope with IMO Tier 3 scheduled to come into effect in 2016, and is currently conducting field test. By doing so, ABB is actively taking part in the effort to save the green earth.

Han Yun-sok, CEO of ABB Korea, remarked, “ABB is putting its R&D focus on energy efficiency improvement. Marine environment conservation,

reduction in CO<sub>2</sub> emissions, energy-saving are the issues being tackled globally. ABB also plans to unveil products and system solutions that provide better capabilities than existing ones.”

In system area, ABB introduced DC system for marine last year. We forecast ice breaking vessel order for new path through the Arctic Ocean or the Antarctic Ocean will increase for some years ahead to reduce fuel consumption and CO<sub>2</sub> emissions. According to this trend, current electric Propulsion System will move to ABB Azipod propulsion. Azipod propulsion system has been introduced some 20 years ago and the



Marine motors



Circuit breaker 'Tmax XT' announced by ABB recently

system has gained a position of a major propulsion system for luxury cruise liners and ice going tonnage. The concept has many benefits. Due to the Azipod propulsion its manoevrability is exellent, it saves space inside the vessel hull and gives a lot of freedom for ship design. Especially in ice going vessels the system improves the performance in ice operation. However, the most important benefit of the system is reduced fuel consumption and CO<sub>2</sub> emissions.

Marine advisory system such as EMMA, marine automation based on ICE 61850 can enhance energy efficiency. It is new very fast relay control, which reduces cabling dramatically in vessels. Bangkokmax Feeder Container vessel designed with On-board DC-Grid, minimized ballast water needs, RudderPod by ABB.

ABB is launching new circuit breaker 'Tmax XT'. This new product is targeted for marine market and heavy industry. Its special features include high breaking capacities up 150kA @415V AC/up 90kA @690V AC, and compact size. In addition, it is available all plug-in versions for all ranges.

Meanwhile, ABB's integrated motor controller UMC (Universal Motor Controller) is one of the key products applied to the shipbuilding and offshore industries. This product, an intelligent motor control module, is for 3 phase AC induction motors and integrates various capabilities such as motor protection, motor control, fault diagnosis, and communication with field bus.

### Eco-friendly shipping with variable speed drives and motors

Protection of the marine environment, emissions reduction and the implementation of new energy saving concepts are vital issues for the shipping industry today. ABB offers the

most effective ways with its drives and motors to achieve all three. By using ABB's drives and motors in pump, fan, winch, propulsion and other applications, massive energy savings of 30-50% can readily be achieved.

ACS 800, which stands out among ABB's drives applied to the shipbuilding industry, increases the safety of the ship and decreased lifecycle costs and CO<sub>2</sub> emissions, fuel consumption. Smooth, accurate and fast control of the entire speed with ABB's DTC (Direct Torque Control) technology reduces noise and vibration levels, minimizing mechanical stress and increasing comfort. All important features and options are built in the drive: line chokes, braking chopper, and EMC filter. Thus, the user can install drives easily. ABB drives offer a variety of software alternatives and communications options which makes the drive suitable for any application.

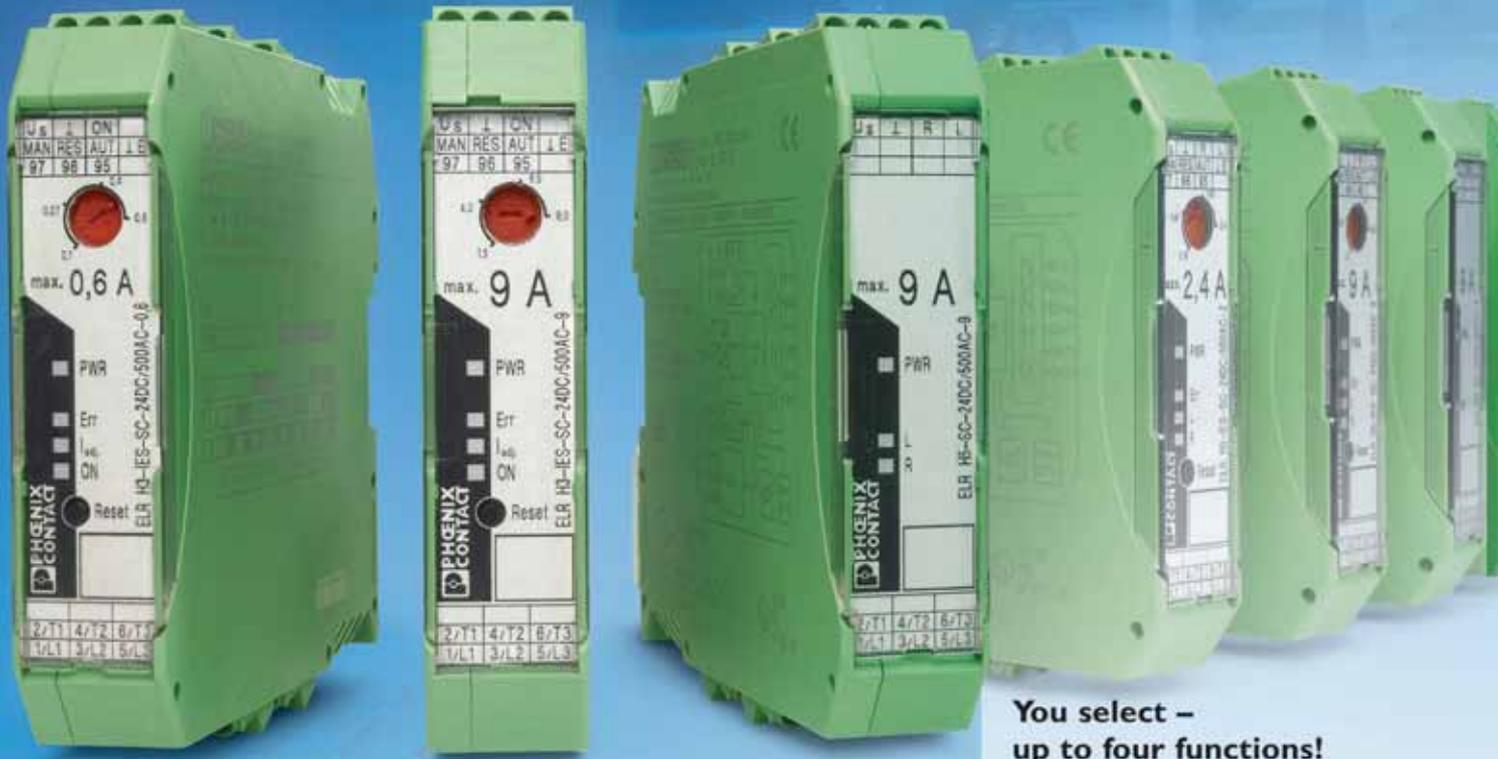
ABB offers a complete range of low voltage motors, ensuring that the right motor can be found for every need including special and hazardous environments. Low voltage motors are available in aluminum and cast iron frames with an output range of 0.09-1,200kW. As well as providing an extensive range of modifications to existing standard motors, ABB can also manufacture customized motors, which is a particular interest in the field of special drive applications. ABB's motors are designed for the highest possible efficiency, aiming to save energy and operation costs during the whole lifetime of the motor, designed for low noise level.

ABB's drives and motors are designed according to the major international classification standards such as ABS, BV, DNV, GL, Lloyds and RINA and allow panel builders and system integrators to build their own solutions necessary to meet the requirements of shipbuilding and maritime industries. 

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# 100 million GT: more than a number

Classification society Germanischer Lloyd (GL) fleet under classification now exceeds 100 million GT. GL has currently more than 7,200 ships from over 1,900 shipping companies worldwide under regular technical supervision.

100 million GT! This is another significant new record Germanischer Lloyd (GL) has reached in its more than 144 years of history. With recent delivery of an 85,676 GT container vessel "Santa Rosa" to Hamburg Süd, GL-registered tonnage has exceeded the 100 million GT mark, and the number of vessels under GL's technical attendance amounted to more than 7,200 worldwide. This means GL has doubled its fleet within six years.

A clear-cut and forward-looking strategy has enabled GL to

maintain an upward trend of its business and grasp opportunities implied in the recent financial and economic crisis. A spirit of innovation is running high to keep GL abreast with constant market changes.

## Core business strengthened

Since 1867 when GL was founded, its key business has been the technical surveillance of ships according to GL's own rules and international regulations. With such a focus, GL has

extended and kept strengthening its classification service network into the Asia Pacific region. A strong combination of its technical expertise, business understanding and client relationships in this region has enabled GL to increasingly benefit from the boom of ship newbuilding market that has almost entirely moved to Asia, especially China and Korea.

GL is committed to always delivering high-quality services in time and regards it as one of its main tasks to perform surveys flawlessly to avoid possible detentions by the Port State Control. High quality staff is indispensable in fulfilling this task and therefore, GL has given a high priority to the constant development of its employees' qualifications, as evidenced by the initial training for new surveyors. Lasting up to 50 weeks, it is industry-wide the most extensive program of its kind. The constant high ranking of GL-classed vessels in the Port State Control statistics underpins the positive effects of GL's efforts, especially with respect to quality and safety.

GL also spares no efforts in improving its services in order to allow its clients added value and a higher degree of flexibility. For instance, GL has launched extended dry docking (EDD) scheme, which allows ship owners to delay the ship's first dry-docking survey for another 2.5 years and thus eliminates the need for one costly special dry-docking survey, resulting in a considerable saving of money and reduced off-hire times. More than 100 ships have already signed up to this scheme.

Therefore, GL was able to grasp business opportunities when the environment for the shipping and shipbuilding markets improved in the 2nd half of 2010. GL achieved a growth in the classified fleet and has managed to maintain and even expand its position under difficult conditions in primary market segments, especially in the containership and multi-purpose vessel markets where GL has traditional strengths. Currently, GL continues to hold top market shares of over 40% and 14% for the classification of these two ship types respectively. And GL has explored the offshore business as one of the market leaders in the classification of Offshore Installation Vessels.

### Greener pursuit

Responsibility for the environment is part of GL's Code of Conduct and its corporate mission. And it is also a general consensus among the maritime market players worldwide. For the maritime industry, optimized designs, reduced fuel consumption and consequently reduction of emissions are powerful levers to protect the environment. But the technical challenges involved cannot be handled by the ship owners alone. GL sees it as its obligation to support them as partners and consultants with its extensive know-how.

GL has been strongly contributing to environmental protection by making considerable investments into the development and propagation of environmentally friendly technologies. GL has set up a dedicated environmental research group within its Strategic Research division, to strengthen solutions to all environmental matters involving ships, including emissions to air, fuel efficiency, etc in support of the maritime industry's green transformation.

While contributing significantly to studies on stricter sulphur limits for marine fuels as envisioned for 2020, GL developed "Environmental Passport", a voluntary class notation, as well as the "Energy Efficiency Operational Indicator", to help enhance environmental awareness and bring solutions to environmental friendly operation. GL is also a major contributor to "FLAGSHIP", an EU-



The container ship "Santa Rosa" is GL classed.



funded maritime transport project aiming to achieve major advances in accurately measuring on-board power requirements and thereby enable a reduction in fuel consumption and negative environmental impact.

As a frontrunner for Inventory of Hazardous Materials (IHM), GL has issued the world's first IHM to a 5,700TEU container-ship E.R. Los Angeles. GL is currently working on other 130 IHMs. Similarly, in 2010 GL issued the world's first-ever Energy Efficiency Design Index (EEDI) certification to Hapag-Lloyd's newbuilding "Vienna Express" (8,749TEU). As early as 1997, the Kyoto Protocol called for the development of measures to reduce CO<sub>2</sub> emissions in shipping, and the IMO took actions by using the EEDI as one of the technical measures.

By sharing the results of its research and development on green technology, GL expects to bring the maritime business more confidence in coping with the challenges of environment-related regulations and rising fuel price.

### Innovation

GL is dedicated to seeking innovative solutions for tough engineering challenges. This effort is fully reflected in some design concepts GL created in support of safer and greener shipping. One example is a concept design for a crude oil tanker called "Aframax BEST-Plus design".

With a 7% decrease in cost of transport, 9% lower oil outflow index (outflow of oil in case of accident), and the highest speed of comparable Aframax designs, it represents the next generation of Aframax oil tankers. In addition, the attained EEDI value in the new design concept is 83% of the latest published reference-line value for this ship size. Therefore, it can comply with EEDI regulations if they were made mandatory today. The design study is based on a project by GL and the National Technical University of Athens, as well as feedbacks from shipyards and oil tanker operators.

In the "Aframax BEST-Plus design", LNG is considered as an alternative fuel option. In another concept design, GL has created a vision for a zero-emission container feeder vessel running on liquid Hydrogen produced by offshore wind farms. A set of fuel cell systems, batteries and pressurised tanks facilitate a ten-day roundtrip at 15 knots in Northern Europe with zero CO<sub>2</sub>, SO<sub>x</sub>, NO<sub>x</sub> and PM emissions.

Thanks to its business success, GL was able to explore non-classification services, such as software and consulting services under Maritime Solutions.

For the "Aframax BEST-Plus design", GL used an advanced optimization environment, integrating software tools to predict required propulsion power, stability, oil outflow index, cargo capacity and hull structural scantlings. Studies conducted among the users of GL's innovative engineering software FRIENDSHIP-Framework show the energy efficiency of designs is improved by 2 to 8%, typically 5%. If applied to an Ultra Large Container Ship, the world's most advanced software for simulation-driven design can achieve average savings of about 2,000t fuel or about 1 million US dollars in fuel costs per year, not counting in emission reduction.

Another example is the ECO-Assistant, a tool developed by GL's maritime consultancy FutureShip and installed on board more than 200 commercial ships of various types worldwide. It allows the crew to trim their vessels in accordance to actual voyage conditions, thereby achieving instant fuel savings of around 3-5% without any modifications to the vessels and thus also considerably reducing CO<sub>2</sub> emissions. For a Bulk Carrier of 70.000t cargo deadweight, this translates into fuel savings of about 340t HFO or USD 160k per year per year.

While the maritime industry is seeking lower emissions, GL has developed a holistic concept for a completely zero-emission vessel - a commercial ship operating entirely without causing any SO<sub>x</sub>, NO<sub>x</sub>, particulate matter or greenhouse gas emissions, whether from its onboard machinery or from the plants producing its fuel - is a vision that sounds too good to be true. But surprisingly, modern technology is entirely capable of building such a ship. In a holistic approach, GL Strategic Research and Development has elaborated on a design concept for a zero emission container feeder vessel, a completely emission-free ship powered by liquid hydrogen that would be produced using wind energy. The concept assumes deployment of the vessel in northern European waters on typical ten-day round-trip voyages.

The 100 million GT represents the trust GL has gained from its clients when servicing them in their best interest, in all efforts. It will pave the way for GL to fulfill its corporate vision of becoming the most respected international technical advisor and trusted partner for all of its clients. 

# Hammelmann High pressure systems in the plant industry

## Process pumps - High pressure pumps – Cleaning systems

Founded in 1949 Hammelmann has decades of experience in the development and manufacture of high pressure systems for all branches of chemical industry.

### Process pumps

Hammelmann Triplex and Quintuplex pumps provide the highest standards of safety and reliability.

Power ratings up to 650 kW  
Flow rates up to 2000 l/min  
Pressures up to 3000 bar

### Typical applications

Methanol injection  
Fatty alcohol process  
LDPE  
Wet oxidation  
CO<sub>2</sub> extraction  
Mill scale removal  
Non woven fabrics  
Boiler feed pumps  
Re-injecting reservoir water

### Typical fluids

- Acrylic acid
- Adipoladipinat
- Butane
- Carbon dioxide
- Diesel oil
- Ester
- Ethanol
- Fatty acids
- Glucose
- Glycol
- Inhibitors
- LDHI
- Methanol
- Methylester
- Pentane
- Process water
- Salt water
- Scale Squeeze
- Vinyl acetate
- Waste water



### High pressure pumps

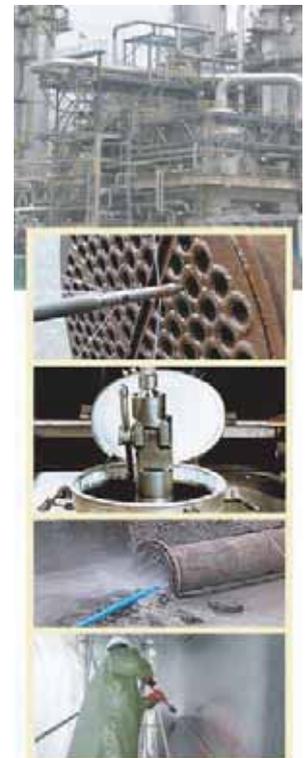
Hammelmann pumps produce maximum performance from a minimal footprint which is the result of combining a compact integral speed reduction gear end with the concept of a vertical configuration.

Power ratings up to 750 kW  
Flow rates up to 1700 l/min  
Pressures up to 4000 bar



### Industrial cleaning with high pressure pumps and applications systems up to 3500 bar

- Heat exchanger cleaning: rigid and flexible flushing lances, tube cleaning nozzles, internal and external heat exchanger cleaning systems
- Tank cleaning: tank cleaning heads, internal cleaning systems for autoclaves
- Pipe and sewer cleaning: standard and reversible sewer cleaning nozzles, powered hose reels
- Surface prep./cleaning: with and without vacuum, remote controlled
- Abrasive cutting: abrasive entrainment and cutting nozzles, abrasive container, precision cutting components





# 'Intergraph 2011 Korea', the industry-leading user conference

Intergraph 2011 Korea, organized by Intergraph Korea, was held for 2 days from August 30 to 31 at L Tower in Yangjae-dong, Seoul. This event provided a platform for showcasing business strategies and upgraded capabilities of major solutions related to the process, power and maritime fields.

Intergraph Korea held 'Intergraph 2011 Korea', a user group conference, at L Tower in Yangjae-dong, Seoul, which ran for 2 days from August 30 to 31.

Intergraph 2011 Korea, an industry-leading user conference, featured keynote sessions by Intergraph global and regional management, and process, power and marine industry representatives from major organisations, including Hyundai Engineering, GS Engineering & Construction Corporation, and Samsung Engineering. This conference provided engineering customers with a unique opportunity to learn about the latest industry developments, and leverage best practices from other companies.

## Presentation of upgraded capabilities

Thomas J. Doran, Intergraph Process, Power & Marine executive vice president in Asia-Pacific, said, "Korea is one of the fastest-growing developed countries with a highly developed economy. The nation is also the world's dominant ship-

builder, and home to several big-name engineering firms, so it is absolutely critical that Intergraph supports our Korean customers in the process, power and marine industries. Intergraph 2011 Korea gives them a platform to learn about the latest business solutions to meet any challenges, while enhancing their global competitiveness and driving continued business success as South Korea's economy continues to grow."

"Intergraph's industry-leading SmartPlant and SmartMarine Enterprise engineering solutions can enhance safety, improve quality, boost productivity, reduce timelines and ensure data accuracy across the facility lifecycle," said Mr. Doran.

"Our customers have always been Intergraph's key focus, and Intergraph 2011 Korea will inspire new levels of innovation in engineering technology to address their needs in an increasingly competitive business environment. We look forward to welcoming our customers and other industry leaders



'Intergraph 2011 Korea', organized by Intergraph Korea, ran for 2 days from August 30 to 31.



Kim Se-eun, current President of Intergraph Korea, is delivering a welcome speech to the attendees.

from around South Korea at this conference, and to deliver a valuable educational experience for continued leadership and success in the years to come.”

Meanwhile, Kim Se-eun, President of Intergraph Korea, said, “I extend cordial welcome to all who attend this Intergraph 2011 Korea, which is the largest event at home and unveils innovative features. This event will provide a unique window into the business strategies and upgraded capabilities of major solutions related to the construction, engineering, heavy industries and others.”

### Powerful portfolio of Intergraph

SmartPlant and SmartMarine Enterprises offer a powerful portfolio of industry-leading, best-in-class design and data management solutions, enabling companies in the process, power, offshore and marine industries to capture integrated engineering knowledge at the enterprise level for the competitive advantage needed in today’s and tomorrow’s market. The integrated suites of SmartPlant and SmartMarine Enterprise solutions enable proven productivity gains, improving engineering efficiency and design productivity by up to 30 percent. Intergraph solutions are endorsed and used by the world’s industry leaders.

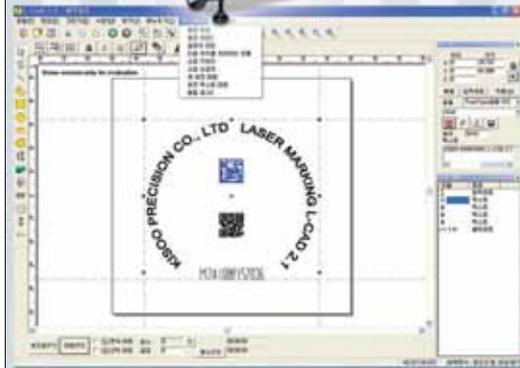
Meanwhile, the ARC Advisory Group, a leading industry analyst firm, ranked Intergraph the No. 1 overall engineering design 3D software and process engineering tools (PET) provider worldwide according to its PET Worldwide Outlook Market Analysis and Forecast through 2013. 

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# World's largest icebreaking vessel makes debut

Hyundai Heavy Industries (HHI) successfully developed the world's largest polar icebreaking vessel recently. This vessel can navigate through 1.7m thick ice and sail at a speed of 6 knots, twice as fast as existing vessel of the same type, and enhances fuel economy by 5%.



Final performance test of HHI's icebreaking commercial vessel model in an ice tank at the IOT in Canada

Hyundai Heavy Industries (HHI) developed the world's largest polar icebreaking vessel.

Recently, HHI successfully completed final performance testing on a model of 190,000-ton icebreaking iron ore carrier, which was carried out in an ice tanker at the IOT (Institute for Ocean Technology) in Canada. This vessel, measuring 310m in length and 51m in width, is the world's largest icebreaking commercial vessel capable of navigating through the 1.7m thick ice in the frozen waters of Canada, known as the harshest marine frontier in Arctic sea, at a speed of 6 knots (about 11km/h).

Icebreaking vessel independently navigates through ice-covered waters to transport cargo without the help of an icebreaker and its performance is determined by how fast and easily the vessel can break a passage through icebound waters.

The icebreaking commercial vessel developed by HHI this time is capable of carrying twice as much cargo and sailing twice as fast as the currently operational 70,000-ton icebreaking commercial vessel, the largest worldwide in its class, and increased fuel economy by over 5%.

The vessel incorporates a dual propulsion system with 2 ring type propellers to enhance mobility and is strong enough to withstand the collision with floating ice.

The demand for icebreaking commercial vessels is expected to rise worldwide as the progressing global warming is making the abundant Arctic resources such as natural gas, crude oil, iron ore easier to exploit and the distance of a voyage between Asia and Europe would be reduced nearly 40% when the Arctic sailing routes open.

An official from HHI said, "This development of the world's largest icebreaking commercial vessel is expected to bring a sea change for the global Arctic shipping market from the perspective of efficiency such as transportation ability. We will exert more effort to develop next-generation technologies that can create new markets."

HHI was selected in June last year as the supervising organization for the government-run project which aims to develop essential welding technology for polar LNG carriers and LNG-FPSO, and has recently spurred development of technology in a bid to tap into new markets for polar vessels and offshore facilities, like developing icebreaking LNG carriers.

HHI signed a contract in February this year and February last year in U.K., and Norway, respectively, to build FPSOs for operation in Arctic waters. 

# Independent development of cargo tank for LNG carriers

Samsung Heavy Industries (SHI) recently developed a model of cargo tank for LNG carriers, using indigenous technology, in collaboration with KAIST for the first time in the shipbuilding industry. Thus, SHI is expected to see a reduction in technical fees paid to foreign companies and be better positioned in winning newbuilding orders.

Samsung Heavy Industries (SHI) has become the first shipbuilder to independently develop a model of cargo tank for membrane type LNG carriers. As the cargo tank was finally developed using domestic technology, the last stumbling block for the nation's independent shipbuilding technology has been removed.

SHI held a launching ceremony on September 6 in London to unveil its new cargo tank (Smart Containment-System Advanced; SCA) for LNG carriers to the ship owners and officials from classification societies, in which the company explained the details related to the development and technical features and advantages.

This cargo tank, if installed in LNG carriers, can reduce KRW 9 to 10 billion in technical fees per vessel, and thus is expected to help widen the gap with competitors regarding the competitiveness in the construction of LNG carriers.

The cargo tank for LNG carrier refers to the tank used to load and unload liquefied natural gas at  $-163^{\circ}\text{C}$  and is one of core facilities for LNG carrier. However, all shipbuilders which build LNG carriers had to pay technical fees to foreign companies that own original technologies.

Under these circumstance, SHI embarked on a research in collaboration with the Korea Advanced Institute of Science and Technology (KAIST) since 2007 with an objective of developing domestic technologies for cargo tank, and was already certified for the basic design and detailed design from major classification societies such as Lloyd's Register Shipping (LR), American Bureau of Shipping (ABS), etc.

The cargo tank for LNG carrier, developed by SHI, incorporates upgraded technology based on existing membrane type cargo tanks. Specifically, it enhanced the membrane shape, incorporates newly-developed secondary barrier materials and ultra insulation new materials, thereby increas-



A launching ceremony held at Hilton London Paddington Hotel in U.K.

ing the stability, air-tightness, and efficiency in transportation. Above all, it improved the corrugated shape of membrane in the first barrier which comes into direct contact with LNG to reduce the cargo sloshing, thus increasing the stability of the vessel in the sea dramatically.

The secondary barrier which encloses the first barrier has enhanced sealing structure, i.e., the air-tightness, as it is made from the newly-developed double-reinforced metal composite materials, instead of triplex which is a glass fiber composite material.

Furthermore, it dramatically improved the LNG transport efficiency by applying ultra insulation new material to the insulation panel that prevents vaporization of LNG.

Roh In-sik, President & CEO of SHI, stressed, "This new cargo tank model for LNG carriers, developed by SHI for the first time worldwide, will relieve SHI of the burden of technical fees and further strengthen the position of SHI in the market for LNG carriers." 🚢



# Shipbuilding & Marine Day celebration was held

The 8th Shipbuilding & Marine Day celebration took place on September 21. This event, formerly known as the Shipbuilding Day, was renamed to Shipbuilding & Marine Day this year. The Shipbuilding & Marine Day was established to commemorate September 15, 1997 when the nation's total new shipbuilding orders exceeded 10 million tons for the first time.



The 8th Shipbuilding & Marine Day held on September 15. The Shipbuilding Day celebration

A ceremony was held to mark the 8th Shipbuilding & Marine Day on September 21 at the Coex Intercontinental Hotel in Seoul. The event was organized by the Ministry of Knowledge Economy (MKE) and Korea Shipbuilders' Association (KOSHIPA).

The Shipbuilding Day was established in 2004 to commemorate September 15, 1997 when the nation's aggregate new-building orderbook stood in excess of 10 million tons for the first time, and has taken place every day. This year, it was renamed to 'Shipbuilding & Marine Day'. The Shipbuilding Day aims to reward those who have made significant contributions to the advancement of the shipbuilding industry and raise the morale and pride of those in the shipbuilding industry, thus promoting continued growth of domestic shipbuilding industry.

The Shipbuilding & Marine Day celebration this year was attended by Choi, Jung-Kyung, MKE, Nam Sang-tae, Chairman of KOSHIPA, about 300 people related to the ship-

building and marine industries, Lee Moon-yeul, a renowned writer, Lee Jang-moo, former President of Seoul National University, and others.

Meanwhile, the attendees made a resolution to ensure that the shipbuilding industry can play a pivotal role in achieving KRW 1 trillion in annual international trade with unrelenting drive to develop technologies for high value-added ships and tap into new markets, thereby serving as the most dynamic engine of the nation's economic growth. In addition, they made a vow to expand investment in green ships and futuristic shipbuilding technologies to stimulate growth of shipbuilding industry,

the nation's flagship industry.

During the ceremony on the same day, Oh Byeong-wook, President of Hyundai Samho Heavy Industries (HSHI), was awarded the Silver Tower Industrial Medal. Chung Sang-ho, a technician of Daewoo Shipbuilding & Marine Engineering (DSME), who developed a new engineering method (dual side LIT method), won the Industrial Service Medal in recognition of his contribution to the improvement in productivity during his 3-decade service in one single field.

Besides, 2 Industrial Medals, 2 Industrial Service Medals, 2 Presidential Commendations, 2 Prizes of Prime Minister, 19 Commendations of the MKE were awarded to a total of 27 persons.

Moreover, Choi, Jung-Kyung, MKE, who attended the ceremony, delivered a speech of encouragement and awarded the prizes to those who rendered distinguished services to appreciate their hard work and dedication. 



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## Rosy prospect for offshore plant market

Offshore plant market is showing strong performance as the reviving global economy and sustained high oil prices in the first half of 2011 sparked heightened interest in the related market. 3 major domestic shipyards which have unmatched competitiveness worldwide in the offshore plant sector are riding high on the growth momentum, exceeding 60% of their new order target for 2011 in the first half.

Offshore plant refers to the structure installed in the sea, including the floating structures. Currently, most offshore plants are used for drilling oil or gas, etc, or producing or unloading the energy resources which are produced. The oil and gas industry comprises two parts which are upstream and downstream. Upstream refers to the phase from the exploration through production to the storage of crude oil, while the down stream involves the refining, distribution and marketing of crude oil. Orders awarded to shipyards are concerned with the upstream. Offshore structure, installed in the

sea, falls under the domain of both shipbuilding industry and the plant industry.

Offshore structure sector is differentiated from the shipbuilding industry in terms of the quality standard, product specification, and technology. In building the floating offshore structure, various processes are applied at the same time, such as the shipbuilding, plant, and engineering processes. Additionally, the demand for offshore structures respond sensitively to the changes in price because they have high price elasticity of demand.

### Order intake of 3 major domestic shipyards

More emphasis has been placed on the offshore plants as major domestic shipyards, such as Hyundai Heavy Industries (HHI), Samsung Heavy Industries (SHI), Daewoo Shipbuilding & Marine Engineering (DSME), etc, are seeing the offshore plants comprise over 60% of their orderbook in the first half of this year.

According to the data published in late July by the Ministry of Knowledge Economy (MKE) and Korea Shipbuilders' Association (KOSHIPA), domestic shipyards won a total of USD 28.3 billion from overseas clients in the first half of 2011. That is a decrease of 15.5% compared to the same period of last year (USD 33.5 billion). However, that number represents an increase of 90.2% if the nation's USD 18.6 billion UAE nuclear power contract, awarded in January last year, is not taken into account.

Particularly, offshore plants and oil/gas field dominated new orders from overseas clients. Domestic shipyards' combined orderbook for offshore plants stood at USD 11.9 billion, exceeding USD 8.6 billion registered last year.

HHI won a total of 63 units worth USD 14.8 billion from the shipbuilding/offshore plant sector (including the order intake of Hyundai Samho Heavy Industry) in the first half of this year, achieving 75% of its annual target of USD 19.8 billion. That number represents an over two-fold increase compared to USD 7 billion registered in the corresponding period of previous year.

HHI received orders for 2 LNG-FSRUs (Floating, Storage, and Regasification Units) and 1 FPSO (Floating, Production, Storage and Offloading) unit, etc, including 9 drillships, in the first half of this year. Particularly, HHI secured contracts for newbuilding drillships for the first time, this year breaking the order impasse, thus achieving excellent results in the drillship



sector which was dominated by SHI and DSME.

An official from HHI said, "New orders for ships and offshore facilities are expected to rise markedly amid the prospect of increased production of crude oil and gas in Africa, Middle East, Russia, and North Sea, considering that the world's leading energy companies are energetically developing the plans for deepwater oil or gas field exploitation."

For that, HHI is currently expanding the gate of the offshore plant dock, called 'H-Dock', which is scheduled for completion by September in 2012. This H-dock is the world's only dock for building FPSO and was completed in April 2009 with an investment of KRW 161 billion.

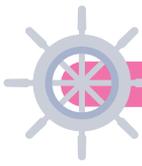
DSME clinched orders for 4 drillships in the first half of this year, continuing to sail smoothly in the offshore plant sector. Special purpose vessels which include the drillship, semi-submersible drilling rig, FPSO, etc, comprised approximately 40% of DSME's total sales in 2010 compared to 14.8% in December 2000. DSME inked new contracts for 10 offshore

Table 1. Order intake of domestic shipyards in 2011

(Unit: USD 1 million)

	Order intake 2010	Target for 2011			Order intake between 2011 to current period			Target achievement ratio			Basis date of order intake
		Total	Merchant ship	Offshore	Total	Merchant ship	Offshore	Total	Merchant ship	Offshore	
HHI	7,450	12,000	7,500	4,500	8,285	5,187	3,098	69%	69%	69%	Late April
SHI	9,706	12,000	4,000	8,000	8,600	3,340	5,260	72%	84%	66%	May 27
DSME	10,600	11,000	5,000	6,000	4,341	2,200	2,141	39%	44%	36%	May 27
Total	27,756	35,000	16,500	18,500	21,226	10,727	10,499	61%	65%	57%	

Source: each companies, Daishin Securities Research Center



plants in 2010, valued at USD 5.24 billion.

DSME has shown strong performance in the semi-submersible drilling rig sector. An official from DSME explained, "DSME's semi-submersible drilling rig is capable of operating at up to 3,000km under water with a maximum drilling depth of over 1km, which makes it suited for operation in deepwater and rough environment."

DSME showed relatively sluggish performance in the offshore plant sector compared to HHI or SHI in the first half of this year amid continuous drought in new order inflows for semi-submersible drilling rig. However, industry experts opine that DSME would be best positioned when new orders for semi-submersible drilling rig increase in the second half of this year.

Meanwhile, DSME is currently expanding its No. 2 dock in a bid to spur growth in its order intake from the offshore plant sector and putting the primary focus of its sales operation on the special purpose vessels. Recently, DSME is proceeding with the acquisition of Daekyung Machinery & Engineering, a manufacturer of boilers for plants.

This year, SHI signed a USD 3.02 billion contract with Royal Dutch Shell to build 1 unit of LNG-FPSO which includes the construction of hull commissioned last year. In addition, SHI received orders for 25 special purpose vessels, including 10 drillships, in the first half of this year and also won orders for 3

offshore plants such as FPSO in the same period.

Driven by this strong performance, SHI surpassed its annual target of USD 11.5 billion in the first half of this year.

SHI has developed the drilling facilities fitted with equipment which provide better mobility and performance than fixed platforms or semi-submersible facilities and won orders for 42 drillships out of 75 units which have been ordered worldwide since the dawn of the new millennium, thus carving out 56% of the global market.

According to a recent report of Maeil Business Newspaper, SHI plans to separately operate a R&D center for offshore plants as part of effort to attain unrivalled competitiveness in the offshore plant sector that encompasses drillship, LNG-FPSO, etc.

The 3 major domestic shipyards' order intake from the offshore plant sector last year stood at USD 13.9 billion, approximately 44% of their total orderbook worth USD 31.5 billion. This year, these 3 domestic shipbuilding giants are pushing the envelope further and aiming to win orders for USD 23.1 billion from the aforesaid sector which comprises 55% of its annual order target of USD 42.3 billion.

### Characteristics of recent offshore plant orders

As the era of easy oil in the Middle East is over, the focus of

oil and gas exploitation is gradually shifting towards offshore E&P projects.

Recently, giant global oil companies are escalating capital expenditure (Capex) investment to develop oil and gas fields. Specifically, a surge in new orders for large-scale deepwater drilling and offshore production facilities is anticipated amid growing investment in deepwater drilling. Additionally, deployment of floating production facilities is expected to increase substantially, rather than fixed production facilities, for developing small and medium-sized oil and gas fields.

By region, the Capex investment has increased remarkably in the Americas region where Brazil is located. The Capex investment has gradually expanded in both Asia and Africa for oil and gas field exploitation and in the North Sea, one of Europe's largest oil and natural gas reserves, for offshore oil field and gas facilities.

In particular, Petrobras plans to inject a total of USD 88 billion in Capex investment between 2010 and 2020.

Since oil was gushed from the blown-out Macondo well into the Gulf of Mexico, world's leading oil companies which are major clients for offshore plants have demanded strict certification for product quality. With the environmental regulation being more stringent, new orders are expected to be awarded steadily to offshore plant manufacturers with extensive track records, rather than new start-ups. In that sense, it may take a little while before Chinese shipyards can be engaged in full-scale competition with Korea's 3 major shipyards in the offshore plant sector.

Recently, local content regulations - which require that a certain amount of domestically produced inputs should be used - are being enforced more rigorously specifically for large-scale resource exploitation projects awarded from countries rich in natural resources. Such regulations aim to stimulate creation of jobs at home and transfer of technology. As these regulations require a certain portion of project to be built domestically, guidelines on the ratio of local production, etc, need to be observed in attempting to secure orders for offshore/plant facilities from these countries for large-scale resource exploitation (in Brazil, African countries, etc).

### Outlook for the offshore plant market

The demand for deepwater drilling, crude oil and LNG production facilities has been spurred amid sustained high oil prices, nuclear crisis in Japan and since the Macondo spill that led to the offshore deepwater drilling moratorium to be



lifted. Thus, the growth in offshore plant market is expected to gather momentum continuously.

According to the data released by HI Investment & Securities, BEP (Break-Even Point) or the hurdle rate for new offshore oil field development ranges somewhere between USD 50 and USD 60 per barrel. Despite slight decrease of oil price due to the declining demand recently, prices above USD 95 per barrel may make the offshore oil field exploitation economically attractive. Additionally, weak dollar and the risk of devaluation arising from S&P's downgrade of the U.S.A.'s credit rating are expected to have positive effect on the oil prices hike.

Over the last 4 years, new orders for offshore plants have been placed even when the oil prices were below the current level (USD 85 per barrel), and furthermore, the falling prices of offshore equipments and ship following the outbreak of global financial crisis have reduced the burden that giant global oil companies faced to make Capex investment, thus raising the prospect for a surge in new orders.

For these reasons, new orders for offshore drilling facilities soared in the first half of this year. A total of 23 drillship orders were awarded to domestic 3 major shipyards in the same period. Additional orders for offshore production facilities are anticipated in the second half of this year along with the resumption of oil and gas field exploitation projects that have been postponed since the global financial crisis began.

Specifically, domestic shipyards are expected to secure orders for offshore production facilities in the second half of this year for Egina oil field off the coast of Nigeria, Ichthys field in Western Australia, oil fields in Malaysia, gas fields in Papua New Guinea, etc.

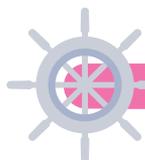


Table 2. Offshore production facility projects expected to be awarded to shipyards by field

Region	Project development	Progress	Offshore production facilities expected to be ordered	Expected price	Expected order
Nigeria	Egina field (Total)	FID expected in 2011	FPSO order expected	USD 2 billion	HHI, DSME and SHI in competition (HHI better positioned)
Australia	Ichthys (Inpex)	FID expected in late 2011	FPSO, CPF, Pipeline orders expected	USD 3 billion	HHI, DSME, SHI in competition (HHI better positioned)
	Sunrise (Woodside)	2012 FID expected	Shell LNG-FPSO order expected	USD 3 billion	SHI
Malaysia	Malaysia FLNG (Petronas)	FEED in progress in 2011 (Technip & DSME)	DSME expected to win order for LNG-FPSO	USD 2 billion	DSME
Papua New Guinea	Elk/Antelope regions (InterOil)	FID expected in late 2011	SHI's Flex LNG-FPSO expected to be deployed (inked in 2008, the unit can be built as charter was confirmed)	USD 2 billion	SHI
	Papua Bay (PNG Floating LNG)	FID expected in 2012	DSME expected to win order for LNG-FPSO	USD 2.5 billion	DSME
Russia	Shtokman (Gazprom, Total)	-Partner agreed upon the gas production -FID expected between late 2011 and 2012	FPU order expected	USD 2.5 billion	DSME and SHI in competition

Source: Data from industries, HI Investment & Securities

Note: The expected prices and orders are based on the estimate of HI Investment & Securities.

## Offshore plants and Korean shipyards

Regarding the orderbook for FPSO which has gained the biggest and brightest spotlight among offshore production facilities over the period spanning from 2007 to current moment, HHI won the orders for 3 units, SHI 3 units (excluding LNG-FPSO), and DSME 2 units. The 3 domestic shipbuilding giants have delivered a total of 19 FPSO units thus far since 2000, playing a pivotal role in catapulting Korea into the ranks of the world's leading builders of FPSO.

HHI, which completed the world's largest H-dock for FPSO in 2008, has obtained orders for large-scale FPSO units and is expected to win additional orders for FPSO units in the second half of this year. Furthermore, SHI and DSME are anticipating newbuilding orders for LNG-FPSO units, the offshore facilities for the production of LNG, this year and expected to win 1 to 2 LNG-FPSO orders in the second half of this year.

Meanwhile, 10 drillships, the offshore drilling facilities, were forecast to be placed yearly, considering the trend of Capex investment in offshore and deepwater oil and gas drilling. However, the forecast was already surpassed in the first half

of this year. With the new orders falling in the second half, there are divergent opinions about the outlook. Nonetheless, over 20 drillship orders are expected to be placed in 2012 and onwards.

According to the data released by Daishin Securities, new orders for drillships will exceed the aforesaid forecast, considering the fact that there are 20 drillships which are over 25 years old and therefore require replacement in the current drillship fleets. Moreover, that number may be surpassed if the demand which shifts upward additionally is taken into consideration.

SHI which clinched orders for 40 drillships until last year has unmatched track record in drillship construction compared to other shipyards. With an excellent track record and expertise accumulated thus far, SHI has unparalleled competitiveness in this field. However, SHI is closely trailed by HHI which penned a contract for drillship for the first time this year and the 3 major domestic shipyards are expected to compete fiercely. 

# HIGH QUALITY PNEUMATIC ACTUATOR & VALVE



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AD Series, AS Series
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- **Limit Switch Box**  
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- **Automatization**  
Flanged Ball Valve, Screwed Ball Valve,  
Butterfly Valve, Globe Control Valve  
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## Features

1. We use SUS material for Brackets / Coupling / Bolts.
2. We can exchange from manual valve being used to automatic valve system.
3. We sell bracket sets for ball valves.



# Parflange F37 Non-Welded System

Proven millions of times, this connector system is backed by decades of experience. The Parflange system belongs to Parker's leak-free Dry Technology program.

## *Parker Hannifin Connectors*

Parker is the inventor of the Parflange system and knows well how to deal with flared tubes and flanged connectors. The excellent sealing performance and the high mechanical strength of Parflange technology are achieved by continuous orbital tube forming.

Proven millions of times, this connector system is backed by decades of experience. The Parflange system belongs to Parker's leak-free Dry Technology program. Dry Technology stands for leak-free systems with soft sealing at every connection point.

### **Parflange F37**

The Parflange F37 flanged connector system is utilising this orbital tube forming technology for tubing assemblies from 16 to 165 mm (1/2" to 6" flanges) outside diameter. It is intended for tube wall thickness up to 9mm and pressure ratings up to 420 bar.

For those connections, where there is no possibility to assemble a pre-flared tube or where manufacturing is limited, Parker provides the F37 Retaining Ring System. This System utilized a Retaining Ring for flange retention along with a highly-engineered seal carrier for leak free performance. The Parflange F37 System goes along with all SAE related flange bore patterns, such as the 1,000 PSI, 3,000 PSI and 6,000 PSI series as well as with the ISO 6164 (400 bar) series. SAE 1000 (50-70 bar) is a low pressure flaring version, which is new in Parker's program. The Parflange F37 system corresponds to hole patterns according to ISO 6162-1; SAE J518; bore pattern 3000 (code 61), ISO 6162-2; bore pattern

6000 (code 62) and also ISO 6164 bore pattern.

It is type approved by DNV, ABS and other major classification companies.

### **Protected from corrosion and even Cr (VI)-free**

As a manufacturer of large flange connectors, Parker is employing Cr (VI)-free corrosion protection on Parflange F37, as it has already done with its other Fluid Connector Products. The removal of Cr (VI) reflects Parker's ongoing commitment to an environmentally clean and safe production process.

### **Different sealing solution**

The F37 seal was developed especially for use with SAE flanges. These special seals guarantee high stability of form. Compared to standard O-Rings, their mechanical properties prevent gap extrusion, even when the flanges "breathe" under pressure. The special profile of the F37 seal is ideally adapted to higher pressures or unsuitable surface finish of the flanges. As an alternative, connectors can be equipped with bonded seal rings.



## Flaring machine (Adjustable)

For smaller tube connecting projects such as the on-site maintenance of, for example, drilling platforms or ships, the Parflange ECO for processing steel and stainless steel tube is available.

The machine works to the Parflange process, proven millions of times over, affording maximum mechanical accuracy and reliability. It does not require any complicated programming or operation to manufacture rapidly smaller quantities up to 165mm outside diameter. The maximum capacity of the machine is around 5 mm wall thickness for a 165mm tube at a remarkably short cycle time of 30 to 60 seconds for the flaring and 1 to 2 minutes for the total operation. Other tube diameter allow even thicker tube wall.



## Grooving machine (Retaining ring connection)

This kind of machine must be utilized for the Retaining Ring system. The compact lathes are clamped on OD of the tube. The tools are rotating around the tube for machining the tube end and outer diameter.

Special tool bits and spacers are designed according to retaining ring groove specification from Parker. The portable tool is ideal for workshop use and on-site installation

(Tube sizes 1" / 25mm to 10" / 273mm).



## The F37-Program - a savings program

F37 is the way to reduce manufacturing times enormously. By comparing welded connections with Parker flange connector systems, significant opportunities for cost savings

become immediately obvious.

- Cutting and deburring tubes
- Tube preparation for the "connecting process"
- Welding and/or assembling
- Inspection (X-ray) of welded connectors
- Flushing the connected tubes
- Applying corrosion protection



In comparison with this, weld-free tube

forming save time and costs. Expensive cleaning and X-raying of the tube connector become immediately things of the past. The manufacturing time for a tube connector quickly reduces by more than half in comparison with conventional welding. To make this clear, Parker has developed a calculator which, on the basis of the individual input data, determines the exact cost saving from Multiple components are supplied under a single part number using Parflange F37 and/or the high-performance flange connectors. Parker flange connector systems accommodate even higher requirements, especially those from the offshore industry, shipbuilding, heavy machinery construction and press manufacture, as well as from mining, recycling plants and mobile.



## Personnel and environment-friendly

By comparing the individual operations for a welded line with Parker flanges connected lines, significant cost savings opportunities become immediately obvious. No vapours putting health at risk are released, in contrast to conventional welding processes. Consequently, usage is possible in locations with high requirements such as, for example, offshore oil platforms. In addition to this flaring machine design errors



in the preparation of flanges are virtually unknown. Stress corrosion cracking generated during welding operations is history and the life of the finished tubing system is increased. Cold formed Parflange technologies save power and energy compared to welding and require neither degreasers nor anti-corrosion agents. When galvanized tubes are used, post-galvanization can be omitted because the zinc-coating is not impaired by flaring. Parker flange connector components are delivered in state of the art Cr (VI)-free surfaces. Parker delivers all the component parts securely packed to the required location. Reliable delivery on the date advised. And then it comes to professional assembly - its specialists will willingly take it on for customer. After testing and a trial run, customer can press the start button to make customer's production a success.

### Parker piping solutions - Complete hydraulic systems from a single supplier



For users worldwide Parker is a systems partner, available for tube connection systems, regardless of tube diameters and for whatever pressure. With the Piping Solutions Parker is able to offer the customer the complete professional solution for hydraulic systems based on services: Engineering, Prefabrication and Installation.

Parker's Complete Piping Solutions go well beyond Parflange F37 Technology, offering a complete professional solution for piping systems. Parker incorporates services that provide a customized turnkey solution. They include consultation, design, pre-engineered tube and pipe assemblies, and even onsite installation services. Parker will Consult during the piping system design, providing advice to engineering and fabrication teams. This collaborative planning provides a solid foundation for the actual fabrication of piping assemblies and installation. Parker engineers will Design piping assemblies (spools). This can include on site measurement/surveying, development or modification of detailed piping drawings, and review of customer technical specifications.

The Parker piping services team provides accurate

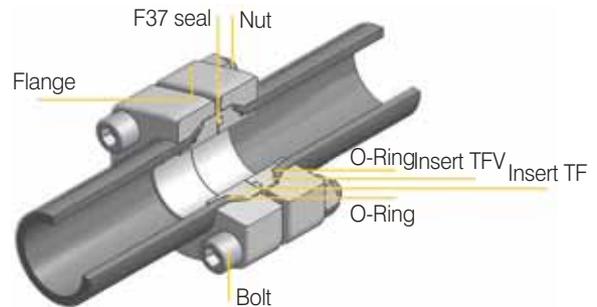
Preengineered piping assemblies. While the Parflange F37 system is inherently cleaner, Parker can flush pipe spools to requirements established by the customer. Additional post fabrication services are also among the engineering services that Parker provides. Parker also is fully engaged in the installation of the piping assemblies. A Parker project manager leads the team of trained installers to maximize installation throughput and quality of installation work. This Parker service imparts a high degree of customer confidence as unforeseen project problems or design changes are addressed on site, minimizing costly project delays. Parker is expanding the footprint of piping solutions centers throughout the world, providing the ability to dispatch resources globally to support customers' piping requirements.

Parker's expanded Piping Systems Solutions Centers provide complete piping solutions for its customers. Whether the job requires the complete redesign and installation of a welded piping system or consultation and delivery of a pre-engineered non-welded piping assembly/spool, Parker's mission is to tailor a solution to maximize its customer's profitability.

### The Parflange F37 program consists of two flange connection technologies

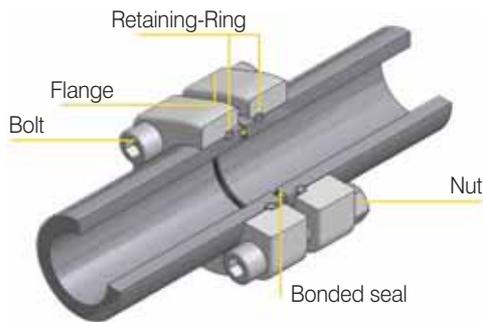
#### Parflange F37 flare flanges

In this configuration, the deburred tube end is flared orbitally to 37° by Parflange technology. An insert, soft sealed by an O-Ring, is located into each pipe end. In between a F37 Seal (optionally Bonded Seal or O-Ring) is placed. By tightening the flanges together, a soft sealed, high pressure tube connection is made. Available as tube-to-tube connection or tube-to-port connection.



#### Retaining ring connection

The retaining ring used in this connection is a stainless steel segmented ring covered by a stainless steel spring. It is



- Reduces system flushing time due to inherently clean piping with no weld-induced contaminants
- Minimizes concerns of stress corrosion cracking of weld joints
- Chrome-6 free carbon steel products for corrosion protection
- Full range of accessories (seamless tube, clamps, adapters, flange components) required for a more complete non-welded system
- Compliant with SAE/ISO 6162-1/2 and ISO 6164 dimensions and flange patterns
- DNV, ABS and other type approved system

assembled in a machined groove on the tube end or adapter. When tightening this system, the flange is pushed against the retaining ring, thus giving a form tight connection. Retaining ring connections complete the Parflange F37 range with bulkhead, tube bend connections.

Key F37 features and advantages:

- Reduces dependency upon welding piping up to 273mm/10
- Heat code traceable components (HCT)

Parker's Parflange F37 System reduces installed cost by reducing welding and fabrication time. Since no weld contaminants are introduced to the system, flushing time can be dramatically reduced as well. Combining this with Parker Korea Marine Service Center's cold bending capabilities, additional improvements in installation time and flow characteristics are evident. ⚓

## Kim Byeong-hee and Lee Sang-man of HHI were selected as 'Master-Craftsmen of Korea'

Hyundai Heavy Industries (HHI) produced 2 Master-Craftsmen of Korea also this year, which attests to the company's unmatched technology nationwide.

HHI announced on September 8 that Kim Byeong-hee (aged 52, deputy general manager/technical supervisor at the Outfitting & Production Dept.) and Lee Sang-man (aged 52, manager/technical chief at the Construction & Equipment Production Technology Dept.) were included in the list of 'Master-Craftsmen in 2011', published recently by Ministry of Employment & Labor and Human Resource Development Service of Korea.

They, the master-craftsman in the machinery field, have garnered acclaim as the best technicians in the production/machinery and tooling design sectors.

The title Master-Craftsmen of Korea is awarded only to the technicians with a careerer spanning over 15 years in the same industry in recognition of significant contribution to technological advancement and unparalleled skills in related fields.

Kim Byeong-hee, the technical supervisor, have performed machining works for 35 years handling about 350 parts used for marine engines since 1976 and filed applications for 6 invention patents and 2 utility model patents. Furthermore, he developed the nation's first equipment to process the tank nozzle of LNG carriers and established standards for a variety of machining techniques.

Lee Sang-man has produced around 560 types of toolings and 450 types of hoisting jigs thus far since his employment in 1982 and filed applications for 16 invention patents and 5 utility model patents which attest to his relentless creativity in driving the improvement of productivity and quality of construction equipments.

HHI has produced a total of 23 Master-Craftsmen of Korea (12 currently working, 11 retired) so far, including aforesaid 2 persons.



# High pressure dynamic seal for plunge pump with pressure above 35 kpsi

HAMMELMANN Maschinenfabrik installed a high pressure pump on a platform in the Gulf of Mexico. A boost pump takes methanol from a tank and feeds it at the required suction pressure via a 10  $\mu\text{m}$  fine filter unit to the high pressure pump. The described pump has been successfully operating on the platform for the past 4 months and has not required any maintenance until now. To date it has run approx. 1,000 hours under load.

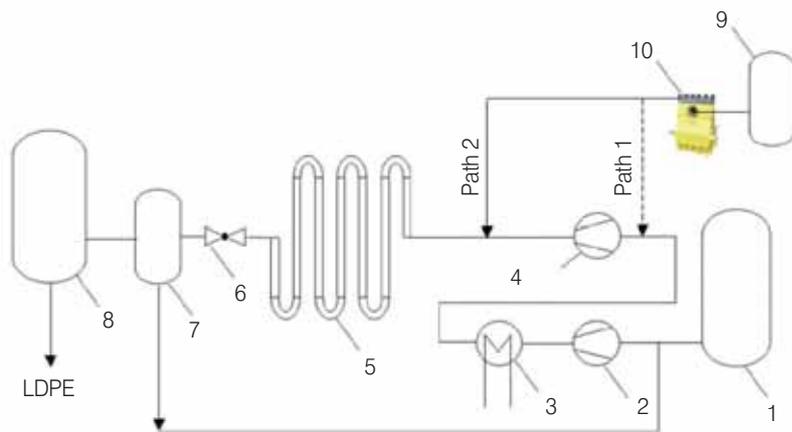
*HAMMELMANN Maschinenfabrik/ Eunha Machinery Industrial*



## Plunge seal for delivering co - Monomers into a 35 kpsi LDPE process

To manufacture modified polyethylene, ethylene gas undergoes multiple stage compression and is then fed into a high pressure reactor (Fig. 1). Depending upon the process variant the polymerization reaction is realized within a tabular

reactor or in an autoclave at a pressure between 23 and 45 kpsi and at temperatures from 150 to 300°C. The chemical reaction is started by the addition of initiators and the product quality is controlled via temperature adjustment within the reactor. At the end of the reactor the pressure is relieved by a valve and the polyethylene is further processed into pellets.



1 - Ethylene tank, 2 - Compressor (1'st stage), 3 - Intermediate cooler,  
 4 - Compressor (2'nd stage), 5 - Reactor, 6 - Relief valve, 7 - High pressure separator,  
 8 - Low pressure separator, 9 - Co-Monometer-Tank, 10 - HP plunger pump

Fig. 1 LDPE-Unit

Co-monomers are introduced to modify the product characteristics.

This usually occurs at the intermediate stage of hyper compression (Path 1 in Fig. 1). This however has disadvantages in that the co-monomer and the ethylene gas must pass through the compressor together. Depending upon the type of co-monomer this process can seriously shorten compressor life. In a new product variant the medium shall be injected into the reactor directly against the high internal pressure which presents an enormous challenge both for the pump and for its' sealing system.

A series of practical and theoretical tests were carried out to determine which sealing system would be most suitable. They are described briefly below:

The melting temperature of some of the co-monomers is considerably dependent upon pressure. Co-monomer remains liquid in atmospheric conditions with a temperature of approx. 15° but it changes considerably with increasing pressure. This characteristic can cause the liquid to freeze as it is compressed within the pump and bring the co-monomer injection process to a halt.

To prevent the crystallization effect described above from occurring the temperature of the medium must be maintained at a point considerably higher than its' freezing point at atmospheric pressure. Working against increasing the temperature is the distinct possibility that the co-monomer will

polymerize. The temperature at which the medium will not polymerize is not fixed and is dependent upon the chemical conversion rate and the dwell time that the fluid remains within the high pressure system. The polymerization is initiated by free radicals which pre-exist in the monomer. These form on the one hand new radicals and propagate the growth of polymer chains. On the other hand the radicals are blocked by inhibitors, bonding the co-monomers and stopping polymerization. The inhibitors are consumed very quickly at high temperatures so that a large quantity of polymer can be produced. When designing an injection system it is important that the dwell time inside the pump and the high

pressure line is shorter than the time required to polymerize the co-monomer at the given temperature and pressure. It should be considered that dead space could be present within the pump where the fluid can be subjected to high pressure and high temperature over a long period. This is typically the case in the sealing areas of pumps with contact plunger seals. This phenomenon cannot occur with dynamic or gap seals as the sealing surfaces are subjected to continuous flushing.

Systems operating in the 35 kpsi range normally generate a clearly measurable temperature increase over the pump that emanates from internal power dissipation (friction, leakage) and from the thermodynamic properties of the medium (compression heating). As a consequence of this effect pumping water will generate only a small temperature increase whereas pumped hydrocarbons can exhibit very high temperature increases. The temperature of Butane for instance, under isentropic compression at 3,000 bar increases by 100K. When co-monomer was pumped a temperature increase of 25K was recorded. This is a favourable temperature increase for the prevention of crystallization but it increases the risk of polymerization within the pump. In view of the above fluid influence findings the dynamic seal appeared to be the most suitable sealing concept for high pressure pumps for use in the LDPE process. The following describes theoretical and practical research into the high pressure sealing system.

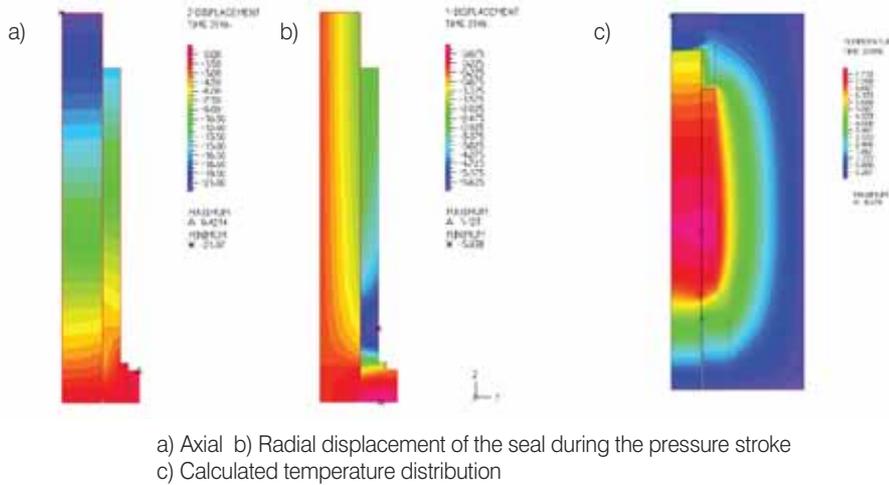
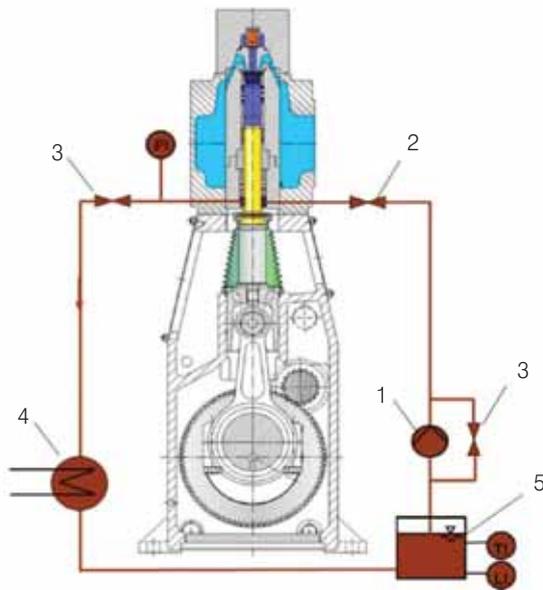


Fig. 2 Results of simulation



1 - Circulating pump, 2 - Non return valve, 3 - Pressure regulating valve, 4 - Cooler, 5 - Tank

Fig. 3 Plunger cooling system

### Verifying the seal concept

The temperature increase within the dynamic seal was simulated to verify the seal concept suitability for pumping comonomer. To this end an iterative method to calculate the deformation of plunger and sealing bushing and the resulting pressure flow in the sealing gap under fluid structure interaction was selected. The calculations were made using the

ADINA programme. The results are shown in Fig. 2.

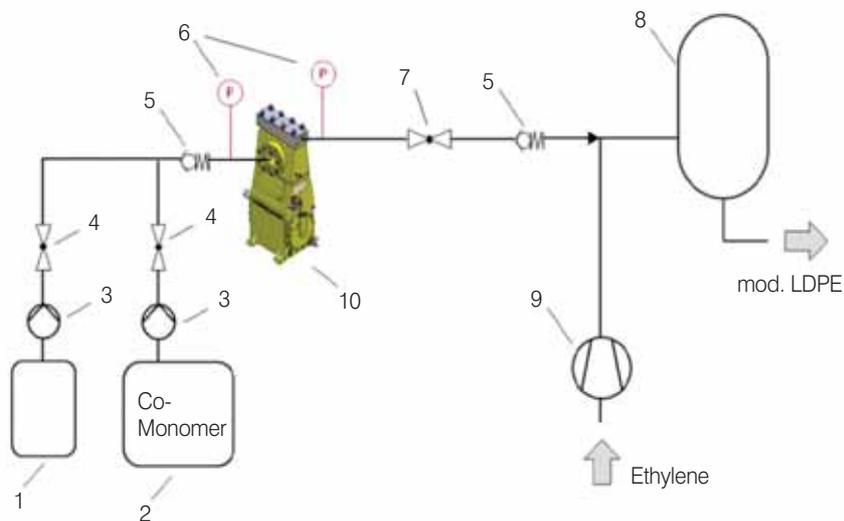
One sees that in the axial direction a relatively large deformation occurs. In comparison the radial deformation is small and acts in the negative y-direction. That means that the sealing bushing is moved towards the plunger during the pressure stroke. This limits the volume of leakage emitting to the suction side via the sealing gap. The pressure energy of the leakage flow within the sealing gap is converted to heat energy due to the pressure drop. The

resulting temperature increase at the sealing bushing is 7.7K (Fig. 2c) which equates to a heat introduction of 100 watts per cylinder. It is necessary to cool the plungers so that the heat build up is dissipated so a cooling medium is applied (Fig. 3) to the area below the high pressure seal of each plunger. The cooling system must ensure that the accumulative heat increase of 100 watts per cylinder is removed. Temperature measurements were taken on a three cylinder test pump to verify the calculated results. A mixture of glycol and water was used as a test medium to simplify the procedure. Differences in the other fluid characteristics such as specific thermal capacity etc. were taken into account. The pump was stopped and measurements were taken at the plunger surfaces.

The dissipated heat was ascertained by measuring the cooling medium temperature. The temperature increased rapidly in relation to time and reached a level critical to the functioning of the sealing. However, with cooling medium a stable temperature was established within a very short time span. This temperature was directly related to the volume of cooling medium employed although a cooling medium flow rate in excess of approx. 1 l/min did not increase cooling efficiency. The calculated heat build up was confirmed by the actual temperature measurements taken. Any differences can be explained by measurement imponderables and fluid characteristic variations between model and measurement.

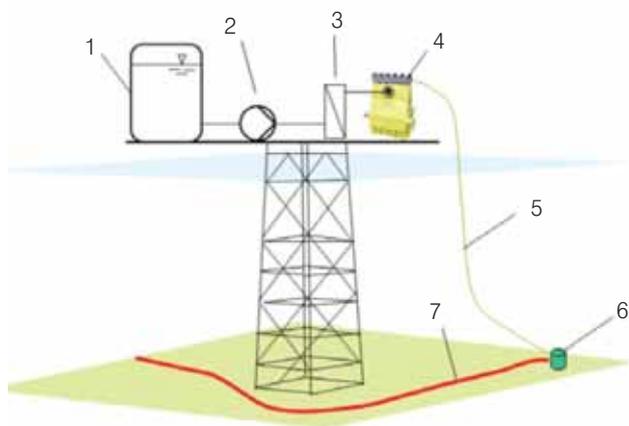
### Operating experience with an LDPE unit

Fig. 4 is a simplified schematic of a co-monomer injection



1 - Flushing oil tank, 2 - Co-monomer tank, 3 - Booster pump, 4 - Shut off valve, 5 - Non return valve, 6 - Pressure sensors, 7 - Shut off valve, 8 - Reactor, 9 - High pressure compressor, 10 - High pressure pump

Fig. 4 Co-monomer injection system for 35 kpsi



1 - Tank, 2 - Booster pump, 3 - Filter unit, 4 - High pressure pump, 5 - Umbilical, 6 - Well head, 7 - Flow line

Fig. 5 Methanol injection installation on an offshore platform

process. The high pressure pump (max. op. pressure 35 kpsi) injects a volume of 3.5 gpm into a process operating pressure of 26 kpsi. The pump plunger cooling is effected by a closed loop circulating system employing compressor oil. The pump plunger chambers and the complete cooling cir-

cuit are hermetically sealed to atmosphere eliminating emissions of medium. The pump flow enters a reactor via a shut off valve and a non return valve. The shut off valve is initially closed and opens once the pump is running and a set pressure is achieved. To this end the pump is started at very low speed and pumping flushing oil. After a set operating period it is switched to pumping co-monomer.

### Operating experience with dynamic plunge seal system injecting methanol against 1,650bar

Fig. 5 shows a high pressure pump installation on a platform in the Gulf of Mexico. A boost pump takes methanol from a tank and feeds it at the required suction pressure via a 10  $\mu$ m

fine filter unit to the high pressure pump. The pump feeds 48 l/min. into an injection line against a pressure of 1,650 bar. The methanol is pumped via an umbilical to the well head which is located at a depth of approx. 2,000 metres.

The design of the high pressure pump which is equipped with dynamic plunger sealing sets selected for reliability at high pressures. The vertically arranged pump with integral reduction gear has an extremely small, space saving footprint. The compact arrangement of the valve sets minimises dead space within the pump resulting in high efficiency and smooth running. Bellows fitted between the crossheads and plungers within the intermediate chamber hermetically seal off the crank section preventing ingress. Gas tight side panels hermetically seal off the intermediate chamber ensuring that no form of the pumped medium can emit to atmosphere. This type of pump is ideal for pumping toxic, explosive and eco-damaging fluids. The described pump has been successfully operating on the platform for the past 4 months and has not required any maintenance until now. To date it has run approx. 1,000 hours under load. 



# Simplicity is the key

Recently, simplicity concept is the centerpiece of design for deepwater rigs. ABB has also placed emphasis on the simplicity concept. ABB thinks that such a design would be easier to install, easier to operate and easier to maintain through the life of the vessel.

And operation concerns in drilling rigs' electrical systems, such as blackout prevention and lean fuel consumption, are better addressed by adapting the performance of industry-standard products and systems, rather than engineering increasingly complex customized solutions.

## ABB Marine

"It's important that the offshore drilling vessels not experience total blackouts," Jorulf Nergard, vice president of sales for ABB, remarked. "This is improved with today's solutions and different than 15 to 20 years ago when often more complicated configured electrical power generation systems would get blackouts without really understanding why."

Mr. Nergard attributes this accomplishment to a pervasive market philosophy of simplicity. "ABB has pushed the simplicity concept when it comes to deepwater rigs for five to six years now. There is an industry trend to avoid failures by creating simpler systems, clean and lean."

### The ideal power generation system

Isolated at the sea, deepwater drillships and semisubmersibles, rely on electrical power to perform every tasks. "Obviously, the power system is the crucial thing aboard a rig," Mr. Nergard said. "Propulsion and drilling systems are now totally dependent on power from electrical sources." These vessels at sea are reaping the benefits of not only redundant power systems but also standardized solutions. While power requirements have not changed; typical power demand for a drillship is 35-45MW and for a semisubmersible is 25-45MW.

A power grid for a drillship is often split into three separate systems comprised of two engines and generators with two azimuthing thrusters in each system. A grid for a semisub typically has four separate systems with two engines and generators and two azimuthing thrusters in each system.

For the most part, standardized power generation systems have replaced specific configurations that called for many crossovers and special arrangement and controls. "The market is emphasizing safe, reliable solutions that should be

standard and proven reliable. In order to do that, simplicity is the key," Mr. Nergard commented.

"One of the areas that is seeing more and more focus from operators and owners is to recover the electrical system faster than the typically 2 min when a blackout situations occurs, and recovery within 30 to 60 second for the thrusters and the drilling system is more what we are seeing today. Although blackout is unlikely to happen in a modern drilling rig installation, but some additional means to recover must be in place to achieve this short recovery time, as our Fast Recovery After Blackout solution (FRAB) will do", Mr. Nergard said.



A total ABB electrical solution includes the Power Generation and Distribution System, Thruster Drive System and Drilling Drives System



West Sirius was delivered to Seadrill in 2008 from Jurong Shipyards. This 6th generation semi-submersible drilling rig is equipped with Power Generation and Distribution systems, Thruster Drive systems and Drilling Drive Systems from ABB.

“The ideal power generation system is one that is designed to keep the vessel in hers position and keep the operation running in the certified conditions, is reliable, is easy to maintain, and can operate with minimal losses and emissions to the atmosphere (will be a big issue),” he said.

“We design electrical systems that use industry-standard components adapted to marine requirements and to focus the design on minimizing the risk that a single failure can shut down an entire rig or drillship,” Mr. Nergard remarked. “Our thinking was that such a design would be easier to install, easier to operate and easier to maintain through the life of the vessel. And operation concerns in drilling rigs’ electrical systems, such as blackout prevention and lean fuel consumption, are better addressed by adapting the performance of industry-standard products and systems, rather than engineering increasingly complex customized solutions.”

Operators are finding the more standardized marine power systems easier to understand and operate. And onshore support personnel are better able to understand what is happening aboard the rig, when such remote assistance is needed.

As an example, ABB’s power systems have become more simplified for sixth generation rigs, i.e., there is a more straight power line from the generated power and control voltage down to the thrusters and drilling system. There are not as



Dhirubhai Deepwater KG1 was delivered to Transocean in 2009. This advanced deepwater drillship is equipped with Power Generation and Distribution systems, Thruster Drive systems and Drilling Drive systems from ABB

many assignment systems and crossover connections as were used in previous generation rigs, he noted.

“Improvements have been made to control, maintain and protect the system,” Mr. Nergard stated.

The system components have become more efficient because of advancements in product development of all parts; fewer components are needed, resulting in reduced production costs and easier maintenance. E.g., sixth generation rigs and ship systems are using switchboards, and frequency drives, with smaller dimensions than in the past. Protection relays and controls are using more microprocessors and have higher capability to communicate on high speed busses. By this improvements the size of the equipment rooms and number of cables are reduced which are cost elements in shipyard construction. Hence, not only is there a reduced number of crossovers in the power distribution systems but the equipment itself make it more cost efficient.

These changes are considered important because if one has a higher number of parts, the system the likelihood for faults increase (MTBF), Mr.Nergard said. Advantages to the rig owner are reduced cost of installation, less components required but with a higher level component specification.

When it comes to making the systems more compact, cost is one driver. “Because we can produce it faster to a lower cost from us, the producer,” he said. “The safety aspect is another



Azipod CZ electric podded thruster unit

driver in that the more simple and efficient the system is, the more reliable it is.”

There are also made solutions to improve the protection against loss of healthy diesel engines and generators, when one generator set has a control error, through a Diesel Generator Monitoring System (DGMS), which can detect and disconnect the faulty generator set timely which was traditionally difficult to discover. This type of errors has caused black outs when the power systems have been connected together. “We see this mean is considered to be a more and more important solution,” Mr. Nergard said.

Through the use of a Remote Diagnostic System (RDS), all of the electrical system parameters have access to be monitored from shore, and the availability for assistance is than significant improved “This is easier available in today’s protection relays and control units, with communication on a high-speed communication bus, which will reduce the number of cable interfaces but increase the capacity of available information,” he said.

A diesel electrical solution is normal for Dynamic Positioned (DP) vessels is driven by the necessary flexibility to configure and vary the power from the power systems, particularly caused by the thruster and drilling loads. “There are big variations when powering the thrusters, because of weather and sea conditions, and the drilling system, varying from very low power for long periods to the maximum possible for shorter

periods, but also the required DP redundancy requirements is easier be met. This flexibility allows connection of power according to the need and also contributes to efficient operation,” he noted.

“For example, when one is running few large engines and need only to feed a small loads there will be a unnecessary big loss, that is better when running many small engines which can be disconnected according to the needs,” Mr. Nergard continued.

### ABB’s Azipod CZ type

In August, ABB has opened a new factory close to Shanghai to turn out the C and CZ Azipod Thruster units. “ABB’s Azipod CZ type has a range of up to 83 tonnes efficient thrust generated from a 4,500kW electrical motor power,” said Mr Nergard. “This can be comparable with traditional mechanical thrusters with motor ratings of about 5,000kW, generating fuel savings of about 10%, while the ‘green effect’ is even higher in the lower part of the thrusters power range. The range which is used during DP operations, for example, ranging from 0 - 1,200kW, can approximately add a further 5% in fuel savings.”

Today’s sixth generation solutions gives also less distortion to the electrical grid made by the Total Harmonic Distortions (THD) generated by the thruster and drilling frequency drives. Today we do not need any additional large filters, but we are connecting the frequency drives in a quasi 24 pulse configuration and are keeping the THD level well below the required 5%, in addition no need for space, circuit breakers, and cables for the previous filters. In order to reduce the dimensions further, the current thruster and drilling frequency drive systems are typically water.

### Present and future solutions

“In the last generation of vessel the solutions have been split up into DP/ automation and electrical power systems,” Mr. Nergard pointed out. “A majority of the functions of the automation systems is connected to the electrical system. So for the future, the automation system will be more integrated in the electrical power system, and we will probably see more of autonomous solutions for e.g., thruster systems. I anticipate that some new solutions will surface in this area.” 



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# Pure thinking

Alfa Laval has long been at work in this regard, making contributions in the areas of bilge water, ballast water, crankcase gas and oily waste. The company's hallmark is equipment that minimizes environmental impact, but also equipment that has a minimal impact on board. As environmental regulations grow more complex, the company's aim is to provide an increasing number of safe, compliant and surprisingly simple solutions.

## *Alfa Laval Korea*

The increasing number of cases where severe penalties have been imposed for discharging bilge water with an unacceptably high oil content into the ocean, and falsification of Oil Record Books, is a growing source of concern for shipping companies. The recent, well-publicised activities of whistleblowers and the resulting prosecutions clearly indicate the need for extreme caution when it comes to the entire process of bilge water management. In response, Alfa Laval is launching the BlueBox Bilge Data Recorder, an advanced, tamper-proof solution designed to prevent these unpleasant irregularities from occurring in the future.

As early as 2008, corporate criminal fines imposed involving oily water separators and environmental infractions had already reached USD 145 million, with the individuals involved sentenced to a total of 18 years' imprisonment.

The situation has now become so critical that the shipping industry itself has published a pamphlet entitled "Shipping industry guidance on the use of oily water separators".

Issued jointly by the Baltic and International Maritime Council, Intercargo, the International Chamber of Shipping, ISF, Intertanko and OCIMF, this publication expresses the global shipping industry's refusal to accept any non-compliance with the International Convention for the Prevention of Pollution from Ships (MARPOL).

### **The PureBilge: Centrifugal separation most efficient**

By far the most efficient technology for bilge water cleaning is dynamic systems utilizing high speed centrifugal separation technology, and Alfa Laval reports that its PureBilge system is a success. PureBilge provides a cleaning performance of 0-5 ppm oil content in the water, it is unaffected by sea heave, oil shocks or high solids loading, and no backflushing is required (in fact, PureBilge is the only bilge water treatment system available on the



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**As the acquisition of Alfa Laval toward Aalborg Industries A/S is slated for completion in May, 2011, the company presents Aalborg products as a member of Alfa Laval Products.**

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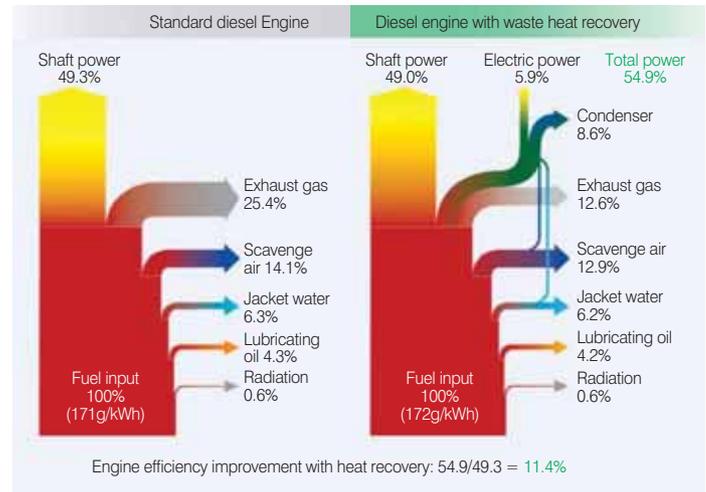
market with a DnV Test Report stating 5 ppm at 5,000 l/h throughput has been reached when tested acc to MEPC107 (49) rules).

### **Efficient and flexible SOx cleaning with the exhaust gas scrubber**

Aalborg Industries has more than 30 years of experience of supplying scrubbers as an integrated part of



Fig. 1 Heat balance example for RTA96C diesel engine - ISO conditions, 100% load



inert gas systems (IGS) on board ships. Alfa Laval's experiences from these systems in combination with the company's experiences from supplying exhaust gas boilers after large marine diesel engines have been used to design a scrubber test rig to cool and clean the exhaust from a test engine at MAN Diesel's test facility in Denmark.

The knowledge and experience from these tests have successively been used to design an exhaust gas cleaning (EGC) system for the installation on board DFDS' Ro-Ro vessel 'Tor Ficaria'. Installed after a 21 MW MAN Diesel B & W engine, it is by far the world's largest EGC system installed on board a vessel. With this installation, Aalborg Industries is preparing for the market introduction of a well-proven EGC solution on par with Alfa Laval's already well-established and innovative products for the maritime business.

The well-proven EGC system is a combined (hybrid) wet scrubbing system able to operate on sea water (open loop) and fresh water (closed loop). At open sea, the system operates in an open loop with sea water and saves the use of NaOH and fresh water. In harbours and estuaries, with strict discharge criteria, the system is able to operate on fresh water in a closed loop system. The combined EGC system thus offers maximum flexibility, and moreover, the operational costs are kept to a minimum. Compared to the use of marine gas oil, the installation of an exhaust gas scrub-

ber has demonstrated an overall CO<sub>2</sub> reduction of at least 10-15% thereby being the solution with the lowest overall carbon footprint.

### Waste Heat Recovery: Great potential of efficiency improvement

For fuel efficiency improvement, the waste heat from the exhaust gas represents the greatest potential savings for the benefit of ship owners and charterers.

After decades of delivering thousands of maritime and land-based waste heat recovery (WHR) systems and exhaust gas economizers for diesel engines, various factors have now rendered a supersize WHR unit a sound economic alternative. With a WHR system, waste energy is used to save fuel and reduce CO<sub>2</sub> emissions.

Aalborg Industries' MISSION XW-TG economizer generates power using a steam turbine driven generator (turbo generator). The MISSION XW-TG is a water tube, forced circulation exhaust gas economizer with double gilled tubes especially designed to utilise thermal energy in exhaust gas from diesel engines. The heat recovery rate of this system is very high, and the system is highly reliable.

Aalborg Industries' economizers have been installed on a number of large container vessels with high-level power requirements. With the heat recovery capacity of the economizer the engines are not required to produce as much power, which in turn saves fuel. Ship owners and charterers using this technology have achieved significant fuel savings and thereby reduced CO<sub>2</sub> emissions in double digit percentages. ⚓



# Offshore grouting and marine flooring solution

ITW Densit is the leading provider of Engineered UHPC (Ultra High Performance Concrete) solutions within the renewable energy and the upstream oil & gas Industry. ITW Densit has 25 years experience in structural strengthening in offshore construction and more than 1,000 installations across the offshore industry.

## *ITW PP & F Korea*

Illinois Tool Works Inc. (ITW) is a diversified manufacturing company with nearly 100 years of history delivering value-added products in a variety of industries. Specifically, ITW designs and produces an array of highly engineered fasteners, stretch film, equipment and consumable systems, fastening tools, decorative materials, and specialty products and equipment for customers around the world.

ITW employs approximately 61,000 people worldwide working in decentralized business units in 57 countries and has more than 19,000 global patents and patent applications.

## Selecting the right grouting for offshore

### *ITW Densit introduction*

ITW Densit is the leading provider of Engineered UHPC (Ultra High Performance Concrete) solutions within the renewable energy and the upstream oil & gas Industry. ITW Densit has 25 years experience in structural strengthening in offshore construction and more than 1,000 installations across the offshore industry. Since the first established offshore wind farms, ITW Densit Ducorit UHPC material has been applied as the high strength structural solution between monopiles and transition pieces of offshore wind turbine foundations.

### *Certification*

As a result of ITW's extensive experience and long track record in the offshore wind industry, Densit has received a Statement of Conformity from Germanischer Lloyd confirms that Ducorit S5 and D4 are applicable for all grouted connections between piles and the support structures of wind turbines.

According to the statement, the grout materials fulfill the

requirements of Germanischer Lloyd's "Guideline for the Certification of Offshore Wind Turbines".

### *Unique features*

ITW Densit Ducorit material has unique properties like ultra high compressive strength (up to 210 MPa), minimal shrinkage, corrosion protection, an ultra high bond with steel, strong fatigue resistance, easy and swift installation, and the possibility of adjusting for verticality. Furthermore, Ducorit UHPC material can develop a significant amount of early strength, reaching 50% of the full strength within 24 hours at 20°C. J-tubes, boat landings and other accessories can be mounted on the transition piece for quick installation ITW Densit grouting solutions are a proven technology.

Since 2000, Densit has grouted more than 1,000 foundations. Densit Supervisors are working everyday grouting transition pieces to monopiles and tripods of wind turbine foundations and sub-stations.

Presently, Densit is grouting offshore solutions at London Array (UK), Lincs (UK), Sheringham Shoal (UK), Walney 2 (UK) and BARD Offshore 1 (Germany).

## Selecting the right flooring

### *Introduction*

ITW PolySpec, is a leading brand of polymer coatings, linings, flooring and sealants for construction and corrosion protection in industrial, institutional, commercial and marine markets. ITW PolySpec differentiate themselves in the marketplace by providing rigorous, consistent product quality, unparalleled customer service and technical support. The company aims to provide innovative solutions for customer

needs.

ITW PolySpec is used on commercial vessels and offshore rigs and is well known throughout the maritime industry. The flooring solutions developed are easy to install seamless underlayments and finish flooring that are capable of providing long service life and protect against corrosion in the most inhospitable of conditions.

### **Certifications**

All vessels bound for international waters are subject to IMO-SOLAS regulations regarding primary deck coverings and finish flooring. ITW PolySpec's focus, and the basis for IMO requirements, is to provide today's maritime industry with the safest marine decking products, in terms of low combustibility, smoke and toxicity generation, and long life-cycle performance.

ABS (American Bureau of Shipping) strives to be the most efficient provider of marine and offshore classification services with a core commitment of promoting maritime safety. IMO-SOLAS approvals and ABS approvals are the highest level of federal approvals available today.

### **Selecting the right flooring**

Every ship or rig needs a flooring solution and customers' are no different. There are many considerations that go into choosing the proper solution. ITW will walk through a few such areas of consideration.

#### **•Durability**

Ships out at sea will experience some of the harshest conditions in the world. The sun's UV rays are beating down, corrosive sea salt battering from all directions, heavy winds, rain, and extreme temperatures. In addition, there should be consideration into if there will be heavy foot traffic, light vehicle traffic, and what types of equipment or items will be moving about the room. Customers want a durable floor that lasts.

#### **•Functionality**

How often will the floor be seen by customers? One such customer that required a high aesthetic value is a USS Aircraft Carrier Museum. This project turned the former Navy ship into a floating museum requiring the durability to withstand 800,000 visitors yearly while requiring a functional marble like finish. If this is customers' project, the customers will want a very functional floor.



#### **•Tonnage**

The ability to reduce the lightship weight will yield more volume for goods and thus more opportunities for the vessel owner. Using more advanced and lighter solutions will help take full advantage of all potential value through weight reduction.

#### **•Safety**

Imagine, it's 2 am and customers are crossing a very dangerous and empty sea. A fire breaks out and the closest body of land is at least 250km away. This is a very real and very scary situation that can occur. It is one of the reasons why all vessels must be subject to IMO-SOLAS regulations for customers' protection and safety.

Rest assured knowing that customers' solution for flooring has met all necessary IMO fire safety standards. Rest assured knowing that the product the customers chose exceeds all standards for being self-extinguishing and not emitting toxins or smoke when burned. Customers will have safety.

#### **•Rest assured**

Rest assured, because customers have more difficult decisions to contemplate. Customers will have already installed the safest flooring material that has passed all necessary approvals and certifications. It's an aesthetically pleasing, functional, and durable solution that is capable of saving customers time and money. Rest assured with ITW PolySpec. 



The FLIR M-Series thermal imaging camera enables continuous 360° pan and +/-90° tilt movement. It contains both a thermal imaging camera that produces crisp thermal images of 640x480 pixels and a daylight/lowlight camera.



# 'FLIR thermal imaging cameras are a great tool'

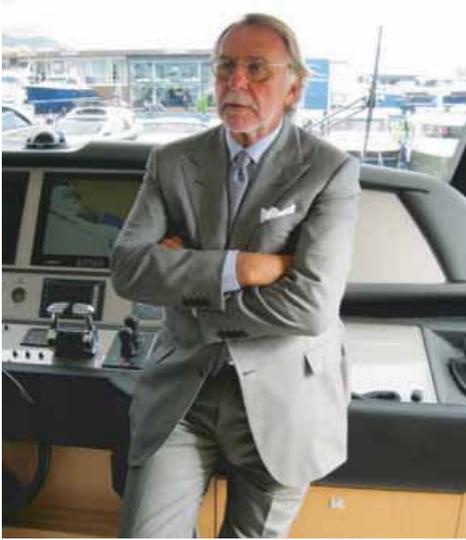
## Chairman of the Ferretti Group on thermal imaging

A very promising segment of the maritime industry is the category yachts. More and more yacht owners are incorporating FLIR thermal imaging cameras in their vessel's set of equipment. One of the first to realize the potential of this innovative technology is Norberto Ferretti, chairman of the Ferretti Group. "I've been using FLIR thermal cameras for four or five years now and it really is a great tool that helps to keep my yacht safe. In some situations it's actually even better than the radar."

### *FLIR Systems Korea*

FLIR thermal imaging cameras can detect extremely small differences in thermal radiation and convert that information into real-time video that's displayed on a monitor in the bridge. The crisp video that a FLIR thermal imaging camera produces allows the captain of a ship to see the vessel's surroundings even in the darkest of nights. Unlike other night vision systems FLIR thermal imaging cameras need no light at all to function and can work in absolute darkness. To discuss the potential thermal imaging

cameras have for use on luxury yachts, Norberto Ferretti has invited FLIR Commercial Systems aboard the Navetta 26 that's on display at the 2010 Genoa Boat Show, a yacht very similar to his private yacht: the Ziacanaia. "I do most of the travelling with my yacht during the night, because during the day I prefer staying at the beach and swimming", explains Mr. Ferretti. "My captain sails through the night and in the morning we arrive in the location where I want to go, so when I wake up we're there. Not only does travelling at night allow me to see the most beautiful of sunrises and sunsets, it also means that I have the entire day left for me to enjoy. So travelling at night really helps me to get the most out of my holidays. And a FLIR thermal imaging camera makes nighttime travelling a lot easier."



Norberto Ferretti, chairman of Ferretti Group on the bridge of the Novetta 26 that was displayed at the 2010 Genoa Boat Show.



The thermal images are shown on a dedicated screen on the bridge. The joystick control-unit is aesthetically integrated.

### 'I wouldn't want to go without it'

According to Mr. Ferretti once a client has a FLIR thermal imaging camera there's no going back. "In my experience a client that has previously included a FLIR thermal imaging camera on his yacht will always order a FLIR thermal imaging camera on every new yacht he buys. And I completely agree. I've had a FLIR thermal imaging camera for several years now and I really wouldn't want to go without. It would indeed be sorely missed if I wouldn't have it anymore."



Riccardo Tebaldi, part of the Ferretti Group Delivery team, uses the HM 324xp+ handheld thermal imaging camera.

### From sailing boat to motorized yacht

In 2010 it was the fiftieth time that yacht builders from over the world displayed their best vessels in the Genovese harbor for the Genoa Boat Show. The Ferretti Group was one of the largest contributors. The Ferretti Group, based in Forlì, Italy, is one of the leading companies in design and construction of luxury motoryachts and sporting boats. The Ferretti story started in 1968 when Norberto Ferretti together with his brother Alessandro, both driven by a great love for the sea, started the Ferretti boatyards.

Nowadays the Ferretti Group has established itself as one of the leading yacht-producers in the world. Custom Line, the company that produces the Navetta 26, is one of the many yacht producers that are a part of the Ferretti Group.

### A new dimension of comfort

The Navetta 26 has been designed to set new standards of quality for life on-board. The clever design of the 26 meters long and almost 7 meters wide motorized yacht enables those on-board to cruise in a new dimension of comfort, relaxation and wellbeing. It has a large open-view window which converts each cabin into a suite on the sea; a sky lounge featuring removable glass walls, which make



The waterproof and shock-resistant FLIR HM-324xp+ portable thermal imaging camera delivers crisp thermal images of 320x240 pixels.



it possible to create a single open space with the external lounge and the sunbathing area featuring comfortable sundecks and a Jacuzzi; and the on-board comfort is ensured by the exclusive Anti-Rolling Gyro System, supplied as standard, which allows for a reduction of over 50% in the rolling caused by wave movement both during navigation and when the yacht is moored.

## Thermal imaging camera on board

According to Mr. Ferretti such a high quality yacht should not lack a high quality thermal imaging camera, so when the Ziacanaia was built he chose to include the FLIR Navigator II thermal imaging camera in the vessel's equipment. When the new FLIR M-Series thermal imaging cameras came out, Mr. Ferretti decided to replace his FLIR Navigator II model on the Ziacanaia with the new FLIR M-625L thermal imaging camera.

The FLIR M-Series thermal imaging cameras are powerful, flexible, and built to last. With the M-Series' variety of sensors and resolutions the thermal imaging cameras from the M-Series can meet a wide range of maritime navigation, collision avoidance, security, and search and rescue needs. The FLIR M-625L thermal imaging camera that's installed on the Ziacanaia contains both a thermal imaging camera that produces crisp thermal



Mr. Ferretti: "The quality of the image and the amount of detail it shows are very impressive."

images with a resolution of 640x480 pixels and a daylight/lowlight camera. The rugged, waterproof gimbal enclosure enables continuous 360° pan and +/-90° tilt movement for horizon-to horizon visibility.

All new Custom Line yachts have a FLIR thermal imaging camera from the FLIR M-Series as standard on the options list. Yacht owners can choose between two dual payload solutions (thermal camera with an incorporated extra ultra low light camera) that is to say the M-625L or the M-324L or between two single payload solutions (thermal only cameras) M-625XP or M-324XP. The M-625L and M-625XP are equipped with a thermal imaging camera that produces crisp thermal images of 640x480 pixels. The M-324L and M-324XP produce thermal images of 320x240 pixels.

## 'Better than the radar'

"My captain is the one who uses the M-Series thermal imaging camera the most aboard my ship and he is very enthusiastic", says Mr. Ferretti. "He even says that in some situations it's more useful than the radar. During the night he uses the FLIR thermal imaging camera to exactly determine his position relative to the beach or rocks, almost as if it is daytime!"

This does not mean that the radar is useless. "It is still a very important instrument on a yacht but a thermal imaging camera can significantly complement the information you get from the radar screen. With radar you only see small 'blips' and that's really useful for detecting other vessels or objects, but it really isn't easy to interpret the information. With the FLIR camera you can immediately identify the vessel or object, because a thermal image is easy to understand."

"Nowadays many yacht builders install two radars on the bigger yachts", continues Mr. Ferretti. "But if a tight budget would force me to choose between



The FLIR M-625L on the Navetta 26 contains both a thermal imaging camera and a daylight/lowlight camera.



The Genoa Boat Show is an annual event that serves as an international reference point for the recreational boating industry.

having one radar and a FLIR thermal imaging camera and having two radars I would definitely choose to have a FLIR thermal imaging camera, because it really complements the radar very well and helps to raise situational awareness.”

### HM-Series handheld thermal imaging cameras

Recently Mr. Ferretti’s crew also started using the FLIR HM-324XP+ handheld thermal imaging camera. Not only does it provide you with a crisp thermal image with resolutions of up to 320x240 pixels, being a handheld self-contained unit it delivers these images from wherever you are standing. The flexibility of these waterproof and shock-resistant portable thermal imaging cameras can be used to dramatically increase situational awareness. “We use it when we take the tender for trips to the shore or to pick up guests”, explains Mr. Ferretti. “Before we had the FLIR HM-324XP+ we avoided this kind of

trip at night, because the darkness makes it a bit risky, but with the FLIR HM-324XP+ we can safely use the tender even at nighttime.”

The FLIR HM-Series handheld thermal imaging cameras are an excellent tool for night-time navigation, they can be life-saving in man over board situations and they’re incredibly useful for securing a shipboard environment, anti-piracy and many other maritime applications.

### ‘Even useful during the day’

The FLIR M-Series and handheld HM-Series thermal imaging cameras both deliver perfect night vision, but that’s not all: they can also be used during the day, according to Mr. Ferretti, “Sometimes floating debris, rocks or other potential hazards that could damage the ship are difficult to see because they have the same color as the surroundings. It’s camouflaged, so to speak. With a FLIR thermal imaging camera you can very easily spot that sort of debris from a large distance, because it shows up very clearly in the thermal image.” But it doesn’t stop there. According to Mr. Ferretti the FLIR M-Series thermal imaging camera can also be used for security purposes. “When my yacht is anchored in a bay it’s a very good tool to monitor the perimeter of the boat. There will be no trespassers sneaking into my boat at night, for even in total darkness a person or vessel that approaches my ship shows up very clearly on the thermal image even at long range. Other vessels are detected at a distance of 2 kilometers and persons at 740 meters.”

### ‘Quality is impressive’

Mr. Ferretti is very pleased with the images his new FLIR M-Series thermal imaging camera delivers. “The quality of the image and the amount of detail it shows are very impressive. You can see the people walking on the shore; you



can see the other vessels into the smallest of details: the cockpit, the bridge, the anchor and even ropes show up distinctly on the thermal image, even in total darkness. It really is amazing. The FLIR thermal imaging camera even shows when the engine of a boat is still warm from recent use.”

But it’s not just a very useful tool, according to Mr. Ferretti. “We also use the FLIR thermal imaging camera for entertainment. For instance: we used it a couple of years ago to look at the volcano at the Italian island Stromboli, near Sicily. With the naked eye we could see no volcanic activity, but on the thermal image we could very clearly see the temperature differences in the rock due to volcanic warmth.”

### ‘M-Series thermal imaging camera a cool gadget’

The M-Series thermal imaging cameras are very intuitive and easy to use. The ergonomic M-Series controller provides ready access to all critical system functions and smooth, effortless control, even in rough seas. “The FLIR thermal imaging camera is also the only piece of electronic equipment we actually show to our guests”, explains Mr. Ferretti. “If we have guests on the yacht we don’t want to bore them with the radar and the chart plotter, but a FLIR thermal imaging camera isn’t boring at all! It is intuitive, easy to use and very appealing. So apart from being a very useful innovation it is also a very cool



The Custom Line Navetta 26, at the 2010 Genoa Boat Show.



Yacht builders from over the world displayed their best vessels in the Genovese harbor, with the Ferretti Group as one of the largest contributors.

gadget. As soon as we let one of our guests play with it they are captivated by its intuitive user interface. And I must say it is also very, very reliable.”

Not only are the M-Series thermal imaging cameras very easy to use, they are also very easy to install and integrate with other maritime equipment aboard a vessel. M-Series systems use cutting-edge Ethernet connectivity for easy installation, control, and interface with other on-board electronics.

FLIR Commercial Systems appreciates the professional collaboration their distributor ENAV has with the Ferretti Group. FLIR distributor ENAV is a competent and professional maritime electronics supplier that undertakes all the activities from purchasing to installation to after sales assistance and service.

“A yacht usually doesn’t come cheap”, continues Mr. Ferretti. “Especially if the client wants a bit of luxury. So you want to make the most of the investment. A FLIR thermal imaging camera really helps you to do that, because it allows you to effectively navigate at night. And in my opinion the money shouldn’t be much of an issue, for FLIR thermal imaging cameras are extremely affordable. Especially if you compare it with the overall price of a yacht the price tag of a FLIR thermal imaging camera seems very marginal.” 

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MegaDrill Services Limited was formed two years ago to construct the Majestic, the largest, most technologically advanced posted barge rig in the world. The Majestic is also the only new construction under way at this time in the posted barge market and will be launched later this year.

# A majestic barge

The Majestic will be the largest, most technologically advanced drilling barge rig in the world

When MegaDrill Services Limited, based in Houston, TX, USA, decided to design and build the most technologically advanced drilling barge in the world, they had many challenges ahead of them. The decision to partner with Integrated Drive Systems (IDS), Inc. in Houston, TX, to build the power, control and drilling systems was an easy choice, however.

## Vacon Korea

IDS founders, David L. Huntington and Norman S. Myers, have been industry leaders and innovators in the drives and controls business since the early 1970s. IDS also needed a trustworthy and capable partner who understood their needs and could meet the requirements for this rare opportunity. Because of previous experience of working together, Vacon was chosen as exclusive supplier of the AC drives used to power the drive system on the drilling barge called the Majestic.

With only just over 30 bottom-founded barges in the world and the Majestic as the only new-build globally, these units have distinctive operating features. Barges do not change location very often and tend to focus on specific shallow-water areas of the world, particularly swamp areas. They also employ crews that remain on board for long periods

while they are working. This unique lifestyle places certain requirements on the rig to accommodate the needs of the workers and enable them to carry out their work as effectively as possible.

## Mud pumps driven by Vacon common DC bus inverter modules

The power for the Majestic comes from three diesel generators each rated at 2,100kW. The entire AC drilling system has four 1,200HP (895kW) motors for driving two 2,200HP (1,640kW) mud pumps (two motors are needed



The drive system that will power the Majestic shown here is being built by IDS in their Houston, TX based shop.



AC drives (VFDs) are now recognized as the preferred method of control for offshore and land rig equipment. AC drives provide many benefits over old technologies including better control, faster block speeds, lower fuel consumption, enhanced drilling and tripping operations, and lower maintenance costs.

for each pump). Each mud pump motor is driven by a Vacon common DC bus (FI13 - 1180 Amp) inverter module. The two 1,800HP (1,343kW) drawworks motors are each driven by a Vacon common DC bus (FI14 - 2250 Amp) module. The top drive and rotary table, through a contactor arrangement, each use the same Vacon common DC bus (FI13 - 1180 Amp) rated for 1,200HP (895kW). In addition, the system includes three large rectifiers for the DC bus supply, three generator control cubicles to control the large engine-generator sets, dynamic braking modules and resistor grids for braking, a PLC-based rig operation control system with touch screen HMIs<sup>1</sup> and auto drill capability, and a motor control center system to control the large number of fixed speed motors.

## Meeting all current environmental, safety and construction regulations

Robert P. Dunn is an industry veteran with a career of 40 years and is owner of MegaDrill. He describes the Majestic, which is being assembled in Singapore, as the best of the best. It is 232 feet (70m) long, has a beam of 70 feet (21m), hull depth of 14 feet (4.3m) and a posted deck of 14 feet (4.3m). The rig is self-sufficient, with accommodation for more than 120 workers, including a fully equipped hospital, recreation room, gym and helicopter waiting room.

Because of the size of the barge, the accommodation on board and the numerous safety systems, the American Bureau of Shipping (ABS) classified the barge itself, as a rig, and its machinery. The rig meets all current environmental, safety and construction regulations laid down by ABS, SOLAS<sup>2</sup> and ILO<sup>3</sup> and by the International Maritime Organization (IMO) on pollution prevention. The drilling mast has an impressive safe hook load: it can lift 2,000,000 lbs (1,000 short tons) of drilling pipe and drill down to 30,000 feet (9,144 metres). The rig is also fitted with a 15,000 PSI (1,000 bar) working pressure for the BOP (blowout preventer)<sup>4</sup> and control system. The safety systems include a water mist system for the engine compartments, a CO<sub>2</sub> system for the electrics, and gas detection throughout the barge with smoke and thermal protection.

Much interest has been generated for the Majestic to work in West Africa, particularly in Nigeria, which is the probable destination upon completion. The rig should be commissioned during the fourth quarter of 2011 and mobilized before year-end. ⚓

1 HMI = Human Machine Interface

2 The International Convention for the Safety of Life at Sea (SOLAS) is an international maritime safety treaty.

3 International Labour Organization

4 BOP (blowout preventer) is the safety device that shears the drilling pipe (sealing the well) in the event of a blowout of oil or gas.



## DSME won an order for 1 LNG-FSRU, the world's largest

Daewoo Shipbuilding & Marine Engineering (DSME) achieved a splendid feat of winning an order for the world's largest LNG-FSRU (Floating Storage and Regasification Unit) in late August. DSME inked a contract with the U.S.-based Exceleerate Energy to build 1 unit of 173,400m<sup>3</sup> LNG-FSRU.

This newbuild LNG-FSRU, valued at over USD 280 million, will be built at DSME's Okpo shipyard in Geoje island and delivered to the ship owner by the first quarter of 2014. Moreover, it is said that new order for additional project of Exceleerate Energy is currently under discussion.

This LNG-FSRU to be built by DSME will adopt onboard regasification system with daily processing capacity of 22.5 million m<sup>3</sup> to ensure supply of gas over the long-term. Capable of using both sea water and self-circulating water, this LNG-FSRU is a cutting-edge and high value-added facility designed to ensure stable operation of regasification system in all weather and port conditions.

Particularly, the key factor that differentiates this LNG-FSRU from the rest is its design based on the previous 8 LNG-RVs which DSME designed and built successfully. Besides, this LNG-FSRU boasts far higher efficiency than existing FSRU with a maximum speed of up to 18 knots (approximately 33.3 km/h) and also provides the capabilities of LNG-RV.

This LNG-FSRU enables the supply of natural gas without need for large-scale investment such as onshore terminal construction, etc. Thus, a skyrocketing demand is expected for DSME's LNG-FSRU which enables cost-effective supply of natural gas, without having to make separate investment, to the regions with relatively flat demand or temporarily increasing demand or soaring demand for natural gas.

Nam Sang-tae, CEO & President of DSME, said, "This newbuilding contract

represents solid partnership based on trust between DSME and Exceleerate Energy which previously placed order with DSME for 8 LNG-RVs along with Belgium-based Exmar. DSME will use this newbuilding LNG-FSRU contract as springboard to win orders for many projects in the period ahead."

Meanwhile, this order brings the total orders for DSME to 40 vessels and offshore facilities worth USD 8.94 billion in all so far this year, achieving 81.3% of its target of USD 11 billion for 2011.



Test-run of LNG-RV similar to the LNG-FSRU ordered to DSME. This LNG-RV was built independently by DSME.

## Nexans signed a contract to supply and install infield power cables for Riffgat offshore wind farm

Nexans signed a contract with Offshore-Windpark RIFFGAT GmbH & Co. KG, a project developer, in late August. Offshore-Windpark RIFFGAT GmbH & Co. KG is owned by Enova and EWE Energie. Nexans will supply and install infield submarine power cables and auxiliary equipments for the Riffgat offshore wind farm located 15km northwest of the German island of Borkum, which is currently under construction.

The Riffgat wind farm, occupying an area of 6km<sup>2</sup>, will consist of 30 wind turbines with a peak generating capacity of 108MW enough to meet the electricity needs of about 100,000 households. The Nexans manufacturing plant in Hannover, Germany, will design and manufacture 24km-long 33kV XLPE submarine infield cables to connect the wind turbines to one another and link

them to offshore substation. Nexans in Norway will undertake engineering, cable-laying and pulling, and cable installation, including the works for the protection of the cables laid on the sea bed using the special Capjet subsea excavator.

The cables will be delivered to the Riffgat wind farm by autumn of 2012, and the installation will begin in July, 2012.

Dirk Steinbrink, Executive Vice President in charge of High Voltage & Underwater Cable

sector of Nexans, said, "This contract attests to the unparalleled excellence of Nexans with proven track record in turnkey projects that includes the cable, accessory, and installation services, and is very important for cementing the position of Nexans as world's leading turnkey supplier in the offshore wind farm sector."

He added, "The Riffgat project is unusual because it is situated 18 to 23m deeper underwater than a majority of offshore wind farms currently being

constructed. So, it provides unique opportunity for Nexans to demonstrate its expertise in the production of the infield cables for deep-water offshore projects, specifically the infield cables that will be installed in much deeper water."

## DSME secured a contract to build 2 semi-submersible rigs for oil field exploitation project

Daewoo Shipbuilding & Marine Engineering (DSME) won an order for 2 semi-submersible rigs, thus exceeding its target of USD 10 billion for 2011.

DSME announced on September 6 (local time) that it signed a contract with Songa Offshore, a Norway-based offshore drilling company, to build 2 semi-submersible rigs. Besides, this contract includes an option for 2 additional units of the same class.

The value of this contract is approximately USD 1.1 billion. These semi-submersible rigs will be delivered to the ship owner by the second half of 2014. These offshore drilling rigs will be chartered to Statoil, a Norwegian state-run oil company, over the long-term for 8 years and operate in the coastal areas of Norway, North Sea, and polar regions.

Currently, Statoil is proceeding with an oil field exploitation project in mid-water of Norwegian continent shelf called 'Category-D'.

These semi-submersible rigs, which measure 116m in length and 97m in width, are equipped with state-of-art systems, including Dynamic Positioning System for deepwater application which consists of GPS system and computer controlled propulsion system and Positioning Mooring system which enables the operations even in shallow sea, and can operate at a maximum depth of about 500m and drill to a maximum depth of 8,500m.

Particularly, these semi-submersible rigs are multi-functional drilling rigs designed and built to enable even the well intervention operations in addition to the drilling functions, and thus are expected to gain spotlight as essential and efficient facility for current offshore oil field exploitation in various regions including the North Sea.

These semi-submersible rigs must meet the very rigorous NORSOK Standard (Norsk Søkkel Konkurransesposisjon), the Norwegian initiative to ensure safety and minimize the cost and time taken for the operations, considering that they will be operating under rough sea conditions and in intense cold weather of Norwegian coastal areas. For that, DSME applied cutting-edge technologies such as winterization technology to these drilling rigs. DSME successfully secured this contract by beating off fierce competition from the basic design phase based on its extensive track record in the con-

struction of semi-submersible drilling rigs for polar regions.

An official from DSME said, "DSME has maintained its leading position in the construction of semi-submersible drilling rigs, winning orders for a total of 25 semi-submersible drilling rigs and delivering 20 units so far. This contract will help pave the way for further growth in DSME's orderbook for semi-submersible drilling rigs necessary in the area of North Sea off Norway."

This new order brings DSME's total order book for ships and offshore facilities to 42 vessels worth USD 10.054 billion so far this year.



Nam Sang-tae (right), CEO & President of DSME, and Asbjorn Vavik (left), President of Songa Offshore, are shaking hands after signing a contract in Cyprus on September 6 (local time) to build semi-submersible rigs.



## HHI won a USD 400 million contract for 2 units of LNG carriers

Hyundai Heavy Industries (HHI) signed a contract to build 2 LNG (Liquefied Natural Gas) carriers, the high value-added vessels.

HHI announced that it entered into a USD 400 million contract on September 16 at its headquarters in Ulsan to build 2 units of 155,000m<sup>3</sup> LNG carriers in a signing ceremony attended by Kim Oi-hyun, Senior Executive Vice President of HHI, and Clarence Lui, CFO & Executive Vice President of BW Maritime.

This contract includes an option for 2 more vessels of the same type, raising the prospect for additional orders.

These vessels are membrane type LNG carriers which measure 288m in length, 44.2m in width, and 26m in height and fitted with Duel Fuel Diesel Engine (DFDE) system that can operate both on diesel and natural gas.

HHI plans to deliver these newbuilds to the ship owner in the second half of 2014 and in the first half of 2015, respectively.

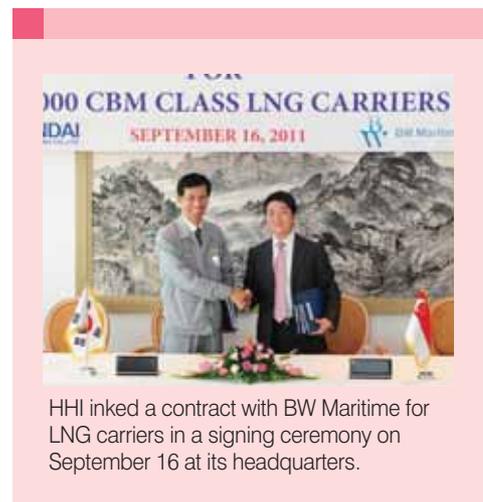
Including this order, HHI won orders for 8 LNG carriers (including 2 units ordered to Hyundai Samho Heavy Industries) and 2 orders for LNG-FSRUs (Floating, Storage, and Regasification Units) so far this year.

HHI, which constructed the nation's first indigenous LNG carrier in 1996, constructed an LNG carrier fitted with DFDE in 2007 for the first time nationwide. In 2009, HHI acquired certification of Classification Society for the LNG cargo tank that it developed independently. Besides, HHI began to develop the welding technology for polar LNG carrier tanks last year, taking the lead in developing technologies related to LNG carriers.

In addition, HHI signed a contract with the Norway-based Høegh in June to

build the world's first new LNG-FSRU, a LNG supply base at sea.

This year, HHI won orders for a total of 79 ships worth USD 17.1 billion (including the order intake of Hyundai Samho Heavy Industries) from the shipbuilding and offshore plant sectors, achieving approximately 87% of its annual new order target of USD 19.8 billion.



HHI inked a contract with BW Maritime for LNG carriers in a signing ceremony on September 16 at its headquarters.

## STX Europe clinched USD 420 million order for 2 offshore plants

STX Europe successfully won an order for Well Intervention Vessel, one of the high value-added vessels among offshore supply vessels.

STX Europe announced on September 8 that STX Finland, its subsidiary, secured an order worth a total of USD 420 million (EUR 300 million) for the construction of 2 Well Intervention Vessels from Eide Marine Services AS.

These vessels measure 122m in length and 45m in width with deadweight of 31,000 tons. Both will be built at Rauma shipyard in Finland and delivered by 2013. Well Intervention Vessels are capable of preliminary research for underwater oil and gas fields, construction support, follow-up maintenance, submarine pipe installation and deepwater drilling.

Particularly, well Intervention Vessels are considered high value-added vessels incorporating highly advanced shipbuilding technology as they are capable of independent works such as construction support for underwater oil fields, as well as simple support such as the supply of manpower, goods, etc, to the offshore platform.

These vessels to be built by STX Finland will operate on the continental shelf

off Brazil after delivery to the ship owner. Having secured this contract, STX Finland is moving to spur diversification into offshore plant sector.



Image of the Well Intervention Vessels to be built by STX Europe

Timo Suistio, the Chief Operating Officer (COO) of STX Finland, said, "These Well Intervention Vessels awarded to us are large projects that require enormous amount of works and collaboration via global network. Using this con-

tract as springboard, STX Finland will diversify its service portfolio into the offshore plant sector.

## STX Dalian was awarded a USD 240 million order for containerships

STX Dalian secured a contract for 8 units (including 6 optional vessels) of 2,000TEU containerships from SEACON (Sea Consortium Ptd., Ltd), a Singapore-based ship owner. This contract is valued at USD 240 million.

These containerships, which measure 172m in length, 30m in width, and 17m in height, will be built at the STX Dalian Shipbuilding Complex in China and will be delivered from April 2013 on a staggered basis.

STX Dalian successfully won this contract even in the midst of a decline in newbuilding containership orders placed worldwide, albeit moderate growth last year, in the aftermath of global financial crisis.

Having secured this contract, STX Dalian embarked on a full-scale diversification of ship models. STX Dalian which focused on the construction of ships such as bulk carriers and pure car carriers so far has diversified its portfolio of ship types. For instance, it was awarded a USD 240 million contract to build 3 units of 6,500TEU containerships from Shipping Corporation of India (SCI), the state-run shipping company, in November last year.

STX Dalian completed 'LOONG' system, its in-house shipyard operation sys-

tem, late last year, which has helped increase productivity remarkably. STX Dalian has an order backlog of USD 3.34 billion as of late August and is expected to build over 30 vessels throughout this year.

An official from STX Dalian Shipbuilding Complex said, "Despite somewhat sluggish market for containerships recently, STX Dalian successfully clinched this contract as it has garnered more widespread recognition from global ship owners for its unmatched technology and expertise. We will drive forward our sales activities with greater vigor in our attempt to win more orders."

## STX OSV recived a KRW 150 billion order for 3 trawler vessels

STX OSV announced on September 19 (local time) that it was awarded contract worth approximately a KRW 150 billion to build 3 trawler vessels for Aker Seafoods ASA.

These vessels measure 70m in length with a deadweight of 1,500 tons. The hulls will be constructed and outfitted partially at STX OSV's Braila shipyard in Romania, while the final fitting will be carried out at a shipyard in Norway. These vessels are scheduled for delivery from the second quarter of 2013 to the first quarter of 2014.

These vessels will feature 'FV 01', a design developed by STX OSV Design which is STX OSV's in-house design company.

These vessels dramatically enhanced environment performance according to the request of the ship owner. They feature twin-screw diesel propulsion engine that increases fuel efficiency, as well as the design that minimizes fuel consumption, and incorporated the catalyst technology to mitigate the emissions of harmful gases.

STX OSV has stood out in the field of fishing vessels built using cutting-edge technology that it has amassed in the platform supply vessel sector. STX OSV plans to use this trawler vessel contract as springboard to branch into the specialized vessel sector.

STX OSV Chief Executive Officer Roy Reite remarked, "These brandnew

trawlers are one of good examples showing our competence in building specialized vessels with the technology that we have amassed from the platform supply vessel sector. I hope that this contract will pave the way for sustained cooperation with Aker Seafoods ASA."



Image of the trawler vessels ordered to STX OSV

# SHIPBUILDING, MARINE, PLANT, OFFSHORE 해양 종합 산업 전시회 “KORMARINE”

## 2011

International Shipbuilding & Marine Exhibition

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Korean shipyards reclaimed the top spot in the global shipbuilding orders/order amount in 2011 after being overtaken by China in 2010 by a slight margin in terms of new orders, shipbuilding volumes and order backlog, thus cementing the status of the country as the world's largest shipbuilder.

The prediction at the beginning of the year was right on target. The order-book for high value-added ships, such as containership and LNG carriers, has grown and the newbuilding orders for offshore facilities have increased amid resumption of delayed projects in tandem with rising oil prices. Particularly, domestic shipyards which have high competitive edge in those 2

sectors have continued to win a wave of new orders since the beginning of the year.

According to UK-based shipping researcher Clarkson, domestic shipyards have maintained strong orderbook and been placed in the top cluster of world's leading shipyards.

Here, we take a close look at the performance of South Korean major 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), STX Offshore & Shipbuilding (STXOS), and others based on the order backlog data. 

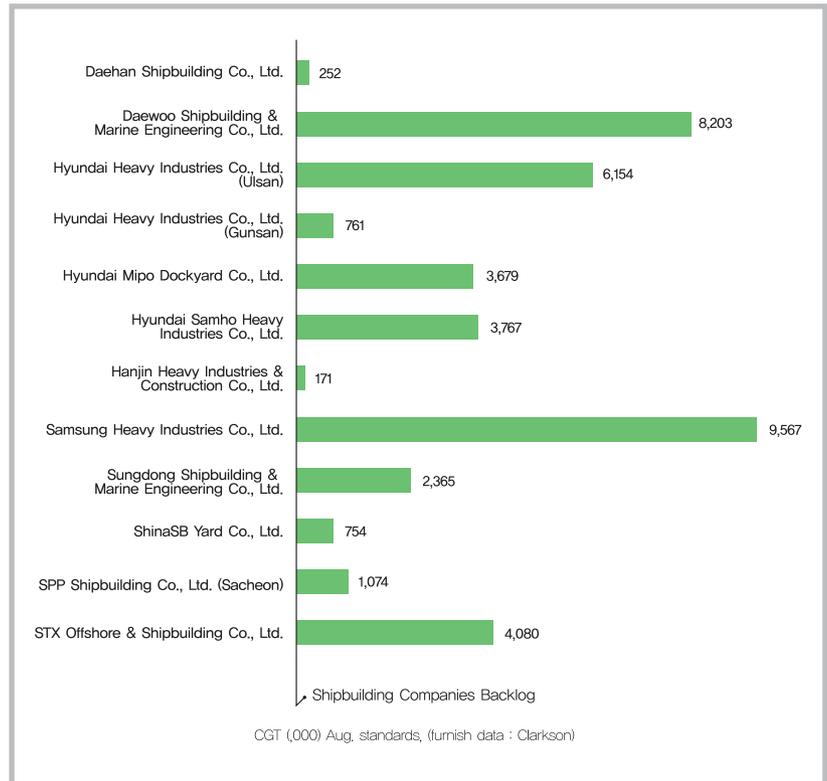


Photo: Sungdong Shipbuilding & Marine Engineering Co., Ltd.

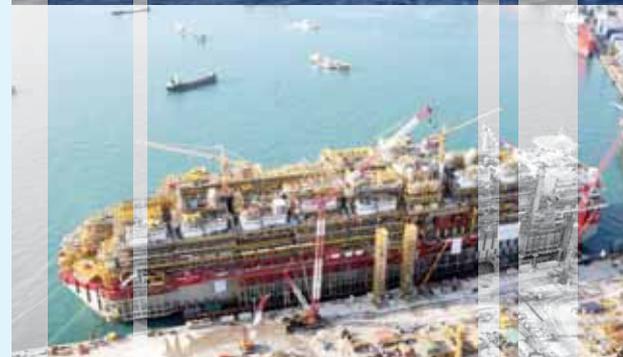


## Offshore plant orders awarded to domestic shipyards in 2011

Date	Type	Number of vessel	Amount	Ship owner
January	Drillship	1 vessel (including 1 optional vessel)	KRW 590 billion	Diamond Offshore Drilling Limited, U.S.A
	Offshore Plant	-	USD 900 million	RasGas, Qatar
	Drillship	2 vessels (including 2 optional vessels)	KRW 1 trillion 140 billion	Noble Drilling, U.S.A
	Deepwater drillship	1 vessel	-	Atwood Oceanics, U.S.A
February	Offshore facility carrier	1 vessel	KRW 265 billion	Dockwise, Netherlands
	FPSO for the North Sea	-	USD 1.2 billion	BP (British Petroleum), U.K
	Platform Supply Vessel	1 vessel	-	-
	Fisheries Research Vessel	1 vessel	EUR 35 million	Ministry of Fisheries and Marine Resources, Republic of Namibia
March	Offshore Platform (North Sea Drilling & Production platform, Quarters & Utilities platform)	1 unit each	USD 600 million	BP (British Petroleum), U.K
	Deepwater drillship	2 vessel (including 2 optional vessels)	KRW 1 trillion 200 billion	Aker Drilling, Norway
	Drillship	2 vessels	USD 1.1 billion	Ship owner, U.S.A
	Platform Supply Vessel	1 vessel	-	Norsea Group AS, Norway
	Platform Supply Vessel	1 vessel	-	-
April	Drillship	1 (including 1 optional vessel)	-	Fred Olsen Energy, Norway
	Drillship	2 vessels	USD 1.12 billion	Maersk, Denmark
	Drillship	1 vessel	USD 680 million	Ocean Rig, Greece
	Shuttle Tanker	2 (including 2 optional vessels)	USD 200 million	European Navigation, Greece
May	Drillship	2 (including 1 optional vessel)	USD 1.12 billion	Rowan, U.S.A
	Deepwater drillship	1 (including 1 optional vessel)	-	Vantage Drilling, U.S.A
	Offshore Platform (Top side of offshore platform)	-	USD 414 million	Statoil, Norway
	FPSO	1 vessel	USD 636 million	Teekay Petrojarl, Norway
	Platform Supply Vessel	2 vessels	Around KRW 120 billion	Farstad Shipping, Norway
	FSO	1 unit	-	PTSC, Vietnam
	LNG-FPSO	1 unit	USD 3.026 billion	Royal Dutch Shell, U.S.A
June	Platform Supply Vessel	2 vessels	Around KRW 150 billion	Island Offshore, Norway
	LNG-FSRU	2 units (including 2 optional vessels)	USD 500 million	Høegh LNG, Norway
	Multifunctional Deep Water Anchor Handling, Offshore Service Vessels	2 vessels	KRW 240 billion	Farstad Shipping, Norway
	Drillship	1 vessel	USD 680 million	Ocean Rig, Greece
July	Drillship	2 vessels	USD 1.1225 billion	Maersk, Denmark
August	LNG-FSRU (Floating Storage and Regasification Unit)	1 vessel	USD 280 million	Excelerate Energy, U.S.A
September	Semi-submersible rig	2 units	USD 1.1 billion	Songa Offshore, Norway
	Well Intervention Vessel	2 vessels	USD 420 million	Eide Marine Services AS, Norway

\*Note : 1. Based on the press release and public announcements of each shipyards, internal estimation of Monthly KORSHIP (estimation until September 15, 2011)

Delivery	Shipyard
Mid 2013	Hyundai Heavy Industries
Late 2013	Hyundai Heavy Industries
On a staggered basis until late September 2013	Hyundai Heavy Industries
Second half of 2013	Daewoo Shipbuilding & Marine Engineering
October, 2012	Hyundai Heavy Industries
Early 2015	Hyundai Heavy Industries
2012	STX OSV
Early 2012	STX Finland
Late 2014	Hyundai Heavy Industries
Second half of 2013	Daewoo Shipbuilding & Marine Engineering
-	Samsung Heavy Industries
Jun-12	STX OSV
2012	STX OSV
Aug-13	Hyundai Heavy Industries
-	Samsung Heavy Industries
Oct-13	Samsung Heavy Industries
2013	STX Offshore & Shipbuilding
Second half of 2013	Hyundai Heavy Industries
Late May, 2013	Daewoo Shipbuilding & Marine Engineering
-	Samsung Heavy Industries
Mid 2013	Samsung Heavy Industries
First half of 2013	STX OSV
Early 2013	Sungdong Shipbuilding & Marine Engineering
2016	Samsung Heavy Industries
First quarter, third quarter of 2013	STX OSV
Second half of 2013, first half of 2014	Hyundai Heavy Industries
From the second quarter of 2013	STX OSV
Nov-13	Samsung Heavy Industries
Jul-14	Samsung Heavy Industries
First quarter of 2014	Daewoo Shipbuilding & Marine Engineering
Second half of 2014	Daewoo Shipbuilding & Marine Engineering
2013	STX Finland





# Major vessels of Korea's leading shipyards

In 2011, Korean shipyards have outperformed their Chinese rivals by wide margin which rapidly closed the gap with the support of Chinese government amid recent global economic slowdown. Korea cemented its global leadership by receiving 8.92 million CGT in new orders, capturing 53.2% share in the global market (as of June).

This remarkable performance reflects the strong position of Korean shipbuilding giants almost sweeping newbuilding orders for high value-added ships (drillship, FPSO, LNG carrier,

er, LNG-FSRU, very large containership, etc). They plan to spur development and construction of high value-added ships using the world's most advanced technologies.

Here, we introduce major ships of Korea's 4 major shipyards which are Hyundai Heavy Industries (HHI), Daewoo Shipbuilding & Marine Engineering (DSME), Samsung Heavy Industries (SHI), and STX Offshore & Shipbuilding (STXOS). ⚓

## Hyundai Heavy Industries (HHI)



LNG-FPSO (LNG-Floating Production Storage-Offloading) of HHI



216,000m<sup>3</sup> LNG carrier built by HHI



309,000DWT VLCC built by HHI



11,700TEU containership built by HHI



Drillship of HHI

## Daewoo Shipbuilding & Marine Engineering (DSME)



LNG-RV of DSME



400,000-ton VLOC built by DSME



Semi-submersible drilling rig



Drillship of DSME



### Samsung Heavy Industries (SHI)



Drilship built by SHI



'Mozah', the world's largest LNG carrier built by SHI



- |   |   |
|---|---|
| 1 | 2 |
| 3 | 4 |

1. Large passenger ship, a pre-cruise ship phase unit, built by SHI
2. FPSO with a storage capacity of 2 million barrels, built by SHI
3. Very large containership of SHI
4. Semi-submersible drilling rig ordered to SHI from Seadrill



## STX Offshore & Shipbuilding (STXOS)



Platform Supply Vessel (PSV) built by STX OSV



'Oasis of the seas', the world's largest cruise ship, and 'Allure of the seas', built by STX Europe



1  
2 3

1. Test-run of 13,000TEU ultra large eco-friendly containership built by STXOS
2. 173,600m<sup>3</sup> LNG carrier delivered by STXOS in August, 2010
3. 'SKANDI AKER', an Off-Shore Construction Vessel (OSCV), built by STX Europe and awarded the Ship of the Year prize in SMM (international trade-fair for shipbuilding, machinery & marine technology) 2010



# StructureScan sonar imaging system for NSE

*Turn-On Electronics*

The StructureScan sonar imaging system option for NSE incorporates the most incredible SIMRAD echosounder technology. Users can enjoy the highest level of structure- and target -finding clarity, with the first and only true, panoramic underwater imaging with phenomenal picture-perfect display detail... to the left, right, and exclusively, straight down coverage below their vessels.

So users can reap a complete, bigger and better underwater picture for finding success, with added features. It is a giant leap above and beyond what a side imaging-only echosounder can ever achieve.

StructureScan has the following unique features:

**-SideScan imaging:** Crisp side-viewing dimensional detail, up to 152m/500ft, port to starboard, allows surveying more water in less time for productive locations. Reveals targets and their scan shadows - structure, game fish and baitfish alike.



**-DownScan imaging:** The SIMRAD innovation of dedicated sounding focused vertically beneath user's vessel removes all guess-work in



StructureScan

structure identification. Superior thermocline detection as well.

**-Broadband Sounder:** Advanced, NSE multi-function display with StructureScan soundings for an all-new view of structure and targets detail



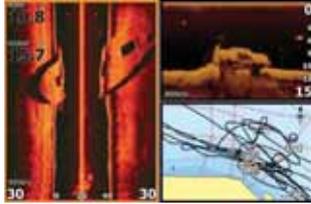
that's easier to interpret.

**-Navionics Guidance:** NSE Navionics compatibility, plus StructureScan, presents the best total on-the-water picture to enhance discovery success, above and below the surface.



New Product

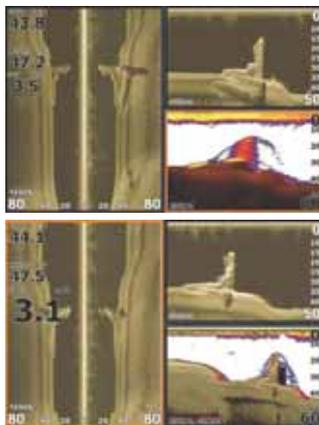
**-Pick your colour:** Select from an extensive NSE palette of display colour choices for the best viewing for water conditions and personal preference.



**-Exclusive DownScan Overlay Finding:** The patent-pending merger of DownScan Imaging with Broadband Sounder sonar in a single display uniquely separates fish from bottom and structure. DownScan Overlay (left) clearly exposes fish arch targets suspended over submerged trees.

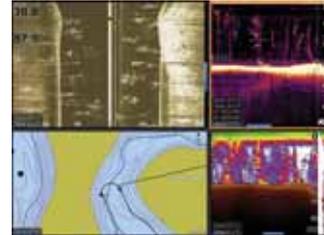


**-DownScan Overlay Illustrated:** These screen shots of a sunken bridge support in a Montana lake clearly displays the difference DownScan Overlay can make. Compare the lower right sonar windows of each. Without overlay (up), Broadband Sounder structure showing is excellent, but not well-defined. By adding DownScan Overlay (down) the structure - and fish - are clearly displayed.

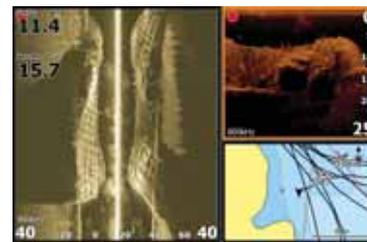


**-Unique multi-Window Display:** Add StructureScan

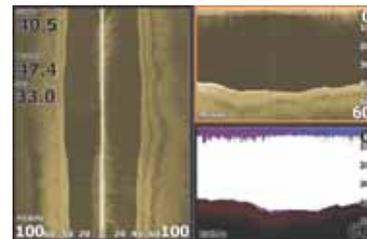
imaging system option to user's NSE and get the whole picture for wholly better targeting, with unique multi-window displays any combination of imaging, sonar and chartplotter views in up to four screen windows on NSE.



**-Synchronized TrackBack Tool:** Another special StructureScan target edge is simultaneous scroll-back in all imaging, sonar and chartplotter history displays for a time-and fuel-saving way to revisit covered water and easily set waypoints. When networked with other NSE displays with mapping, waypoints set on one are automatically posted to all.



**-Speedy Relief:** This screen view is seemingly unremarkable, until user notices the recorded boat speed -33 mph- and still showing StructureScan side- and down-looking imaging without fade or break-up. So user can cover more water, and find productive structure and target faster.



-TEL: +82-51-462-3930  
-http://www.turnon.co.kr

# Fiber optic patch cables and surge protection

Phoenix Contact Korea



Fiber optic patch cables



Surge protection for SMA antenna connectors in radio systems

Phoenix Contact is expanding its glass fiber optics product line to include the M12 circular plug connector. Now it is possible to fit indoor, flex and outdoor cables in variable lengths with all available connectors. In addition to the company's standard products, we also offer customized solutions tailored to customers' individual requirements.

Cables and connectors can be flexibly combined for use in a variety of settings, from offices (IP20) to rugged industrial environments (IP67). Order quantities as low as one piece are possible. The new ordering matrix in the catalog makes individual orders easy. Customers requiring solutions not offered in the catalog can order customer-specific products.

In addition to providing high data transmission rates, fiber optics can be easily installed in potentially explosive areas and is not susceptible to electromagnetic interference.

Meanwhile, the new CSMA-LAMBDA/4-2.0-BS-

SET coaxial protective adapter from Phoenix Contact protects radio system antenna connectors for narrow-band signals with a frequency range from 1.7GHz to 2.3GHz. The adapter is suitable for use with antenna connectors in cellular telephony, Trusted Wireless and IO radio systems.

The protective element is a  $\lambda/4$  rod that short-circuits surges lying +/-15% outside the nominal frequency of 2GHz. This technology provides a protection level without interfering with the useful signal. The protection device set consists of a surge protector and SMA connector adapters. The protection device can optionally be installed directly into the antenna line or on the terminal device without the need for an additional adapter cable. The CN-UB/MP mounting plate facilitates installation in the control cabinet.

-TEL: +82-31-740-9900  
-http://www.phoenixcontact.co.kr

# Thermal night vision imager

*FLIR Systems Korea*

FLIR Systems recently announced its latest addition to the First Mate family of handheld thermal night vision cameras, the First Mate MS. First Mate is the most popular line of handheld marine thermal night vision cameras in the world, giving every boater the power to see clearly whenever it's hard to see, even in total darkness. The new First Mate MS uses the same thermal imaging technology as FLIR Systems' best-in-class Navigator II, Voyager II, and M-Series thermal night vision systems, but it's even smaller, lighter, and more affordable than ever before. First Mate MS is ultra-compact, easy to use, weighs only 12 ounces, and has a long-life rechargeable Li-Ion battery in a rugged, all-weather design. Available in two resolutions for user's choice of image quality



(240x180 or 320x240) First Mate MS also has a 2x digital zoom capability and a host of other features.

First Mate MS

First Mate MS provides go-anywhere thermal night vision for everyone on the water.

-TEL: +82-2-565-2714~7  
-http://www.flir.com

## Emerson has introduced Super Duplex stainless steel Micro Motion Coriolis meters

Emerson Process Management now offers its MicroMotion High Capacity Coriolis meter in Super Duplex material to handle corrosive applications and harsh environments. The Super Duplex meter is available for line sizes from 8"-10" (DN 200-250mm) and improved pressure rating to 2,320 psi (160 bar). Super Duplex stainless steel offers the same reliability, accuracy and turn down performance as meters made with 316 stainless steel material, with the added benefit of increased corrosion resistance and pressure rating. Super Duplex delivers excellent resistance to high chloride levels found in the oil field, such as formation water, and is particularly well suited for measuring production fluids and medium pipeline pressure applications. Because of the corrosive compounds in crude oil, natural gas, and other hydrocarbon streams, more reliable and robust meters are required that can deliver highly accurate measurement over wide flow ranges.

The Micro Motion ELITE High Capacity Coriolis meter offers  $\pm 0.10$  percent mass and volume flow accuracy for liquids and mass accuracy of  $\pm 0.35$  percent for gas. The High Capacity Coriolis meter also offers density accuracies of  $\pm 0.0005$  g/cc and can handle a maximum liquid flow capacity of 94,000 lb/min (2,550 tons/hr).

Emerson's Micro Motion Coriolis meters are designed with no moving parts so they are not subject to wear or measurement drift associated with the rotating components of positive displacement (PD) or turbine meters. In addition, Micro Motion Smart Meter Verification delivers measurement confidence by verifying the complete meter performance (sensor, drive and signal processing) while the operation is flowing and without removing the meter from the line. Smart Meter Verification can check meter performance on a set schedule or at the touch of a button in minutes.

# Desiccant dehumidifier

Munters Korea



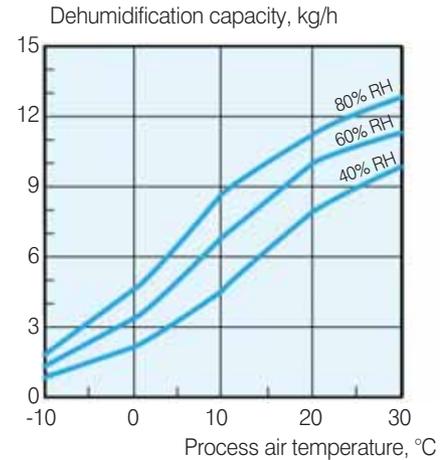
ML1350

The ML1350 desiccant dehumidifier is designed to efficiently dehumidify in low moisture applications. It is equipped with an internally sealed rotor unit. The rotor casing is constructed of durable thermoset plastic and contains isolated sections that provide a precise balance for dehumidification, reactivation, and heat recovery airflows. Its rugged formed metal frame and access panels are produced from corrosion resistant Aluzink.

The electrical control system conforms to EN 60204 (IEC204) standards. The electrical components are mounted on busbars and are constructed of halogen-free plastic. The electrical system is designed for up to 690V and 60°C. ML Series dehumidifiers conform to both harmonised European Standards and to CE marking specifications.

ML1350 has the following features:

- Advanced control panel: diagnostic fault display
- Unique plastic rotor casing 100% corrosion resistance
- Dehumidifies efficient down to -20°C.
- Dehumidifies to low dewpoint
- Interchangeable front and back panels - easier to install



Dehumidification Capacity: Approximate capacity in kg/h at different inlet process air relative humidity, % RH.

Hours run counter (monitors the number of hours the system is operational), Blocked filter alarm, rotor stopped alarm, humidity control system with alarm & display, and stainless steel sheet metal casing can be added as optional features.

## Munters rotor technology

Meanwhile, the desiccant rotor is manufactured from a corrugated composite material that is highly effective at attracting and holding water vapour. Every Munters dehumidifier applies a unique rotor technology. Airflows, air conditions, rotor sections, and rotor rotation speeds are optimised for specific applications. An innovative control system maximises the units energy efficiency.

A characteristic of the ML Series rotor technology is an extra rotor sector which provides high capacity, while simultaneously recovering heat, thereby effectively reducing the electrical power requirement.

-TEL: +82-2-761-8701  
-http://www.munters.co.kr



# KOMEA (Korea Marine Equipment Association)

## Member List

### AMS CO., LTD.

head office : SAHA-GU, BUSAN  
 homepage add : www.albatros.co.kr  
 main products : universal machine  
 TEL : +82 51-293-8641

### BUMHAN INDUSTRIES CO., LTD.

head office : Changwon Gyeongnam  
 homepage add : www.bumhan.com  
 main products : air compressor, high pressure air compressor,  
 high pressure air dryer & reducing stations  
 TEL : +82 55-251-6070

### BOYANG HARDWARE CO., LTD.

head office : Gimhae Gyeongnam  
 homepage add : www.byhd.co.kr  
 main products : stairway body, ladder, handrail & stormrail, other  
 outfittings, sanitary & furniture hardware  
 TEL : +82 55-345-1951/3

### BY CONTROLS INC.

head office : Gimhae Gyeongnam  
 homepage add : www.bycontrols.com  
 main products : control valves, hydraulic & pneumatic actuator,  
 valve remote control sys  
 TEL : +82 55-345-6110

### BC TAECHANG IND. CORP.

head office :  
 homepage add : www.bcinternational.co.kr  
 main products : water jet power pump, marine tape, petro tape,  
 corroshield bt  
 TEL : +82 55-333-1985

### CHK CO., LTD.

head office : Gangseo Busan  
 homepage add : www.chkj.co.kr  
 main products : fire damper, junction box, steel furniture, pilot  
 chair, cable box  
 TEL : +82 51-831-9500

### CMR KOREA CO., LTD.

head office : Geumjeong Busan  
 homepage add : www.cmrkorea.com  
 main products : Marine Telephone, Marine CCTV, Anemometer,  
 TEL : +82 51-521-2883

### CAPE INDUSTRIES LTD.

head office : Yangsan Gyeongnam  
 homepage add : www.capeind.com  
 main products : cylinder liner-man b&w, sulzer(wartsila)  
 TEL : +82 55-370-1234

### Emerson Process Management Marine Solutions Korea Co., Ltd.

head office : Saha-Gu, Busan  
 homepage add : www.emersonprocess.com/marine  
 main products : Valve Remote Control Systems, Tank Level  
 Gauge Systems, Marine Tank Management Systems  
 TEL : +82 51-602-5555

### DAEYANG INSTRUMENT CO., LTD.

head office : Saha-Gu, Busan  
 homepage add : www.daeayang.co.kr  
 main products : precision instrument-anemometer rudder angle  
 indicator, engine monitoring system, temperature sensor  
 TEL : +82 51-200-5303

### DAE JIN IND. CO., LTD.

head office : Gangseo Busan  
 homepage add : www.daejinqc.co.kr  
 main products : aluminium/steel/wooden furniture, catering  
 furniture, fire & gas damper a60  
 TEL : +82 51-831-4551

### DAE JIN DAMPHA CO., LTD.

head office : Ulju Ulsan.  
 homepage add :

main products : ceiling panel, wall panel  
 TEL : +82 52-225-2361

### DAECHUN INDUSTRIAL CO., LTD.

head office : Gimhae Gyeongnam  
 homepage add : www.daechun.co.kr  
 main products : multi core tube, stainless steel tube  
 TEL : +82 55-345-2288

### DAIHAN ANCHOR CHAIN MFG. CO., LTD.

head office : Nam-Gu Incheon  
 homepage add : www.dhac.co.kr  
 main products : anchor chain grade 2, anchor chain grade 3,  
 mooring chain r3, (stud & studless)  
 TEL : +82 32-862-0091/4

### DONG KANG M-TECH CO., LTD.

head office : Kangnam-Gu, Seoul  
 homepage add : www.dkmtech.com  
 main products : water jet,(hj212, hj292, hj322, hm461, hm817),  
 night navigator(nn-9000, nn-3000)  
 TEL : +82 2-553-0181

### DONG WOO MACHINERY & ENGINEERING CO., LTD.

head office : Changwon Gyeongnam  
 homepage add : www.hanyang-p.co.kr  
 main products : provision crane, hose handling crane, cargo m/r  
 room, center frame  
 TEL : +82 55-295-3261

### DONG-I INDUSTRIAL CO., LTD.

head office : Chin-ju Gyeongnam  
 homepage add : www.e-dongi.com  
 main products : marine gear box, hyd. steering system, power  
 take off  
 TEL : +82 55-755-9928

### DONGHWA ENTEC

head office : Gangseo Busan  
 homepage add : www.dh.co.kr  
 main products : e/r heater & cooler, plate cooler, frash water  
 generator, charged air cooler, lng cargo handling system,  
 TEL : +82 51-970-1000

### DOOSAN ENGINE CO., LTD.

head office : Changwon Gyeongnam  
 homepage add : www.doosanengine.com  
 main products : marine diesel engine, diesel power plant  
 TEL : +82 55-260-6000

### DONGNAM MARINE CRANE CO., LTD.

head office : Gimhae Gyeongnam  
 homepage add : www.dmcrcrane.co.kr  
 main products : hose handling crane, hose handling crane,  
 provision crane, engine room crane, offshore crane  
 TEL : +82 55-720-3001

### DAEMMSTOFF INDUSTRIE KOREA LTD.

head office : Saha-Gu, Busan  
 homepage add : www.daemmstoff.com  
 main products : KVM Sealing Compound, Mangana Retaining  
 Compound, Durasin Chocking Compound, Panda-90  
 TEL : +82 51-261-7073

### DAEYANG ELECTRIC CO., LTD.

head office :  
 homepage add : www.daeayang.co.kr  
 main products : lighting fixture, main switch board, fan, precision  
 instrument,  
 TEL : +82 51-200-5303

### DAE HEUNG COOLER CO., LTD.

head office : Pocheon Giyeonggi  
 homepage add : www.cooler.co.kr  
 main products : heat exchanger, gas cooler, oil cooler, air cooler,  
 water chiller  
 TEL : +82 31-532-9667/9

### DONG-A VALVE IND. CO.

head office :  
 homepage add :  
 main products : gate valves, globe valves, check valves(swing,  
 dual, single), strainer(basket, y-type)  
 TEL : +82 51-831-1500

### DK TECH CORPORATION

head office :  
 homepage add : www.dklok.com  
 main products : Instrumentation Fitting & Valve-Compression  
 Tubing Fitting, Pipe & Weld Fitting, Needle, Check, Ball, Plug  
 TEL : +82 55-338-0032

### DAE HEUNG MARINE CORP. LTD.

head office :  
 homepage add :  
 main products : rudder, block, bolster  
 TEL : +82 55-346-3663

### DONGJIN M.P. TECH CO., LTD.

head office :  
 homepage add : www.epmp.net  
 main products : Instrumentation Fitting & Valve-Compression  
 Tubing Fitting, Pipe & Weld Fitting, Needle, Check, Ball, Plug  
 TEL : +82 55-346-0303

### DAEYANG METAL CO., LTD.

head office : Saha-Gu, Busan  
 homepage add : www.dcm.co.kr  
 main products : chain wheel, main bearing support, uec center  
 piece, piston crown  
 TEL : +82 51-264-0831/5

### FINETEC CENTURY CORPORATION

head office : Kangnam-Gu, Seoul  
 homepage add : www.century.co.kr  
 main products : Air Conditioner, Chilling Unit, Air Conditioning  
 Equipment  
 TEL : +82 2-2185-7000

### GENERAL MARINE BUSINESS INC.

head office :  
 homepage add : www.gmbmarine.com  
 main products : ship shore communication sys. emergency  
 shutdown sys. trim/list indicator  
 TEL : +82 52-254-5215

### G.S HIGH TECHER CO., LTD.

head office : Gangseo Busan  
 homepage add : gshightecher.koreasme.com  
 main products : Air vent heads, Auto air vent heads, Pipe  
 coupling, Expansion joint  
 TEL : +82 51-832-0456

### GS-HYDRO KOREA LTD.

head office : Saha-Gu, Busan  
 homepage add : www.gshydro.co.kr  
 main products : Hydraulic Pipe, High Pressure Pipe, Steering  
 Gear Hydr. Pipe  
 TEL : +82 51-266-8221/5

### HY-LOK CORPORATION

head office :  
 homepage add : www.hy-lok.com  
 main products : HY-Lok Tube Fittings, Bite Type (DIN 2353, JIS  
 b2351) Fittings, 37°Flared Type(SAE J514) Fittings  
 TEL : +82 51-9700-800

### HANKUK MIBOO CO., LTD.

head office :  
 homepage add : www.hankookmiboo.co.kr  
 main products : Spiral Duct, Cold Chamber, Deck Covering  
 TEL : +82 51-263-3621

### HI AIR KOREA Co., Ltd.

head office :  
 homepage add : www.hiarkorea.co.kr

main products : Air Conditioning System, Refrigeration Plant, Package A/C, Ventilation Fan  
TEL : +82 55-340-5000

#### **HAN KOOK FLEXIBLE CO.**

head office :  
homepage add : www.hkflex.com  
main products : Flexible, Expansion Joint, Rubber Compensator  
TEL : +82 51-508-6291/3

#### **HANLA LEVEL CO., LTD.**

head office :  
homepage add : www.hanlalevel.co.kr  
main products : Cargo Tank Monitoring Sys. Tank Remote Sounding Sys. High Level Alarm Sys.  
TEL : +82 51-605-3000

#### **HALLA INDUSTRIAL CO., LTD.**

head office :  
homepage add : www.hallaiq.co.kr  
main products : Refrigeration Pumps (NH<sub>3</sub>, R22, NHO<sub>3</sub>, CO<sub>2</sub>), Volute Pumps, Turbine Pumps  
TEL : +82 51-264-2201/5

#### **HANSHIN ELECTRONICS CO., LTD.**

head office :  
homepage add : www.ehanshin.com  
main products : Public Address System (hpa-9600, hpa-9200, hpa-7300), Marine Telephone  
TEL : +82 51-412-5551

#### **HAN JO CO., LTD.**

head office : Yeongdo Busan  
homepage add : www.hanjoems.co.kr  
main products : expansion joint, Fuel Injection Pipe, Air Filter  
TEL : +82 51-414-7201

#### **HAEAN MACHINERY IND. CO., LTD.**

head office :  
homepage add : www.haean21.com  
main products : Marine Crane, Deck Machinery(Outfitting), Special Equipment  
TEL : +82 55-345-2024

#### **HYUNDAI LIFEBOATS CO., LTD.**

head office :  
homepage add : www.hdboat.com  
main products : Life Boat & Rescue Boat  
TEL : +82 52-237-4850/4

#### **HYUNDAI MARINE MACHINERY CO., LTD.**

head office :  
homepage add : www.hmmco.co.kr  
main products : Hyundai-Atlas Incinerator, Hyundai-Jowa 15ppm Bilge Separator, Auxiliary Blower, Ventilation Fan  
TEL : +82 32-583-0671

#### **HYUNDAI ELEVATOR CO., LTD.**

head office :  
homepage add : www.hyundaielevator.co.kr  
main products : Elevator, Escalator, Auto. Parking System  
TEL : +82 31-644-5114

#### **HYUNDAI WELDING CO., LTD.**

head office :  
homepage add : www.hdweld.co.kr  
main products : Covered Electrode ARC Welding Consumables, Sub-Merged ARC Welding Flux & Wire  
TEL : +82 2-6230-6010/2

#### **HYUN DAE FITTING CO., LTD.**

head office :  
homepage add : www.hdfco.co.kr  
main products : Flange, Stainless Steel, Duplex Stainless Steel, Forged Carbon Steel  
TEL : +82 51-831-0891

#### **HYUN JIN CO., LTD.**

head office :  
homepage add : www.hyunjinn.co.kr  
main products : Control Colsole, Light Signal, Column, Control Panel  
TEL : +82 51-263-9841

#### **HYUNJIN MATERIALS CO., LTD.**

head office : Gangseo Busan  
homepage add : www.hjmco.co.kr  
main products : Marine Engine Uses-Camshaft & C/Flange, Connecting Rod, Cross Head  
TEL : +82 51-602-7700

#### **HOSEUNG ENTERPRISE CO., LTD.**

head office : Gangseo Busan  
homepage add : hoseung.koreasme.com  
main products : Package Unit for Engine Room, Portable Tank, Ventilator, Cable Box  
TEL : +82 51-831-2233/4

#### **HOCHANG MACHINERY INDUSTRIES CO., LTD.**

head office :  
homepage add : www.hoc21.com  
main products : Deck Machinery, Hose Handling Crane, Provision Crane, Cell Guide  
TEL : +82 52-255-2000

#### **HAE WON INDUSTRY CO.**

head office :  
homepage add : haiwon1.koreasme.com  
main products : marine diesel engine parts(water seal, inflatable ring, mating ring, compact seal, cr-line)  
TEL : +82 51-831-4600

#### **HODU INDUSTRIAL CO.**

head office :  
homepage add :  
main products : ups & rectifier sys. hull stress monitoring sys. waste compactor  
TEL : +82 51-291-9512

#### **I.M.E. CORPORATION**

head office :  
homepage add : www.promarine21.com  
main products : engine valve & seat, all type engine  
TEL : +82 55-346-1127

#### **IL SEUNG CO., LTD.**

head office : Gimhae Gyeongnam  
homepage add : www.ilseung.co.kr  
main products : Sewage treatment plant. Biological type, Frash water generator. Plate. tubular type,  
TEL : +82 55-345-4114

#### **IL-SUNG IND. CO.**

head office :  
homepage add :  
main products : Hot water calorifier, Silencer(for m/e, g/e, fan), Mist eliminator, Washable air filter  
TEL : +82 51-312-4056

#### **JUNG GONG IND. CO., LTD.**

head office :  
homepage add : www.jung-gong.com  
main products : Ordinary window & side scuttle, Heated window, Fire resistant window & side scuttle, Window for passenger ship, Window box, Roller blind  
TEL : +82 51-261-2911

#### **JUNG-A MARINE CO., LTD.**

head office :  
homepage add : www.jung-a.co.kr  
main products : Accommodation ladder, Wharf ladder, Window wiper  
TEL : +82 51-831-4147

#### **DONGHWA PNEUMATIC TECHNOLOGY CO., LTD.**

head office :  
homepage add : www.jptec.co.kr  
main products : marine reciprocating air compressor, industrial air compressor, screw type air compressor  
TEL : +82 51-831-3227

#### **JUNGSAN ENTERPRISE CO., LTD.**

head office :  
homepage add : www.jungsan.com  
main products : Bolt & Nut (Exhaust valve, Cylinder cover, Connecting-rod, Main bearing & etc.)  
TEL : +82 52-254-3290

#### **JHK INC.**

head office : Gimhae Gyeongnam  
homepage add :  
main products : Container Fixed Fitting, Car Lashing Equipment  
TEL : +82 55-346-2225

#### **JONGHAP MACHINERY CO., LTD.**

head office : Yangsan Gyeongnam  
homepage add : www.jonghap.biz  
main products : sewage treatment plant, welding positioning equipment sys. parts former  
TEL : +82 55-383-2300

#### **JS CABLE LTD.**

head office : Cheonan Chungnam  
homepage add : www.js-cable.co.kr  
main products : offshore & marine cable, power cable, speciality cable, nuclear cable  
TEL : +82 41-559-4800

#### **KANGRIM HEAVY INDUSTRIES CO., LTD.**

head office : Changwon Gyeongnam  
homepage add : www.kangrim.com  
main products : boilers, marine & industrial, inert gas system(i.g.s.), i.g. & n.generator  
TEL : +82 55-269-7701

#### **KANGRIM INSULATION CO., LTD.**

head office : Saha-Gu, Busan  
homepage add : www.kangrim.com  
main products : lng & lpg carriers tank & pipe cryogenic insulation, lng receiving terminal tank & pipe cryogenic insulation  
TEL : +82 51-220-6001

#### **KUNSUL CHEMICAL IND. CO., LTD.**

head office : Jin-Gu Busan  
homepage add : www.jebi.co.kr  
main products : marine & heavy duty, protective coatings  
TEL : +82 51-892-4221/7

#### **KYUNG EUN CERAMICS CO., LTD.**

head office : Gimhae Gyeongnam  
homepage add : www.ke-ceramics.com  
main products : ceramic back-up tape  
TEL : +82 55-345-7761

#### **KUKDONG ELECTRIC WIRE CO., LTD.**

head office : Jincheon Chungbuk  
homepage add : www.cablekukdong.co.kr  
main products : shipboard cable, lan utp cable, power cable, rubber cable, pvc cable  
TEL : +82 43-530-2000/1, +82 2-2140-3061

#### **KUMKANG PRECISION CO., LTD.**

head office : Saha-Gu, Busan  
homepage add : www.kkmarine.co.kr  
main products : marine valve, valve for engine, air reservoir tank  
TEL : +82 51-262-4890

#### **KUMOH MACH. & ELEC. CO., LTD.**

head office : Gijang Busan  
homepage add : www.komeco.net  
main products : eng. & t/c tacho system, vibration measuring system, d/g engine control panel  
TEL : +82 51-724-5070

#### **KEYSUNG METAL CO., LTD.**

head office :  
homepage add : www.keysungmetal.com  
main products : valves for marine & offshore plant, cryogenic valves, strainer  
TEL : +82 51-831-3391

#### **K. C. LTD.**

head office :  
homepage add : www.iccp-mgps.com  
main products : I.C.C.P. System, Anti-fouling System(M.G.P.S.), Shaft Earthing Device  
TEL : +82 51-831-7720

#### **KSP CO., LTD.**

head office :  
homepage add : www.kspvalve.com  
main products : Engine Valve, Flange  
TEL : +82 51-831-6270/7

**KTE CO., LTD.**

head office :  
 homepage add : www.kte.co.kr  
 main products : Marine Switchboard(high, low), Marine Control Console, Alarm Monitoring System, Thruster  
 TEL : +82 51-265-0255

**KOKACO CO., LTD.**

head office :  
 homepage add :  
 main products : Exhaust Valve & Valve Seat Grinding Machine, Nozzle Lapping Machine  
 TEL : +82 51-403-4114/6

**KONGBERG MARITIME KOREA LTD.**

head office :  
 homepage add : www.km.kongsberg.com  
 main products : IAS, DP, K-Chief 500, Auto Chief c20, K-Gauge, K-Bridge, MIP, MBB  
 TEL : +82 51-749-8600

**KEYSTONE VALVE(KOREA) LTD.**

head office : Anseong Gyeonggi  
 homepage add : www.tycovalves.com  
 main products : Butterfly Valve, Ball Valve, Safe Valve  
 TEL : +82 31-670-2500

**KEON CHANG IND. CO., LTD.**

head office :  
 homepage add : www.keonchang.co.kr  
 main products : marine equipment, ladle turret, roll stand assy, side trimmer & chopper, bloom c c, screw conveyor, etc.  
 TEL : +82 51-203-0161

**KWANG SAN CO., LTD.**

head office :  
 homepage add : www.kwangsan.com  
 main products : heating coil, sus spool, air vent head, expansion joint  
 TEL : +82 51-974-6301

**KEUMYONG MACHINERY CO., LTD.**

head office : Buk-gu, Daegu  
 homepage add : www.keumyong.com  
 main products : exhaust valve complete with valve spindle, axial vibration damper  
 TEL : +82 53-608-8110/6

**KWANG SUNG CO., LTD.**

head office :  
 homepage add : ikwangsung.com  
 main products : t-girder, panel, stair, handrail, inclined ladder,  
 TEL : +82 55-338-9973

**KUK DONG ELECOM CO., LTD.**

head office : Saha-Gu, Busan  
 homepage add : www.kukdongelecom.com  
 main products : marine & offshore light fixtures, explosion-proof lights, flood & search lights, mgf packing system  
 TEL : +82 51-266-0050

**KYUNGSUNG INDUSTRY CO., LTD.**

head office : Gangseo Busan  
 homepage add : www.e-clamp.com  
 main products : clamp, sus corner, anchor strip  
 TEL : +82 51-831-4960

**LS CABLE LTD.**

head office :  
 homepage add : www.lscable.co.kr  
 main products : marine shipboard & offshore cable, bare conductor wire, (pvc/pe/xlpe/rubber) power & control cable  
 TEL : +82 2-2189-9114

**LEE YOUNG INDUSTRIAL MACHINERY CO., LTD.**

head office : Ulju Ulsan  
 homepage add : www.leeyoung.co.kr  
 main products : engine casing, corr. bhd, upper deck, built-up longitudinal, chain locker, lashing bridge  
 TEL : +82 52-231-5800

**MIN SUNG CO., LTD.**

head office : Sasang Busan

homepage add : www.minth.co.kr  
 main products : cable tray, hatch, electric cable box  
 TEL : +82 51-305-8862

**MtH CONTROL VALVES CO., LTD.**

head office :  
 homepage add : www.mth.co.kr  
 main products : crankcase relief valve, main starting valve, pneumatic control valve, safety relief valve  
 TEL : +82 51-974-8800

**MSL COMPRESSOR CO., LTD.**

head office : Pocheon Giyeonggi  
 homepage add : www.mslcomp.com  
 main products : breathing air compressor, h,p air compressor, n2 gas booster  
 TEL : +82 31-853-7000

**MYCOM KOREA CO., LTD.**

head office :  
 homepage add : www.mycomkorea.com  
 main products : screw compressor unit, reciprocating compressor unit, condensing unit, brine chilling unit  
 TEL : +82 55-294-8678

**MYCOM KOREA CO., LTD.**

head office :  
 homepage add : www.mycomkorea.com  
 main products : screw compressor unit, reciprocating compressor unit, condensing unit, brine chilling unit  
 TEL : +82 55-294-8678

**Myung Sung Engineering Co., Ltd.**

head office : Mokpo Jeonnam  
 homepage add :  
 main products : rudder & rudder stock, rudder horn, stern roller  
 TEL : +82 61-276-7650

**Marine Radio Co., Ltd.**

head office :  
 homepage add : www.mrckorea.com  
 main products : public address system, auto tel. exchanger sys. communal aerial sys. marine clock system  
 TEL : +82 51-414-7891

**NK CO., LTD.**

head office :  
 homepage add : www.nkcf.com  
 main products : ballast water system, co2system, deck foam system, dry power system  
 TEL : +82 51-204-2211/3

**ORIENTAL PRECISION & ENGINEERING CO., LTD.**

head office :  
 homepage add : www.opco.co.kr  
 main products : deck house, funnel & engine room casing, life boat davit, engine room crane  
 TEL : +82 51-202-0101

**OSCG CO., LTD.**

head office : Sasang Busan  
 homepage add : www.oscg.net  
 main products : cable gland(eexd & e), adapter / reducer, flexible connectors  
 TEL : +82 51-305-3910

**PANASIA CO., LTD.**

head office : Gangseo Busan  
 homepage add : www.pan-asia.co.kr  
 main products : cargo monitoring sys. tank level gauge sys. high & overflow alarm sys.  
 TEL : +82 51-831-1010

**SARACOM CO., LTD.**

head office : Yeongdo Busan  
 homepage add : www.saracom.net  
 main products : gmdss, ship sound signal appliances, navigation equipment, fire detection system  
 TEL : +82 51-600-9000

**SAMGONG Co., Ltd**

head office :  
 homepage add : www.sam-gong.co.kr  
 main products : oil purifiers, ships accommodation ladders, ships

windows  
 TEL : +82 51-200-3040/1

**SAMYOUNG MACHINERY CO., LTD.**

head office : Daedeok Daegeon  
 homepage add : www.sym.co.kr  
 main products : cylinder head, cylinder liner, piston  
 TEL : +82 42-625-4064

**SAMYUNG ENC CO., LTD.**

head office :  
 homepage add : www.samyungenc.com  
 main products : ais(si-30)-auto. identification sys. dsc vhf radio telephone(str 6000a)-gmdss equipment  
 TEL : +82 51-601-6601

**SUH HAN INDUSTRY CO., LTD.**

head office :  
 homepage add : www.suhhani.co.kr  
 main products : cable tray others-steel, galvanized steel, stainless steel, aluminium  
 TEL : +82 51-204-1920

**SEOHAE MARINE SYSTEM CO., LTD.**

head office :  
 homepage add : www.seohae-ms.com  
 main products : hatch-pontoon type, folding type, side rolling type, etc. lashing equipment-2/3tier  
 TEL : +82 51-204-8408

**SUNBO INDUSTRIES CO., LTD.**

head office :  
 homepage add : www.sunboind.co.kr  
 main products : tank top unit, engine room unit, package unit  
 TEL : +82 51-261-3454

**SUNG KWANG BEND CO., LTD.**

head office :  
 homepage add : www.skbend.com  
 main products : pipe fittings-butt. welding / socket welding / thread type/ flange  
 TEL : +82 51-3300-200

**SUNG MI CO., LTD.**

head office :  
 homepage add : www.sung-mi.co.kr  
 main products : fire retarding doors, fire retarding wall, ceiling panel  
 TEL : +82 55-329-1117

**SUNGSIN INDUSTRIES CO., LTD.**

head office :  
 homepage add : sunsin.koreasme.com  
 main products : hatch coaming, t-bhk block, fore mast & port, water separator  
 TEL : +82 54-776-6441

**SUNG IL CO., LTD. (SIM)**

head office :  
 homepage add : www.sungilsim.com  
 main products : pipe spool fabrication, induction pipe bending, marine engine pipe  
 TEL : +82 51-831-8800

**ESAB SeAH CORP**

head office :  
 homepage add : www.esab.co.kr  
 main products : welding consumable, welding equipments  
 TEL : +82 55-289-8111

**SEUN ELECTRIC CO., LTD.**

head office :  
 homepage add : www.seunelectric.co.kr  
 main products : battery charger and dist. board. full auto. charging sys. lcd display monitor  
 TEL : +82 51-208-4641

**SE-WON INDUSTRIES CO., LTD.**

head office :  
 homepage add : www.sewon-ind.com  
 main products : high velocity p/v valve, gas free vent cover, flame screen  
 TEL : +82 51-728-4191

**SAEJIN INTECH CO., LTD.**

head office :

homepage add : www.sjhind.com  
main products : emergency towing system, telescopic radar post,  
deck fittings(mooring fitting), industrial m/c & etc.  
TEL : +82 55-328-1770

#### **SE JIN IND. CO., LTD.**

head office : 61-68 Ungnam-dong, Changwon-si,  
Gyeongsangnam-do.  
homepage add : www.sejin89.co.kr  
main products : piping, h.f.o supply unit, purifier module each kind  
TEL : +82 55-239-4700

#### **SPECS CORPORATION**

head office :  
homepage add : www.specs.co.kr  
main products : system division-oil mist detector, portable level  
temp/oil  
TEL : +82 31-706-5211

#### **SHIN DONG DIGITECH CO., LTD.**

head office :  
homepage add : www.shindong.com  
main products : satellite tv sets-satellite communication  
equipments, draft buoy(1m, 1.6m, 2.4m disc buoy)-ocean  
information technology division  
TEL : +82 51-467-5001

#### **SIL LA METAL CO., LTD.**

head office :  
homepage add :  
main products : propeller(f.p.p.), c.p. propeller blade & hub,  
propeller shaft, inter shaft  
TEL : +82 51-831-5991/8

#### **SHINMYUNG TECH CO., LTD.**

head office :  
homepage add :  
main products : air & electric winch-0.2ton ~ 10ton, air motor-1p ~  
25p, davit (all)-0.2ton ~ 5ton  
TEL : +82 55-363-7091

#### **SHINSUNG DIESEL KIKI CO.**

head office :  
homepage add : nozzle.koreasme.org  
main products : for marine engine-nozzle, plunger assy, delivery  
valve assy  
TEL : +82 51-264-8829, 262-8869

#### **SHIN SHIN MACHINERY CO., LTD.**

head office :  
homepage add : www.sspump.com  
main products : centrifugal pumps, gear pumps, screw pumps,  
submersible pumps  
TEL : +82 51-727-5300

#### **SHINA METALTECH CO., LTD.**

head office :  
homepage add : www.shinametal.com  
main products : white metal bearings-marine metal bearing,  
automotive metals  
TEL : +82 52-298-2100/4

#### **SHIN YOUNG HEAVY INDUSTRIES CO.,LTD**

head office :  
homepage add : www.syhico.com  
main products : oil & gas system, hydraulic system  
TEL : +82 61-800-3700

#### **S & W CORPORATION**

head office :  
homepage add :  
main products : cam & camshaft, valve spindle & seat ring, piston  
pin  
TEL : +82 51-205-7411

#### **S.A. MART CO., LTD.**

head office :  
homepage add : www.samartkr.com  
main products : control lever, control cable, hydraulic steering  
system, auto pilot system, stern drive system  
TEL : +82 32-815-6314

#### **STX ENGINE CO., LTD.**

head office :  
homepage add : www.stxengine.co.kr

main products : marine diesel engine, military diesel engine, gas  
engine, gas turbine  
TEL : +82 55-280-0114

#### **SIMULATION TECH INC.**

head office : Geumcheon Seoul  
homepage add : www.simulationtech.co.kr  
main products : Emergency Shutdown System, Grease  
Extractor/de-Oiler, Operator Training Simulator  
TEL : +82 2-3281-0960

#### **SHINHAN MACHINERY CO., LTD.**

head office :  
homepage add : www.shinerpia.com  
main products : deck house, engine casing & funnel, fore/after-  
end block & others  
rudder, living quarters  
TEL : +82 52-231-3525

#### **SAMGONG INDUSTRIAL CO., LTD.**

head office : Pyonghaek Gyeonggi  
homepage add : www.samgong.com  
main products : inflatable rubber products  
TEL : +82 31-654-4805/6

#### **SIN YOUNG ENTERPRISE CO., LTD.**

head office : Gimhae Gyeongnam  
homepage add : www.sy-ind.com  
main products : main hole, access hatch, bollard  
TEL : +82 55-346-0034

#### **SUNG JIN GEOTEC CO., LTD.**

head office : Namgu Ulsan  
homepage add : sgtkor.co.kr  
main products : bulbous bow, stern block, hull block, module,  
Ing/lpg tank  
TEL : +82 52-228-5801

#### **STACO CO., LTD.**

head office : Gangseo Busan  
homepage add : www.staco.co.kr  
main products : Wall Panel, Ceiling Panel, Unit Toilet, Cabin Door,  
Furniture,  
TEL : +82 51-831-7000

#### **STX ENPACO CO., LTD.**

head office :  
homepage add : www.stxenpaco.co.kr  
main products : turbocharger, diesel engine parts, marine equip.  
TEL : +82 55-282-1131

#### **SEOUL ELECTRIC CABLE CO., LTD.**

head office : Eum-seong Chungbuk  
homepage add : www.seoulcable.com  
main products : offshore & shipboard cables, travelling cables,  
high voltage power cables  
TEL : +82 43-879-7200

#### **SMECO**

head office :  
homepage add :  
main products : piston, piston liner, piston skirt  
TEL : +82 41-864-3030

#### **SURO PROPELLER & MACHINERY CO**

head office : Yeongdo Busan  
homepage add : www.suropump.co.kr  
main products : Propeller(d : 2500mm), Shaft (l : 6m), Pump  
TEL : +82 51-415-0444

#### **SHIN-A ENTERPRISE CO., LTD.**

head office : Saha Busan  
homepage add : www.shina-ent.com  
main products : navigation equipment, communication equipment,  
monitoring system equipment  
TEL : +82 51-204-6221/5

#### **TK CORPORATION**

head office :  
homepage add : www.tkbend.co.kr  
main products : Elbow, Reducer, Tee, Cap  
TEL : +82 51-831-6550

#### **TAE YOUNG TRADING LTD.**

head office : Junggu Seoul

homepage add : www.marine-material.com  
main products : Receptacles & Wire Accessories, Floodlight,  
Deck Light, Reflected Lamps  
TEL : +82 2-2272-1960

#### **TANKTECH Co., Ltd.**

head office :  
homepage add : www.tanktech.co.kr  
main products : High Velocity P/V Valve, Local Fire Fighting Sys.  
Tank Cleaning Machine  
TEL : +82 51-979-1600

#### **TECHMARINE S/W CO., LTD.**

head office :  
homepage add : www.techmarine.net  
main products : Loading Computer System  
TEL : +82 51-467-7003

#### **FRIEND CO., LTD.**

head office : Gangseo Busan  
homepage add : www.tsdream.co.kr  
main products : cable tray, heating coil, strainer  
TEL : +82 51-974-7900

#### **TMC CO., LTD.**

head office : Cheonan Chungnam  
homepage add : www.tmc-cable.com  
main products : marine cable, optical fiber cable  
TEL : +82 2-771-3434

#### **WARTSILA ACCOMMODATION SYSTEMS KOREA, INC.**

head office : Goseong Gyeongnam  
homepage add : www.waskorea.co.kr  
main products : unit toilet, unit cabin, wall panel, ceiling panel,  
door  
TEL : +82 55-673-7315

#### **WOOSUNG IND. CO., LTD.**

head office :  
homepage add :  
main products : steel door, ventilator, mooring fitting, h/c fitting,  
hand rail  
TEL : +82 55-331-1651

#### **WHA YOUNG CO., LTD.**

head office : Miryang Gyeongnam  
homepage add : www.whayoung.co.kr  
main products : Supply Unit Assy, Collector Block Assy, Fuel &  
Exh. Movement, Fuel Pump Assy  
TEL : +82 55-359-1100

#### **WILSON WALTON CORRPRO KOREA**

head office :  
homepage add : www.wvwkorea.com  
main products : i.c.c.p system, m.g.p.s, s.g.d  
TEL : +82 51-831-0131

#### **YOUNG KWANG MACHINE CO., LTD.**

head office :  
homepage add : www.ykme.co.kr  
main products : package unit, group unit, module unit for industrial  
plant  
TEL : +82 54-776-5456/9

#### **YOOWON INDUSTRIES LTD.**

head office :  
homepage add : www.yoowonind.com  
main products : steering gear, auto filter, deck machinery  
TEL : +82 51-205-8541

#### **YOUJEON STEEL CO., LTD.**

head office : Changwon Gyeongnam  
homepage add : www.youjeonsteel.co.kr  
main products : Marine Engine Parts-Engine Bed  
TEL : +82 55-297-2121

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

- Address : 85, Da-dong, Jung-gu, Seoul, Korea • Tel : +82-2-2129-0114 • Fax : +82-2-2129-0077~8 • <http://www.dsme.co.kr>
- Products : LNG Carriers, LNG-RVs, LNG-FPSOs/FSRUs, LPG Carriers, LPG-FPSOs, ULCCs, VLCCs, Suezmax/Aframax/Panamax Tankers, Shuttle/Chemical Tankers, Product Carriers, Containerships, Capesize/ Kamsarmax/ Supramax Bulk Carriers, Ore Carriers, VLOCs, Ro-Ro Ships, PCTCs, Passenger Car Ferries, FPSOs, FSOs, FPU, Drill Ships, Semi-Submersible Drilling Rigs, Fixed Platforms, Submarines, Submarine Rescue Vessels AUVs, Destroyers, Battle Ships

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### SAMSUNG HEAVY INDUSTRIES CO., LTD. (SHI)

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

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### SLS SHIPBUILDING CO., LTD.

- Address : 227, Danam-dong, Tongyeong, Gyeongnam, Korea • Tel : +82-55-640-3301/3340 • Fax : +82-55-649-2114 • <http://www.slsship.co.kr>
- Products : 43,000DWT Stainless Steel Chemical Tanker, 44,000DWT Chemical Tanker, 45,000DWT Chemical Tanker, 51,000DWT Product/Chemical Tanker, 49,700DWT Product Oil Tanker, 41,000DWT Product/Chemical Tanker, 40,000DWT Product/Chemical Tanker, 58,000DWT Supramax Bulk Carrier

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### HYUNDAI MIPO DOCKYARD CO., LTD. (HMD)

- Address : 1381, Bangeo-dong, Dong-gu, Ulsan, 682-712 Korea • Tel : +82-52-250-3031~3040 • Fax : +82-52-250-3056 • <http://www.hmd.co.kr>
- Products : Product/Chemical Tankers, Containerships, Self-Unloading Bulk Carriers, Multipurpose Cargo Carriers, Drillships, Cable Layers, Pipe Layers, FPSOs, Car Ferry & Passenger Ships, LPG Carriers, Pure Car / Truck Carriers, General Cargo Carriers, Ro-Ro Vessels

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

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

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### HYUNDAI HEAVY INDUSTRIES CO., LTD. (HHI)

- Address : 1, Jeonha-dong, Dong-gu, Ulsan, Korea • Tel : +82-52-202-2114 • Fax : +82-52-202-3470 • <http://www.hhi.co.kr>
- Products : Bulk Carriers, Containerships, Tankers, VLCCs, Product Carriers, Multi-purpose Cargo Ships, OBO Carriers, Pure Car Carriers, LPG Carriers, Ro-Ro Ships, Chemical Tankers, Offshore Rigs/Barges, LNG Carriers, Passenger Ships, Drill Ships, Special & Naval Ships, FPSO, FSO, Semi-submersible Drilling Rig, Other Vessels

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### HANJIN HEAVY INDUSTRIES & CONSTRUCTION CO., LTD.

- Address : 29, 5-ga, Bongnae-dong, Yeongdo-gu, Busan, Korea • Tel : +82-51-410-3240 • Fax : +82-51-410-8477 • <http://www.hanjinsc.com>
- Products : Container Carriers, Product/Chemical/Crude Oil Tankers, LNG/LPG Carriers, Cable Ships, Supply Boats, Semi-Submersible Drilling Rigs, Dredgers, Naval Ships, Special Purpose Ships, Bulk Carriers

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### STX OFFSHORE & SHIPBUILDING CO., LTD.

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

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### DAESUN SHIPBUILDING & ENGINEERING CO., LTD.

- Address : 12, 4-ga, Bongrae-dong, Yeongdo-gu, Busan, Korea • Tel : +82-51-419-5090~1 • Fax : +82-51-416-7965 • <http://www.daesunship.co.kr>
- Products : Container Ships, Bulk Carriers, Tankers, MPC & General Cargo Ships, Gas Carriers, Ro/Ro ships, Tug Boats, Fishing Boats/Vessels, Special Purpose Vessels



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