

Kawasaki Gallery
Heizo Kanayama's World



Place Pigalle in the Rain, 1915, 60.1 x 72.1 cm, oil on canvas, from the collection of Hyogo Prefectural Museum of Art.

A Parisian Square in the Rain

Shusaku Sagara, Associate Curator, Hyogo Prefectural Museum of Art

In 1912, Kanayama traveled to Europe to study and spent some four years visiting every corner of the continent, mostly France, producing scores of paintings along the way. He also spent a considerable amount of time studying the high-quality oil paints used by European artists. Thanks to the knowledge he acquired during his travels, Kanayama was able to create works that retained their original hues.

In his last year in Europe, Kanayama stayed at a hotel facing Place Pigalle, today a famous red-light district in Paris, perhaps because of its proximity to Montmartre. This piece was presumably painted during that stay. A study with a nearly identical composition, and a version depicting the scene on a

sunny day, *Place Pigalle in the Day*, also exist. Painting the same scene at different times of the day to capture its changing profile is a method reminiscent of Claude Monet's. Yet an approach that focuses on rendering the nuances in varying weather is a hallmark of Kanayama's works — he continued to refine his technique for depicting moisture and water throughout his life. Using a pointillist style in the manner of the Impressionists, the artist here gives a precise rendition of the wet road surface and building facades, as well as the people and cars passing along Boulevard de Clichy. The plants encircling the fountain, rendered in vivid green, stand out as a geometric element adding structure to a work that is marked by its deep lyricism.



Heizo Kanayama and Kawasaki

Heizo Kanayama (1883 -1964) went to Europe in 1912, after graduating at the top of his class from the Tokyo University of the Arts. He won the second prize at the Ministry of Education Art Exhibition in 1916, and went on to create many masterpieces in which nature is a recurring theme. Kanayama left an indelible imprint on the history of modern art in Japan.

The Shipyard, exhibited at the Ministry of Education Art Exhibition in 1917 (and featured in *Scope 83*), is the work that first brought Kawasaki and Kanayama together. Toward the end of Kanayama's life, Kawasaki agreed to the artist's request to permanently house 138 pieces of his artwork. Kawasaki has since donated a major portion of this collection to the Hyogo Prefectural Museum of Art.

Scope

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Precision Machinery Business Makes Great Strides in China

A Visit to the Front Lines in China and the Mother Factory in Japan



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About the Cover

The cylinders of a hydraulic pump before pistons are loaded into the elliptical holes. Pumps are a crucial component for controlling hydraulic excavators. See Frontline for an in-depth look at Kawasaki's growing precision machinery business in China.

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Scope

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Kawasaki's precision machinery business is thriving, growing threefold in the past few years.

The main driver behind this growth is hydraulic equipment for Chinese-made construction machinery. Backed by a rapidly expanding economy, China is heavily investing in large-scale land and urban development projects. It is now the world's biggest market for construction machinery—especially hydraulic excavators—with further growth projected in the long run.

Kawasaki operates several local bases in China: Kawasaki Precision Machinery Trading (Shanghai) Co., Ltd. for sales and services, and Kawasaki Precision Machinery (Suzhou) Ltd. and Kawasaki Chunhui Precision Machinery (Zhejiang) Ltd. for production. At the Suzhou site, a new plant launched full-scale operations in November 2011, doubling production capacity. Back at Kawasaki's Nishi-Kobe Works in Japan, the mother factory for the global precision machinery business, production of core parts continues in high gear.

Hydraulic pumps being assembled for excavators at the new Kawasaki Precision Machinery (Suzhou) Ltd. plant, which produces high-quality hydraulic equipment using the same production facilities and manufacturing skills as at the Nishi-Kobe Works.

Completion of New Plant Doubles Annual Capacity to 110,000

● Replicating the Quality of Nishi-Kobe Works

The city of Suzhou, Jiangsu Province, is a two-hour drive from Shanghai. In a corner of the city's industrial district sits the new plant of Kawasaki Precision Machinery (Suzhou) Ltd., or KPM (Suzhou), where production began full swing on November 1, 2011. KPM (Suzhou) is a wholly owned subsidiary of Kawasaki, established in December 2005 as a manufacturing base for hydraulic components of construction machinery in China.

The new 13,500 m² plant has production lines from an old plant nearby, as well as new facilities to boost production capacity.

Using pistons, cylinders and other core parts supplied from the Nishi-Kobe Works, KPM (Suzhou) can now produce 60,000 hydraulic pumps and 50,000 hydraulic motors a year, bringing the combined total to 110,000—double the capacity of the old plant. When combined with the 40,000 hydraulic pumps manufactured at Kawasaki Chunhui Precision Machinery (Zhejiang) Ltd., or KCPM, in Shangyu, Zhejiang Province, the annual production capacity in China for both products totals 150,000.



Kawasaki's new plant began full-scale operations on Nov. 1, 2011. It can produce 60,000 hydraulic pumps and 50,000 hydraulic motors a year, twice the capacity of the old plant.

● Earning the Users' Trust

KPM (Suzhou) spares no effort to provide products that meet the requirements of Chinese construction machinery manufacturers. The lineup of hydraulic equipment offers a wide range of choices, and minute performance adjustments are made on request to accommodate the most exacting of demands. Kawasaki's attitude is to always doggedly pursue the users' satisfaction until Kawasaki itself is satisfied

—this attitude has earned the firm the trust and approval of Chinese customers.

While hydraulic pumps for 20 ton class excavators remain the main product line, KPM (Suzhou) has begun preparations to manufacture pumps for larger classes as well. KPM (Suzhou) is also set to begin manufacturing new hydraulic products for other machinery, such as mobile concrete pumps, to serve China's needs.



In shipping inspections, performance of each product is checked using the same equipment used at the Nishi-Kobe Works.



Machining centers (multifunctional numerically controlled machine tools) from Japan are used in the processing shop of the new plant.

Overwhelming Share Among Chinese Manufacturers

● Sales Efforts Launched in 1993

Kawasaki's offerings for hydraulic excavators include hydraulic pumps, hydraulic motors with reduction gears, and multiple control valves, all of which are indispensable for the operation and control of machinery (see Fig. 1).

Sales and services in China are handled by Kawasaki Precision Machinery Trading (Shanghai) Co., Ltd., or KPM (Shanghai). In 1993, Kawasaki launched its hydraulic equipment business in China well ahead of other Japanese manufacturers, pitching the high quality of its products and on-time delivery. The market size in China started expanding each year from around 2003, and this growth was reflected in Kawasaki's sales figures. The high performance and quality of Kawasaki's products, cultivated through decades of catering to customers in Japan, as well as its unique ability to satisfy customer needs, led to its success in China.

In 2010, some 170,000 hydraulic excavators were sold within China, surpassing the previous year's sales figure of 100,000. The sales volume for 2011 was roughly the same as in 2010. Kawasaki's hydraulic equipment is used in over 90% of hydraulic excavators (excluding 10 ton and smaller classes) made by Chinese domestic manufacturers.

● New Company Created for After-Sales Services

The rapid growth of Kawasaki's hydraulic equipment business in China over the past few years has given rise to a need for enhanced

after-sales services. KPM (Shanghai) opened a new customer service center in Shanghai in October 2011, with an eye to enhancing Kawasaki's brand image by delivering fast and reliable services.

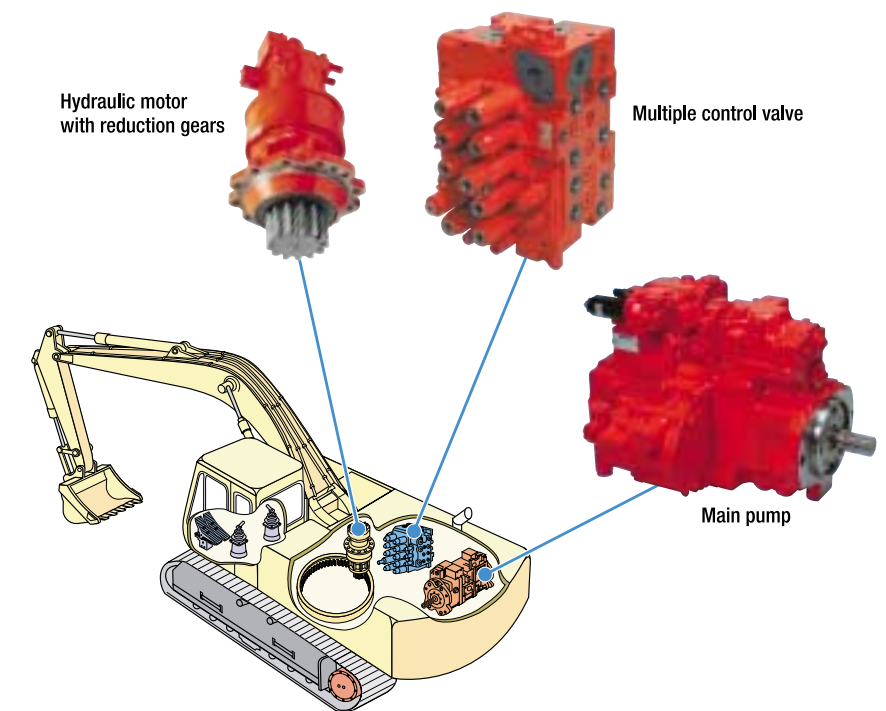


Fig.1 Main hydraulic components of construction machinery



The office of Kawasaki Precision Machinery Trading (Shanghai) Co., Ltd. A small number of highly skilled salespeople traveled all over China to establish Kawasaki's dominant share.



Overhauling hydraulic equipment at Kawasaki Precision Machinery Trading (Shanghai) Co., Ltd.'s Customer Service Center.

Mother Factory of the Global Precision Machinery Business

● Core Parts Receive Ultra-Precision Machining

Core parts for hydraulic equipment are manufactured in a dedicated plant at the Nishi-Kobe Works and supplied to manufacturing and service bases in China and other parts of the globe. This plant has been in operation since July 2007.

Core parts—pistons, shoes, cylinders and valve plates—are the most important components of hydraulic pumps and motors.

Parts such as pump casings and valve blocks that are made by finishing castings are manufactured locally at overseas plants. However, moving parts like pistons, which rub against each other at high speeds, need to be machined with ultraprecision to a tolerance of microns (a thousandth of a millimeter), a task that requires an extremely high level of machining technique. For this reason, all core parts are manufactured at the Nishi-Kobe Works.

● State-of-the-art Automatic Processing Devices Run 24/7

The spotless floors of the core parts plant are lined with a vast array of state-of-the-art, automated processing devices that handle everything from machining to heat treatment. Operating around the clock, these devices are managed with remarkable efficiency by minimal staff.



A view of the new Nishi-Kobe Works Plant 4, in full operation since June 2011.

The plant produces as many as 400,000 sets of pistons, shoes, cylinders and valve plates annually.

● Fulfilling the Customers' Needs

The high quality and reliability of the products are not the only factors behind Kawasaki's success in China: convinced of China's market potential, Kawasaki placed China at the center of its global strategy early on and launched business efforts on the ground ahead of others.

To respond to the varied requests of construction machinery manufacturers from around the world, the Engineering Division of Kawasaki's Precision Machinery Company is staffed with 250 design engineers, assigned by

product, who pore over every single detail while ensuring that the job gets done fast.

Specifications of hydraulic equipment often differ by manufacturer, even for excavators that belong to the same class. Kawasaki makes every effort to fulfill such varying specifications, down to the smallest details.

The trust accorded Kawasaki's hydraulic equipment in China is the fruit of years of these efforts, with their focus on the customer.

At the Nishi-Kobe Works, a new plant (Plant 4) began operations in full swing in June 2011, producing 48,000 hydraulic pumps a year and shipping them to sales bases in and outside of Japan.



An assortment of automatic processing devices at the Nishi-Kobe Works core parts plant.



Cylinders for hydraulic equipment are inspected for the slightest imperfection.

Our Goal Is to Become the No. 1 Brand in the World

The recent leap in the precision machinery business has been fueled by the success of hydraulic equipment for excavators—Kawasaki boasts a 90% share of the market for hydraulic excavators made by Chinese domestic manufacturers. China's market growth has plateaued due to the effects of monetary policy and so forth, but business remains brisk with local manufacturers, and we see a huge underlying demand in the long haul.

India's hydraulic excavator market is growing rapidly as well, nearly tripling in the last five years. Up to this moment, we have been exporting hydraulic pumps manufactured in Japan to hydraulic excavator manufacturers in India. But this will change. Recently, we signed a joint-venture agreement with a local company to establish a firm that will handle the manufacture, sale and service of hydraulic pumps for construction machinery in India. Production is set to

begin in July. By 2015, the new company is projected to reach an annual production capacity of 15,000 units. Kawasaki's precision machinery business will now be operated out of six countries and regions, as shown in the illustration below. With this global network, we are ready to further expand our business.

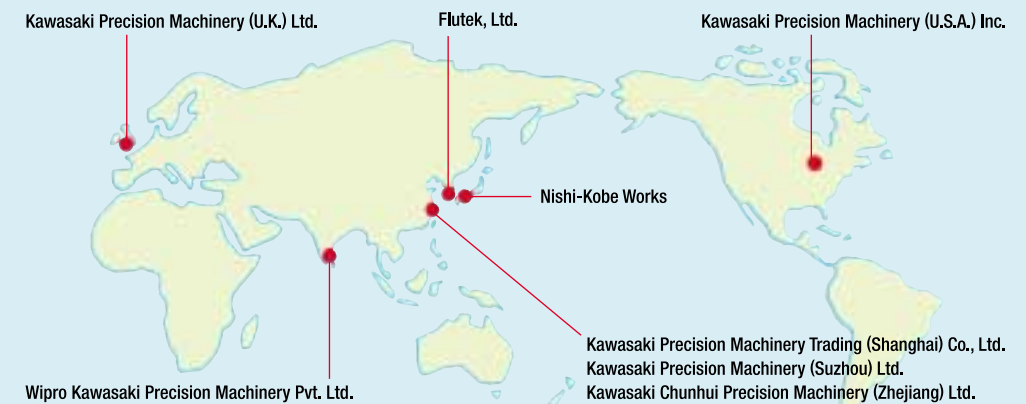
We have set our sights on more than doubling the business by FY 2020 and becoming the No.1 brand in the world. I've heard that in China, construction companies sometimes ask whether the hydraulic equipment used is KPM's (Kawasaki's) before purchasing hydraulic excavators. This is a great honor, and we want to hear stories like this from around the world.

There is huge potential in the hydraulic business. I am currently interested in a hybrid system combining hydraulic and electric technologies. In applications such as industrial robots and injection-



Makoto Sonoda
President, Precision Machinery Company

molding machines, hydraulics is gaining attention again for its capacity to generate great force using a small device. HST (Hydraulic Static Transmission), used for agricultural machinery, also shows promise. We will continue to create new hydraulic businesses in these and other areas, in pursuit of our goal of becoming the No. 1 brand in the world.



Reaching for New Heights in Speed and Comfort — An Inside Look at the Series E5 Hayabusa



Defining New Standards of Speed and Comfort

In March 2011, the Series E5 Shinkansen (bullet train) made its debut for the new Hayabusa services on the Tohoku Shinkansen Line, operated by the East Japan Railway Company (JR East). The most striking feature of the new train is a characteristically long nose designed to minimize the blasting noise generated when the train exits a tunnel.

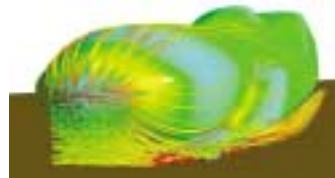
Speed is another defining feature of the Series E5. Although the trains currently in service in Japan operate at a maximum speed of 300 km/h, the E5 is capable of traveling at up to 320 km/h. When the E5 is finally allowed to unleash its full potential during normal service operation in the spring of 2013, it will become the fastest train in Japan. At 320 km/h, Tokyo and Shin-Aomori will only be 3 hours and 5 minutes apart.

The Series E5 is also fitted with various acoustic features for minimizing environmental noise: low-noise pantographs, bogie shrouds for dampening wheel noise, and intercar fairings for minimizing aerodynamic noise generated from the joining sections between cars.

Since November 2011, the Series E5 has also been in use for services other than Hayabusa.

Optimized Nose

The nose section spans 15 m. When the train enters a tunnel at high speeds, the air inside gets compressed and pushed forward, generating a sound blast at the other end of the tunnel, called micropressure waves. A state-of-the-art technique (front shape optimization method) developed by Kawasaki was used to predict the various aerodynamic phenomena that occur when traveling at high speeds. This study resulted in an optimal nose design that reduces micropressure waves. Even when operated at 320 km/h, the Series E5 generates fewer micropressure waves—and less environmental noise—than the current Hayate (Series E2), which runs at 275 km/h.



Cockpit

High-functional cockpit designed by Kawasaki. All necessary information is displayed on monitors, allowing the driver to keep an eye on the monitors and the field of view ahead.



Power Failure Detection System

This detects a failure of the overhead lines in the event of an earthquake and brings the train to a stop.

Automatic Train Control (ATC)

This safety system that operates the brake based on the location information of the train running ahead and that of own train, preventing collisions and excessive speed.

GranClass

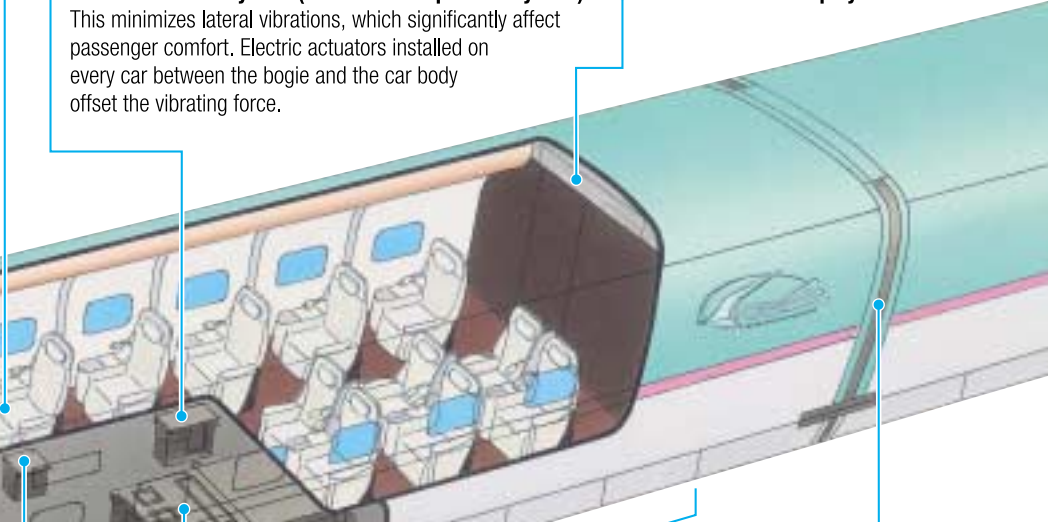
The first of its kind on a Shinkansen, the GranClass car offers maximum luxury and comfort, as its name is meant to express. Attention is given to every single detail to enhance passenger comfort. Each GranClass car contains only 18 seats, arranged in rows of 3 in a 2+1 configuration. The seats, upholstered in genuine leather and electrically powered to recline to an angle of 45 degrees, were jointly developed and manufactured by Kawasaki Rolling Stock Component Co., Ltd. and RECARO Japan Co., Ltd.



Vibration Control System (Full Active Suspension System)

This minimizes lateral vibrations, which significantly affect passenger comfort. Electric actuators installed on every car between the bogie and the car body offset the vibrating force.

LED Information Display



Intercar Fairings

Intercar fairings wrap around the adjoining sections between cars to create a smooth surface over the entire train, minimizing air friction. The result is less running resistance and aerodynamic noise. The fairings, jointly developed with JR East, employ a link mechanism for mobility.



Air Conditioning System

Auxiliary Power Supply

Continuous Ventilation System

Air Conditioning System

Carbody Tilting System

Tilts the car body with airsprings installed on every car when rounding curves to minimize centrifugal force, maintaining passenger comfort.

L-shaped Guide

This guide restricts lateral movement of the wheels should the car derail.



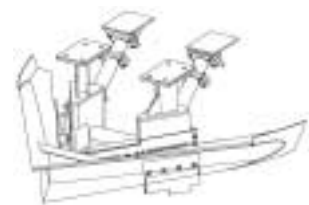
Front Cover Opening/Closing Mechanism, Joining/Separating Device

The Series E5 will be joined with E3 and the upcoming E6 cars. When connecting these cars in operation, the front cover will be opened sideways from the center, and the trains will be joined using the tightlock coupler and electrical coupler housed behind the cover.



Obstacle Deflector

This is a device for deflecting obstacles lying on the track. Behind the snow plow, a newly developed box-shaped shock absorber is installed, which enabled reducing the body weight while maintaining anti-obstacle performance.



Ordinary Car and Green Car Seats

All seats in Green Cars (first-class) and ordinary cars (second-class) are fitted with an adjustable headrest. Proposed by Kawasaki Rolling Stock Component Co., Ltd., these headrests mark a first for second-class Shinkansen cars.



Ordinary Car



Green Car

Development of Tidal Power Generation System Launched

Kawasaki recently began development of a power generation system utilizing ocean tides, a promising renewable energy source.

Found around the globe, tidal currents have huge potential to produce a stable supply of electricity and are virtually immune to the effects of climate and weather. Over the years Kawasaki has amassed a wealth of experience in developing and building

ocean-going vessels, research vessels and marine engines, as well as various marine structures along with advanced engineering technologies for high-efficiency gas turbine power generation plants and more. Kawasaki will leverage this expertise to develop a highly reliable and efficient tidal power generation system that has a competitive edge in the global market.



Japan's New Energy and Industrial Technology Development Organization (NEDO) has selected Kawasaki to be the general contractor for a project demonstrating the use of a tidal power generation system off the coast of Okinawa. In this project, Kawasaki will work with Okinawa Electric Power Co., Inc. and Okinawa New Energy Development Co., Inc. to harness power by leveraging the know-how acquired during past projects demonstrating the use of grid-connected solar, wind and other renewable power sources.

Kawasaki is moving full speed ahead on technological development for this test, with an eye to full-scale testing at the European Marine Energy Centre (EMEC) in Scotland, a country that leads the world in ocean energy development.

A supplier of renewable energy applications and products that include everything from small hydraulic power generation systems to biomass, wind and solar power systems, Kawasaki is making inroads into the international market via large-scale projects in Britain and elsewhere that hold the promise of major growth, as well as commercial power generation projects in Japan. Kawasaki is generating a smaller carbon footprint as it moves forward to make more efficient use of the earth's limited resources as it helps to build a brighter future for everyone. ::

Kawasaki Partners on Engine Development for Airbus A320neo

Kawasaki will collaborate on a program to develop and produce the PW1100G-JM engine that will power the Airbus A320neo family of aircraft. The program has been launched jointly by U.S.-based Pratt & Whitney, Germany's MTU Aero Engines AG and Japan Aero Engines Corporation (JAEC), in which Kawasaki is a participating member. This is the same group that has been partnering on International Aero Engines' V2500 program for the Airbus A320 family of aircraft.

Airbus announced that it has already received orders for more than 1,400 A320neo airplanes, which come with a choice of two engines. While the engine options for all of these orders have not yet been finalized, the PW1100G-JM engine has been chosen by a host of airline companies

that have purchased the A320neo. It will be installed in approximately 400 A320neos in the U.S., Germany and India.

The PW1100G-JM is a turbofan engine equipped with an advanced gear system that enables the engine's fan to operate at a lower speed than the low-pressure compressor and turbine. The combination of the gear system, state-of-the-art composite materials technology, and an advanced core will deliver double-digit improvements in fuel efficiency as well as major reductions in exhaust emissions and engine noise.

As a partner in the PW1100G-JM engine development and production program through JAEC, Kawasaki holds a 25% share of the JAEC contract (approximately 6% of the entire program). Just as it was in the V2500 program, Kawasaki is responsible

for developing and manufacturing the primary parts of the engine's fan and low-pressure compressor, as well as for conducting some of the tests needed to obtain type certification.

Over the last 30 years Kawasaki has participated under the JAEC banner in a number of international collaboration programs to develop small and midsize commercial aircraft. Kawasaki will leverage its wealth of experience to help drive the PW1100G-JM project toward successful development and mass production.

Kawasaki looks forward to continuing to play an active role in joint aircraft engine development and production programs as it builds on the technological and production foundation that will take its aircraft engine business to new heights. ::

Hydraulic Pump Joint Venture to Be Set Up in India

Kawasaki recently signed an agreement with Wipro Limited, based in Bangalore, India, to set up a joint venture in India for the manufacture, sale and servicing of hydraulic pumps for construction machinery.

Spurred by a rapidly growing economy, India's hydraulic excavator market is booming, with the total demand in 2010 reaching 12,000 units, triple the 2005 figure. With the economy showing no signs of waning and investment in infrastructure expected to grow, the market is projected to reach a scale on the order of 30,000 units a year in 2017, becoming the second largest market after China.

The joint venture agreement is aimed at catering to the growing demand for local production, stemming from the brisk demand for hydraulic excavators in India. Kawasaki

will combine its considerable expertise in hydraulic machinery with Wipro's proven track record and powerful marketing resources to expand sales in India.

The new company will set up a manufacturing facility in Bangalore, scheduled to start operation in July 2012, which will initially produce 4,000 units a year. Annual production of 15,000 units is expected by 2015.

Kawasaki has been selling hydraulic pumps from its Nishi-Kobe Works directly to hydraulic excavator manufacturers in India. The establishment of a new manufacturing base in India will shorten the lead time and enable more flexibility to respond to changes in customer requirements.

Kawasaki will deliver high-quality, high-performance products and provide full after-

sales services through the new joint venture, thus ensuring customer satisfaction on all levels. By aggressively expanding business operations, Kawasaki aims to rapidly establish itself as a leading player in India's hydraulic machinery industry. ::

Overview

Company name: Wipro Kawasaki Precision Machinery Private Limited
Location: Bangalore, Karnataka, India
Representative: Hidehiko Shimamura
Capital: Rs. 500 million (approx. 800 million yen)
Ownership: 74% Kawasaki, 26% Wipro
Operations: Manufacture, sales and servicing of hydraulic pumps for construction machinery

Boilers Selected for World's First Floating LNG facility

Technip, a leader in engineering procurement and construction (EPC) for the energy industry, recently awarded a contract to Kawasaki for



seven boiler units that will be installed on the world's first Floating LNG (FLNG) facility, Prelude, being built by Shell near Australia. The boilers are the largest ever for marine use.

They will be installed on the topside of Prelude FLNG, and supply 220 tons/hour of high-temperature, high-pressure steam to be used for power generation and LNG production processes in the facility.

Shell's Prelude FLNG will be moored over 200 km off shore of North West Australia, in water about 250 m deep. At 488 m long and 74 m wide, Prelude will be the largest floating offshore facility in the world.

Kawasaki has supplied more than 1,200

boiler units, not only for land use but also for marine use, including LNG carriers, to customers around the world. This contract is testimony to Kawasaki's proven track record and technical capabilities, as its reliable and robust boilers can operate under severe offshore conditions.

In parallel with an expected increase in worldwide energy consumption, FLNG facilities are expected to expand globally in addition to conventional onshore LNG plants, and opportunities for boilers for such facilities will grow accordingly.

Kawasaki will continue to promote its winning track record as a leading supplier of boilers for offshore floating facilities. ::

Overhaul Facility for Gas Turbines to Be Built in Malaysia

Kawasaki is planning to build an overhaul facility for gas turbines in Malaysia, enabling it to enhance its after-sales services in Asia, where the recent economic growth has led to increased demand for gas turbine cogeneration systems.

To better serve customers in Asia, Kawasaki Gas Turbine Asia Sdn. Bhd. (KGA) was established in Kuala Lumpur, Malaysia, in 1999. Since then, KGA has marketed gas turbine generators and provided customer services in the region. The new facility will have a floor space of 1,270 m² on a 5,180 m²

site near Kuala Lumpur, and will carry out disassembly of engine, inspection, repair and replacement of parts, assembly, and operation testing for 6 to 8 MW gas turbines, the main models in Asia.

Currently, KGA handles maintenance services only at the customer's site. Overhaul work involving disassembly of engines, repair, and operation testing is performed in the Akashi Works. Construction of this new overhaul facility will enable all after-sales services to be performed locally by KGA, providing users with more cohesive and

thorough services.

The project is currently in the design phase, with construction scheduled to begin in spring 2012 and operations in November 2012. The facility will have a capacity to overhaul 24 units a year.

Kawasaki will continue its efforts to provide outstanding services to customers in Asia through KGA. Leveraging its global network, which spans North America, Europe, Russia, the Middle and Far East, Kawasaki will further expand its reach around the world. ::